3.11 Geology, Soils, and Geologic Hazards

Geomorphology and sediment transport in the Klamath River watershed have implications on water quality and the survivability of aquatic species that use the sediment beds for reproduction (e.g., egg laying, larval stages). This section provides material relevant to the analysis of each of these issues; however, specific impacts on water quality and aquatic biology are addressed in Section 3.2, Water Quality, and Section 3.3, Aquatic Resources. This section assesses the changes to geomorphology and the potential for shoreline landslides and erosion due to sediment transport processes within the Klamath River watershed. This analysis also assesses the potential for local sedimentation in eddies and other "dead" zones in the Klamath River channel, as well as the effects on the estuary both during and following dam removal activities. Finally, this section discusses the potential for impacts from geologic hazards such as seismology and volcanology in the project area.

3.11.1 Area of Analysis

The area of analysis, or "project area," for the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for geology, soils and geologic hazards includes the riverbed and reservoir banks at the sites of the Four Facilities as well as the riverbed and adjacent banks along the Klamath River downstream from Iron Gate Dam to its mouth at the Pacific Ocean.

3.11.2 Regulatory Framework

Geology, soils, and geologic hazards within the area of analysis are regulated by State and local laws and policies, which are listed below.

3.11.2.1 State Authorities and Regulations

- Oregon Statewide Planning Goals and Regulations (Oregon Department of Land Conservation and Development, 2001)
- Oregon Revised Statute 455.477 (Oregon, State of, 2009 edition)
- Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code, Division 2, Chapter 7.5)
- Seismic Hazards Mapping Act (California Public Resources Code, Division 2, Chapter 7.8)

3.11.2.2 County Authorities and Regulations

- Siskiyou County General Plan, Land Use and Seismic Safety elements (Siskiyou County 1975, 1980)

3.11.3 Existing Conditions/Affected Environment

The potential removal of the Four Facilities raises concerns regarding the amount and nature of sediments stored in the respective reservoirs. Data collected to date indicate

that approximately 13.1 million cubic yards (yd^3) of deposits are stored in the four reservoirs and that these deposits consist of fine-grained particles (coarse sand and finer). The channel bed of the river mainstem downstream is primarily composed of cobble-sized material (Stillwater Sciences 2008; U.S. Department of the Interior [DOI] 2010).

3.11.3.1 Regional Geology

The Klamath Basin lies at or near the convergence of three tectonic plates that influence the geologic setting of the region: the Pacific, Juan de Fuca, and North American Plates. Consequently, the Klamath River flows through four distinct geologic provinces, each of which changes the character of the river's channel morphology and its tributary watersheds, varying the supply of inputs such as water, sediment, nutrients, and wood (Federal Energy Regulatory Commission [FERC] 2007). The Upper Klamath Basin lies in the transition zone between the Modoc Plateau and Cascade Range physiographic provinces, with the Klamath River cutting west through the Klamath Mountain province and then the Coast Range province where it reaches the Pacific Ocean near Requa, California (Figure 3.11-1; California Department of Conservation 2002; DOI 2010).

The Modoc Plateau abuts the Basin and Range Province where volcanic ramparts transition to escarpments with the valleys of the Basin and Range province. The Basin and Range province is an area of relatively young (Quaternary to Tertiary age) volcanic rocks with lesser amounts of intrusive rocks (DOI 2010). Basin and Range faults either displace the volcanic ramparts of the Modoc Plateau or are buried beneath them. The Klamath River passes through this province from the city of Klamath Falls to the Oregon-California State line. Below the State line, the river passes through the Cascades province. The portion of the basin that straddles the Modoc Plateau and Cascade Range provinces is typically called the "Upper" Klamath Basin. As the Klamath River flows towards the Pacific Ocean, downstream from Iron Gate Dam, it passes through the Klamath Mountains geomorphic province (which includes the Trinity Alps, Salmon Mountains, Marble Mountains, and Siskiyou Mountains). Rocks here are completely different from rocks upstream of Iron Gate Dam and are composed mostly of Cretaceous to Paleozoic age metamorphosed marine igneous and sedimentary rocks. Consequently, numerous faults and antiforms[1] are exposed along the river's path as it winds its way through the Klamath Mountains to the Pacific Ocean (DOI 2010).

Below river mile (RM) 40 (from the town of Weitchpec to the Pacific Ocean) the Klamath River traverses the Coast Range province. The geology of this area is underlain mostly by the Eastern Belt of the Franciscan Complex and a sliver of the Central Belt along the coast. The Eastern Belt is composed of schist and meta-sedimentary rocks (mostly metagraywacke) with minor amounts of shale, chert, and conglomerate. The Central Belt is principally an argillite-matrix mélange that contains kilometer-sized slabs of greenstone, serpentinte, graywacke, and abundant meter-size blocks of greenstone, graywacke, chert, higher-grade metamorphics, limestone, and lenses of serpentinite

[1] An antiform refers to a fold in the geology which curves upward but which the age of the geologic layers at the surface are unknown.

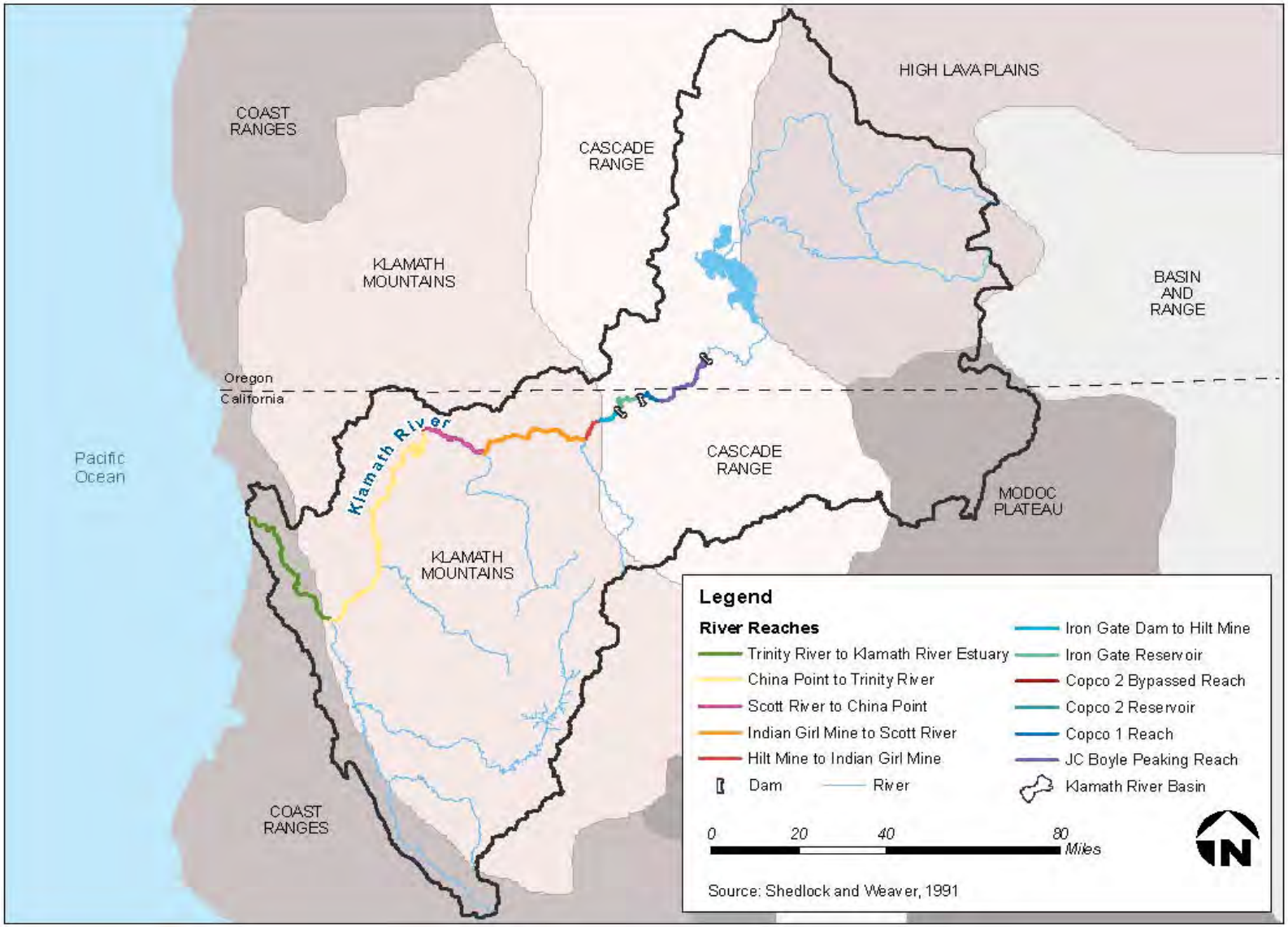

Figure 3.11-1. Klamath Basin Physiographic Provinces.

(Jayko and Blake 1987). Movement of the tectonic plates results in faulting in the Coast Range and the continued uplifting of the Franciscan rocks. This movement in conjunction with high precipitation rates and the compositionally weak nature of the rocks has resulted in high erosion rates that create steep hillslopes and high sediment yields (FERC 2007).

3.11.3.2 Geomorphology

In many ways the Klamath River is the reverse of most river systems. The headwaters flow through relatively flat, open country, and then flow through mountainous areas with input of cold water from the major tributaries. Accordingly, the river is warmer and flatter upstream of the project area, while downstream portions, beginning at the project area, tend to be colder and steeper. The Klamath River from the Oregon-California State line to downstream from Iron Gate Dam is a predominantly non-alluvial, sediment supply-limited river flowing through mountainous terrain. Downstream from the dam and for most of the river's length to the Pacific Ocean, the river maintains a relatively steep, high-energy, coarse-grained channel frequently confined by bedrock. Much of the course of the river in the Klamath Hydroelectric Reach is bedrock controlled, interspersed with relatively short alluvial reaches; thus, the influence of the Four Facilities on river geomorphology within the project area and downstream is limited. Floodplain development is minimal, and wider valleys allowing alluvial channel migration processes are rare. The following subsections provide a more detailed description of the geology and geomorphology of each of the subject reservoirs and associated river reaches, beginning with J.C. Boyle Reservoir and continuing downstream to the river estuary.

3.11.3.2.1 J.C. Boyle Reservoir

The bedrock surrounding and underlying J.C. Boyle Reservoir is principally composed of moderately well-bedded to massive, moderately well-consolidated sedimentary rocks containing volcanic material. Lava flows overlie these rocks and form many of the ridges above the reservoir. In the downstream portion of the reservoir (downstream from the Highway 66 Bridge), young lava flows line the sides of the reservoir (DOI 2010).

3.11.3.2.2 J.C. Boyle Peaking Reach

Downstream from J.C. Boyle Reservoir, the river canyon begins to open and channel slope decreases. This reach has a relatively low gradient (approximately 0.8 percent) and alternates between pools, bars, runs, and riffles. There is a wide terrace, which supports a riparian corridor of varying width along the channel, beyond which there is a floodplain. There are several side channels in conjunction with lateral bars and islands (FERC 2007).

3.11.3.2.3 Copco 1 Reservoir

The Copco 1 Reservoir is at a topographic transition area on the Klamath River, such that about 80 percent of the reservoir occupies a formerly lower gradient reach of the river. This break in stream gradient is largely the result of cinder cones and associated lava flows at the downstream portion of the reservoir (FERC 2007). Thus, geologic conditions in Copco 1 Reservoir are different than those in J.C. Boyle Reservoir, even though the bedrock beneath and surrounding both reservoirs consists primarily of rocks

formed from older volcanic flows overlain by younger lava flows. The rocks that underlie Copco 1 Reservoir contain thick deposits of airfall tuff and ash flows and there are several young volcanic eruptive cinders and cinder cones adjacent to the reservoir. Additionally a diatomite deposit along the southern downstream shore of the reservoir near Copco 1 Dam is even with or extending up to 20 feet above the reservoir surface (PanGeo 2008).[2] Several streams enter Copco 1 Reservoir, including Long Prairie Creek, Beaver Creek, Deer Creek, and Raymond Gulch. Sediment depositions and/or delta formations are present at the mouths of the larger streams in the reservoir (DOI 2010).

3.11.3.2.4 Copco 2 Reservoir

Copco 2 Reservoir is a relatively short impoundment (extending just over 0.25 mile) that lies immediately downstream from Copco 1 Dam. The reservoir is narrow and confined by a narrow bedrock canyon formed by lava flow (FERC 2007). As it is at Copco 1 Dam, rock at the Copco 2 Dam consists of a combination of lava flows and shallow intrusions. The bedrock surrounding and underlying the reservoir comprises basalt and andesite and steep slopes consisting of volcanic cobbles and boulders lie along both sides (DOI 2010).

3.11.3.2.5 Copco 2 Bypass Reach (RM 198.3–196.9)

Downstream from Copco 2 Dam, the Copco 2 Bypass Reach is characterized by a confined, boulder- and bedrock-dominated channel. The river in this reach is strongly influenced by the lava flow on the right bank of the river and there is minimal floodplain area. The average gradient of the reach is about 1.9 percent. Fossilized boulder-cobble bars dominate the channel cross section. Measurements of the bar by PacifiCorp during the FERC relicensing proceedings found that the median grain size was approximately 10 inches. Bedrock ledges also exist within the reach. Near the end of the reach, the Copco 2 Powerhouse discharges water into the Klamath River (FERC 2007).

3.11.3.2.6 Iron Gate Reservoir and Tributaries (RM 196.9–190.1)

Like Copco 1 Reservoir, Iron Gate Reservoir overlies a topographic transition on the Klamath River, where a steeper reach of river upstream (that of the Copco 2 Bypass Reach and a portion of the river inundated by Copco 1 Reservoir and Copco 2 Reservoir) transitions into the lower gradient reach downstream from Iron Gate Reservoir. In this area, the topography widens, and the channel is less restricted by the localized basalt lava flow from north of the Copco 2 Bypass Reach (FERC 2007). The reservoir has relatively steep topographic side-slopes and a narrow channel with numerous side drainages. Three of these side drainages are large, and two (Camp Creek at Mirror Cove and Jenny Creek) likely contribute substantial amounts of sediment to the reservoir. Except for these three side drainages, Iron Gate Reservoir hosts a relatively similar depositional environment throughout its length (DOI 2010).

[2] Diatomite is a chalk-like, soft, friable, earthy, very fine-grained, siliceous sedimentary rock, usually light in color. It is principally as a filter aid; but it has many other commercial applications, such as cement additives, absorbents, fillers, and insulation (USGS 2011).

3.11.3.2.7 Iron Gate Dam to Hilt Mine (RM 190-181)

The first reach downstream from Iron Gate Dam consists of a narrow floodplain and terraces confined by bedrock hills of the Western Cascade Volcanics and sedimentary rocks of the Cretaceous Hornbrook Formation. The channel is mostly single thread with a few areas of split flow that form mid-channel bars and side channels of short length. Most of the bars are at least partially vegetated, leaving few areas of exposed bars in the reach. Main tributaries that enter this reach include Brush Creek, Bogus Creek, Little Bogus Creek, Willow Creek, and Cottonwood Creek. With the exception of Cottonwood Creek, these tributaries form relatively small alluvial fans at their confluences with the Klamath River. Cottonwood Creek forms a large alluvial fan at its confluence with the river. Klamath River terraces are carved into the Cottonwood Creek alluvial fan deposits, suggesting that sediment input from Cottonwood Creek is limited to areas near and within the main channel of Cottonwood Creek (Reclamation 2012).

3.11.3.2.8 Hilt Mine to Indian Girl Mine (RM 181-174.6)

In this reach, the change in the physical characteristics of the bedrock marks a transition in channel confinement, where more resistant rocks create a narrow canyon with narrow alternating terraces along the reach length. Few bars exist in this reach; at RM 179, a mid-channel bar appears to be associated with the Williams Creek alluvial fan, which enters at the upstream end of the high terrace of the Randolf Collier rest area. The Shasta River enters from the south near RM 177 and forms a small gravel bar at its confluence with the Klamath River. The only other notable tributary in the reach is Ash Creek, which forms a fan of negligible size at its confluence with the Klamath River. Other notable features in this reach are associated with in-stream mining, including cobble-boulder benches and bars and a few wing-dam pits (Reclamation 2012).

3.11.3.2.9 Indian Girl Mine to Scott River (RM 174.6-143)

From Indian Girl Mine, the river valley broadens slightly within the canyon and allows for the preservation of broad gravelly terraces that have been extensively mined. In areas not obscured by mining, overflow channels are present on the terrace surfaces. Unvegetated bars are more prevalent in this reach and exist as point bars along the inside bends of channel meanders as well as mid-channel bar and side channel complexes. The channel maintains a mostly single thread meandering morphology with some areas of split flow around mid-channel bars.

At Gottville, several tributaries enter from the north and form a large alluvial fan complex that constricts the river and forms the Langley Falls rapid and associated large eddy directly upstream. Downstream from Gottville, between RM 166 and 161.5, the river valley narrows to about half the width of that upstream. Low terraces and point bars exist in this reach and have been extensively mined with tailings piles still visible on some of the surfaces. Channel morphology is less winding than that upstream and is single thread with a few small mid-channel bars. At the downstream end of this subreach, the Miller Gulch alluvial fan acts to constrict the channel. The river forms an eddy between the upstream end of the Miller Gulch fan and a small tributary fan from the opposite bank.

From Miller Gulch (RM 161.5) to Horse Creek (near RM 147), the river valley broadens again to include terraces with at least two levels and gravel bars. In several locations, the channel sinuosity increases. A narrow section exists in this reach from between RM 154 and RM 150 and is confined by bedrock on both sides of the river and by the Kohl Creek alluvial fan near RM 152. From RM 150 to Horse Creek, the river returns to a broader valley with a large remnant stream channel in the Cherry Flat area that has been extensively placer mined.

From Horse Creek to Scott River (RM 143), the river valley narrows and is confined by bedrock on both sides of the river. Terraces and bars are restricted to the insides of meander bends. Several small tributaries enter in this reach, forming steep alluvial fans at the confluence with the Klamath River, some of which have narrow terraces cut on their front edges. Channel morphology is single thread with a few small, unvegetated, mid-channel bars and point bars (Reclamation 2012).

3.11.3.2.10 Scott River to China Point (RM 143-118)

Downstream from Scott River from RM 143 to 132, the extent and height of unvegetated gravel bars increases and bars become more prevalent with discontinuous narrow alluvial terraces forming along the canyon margins. Large alluvial fans control river position from RM 141 to 139 along the south side of the river. At Seiad Valley, large alluvial fans from Seiad Creek, Little Grider Creek and Grider Creek form a wider alluvial valley in which terraces are cut on the front edges of the fans and large bars and riffles are formed along the river channel as a result of tributary sediment contributions to the Klamath River.

From RM 130 to 121.5, the Klamath River flows through a winding bedrock canyon with unvegetated bars located on the insides of meander bends. Valley terraces and bedrock-cored bars are prevalent in this reach. From RM 121.5 to China Point, the canyon narrows as it enters bedrock of the Jurassic Galice Formation. Bedrock benches form along the channel margins. At China Point, an extensive, unvegetated gravel bar lies on the inside of the bend along with a higher alluvial terrace. On the south side of the river, a remnant channel is elevated above the present channel. Tributaries that contribute sediment to the river in this reach include Thompson, Fort Goff, Portuguese, Grider, Walker, O'Neil, and Macks Creeks (Reclamation 2012).

3.11.3.2.11 China Point to Trinity River (RM 118-43.5)

From China Point to Deason Flat (RM 118-104), the channel is narrow with numerous valley terraces that have been extensively mined. Well-developed bars and riffles are formed at tributary confluences and meander bends. The lower three miles of this reach (RM 107-104) contain a greater number of unvegetated bars, which are formed by sediment inputs from Elk and Indian Creeks and channel constrictions downstream from RM 104. Tributaries in this reach contain large landslides, with Indian Creek watershed containing the most of any tributary.

From Deason Flat to Dutch Creek (RM 104-92), the river flows through a narrow bedrock canyon with low bedrock benches and gravelly veneers. Wider sections interspersed in this reach have small valley terraces that have been extensively mined and unvegetated gravel bars. This reach also contains notable landslides along the main stem, the largest of which is on the west side of the river between RM 98.5 and RM 93. Independence and Clear Creeks both contribute large amounts of sediment to the river in this reach.

From Dutch Creek to Trinity River (RM 92-43.5), the river is contained in a narrow bedrock canyon with intermittent alluvial reaches. This reach also includes the wider alluvial valley at Orleans (RM 58.5). Geomorphic features include valley terrace and bars, alluvial terraces and bars, bedrock benches and alluvial fans. Numerous landslides lie along the river and interact with the river through sediment contributions and controlling channel position. This reach is the downstream limit of channel mining on the Klamath River. Tributaries that are major contributors of sediment include Salmon River, Trinity River, Bluff Creek, Camp Creek and Ukonom Creek (Reclamation 2012).

3.11.3.2.12 Trinity River to Klamath River Estuary (RM 43.5-0)

From Trinity River to Cappell Flat (RM 43.5-35), a narrow bedrock canyon with few bars and no floodplain or terraces exists, and is primarily bedrock controlled. Landslides and alluvial fans are less common, but locations still exist where these features have temporarily dammed the river based on remnant boulders in the channel and deposits on opposite banks.

From Cappell Flat to Starwein Flat (RM 35-10), the river flows through a narrow, confined valley with minimal floodplain and terraces. Bars are well developed and are either alternate bars formed in straighter reaches or point bars formed at meander bends. The extent of the bars increases in the downstream direction. Tributaries create split flow channels, mid-channel bars and riffles at their confluences with the main stem. Major sediment contributors include Blue, Pecwan, Cappell, Bear, and Tectah Creeks.

From Starwein Flat to the mouth (RM10-0), the river transitions into a wide valley with floodplain surfaces and narrow terrace remnants. Well-developed bars of variable height lie along the reach and several large pools and few riffles are present. Turwar Creek is the only major sediment producer in this reach, contributing mostly fine materials to the Klamath River (Reclamation 2012). The lower seven miles of the Klamath River to its mouth at the Pacific Ocean is classified as a "Confined River System" with a relatively steep gradient. The river channel is largely confined by banks of hard bedrock, which keep it from forming shallow braided channels. Thus, the river is relatively narrow with cross-channel widths typically between 650 and 800 feet except at large bends and areas where bank/bar erosion is active. In these areas, the channel width increases up to 1,600 feet (the river makes several large bends that are controlled by the local geology). The relatively narrow river banks and highly variable flow (commonly 18,000 to +30,000 cubic feet per second [cfs]) make the river system "flashy", creating large variations in bedload capacity and bedload sediment gradations (DOI 2010).

The mouth of the river is characterized by a wave-dominated delta with a large barrier island parallel to the coastline (i.e., offshore sandbar). Behind the barrier island is a shallow lagoon about 2,500 feet long by less than 1,000 feet wide. This area of the Klamath River is highly dynamic, changing positions during large flood events and transporting most of its suspended load or silt and clay out to sea. The limited size of the lagoon is dominated by deposits of medium grained sand and silty sand with only very local accumulations of fine-grained materials (DOI 2010).

3.11.3.3 Sediment Supply and Transport

The Klamath River is supply limited for fine material (sands and small gravels), but capacity limited for large material (cobbles and boulders) (Reclamation 2012). Practically no substantial sediment is supplied to the Klamath River from the watershed above Keno Dam; because of its large surface area, Upper Klamath Lake traps practically all sediment entering it from its tributaries.

The Lead Agencies estimate average annual sediment delivery at approximately 200,000 tons per year (ton/yr) from Keno Dam to Iron Gate Dam. The Scott River supplies approximately 607,000 tons/yr; the Salmon River supplies 320,000 tons/yr; and the Trinity River supplies 3.3 million tons/yr. The total annual delivery of sediment to the ocean from the Klamath River is estimated at 5.8 million tons/yr. The total annual delivery of sediment with a size greater than 0.063 millimeters (mm) [coarse sand] is estimated to be 1.9 million tons/yr (Reclamation 2012). Table 3.11-1 provides the cumulative annual sediment carried downstream by the Klamath River and shows the proportion of coarse material and fine material within the load.

3.11.3.4 Reservoir Substrate Composition

In 2010, DOI conducted a sediment sampling study in the subject reservoirs to describe sediment composition and determine sediment thickness throughout all major sections of the reservoirs[3]. The study found that fine-grained sediment in all of the reservoirs but Copco 2 Reservoir consisted primarily of elastic silt and clay, with lesser amounts of elastic silt with fine sand. The sediment was determined to be mostly an accumulation of silt size particles of organic material such as algae and diatoms, and silt size particles of rock. The average grain size decreases nearer to the dams because smaller particles settle more slowly than larger particles. Accordingly, the upper reaches of each reservoir contained a higher percentage of silt, sand, and gravel than the lower reaches, which contain more clay, sandy elastic silt and elastic silt with trace sand. The elastic silt in all of the reservoirs had the consistency of pudding, and had very high water content (greater than 100 percent). The fine-grained sediment was also found to have a low cohesion and to be erodible; where water flowed greater than 2 to 4 miles per hour, accumulations of sediment were less than a few inches (DOI 2010). Table 3.11-2 describes the physical properties of the sediment in each reservoir, and the following paragraphs summarize the findings for each reservoir.

[3] The study also addressed the chemical composition of the reservoir sediment. A summary of these results and the associated implications are addressed in Section 3.2 Water Quality.

Table 3.11-1. Cumulative Annual Sediment Delivery to the Klamath River

Source Area	River Mile	Cumulative delivery[1]		
		Total (tons/year)	% particles ≥0.063 mm	% particles ≤0.063 mm
Keno Dam to Iron Gate Dam	192.7	151,000	16%	84%
Iron Gate Dam to Cottonwood Creek	184.9	160,961	16%	84%
Cottonwood Creek	184.9	175,560	17%	83%
Cottonwood Creek to Shasta River	179.3	177,715	18%	82%
Shasta River	179.3	199,259	19%	81%
Shasta River to Beaver Creek	163.3	231,710	21%	79%
Beaver Creek	163.3	279,869	23%	77%
Beaver Creek to Scott River	145.1	373,073	25%	75%
Scott River	145.1	980,393	29%	71%
Scott River to Grider Creek	129.4	1,048,860	30%	70%
Grider Creek to Indian Creek	108.4	1,099,934	30%	70%
Indian Creek	108.4	1,173,246	30%	70%
Elk Creek	107.1	1,211,930	30%	70%
Clear Creek	100.1	1,253,972	30%	70%
Dillon Creek	85.8	1,282,389	30%	70%
Indian Creek to Dillon Creek	85.8	1,354,759	30%	70%
Dillon Creek to Salmon River	66.5	1,440,282	30%	70%
Salmon River	66.5	1,760,904	31%	69%
Salmon River to Camp Creek	57.3	1,785,769	31%	69%
Camp Creek	57.3	1,831,523	31%	69%
Camp Creek to Red Cap Creek	53.0	1,855,021	31%	69%
Red Cap Creek	53.0	1,897,796	31%	69%
Red Cap Creek to Bluff Creek	49.8	1,913,925	31%	69%
Bluff Creek	49.8	2,014,594	31%	69%
Bluff Creek to Trinity River	43.4	2,035,830	31%	69%
Trinity River	43.4	5,353,164	32%	68%
Blue Creek	16.1	5,455,971	32%	68%
Trinity River to Mouth	0.0	5,834,091	32%	68%

Source: Adapted from Stillwater Sciences 2010

[1] Density = 1.5 tons/yd^3. Mass report in US short tons. Above Cottonwood Creek, assumes 16 percent of total load is ≥0.063 based on grains size distribution of reservoir sediment (Gathard Engineering Consulting 2006). Below Cottonwood Creek, assumes 10 percent of total load is bedload and 24 percent of suspended load is sand ≥0.063 Coarse sediment delivery to the ocean is less than presented in this table when attrition by abrasion is considered.

Key:

mm: millimeters

Table 3.11-2. Physical Properties of Reservoir Sediment

Reservoir	Location	Volume yd^3	% Clay[1]	% Silt[1]	% Sand[1]	% Gravel [1]	Liquid Limit (%)	Plasticity Index (%)	Moisture Content (%)	Porosity (%)	Dry Bulk Density lb/ft
J.C. Boyle	Upper Reservoir	380,000	17.3	26.2	56.5	0.0	45.5	14.7	173	0.82	29.5
	Lower Reservoir	620,000	38.2	49.7	12.1	0.0	173	60.6	345	0.90	16.3
	Pre-Reservoir		3.7	9.5	28.4	58.5	44.9	12.7	23.4	0.38	101
Copco I	Upper Reservoir	810,000	27.9	46.8	25.1	0.2	109.3	49.3	287	0.88	19.2
	Lower Reservoir	6,630,000	55.8	34.2	10.0	0.0	154.3	59.1	295	0.88	18.7
	Pre-Reservoir		35.6	42.2	22.2	0.0	105.0	41.5	153	0.80	32.6
Iron Gate	Upper Reservoir	830,000	35.4	43.1	21.6	0.0	70.9	29.9	192	0.83	27.0
	Lower Reservoir	2,780,000	60.7	25.5	13.5	0.4	118.7	51.4	276	0.88	19.8
	Pre-reservoir		33.6	16.9	20.4	29.1	60.6	32.5	37.9	0.50	81.8
	Upper Tributary	300,000	31.8	42.7	25.5	0.0	60.7	22.7	102	0.73	44.4
	Lower Tributary	800,000	61.8	32.0	6.1	0.0	112.2	49.6	284	0.88	19.3

Source: DOI 2010; Reclamation 2012.

[1]Clay = 0 to 0.005 mm; Silt = 0.005 to 0.075 mm; Sand = #200 to #4 sieve; Gravel = #4 to 3 inch.

Key:
yd^3: cubic yards
lb/ft: pounds per foot

3.11.3.4.1 J.C. Boyle Reservoir

As shown in Table 3.11-2, the upper portion J.C. Boyle Reservoir primarily has coarse-grained sediment, both as pre-reservoir alluvium and reservoir sediment. The reservoir has an abundance of gravel/sand bars and cobbles exposed above the reservoir water surface, with sub-surface sand and gravel found by stab-sampling. The reservoir also likely has small, local accumulations of fine grained reservoir sediment within the upper 5,000 feet of the reservoir, but most of the reservoir sediment in this section is coarse grained. The reservoir sediment becomes finer grained with distance downstream. Sediment sampling conducted by the DOI indicates that about 5,000 feet downstream, reservoir sediment is three to five feet thick and composed of silty sand to poorly graded sand with silt with less than about 15 percent fine grained material (DOI 2010).

Only thin deposits of reservoir sediment were present at the sample sites in the middle section of the reservoir. The reservoir sediment consisted of fine-grained elastic silt with substantial accumulations of organic material. Pre-reservoir material consisted of coarse grained alluvium (silty gravel and sand), and bedrock consisted of volcaniclastic rock intensely weathered/decomposed to lean clay. Reservoir sediment was thickest in the lower section of the reservoir (ranging from 14 to 22 feet thick). Sediment in the lower section was uniformly elastic silt with greater than 90 percent fine-grained material. The sediment overlaid coarse grained pre-reservoir alluvium consisting mostly of silty gravel with sand (DOI 2010).

3.11.3.4.2 Copco 1 Reservoir

The upper portion of Copco 1 Reservoir has a sediment thickness ranging from 3.5 to 8.0 feet consisting of elastic silt with sand. Sediments in the rest of the reservoir are relatively uniform and composed of elastic silt, containing between 88 and 99 percent fine-grained material. Sediment thickness in the main reservoir ranges from 1.3 to 9.7 feet deep (DOI 2010).

3.11.3.4.3 Copco 2 Reservoir

The upper 500 feet of the Copco 2 Reservoir contained deposits primarily composed of cobble boulders. Similarly, the channel invert appeared to be covered mostly with angular gravel to boulder size talus and minor interstitial sand. Flow velocities in the reservoir channel at the time of sampling were relatively fast, therefore, it is likely that sediment composed of silt and clay did not deposit or had been previously eroded. Results of core drilling attempts show that cobbles, boulders, gravel, and sand formed the deposits in the bottom of the reservoir and there is a lack of fine-grained sediment (DOI 2010).

3.11.3.4.4 Iron Gate Reservoir

Iron Gate Reservoir has relatively steep side-slopes and a narrow channel with numerous side drainages. Three of these side drainages are large, and two likely contribute substantial amounts of sediment to the reservoir. Except for the three principal side drainages, Iron Gate Reservoir has a relatively similar depositional environment throughout its length. Only the upper 6,000 feet of the reservoir has a substantial percentage of sand within the reservoir sediment. Sediment thickness ranged from 1.4 to

9.2 feet, with most samples having a thickness of less than 5 feet. Reservoir sediment was relatively uniform throughout the reservoir and consisted of elastic silt with 85 to 98 percent fine-grained material (DOI 2010).

3.11.3.5 Slope Stability/Landslides

Landslides (both into the subject reservoirs and the mainstem Klamath River) are one potential source of sediment supply to the river system. Potential landslide/rock fall areas include relatively steep slopes underlain by tuff, as well as areas of deep colluvium/talus slopes that could produce slumps and debris flows. Talus slopes are found along the Klamath River between J.C. Boyle Dam and Copco 2 Reservoir. Identified slope stability/landslide occurrences and observations at reservoirs in the study area include the following.

Recent observations of the subject reservoirs identified no areas of unstable slopes or existing landslides adjacent to J.C. Boyle Reservoir or Copco 2 Reservoir.

No areas of large-scale active landslides were observed in the slopes adjacent to Copco 1 Reservoir. Several small-to-medium sized landslide features are present on the north shore of the reservoir that may have been caused by rainfall and/or subsurface ground water flows (Figure 3.11-2). However, the preliminary evaluation conducted by PanGeo indicates that the slopes in these areas are currently stable. Other areas of past landslides include an old, inactive slide that is visible on the westernmost end of the reservoir and a colluvium fan on the north shore immediately west of Spannus Gulch. In addition to potential sediment inputs from past landslides, wave action at the shoreline of the reservoir has eroded sand and volcaniclastic tuff beneath diatomite beds and has resulted in the calving of diatomite into the reservoir creating vertical exposures as high as 20 feet in the diatomite. The diatomite that has calved into the reservoir has most likely been eroded and re-deposited within the reservoir. Elsewhere around the reservoir, shoreline erosion has been minimal (PanGeo 2008).

Within Iron Gate Reservoir, the adjacent hillside slopes are generally considered stable with no active landslide areas. However, geomorphic features suggestive of old, inactive landslides (including small slumps a few meters wide and possible slides covering square miles) were identified on the south rim slopes above the reservoir and may have contributed to past sediment input into the reservoir. In addition, a low level of wave-induced shoreline erosion at the margin of the reservoir was observed and reported in the PanGeo (2008) study. However, the erosion has not substantially undercut or disturbed the hillside slopes, and the exposed material along the shoreline comprises relatively competent volcanic or volcaniclastic rock. According to the PanGeo study, recent erosion rills in the red volcaniclastic materials underlying the hillside slopes indicate that these fine-grained materials may be vulnerable to rapid erosion in the future if subjected to concentrated water flows (PanGeo 2008).

Figure 3.11-2. Existing Potential Landslide Areas.

Potential landslide/rockfall areas downstream from the Four Facilities include all steep slopes underlain by tuff, as well as areas of deep colluvium/talus slopes that could produce slumps and debris. Talus slopes are found through the Klamath River Canyon (the stretch of river between J.C. Boyle and Copco 2 Dams). Continuous creep of talus and rapid rockfalls are likely on and near talus slopes, and the potential exists for slow-to-moderate migration of some of the large slides. Landsliding is also prevalent in the Franciscan geology of the lower Klamath River watershed and along tributary watersheds within the Klamath Mountain geomorphic province, such as the Salmon River (FERC 2007). As discussed above when describing the geomorphology of the river, existing landslide areas are present downstream from the Scott River confluence.

3.11.3.5.1 Soils

Upper Klamath River

Soils in the vicinity of the Upper Klamath River, surrounding J.C. Boyle Reservoir, and along the river south to the Oregon-California border generally consist of lacustrine and alluvial clay, silt, fine-grained sand and peat (Priest et al 2008). The primary soil association along both sides of the river is Skookum-rock outcrop-Rubble land complex with 35 to 70 percent slopes. Immediately surrounding Keno Impoundment, soils consist of the Bly-Royst complex (Natural Resources Conservation Service [NRCS] 2005).

Klamath Hydroelectric Project

Soils along the Klamath River and on reaches between the subject reservoirs are less homogenous in California. However, the various soil formations can be grouped generally into those on steeper slopes, floodplain or terrace surfaces, or directly along the river itself. The soils on steeper slopes are shallow to moderately deep and comprise a 7-8 inch surface horizon of gravelly loam, and an underlying horizon of gravelly, clayey loam. Floodplain and terrace soils are comprised of deep, well-drained alluvium and colluvium. Directly along the river, soils are comprised of unconsolidated alluvium, colluvium, and fluvial deposits. These geologically recent deposits consist of unconsolidated sand, silt, and gravels deposited by water or erosion (FERC 2007).

Below Iron Gate Dam

Soils along the Klamath River below Iron Gate Dam are generally composed of associations consisting of gravelly clay loam and gravelly sandy loam (Holland-Clallam, Skalan, Weitchpec, and Lithic Mollic Dubakella associations). Soils on steeper slopes are deeper (22 to 60 inches) than those on less steep slopes and along the floodplain. These soil associations are all classified as well-drained, with low to no flooding frequency or ability for ponding water. Soils directly along the river in floodplain areas are comprised of alluvial deposits consisting of sand and gravels (NRCS 2007 and 2008).

3.11.3.6 Faults and Seismicity

Review of available fault and earthquake epicenter maps for northern California and southern Oregon show no fault lines or earthquake epicenters beneath Iron Gate Dam or the Copco Dams and Reservoirs. However, volcanic vents occur very close to the two Copco Dams. Faults exist beneath the J.C. Boyle Dam and Reservoir. However, these faults have not moved within the past 1.5 million years and, therefore, are termed not

active (Personius et al. 2003). No earthquake epicenters are mapped beneath the J.C. Boyle Reservoir, but one of the largest earthquakes ever recorded in Oregon occurred in 1993 in and around the Klamath Falls areas approximately 15 miles north of the J.C. Boyle Reservoir.

In California, the nearest active fault to the Four Facilities is the Meiss Lake fault, approximately five miles east of the Klamath River near the California/Oregon State line in Siskiyou County. The next nearest California-zoned active fault in relation to the Four Facilities is the Mahogany Mountain fault zone approximately 6 miles east (Jennings and Bryant 2010).

3.11.3.7 Volcanic Activity and Associated Strata

The High Cascades geomorphic province consists of a narrow band of shield volcanoes built on top of the eastern portion of the Western Cascades strata. The High Cascades are represented in the vicinity of the Four Facilities by the extinct cones of Eagle Rock Mountain to the south of the Klamath River valley, the Secret Spring Mountain and McGavin Peak to the southeast, and Mount Shasta to the Northwest. There are also a series of basaltic volcanoes extending northward into Oregon towards Klamath Falls, which have been dissected by subsequent basin and range block faulting (PanGeo 2008).

In addition to the large shield volcanoes with their multiple eruptive events, numerous smaller vents and volcanoes are present in the area. The majority of the volcanism in the Upper Klamath Basin consists of single events from a given vent and most of the smaller explosive cones are formed from the interaction of flow material intersecting ground water (hydrovolcanic events). High Cascades volcanism continues to the present day (PanGeo 2008). Within the past 10,000 years, the average frequency of Mount Shasta eruptions is one every 800 years. Over just the past 4.500 years however, the average eruption frequency has increased to one every 600 years. The last known eruption occurred approximately 200 years ago (Miller 1980).

The rocks in the vicinity of the Four Facilities range in age from roughly 45 million years old up to the present. Copco and Iron Gate Dams are in the Western Cascades. The volcanic activity that formed the Western Cascades is thought to have started between 42 and 45 million years ago (Eocene) and continued until approximately 10 and 5 million years ago. Over time, the main area of volcanic activity shifted eastward and narrowed. The intensity of volcanism also diminished and erosion activity erased much of the evidence of the original volcanoes. Estimates of the thickness of the Western Cascades strata range from between 12,000 and 15,000 feet to greater than 20,000 feet (PanGeo 2008).

In the vicinity of Copco Reservoir, up to half of the Western Cascade strata are exposed in the Klamath River Canyon as a result of river down cutting. In this exposure, the Western Cascade strata are comprised of inter-bedded tuffs, ash, and lava flows dipping down to the east at approximately 25 degrees. The east dipping strata of the Western Cascade is overlain by the nearly flat lying High Cascade strata composed of younger Pliocene lava flows with a cumulative thickness of up to 500 feet. Particular zones of the

inter-bedded strata of the Western Cascade may serve as geothermal reservoirs when coupled with a heat source and sealed by overlying High Cascade lava flows, (Hammond 1983).

3.11.4 Environmental Consequences

3.11.4.1 Environmental Effects Determination Methods

The environmental consequences of the alternatives focus on changes to geomorphology and sediment transport. This analysis discusses potential increases in geologic hazards downstream from the reservoirs, as well as potential increases in erosion in the Upper Klamath Basin under implementation of each of the alternatives.

DOI used the Sedimentation and River Hydraulics-One Dimension Version 2.4 sediment transport model to analyze the potential transport of reservoir sediment downstream based on different drawdown scenarios. The analysis below uses the results of DOI's sediment transport modeling to evaluate changes in downstream sediment regimes and the effect of the changes on shoreline geology downstream from the reservoirs. The analysis also qualitatively analyzes the potential for local sedimentation in eddies and other low gradient zones in the Klamath River channel.

3.11.4.2 Significance Criteria

For the purposes of this EIS/EIR, impacts would be significant if they would result in the following:

- Substantial soil erosion into reservoir areas or along the Klamath River.
- Cause new or exacerbate existing landslides along the banks of the reservoirs.
- Incomplete flushing of sediment with substantial deposition downstream, which adversely affects other associated resources (i.e., Water Quality, Fish Resources, Mollusks, and Benthic Invertebrates).
- Exposure of people or structures to adverse effects resulting from rupture of a known earthquake fault, strong seismic ground shaking, or volcanic activity.
- Remove access to diatomite beds for extraction.

3.11.4.3 Effects Determinations

3.11.4.3.1 Alternative 1: No Action/No Project

Under the No Action/No Project Alternative, J.C. Boyle, Iron Gate, and Copco 1 Reservoirs would continue to trap sediment at rates similar to historical rates. Based on historic sediment trapping rates and sediment levels in each reservoir, it is estimated that approximately 23.5 million yd^3 of sediment would be stored behind the dams in 50 years time (i.e., by 2061). Studies conducted by DOI indicate that the trapping efficiency of J.C. Boyle Dam may decrease slightly as the reservoir capacity decreases but the rate at which this may happen is uncertain and is not likely to change substantially over the next 50 years (Reclamation 2012). It is likely that after the storage capacity reduces to a certain level, sedimentation in the reservoirs would stop and sediment would begin to

pass through the reservoir pools and be transported downstream. Table 3.11-3 summarizes the current estimated volume of sediment in each reservoir, the respective sediment trapping rate, and the anticipated sediment volume in each reservoir in 50 years.

No future substantial erosion or landslides are expected to occur downstream from any of the Four Facilities under the No Action/No Project Alternative. As described in Section 3.11.3 (Existing Conditions/Affected Environment), river elevation downstream from the dams is primarily controlled by large boulders and bedrock, and only limited adjustment is possible. **There would be no change from existing conditions as a result of the No Action/ No Project.**

Table 3.11-3. Estimated Future Sediment Volume in Reservoirs under the No Action/No Project Alternative

Reservoir	Original Storage Capacity (acre-ft)	Current Sediment Volume (yd^3)	Sedimentation Rate (yd^3/yr)	2061 Sediment Volume (yd^3)	% Reduction in Storage Capacity
J.C. Boyle	3,495	1,000,000	19,600	2,020,000	36
Copco 1	46,867	7,400,000	81,300	11,600,000	15
Copco 2	73	0	0	0	0
Iron Gate	58,794	4,700,000	100,000	9,900,000	10
Total	109,229	13,100,000	201,000	23,500,000	13

Source: Reclamation 2012

Key:

yd^3: cubic yards

yd^3/year: cubic yards per year

lb/ft: pounds per foot

Under the No Action/No Project Alternative, Copco 1 Reservoir would continue to prohibit access to diatomite beds. Diatomite beds are at the southern shore of the reservoir near the dam and are even with or extending up to 20 feet above the reservoir surface. Wave action at the shoreline has eroded the diatomite. Because of their location in the reservoir and existing erosion, diatomite resources are currently inaccessible for extraction purposes. **There would be no change to the existing conditions of diatomite beds under the No Action/No Project Alternative because the resources would continue to be inaccessible.**

3.11.4.3.2 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

Soil disturbance associated with heavy vehicle use, excavation, and grading could result in erosion during removal activities. As described in the Affected Environment, shoreline erosion is generally not a substantial factor affecting the Iron Gate and J.C. Boyle Reservoirs, although it is an issue at Copco 1 Reservoir, where eroded sand and volcaniclastic tuff has resulted in the subsequent calving of diatomite into the reservoir. This existing erosion is caused by wave action in the reservoir (PanGeo 2008). Soil disturbance associated with heavy vehicle use, excavation, and grading could result

in erosion during removal activities at Iron Gate and J.C. Boyle Reservoirs and could exacerbate existing erosion at Copco 1 Reservoir. Prior to demolition, coverage under the General Stormwater National Pollution Discharge Elimination System (NPDES) Permit for Construction Activities in both Oregon and California would be required as per Section 402 of the Clean Water Act. Coverage under this permit requires the development and implementation of an Erosion and Sediment Control Plan prior to deconstruction that describes best management practices (BMPs) to prevent erosion during demolition activities. Implementation of these BMPs would minimize the potential for erosion into the reservoir areas. **Erosion impacts into the reservoir areas would be short term and less than significant.**

Drawdown of the three largest reservoirs could cause some instability along the banks of the reservoirs. The sediment deposited within the reservoirs since dam construction is expected to be relatively weak and susceptible to slumping. However, the reservoir sediment on the terraces of the reservoirs is only a few feet thick and slumping toward the river channel will only occur primarily during drawdown. After drawdown, the remaining reservoir sediment will harden and be stable. The pre-dam topography that exists underneath the reservoir sediment is expected to be relatively stable, though some slumping could occur on slopes with inclinations from 18 to 40 degrees, and would be dependent on the drawdown rate (i.e. slower drawdown rates would result in less slumping). The PanGeo (2008) study, which was described in Section 3.11.3 (Existing Conditions/Affected Environment), concluded that the hillside slopes below the pool levels behind Iron Gate, Copco 1, and J.C. Boyle Dams would likely perform relatively well and remain stable during drawdown activities. In addition, no large-scale landslides are anticipated in newly exposed areas and any new slides that may develop would most likely be below the existing water level in the reservoirs, although such slides could create higher deposition on the terraces above the newly formed river channel. **These potential landslide impacts would be short term and less than significant.**

Reservoir drawdown at Copco 1 would reduce the potential for erosion and future landslides. Because existing erosion at Copco 1 Reservoir is largely the result of wave action, emptying the reservoir would remove this source of shoreline erosion. As noted above, no large-scale landslides are anticipated in newly exposed areas during drawdown. In the long term with implementation of reservoir restoration actions including hydro seeding, landslides and erosion would not be expected at a higher frequency or of a larger size than what is currently contributed from the slopes adjacent to the reservoirs. **Thus, long-term impacts with regards to erosion and potential landslides at Copco 1 Reservoir would be less than significant.**

Drawdown of reservoirs could cause bank erosion downstream. The drawdown of the four reservoirs would occur simultaneously beginning in January 2020. Based on the current project schedule and drawdown rate restrictions, the controlled released would maintain the minimum required flows in each reach. Section 3.6, Flood Hydrology, discusses historic flow rates and discharge statistics for each of the reservoirs. The proposed drawdown rates are consistent with the historic discharge rates from the reservoirs and would be adjusted depending on the water year; therefore, flow rates

downstream from the dams are not anticipated to increase substantially above median historic rates, if at all (discharges from the reservoirs would be similar to seasonal 10-year flood flows from the reservoirs).

Although some landslides and erosive areas have been identified in the lower river, based on the expected flow rates that are similar to existing flow rates, substantial amounts of additional erosion are not expected to occur downstream from any of the dams as a result of reservoir drawdown. **Any erosion downstream would be minimal; these impacts would be short term and less than significant.**

Drawdown of reservoirs and release of sediment would result in short-term increases in sedimentation in slow-moving eddies and pools downstream from the reservoirs and in the Klamath River estuary. During reservoir drawdown in 2020, the sediment behind the four dams would be released downstream. DOI conducted modeling of the reservoir drawdown and erosion of reservoir sediment. The drawdown of Iron Gate Reservoir would ultimately control sediment released from Copco 1 and 2, and J.C. Boyle Reservoirs due to its location furthest downstream. Since all reservoirs would be drawn down concurrently, sediment released from the upstream reservoirs would remain suspended and is not anticipated to settle within Iron Gate Reservoir. However, the released sediment would likely exceed the carrying capacity of the river during some water year types, and would result in sedimentation and particle settling downstream in eddies, pools, and the Klamath River estuary. The potential for deposition downstream is dependent on particle size and the water year type in 2020, and subsequent years. In general, sediment transport capacity in a dry year would be small and any downstream sediment deposition would stay in place, until the next substantial series of storms or snowmelt came. In contrast, during a wet year, suspended sediment would be more likely to be carried through the river to the ocean without substantial settling and deposition[4].

To determine how much sediment would be moved through the river, a study compared the settling velocity[5] of the reservoir sediment to the velocity profiles downstream from Iron Gate Dam. Based on the slope of the river and composition of river substrate downstream from the dam, as well as the daily average discharge (approximately 3,000 cfs), the study found that particles with a settling velocity less than 0.23 ft/s have the potential to be mobile as suspended sediment. This corresponds to sediment particles finer than 0.68 mm (coarse sand) (Table 3.11-4; Stillwater Sciences 2004).

[4] Representative dry, median, and wet water years were defined as the 90%, 50%, and 10% exceedance flow volumes for the period from March to June at Keno on the Klamath River. The dry, median, and wet water years were 2001, 1976, and 1984, respectively.

[5] Settling velocity is the rate at which particles suspended in a fluid subside and are deposited. Settling velocity is dependent on gravitational force, the type of fluid, how smoothly and quickly the fluid is flowing, and the particle size and shape.

Table 3.11-4. Estimated Particle Sizes that would be Suspended at Average and Maximum Daily Discharge Rates

Discharge	3,000 cfs	7,000 cfs
Shear velocity	0.58 ft/s	0.76 ft/s
Maximum settling velocity for suspension	0.23 ft/s	0.34 ft/s
Corresponding particle size	0.42 mm	0.68 mm
Corresponding size class	Medium sand	Coarse sand

Source: Stillwater Sciences 2004

Key:

cfs: cubic feet per second (discharge rate)

ft/s: feet per second

mm: millimeters

Modeling conducted by DOI analyzed the deposition rate of the released sediment downstream from Iron Gate Dam for a 2-year period following commencement of drawdown activities. Three types of water year scenarios were analyzed (dry, wet, and average). The results of the modeling found that under all three water year types, fine sediment would be transported downstream as suspended sediment (Reclamation 2012). As described in the Affected Environment, sediment sampling in the reservoirs has indicated that, with the exception of Copco 1, the majority of sediment is composed of fine-grained elastic silt. Therefore, it is expected that deposition would occur in pools or along vegetated area during low-flow periods, but that the deposition would be flushed downstream during high-flow events. Any settling or sedimentation of fine sediment in eddies or pools is expected to be minimal and short-lived. Further, as described in Section 3.11.3.2, Geomorphology, there is no sandbar within the mouth of the Klamath River itself; rather the sandbar is located offshore. As a result, the majority of the suspended sediment load from the river is carried out to sea and does not remain in the estuary itself. The amount of sediment delivered to the ocean in a given year is entirely dependent on the water year type.

In a wet year, the additional sediment load from removal of the dams would be relatively small compared to a dry year. However, the amount of sediment delivered to the ocean following removal of the dams is still expected to be less than the average annual supply. The only reservoir material that would be transported to the estuary would be fine material which is not expected to deposit at the estuary (Reclamation 2012). Downstream from Iron Gate Dam, a substantial increase in sand content is expected in the reach between the dam and Bogus Creek. Sand is expected to increase by up to 40 percent in the month immediately following reservoir drawdown. Under a wet year scenario, the sand would decrease to below 20 percent within a year; however, under a median or dry scenario, a subsequent wet year would be required to flush the sand material from the bed. Downstream from Bogus Creek, it is expected that sand may take longer to be flushed downstream and under dry or median year scenarios it could

take 5 to 6 years for sand in the bed to return to equilibrium levels between Bogus Creek and Willow Creek and up to 10 years between Willow Creek and Cottonwood Creek (Reclamation 2012).

Particles greater than coarse sand would be deposited in eddies and slow-moving pools downstream following dam removal, primarily between Iron Gate Dam and Cottonwood Creek. Under the wet year scenarios, the coarse sediment load would take approximately 15 months (until March 2021) to be completely flushed downstream and into the Pacific Ocean. Although the coarse material would deposit temporarily in slow-moving portions of the river, there would be no substantial change in river bed elevation. In contrast, if drawdown were to occur during a dry year, modeling indicates that substantial deposition would still be present between Iron Gate Dam and Shasta River at the end of the 2-year modeling period. The model results as described in Section 3.3.4.3 indicated that under all three water type scenarios, the only measurable sedimentation will occur in the reach from Bogus Creek (RM 189.6) to Cottonwood Creek (RM 182.1). From Willow Creek (RM 185.0) to Bogus Creek, the reach averaged deposition is expected to be about 1.5 feet and from Cottonwood to Willow Creeks there is expected to be slightly less than 1 foot of deposition. Downstream from Cottonwood Creek, there is less than 0.25 feet of deposition expected and this is considered to be inconsequential (Reclamation 2012). Further, when considered in comparison to sediment loading from other existing sources along the Klamath River (refer to Table 3.11-1 above), the magnitude of the anticipated sediment release from behind the reservoirs is relatively small. A study by Stillwater Sciences (2010) assessed the sediment loading to the Klamath River based on the cumulative sediment load already contributed by tributaries to the river. The numeric modeling predicted high, medium, and low values for reservoir sediment release based on different hydrologic scenarios and the assumed dimensions of the new channel that would be created within the former reservoirs. The model predicted that the median fine-grained and total sediment load released by dam removal would not be substantially more than the cumulative average annual fine-grained and total sediment delivery between Iron Gate Dam and the Scott River. The model also predicted that the overall contribution of reservoir sediment to the river system decreased substantially downstream (Stillwater Sciences 2010).

The total sediment transport capacity of the river was not assessed in the Stillwater Sciences Study, and as such it does not demonstrate that the additional sediment load from dam removal would not deposit in the Klamath River. Rather, the findings of the analysis suggest that the release of sediment downstream during reservoir drawdown would not exceed the existing sediment load added by any tributary, and as such, the transport capacity of the river may be sufficient to transport the additional load, particularly since the river is supply-limited in regards to fine-grained material and sand.

Sedimentation impacts are therefore expected to be short term. The significance of impacts with regard to sediment deposition is dependent on the corresponding impacts of the deposition on aquatic biology (see Section 3.3, Aquatic Resources) and water quality (see Section 3.2, Water Quality). As discussed in these sections, sediment deposition would not result in substantial adverse impacts and no mitigation measures are indicated.

Therefore, impacts with regard to sediment deposition downstream from Iron Gate Dam would be short term and less than significant.

Drawdown of reservoirs could result in changes to seismic or volcanic activity. As described in the Affected Environment, although the Four Facilities are in a historically seismic active area, the nearest active fault is approximately five miles from the dams proposed for removal. It is noted that faults do exist under J.C. Boyle Reservoir. However, these faults are reported not to have moved within the past 1.5 million years and, therefore, are termed as not active (Personius et al. 2003). Under the Proposed Action, the Four Facilities would be removed as described in Chapter 2, Proposed Action and Description of Alternatives. Sediment currently held behind the dams would be released during the same year period. Although there is substantial literature regarding the inducement of seismicity by reservoir filling, little is documented with regard to the drawdown of reservoirs of this size. Consequently, it is not expected that reservoir draining would cause such actions. Reservoir draining is also not expected to cause volcanic activity due to the distance from volcanic hazards (e.g., Mount Shasta). Further, following removal of the Four Facilities, no new structures would be constructed in the project area. **Therefore, the impacts with regard to increased risk of hazards associated with ground rupture or seismic shaking during reservoir drawdown would be less than significant.**

Following dam removal, reservoir sediment remaining could result in changes in the amount of erosion in the river channel. Reclamation 2012 modeled sediment erosion based on representative dry, median, and wet years from the hydrologic period of record between 1961 and 2008. Sediment would continue to accrue in the reservoirs from existing conditions through dam removal. Results indicated that if dam removal occurred during a wet year, up to 57 percent of the reservoir sediment would be eroded. In contrast, if removal were to occur during a dry year, about 36 percent of the sediment would be eroded. The remaining sediment would be expected to remain on the reservoir terraces and dry. However, as discussed in Section 3.11.3.4 (Reservoir Substrate Composition), sediment in the reservoirs is fairly shallow (4-8 feet thick). Therefore, following erosion of the sediment during dam removal, the remaining sediment would be much more like a landscape veneer than a wedge along the newly formed river channel.

Field tests (Reclamation 2012) were conducted to determine the characteristics of dried reservoir sediment. Table 3.11-5 shows a comparison of the depth of wet and dry sediment samples. As the table shows, the desiccated depth of the sample was about 60 percent of the initial depth. Deep cracks developed in the soil and the sample pulled away from the container edges. The estimated reduction in volume of the sample was about 66 percent. The porosity changed from 0.82 to approximately 0.46 and the bulk density increased from 29.5 pounds per cubic foot (lb/ft^3) to approximately 87 lb/ft^3. The bulk density of the dried reservoir sediment would be similar to that of the pre-dam sediment in the reservoir area. Erosion tests conducted by the Agricultural Research Service (Simon and Bell 2010) found that the erosion resistance of dried sediment was more than 10 times higher than the resistance of wet sediment.

Therefore, minimal erosion is expected following completion of reservoir drawdown and dam removal activities. **The impact of dam removal on erosion would be long term but less than significant.**

Table 3.11-5. Comparison of Wet and Dry Reservoir Samples

Container	Initial Thickness (inches)	Final Thickness (inches)	% of Original Thickness
1	7.00	4.25	60
2	7.88	4.63	59
3	4.50	2.75	61

Source: Reclamation 2012.

Following dam removal, reservoir sediments remaining could result in changes to downstream sediment deposition. As discussed above, once dry, the remaining sediment in the former reservoir areas would be unlikely to erode downstream except during storm and other high-flow events. As previously discussed, the Klamath River is supply-limited for fine-grained material. Further, based on the estimated settling velocity of the remaining sediment and average flows during wet years and storm events, it is expected that any eroded sediment would be transported as suspended sediment flushed downstream. **Therefore, impacts of dam removal on downstream sediment supply would be long term, but less than significant.**

Following dam removal, the reservoir sediment remaining would dry and could affect restoration activities and/or future road construction activities. As discussed previously, following dam removal an estimated 44 to 62 percent of the sediment in the reservoirs would remain and is expected to settle on the terraces of the new river channel. Initial sampling conducted on the sediment indicates that once dry, it has a tendency to crack and substantially decrease in porosity. This characteristic would not necessarily limit the range of restoration activities but could limit future construction activities (e.g., access road construction, recreation facilities) that could occur in the former reservoir area. Limitations on future construction due to sediment properties are analyzed in the Reservoir Restoration Study (DOI 2011). **The potential limiting characteristics of the remaining sediment in the reservoirs would be considered a significant impact, but mitigation measure GEO-1 would reduce these impacts to less than significant.**

Following dam removal, diatomite beds near Copco Reservoir would be inaccessible. Under Proposed Action, the ownership of the reservoir land would be transferred to the Dam Removal Entity (DRE). After transfer it is likely that the DRE would not allow access to the diatomite beds for commercial extraction. Additionally, any paleontological resources potentially contained within the diatomite beds would remain inaccessible. **Therefore, there would be no change from existing conditions for diatomite beds under the Proposed Action because the resources would continue to be inaccessible.**

Following reservoir drawdown, recreational facilities currently located on the banks of the existing reservoirs would be removed. The existing recreational facilities provide

camping and boating access for recreational users of the reservoirs. Once the reservoirs are drawn down, these facilities would be removed. The removal of the recreational facilities would not affect sediment supplies, contribute substantially to erosion, or expose people or populations to geologic hazards. **Therefore, there would be no change in the existing conditions of geology, soils, or geologic hazards as a result of the recreational facilities.**

Keno Transfer

The Keno Transfer could have adverse effects to geology, soils, or geologic hazards. The Keno Transfer is a transfer of title for the Keno Facility from PacifiCorp to the DOI. This transfer would not result in the generation of new impacts on geology and soils compared with existing facility operations. Following transfer of title, DOI would operate Keno in compliance with applicable law and would provide water levels upstream of Keno Dam for diversion and canal maintenance consistent with agreements and historic practice (Klamath Hydroelectric Settlement Agreement [KHSA] Section 7.5.4). **Therefore, the implementation of the Keno Transfer would result in no change from existing conditions.**

East and Westside Facilities – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects to geology, soils, or geologic hazards. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate water flows currently diverted at Link River Dam into the two canals, back in to Link River. Redirection of flows would not change sedimentation rates in Upper Klamath Lake and the action would have no impact to geology and soils. **Therefore, the decommissioning of the East and Westside Facilities would result in no change from existing conditions.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Following reservoir drawdown, the City of Yreka Water Supply Pipeline would be relocated. The existing water supply pipeline for the City of Yreka passes under the Iron Gate Reservoir and would have to be relocated prior to the decommissioning of the reservoir to prevent damage from deconstruction activities or increased water velocities once the reservoir has been drawn down. The pipeline would be suspended from a pipe bridge across the river near its current location. The construction of a pipe bridge would not affect sediment supplies, contribute substantially to erosion, or expose people or populations to geologic hazards. **Therefore, there would be no change in the existing conditions of geology, soils, or geologic hazards as a result of the pipeline relocation.**

KBRA – Programmatic Measures

The KBRA has one element that could result in changes to geology, soils and geologic hazards:

- Phases I and II Fisheries Restoration Plans

Phases I and II Fisheries Restoration Plans

Implementation of the Phase I and Phase II Fisheries Restoration Plans could result in construction related sediment erosion. Several ongoing resource management actions related to fishery health and water quality may be amplified under the Phase I Plan (Section 2.4.3.9). The following sections describe the ongoing actions and types of new programs that could be implemented, and their anticipated short-term and long-term effects at a programmatic level.

Floodplain Rehabilitation

Floodplain rehabilitation work would include activities to improve or restore connections between channels and floodplains to create and maintain off-channel habitat accessible to overwintering juvenile salmonids. In the short term (i.e., during construction activities), these activities may involve the use of backhoe equipment to dig channels, remove/reposition levees and dikes, and conduct mechanical planting. These construction activities could result in increased erosion as a result of ground disturbance. In the long term, increased seasonal off-channel habitat, wetland restoration, and levee setbacks, may reduce sediment erosion due as a result of potential reduction in flood flow velocity in some flood events through the reestablishment of floodplains.

Woody Debris Placement

In-stream and streambank large woody debris placement may include both mobile wood (i.e., unanchored) and complex stationary (i.e., anchored) structures and may be used to create off-channel fish habitat or provide cover in deeper pools. In the short term, these activities may involve the use of construction equipment to place large wood in the stream channel or along banks. These activities could result in increased erosion as a result of ground disturbance in construction staging areas and on the stream banks and in the streambeds.

Fish Passage Correction

Correction of fish passage issues throughout the Klamath Basin may include culvert upgrades or replacement to meet current fish passage standards and correction of other fish blockages to restore access to new or historical habitats. In the short term, these activities may include in-channel construction of culverts through existing roadways, which could result in increased erosion as a result of ground and riverbank disturbance.

Mechanical Thinning and Prescribed Burning

Mechanical thinning and prescribed burning of upland forest areas may be used to mimic some of the functions and characteristics historically provided by a natural fire regime. In the short term, thinning and prescribed burning could increase sediment erosion through reduction in groundcover. In the long term, thinning and prescribed burning may reduce the potential for catastrophic fires and the associated high rates of erosion and nutrient release (primarily phosphorus) to tributaries and the main-stem Klamath River.

Road Decommissioning

Road decommissioning would reduce road densities in areas with a high potential for slope failure and would stabilize hillsides. In the short term these construction activities could result in increased erosion as a result of ground disturbance. In the long term, these activities would decrease the incidence of road failure and would minimize a source of landslide and erosion generated input of sediment into water bodies in the Klamath Basin.

Gravel Augmentation

Gravel augmentation involves the direct placement of spawning size gravel into the stream channel. Gravel augmentation can increase spawning habitat in systems by increasing the amount of area with suitable substrate. Gravel augmentation activities may involve transportation of gravel from an off-site source using dump trucks and placement in the stream using backhoes. In the short term, this could introduce fine sediments into the river channel. Depending on the water year during which gravel augmentation takes place, this sediment could result in temporary deposition downstream.

Summary

Construction actions including the operation of construction equipment and the associated soil disturbance could result in erosion into the active river channel and could cause new or exacerbate existing landslide areas. Additionally, gravel augmentation could result in temporary sediment transport and deposition downstream from the construction site. Construction activities associated with the Restoration Plan would not occur in the same location or at the same time as hydroelectric facility removal. Therefore, erosion effects would not add to potential effects of dam removal activities. However, negative short-term effects of increased sediment erosion, and landslides generated by the restoration plan's construction activities could occur, but would be reduced by construction-related BMPs that would be implemented. **Given implementation of BMPs (see Appendix B), the short-term effects on sediment erosion and landslides and would be less than significant. In the long term, implementation of the Phase I and II Fisheries Restoration Plans would be expected to generate a beneficial reduction in sediment erosion through improved river channel stability, and generate no change from existing conditions for landslides**. **Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

3.11.4.3.3 Alternative 3: Partial Facilities Removal of Four Dams

Under this alternative, short-term demolition activities and drawdown of reservoirs would still occur; however, demolition would consist only of in-stream facilities and select ancillary facilities. Impacts to soils and sediments would be the same as those described for the Proposed Action.

Keno Transfer

The geology and soils impacts of the Keno Facility Transfer under the Partial Facilities Removal of Four Dams Alternative would be the same as for the Proposed Action.

East and West Side Facility Decommissioning – Programmatic Measures

The geology and soils impacts of the east and west side facility decommissioning under the Partial Facilities Removal of Four Dams Alternative would be the same as for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the relocating the City of Yreka's Water Supply Pipeline would be the same as those described for the Proposed Action.

KBRA – Programmatic Measures

Under this alternative, the KBRA would be fully implemented; therefore, impacts to soils and sediments would be the same as those described for the Proposed Action.

3.11.4.3.4 Alternative 4: Fish Passage at Four Dams

Short-term construction under the Fish Passage at Four Dams Alternative could change erosion patterns. Under this alternative, no demolition of the Four Facilities would take place; however, short-term construction activities would occur during installation of fish passage at the four dams. The potential exists for short-term increases in erosion along the banks of the reservoirs during construction activity. Prior to any construction, coverage under General Stormwater Permits and the development and implementation of Erosion and Sediment Control Plans would be required as per Section 402 of the Clean Water Act. **Accordingly, erosion impacts would be short term and less than significant.**

Under the Fish Passage at Four Dams Alternative, J.C. Boyle, Iron Gate, and Copco 1 Reservoirs would continue to trap sediment at rates similar to historical rates. The reservoir drawdown and sediment transport impacts described under the Proposed Action would not occur. **The reservoirs would continue trapping sediment and there would be no change from existing conditions.**

Under the Fish Passage at Four Dams Alternative, the Copco 1 Reservoir would continue to prevent access to the diatomite beds. Diatomite resources and any associated paleontological resources are currently inaccessible due to the presence of the Copco 1 Reservoir. **There would be no change from existing conditions for the diatomite beds because the resources would continue to be inaccessible.**

3.11.4.3.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Reservoir drawdown could cause instability along the banks of the reservoirs, reservoir bank instability, and construction generated erosion. Under this alternative, only Iron Gate and Copco 1 Dams would be removed and fish passage would be installed at Copco 2 and J.C. Boyle Dams. Impacts associated with short-term construction and demolition activities would be as described for the Proposed Action. **Impacts associated with reservoir drawdown and sediment transport would be similar to the impacts**

described for the Proposed Action. However, the magnitude of any impacts would be less than described for the Proposed Action due to the retention of sediment behind J.C. Boyle and Copco 2 Dams.

Following dam removal, the diatomite beds near Copco Reservoir would become more accessible. Diatomite resources and any associated paleontological resources are currently inaccessible due to the presence of the Copco 1 Reservoir. **Therefore, there would be no change from existing conditions for the diatomite beds because the resources would continue to be inaccessible.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the relocating the City of Yreka's Water Supply Pipeline would be the same as those described for the Proposed Action.

3.11.4.4 Mitigation Measures

3.11.4.4.1 Mitigation Measure by Consequences Summary

Mitigation Measure GEO-1 – Prior to commencing construction of new recreation facilities or access roads in the former reservoir areas, geotechnical analysis of the proposed site should be conducted by a qualified geologist to determine the limitations of construction on the sediment. If geotechnical tests indicate that the sediment is not suitable to accommodate the proposed activities, the site should be avoided or a sediment removal or treatment plan should be developed and sediment should be removed prior to beginning construction activities.

Effectiveness of Mitigation in Reducing Consequences

Implementation of Mitigation Measure GEO-1 would ensure that any remaining sediment in the former reservoir areas are appropriately studied and dealt with prior to construction, such that any future proposed activities do not result in significant erosion or sedimentation downstream.

Agency Responsible for Mitigation Implementation

The Dam Removal Entity would be responsible for implementing mitigation measure GEO-1.

Remaining Significant Impacts

Following implementation of GEO-1, no significant adverse impacts associated with Geology and Soils are anticipated. If the deposition of reservoir sediment downstream resulted in adverse impacts to fish habitat or habitat for other aquatic species, impacts would be considered significant. The potential for such impacts and mitigation for them have been addressed in the relevant chapters of this EIS/EIR.

Mitigation Measures Associated with Other Resource Areas

Several other mitigation measures require construction, including mitigation measures H-2 (flood-proof structures), GW-1 (deepen or replace affected wells), WRWS-1 (modify or screen affected water intakes), REC-1 (develop new recreational facilities and access to river), TR-6 (assess and improve roads to carry construction loads), and TR-7 (assess

and improve bridges to carry construction loads). These measures could disturb soil because of construction activities associated with heavy vehicle use, excavation, and grading. Prior to demolition, coverage under the General Stormwater NPDES Permit for Construction Activities in both Oregon and California would be required as per Section 402 of the Clean Water Act (refer to Section 3.2, Water Quality, for more information). Coverage under this permit requires the development and implementation of an Erosion and Sediment Control Plan for each reservoir area. Implementation of these plans would minimize the potential for erosion during demolition activities. **These impacts would be short term and less than significant.**

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3.12 Tribal Trust

Indian trust resources consist of certain real property, natural resources and related rights, held in trust by the Federal Government for federally recognized Indian Tribes or individual Indians. Trust resources and rights cannot be sold, leased, or otherwise encumbered without approval of the United States. Trust resources attributed to tribes are called "tribal" trust resources, and trust resources attributed to individual Indians (usually called "allottees") are called "individual" trust resources. Some tribes have the trust right to use resources that are transitory or migratory in nature and that move beyond the reach of Federal or tribal management (e.g., fish and water). In such cases, it is a tribe's ability to access, use, and obtain sufficient quantities of those resources that is the trust resource. This right to obtain trust resources does not necessarily exclude other users from access to the resource. For additional information on Water Rights/Water Supply related to Tribal Trust, see Section 3.8.

In the case of the Klamath Basin Indian Tribes, the Federal Government has the responsibility to safeguard the fishery to ensure that tribes with fishing rights are able to practice those rights. Water quality and quantity are essential for success of a safeguarded fishery, with some Klamath Basin tribes also maintaining federally recognized water rights. Tribes of the Klamath Basin also use resources that may not meet the legal definition of trust resources. These resources are referred to as resources traditionally used by tribes. Resources traditionally used by tribes are those that are related to tribal cultural values associated with a tribal way of life that may not meet the definition of a trust resource, but which may or may not be entitled to legal protection under statute, regulation, or other law or regulation. Although the tribes of the Klamath Basin share many cultural values, their histories and practices are not necessarily the same. Thus, each of the six tribes may have its own set of resources that it considers important to the formation and maintenance of its culture but that the United States does not currently regard as a trust resource.

In addition to trust responsibility associated with trust resources, the Federal Government has a government-to-government relationship with federally recognized tribes based on, or otherwise arising from, treaties, statutes, executive orders and the historical relationship between the United States and Indian tribes. Cultural values related to a tribal way of life centered on rivers and lakes are composed of myriad values, styles, practices, resources, and items transmitted and evolving through time that together define the unique identities of the Yurok, Hupa, Karuk, Shasta, Klamath, Modoc, and Yahooskin (a band of Snake) cultures. Cultural values more specifically can be described as the unique manner in which tribal people access, take, prepare, administer, consider and otherwise use natural resources in unique tribal ways. To the extent that such resources and related values are diminished by ecosystem degradation, related cultures are also degraded and cultural transmissions become inhibited, which can contribute to the detriment of the mental, spiritual, and physical health of the Indians of the Klamath Basin.

This section provides a history of the Indian Tribes of the Klamath Basin, their salmon based economy and barter system, their trust resources, other resources traditionally used by the tribes, and traditional cultural practices associated with these resources. This section also documents the effects of the Klamath Hydroelectric Project dams on these resources and values and also reflects the replacement of a salmon based economy (cyclic based upon nature and natural occurring events) with that of an industrial economy (dams). The information presented in this section is primarily drawn from two 2011 United States Department of the Interior (DOI) reports: 1) Current Effects of Implementing the Klamath Hydroelectric Settlement Agreement (KHSA) and Klamath Basin Restoration Agreement (KBRA) on Indian Trust Resources and Cultural Values (2012); and 2) Potential Effects of Implementing the KHSA and KBRA on Trust Resources and Cultural Values[1] (2011).

As part of the studies, government-to-government consultations were conducted with the six basin tribes to solicit input from the tribal governments regarding their assessment of effects on Indian trust resources, tribal rights to take those resources, other resources traditionally used by tribes, and cultural values related to those resources and rights within the study area resulting from the current operations of the Klamath River. The reader should note that inclusion of any claims and assertions put forth by these tribes does not necessarily imply that the U.S. government endorses those views.

Three rounds of consultation meetings were held between the DOI and each of the six tribal governments The purpose of the first consultation meetings (Round 1) was for DOI to describe the study process of the elicit information about the histories and backgrounds of the tribes, and discuss how the dams might be currently affecting their resources and rights and related cultural values. In response, the Yurok, Resighini, Karuk, and The Klamath Tribes provided comprehensive background documents (DOI 2012 appendix X, Y and Z). The Round 2 meetings were conducted to collect comments from the tribes concerning the two technical reports and the potential effects of the Dams In Scenario and the Dams Out Scenario on their trust and other resources and rights. In Round 3, DOI sought comments from the tribes on the first draft of the Potential Effects of Implementing KHSA and KBRA on Trust Resources and Cultural Values Reports. For additional details on government to government meetings between DOI and the Klamath Basin Tribes, please see Chapter 7 Consultation and Coordination.

3.12.1 Area of Analysis

The area of analysis for Indian trust resources and other traditional resources includes the entire 263 miles of the Klamath River and the Klamath Basin.

[1] Unless otherwise cited the information in this section is drawn from these reports.

3.12.2 Regulatory Framework

Tribal Trust, within the area of analysis are regulated by several Federal laws and policies, which are listed below.

3.12.2.1 Federal Authorities and Regulations

- American Indian Religious Freedom Act
- Federal Power Act
- Executive Order 13007
- Executive Order 13084

3.12.3 Existing Conditions/Affected Environment

The information presented in this section is primarily drawn from the 2011 and 2012 DOI reports on Indian trust resources and cultural values in the study area. These reports identify Indian trust resources in the study area and document the effects of the Klamath River dams on those resources. Where no citations appear in Section 3.12.3, the information and discussion presented is based on the 2011 and 2012 DOI reports. Section 3.13, Cultural and Historical Resources, presents additional information regarding the Indian Tribes in the area of analysis.

This section presents individual histories of the six tribal governments in the study area. The federally recognized tribes in the study area include The Klamath Tribes, Quartz Valley Community, Karuk Tribe, Hoopa Valley Tribe, Yurok Tribe, and Resighini Rancheria. These tribes live along different reaches of the Klamath River and in different areas of the Klamath Basin. Each tribe has a unique history of its long-term occupation and use of the study area and establishment of its tribal government, reservations, rancherias, or other tribal lands. The section is organized by tribe to highlight the tribes' individual histories and to identify the specific Indian trust resources of each tribe and the impacts of the Klamath Hydroelectric Project on those trust resources.

3.12.3.1 The Klamath Tribes

3.12.3.1.1 The Klamath Tribes History

The Klamath Tribes are composed of three historically separate tribes: the Klamath Tribe, the Modoc Tribe, and the Yahooskin band of Snake Indians. The current membership is about 3,400 and the current total land base is approximately 600 acres[2].

The Klamath Tribes Treaty of 1864 (16 Stat. 707) (Treaty) was signed in the Wood River subbasin on October 14 near modern-day Fort Klamath. The Klamath Tribes signed the treaty, ceding more than 22 million acres of their traditional territories to the United States. These ceded lands included much of south-central Oregon as well as portions of north-central California. Based on the language in the Treaty, from the date the Treaty was signed the Klamath, Modoc, and Yahookskin became known as The Klamath Tribes.

[2] As discussed below, the land base of the Klamath Tribes was substantially eliminated as the result of the United States' Termination Policies of the 1950s.

Under the Treaty, approximately 1.9 million acres, primarily Klamath ancestral lands, were retained for the Klamath Indian Reservation. As a result, the Klamath Reservation was the largest reservation in the State of Oregon. Under the Treaty, The Klamath Tribes also reserved the rights to hunt, fish, trap, and gather plants throughout the reservation in perpetuity.

In 1887, Congress passed the General Allotment Act, which fundamentally changed the nature of land ownership on the Klamath Reservation. Under the allotment system, approximately 25 percent of the original Klamath Reservation passed from tribal to individual Indian ownership over a number of decades. Subsequently, many of these individual Indian-owned allotments passed into the hands of non-Indians.

The construction of Copco 1 Dam in 1918 and the resulting loss of anadromous fish had disastrous effects on The Klamath Tribes; however, The Klamath Tribes continued to harvest staple fish, game, and plant materials both on and off-reservation.

In 1954, as part of a nationwide effort to assimilate Indian Tribes into the cultural and economic mainstream, the Federal Government chose The Klamath Tribes for the experiment of "termination," and enacted the Klamath Termination Act (25 USC §564, et seq.). The Klamath Tribes were chosen in part because of their self-sufficiency, which was due, in part, to the resource harvest; however, termination ultimately resulted in separating the Tribes from the factors that had enabled their self-sufficiency.

Throughout the termination process, the United States divided the reservation into large timber tracts, intending to sell them to private timber companies; however, for various reasons, only one such tract was actually sold, and the government found it impossible to dispose of the others. In 1961, the United States itself purchased large forested portions of the former Klamath Reservation. This forestland became part of the Winema National Forest under the jurisdiction of the United States Forest Service. The balance of the reservation was placed in a private trust for the "remaining" tribal members who had opted to retain an interest in the tribal lands. In 1973, these remaining Indian lands were condemned and purchased by the government, and added to the Winema National Forest.

Termination ended The Klamath Tribes' status as a federally recognized Indian Tribe, dissolved the Federal recognition of the tribal government, and nullified some Federal fiduciary responsibilities to the tribal community. It did not, however, dissolve the Tribes' own government and social organization, and did not convert Indians into non-Indians... The social, economic, and cultural consequences of termination were both significant and complex and are generally viewed as dire by Klamath Tribes' members.

Reservation employment and benefits disappeared, and access to traditional lands and resources quickly eroded. Control over irrigation water supporting tribal farms diminished as well, as government-owned irrigation infrastructure was privatized and fell into non-Indian control. Under this Termination Act, tribal members were encouraged to give up their interest in tribal property in return for cash. A large majority of the tribe chose to do this. A provision of this Act continued the Indians' right to hunt, fish, trap,

and gather on the former reservation land. Cash payments for liquidated tribal assets were distributed irregularly within the tribal community, and those lands retained by tribal members were often lost to taxes and acquired by non-Indians. In addition, some non-Indian merchants, lawyers, and business people took advantage of the situation to engage in unscrupulous practices that hastened the transfer of this wealth away from tribal members. Once a model of economic self-sufficiency, the former members of The Klamath Tribes now had poverty levels that were three times those of their non-Indian neighbors.

Over the next three decades, tribal members and their families continued to reside principally on former reservation lands. Despite the loss of tribal lands, most continued to practice traditional subsistence harvests of game, plants, and fish, especially within the former reservation boundaries. Today The Klamath Tribes have re-acquired about 600 acres of their former reservation. The United States holds title to approximately 70 percent of the former reservation lands.

On August 26, 1986 The Klamath Tribes officially regained Federal recognition under the Klamath Restoration Act (25 USC §566, et seq.). However, the Restoration Act did not restore The Klamath Tribes' former reservation lands and tribal efforts to regain a tribal land base continue.

The Tribes are now acquiring lands in the former reservation as they can and are placing them in Federal trust. Significantly, for the present discussion, restoration did not restore to the Tribes the anadromous fisheries lost due to the construction of Copco 1 Dam and the other Klamath River dams. The tribal members continue to practice their cultural traditions, including traditional subsistence practices and related ceremonies. The Tribes maintain active natural and cultural resources departments.

3.12.3.1.2 The Klamath Tribes' Cultural Practices

Fishing

The Federal courts have confirmed that The Klamath Tribes' hunting, fishing, gathering, trapping, and water rights survived Termination. These resources, especially fish, have played a central role in the physical, social, and spiritual well-being of the Klamath people for millennia. The Klamath Basin from Link River to the headwaters of the Wood, Williamson, Sprague, and Sycan River subbasins once had an almost continuous geographical distribution of traditional sites and activities including resource harvest areas, ceremonial sites, and burials areas, which surrounded the major population centers.

The Klamath Tribes relied heavily on upland game (e.g., deer, elk, and pronghorn antelope) and plant foods (e.g., yampah, wild plum, and many other fruits and berries), but riverine and especially marsh resources were of equal importance. Salmon and multiple species of sucker, trout, eel, lamprey, mussels, and other fish were dietary staples, while marsh and riparian plants, such as the yellow pond lily (Wocus or Wokus), tule, cattail, and willow provided staple foods and materials for essential tools and crafts. The Klamath, Modoc, and Yahooskin traditionally recognized all of the plants and animals of their traditional territory as possessing their own spiritual powers; tribal

members took active steps from ceremonial activities to active management techniques to maintain respectful relationships with the species on which they most depended to ensure that the species would return abundantly in future years. These ritual activities were an essential part of the ceremonial tradition of the historical Klamath Tribes, and they have continued into the modern day.

The confluence of Spencer Creek and the Klamath River was a particularly important salmon fishing site for the Modoc tribe. The site also afforded fishing opportunities that were rare downstream from the Link River because of natural shallows that obstructed the salmon during low-water years until levels began to rise from springtime snowmelt. Salmon were speared there in large numbers. In the 19th century, Modocs still gathered there and "pulled salmon out with pitchforks" just downstream from this shallows. Captain Jack, leader of the Modocs during the Modoc War, was said to have fished the Klamath Canyon extensively and most commonly fished Spencer Creek. Following the Modoc War, some Modoc families maintained ties to the area. For example, Indian women married to white men stayed in the area, providing a lasting foothold in the Klamath River corridor.

Klamath Canyon, particularly the zone from Spencer Creek downstream, was a major historic center of settlement, salmon procurement, and trade for the Klamath and Modoc Indians. During salmon fishing time, Klamaths, Shastas, and Modocs occupied separate groups of structures within larger, multi-tribal communities. The communities along the Klamath Canyon floor were important centers of social, ceremonial, economic, and political activity timed to coincide with the peak salmon harvest. The presence of fish at sites downriver from the Upper Klamath Basin drew some Modocs and Klamaths downstream into the canyon; but since some fish worked their way into the Upper Basin, Klamaths and Modocs did not have to go to the canyon to fish.

Salmon were numerous throughout much of The Klamath Tribes' traditional territory, including the Upper Basin. The fish were commonly said to arrive in runs so large that "it looked like you could walk across their backs;" and the fish were packed so tightly in shallow river channels that they could be speared with ease. Klamath men used spears to catch fish, and, during the 19th and early 20th centuries, it was common knowledge that the large numbers of salmon thrashing in the Sprague, Williamson, Link, and Wood River basins would "spook the horses" and people understood not to ride close to the rivers during salmon runs to avoid being thrown. Because salmon were numerous and relatively ubiquitous, the location of fishing stations reflected not wholly the extent of fish distribution, but rather areas convenient for fishing, such as naturally available shallows where fish could be easily speared, natural barriers that caused the fish to become "bunched up," nearby settlements and secondary resources, springs and spawning grounds, and other factors that influenced the locations of salmon fishing within the Klamath and Modoc territories.

Historically, The Klamath Tribes fished not only for salmon and steelhead, but also for mullet, suckers, trout, sturgeon, eels, and lamprey. Anadromous lampreys were harvested in large numbers during salmon season, often being gigged or speared. Most

large-scale fishing within the Upper Klamath Basin was timed to coincide with salmon runs, but all species were taken at these times and places. Salmon and mullet appeared at roughly the same times and at the same places. Trout also appeared with these fish to consume the spawn of both species. Together, these fish provided a tremendous, dependable food resource for the Klamath and Modoc people.

Detailed environmental knowledge once guided tribal member movements to and between salmon fishing sites, and some of this knowledge persists today. They knew which fishing stations and which riffles would provide the right conditions for salmon fishing based on the level of the water in front of their home village. Today, experienced Klamath fishermen still possess the knowledge of how water levels near their home relate to the exposure or submersion of riffles as well as general fishing conditions at trout-fishing sites.

Salmon-fishing sites were usually accompanied by settlements or seasonal encampments. Many of the largest Klamath and Modoc winter villages were close to large salmon fishing stations. The Indians said, “where the fish were, we were.” Springtime salmon fishing marked the end of the lean winter months, and the proximity of winter villages to salmon fishing sites ensured that salmon would be detected and thus available from the onset of each year’s spring migration. Although late spring and summer involved other subsistence activities far from these villages, the fall Chinook salmon run was said to draw people back to many of these villages. The success of fall fishing had major implications for a community’s food supplies when alternative resources were limited, and a poor fall salmon run indicated a potentially difficult winter ahead. Salmon thus occupied a crucial position within the seasonal round, with salmon runs marking both the beginning and the end of annual resource procurement.

Multi-village and multi-tribal gatherings centering on the salmon harvest were important social and ceremonial events. The movement of the tribes associated with the salmon runs shaped much of Klamath and Modoc social life: “Early spring finds them leaving for favorable fishing stations where there are successive fish runs,” one local reported. Salmon fishing at certain productive fishing stations, such as those on the Klamath Canyon, Link River, and Beatty Springs, were “where you met the person you were going to marry.” Gambling contests, races, and group dances were facilitated by these large gatherings of families from different villages. Dried salmon was used in trade, particularly with interior populations such as Paiutes and interior Pit River bands, providing the Klamath and Modoc with access to trade goods from these interior locations. Mobility and social diversity of the population participating in the salmon harvest fostered multi-tribal gatherings even at sites quite distant from salmon-fishing stations. For example, Tule Lake villages, including those at the Lava Beds, served as a stopover point for Modocs, Paiutes, and other tribes traveling to and from the Klamath Canyon to catch or barter for salmon.

Salmon was also typically shared within the community. Tribal members typically caught surplus salmon to feed the elderly, children, and those with disabilities who were unable to participate in the salmon harvest. This practice also appears in classic

ethnographic studies of The Klamath Tribes and is an ongoing one today. This redistribution of the salmon catch cemented social bonds within and between communities, in addition to ensuring food security in the community as a whole. These practices are still a source of pride among many tribal members today. Young people still share the catch of other fish species, especially trout and mullet, in the traditional manner. "You always give away fish to the elders…you always give away the first deer you kill…our grandparents taught us that and young people still need to listen to that," a tribal member described. Young men who go on salmon fishing trips outside of the Upper Klamath Basin also redistribute modest quantities of salmon among tribal members, and such salmon is highly prized. Young people "always drop by to drop off fish" after these long-distance fishing trips, said one tribal member. Access to fishing sites and fishing gear is viewed as essential to a family's security; some tribal members mentioned that they have inherited fishing gear from their elders, which is understood as a sign of one's obligation to continue fishing for the extended family in the elder's absence.

Affidavits of tribal members compiled in the early 1940s suggest that between one-half and one-sixth of the aboriginal diet consisted of salmonid fish. Rates of salmon consumption likely varied over time and between individual communities and households, but a review of both written accounts and contemporary oral histories suggests that salmonid fish were consumed in large quantities by most Klamaths and many Modocs as a dietary staple.

Salmon was an essential part of the Klamath Basin ecology, with salmon carcasses in particular providing food for many species of animals and nutrients that facilitate the health of marsh plant communities. Tribal members identified the following effects associated with a reduction in salmon:

> "When the salmon leave, everything else falls apart."
> "A lot of other fish started to disappear as soon as the salmon were gone."
> "Trout fed on the salmon spawn…once the salmon were gone, they went after the sucker spawn more…and then there weren't as many trout and suckers."

The Klamath Tribes' members also report that their ancestors used to manage fish populations. Staple fish, such as salmon, trout, mullet, and suckers were harvested according to a rule that "you should never take more than you needed…you take what you need, then quit" and this rule still guides the actions of tribal members today. Chub and other species were known to eat salmon and trout eggs, and increases in chub populations corresponded with subsequent decreases in salmon and trout populations. For this reason, when fish populations were thought to be out of balance, men sometimes intentionally caught large numbers of chub and tossed them onto the banks to be eaten by birds and other creatures. This practice is said to have continued into the 20th century.

Religious Practices

Salmon played an important ceremonial and religious role in Klamath and Modoc culture. The tribes have creation stories that relate to salmon fishing and salmon fishing

sites, and most of the large salmon fishing dams were historically viewed as the handiwork of the Creator, *Gmukampc*. "…the special creation of [*Gmukampc*] was man, and whatsoever stands in direct connection with his existence, welfare, and customs, as fishing places…," noted ethnographer Gatschet (1890). Gatschet further notes that events in Klamath oral tradition were sometimes said to center on *tsiäls-hä'mi*, ("salmon time") that is part of the Klamath seasonal round.

It is understood by The Klamath Tribes that salmon possess a spirit and that this spirit must be respected and honored in order to ensure the return of the fish. Salmon fishing was guided by certain protocols, which acknowledged the belief that the fish possessed a spirit and sentient qualities. For example, unused portions of fish carcasses were put back in the water "so that they will come back" in following years. Tribal members also conducted first salmon ceremonies at the beginning of each year's run to ritually distribute salmon flesh and honor the salmon. These ceremonies could last two or three days, and involved large salmon feasts celebrating the return of the salmon and the end of winter hunger. Currently, traditional ritual activity continues by The Klamath Tribes' members to ritually ensure the return or resuscitation of salmon, mullet, and other important species and to influence water levels and water quality for the benefit of fish.

Oral Traditions

The Klamath Tribes' oral traditions, including the "*Gmukampc* tears down the fish dam" story, are said to impart teachings that still guide tribal members in dealing with moral or ethical dilemmas. These stories are tied to particular landscape features that are prominent in the vicinity of traditional salmon fishing sites. In some cases, certain landscape features of religious significance distant from salmon fishing sites also possess ceremonial associations with salmon fishing. These oral teachings relate to salmon fishing and impart lessons from *Gmukampc*, the Creator, regarding fundamental moral and ethical principles. One principal story reflects The Klamath Tribes' sentiments regarding the Klamath Hydroelectric Project and its effects on fish populations and their ability to acquire fish:

> The people who lived there [below the Chiloquin forks] had a big fish dam. They got greedy and kept building it higher, catching all the fish until no fish could get past them…the people upstream couldn't catch anything and were starving. They said the Creator got angry…and he asked the animals to help him tear down the dam….After the dam was gone, the people were all turned into rocks…they got punished. People fishing there could always see those rocks…it reminded them. (Spier 1930)

3.12.3.1.3 The Klamath Tribes' Potentially Affected Trust Resources

A government-to-government consultation meeting concerning the effects of current Klamath River dam operations on The Klamath Tribes' trust resources and other resources traditionally used by The Klamath Tribes was held on October 4, 2010. A variety of trust resources have been affected by current dam operations; however, the

meeting focused on The Klamath Tribes' fish resources and water conditions that relate to the health of the fishery. Table 13.12-1 identifies trust resources and rights associated with The Klamath Tribes.

Table 3.12-1. Effects of Current Dam Operations on Klamath Tribes Trust Resources and Rights

Trust Resource/Right	Effects
Water resources	Poor flow management (e.g., peaking regimes, flow pulses, flow homogenization, aquatic ecosystem functionality)
	Altered water temperature regime
	Reduced bedload sediment transfer in the Project Reach (JC Boyle to Iron Gate Dam) until about the Shasta River.
	Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
Aquatic resources	Loss of habitat
	Less suitable water temperature regime
	Reduced bedload transfer
	Increased potential for disease/parasites
	Reduced population size
Terrestrial resources	Reduced food availability
	Loss of riparian habitat

Source: DOI 2011, DOI 2012

Among the anadromous fish The Klamath Tribes used as staple foods are fall and spring Chinook salmon, steelhead, Pacific lamprey, and possibly coho and sockeye salmon. These fish entered the Klamath Reservation along the drainages of the Sprague, Williamson, and Wood Rivers and were also found in the open waters of Upper Klamath Lake. Historically, The Klamath Tribes also depended on a variety of other resident fish species, primarily the adfluvial and resident rainbow trout, *c'waam* or Lost River sucker, and *koptu* or shortnose sucker, cutthroat trout, Klamath smallscale sucker, Klamath largescale sucker, Pit-Klamath brook lamprey, blue chub, tui chub, and speckled dace. Although the exact quantity of fish historically consumed by The Klamath Tribes is difficult to establish, anadromous salmonids were staple foods. Anadromous salmonids were the focus of extended multifamily fishing operations often lasting weeks or months, and were an important source of wealth and stability to The Klamath Tribes prior to the construction of Copco 1 Dam in 1918.

The construction of Copco 1 Dam blocked anadromous fish runs into the Upper Klamath Basin and abruptly ended The Klamath Tribes' access to all anadromous fish. Two other major fisheries, adfluvial and resident salmonids (trout) and Catostomids (suckers), could still be used by The Klamath Tribes after the demise of the anadromous fisheries. The catostomid fishery consisted primarily of *c'waam* (Lost River sucker) and *koptu* (shortnose sucker) until the Tribes closed their fishery in 1986 to protect it in the face

of severe population declines. This move by the Tribes in turn prompted the Federal Government to list these fish as endangered in 1988 under the Endangered Species Act. As the only surviving tribal fishery, adfluvial and resident salmonids today represent an invaluable resource to tribal members.

Water quality and flows in the Klamath River and its tributaries associated with current dam operations are an important issue to The Klamath Tribes. Water conditions affect the ability of anadromous fish species to survive. The Klamath Tribes retain a right to instream water quantities in on-reservation and off-reservation locations at levels that are sufficient to support fishing and other harvest rights on former reservation lands, as affirmed in 1984 with the 9th Circuit Court of Appeals' decision in United States v. Adair, 723 F.2d 1394. A number of ritual traditions of The Klamath Tribes depend on access to clean water from natural sources, which is used in ritual purification of people, places, and objects, as well as in rituals associated with drought abatement and other environmentally restorative activities. However, the water of the Klamath River is widely viewed as inappropriate for these ritual uses because of the effects of the dams on water temperature, algae development, and other variables of water quality.

The current operations of the Klamath River dams have had a range of secondary effects on The Klamath Tribes. Among these effects are the decline of fish and wildlife in addition to the loss of cultural and social practices, diminished economic opportunity, and negative health effects resulting from dietary changes that became necessary with the loss of traditional food sources.

Tribal oral tradition suggests that the timing of catostomid (sucker) and trout population declined following the extirpation of anadromous salmonids, reflecting partial dependence of these resident fish on marine protein from salmonid sources. In recent interviews, numerous tribal members noted that the once-abundant numbers of these other culturally significant species have diminished, attributing this change in part to the absence of anadromous fish within the Upper Klamath Basin. Recent studies have confirmed that no fewer than 137 other wildlife species depend on salmon consumption for some portion of their life cycle, drawing sustenance from smolts, adult salmon, or salmon carcasses. Subsistence fish and wildlife species affected by the absence of salmon include, but are not limited to, black bear, mule deer, and a large number of waterfowl species. Several salmon-dependent wildlife species are of traditional cultural significance to members of The Klamath Tribes beyond their subsistence value, including but not limited to the Bald and Golden eagles, coyote, cougar, American marten, weasel, bobcat, red and gray foxes, northern river otter, various bat species, raven, crow, red-tail hawk, blue jay, and a variety of songbirds.

Many non-salmon species and ecologically linked plants are significant for the cultural and economic well-being of The Klamath Tribes. The Klamath Tribes traditionally used pelts, feathers, and other body parts from some of these animals in ceremonial regalia, traditional crafts, and for other purposes. In a few cases, tribal members relied on the sale of pelts from some of these species for supplemental income. In ethnographic interviews, tribal members referred to a number of culturally preferred riparian and marsh

plant species that are said to have declined in population in the last century. Foremost among these is the yellow pond lily (Wocus), a source of edible seeds that has served as one of the most important staple plant foods of The Klamath Tribes. The decline in some riparian plant species may correlate with declines in the fish population of the Upper Klamath Basin and may reflect the reduction in nutrient loading to marsh plant procurement areas.

Prior to the extirpation of anadromous salmonids from the Upper Klamath Basin, salmon were the focus of a complex of cultural traditions, including distinctive fish harvesting and processing technologies; traditional ecological knowledge relating to fish habitats and behavior; and ritual traditions centering significantly on the maintenance of harvestable fish populations through ceremonial displays of respect for the fish, the Creator, and other spiritual forces said to influence the return of the fish. Through such practices, The Klamath Tribes have always played an active role in the stewardship of anadromous fish resources, and contemporary tribal members perceive this role as a cultural right and responsibility.

The absence of the fish has compromised the ability of members of The Klamath Tribes to pass knowledge from generation to generation relating to the fish and their harvest. The importance of salmon harvest is further reflected in The Klamath Tribes' languages, place names, songs, stories, and the moral teachings provided to children. Large gatherings associated with the fish harvest once served as a venue for economic exchanges, reunion with kin from other communities, and the forging and maintenance of intercommunity ties within the larger tribal population. The demise of the fish populations has interrupted the performance of these important social and cultural functions.

Although The Klamath Tribes have the most direct interest in resources upstream of the four Klamath River hydroelectric dams, the current operations of the Klamath Hydroelectric Project have affected The Klamath Tribes' resource interests in the footprint of the dams and impoundments, and downstream from the dams in lands ceded by The Klamath Tribes. In the Klamath River corridor, for example, harvest activities historically focused on riparian resources. Plants, animals, soil, and rocks are all of concern to Klamath Tribes members, both economically and environmentally. The Indians commonly gathered riparian vegetation, including but not limited to willows for basketry and drying racks; tree species such as cottonwood for firewood; sedges, rushes, cattails, and tule for basketry mats and bedding; and a variety of berries and medicinal plants uniquely concentrated in the riparian corridor. Game in the riparian corridor, such as white- and black-tail deer, rabbit, groundhog, and birds, were also taken.

Various forms of evidence suggest that The Klamath Tribes' gathering activities were concentrated in relatively recent alluvial deposits consisting of gravel bars and fresh deposits of silt, loam, and sand-sized particles. At these sites, culturally prized early successional vegetation was abundant and desirable. For example, roots used in basketry

were unusually long, straight, and easy to dig. Additionally, tribal members gathered rocks for use as cooking stones along the riparian corridor, especially basalt cobbles and other dense, nonporous stones.

3.12.3.1.4 The Klamath Tribes' Health Impacts

Because salmon was the first dietary staple to be lost to The Klamath Tribes, its depletion was said to have initiated dramatic dietary shifts among tribal members. For a time, this fostered increased consumption of deer, mullet, and sucker, which some tribal members believe resulted in localized overuse of these resources, particularly in the light of game management practices of the State of Oregon. For some, the loss of the salmon was the catalyst for a dietary transition that led to the ultimate dependence of The Klamath Tribes on the purchase of processed foods and the use of supplementary commodity foods.

Tribal members attributed a number of historical health problems to the loss of salmon. A 1920s tuberculosis epidemic was said to have been worsened by the rapid impoverishment of the diet in preceding years. Recent Indian Health Service studies endorsed by The Klamath Tribes concluded that a host of physical ailments plaguing members of The Klamath Tribes have been linked to the demise of the aboriginal diet. Diabetes, hypertension, obesity, and related cardiovascular ailments are particularly widespread, reflecting dramatic changes in food consumption and procurement patterns. A number of tribal members expressed the view that the loss of salmon was among the most significant components of this dietary shift.

3.12.3.1.5 Alternative 1: No Action/No Project Alternative - The Klamath Tribes and Damming of the River

Continued impoundment of water could affect tribal trust resources. The current Klamath River dam operations have measurable consequences on the exercise of The Klamath Tribes' Treaty harvest rights on the former Klamath Reservation; consequences which would continue under the No Action/No Project Alternative. In response to the loss of the Klamath Reservation as a result of the 1954 Klamath Termination Act and the absence of provisions for the reservation's return in the 1986 Klamath Restoration Act, The Klamath Tribes have been actively acquiring lands within the boundaries of the former reservation and placing them in trust status. Existing and pending trust lands include properties that are transected by waters formerly housing populations of anadromous fish. These trust lands are entirely in the Upper Klamath Basin and affected by the same environmental variables that apply to that region...

Salmon have not been sighted in the areas upstream of the dams in about 100 years. However, in 1907, before the dams went into service, Barrett (1910) reports that "Fish were abundant in the lakes, salmon and salmon trout being especially esteemed by the Indians." Other firsthand observations confirm the presence of salmon before the dams were built. In the 1940s, in preparation for a lawsuit against Copco for blocking the anadromous fish runs, Bureau of Indian Affairs (BIA) Superintendent B.G. Courtright interviewed 50 older members of the Klamath Tribe and non-Indian settlers in the area about salmon in the Klamath Basin. These unpublished affidavits unanimously report there were salmon in fisheries as far upstream of Klamath Lake as the Sprague and

Williamson rivers, Upper Klamath Lake, and Spencer Creek. Spier (1930) reported that salmon in the Klamath Basin "…ascend all the rivers leading from Klamath Lake...going as far up Sprague River as Yainax, but are stopped by the falls downstream from the outlet of Klamath marsh." A tribal elder in the 1940s also stated that he had observed salmon as far up the Sprague River as Bly.

Salmon continue to be symbolically and culturally important to members of The Klamath Tribes. Moreover, tribal members insist that traditional salmon fishing stations are still being used today, whether for subsistence purposes, ceremonial activities, or instruction of children on tribal history and culture. Resources that were once harvested secondarily to the salmon harvest have now become the focus of subsistence activity at these stations, and tribal members still use certain historic campsites at these stations during subsistence, social, and ceremonial activities. Tribal members continue to participate in ritual activities "to bring back the salmon," while The Klamath Tribes government continues to explore legal and administrative options to achieve the same goal.

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin, as noted above. However, the current operations of the four Klamath River dams adversely affect the trust resources of The Klamath Tribes and other resources traditionally used by the tribes, and, by extension, their cultural values (Table 3.12-1), and their continued operation under the No Action/No Project Alternative would result in no change from existing adverse conditions.

3.12.3.1.6 Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect tribal trust resources.[3] Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by The Klamath Tribes (Table 3.12-1). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

KBRA – Programmatic Measures

The KBRA has several programs that could result in impacts/effects to trust resources and other traditional resources used by The Klamath Tribes. Specific KBRA programs potentially affecting trust resources and other traditional resources include:

[3] Tribal Trust Resources and other traditionally used resources are also discussed in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

- Tribal Fisheries and Conservation Management Program
- Klamath Tribes Interim Fishing Site
- Mazama Forest Project

Other KBRA programs would have effects on trust resources of aquatic resources, water quality, and terrestrial resources; these programs' effects are discussed in Sections 3.2, 3.3, and 3.5 of this EIS/EIR.

Implementation of the Tribal Fisheries and Conservation Management Program could result in impacts/effects to Trust Resources and other traditionally used resources. As the original stewards of the natural resources of the Klamath Basin, The Klamath Tribes hold special positions in the Basin and have interests in and a traditional relationship to the Basin ecosystem and its fisheries. Implementation of the Tribal Fisheries and Conservation Management Program would provide funding to assist the tribe in developing their capacity to participate in resource management activities within the Basin, particularly relating to tribal fishing and revitalization of tribal subsistence and other economic activities. The timing of and specific locations where these resource management actions could be undertaken is not certain but the improvements they are anticipated to support in trust resources would contribute to the positive effects of hydroelectric facility removal. Implementation of the Tribal Fisheries and Conservation Management Program would generate beneficial effects to trust resources and other traditionally used resources. Implementation of specific plans and projects associated with the Tribal Fisheries and Conservation Management Program will require future environmental compliance as appropriate.

Establishment of The Klamath Tribes Interim Fishing Site could result in impacts/effects to Trust Resources and other traditionally used resources. Actions associated with The Klamath Tribes Interim Fishing Site include establishment of an interim fishing site for Klamath Tribal members between Iron Gate Dam and Interstate -5. The improvement in salmon fishery access generated by development of The Klamath Tribes Interim Fishing Site would contribute to the positive effects of hydroelectric facility removal. Establishment of The Klamath Tribes Interim Fishing Site would generate beneficial effects to trust resources by providing tribal members with access to the salmon fishery prior to hydroelectric facility removal.

Implementation of the Mazama Forest Project could result in impacts/effects to Trust Resources and other traditionally used resources. Actions associated with the Mazama Forest Project include the purchase and management of 90,000 acres of timberland on former reservation land owned by the Klamath Tribe (Chui 2008; Kerr 2012). The improvement in trust resources and other traditionally used resources generated by the Mazama Forest Project would contribute to the effects of hydroelectric facility removal. Implementation of the Mazama Forest Project would generate beneficial effects to trust resources and other traditionally used resources because of the implementation of appropriate forest management plans. Implementation of specific plans and projects associated with the Mazama Forest Project will require future environmental compliance as appropriate.

3.12.3.1.7 Alternative 3: Partial Facilities Removal of Four Dams

Partial facilities removal could affect tribal trust resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for fish passage. Keno Dam would be transferred to the DOI, The East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit water, aquatic, and terrestrial resources issues related to trust resources and rights identified by The Klamath Tribes (Table 3.12-1). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.1.8 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect tribal trust resources. Under the Fish Passage at Four Dams Alternative, operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not fully resolve the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by The Klamath Tribes (Table 3.12-1). Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to trust resources and rights would persist.

3.12.3.1.9 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect tribal trust resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by The Klamath Tribes (Table 3.12-1), but not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.2 Quartz Valley Community

3.12.3.2.1 Quartz Valley Community History

Most of the Quartz Valley Community's tribal members are descendants of people of Karuk ancestry, although a few tribal members are also of Shasta ancestry. Therefore, their cultural traditions are similar to those described in the Karuk section of this report.

The Quartz Valley Community is a federally recognized tribe representing people of middle Klamath (Karuk) and Shasta Indian ancestry. The Quartz Valley Indian Reservation is in Siskiyou County near the community of Fort Jones. The population is around 126, with a tribal enrollment of about 150. Total reservation size is 174 acres. Some tribal members are descendants of the same tribal leaders that signed the unratified 1851 Treaty R negotiated between Indian Agent Redick McKee and Indian inhabitants of Scott Valley and the upper Trinity and Klamath Rivers. The original Quartz Valley Indian Reservation, once near the present-day reservation, was abolished in the 1960s.

The current Tribal mission is stated as:

> While on earth we must practice stewardship, protection, and enhancement of the air we breathe, the water we drink, the soil that supports us, and the lives we cherish. It is our duty to protect and enhance these resources for the continued prosperity of the Quartz Valley Indian Tribe and our fellow brothers and sisters we share this earth with.
>
> In partial fulfillment of the mission statement, the tribe employs several full-time and part-time positions to operate the Tribal Environmental Protection Department. Current achievements are creek restoration projects, salmon surveys, water quality monitoring, establishment of a native garden, and the recent opening of a microbiology lab for testing the Tribe's ground water.

3.12.3.2.2 Quartz Valley Community Cultural Practices Fishing, Trade and Barter, Religious Practices, and Oral Traditions

The Quartz Valley Community are of Karuk and Shasta Decent. Cultural practices and values or the Karuk people are described in Section 3.12.3.3.

3.12.3.2.3 Quartz Valley Community Potentially Affected Trust Resources

The Quartz Valley Community does not have a reserved right to the Klamath River fishery. The tribe is not reliant on Klamath River water, nor does it retain Klamath River reserved water rights. The tribe's land base is not along the Klamath River but on a tributary to the Scott River, which is a tributary to the Klamath. Therefore, there are no primary effects on Quartz Valley trust resources although there are effects on Quartz Valley resources traditionally used by the tribe, health, and cultural values and well-being.

Traditionally used fish resources of the Scott River include Chinook salmon, coho salmon, steelhead and Pacific lamprey. The Quartz Valley Indian Reservation relies on these fish for sustenance and their spiritual well being. These fish need to survive their migration through the Klamath River to and from the ocean. Therefore, the tribe has an interest in Klamath River health.

Any fishing and concomitant water rights to which the Quartz Valley Community may be entitled have not yet been determined. However, Quartz Valley tribal members have historically fished for salmon, steelhead and eels (Pacific lamprey) in the Scott River and Shackleford Creek.

Despite the lack of a recognized right by the United States or the State of California many members of tribe fish on the Klamath River, often with Karuk Tribe members to whom they are related, and have done so in an unbroken tradition dating back to time immemorial. Table 13.12-2 identifies resources traditionally used by the Quartz Valley Tribe.

Table 3.12-2. Effects of Current Dam Operations on Resources Traditionally Used by the Quartz Valley Tribe

Other Resources Traditionally Used By The Tribe	Effects
Water resources	Altered flows
	Altered water temperature regime
	Reduced bedload sediment transfer in the Project Reach (JC Boyle to Iron Gate Dam) until about the Shasta River.
	Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
	Diminished aesthetics
	Human exposure to toxic water while conducting cultural activities
	Diminished opportunity for traditional bathing
Aquatic resources	Loss of habitat
	Less suitable water temperature regime
	Reduced bedload transfer
	Increased potential for disease/parasites
	Reduced population size
	Loss of traditional salmon diet and increased risk of heart disease, strokes, diabetes, and obesity
	Depression, alienation, and possible suicide
	Tribal members leaving ancestral territory
	Lost opportunities for transmitting traditional knowledge
Terrestrial resources	Reduced food availability
	Loss of riparian habitat
	Diminished plant availability for cultural practices and related benefits
	Loss of opportunity for inter-generational traditional knowledge transmission

3.12.3.2.4 Quartz Valley Community Health Impacts

The members of the Quartz Valley Community refrained from making any comments.

3.12.3.2.5 Effects Determinations

Alternative 1: No Action/No Project – Quartz Valley Community and Damming of the River

Continued impoundment of water could affect traditionally used resources. The dams are responsible for a drastic reduction in spawning habitat and a major component of many other changes in the river system, such as water quality and water temperature. All of these changes have created an environment in which it is difficult or impossible for many species to flourish. In addition to environmental effects, the changes in the river secondarily have resulted in diminished physical, mental and social health. For thousands of years the Indians who depend on the river have been part of a functioning social, economic, and cultural health system that is currently dying.

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin. Mining activities in the Klamath Basin have significantly decreased over the last several decades, and timber extraction in the basin is more regulated at the Federal and State levels than in past decades.

However, the current management of the Klamath River adversely affects the resources traditionally used by the Quartz Valley Community and, by extension, their cultural values, and their continued operation under the No Action/No Project Alternative would result in no change from existing conditions.

Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect traditionally used resources. Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources traditionally used by the Quartz Valley Tribe. Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

KBRA

The KBRA has several programs that could result in impacts/effects to traditional resources used by the Quartz Valley Community. Specific KBRA programs potentially affecting traditional resources include the Tribal Fisheries and Conservation Management Program. Other KBRA programs would have effects on aquatic resources, water quality, and terrestrial resources; these programs' effects are discussed in Sections 3.2, 3.3, and 3.5 of this EIS/EIR.

3.12.3.2.6 Alternative 3: Partial Facilities Removal of Four Dams Alternative

Partial facilities removal could affect traditionally used resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources traditionally used by the Quartz Valley Community. Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.2.7 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect traditionally used resources. Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not fully resolve the water, aquatic, and terrestrial resources issues related to traditionally used resources identified by the Quartz Valley Community. Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to traditionally use resources would persist.

3.12.3.2.8 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect traditionally used resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address issues associated with the water, aquatic, and terrestrial resources traditionally used by the Quartz Valley Tribe but not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.3 Karuk Tribe

3.12.3.3.1 Karuk History

The Karuk Tribe has been federally recognized since 1979 and occupies territory along the middle section of the Klamath River. The 2000 United States Census reported tribal membership to be 2,702 individuals. In 2004, the California Department of Housing and Community Development reported tribal membership to be 3,164 individuals. Currently,

Karuk are one of the largest tribes in California with approximately 4,800 members. The Karuk maintain offices in Orleans, Humboldt County; Happy Camp, Siskiyou County; and the City of Yreka, Siskiyou County, all in California.

The tribe's ancestral territory was about 1.4 million acres. Currently, the Karuk own 652 acres in trust status. The Karuk Tribe is a Self-Governance Tribe under Indian Self-Determination Act of 1975 (California Department of Housing and Community Development, California Indian Assistance Program 2004, as cited in DOI 2011 and DOI 2012). The tribe has a constitution that was initiated in April 1985 and the Karuk maintain a robust Natural Resources Department.

3.12.3.3.2 Karuk Cultural Practices

The Karuk Tribe has effectively maintained its cultural identity and traditional practices. Tribal members still engage in traditional hunting, gathering, and resource management activities. This includes preservation and use of the Karuk language, basket-making, fabrication of regalia, practice of traditional religious ceremonies, and stewardship of natural resources through use of fire and harvest management techniques.

Fishing

The Klamath and Salmon River fishery and other resources supported more than 100 ancestral Karuk villages along the Klamath and Salmon Rivers. Karuk established villages on beaches, river bends, benches, and near fishing sites to exploit riverine resources. Indeed, Karuk incorporate ritual, spiritual, and technical elements of their culture to facilitate management and enrichment of local ecosystems. These culturally based natural resource management practices are articulated in the Karuk Tribe's Eco-cultural Resources Management Plan.

The Karuk diet traditionally consisted mostly of salmon, deer, and acorns. Fish, especially salmon, have always been a major food resource and the focus of ceremonies for the tribe. Karuk use several methods, both traditional and contemporary, to catch fish. Fish important to the Karuk include spring-run Chinook or king salmon, fall-run Chinook, out-migrating Chinook smolt, coho or silver salmon steelhead, trout, sucker, bullhead, sturgeon, and Pacific lamprey. Freshwater mussels also have cultural significance for the Karuk not only as food, but also as important tools. For example, a mussel tool, an *íshuvar*, is used in traditional basket-making.

Religious Practices

Ceremonies provide insight into the cultural life and underlying values of the Karuk. These ritualistic celebrations also demonstrate the interrelationship of Karuk and other tribes along the Klamath River. In one respect, the ceremonies are reenactments of stories involving the *ikxareeyavsa*, or immortal ones. However, these ceremonies go beyond symbolism to teach important practical lessons about careful management of resources, hard work, and the importance of observing rituals.

The Karuk are known among tribes in the Klamath Basin as "The Fix-the-World People" because of their role in the annual *Piky'avish*, or World Renewal Ceremonies. *Piky'avish*

starts with the First Salmon Ceremony in early spring and continues throughout late summer into early fall. The scheduling of the dance cycle is determined each year by a ceremonial leader, who also appoints a *fataveenaan* (medicine man or priest) each year. This appointment is both a source of honor and a great deal of work because the *fataveenaan* is required to undergo a lengthy ordeal of fasting, praying, and walking the medicine trails.

The First Salmon Ceremony marks the passing of the first spring Chinook salmon up the Klamath River. This migrating salmon was allowed to pass all the way up the Klamath River to its spawning ground. Indians believed that the first spring Chinook migrating upstream would leave its scales at each spawning location for the rest of the salmon run to follow. Eating this first migrating salmon of the year was considered taboo; if eaten, it was believed to cause convulsions and death. Permitting this fish to pass safely upstream lifted the taboo and allowed the people to fish for salmon in the river. The dramatic decline in the spring Chinook run has made it impossible for the Klamath Basin tribes to conduct the First Salmon Ceremony.

The Karuk and Yurok Tribes coordinate the performance of their First Salmon Ceremonies based on the appearance of fish in the Klamath River. Chinook historically spawned as far north as the Williamson River, an area that was available as spawning grounds prior to the damming of the Klamath River and the reconstruction of Klamath Lake in its present form. The First Salmon Ceremony is typically conducted around April when the fish first breech the sandbar at the mouth of the river, marking their transition from the Pacific Ocean back to the fresh water of the Klamath River.

The most important of Karuk ceremony is *Piky'avish*, or literally "fix the world." Called by different names in by different tribes, many tribes of the Klamath as well as the Pacific Northwest practice a similar ceremony. In Kroeber and Gifford's *Karok Myths* (1980), tribal member Georgia Orcutt captured the emotional nature of the *Piky'avish* as follows: "At the beginning of the *Piky'avish*, it looks like everything down, nobody happy. *Piky'avish* means 'making the world right.' *Fatawanun* [*fataveenan*] fixed it so everything is coming up nice."

According to Kroeber and Gifford (1980), the Karuk ceremony has three major aspects:

> The first is a period of usually not more than ten days during which the priest remains much in the sweathouse, fasts, and prays for abundance of food, the elimination of sickness and the stability of the world. He also visits sacred spots; and young men engage in archery contests. The second part is the climax of the ceremony, when the priest keeps an all-night vigil by a sand pile called *yuxpit*. This vigil is accompanied and followed the next day, by the Deerskin Dance, or its surrogate, an imitation affair employing branches instead of deerskins; at *Inam* [*Inaam*] and *Katamin* [*ka'tim'iin*] the War Dance is part of the dance ritual. The third part is the anticlimactic retreat of the priest and other officials.

The ceremonies feature a variety of ritual dances. The Jumping Dance (or Jump Dance) is held in the spring during the first salmon run. The Deerskin Dance is held in the fall in association with the acorn harvest and the second salmon run. It is performed in alternating years with the Medicine Dance, during which other decorated skins including martin and otter are displayed rather than the famous white deerskins. Both dances feature displays of wealth, along with dancing and singing.

According to Karuk creation stories, fishing weirs were created by one of the immortals. The fishing harpoon also appears in one of a series of creation stories that present accounts of the origins of humans, institutions, and tools. In the story, the Blue Heron develops the two-pointed harpoon so that even people without rights or nets could still catch fish. According to the story, *Chukchuk* took a long stick and fastened two smaller sticks to the end of it. He thought, "I will spear salmon. Let me make that kind. Let me make it so that if a man has no fishing place and he sees salmon he can catch them. If he has no net he will kill them in this way" (Kroeber 1925a).

3.12.3.3.3 Karuk Potentially Affected Trust Resources

In a government-to-government consultation meeting concerning Karuk Tribe trust resources affected by current dam operations held on September 30, 2010, the Karuk Tribe asserted the following as tribal trust resources: water, fish, mollusks, riparian plants, wetlands, and all other plants and wildlife dependent on a healthy river and playing a role in Karuk ceremonies. This assertion was coupled with the assertion that the United States has a trust responsibility to protect such resources and ensure that such resources are managed for the beneficial use of the Tribe and its membership. In addition, the Karuk assert that Federal Government has responsibilities to the Tribe in the areas of social welfare, education, and health and a responsibility to uphold certain Federal laws, such as the National Historic Preservation Act and the American Indian Religious Freedom Act. The United States does not necessarily agree that all of the above resources are in trust but the resources are important to the Karuk (and thus to the United States) for their traditional ceremonial use. Table 3.12-3 identifies Karuk traditionally used resources that are affected by the four Klamath River dams.

Unlike The Klamath Tribes, Congress never formally ratified the treaty negotiated between the United States and the Karuk Tribe in 1851, and no statute or executive order otherwise set aside reservation lands for the Tribe. The Karuk Tribe began efforts in 1978 to receive Federal recognition. In November 1978, the Bureau of Indian Affairs Central Office (BIA) staff conducted a field trip to Northern California. The BIA determined that the aboriginal subentities of the tribe consisted of three communities located in Happy Camp, Orleans, and Siskiyou (Yreka). See 13 IBIA 76, 78; 1985 WL 69127 (I.B.I.A.). The Assistant Secretary for Indian Affairs, in a memorandum entitled "Revitalization of the Government-to-Government Relationship Between the Karok (sic) Tribe of California and the Federal Government," notified the local offices of the Bureau of Indian Affairs on January 15, 1979, that: Based on the findings collected . . ., the continued existence of the Karoks as a federally recognized tribe of Indians has been

Table 3.12-3. Effects of Current Dam Operations on Resources Traditionally Used by the Karuk Tribe

Other Resources Traditionally Used By The Tribe	Effects
Water resources	Altered flows
	Altered water temperature regime
	Reduced bedload sediment transfer in the Project Reach (JC Boyle to Iron Gate Dam) until about the Shasta River.
	Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
	Diminished aesthetics
	Human exposure to toxic water while conducting cultural activities
	Diminished opportunity for traditional bathing
Aquatic resources	Loss of habitat
	Less suitable water temperature regime
	Reduced bedload transfer
	Increased potential for disease/parasites
	Reduced population size
	Loss of traditional salmon diet and increased risk of heart disease, strokes, diabetes, and obesity
	Depression, alienation, and possible suicide
	Tribal members leaving ancestral territory
	Lost opportunities for transmitting traditional knowledge
Terrestrial resources	Reduced food availability
	Loss of riparian habitat
	Diminished plant availability for cultural practices and related benefits
	Loss of opportunity for inter-generational traditional knowledge transmission

Source: DOI 2011, DOI 2012

substantiated. In light of this finding, I am directing that the government-to-government relationship, with attendant Bureau services within available resources, be re-established."

The United States has more recently taken lands into trust for the benefit of the Karuk Tribe, including over 810 acres in Siskiyou County and approximately 40 acres in Humboldt County. Most of the Tribe's aboriginal lands along the Klamath River, above the Klamath Trinity Confluence, now form part of the Klamath National Forest. Any fishing and concomitant water rights to which the Karuk Tribe may be entitled have not yet been determined. Regardless, the Karuk assert that an inability to use traditional resources affects their general health and well being and cultural values.

In the consultation meeting, only effects on fish and water were discussed in detail. Nonetheless, the lack of fish in the local economy has secondary effects on general tribal

health and cultural well being. The Karuk Tribe, when asked if such resources were affected by the current dam operations, emphatically responded, "Yes." Tribal representatives at the meeting stated that water quality and fish returns have diminished, and, being a tribe that lives along the river, their aesthetic quality of life has also diminished. They rarely bathe in the river, as they did historically, and in an area with fewer available fish, tribal members are likely to consume less of the traditional food base and pay less attention to the culturally inherited management traditions of a "Salmon People." This situation has exacerbated related impacts on tribal health, such as higher rates of obesity, diabetes, heart disease, stroke, and mental diseases such as depression.

Since the construction of the dams on the Klamath River, the numbers of a variety of river species have plummeted. Some of these fish had traditionally been a source of food and cultural ceremonies and practices for the Karuk Tribe, as well as a means of trade and income. Not only salmon, but also steelhead, sturgeon, suckers, lampreys, clams, mussels and other aquatic species appear to have declining populations as a result of the dams effects on water flow, temperature, and on the river environment.

Karuk believe one of the most significant impacts of the Klamath River dams is the way that the natural process of seasonal warming and cooling trends in the river is altered by the presence of reservoirs. In effect, the reservoirs appear to create a "thermal lag" in both the spring and the fall. This means that the river warms more slowly in the spring and cools more slowly in the fall than it would without the dams. The result of these thermal effects is a delay in timing of runs for the migration of fall Chinook salmon. For Karuk, this translates into a shorter fishing season in the fall. Before construction of Iron Gate Dam, Karuk fishermen report that fishing at Katimiin started in late July. Since construction of Iron Gate Dam, fish do not typically arrive at Ishi Pishi Falls until early September. In addition to limiting the number of fishing days available in the fall, the opportunity to harvest spring Chinook salmon has been completely lost to the Karuk since construction of Iron Gate Dam.

Water quality plays a very significant role in Karuk tribal culture because of its effect on culturally relevant aquatic species. Water quality also affects the ability of *Fataveenan*, or World Renewal priests, to conduct ceremonies. *Pikiavish* starts with the Spring Salmon Ceremony in early spring and continues throughout late summer into early fall. Key ceremonial participants bathe multiple times a day in the Klamath River for 10 days in a row. This is the time of year when the blooms of the toxic algae, *Microcystis aeruginosa*, are at their peak.

To avoid interfering with cultural and religious ceremonies and practices, the water conditions in the Klamath River must allow for specific species to be present in adequate supplies. This includes species that are consumed by participants, such as salmon and lamprey as well as species used in ceremonies, such as crayfish and willows. Water conditions must also be safe for what is usually termed "recreational contact" as well as human consumption.

Degraded water quality in the Klamath Basin, including the seasonal presence of algal toxins in the Klamath River and reservoirs, has impaired the ability of Karuk to use the water for cultural purposes. Known and/or perceived health risks associated with degraded water quality have resulted in the alteration of cultural ceremonies to exclude or limit ingestion of river water. Additionally, known or perceived risk of exposure to degraded water quality conditions during ceremonial bathing and traditional cultural activities, such as gathering and preparing basket materials and plants for other purposes, has resulted in an impairment of cultural use.

According to Karuk cultural biologist Ron Reed, the World Renewal Ceremony is held on the Klamath River at Clear Creek, Somes Bar, and Orleans during July, August, and September of each year. The medicine man, who leads the ceremony, walks 14 miles through the ridges and hills along the Klamath River and is joined halfway through his journey by children and adults of the tribe who follow him the rest of the way for good luck. Traditionally, when the medicine man reached the Klamath River at the end of this walk, he drank water from the river to complete the ceremony. Currently, this does not occur very often because blooms of *Microcystis aeruginosa* have led to health warnings along the river. However, children are still known to jump in the river and drink the water.

Bathing in the river is an important part of most Karuk ceremonies. For example, bathing in the Klamath River and its tributaries is a requirement for participants in the Brush Dance Ceremony. Bathing is also associated with funeral services, subsistence practices, recreational swimming, courtship, and individual hygiene. Bathing associated with funeral rituals occurs year around and includes preparation for burial and purification after burial.

Karuk tribal member collect willow roots, wild grape, cottonwood, and willow in the riparian zone along the Klamath River and use these materials to make baskets. Traditional collection of these basketry materials often involved wading in the water, and washing and cleaning the materials in the river. Willows are peeled by mouth following cleaning with river water, and plants are also collected for food, medicine, and other cultural functions. Given current degraded water quality conditions, ingestion of water as a result of traditional cultural activities or use of materials harvested from the river may pose a potential health risk.

Prior to construction of dams on the Klamath River, steelhead spawned freely not only in the Klamath River and its tributaries, but in Upper Klamath Lake and beyond. An estimated 650 miles of salmon habitat were lost with the construction of four dams in the Klamath River (unpublished report prepared for The Klamath Tribes and Yurok Tribe). This is a significant amount of habitat no longer available for spawning and rearing. In interviews with Karuk tribal members, they refer to loss of steelhead runs that were once vigorous, supplying fish even at times of the year when salmon runs were no longer taking place. Furthermore, steelhead eat juvenile salmon; therefore, without a healthy salmon run, there will not be a healthy steelhead run.

Steelhead can be a resident fish or they can be anadromous. One prevalent theory about the loss of migratory steelhead is that steelhead produced in the hatchery at Iron Gate Dam comprises a resident population. They are released from the hatchery into a nutrient-rich system immediately downstream from Iron Gate Dam, where there are no triggers to force them to migrate. They have enough food to keep them there; and no other steelhead are coming from downriver to compete with them, increase the densities, and compel them to move. The result is a resident population of non-migratory steelhead.

This lack of migratory steelhead affects the local economy and the well-being of the Karuk. Steelhead fishermen from outside the area used to pay for the privilege of fishing for the Klamath steelhead, bringing money into the local economy to the benefit of the Karuk. In the late 1960s and early 1970s, steelhead fishermen lined the banks of the Klamath River. Today, the numbers of steelhead are so low that the sport is no longer viable.

Karuk tribal members who harvest lamprey eels report an extreme decline in their numbers. Lamprey has traditionally been an important food source for the Karuk and has augmented salmon in their diet, particularly as salmon have become scarce.

Freshwater mussels have also been both an important food source for the Karuk and other groups and an essential part of tribal ceremonies. During the early 20th century, mussels were gathered for food and for use in rituals late in the season when the river flows were low. These low flow periods are unfortunately the time of year when the mussels are most contaminated. Even though there are few to be found, people continue to use freshwater mussels as a food source, but their use in ceremonies has been greatly reduced. Historically, women also used the mussel shells for spoons, tools, and jewelry.

3.12.3.3.4 Karuk Health Impacts

The Karuk have been denied traditional food sources such as salmon over the last 150 years, and have increasingly adopted western foods. The decrease in the availability of traditional foods, including salmon, trout, eel (various species of lamprey), mussels, and sturgeon, is responsible for many diet-related illnesses among Indians, including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney problems, and strokes (Karuk Department of Natural Resources 2007). These conditions result from the lack of proper nutrient content in foods consumed in place of the traditional foods, as well as from the decrease in exercise associated with fishing and gathering food.

The health of many people, including the Karuk, is closely linked to the health of the river. The three largest tribes in California eat fish from the Klamath River, and the declining river system is directly related to the inability of tribal members to continue eating traditional diets. Although early anthropologists described the Klamath River tribes as some of the wealthiest people in California, since European contact, they have become some of the poorest. One result is that the Klamath corridor has some of the lowest incomes and the highest rates of hunger in California. Local populations have traditionally had much of their food supplied by the Klamath River. This continues to be

the case, but with the decline in river health this becomes increasingly difficult. Given the economic impoverishment of the region, there is no general access to healthy alternative foods without subsistence fishing and gathering (See also Section 3.16, Environmental Justice). As a result, hunger is significantly related to the presence and effects of the dams, and these effects are directly connected to the traditional subsistence economy.

The estimated diabetes rate for the Karuk Tribe is 21 percent, nearly four times the U.S. average, and the estimated rate of heart disease for the Karuk is 39.6 percent, three times the U.S. average. Spring Chinook salmon represented a large volume of healthy food for the Karuk people until the 1960s and 1970s. Diabetes is a recent occurrence in the Karuk population. In the 2005 Karuk Health and Fish Consumption Survey, Karuk families were asked when diabetes first appeared in their family and when spring salmon stopped playing a significant role in their family diet. Over 90 percent of reporting families say that before 1950 spring salmon played a significant role in the family diet and less than 15 percent reported occurrence of diabetes. By 2005, no families claimed that spring salmon played a significant role in the family diet and nearly 100 percent reported occurrence of diabetes (Norgaard 2005).

Historically, consumption of fish by the Karuk Tribe was estimated at 450 pounds per person per year, whereas in 2003, the Karuk people consumed fewer than 5 pounds of salmon per person. In 2005, more than 80 percent of Karuk households surveyed reported that they were unable to harvest adequate amounts of eel, salmon, or sturgeon to fulfill their family needs. Furthermore, 40 percent of Karuk households reported that there are fish species that their family historically caught that are no longer harvested.

Difficulty in meeting basic needs can result in overwhelming physical and psychological stress. Traditionally, fishing is done by Karuk men. With the loss of the salmon comes a loss of a man's sense of pride in being able to provide food for his family and tribe. For a tribe that has called itself The People of the Fish, there is an indisputable loss of identity when there are no fish. For a people whose belief system includes their specific role on earth, that they have a predefined relationship with nature that needs to be honored, there is a sense of failure when they are unable to fulfill that role.

The changes that have caused wildlife to becoming scarce and the rivers polluted, may make it hard for young people to understand the ways of their parents and grandparents. They wonder why the tribe focuses on ceremonies that revolve around periodic fish runs and ritual eating of salmon when the availability of fish is so erratic. Never having seen it themselves, they do not understand that in the past there could be eight yearly runs of salmon in the Klamath when all they see is one-half of a fall run. Without tradition as an anchor, young people are sometimes drawn to gangs to establish a feeling of belonging, and leave Karuk territory for cities (DOI 2011; DOI 2012).

The act of eating salmon from the Klamath River affirms sense of place, identity, connection, and community. This orientation draws individuals into relationships of responsibility to care for the fish. Such a world view and set of relationships are in stark

contrast to the separate, individualistic modality of the dominant culture in which plants and animals are "resources" and people are expected to watch out for their individual interests. Relationships between Karuk people and plants and animals fulfill profound mental, emotional, and spiritual functions. In the absence of these food species, traditional activities such as dip net-fishing, eeling, or berry picking have come to an end.

The destruction of the Klamath River fishery has led to both poverty and hunger. As described above, prior to contact with Europeans and the destruction of the fisheries, the Karuk, Hoopa, and Yurok Tribes were the wealthiest people in what is now known as California, and now they are amongst the poorest. The devastation of the resources, especially the fisheries, is directly linked to the disproportionate unemployment and low socioeconomic status of Karuk people today. This dramatic reversal is directly linked to the destruction of the fisheries resource base. Poverty and hunger rates for the Karuk Tribe are among the highest in the State and nation. Median income for Karuk families is $13,000. The poverty rate for Karuk tribal members in Siskiyou County is 88.4 to 91.9 percent. Section 3.16, Environmental Justice, offers more information regarding poverty and employment levels among populations in the area of analysis.

3.12.3.3.5 Effects Determinations

Alternative 1: No Action/No Project - Karuk and Damming of the River

Continued impoundment of water could affect traditionally used resources. The dams are responsible for a drastic reduction in spawning habitat and many other changes in the river system, such as water quality, water temperature, and flow regimes. All of these changes have created an environment in which it is difficult or impossible for many species to flourish. In addition to environmental effects, the changes in the river caused by the dams secondarily have resulted in diminished physical, mental and social health. For thousands of years the Indians who depend on the river have been part of a functioning social, economic, and cultural health system that is currently dying.

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin. Mining activities in the Klamath Basin have significantly decreased over the last several decades, and timber extraction in the basin has slowly become controlled by better regulations at the Federal and State levels.

However, the current operations of the four Klamath River dams adversely affect the resources traditionally used by the Karuk and, by extension, their cultural values, and their continued operation under the No Action/No Project Alternative would result in no change from existing adverse conditions.

Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect traditionally used resources. Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented,

and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources traditionally used by the Karuk (Table 3.12-2). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

KBRA – Programmatic Measures

The KBRA has several programs that could result in impacts/effects to traditional resources used by the Karuk. Specific KBRA programs potentially affecting traditional resources include the Tribal Fisheries and Conservation Management Program. Other KBRA programs would have effects on trust resources of aquatic resources, water quality, and terrestrial resources; these programs' effects are discussed in Sections 3.2, 3.3, and 3.5 of this EIS/EIR.

Implementation of the Tribal Fisheries and Conservation Management Program could result in impacts/effects to traditionally used resources. As the original stewards of the natural resources of the Klamath Basin the Karuk hold a special position in the Basin and have interests in and a traditional relationship to the Basin ecosystem and its fisheries. Implementation of the Tribal Fisheries and Conservation Management Program would provide funding to assist the tribe in developing their capacity to participate in resource management activities within the Basin, particularly relating to tribal fishing and revitalization of tribal subsistence and other economic activities. The timing of and specific locations where these resource management actions could be undertaken is not certain but the improvements they are anticipated to support in trust resources would contribute to the effects of hydroelectric facility removal. Implementation of the Tribal Fisheries and Conservation Management Program would generate beneficial effects to traditionally used resources. Implementation of specific plans and projects associated with the Tribal Fisheries and Conservation Management Program will require future environmental compliance as appropriate.

3.12.3.3.6 Alternative 3: Partial Facilities Removal of Four Dams Alternative

Partial facilities removal could affect traditionally used resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources traditionally used by the Karuk (Table 3.12-2). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.3.7 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect traditionally used resources. Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be

constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not fully resolve the water, aquatic, and terrestrial resources issues related to traditionally used resources identified by the Karuk Tribe (Table 3.12-2). Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to traditionally use resources would persist.

3.12.3.3.8 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect traditionally used resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address issues associated with the water, aquatic, and terrestrial resources traditionally used by the Karuk (Table 3.12-2), but not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.4 Hoopa Valley Indian Tribe

3.12.3.4.1 Hoopa Valley Indian Tribe History

The Hoopa Valley Indian Reservation is in the northeastern corner of Humboldt County in northern California, approximately 50 miles inland from the Pacific Ocean, and encompasses roughly 20 percent of Hupa aboriginal territory. The reservation, known as "the 12-mile square," is laid out geometrically with sides approximately 12 miles in length for a total of a little less than 144 square miles. At close to 90,000 acres, the reservation is the largest in California.

The northern portion of the reservation is in Yurok ancestral territory. The Trinity River bisects the reservation. A small length of the northern border of the reservation includes about a quarter mile reach of the Klamath River called Saints Rest Bar several miles upriver from Weitchpec, California. The 2000 U.S. Census counted 2,633 people on the reservation, and the tribe listed an enrollment of 2,130 in 2004.

The word Hupa is from the Yurok name for the Hoopa Valley. Hoopa is used when referring to the name of the tribe, and Hupa is used when referring to the people, place, or culture. The Hupa called themselves *Natinook-wa*, meaning "people of the place where the trails return." The Hupa are culturally related to the Yurok and also the Karuk.

Currently, the Hoopa Valley Tribe employs hundreds of people and has established a wide array of industries that support numerous business enterprises. Timber extraction,

gravel extraction, modular house manufacturing, a hotel, a restaurant, and a small casino are the major economic enterprises of the Hoopa Valley Tribe. The Hoopa Valley Tribe also maintains a modest fishery program.

3.12.3.4.2 Hoopa Valley Indian Tribe Cultural Practices

Fishing

The Trinity River is of prime importance to the Hoopa Valley Tribe because it is the river that runs through the Hoopa Valley Indian Reservation. Fish destined for the Trinity River must pass through the lower Klamath River and are therefore affected by Klamath River conditions. Poor conditions in the Klamath River could affect fish populations available to the Hoopa Valley Tribe.

The Trinity River is of unique and irreplaceable value to the Hupa. It is a vital natural resource that is the foundation of their social and cultural way of life. At its most basic level, the river has always been a source for food and other necessities of daily Hupa life. The river also provides basket materials, fish net materials, and a means of transportation. Even rocks from the river are used by Hupa people in their traditional cultural practices. Uses of the Trinity River by the Hupa people are highlighted by maintenance of fisheries and religious ceremonies (e.g., ceremonies that involve prayers offered by people trained to make medicine).

Many natural foods were available to the Hupa, with salmon and acorns providing the bulk of the native diet. When the salmon entered the Trinity River each spring and fall, the year's supply of fish was taken by Hupa using a variety of efficient devices. Other important fish include steelhead, sturgeon, and lamprey eels. Surplus stocks of fish were preserved for future consumption by drying in the smoke of fires.

Religious Practices

Religious beliefs and practices played an important role in everyday life for the Hupa people. An almost endless series of taboos had to be scrupulously observed, daily supplications were made for health and wealth, and acts were performed to ensure luck. In addition, each person was supposed to maintain a devout frame of mind throughout the day, particularly during important group rituals when reverent thoughts by participants and onlookers were considered essential for their success.

The religion of the Hupa is based on individual effort through ritual cleanliness as well as ceremonies that bring the entire tribe together. The tribes of the region, including the Hoopa, practice the annual World Renewal Ceremonies, which involve songs and dances that have been preserved for generations. The Hoopa and Yurok tribes also practice the White Deerskin Dance. These rituals are associated with the river as well as with medicine to cure sickness, but also roots, herbs, and bark used to promote spiritual health. The Brush Dance, for example, is a social event as well as a healing ceremony in which certain tribal members dance, sing, make medicine, and pray to bless a particular sick child or infant.

The Hoopa Valley Indians continue to conduct many of their traditional religious ceremonies, and the cultural significance of the Trinity River is captured in many of these ceremonies. Ancient religious sites on the river were believed to be designated by spiritual deities at a time beyond living memory are still used in current tribal rituals. Prayers conducted at the dances are directed toward the well-being of everyone, and food, particularly fish, is shared with all who attend the ceremonies.

The greatest divinity for the Hupa people is *Yimantuwingyai*, "the one lost (to us) across (the ocean)," also known as *Yimankyuwinghoiyan*, "old man over across," who establishes the order and condition of the world and is the leader of the *kihunai*, or ancestors. *Yimantuwingyai* seems to be a combination of the tricky and erotic *Wohpekumeu* and the more heroic *Pulekukwerek* of the Yurok, who is also similar to the Hupa *Yidetuwingyai*, "the one lost downstream" (Kroeber 1925b:134). A traditional story concerning *Yidetuywingyai* tells of the time when the sun and earth alone existed. From the sun and earth were born twins, *Yidetuywingyai* and the ground on which men live. This particular cosmogony has not been found among the Yurok or Karuk and may have reached the Hupa through the influence of more southerly tribes (Kroeber 1925b:134).

The White Deerskin and Jump Dances, the Flower Dance, and the Brush Dance all demonstrate the importance of the river flows to the Hupa people and how vital the rivers are to Hupa familial and tribal material well-being and self-esteem. Unfortunately, the Hupa report that, although these dances and other religious ceremonies have continued in modern times, the decline of the Trinity River's health has made their practice increasingly difficult for Hupa medicine people, dancers, and others. Thus, the adverse impacts of an unhealthy river extend beyond the fisheries to religious ceremonies.

The Hupa honor the Earth and the Creator for providing sustenance and for allowing the continuance of the tribe in two major ceremonies celebrating world renewal, the White Deerskin Dance and the Jump Dance. Both ceremonies are closely tied to the river. A Hupa name for the White Deerskin dance is *hun'q'ehch'idilye*, "along the river religious dance." This important ceremony is conducted at village sites and resting places near the Trinity River and involves travel on the river. The exact timing of the dances depends on the river and its waters. The White Deerskin Dance is held from late August into September. The Jump Dance follows 10 days after the conclusion of the White Deerskin Dance. Both dances are elaborate ceremonies that take place over a period of 10 days. As part of the rituals, the Hupa offer salmon they have caught at their fishing sites for the ceremony and to share with the participants and attendees.

The Jump Dance takes place along the river and has its own dance steps, songs, and regalia, and is dedicated to the good of the world. The completion of the Jump Dance signals a blessing for the year to come, with the hope that all people may be satisfied with small quantities and have their needs met. Both the White Deerskin Dance and the Jump Dance depend on a healthy river for fish, basket materials, bathing, and ambiance. The flows of the river are also a central element of these dances as they influence the dancers'

ability to travel the river in the manner of their ancestors. The Hupa claim that as the river's flows have declined, so has the Hupa's ability to practice these ceremonies.

The Boat Dance is a spectacular segment of the White Deerskin Dance involving dancing and singing while crossing the Trinity River. As the Boat Dance proceeds, the camps follow the dancers from the east side of the river to the west side. In this way, the dance echoes the river's flows and their connotation of river health. The next day, as the dance continues, the camps move to different sites until the dance concludes.

The Brush Dance is held for the purpose of curing a sick baby or child. Hupa people traditionally bathe in the Trinity River each morning of the dance, and they use baskets made with willows growing along the river in the ceremony. The dance is called the Brush Dance because part of the ceremony requires the participants to fill their quivers with willow brush. Operations along the Trinity River are thought to have reduced the abundance of willow brush and other basket-making materials vital to this dance.

The Flower Dance is held at various Hupa towns along the river. The purpose of this dance is to train a girl who has just reached adolescence to lead a good life as an adult woman. The girl for whom the dance is held traditionally bathes at seven sacred places in the river during training in the Flower Dance ceremony.

3.12.3.4.3 Hoopa Valley Indian Tribe Potentially Affected Trust Resources

A government-to-government consultation meeting concerning the effects of current dam operations on Hoopa Valley Indian Tribe trust resources was held on November 8, 2010. Although current operations of the four Klamath dams are more likely to affect resources of the Klamath River, Klamath water quality affects resources traditionally used by the Hoopa and their fishing rights by adversely affecting fish destined for the Trinity River, which must pass through approximately 42 miles of the Klamath River before turning up the Trinity River and through the Hoopa Valley, where Hoopa Tribal members participate in a tribal subsistence fishery. Table 13.12-4 identifies Trust Resources and rights associated with the Hoopa Valley Indian Tribe.

Table 13.12-4. Effects of Current Dam Operations on Hoopa Valley Indian Tribe Trust Resources and Rights

Trust Resource/Right	Effects
Water resources	Altered flows
	Altered water temperature regime
	Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
Aquatic resources	Loss of habitat
	Less suitable water temperature regime
	Reduced bedload transfer
	Increased potential for disease/parasites
	Reduced population size
Terrestrial resources	Reduced food availability
	Loss of riparian habitat

Source: DOI 2011, 2012

The Hoopa Valley Tribe also provided information suggesting that no mitigation was historically required for the reduction of miles of salmonid fishery habitat upriver of Copco 1 and Copco 2 Dams because such mitigation was not required when the dams were completed[4]. When other dams were constructed, mitigation was required for the loss of fish habitat, but only for the several miles between Iron Gate Dam and Copco No. 2 Dam, (i.e., the Iron Gate Fish Hatchery was built to mitigate for the loss 16 miles of habitat and not for the loss of all upriver habitat). The hatchery does not manage spring Chinook salmon because these fish were primarily affected by previous dam construction, and to a lesser extent than Iron Gate Dam.

3.12.3.4.4 Hoopa Valley Indian Tribe Health Impacts

The secondary effects of the Klamath River dams on the people of the Hoopa Valley Tribe include emotional and physical health effects such as increased obesity, diabetes, heart disease due to loss of the traditional salmon diet, and depression, alienation, and suicide. Additionally, the tribal members experience a loss of opportunity for intergenerational transmission of traditional knowledge. These conditions result in tribal members, especially young people, leaving the reservation for opportunity elsewhere (DOI 2011; DOI 2012).

3.12.3.4.5 Effects Determinations

Alternative 1: No Action/No Project - Hoopa Valley Indian Tribe and Damming of the River

Continued impoundment of water could affect tribal trust resources. Members of the Hoopa Valley Tribe have offered firsthand accounts of the decline of the river and its effects on the people.

Byron Nelson, a Hupa elder, stated:

> Though many Hupa and Yurok still hold to traditional beliefs and engage in certain time-honored practices such as shamanism and basketry, the decline of the rivers' health, the center of their culture and spirituality, has led to a loss of self-esteem, an increase in cynicism, and has greatly hurt the cohesiveness and health of these tribal communities. The rivers are the focalizing element of the society; with their loss, it seems much of the hope has also been lost.

According to Nelson, cultural stress related to an unhealthy Klamath and Trinity rivers has resulted in a broad spectrum of social and educational problems, including the

[4] In this instance, the EIS/EIR is reporting the views of a Hoopa Valley Tribal member. However the now inoperable Fall Creek Hatchery was built by the California Oregon Power Company in 1919 in lieu of a fish ladder over Copco 1 Dam. The 110 feet high dam was considered too high for salmon and steelhead to pass over successfully. Furthermore, no provision could be made for safe passage of young downstream migrants. Chinook salmon eggs for the facility were collected at the Klamathon Egg taking station while steelhead eggs were obtained at Fall Creek and Bogus Creek collecting stations (Leitrtz 1970).

According to Leitrtz, the stakeholders at that time knew that anadromous fish went at least as far as Spencer Creek. While some believed they went all the way to the Sprague and Williamson, many others did not. This may explain why only minimal attempts to mitigate Copco 1 occurred.

disruption of traditional occupations and the loss of opportunities for religious practice and community participation in tribal culture. Limitations in the tribes' access to resources has restricted the practice of some of their most important traditions, including freely fishing the once prolific seasonal salmon runs and participating in the concurrent cycle of ceremonies. It appears that the access to resources may also be a cause of younger tribal members leaving the area.

The damming of the river has wide-ranging effects on the culture of the Hoopa Valley people. Despite significant degradation of the river ecosystem of the Klamath/Trinity region through the end of the 19th century and the first half of the 20th century, the Hupa persisted in their traditional reliance on the rivers and their resources. Although they found it increasingly difficult, the tribes continued to practice their ceremonies and religions; gathered vegetation for baskets, food, medicines, and other purposes; and met and ate together along the riverbanks. Fish caught by the tribes, as much as possible, continued to be an important component of their diets. Many of the current tribal members grew up with a strong physical connection to the rivers and great appreciation for the traditions and ways of life of their ancestors.

A reason for the ability of the tribes to maintain some of their traditional relationship to the rivers was that the rivers' flows remained relatively unimpeded. This all changed with the building of the dams. The dams, along with other diversions and impoundments in the Klamath/Trinity Basin, have dramatically altered the region's rivers. Fishing and traditional-use sites have become clogged with debris, and declines in fish population persist.

In the past, Federal regulations governing fishing on the Hoopa Valley Indian Reservation have permitted the taking of fish for ceremonial purposes even when the fisheries were closed to harvest. This fact is evidence that the Federal Government recognizes that fishing and fish are an integral and indispensable part of the religious and ceremonial life of the tribe. Unfortunately, the poor condition of the fishery in recent times has in some instances forced the Hupa to purchase fish from sources off their reservations to provide for all who attend their ceremonies. Tribal elder Byron Nelson stated:

> A lack of fish has resulted in the scaling down or even cancellation of ceremonies. The continual practice of ceremonies represents an important means for keeping tribal members who live off the reservations connected to their culture and families. However, without enough salmon, many do not come back; and the planning of ceremonies, once a time to appreciate nature's abundance and of spiritual celebration, often brings significant anxiety to the region's native peoples.

According to a report by the California Department of Fish and Game, the fish kill of 2002 affected all of the tribes along the Klamath River; however, the Trinity River in the Hoopa territory was also affected. Although a larger number of Klamath River fall-run Chinook died, a greater proportion of the Trinity River run was affected by the fish kill.

This is because the Trinity run is substantially smaller than the Klamath run on an annual basis, and the Trinity run was at its peak during the height of the fish kill. The effects were more pronounced in the Trinity River than the Klamath River because the fish kill occurred downstream from the confluence of the Trinity and the Klamath, and thus eliminated much of the fishing opportunity on the Trinity River.

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin, as noted above. However, the current operations of the four Klamath River dams significantly affect the trust resources of the Hoopa Valley Tribe and other resources traditionally used by the Hoopa, by extension, their cultural values, and their continued operation under the No Action/No Project Alternative would result in no change from existing conditions.

3.12.3.4.5 Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect tribal trust resources and other traditionally used resources. Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, The East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Hoopa Valley Indian Tribe (Table 3.12-3). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

KBRA – Programmatic Measures

Upon becoming a Party to the KBRA in accordance with Section 38, the Hoopa Valley Tribe will be eligible for funding to implement programs under the KBRA. The KBRA has several programs that could result in impacts/effects to Trust Resources and other traditional resources used by the Hoopa Valley Tribe. Specific KBRA programs potentially affecting Trust Resources and other traditional resources include the Tribal Fisheries and Conservation Management Program. Other KBRA programs would have effects on trust resources of aquatic resources, water quality, and terrestrial resources; these programs' effects are discussed in Sections 3.2, 3.3, and 3.5 of this EIS/EIR.

Implementation of the Tribal Fisheries and Conservation Management Program could result in impacts/effects to Trust Resources and other traditionally used resources. As the original stewards of the natural resources of the Klamath Basin the Hoopa Valley Tribe holds a special position in the Basin and has interests in and a traditional relationship to the Basin ecosystem and its fisheries. Implementation of the Tribal Fisheries and Conservation Management Program would provide funding to assist the tribe in developing their capacity to participate in resource management activities within the Basin, particularly relating to tribal fishing and revitalization of tribal subsistence and other economic activities. The timing of and specific locations where these resource management actions could be undertaken is not certain but the improvements they are

anticipated to support in trust resources would contribute to the effects of hydroelectric facility removal analyzed above. Implementation of the Tribal Fisheries and Conservation Management Program would generate beneficial effects to Trust Resources and other traditionally used resources. Implementation of specific plans and projects associated with the Tribal Fisheries and Conservation Management Program will require future environmental compliance as appropriate.

3.12.3.4.6 Alternative 3: Partial Facilities Removal of Four Dams

Partial facilities removal could affect tribal trust resources and other traditionally used resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Hoopa Valley Indian Tribe (Table 3.12-3). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.4.7 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not fully resolve the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Hoopa Valley Indian Tribe (Table 3.12-3). Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to trust resources and rights would persist.

3.12.3.4.8 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Hoopa Valley Indian Tribe (Table 3.12-3), but

not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.5 Yurok Tribe

3.12.3.5.1 Yurok Tribe History[5]

With more than 5,000 members, the Yurok Tribe is the largest tribe in California. The tribe's ancestral territory covers approximately 350,000 acres and includes approximately 50 miles of Pacific coastline. Today, the tribe's reservation, located in Del Norte and Humboldt Counties, California, encompasses approximately 57,000 acres, and consists of a strip of land beginning at the Pacific Ocean and extending a mile along each side of the Klamath River a distance of about 45 miles upriver, to just above the confluence of the Klamath and Trinity rivers. This reservation configuration came about through a complex series of Federal reports and legislative acts.

Today the Yurok Tribe, headquartered in Klamath, California, with an upriver office located in Weitchpec, California, employs more than 200 people, boasts one of the most substantial fishery programs on the entire Klamath River, and self-regulates its subsistence and commercial fishery. The tribe actively participates in the in-river and upslope restoration of its ancestral lands and has signed a collaborative management agreement with the DOI that memorializes the prime role that the Yurok Tribe maintains in managing its resource base (DOI 2011; DOI 2012).

In summary, Sloan (2011:55) states:

> The inseparable relationship of the Yurok people with the environment and resources provided by the rivers of the Klamath-Trinity Basin cannot be overemphasized. The Klamath River is a vital natural resource which is the foundation of Yurok social and cultural way of life. At its most basic level, the River has always been a source for food and other necessities of daily life…Even rocks from the river are used by Yurok people to practice their cultural ways. The Yurok River is traveled during religious ceremonies and in recreational activities, it is integral to the Yurok language and its oral tradition and truly represents the binding force of their community. Yurok use of the River developed over a long period of time as evidenced by the complexity of their religious ceremonies and practices. In aboriginal times, religious practices were integrated with fisheries management.
>
> The Yurok have many traditional dances and ceremonies which they have long practiced along the banks of the Klamath and Trinity Rivers. The Yurok's ceremonial way-of-life has greatly suffered with the deterioration of the region's rivers. The Yurok have always depended on the Klamath

[5] A detailed report documenting the history and culture of the Yurok prepared by Sloan (2011) is included in Appendix B of the DOI (2012) report.

> and Trinity Rivers and the sustenance that their flows provide, they name themselves after the rivers and much of their universe is defined in terms of their physical relation to rivers. Residency, natural and cultural resource sites, ceremonial practices, oral history, transportation routes, economic and sociological resources, indeed the Yurok identity, are all intricately woven into the ecosystems of the Klamath and Trinity Rivers. Yurok continue to live upon some of the forty-four village sites that line the Klamath and lower Trinity Rivers. These are places where Yurok have lived, fished, gathered, prayed and have been buried for countless centuries.

3.12.3.5.2 Yurok Cultural Practices

Fishing

The Yurok have long practiced their traditional dances and ceremonies along the banks of the Klamath River. Consequently, deterioration of the Klamath River affects Yurok ceremonial and traditional practices. The lives of the Yurok people have always been intricately tied to the river. Historically, they depended on the river for sustenance, and much of their world was defined in terms of their physical relation to the river. Natural and cultural sites, daily and seasonal ceremonial practices, oral traditions, transportation routes, economic resources, social relationships, and the Yurok identity were all drawn from the river.

The Yurok base time and direction on the flows of the Klamath River as much as on the rising and setting of the sun, which can be obscured by the steep terrain, deep forests, and rainy conditions of the Klamath Basin. As one Yurok elder said, “Without this river we would not know who we are, where we’re from, or where we’re going.” Under natural conditions, the rates and sounds of the river’s flow tell the Yurok both the season and the time of day. The skill of the Yurok fisherman has always been measured by his ability to navigate the Klamath River in the dark, not by the stars or landmarks, but by correlating the location and swiftness of the current and back eddies of the river with the sounds that are unique to each bend and riffle. Moreover, the Yurok people are so attuned to the river that they have a name for each characteristic of the water’s movement. Even when Yuroks are away from the river, they remain acutely aware of their location in relation to it, always measuring direction by the river’s flow. For example, it is not uncommon to refer to the burners on a kitchen stove as upriver or downriver, depending on their position. One Yurok elder said, “The river flows like our blood. It is our veins and arteries.”

Many of the Yurok cultural sites on the Klamath and lower Trinity Rivers are traditional fishing spots owned by families. Fishing spots are locations where there are deep holes, significant back eddies, and ideal spots to set a net or erect a platform out over the river. Fishing spots can be given, inherited, loaned, leased, and bought and sold, and are central to the Yurok economy. Over time, as the rivers’ flows have changed, so have the locations of these cultural sites. To this day the Yurok continue to live in some of the

village sites that line the Klamath and lower Trinity Rivers, where they still practice many of their traditions in places where the Yurok have lived, fished, gathered, prayed, and buried their dead for centuries.

The Yurok Tribe conducted subsistence fishing in 1987 through 1989. Since 1990, tribal commercial harvests have been marginal and have not provided a comfortable standard of livelihood as originally envisioned for the Yurok in the Hoopa Yurok Settlement Act. At the same time, subsistence fishing has been severely limited. The decreased harvests have had a significant adverse impact on the tribe's economies and health, as described below.

Trade and Barter

Fish are the Yurok Tribe's most valuable asset and a mainstay of their economy. Abundant fish allow Yurok to feed themselves and their families and to acquire products from outside their territory through trade. Fish was a trading commodity available to any enterprising man. A young man who diligently fished and successfully traded fish for other items could amass sufficient wealth to buy a boat, travel to collect all of the necessary items to fashion intricate ceremonial regalia, and to allow him to marry. Fish were the baseline resource that facilitated the acquisition of wealth and upward social mobility in Yurok culture.

Religious Practices

First Salmon Ceremonies were initiated around April when fish first breeched the sandbar at the mouth of the Klamath River. The ceremony was conducted to celebrate the harvesting of fish and to pray for continuing prosperity and access to subsistence resources. Written and oral tradition indicates that prior to impacts on the fishery beginning with miners who arrived during the Gold Rush, salmon were entering the river in distinguishable waves throughout the year. The major run was traditionally that of the spring salmon. George R. Field, supervisor of the cannery of the Klamath Packers Association at the mouth of the Klamath, described the runs in 1930:

> As the run of winter steelheads ceases, about March 30, spring Salmon begin to come. A few enter the Klamath in the later part of February, but the run really starts in March and slackens or almost entirely passes by the last of May. These fish average about 11 pounds in weight and are indistinguishable from those which come later, except that the eggs are always immature. These spring salmon may be caught in the smaller streams fed by melting snow at the headwaters of Salmon River during the month of May.

In early spring the first salmon to enter the Klamath River was traditionally speared and ritually eaten by Yurok medicine men, which signified the beginning of the fishing season. The beginning of fishing season also marked the construction of the fish dam at Cappell, located 33 miles from the mouth of the Klamath River. The fish dam that has not been constructed since 1913 was built by Yurok men under the supervision of a

Yurok medicine man. Dam construction sanctified the taking, distribution, and consumption of salmon. All other ceremonies were scheduled only after the fish dam ceremony took place.

Salmon are ritually managed to ensure that Yurok are provided with fish and that enough fish spawn to maintain the fishery. Yurok maintain a general reverence for salmon; however, a strong belief prevails that without proper ceremony the salmon will not return in sufficient numbers. Regardless, the river is central to most Yurok ceremonies. There are several rocks along the river etched with petroglyphs that provide instructions from the Creator to the Yurok people. One message is a warning that when the rivers stop flowing that will mark the end of the Yurok world. Accordingly, some elders have prophesied that the manipulation of flows by damming represents the beginning of the end for the Yurok.

The Brush Dance, intended as a communal focus around an ailing child, is held in many of the traditional village sites along the Klamath River. The ceremony requires the proper river setting and the availability of river resources. As a Brush Dance unfolds over a four-day period, the participants celebrate the wealth that the riverine environment provides. Baskets made of plant materials collected at the water's edge are used to hold food and ceremonial medicine. Acorns are cooked in the baskets and converted into a nourishing mush using hot rocks gathered from specific river bars. Regalia used by dancers is constructed from various plant and animal products that the riverine environment provides. Ceremonial hosts are expected to feed visitors salmon, and to fail in providing such traditional food to guests is considered an insult.

Beginning with the California Gold Rush and the appearance of large numbers of EuroAmericans in traditional Yurok territory, Yurok traditional cultural practices began to decline; however, during the 1970s and 1980s Yurok cultural practices were revitalized. Tribal elders began to teach young people traditional Yurok practices and ceremonies. The Jump Dance was conducted in Pecwan in 1984, a War Dance was held in the late 1980s, communities came together to support the revival of Brush Dances, and in 2000 the White Deerskin Dance was held for the first time in many years at Weitchpec (DOI 2011; DOI 2012).

Oral Traditions

The anthropologist Alfred Kroeber traveled throughout Yurok territory in the early 1900s interviewing Yurok people and documenting the tribe's riverine way of life. Kroeber (1976) presents 169 Yurok stories, of which 77 make direct reference to the Klamath River. Among the stories are tales and information regarding construction of fish dams, locations and origins of ceremonies held along the river, bad places in the river, locations where the first salmon was created, what one must do with salmon caught at certain locations, how the river came to flow the way it does, and death passage on the river. It is evident from transcriptions of Yurok stories that the Klamath River is an integral part of their way of life and a basis of their tradition and culture. These stories highlight a healthy and vibrant river ecosystem.

The use of the Yurok language dramatically decreased when non-Indians settled in the Yurok territory, and by the early 1980s it was near extinction. When the Yurok Tribe began to operate as a formal tribal government in 1988, the Yurok created a language revitalization program. The use of old records helped new language learners, but hearing fluent speakers was the most effective way for young people to acquire the language (DOI 2011; DOI 2012).

3.12.3.5.3 Yurok Potentially Affected Trust Resources

In a government-to-government consultation meeting concerning Yurok trust resources affected by current dam operations held on September 28, 2010, the Yurok Tribe asserted the following as Yurok trust resources: water, fish, land, wildlife, minerals, and timber. The Yurok Tribe asserted that the United States has a trust responsibility to protect such resources and ensure that such resources are managed for the beneficial use of the Tribe and its membership. The Yurok further assert that the Federal Government has other trust responsibilities to the Yurok in the areas of social welfare, education, and health. For example, Yurok believe that limited access to water, aquatic, and terrestrial resources has restricted the ability of Yurok to practice of some of their most important traditions. This includes freely fishing the once-prolific semi-annual salmon runs and participating in the cycle of ceremonies initiated concurrently. In the past, the Yurok were not inclined to leave their territory; currently, several factors, including an inability to meet subsistence needs from the fishery and a perception that the rivers are dirty, prompt younger tribal members to leave the area to find work (DOI 2011; DOI 2012).

The Yurok tribal chairperson, when asked if such trust resources were affected by the current dam operations, responded “Yes” and went on to relate that the Yurok understand that their resources are intricately interconnected to multiple ecosystems. The Yurok World Renewal Ceremonies, recently completed at the time of the meeting, were provided as an example of how Yurok understand and pray for the integrity of such ecosystems. Table 13.12-5 identifies trust resources and rights associated with the Yurok Tribe. The United States does not necessarily agree that all of the above resources are in trust (and therefore form the basis of a trust relationship), but the resources are important to the Yurok (and thus to the United States) for their traditional and ceremonial use.

3.12.3.5.4 Yurok Health Impacts

Secondary effects of the Klamath River dams on the Yurok Tribe include emotional and physical conditions such as increased obesity, diabetes, and heart disease due to loss of traditional salmon diet, and depression and alienation that can result in suicide (DOI 2011; DOI 2012).

3.12.3.5.5 Effects Determinations

Alternative 1: No Action/No Project - Yurok and Damming of the River

Continued impoundment of water could affect tribal trust resources and other traditionally used resources. The damming of the river has resulted in changes in the

Table 13.12-5. Effects of Current Dam Operations on Yurok Tribe Trust Resources and Rights

Trust Resource/Right	Effects
Water resources	Altered flows
	Altered water temperature regime
	Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
	Diminished aesthetics
	Algae clogged fishing nets
	Human exposure to toxic water while conducting cultural activities
	Diminished opportunity for traditional bathing
Aquatic resources	Loss of habitat
	Less suitable water temperature regime
	Reduced bedload transfer
	Increased potential for disease/parasites
	Reduced population size
	Diminished livelihood
	Loss of traditional salmon diet and increased risk of heart disease, strokes, diabetes, and obesity among tribal members
	Depression, alienation, and possible suicide
	Tribal members leaving ancestral territory
	Lost opportunities for transmitting traditional knowledge
Terrestrial resources	Reduced food availability
	Loss of riparian habitat
	Diminished plant availability for cultural practices and related benefits
	Loss of opportunity for inter-generational traditional knowledge transmission

Source: DOI 2011; DOI 2012

flows of the water and the resources it offers to the tribe, along with myriad losses to tradition and culture (USFWS et al. 1999). Despite significant degradation of the river ecosystem of the Klamath region through the latter 19th and first half of the 20th centuries, the Yurok persisted in their traditional reliance on the river and its resources. Although it became increasingly difficult, the tribe continued to practice its ceremonies and religions and gathered vegetation for baskets, food, medicines, and other purposes. As much as possible, Klamath River fish caught by the Yurok tribal membership continued to be an important component of the tribe's diets. Indeed, many of today's older Yurok grew up with a strong physical connection to the river and a great appreciation for the traditions and ways of life of their ancestors.

The presence of the dams on the upper reaches of the Klamath River has brought about changes in Yurok culture. Sites for fishing and traditional use have become clogged with

debris and algae, and fish populations have declined. Observers report that when tribal members try to use their traditional fishing nets, they fill with algae, which is a sign of an unhealthy river.

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin. Mining activities in the Klamath basin have significantly decreased over the last several decades. Timber extraction in the basin has slowly become controlled by better regulations at the Federal and State levels to the point where timber extraction is now better characterized as forest management.

However, the current operations of the four Klamath River dams significantly affect the trust resources of, and other resources traditionally used by the Yurok Tribe and, by extension, their cultural values, and their continued operation under the No Action/No Project Alternative would result in no change from existing conditions.

3.12.3.5.6 Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect tribal trust resources and other traditionally used resources. Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the KBRA would be implemented, the East and Westside Facilities would be decommissioned, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Yurok Tribe (Table 3.12-4). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

KBRA – Programmatic Measures

The KBRA has several programs that could result in impacts/effects to trust resources and other traditional resources used by the Yurok. Specific KBRA programs potentially affecting trust resources and other traditional resources include the Tribal Fisheries and Conservation Management Program. Other KBRA programs would have effects on trust resources of aquatic resources, water quality, and terrestrial resources; these programs' effects are discussed in Sections 3.2, 3.3, and 3.5 of this EIS/EIR.

Implementation of the Tribal Fisheries and Conservation Management Program could result in impacts/effects to Trust Resources and other traditionally used resources. As the original stewards of the natural resources of the Klamath Basin the Yurok hold a special position in the Basin and have interests in and a traditional relationship to the Basin ecosystem and its fisheries. Implementation of the Tribal Fisheries and Conservation Management Program would provide funding to assist the tribe in developing their capacity to participate in resource management activities within the Basin, particularly relating to tribal fishing and revitalization of tribal subsistence and other economic activities. The timing of and specific locations where these resource management actions could be undertaken is not certain but the improvements they are

anticipated to support in trust resources would contribute to the effects of hydroelectric facility removal. Implementation of the Tribal Fisheries and Conservation Management Program would generate beneficial effects to trust resources and other traditionally used resources. Implementation of specific plans and projects associated with the Tribal Fisheries and Conservation Management Program will require future environmental compliance as appropriate.

3.12.3.5.7 Alternative 3: Partial Facilities Removal of Four Dams

Partial facilities removal could affect tribal trust resources and other traditionally used resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Yurok Tribe (Table 3.12-4). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.5.8 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not fully resolve the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Yurok Tribe (Table 3.12-4). Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to trust resources and rights would persist.

3.12.3.5.9 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Yurok Tribe (Table 3.12-4), but not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.6 Resighini Rancheria

3.12.3.6.1 Resighini Rancheria History

The Resighini Rancheria was originally thought to consist of 228 acres. A resurvey in 1974 determined the size of the Rancheria to be 238.78 acres. It is located in Del Norte County, California. It is primarily settled by Yurok Indians affiliated with the Yurok Coast Indian Community. (Davis, R. B., Letter to Acting Superintendent of Indian Affairs. (July 27, 1973)) The Resighini Rancheria has 132 enrolled members. A population of 36 was reported to live on Rancheria lands in the 2000 U.S. Census. The Resighini Rancheria is located several miles inland from the mouth of the Klamath River and rests on the southern banks of the river, completely surrounded by the Yurok Reservation.

The land for the Rancheria was purchased from ranch owner Augustus (Gus) Resighini by the Secretary of the Interior in 1938 under the authority of the Indian Reorganization Act. The Secretarial proclamation, deeming the land "reservation," proclaimed the purchase was to "provide for the protection of the soil, the proper development of the land, and the equitable distribution of benefits from the land."(*Secretarial Proclamation proclaiming the purchased lands a reservation. (October 21, 1939))* The lands, although located mostly in the floodplain of the Klamath River, were productive hay fields and supported a substantial dairy farm. Additional letters between various Indian Agents and the central office of the Secretary, justifying the purchase, commented on the possibility of Rancheria members continuing to operate the dairy farm, produce hay, grow vegetable gardens, and perhaps receive jobs as fishing guides for the burgeoning recreational fishery that the Klamath River was, at that time, known for providing.

The original proposal to create the Resighini Rancheria described the "228-acre" tract of land as "agricultural" with conditions that are "ideal for farming or dairying."(*Merin (December 28, 1937))* However, the value of the land as agricultural was directly connected to the loss of the traditional fisheries. During the settlement of this land, disastrous flooding periodically occurred, with a 100-year flood washing through in 1964. This natural disaster led to the removal and evacuation of Indian families to other local areas.

In 1975, a band of Yurok Indians stood together and formally created a non-traditional form of government with a constitution and bylaws, which were approved and ratified by Indian commissioner Bruce Thompson from the Department of the Interior. In 1979, the Indian people who chose to return to the Resighini Rancheria began the challenge of rebuilding.

In past years, commercial and subsistence fishing was a primary means of economic and subsistence support for the Yurok along the Klamath River. However, with the closure and restrictions on tribal fishing, the Yurok people lost this means of support.

Today the Resighini Rancheria employs a dozen people and operates a campground. A former casino and cafe received flood damage in the 1990s and are no longer operational. The tribe also operates a gravel-extraction enterprise along the course of a secondary

channel to the Klamath River that runs through rancheria boundaries. Ground water wells have been assessed and are slated for improvements that will lead to better water distribution throughout the rancheria in support of several residences and the campground and for irrigating agricultural lands. The tribe recently purchased off-rancheria and adjacent fee lands totaling 196 acres. This additional acreage is mostly riparian habitat along the mainstem of the Klamath River and includes the old Waukel Flat Indian Agent site.

The Rancheria has a reserved water right per the reserved water rights doctrine. The reserved rights doctrine provides that when lands are set aside as Indian or other Federal reservations, sufficient water to fulfill the purpose of the reservation is reserved as well. Federal reserved water rights arise expressly or by implication from Federal treaties, statutes, and executive orders, and vest no later than the date the reservation was established. Unlike State appropriative rights, Federal reserved water rights are for present and future uses and may be exercised at any time and are not lost through non-use. While Federal reserved water rights may be quantified and administered by States in the context of comprehensive State water adjudication, they are otherwise governed by Federal, not State, law.

3.12.3.6.2 Resighini Rancheria Cultural Practices
Fishing, Trade and Barter, Religious Practices, and Oral Traditions

The Indians of the Resighini Rancheria are Yurok people; consequently they share their cultural practices and values with the general culture described for the Yurok Tribe. Resighini tribal members recently participated in the Weitchpec Jump and Deerskin ceremonies.

The original “Merin” proposal to create the Resighini Rancheria described the tract of land as “agricultural” with conditions that are “ideal for farming or dairying.” However, the value of the land as agricultural was directly connected to the loss of the traditional fisheries. In past years, commercial and subsistence fishing was a primary means of economic and subsistence support for the Yurok along the Klamath River. However, with the closure and restrictions on tribal fishing, the Yurok lost this means of support. Under the Hoopa-Yurok Settlement Act of 1988, 25 U.S.C. §§ 1300i, et seq., (The Settlement Act) the extended strip of land along the Klamath River was cleaved from the original Hoopa Valley Reservation and designated the Yurok reservation. Section §1300i- 1(e) then vested in the Yurok Tribe the authority to govern the Yurok Reservation and to administer the unalloted trust land and assets – including the fisheries – of the Yurok Reservation.

Pursuant to The Settlement Act, members of the Resighini Rancheria with Yurok heritage were given an opportunity to join the Yurok Tribe. The Settlement Act also provided qualified Indians of the original Hoopa Valley Reservation, which included allottees or their descendants, the opportunity to elect membership in the Yurok Tribe. 25 U.S.C. 1300i-5(c)(1). An Indian who chose not to affiliate with the Yurok Tribe (or

the Hoopa Valley Tribe) received a lump sum payment, but lost any "interest or right whatsoever in the … resources within or appertaining to… the Yurok Reservation." 25 U.S.C. 1300i-5(d)(3).

The Settlement Act also provided an opportunity for the Resighini Rancheria (along with others) to merge its lands and membership with the Yurok Reservation if a majority of the Rancheria's adult members voted in favor of such merger. 25 U.S.C. sec. 1300i-10(b). The Resighini Rancheria members did not exercise this option, the Rancheria remains a separate sovereign tribal government, and the Tribe and its lands were not extinguished through merger with the Yurok Reservation as would have occurred had its members exercised the merger option under The Settlement Act.

3.12.3.6.3 Resighini Rancheria Potentially Affected Trust Resources

In a government-to-government consultation meeting concerning Resighini Rancheria trust resources affected by current dam operations held on September 29, 2010, the Resighini Rancheria asserted the following as Rancheria trust resources: gravel (minerals); water as it relates to ground water for domestic, agricultural, and recreational (campground) uses; riparian plants; wetlands; fish; land; and wildlife. The Resighini Rancheria asserted that the United States has a trust responsibility to protect such resources and ensure that such resources are managed for the beneficial use of the Rancheria and its membership. The Rancheria further asserted that the Federal Government has trust responsibilities to the Rancheria in the areas of social welfare, education, and health. The United States does not necessarily agree that all of the above resources are trust resources but the resources are important to the Rancheria (and thus to the United States) for their traditional ceremonial use. Table 3.12-6 identifies Resighini Rancheria Trust Resources and rights and resources traditionally used by Rancheria members.

Any Klamath River salmonid fishing rights and concomitant water rights to which the Resighini Rancheria may be entitled have not yet been determined [Solicitor's Opinion M-36979 October 4, 1993]. Regardless, the general health and well being and cultural values of the members of the Rancheria are affected by a lack of fish in the local economy and overall water quality. The lack of fish in the local economy also has secondary effects on general tribal health and cultural well being. The Rancheria tribal council person, when asked during consultation if such resources were affected by the current dam operations, responded, "Yes" and went on to relate that water quality has declined, erosion of lands occurs at a higher rate, replenishment of gravel extraction beds has diminished, and fish returns are low. In addition, as a tribe that lives alongside the river, their aesthetic quality of life has diminished. The Rancheria people are at risk when they bathe in the river, tourists are less interested in visiting the Klamath River and staying in the campground, and in an area with fewer available fish, tribal members are likely to consume fewer traditional food resources. This has led to related impacts on tribal health such as higher rates of obesity, diabetes, heart disease, and stroke (DOI 2011; DOI 2012).

Table 3.12-6. Effects of Current Dam Operations on Trust Resources and Rights and Resources Traditionally Used by the Resighini Rancheria

Trust Resource/Right	Other Resources Traditionally Used By The Tribes	Effects
Water resources (ground water)		Indeterminate ground water quality
	Water resources (instream)	Altered flows
		Altered water temperature regime
		Degraded water quality caused by nutrient input, dissolved oxygen, pH, algal toxins and other contaminants
		Diminished aesthetics
		Algae clogged fishnets
		Human exposure to toxic water while conducting cultural activities
		Diminished opportunity for traditional bathing
	Aquatic resources	Loss of habitat
		Less suitable water temperature regime
		Reduced bedload transfer
		Increased potential for disease/parasites
		Reduced population size
		Less traditional salmon diet and increased risk of heart disease, strokes, diabetes, and obesity
		Tribal members leaving reservation
		Fewer opportunities for transmitting traditional knowledge
		Increase in invasive species (Asian clams)
Terrestrial Resources		Real property: erosion and flooding
		Mineral: less gravel replacement
	Terrestrial resources	Reduced food availability
		Reduced riparian habitat
		Diminished plant availability for cultural practices and related benefits
		Loss of opportunity for inter-generational traditional knowledge transmission

Source: DOI 2011; DOI 2012

The Yurok of the Resighini Rancheria bathe in the river and use its water for daily and ritualistic purposes. Because of their reliance on the river for so many aspects of their lives, they are concerned about the quality of its water. The Klamath Hydroelectric Project has effects on water quality and related environmental issues, such as watershed health, riparian habitats, erosion, sediment, turbidity, sources of pollution and temperature changes, algae blooms, low dissolved oxygen, high pH, and un-ionized

ammonia. The cumulative effects may result in health problems, not just for the people who live on the Rancheria, but also for the tourists who come and camp in the area every year, and for people who use the water for business purposes or who work for those businesses.

A 1975 Resighini Rancheria Water Resources Investigation Report states that samples were not taken of the water in the abandoned well. It also states that coliform was found in a sample taken from a stream running through the Rancheria. A second report completed by the Bureau of Reclamation (Reclamation) in 2010 to document an Environmental Assessment of the Resighini Rancheria's Water Resources states: "The Rancheria is in need of an additional source of dependable drinking water to reduce potential health risks associated with their current operation." Later, the same document states: "Hydrogeologic information is currently not available for water-bearing formation, ground water level trends, and ground water storage for the Lower Klamath River Valley ground water basin."

3.12.3.6.4 Resighini Rancheria Health Impacts

Secondary effects of the Klamath River dams on the people of the Resighini Rancheria include emotional and physical health effects such as increased obesity, diabetes, heart disease due to loss of the traditional salmon diet, and depression, alienation, and suicide. Additionally, the tribal members experience a loss of opportunity for inter-generational transmission of traditional knowledge. These conditions result in tribal members, especially young people, leaving the reservation for opportunities elsewhere (DOI 2011; DOI 2012).

3.12.3.6.5 Effects Determinations

Alternative 1: No Action/No Project - Resighini Rancheria and Damming of the River

Continued impoundment of water could affect tribal trust resources and other traditionally used resources. The Klamath River dams have significantly reduced the ability of tribal members to engage in traditional and contemporary subsistence and religious practices. The availability and rights to traditional foods and basket-making materials have been affected by the presence of the dams. The dams have altered the natural flows of the river, which has affected the formation of the sand spit in terms of sand buildup and the ability of the river to clear a path through the spit to the ocean. As a result of altered functions, including increased sand build up coupled with seasonal low flows, the Rancheria has experienced more fall flooding of its lands.

The Rancheria members have noticed an invasion of clams (identified generally as "Asian clams") and wonder how that might alter the ecosystem. The tribe is not sure whether invasive species can be directly attributed to the dams, but does know that the clams have migrated from upriver to downriver. Although new species are introduced into the ecosystem with unknown consequences to Rancheria members, the Rancheria has also witnessed the demise of traditional species such as the spring run of Chinook and

the near extinction of the Klamath population of eulachon. The demise of these populations is generally attributed to poor Klamath River water quality (DOI 2011; DOI 2012).

Many historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin. Mining activities in the Klamath basin have significantly decreased over the last several decades. Timber extraction in the basin has slowly become controlled by better regulations at the Federal and State levels to the point where timber extraction is now better characterized as forest management, as noted above.

However, the current operations of the four Klamath River dams significantly affect the trust resources of the Resighini Rancheria and, by extension, their cultural values, and their continued operation under the No Action/No Project Alternative would result in no change from existing conditions.

3.12.3.6.6 Alternative 2: Full Facilities Removal of Four Dams Alternative (the Proposed Action)

Removal of the Four Facilities could affect tribal trust resources and other traditionally used resources. Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the City of Yreka Water Supply Pipeline would be installed, and the KBRA would be implemented. KBRA programs would have effects on trust resources of aquatic resources, water quality, and terrestrial resources, which are discussed Sections 3.2, 3.3, and 3.5 of this EIS/EIR. Implementation of the Proposed Action, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Resighini Rancheria (Table 3.12-5).

3.12.3.6.7 Alternative 3: Partial Facilities Removal of Four Dams

Partial facilities removal could affect tribal trust resources and other traditionally used resources. Under the Partial Facilities Removal of Four Dams Alternative, four dams and their associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the East and Westside Facilities would be decommissioned, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be installed. Implementation of the Partial Facilities Removal of Four Dams Alternative, including the KHSA and KBRA, would, in the long term, benefit the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Resighini Rancheria (Table 3.12-5). Actions addressing these issues are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

3.12.3.6.8 Alternative 4: Fish Passage at Four Dams

Fish passage at four dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish

passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Four Dams Alternative would benefit fish populations. However, implementation of this alternative would not resolve the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Resighini Rancheria (Table 3.12-5). Under the Fish Passage at Four Dams Alternative issues related to water, aquatic, and terrestrial resources related to trust resources and rights would persist.

3.12.3.6.9 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

Fish passage at two dams and facilities removal of two dams could affect tribal trust resources and other traditionally used resources. Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented. Implementation of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would address the water, aquatic, and terrestrial resources issues related to trust resources and rights identified by the Resighini Rancheria (Table 3.12-5), but not to the same degree as the Proposed Action or Partial Facilities Removal of Four Dams Alternatives. Actions addressing issues related to water, aquatic, and terrestrial resources are presented in Sections 3.2, 3.3, 3.4, and 3.5 of this EIS/EIR.

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3.13 Cultural and Historic Resources

This section discusses the Proposed Action and alternatives' potential effects on cultural resources, historic properties, and historical resources.[1] United States Department of the Interior (DOI) elected to utilize the National Environmental Policy Act (NEPA) process to meet the requirements of Section 106 of the National Historic Preservation Act (NHPA) as allowed under 36 CFR Section 800.8(c). DOI defines the undertaking, for purposes of Section 106 of the NHPA, as the removal of the four PacifiCorp dams which may be a result of the Secretarial Determination. The proposed undertaking has the potential to affect historic properties triggering compliance with Section 106 of the NHPA. The analysis and consultations concerning any effects of the Proposed Action and alternatives on historic properties will be integrated into the NEPA review and documentation pursuant to the criteria identified in 36 CFR Section 800.8(c)(1)-(4). The following section also incorporates the compliance requirements of the California Environmental Quality Act (CEQA).

3.13.1 Area of Analysis

The area of analysis for cultural and historic resources includes the area of potential effects (APE) for the Proposed Action (removal of the four dams and facilities) as this represents the largest APE of all alternatives and is inclusive of all APEs for each of the other alternatives. The APE is defined as the Klamath River from the outlet at Keno Dam to the river's outlet at the Pacific Ocean (approximately 250 miles long), and extending outward for 0.5 miles from each bank of the river, plus a 0.5-mile-wide corridor from the high water mark surrounding each of the four reservoirs, and all four dams and associated facilities.

3.13.2 Regulatory Framework

The following definitions are common terms used to discuss the regulatory requirements and treatment of cultural resources:

> **Cultural Landscape** is a geographic area, including both cultural and natural resources, associated with an historic event, activity, or person or exhibiting other cultural or aesthetic values. (Birnbaum 1994). An ethnographic landscape, one type of cultural landscape, is described as a landscape containing a variety of natural and cultural resources that associated people define as heritage resources. (Birnbaum 1994). Cultural landscapes may be evaluated for eligibility as a historic property following the criteria 36 CFR Section 60.4.

[1] Revisions to this section of the EIS reflect DOI's obligations under Section 106 of the NHPA, which is being integrated into the NEPA process and documentation, including DOI's on-going consultation efforts with the consulting parties as discussed herein. The revisions in part seek to respond to comments, suggested edits, and/or proposed additions that were raised by consulting parties.

Cultural resource is a term used to describe several different types of properties, both made/modified by people and natural: prehistoric and historical archaeological sites; architectural properties such as buildings, bridges, and infrastructure; and resources of traditional or historic importance to Indian tribes and other cultural groups.

Historic properties is a term defined in 36 CFR Part 800, the implementing regulations for Section 106 of the NHPA, as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places (National Register), including artifacts, records, and material remains related to such a property. Criteria for eligibility for listing on the National Register are found at 36 CFR Section 60.4. The term includes properties of traditional religious and cultural importance (Traditional Cultural Properties or Cultural Landscapes) to an Indian tribe or other cultural group that also meet the National Register criteria.

Historical resource is a CEQA term that includes buildings, sites, structures, objects, or districts, each of which may have historical, prehistoric, architectural, archaeological, cultural, or scientific importance, and is eligible for listing or is listed in the California Register of Historical Resources (California Register).

Historic District is a significant concentration, linkage, or continuity of sites, buildings, or structures united historically or aesthetically by plan or physical development. A Historic District derives its importance from being a unified entity, even though it is often composed of a wide variety of resources. The identity of a District results from the interrelationship of its resources, which can convey a visual sense of the overall historic environment or be an arrangement of historically or functionally related properties. A District can include sites, structures, and features that, on their own, lack individual distinction, but are significant as a group. A District will have an identified theme and time period of significance.

Programmatic Agreements are negotiated agreements between Federal agencies, the Advisory Council on Historic Preservation (ACHP), and State Historical Preservation Officers (SHPOs), in consultation with other interested parties, that govern the implementation of a particular program or the resolution of adverse effects from certain complex project situations or multiple undertakings, as defined in 36 CFR Section 800.14. Programmatic Agreements may be used when effects on properties are similar and repetitive or are multi-State; when effects on historic properties cannot be fully determined prior to approval of an undertaking; when non-Federal parties are delegated major decisionmaking responsibilities; and for dealing with the potential adverse effects of complex projects or multiple undertakings.

> **Traditional Cultural Property (TCP)** is defined as a property eligible for inclusion in the National Register "because of its association with cultural practices or beliefs of a living community that (a) are noted in that community's history, and (b) are important in maintaining the continuity of the community (Parker and King 1998)."

3.13.2.1 National Historic Preservation Act of 1966, as amended in 1992

The NHPA is the primary Federal legislation governing preservation of cultural and historical resources in the United States. The NHPA established a national historic preservation program which encourages the identification and protection of cultural resources. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties listed in or eligible for the National Register and afford the ACHP a reasonable opportunity to comment on such undertakings (16 USC Section 470f). The ACHP promulgated the Section 106 implementing regulations, found at 36 CFR Part 800, which sets forth the Section 106 process, including consultation requirements.

3.13.2.1.1 Compliance with Section 106 of the NHPA

As allowed under the Section 106 regulations, DOI has elected to integrate compliance with Section 106 through the NEPA process pursuant to 36 CFR Section 800.8(c)(1)-(4). This integrated approach satisfies the regulatory steps of the Section 106 process by using the NEPA process and the documentation required for the preparation of an Environmental Impact Statement (EIS)/ Record of Decision (ROD) to evaluate and resolve an undertaking's potential adverse effects on historic properties. The regulations identify specific requirements that the Federal agency must meet through the NEPA process and documentation in lieu of the Section 106 process set forth in 36 CFR Sections 800.3 through 800.6. These standards, and a description of how DOI will meet those standards, are described below.

Initiation of the Section 106 Process

The definition of the Federal undertaking is an important step in the initiation of the Section 106 process. In this case, the proposed undertaking is the potential removal of the four lower PacifiCorp dams. The proposed undertaking and the alternatives being analyzed in this EIS/Environmental Impact Report (EIR) are limited to only the selection of an approach involving partial or full dam and associated facilities removal, the installation of fish passages, and activities associated with the action alternatives. The specific details of how the proposed undertaking or the alternatives might be implemented are not fully known at this time and cannot be fully analyzed in this EIS/EIR, nor will a decision through the EIS/EIR authorize the removal of dams without additional compliance with NEPA and other Federal environmental laws, including Section 106 of the NHPA. Future decisions will evaluate how to implement the Proposed Action or other selected action alternative.

Use of the NEPA Process In Lieu of the Section 106 Procedures Set Forth in 36 CFR Sections 800.3 through 800.6

The regulations for Section 106 permit Federal agencies to integrate Section 106 compliance with the NEPA process (36 CFR Section 800.8). Due to the scope and scale of this undertaking, DOI has chosen to utilize this provision in order to reduce redundancies when complying with both laws; provide the broadest possible opportunities and greatest convenience for the public to review and consult on DOI's Proposed Action; and ensure that concerns pertaining to historic properties are fully integrated into the EIS and the ROD.

The Section 106 regulations clearly state that integrating the Section 106 compliance process with NEPA does not waive Federal agency obligations under either law. While the regulations do permit the DOI to take advantage of the NEPA process, the Agency must still adhere to the fundamental direction for compliance with Section 106. The following summarizes the DOI's actions to comply with these provisions (36 CFR Sections 800.8(c)(1) through 800.8(c)(4)).

Notifications

A Federal agency must disclose its intent to integrate the Section 106 process with the NEPA process to the appropriate SHPOs/Tribal Historic Preservation Officers (THPOs) and the ACHP prior to the review. DOI notified the ACHP, the California SHPO and Oregon SHPO, and the Yurok THPO and Karuk THPO, of its intent to implement the Section 106 regulations through the NEPA process by letter dated June 23, 2011.

Identifying consulting parties pursuant to 36 CFR Section 800.3(f)

The public involvement process for NEPA has been extensive and sustained. It has included outreach and invitations to consult to other Federal agencies, State and local governments, nongovernmental organizations, and the public. In addition, DOI has separately notified the ACHP, California SHPO, Oregon SHPO, six federally recognized Indian tribes (including the Yurok and Karuk THPOs), two Indian organizations, and other interested parties.

Identify Historic Properties and Assess the Effects

For purposes of the Proposed Action to remove the four lower PacifiCorp's dams (and for the evaluation of alternatives), DOI established as the APE the Klamath River from the outlet at Keno Dam to the river's outlet at the Pacific Ocean (approximately 250 miles long), and extending outward for 0.5 miles from each bank of the river, plus a 0.5-mile-wide corridor from the high water mark surrounding each of the four reservoirs, and all four dams and associated facilities. The effort to identify and assess effects reflects DOI's consideration of the project alternatives and is commensurate with the assessment of other environmental factors. The identification of and potential effect on some historic properties cannot be fully determined prior to approval of either the proposed undertaking or an alternative evaluated in this EIS/EIR. Future decisions regarding implementation of the selected alternative will further develop the APE and identify cultural and historic properties that may be affected by future actions such as road construction or improvements and reservoir drawdown.

DOI identified known historic properties listed or eligible for the National Register, such as the Klamath Hydroelectric Facilities, and also the types of historic properties likely to occur within this area through records searches at the North Central Information Center at California State University, Chico; the Northwest Information Center, Rohnert Park; the North Coastal Information Center, Klamath, California; the Oregon Office of Historic Preservation; the Klamath National Forest; a sacred lands search conducted by the California Native American Heritage Commission; and a review of archaeological, ethnographic, and historic information. DOI also sought information from the SHPOs, Indian tribes, Native American organizations, and the public regarding information about historic resources through the scoping process for the EIS/EIR and the initiation of consultations under Section 106 of the NHPA. This data is presented in Section 3.13.3. The potential effects of the proposed undertaking and the alternatives are discussed in Section 3.13.4.

Consult Regarding the Effects of the Undertaking with Tribes that May Attach Religious and Cultural Significance to Affected Historic Properties:
Tribal consultation for Section 106 was initiated via letters dated October 19, 2010, and June 23, 2011, and continued throughout the NEPA process through correspondence, meetings, government-to-government meetings, emails, and telephone calls. Government-to-government meetings were held with the Karuk Tribe on December 6, 2011; the Quartz Valley Community on January 9, 2012; the Hoopa Valley Tribe on January 10, 2012; the Yurok Tribe on January 11, 2012; the Resighini Rancheria on January 11, 2012; and the Klamath Tribes on March 7, 2012. Tribal consultation is ongoing.

Involve the Public in accordance with the Agency's Published NEPA Procedures
The public has been involved in the scoping process for this EIS/EIR and was provided an opportunity to review and comment on this EIS/EIR. The Shasta Nation and the Shasta Indian Nation were involved in the NEPA process and consultations with both organizations are ongoing.

Develop, in Consultation with Consulting Parties, Alternatives and Proposed Measures that Might Avoid, Minimize, or Mitigate Any Adverse Effects of the Undertaking on Historic Properties
Selection of one of the proposed alternatives, other than the No Action Alternative, would be the first part of a multi-tiered decisionmaking process. The Proposed Action and the alternatives being evaluated in this EIS/EIR will require additional environmental compliance prior to initiation of ground disturbing activities. Section 106 consultation was initiated with ACHP, SHPOs, and other consulting parties, and will be ongoing through a final decision and any future agency decisions. DOI identified known historic properties and methods to further identify and evaluate historic properties. DOI has also sought information from Indian tribes regarding the identification of areas with religious or cultural importance, and this section discusses the potential effect to such resources. Measures to avoid, minimize or mitigate adverse effects are also evaluated in this section. These measures would be offered as binding commitments for future decisions, and will help to coordinate future development through those decisions. The mitigation measures

also serve as a program of action to avoid, minimize, or mitigate the effects on historic properties, through continued consultations under Section 106 of the NHPA, associated with the selected alternative.

Review of Environmental Documents

DOI submitted the Draft EIS/EIR for review and comments to the SHPOs, Tribal Historical Preservation Officers (THPOs), ACHP, Indian Tribes, Native American organizations, and other parties identified as interested parties.

Approval of the Undertaking

The measures to avoid, minimize, or mitigate potential adverse effects associated with the Proposed Action or the selected alternative will be incorporated into the Record of Decision and represent a binding commitment as the selected alternative is carried out.

3.13.2.2 Native American Graves Protection and Repatriation Act (NAGPRA)

Section 3 of NAGPRA applies to Indian human remains and other cultural items found on Federal lands and tribal lands, and addresses the treatment and disposition of those remains and items in consultation with relevant tribe(s) (see Appendix D of NAGPRA). Any Indian human remains or other cultural items found on Federal land or tribal land affected by the Proposed Action and alternatives would be subject to the procedures under NAGPRA.

3.13.2.3 Executive Order 13007 Indian Sacred Sites

In certain instances, Executive Order (EP) 13007 of May 24, 1996, may apply to the proposed alternatives for this undertaking. EO 13007 was signed by President Clinton "to protect and preserve Indian religious practices" and states as follows:

> "**Section 1.** *Accommodation of Sacred Sites.* (a) In managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.
>
> (b) For purposes of this order:
>
> (i) "Federal lands" means any land or interests in land owned by the United States, including leasehold interests held by the United States, except Indian trust lands;
>
> (ii) "Indian tribe" means and Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to Public Law No. 103-454, 108 Stat. 4791, and "Indian" refers to a member of such an Indian tribe; and
>
> (iii) "Sacred site" means any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian

individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site."

3.13.2.4 Archaeological Resources Protection Act of 1979

The Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470aa-470mm; Public Law 96-95 and amendments to it) was enacted "…to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals (Sec. 2(4)(b))." Section 4 of the statute and Sections 16.5-16.12 of the uniform regulations describe the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archaeological resource on Federal or Indian lands. The curation requirements of artifacts, other material excavated or removed, and the records related to the artifacts and materials are described in Section 5 of the act. This section also authorizes the Secretary of the Interior to issue regulations describing in more detail the requirements regarding these collections. These regulations, which affect all federally owned or administered archaeological collections were issued in 1990 as 36 CFR Part 79. The primary impetus behind ARPA was the need to provide more effective law enforcement to protect public archaeological sites. Two improvements over the Antiquities Act, which was the statute designed to provide this protection prior to ARPA's enactment, were more detailed descriptions of the prohibited activities and larger financial and incarceration penalties for convicted violators. Section 6 of the statute describes the range of prohibited actions, including damage or defacement in addition to unpermitted excavation or removal. Also prohibited are selling, purchasing, and other trafficking activities whether within the United States or internationally. Section 6(c) prohibits interstate or international sale, purchase, or transport of any archaeological resource excavated or removed in violation of a State or local law, ordinance, or regulation. Section 9 requires that managers responsible for the protection of archaeological resources hold information about the locations and nature of these resources confidential unless providing the information would further the purposes of the statute and not create a risk of harm for the resources. (Summary taken from http://www.nps.gov/archeology/tools/Laws/arpa.htm.)

3.13.2.5 California Environmental Quality Act

For the purpose of this Klamath Facilities Removal EIS/EIR, California public agencies must consider the effects of their actions on both "historical resources" and "unique archaeological resources." Pursuant to Public Resources Code (PRC) Section 21084.1, a "project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." Section 21083.2 requires agencies to determine whether proposed projects would have effects on "unique archaeological resources."

"Historical resource" is a term with a defined statutory meaning (PRC, Section 21084.1 and State CEQA Guidelines, Section 15064.5 (a), (b)). The term embraces any resource listed in or determined to be eligible for listing in the California Register. The California Register includes resources listed in or formally determined to be eligible for listing in the National Register, as well as some California State Landmarks and Points of Historical Interest.

Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the California Register and are presumed to be historically or culturally significant for purposes of CEQA unless a preponderance of evidence indicates otherwise (PRC, Section 21084.1 and California Code of Regulations, Title 14, Section 4850).

In addition to assessing whether historical resources potentially affected by a proposed project are listed in the California Register or have been identified as historically or culturally significant in a survey process, Lead Agencies have a responsibility to evaluate them against the California Register criteria prior to making a finding as to a proposed project's impacts on historical resources (PRC, Section 21084.1 and California Code of Regulations, Section 15064.5 (a)(3)). Under California Code of Regulations (CCR), Title 14, Chapter 3, Section 15064.5 (a)(3) a historical resource is defined as any object, building, structure, site, area, place, record, or manuscript that meets the following criteria:

a) Is historically or archeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political or cultural annals of California.

b) Meets any of the following criteria:

   (A) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.

   (B) Is associated with the lives of persons important in our past.

   (C) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.

   (D) Has yielded, or may be likely to yield, information important in prehistory or history.

Archaeological resources may also qualify as "historical resources" and PRC 5024 requires consultation with the Office of Historic Preservation when a project may affect historical resources located on State-owned land.

For historic structures, CEQA Guidelines Section 15064.5, subdivision (b)(3), indicates that a project that follows the Secretary of the Interior's *Standards for the Treatment of*

Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings, or the Secretary of the Interior's *Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (1995) shall be considered as mitigating impacts to a less-than-significant level.

CEQA addresses impacts, potentially significant and significant impacts, to historical resources. Historical resources are properties that are either listed on or determined eligible for inclusion on the California Register and significant impacts are defined at CCR Section 15382 as: "…a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic and aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant."

As noted above, CEQA also requires Lead Agencies to consider whether projects will affect "unique archaeological resources." PRC Section 21083.2, subdivision (g), states that "'unique archaeological resources' means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.
3) Is directly associated with a scientifically recognized, important prehistoric or historic event or person."

Treatment options under PRC Section 21083.2 include activities that preserve such resources in place in an undisturbed state. Other acceptable methods of mitigation under PRC Section 21083.2 include excavation and curation or study in place without excavation and curation (if the study finds that the artifacts would not meet one or more of the criteria for defining a "unique archaeological resource").

In addition, California law protects Indian human remains and associated cultural items regardless of their antiquity and provides for the sensitive treatment and disposition of those remains. Section 7050.5(b) of the California Health and Safety Code specifies protocol when human remains are discovered. The code states:

> In the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the human remains are discovered has determined, in accordance

> with Chapter 10 (commencing with Section 27460) of Part 3 of Division 2 of Title 3 of the Government Code, that the remains are not subject to the provisions of Section 27492 of the Government Code or any other related provisions of law concerning investigation of the circumstances, manner and cause of death, and the recommendations concerning treatment and disposition of the human remains have been made to the person responsible for the excavation, or to his or her authorized representative, in the manner provided in Section 5097.98 of the Public Resources Code.

California Health and Safety Code at Sections 8010-8011 established the California NAGPRA 2001. The State repatriation policy is consistent with and facilitates implementation of the Federal NAGPRA. The California act strives to ensure that all California Indian human remains and cultural items are treated with dignity and respect by encouraging voluntary disclosure and return of remains and cultural items by publicly funded agencies and museums in California. The act also provides a mechanism for aiding California Indian Tribes, including non-federally recognized tribes, in filing repatriation claims and obtaining responses to those claims.

CCR Section 15064.5, subdivision (e), requires that excavation activities be stopped whenever human remains are uncovered and that the county coroner be called in to assess the remains. If the county coroner determines that the remains are those of Indian Tribes, the Native American Heritage Commission must be contacted within 24 hours. At that time, the Lead Agency must consult with the appropriate Indian Tribes, if any, as identified by the Native American Heritage Commission. CCR Section 15064.5 directs the Lead Agency, under certain circumstances, to develop an agreement with the Indian Tribes for the treatment and disposition of the remains.

In addition to the mitigation provisions pertaining to the accidental discovery of human remains, the State CEQA Guidelines also require that a Lead Agency make provisions for the accidental discovery of historical or archaeological resources, generally. Pursuant to CCR Section 15064.5, subdivision (f), these provisions should include “an immediate evaluation of the find by a qualified archaeologist. If the find is determined to be an historical or unique archaeological resource, contingency funding and a time allotment sufficient to allow for implementation of avoidance measures or appropriate mitigation should be available. Work could continue on other parts of the building site while historical or unique archaeological resource mitigation takes place.”

Burials would be subject to Federal NAGPRA on Federal land and Indian land, California State burial laws in California, and Oregon State burial laws in Oregon.

3.13.3 Existing Conditions/Affected Environment

The presence of historic properties (or historical resources under CEQA) within the APE for each alternative was identified by conducting background and archival research and consulting with parties with knowledge of the area to identify known resources. In addition, through archival and background research, consultations, and knowledge of

known resources, the types of historic properties likely present in inaccessible areas (primarily areas currently inundated by the reservoirs) were identified.

Due to the nature of the action being proposed, potential effects on all historic properties cannot be fully determined prior to approval of either the Proposed Action or an alternative evaluated in this EIS/EIR. The identification and evaluation of certain resources, and the potential effects to those resources, can only be understood and addressed as particular details of how to carry out the selected alternative are developed. One particular example is historic properties and cultural resources that are thought to be currently under water that could be exposed during reservoir draw down, as a direct result of dam removal. Another example is the construction or modifications to related facilities, roads, or temporary systems that may be necessary to implement the selected alternative, which will only be known when DOI develops particular details for accomplishing the proposed alternative. As specific details are developed through designs and plans to implement the selected alternative, the designated Federal officials will conduct additional steps to identify and evaluate historic properties and alternatives to avoid, minimize, or mitigate adverse effects, in consultation with the consulting parties, in accordance with 36 CFR Part 800 and the stipulations identified in this EIS/EIR.

3.13.3.1 Regional Prehistory and Ethnography

The cultural resources area of analysis includes four culture areas; the Columbia Plateau, Great Basin, California, and Northwest Coast. These culture areas have unique histories and are occupied by different Native American cultures that exhibit diverse traits and ecological adaptations. The cultural resources analysis will focus on The Klamath Tribes, Shasta, Karuk, Hoopa, and Yurok peoples that occupy the territory along and adjacent to the Klamath River. These people have a long history of occupation of the area and traditional beliefs identify that the groups have occupied the area for time immemorial.

3.13.3.1.1 Columbia Plateau and Great Basin Culture Areas

Prehistory

The upper Klamath River and Klamath Lakes area exhibit a blend of cultural traits from the Columbia Plateau and Great Basin culture areas. The chronology of the area may be organized into the Paleoarchaic, Early Archaic, Middle Archaic, Late Archaic, and Late Prehistoric periods.

Paleoarchaic (14,000 to 7,000 Before Present [BP])

During the Paleoarchaic period, the Klamath Basin was occupied by hunter-gatherers that tended to focus on hunting large game animals, but also supplemented their diet with fish, birds, and plant resources. These groups were seasonally mobile and generally small in size (Ames et al. 1998). Two of the oldest sites in the region are Paisley Cave, which is dated at 14,200 BP (Balter 2008) and Fort Rock Cave, which is dated between 13,200 and 10,200 BP (Aikens and Jenkins 1994). The oldest site in the upper Klamath River area is the Klamath Shoal midden site, 35KL21, which yielded a date of 7,700 BP.

Early Archaic (7,000 to 4,500 BP)

Most of the archaeological evidence for early human occupation in the Klamath River Canyon dates to the beginning of the Early Archaic period (Mack 1983 and 1991). Semi-subterranean house pits first appear in the Plateau region during this period suggesting that some people were adopting a less mobile lifestyle. Typical artifacts associated with the Early Archaic include large stemmed, lanceolate, or leaf-shaped projectile points, knives, gravers, scrapers, and some cobble and ground stone tools (e.g., abraders or grinding slabs, mortars, mullers, and stone bowls).

Middle Archaic (4,500 to 2,500 BP)

The Middle Archaic period is characterized by an increase in the exploitation of riverine and marsh environments and food resources such as salmon and various plant roots/tubers. There was also an increase in the use of milling stones and pestles at sites during this period. Typical Middle Archaic artifacts include broad-necked, corner-notched, and side-notched projectile points, many types of ground stone tools, bone and antler tools (e.g., chisels and wedges), and specialized fishing gear (e.g., bone harpoon barbs and net sinkers).

Late Archaic/Late Prehistoric (2,500 to 200 BP)

Several major cultural changes occurred during the Late Period, including: the widespread appearance of pit houses; a shift to a heavy reliance on fishing; the use of storage pits for salmon; camas exploitation; the development of seasonal land use patterns (i.e., use of “winter villages”); the appearance of the bow as evidenced by the presence of small corner- and side-notched projectile points at sites; and the appearance of Olivella shell beads. Extensive trade networks became important across the region by as early as 1,500 years ago, as suggested by tools made from obsidian sources 110 to 120 miles away and the presence of beads made from marine shells.

Ethnography

The Klamath Tribes were constituted as a result of the Klamath Treaty of 1864, later ratified by Congress, and includes the Klamath, Modoc, and Yahooskin Band of Snake Indians. Prior to their placement on a shared reservation, these groups utilized overlapping resource areas in the Klamath Basin. When these groups were forcefully placed on the same reservation, they began to become more integrated. The Klamath and Modoc people occupy the entire upper Klamath Basin and adjacent interior drainages to the east, living in close association with the marsh and riverine resources of this area. The Klamath and Modoc tribes were the only populations residing in the Upper Klamath Basin prior to Euro-American contact, but they participated in salmon fishing and social gatherings along the Klamath River at least as far downstream as Seiad Valley in California. The Yahooskin principally occupy lands east of the Klamath Basin, but did participate in resource harvests, including salmon harvests, with Klamath and Modoc on the Sprague River and other Klamath River tributaries. The discussion of The Klamath Tribes will focus on the Klamath and Modoc because of their close proximity to the APE.

Stern (1998) summarizes ethnographic information regarding the Klamath Tribe collected by Barrett (1910), Spier (1930), and Berreman (1937). Deur (2011) also

presents a summary of the ethnography of the Klamath Tribes and their relationship to the Klamath River. The Klamath and Modoc are members of the Plateau Penutian language family and they speak dialects of a single language (Stern 1998). Klamath ancestral territory stretches from the southern boundary of the Deschutes River watershed in the north to Shovel Creek, which is along the Klamath River south of the Oregon and California border and from the Cascade Mountains in the west to the escarpment of Winter Rim in the east (Stern 1998). This area encompasses the Sprague River and Sycan Rivers, Sycan Marsh, Klamath Lake, and Klamath Marsh (Spier 1930; Berreman 1937). Modoc ancestral territory extends from Mount Shasta in the south to an area near the current California and Oregon border in the north and from the eastern slope of the Cascade Range near Mount Shasta to the area around Goose Lake in the east (Ray 1963). This area encompassed Lower Klamath Lake and Tule Lake.

Klamath and Modoc were both organized in villages that collectively owned productive fishing or other resource (e.g., seed or other plants) gathering areas. Influential heads of households, supported by extended families, assumed leadership roles in the villages (Stern 1998). Villages included various types of structures including semi-subterranean winter lodges for families and extended families. The Klamath and Modoc rebuilt their winter lodges in the fall. Spier (1930) identified five geographic subdivisions of winter villages:

- Klamath Marsh-Williamson River group on the southern margin of Klamath Marsh and the Lower Williamson and Sprague rivers (about 34 villages, plus four to five villages on the upper Sprague and Sycan rivers).
- Agency Lake group on Agency Lake and the northern arm of Klamath Lake (one village and one hamlet).
- Lower Williamson River group close to the mouth of Williamson River (about seven villages).
- Pelican Bay group that includes the Pelican Bay district on the west side of Klamath Lake, Four Mile Creek, and the marsh north of the lake (about eight villages).
- Klamath Falls group: along Klamath Lake south of Modoc Point (about 14 villages).

The permanent winter villages were never totally abandoned during the year. Each group of villages maintained one or more places for cremation of the dead. The ashes of cremated individuals were covered with soil and rocks. Individuals dying away from home might be interred under piles of rocks or cremated and returned to the cremation ground. Particular sweat houses, said to have been built by the legendary *Kemu'kumps*, and a hot spring were used to cleanse mourners.

Fish is the primary resource for the Klamath and Modoc; consequently settlements clustered near rivers and streams. Runs of fish began in the early spring and lasted into the fall (Spier 1930). Men, with some assistance from women, fished throughout the year from the banks of rivers or streams or from canoes using long-handled dip nets, spears,

harpoons, and hook-and-line. During parts of the year, fish drives were also used to harvest fish. Members of the tribe would drive fish toward individuals dragging triangular nets on A-frames or purse nets through the water either on foot or from a canoe. Gill nets drawn between canoes and traps were also used to acquire fish. In addition, stone barriers were constructed on some streams to restrict fish passage and facilitate fishing.

Klamath and Modoc typically left their winter villages in early spring to begin a seasonal round of harvest activities. Spring activities began with harvesting fish from the run of large suckers that took place in Upper Klamath Lake in March. Fish were dried on the branches of pine saplings and sometimes pounded into a meal and bagged for storage. As the spring sucker run subsided, Klamath and Modoc women turned their attention to digging ipos (*Carum oregonum*) roots, gathering waterfowl eggs, and scraping the cambium layers of young ponderosa pines for food. By late spring, women dug camas bulbs in wet meadows, baking them in earth ovens and sun-drying them for storage while men hunted waterfowl and other animals.

Summer was the season when women harvested wocas, the nutritious seeds of the yellow pond lily, at Klamath Marsh, Sycan Marsh, Tule Lake, Lower Klamath Lake, and other water bodies. Wocas were an important food resource and shaman conducted a ceremony at the beginning of the harvest. The seeds were processed for soup and flour. Women also collected cattail roots for drying and grinding into meal. During the summer months men hunted waterfowl and a variety of small mammals.

In fall, Klamath and Modoc gathered chokecherries, serviceberries, Klamath plums, pine nuts, blackberries, and gooseberries. Klamath and Modoc eventually moved into the high country of the western Cascades to harvest huckleberries. Women dried the berries before fires, while men hunted deer and elk and trapped furbearing mammals. Deer hunting methods included stalking and driving the animals into the lakes, rivers, or confined spaces where they could be clubbed by women in canoes or shot with bows and arrows. Whitefish were also harvested in the fall primarily by the use of dip-nets.

Klamath and Modoc sought power by visiting places where they believed that sacred beings resided and sought to gain their power through ritualized activities. Klamath and Modoc parents sent boys and girls on a power quest when they reached puberty. Fathers and mourning kinsmen sometimes sought power at the birth of a child or death of a wife or child (Stern 1998). Seekers of power often sought specific competence such as luck in hunting or fishing, war, love-making, gambling, foot-racing, or curing. Seekers of power went alone into the mountains for 5 days to fast, pile rocks, wrestle with trees, run, perhaps take sweat baths, and climb hills. Power might come in the form of a dream or a visit by a spirit, which would be followed by the seeker waking with blood in his mouth or nose and a personalized spirit song in his ears.

Shamans, mourners, and gamblers also sought power by swimming in deep river eddies. During the day, the seeker sweated and fasted, waiting in the brush until nightfall. At that time the power seeker went to the river and dove to the bottom in search of a spirit.

The seeker did not appear to be frightened even if he saw something moving under the water. Similar to other power seeking events, it is reported that sometimes a seeker surfaced from the bottom of the river unconscious, with blood flowing from his mouth and/or nose (Spier 1930).

Shamans performed important ceremonies in midwinter gatherings, first-fruit rites for wocas gathering, and other occasions. They also cured illnesses and provided spiritual and practical support during warfare. Novice shamans received their initiation as a group at midwinter ceremonies. Helpers worked with shamans over a 5-day period during the ceremonies to call spirits, interpret spirit messages, and lead the audience in singing sacred songs.

EuroAmerican expansion into Klamath and Modoc territory had a dramatic effect on their traditional cultural practices. Regardless, The Klamath Tribes exhibited considerable and well-documented persistence in their ceremonial and social traditions, particularly as they related to site-specific and resource-specific traditions. However, in 1954 Congress terminated the reservation and its trust relationship with The Klamath Tribes. The Klamath Tribes retained some rights to resources, but a majority of the tribal members withdrew from the tribe and received a portion of the tribal holdings. The trust account created for the rest of the members was later liquidated. In addition, in 1974 the Federal Government condemned thousands of forest acres that had been part of the Klamath Reservation so that the forest land could be added to the Winema National Forest (Klamath Tribes 2003).

The Klamath Tribes accomplished restoration of Federal recognition in 1986 and began to rebuild their tribal government, economy, and community. Currently, the tribal Culture and Heritage Department is working to protect, preserve, and enhance traditional cultural values (Klamath Tribes 2003). The Klamath Tribes are also pursuing a variety of economic enterprises through their Economic Self-Sufficiency Plan. (Refer to Section 3.12 Tribal Trust for additional information on traditional and current lifeways and the history of Federal recognition.)

3.13.3.1.2 Northern Interior California Culture Area

Prehistory

Previous archaeological investigations near the area of analysis were conducted in response to hydroelectric developments and highway construction projects beginning in the 1940s. The more recent investigations of Basgall and Hildebrandt (1989) and Cleland (1997a, 1997b) are the most relevant to this analysis because it is likely that the subsistence and settlement patterns they identify are similar to the patterns along the Klamath River in California.

Basgall and Hildebrandt (1989) propose a three-phase cultural chronology for the northern Sacramento River Canyon that includes the Pollard Flat Phase (2,700–5,300 BP), the Vollmers Phase (1,700–4,500 BP), and the Mosquito Creek Phase (1,900 BP to contact). The Pollard Phase appears to represent a forager population that occupied residential base camps for extended periods of time, and is characterized by

relatively large projectile points, ground stone tools, anvils, mauls, and net weights. The Vollmers Phase represents populations that were more mobile than those of the previous phase, while still maintaining residential camps, and are characterized by medium size projectile points, ground stone tools, anvils, mauls, and net weights. The Mosquito Creek Phase populations consisted of small groups that practiced a pattern of seasonal transhumance, and are characterized by small projectile points, ground stone tools, and the absence of hand stones, milling stones, hammer stones, anvils, mauls, and net weights.

Cleland's (1997a, 1997b) chronology for the Lake Britton area is divided into six periods spanning 7,000 years. The six periods include: Paleo-Indian (prior to 7,500 BP; Early Archaic-A (5,000–7,500 BP); Early Archaic-B (3,900–5,000 BP); Middle Archaic-A (3,000–3,900 BP); Middle Archaic-B (2,000–3,000 BP); Late Archaic (1,000–2,000 BP); and Emergent (150–1,000 BP).

The Paleo-Indian Period is poorly represented and indicates sporadic use of the area. The Early Archaic-A Period reflects an intensification of use of the area. Sites associated with this period are usually on mid-slope terraces and tend to be situated some distance from the Pit River. The Early Archaic-B Period reflects increased occupation of the area. Sites still tend to be situated on terraces and benches above the Pit River, but freshwater mussel shells appear at sites suggesting the exploitation of riverine resources.

The Middle Archaic-A Period is highlighted by a continued increase in the intensity of use of the area and a diversification of the overall settlement pattern. Occupation of the higher terraces above the Pit River continues, but habitation sites also occur closer to the river. The diversified settlement pattern of the Middle Archaic-A Period continues during the Middle Archaic-B Period, but there is increased occupation of sites near the

Pit River. The Late Archaic-A Period is characterized by an increase of more riverine sites. This pattern continues into the Emergent-A Period during which occupation of riverine sites intensifies.

Ethnography

Silver (1978) summarizes ethnographic information regarding Shasta collected by Dixon (1907), Voegelin (1942), and Holt (1946). Shasta territory extended north to a point about 20 miles north of Ashland, Oregon, including the Rogue River; south to Mt. Shasta; west to Seiad Valley on the Klamath River, southwest to New River; and east to Beswick (Silver 1978). Shasta groups are members of the Hokan language family.

There are several groups of Shasta that exhibit different cultural traits. Information presented here focuses on the Klamath River Shasta, called the Wiruhikwaiiruka or Kammatwa (Daniels 2003). Shasta were organized into autonomous tribelets consisting of extended family groups that occupied a group of villages. The family was the basic social unit of the Shasta, with the village being the political and economic unit. Each village had a chief, whose position was usually hereditary, to provide leadership and organize important social, political, and economic events (Silver 1978). Shamans

conducted a variety of ceremonies in villages, and Shasta considered Mount Shasta to be sacred ground that was used for healing, blessing, and ceremonies. Mount Shasta is a significant part of Shasta traditions and ceremonialism.

Shasta along the Klamath River tended to build their winter villages near the river. Villages had recognized territories with areas for each family, including fishing places with fish weirs along the Klamath. Hunting territories also were held privately over the long term, in contrast to tobacco-growing plots and acorn-gathering trees, which were claimed only for brief periods. Typical villages consisted of brush shelters, bark houses, sweathouses, assembly houses, and winter houses (Silver 1978).

During the spring and summer, Shasta established temporary hunting and gathering camps in the foothills and mountains to exploit seasonally available resources in those ecological zones. Shasta relied on a subsistence pattern emphasizing gathering, hunting, and fishing, and exploited a variety of plant and animal resources as they became seasonally available. For example, resources used by the Shasta included deer, brown bear, rabbit, a variety of small mammals, fish, birds, insects, acorns, buckeye, pine nuts, manzanita berries, and a variety of other plants. Acorns were a staple of the Shasta diet. Regardless of the variety of resources available to the Shasta, the primary components of their diet were deer, Chinook salmon, and acorns (Dixon 1907; Silver 1978).

Individual hunters and communal hunting parties hunted deer using bows and arrows, snares, dogs, and drives (e.g., driving deer over cliffs). Waterfowl and quail were taken using nets, snares, and traps (Moratto 1984). Spring and fall salmon runs were important fishing times for the Shasta. Fishing techniques included using set, dip, and long flat seine nets, basket traps, weirs, hook and line, and spears. In the spring Klamath River Shasta waited to catch salmon until a member of another Shasta group called the Kammatwa caught the first fish and performed a ritual. Klamath River Shasta could then catch and process the fish for storage but could not eat them until the Karuk performed the White Deerskin Dance ceremony. Salmon and trout were sun dried and stored in baskets for winter consumption (Silver 1978). Women and children also dove for mussels in the Klamath River during the spring.

Shasta traded pine nuts, obsidian blades, and juniper beads with their neighbors for obsidian from the Achumawi; pine nut necklaces from the Wintu; canoes from Karuk and Yurok; acorns, baskets, dentalia shells, haliotis shells, and other shells from the Karuk, Hoopa, and Yurok; and beads from Wintu (Silver 1978). Shasta also acted as a middleman for the Achumawi, who acquired dentalia shells from groups in the Columbia River area. In addition, Shasta occasionally attended Karuk, Hoopa, and Yurok dances.

EuroAmerican settlement of the study area accelerated as a result of the Gold Rush. Conflicts between Indian Tribes and EurAamericans resulted in the Rogue River Indian Wars of 1850-1857 that pushed Shasta from their traditional fishing, hunting, and village sites. A treaty in 1851 established a reservation in Scott Valley for Shasta, but conflict between EuroAmericans and Shasta persisted. Consequently, in the 1870s Shasta welcomed cultural revivalist movements such as the Ghost Dance. From the 1870s

through the 1940s most Shasta in the APE lived at the Frain Ranch or Bogus Tom Smith's Rancheria (Daniels 2003) and continued to practice their traditional subsistence activities. Currently, Shasta are attempting to preserve, protect, and maintain traditional cultural practices, including sites associated with those practices.

3.13.3.1.3 Northwest California Culture Area

Prehistory

Fredrickson (1973) identified six patterns or modes of adaptation (i.e., Post, Borax Lake, Berkeley, Mendocino, Gunther, and Augustine Patterns) for northwest California and the North Coast Ranges and assigned them to six time periods: Paleo-Indian (10,000–6,000 B.C.); Lower, Middle, and Upper Archaic (6,000 B.C.–A.D. 500); and Upper and Lower Emergent (A.D. 500–1800) periods. The patterns applicable to northwest California are the Post, Borax Lake, Mendocino, and Gunther.

The Post Pattern (12,000–8,000 BP) represents the earliest occupation of the area and is characterized by fluted, concave-base projectile points and crescents. Regardless, archaeological sites with well-defined assemblage of typical Post Pattern artifacts are not well represented in northwest California.

The Borax Lake Pattern (8,000–2,500 BP) represents a generalized hunting and gathering subsistence pattern. It is characterized by heavy, wide-stemmed points with indented bases, serrated bifaces, ovoid tools, hand stones, and milling slabs (Hildebrandt 2007). The Borax Lake Pattern is identified at sites across a wide variety of environments in Humboldt and Trinity Counties. For example, sites CA-HUM-567 and CA-HUM-367 are along Pilot Ridge and South Fork Mountain and site CA-TRI-1008 is along a river terrace adjacent to the Trinity River. Site CA-HUM-567 includes a house floor and post holes dated at 6,000 BP.

The Mendocino Pattern (5,000 BP–AD 500) appears to represent a hunting and gathering subsistence pattern that is well adapted to local environments and typically exploits seasonally available resources across different ecological zones. It is characterized by side-notched, corner-notched, and concave base dart points, hand stones, milling slabs, and in some cases small numbers of cobble mortar and pestles. The Mendocino Pattern is not clearly defined in northwestern California, but it has been identified at sites such as CA-DNO-11 at Point St. George, CA-DNO-1 and CA-DNO-26 along the Smith River, CA-HUM-351 in Humboldt Bay, and CA-HUM-538, -588, and -595 in the northern mountains of Humboldt County (Hildebrandt 2007).

The Gunther Pattern (Post A.D. 500) appears to be associated with the exploitation of marine and riverine resources. It is characterized by Gunther barbed projectile points, concave based points used for composite harpoons, spears, hooks ground and polished stone artifacts, flanged pestles, notched net sinkers, and steatite bowls. Sites representing the Gunther Pattern in Del Norte and Humboldt Counties that are associated with exploitation of marine mammals and fish include sites CA-DNO-11, CA-HUM-129, -118, and -67 (Hildebrandt 2007). The Gunther Pattern appears to represent the earliest evidence of subsistence patterns associated with the exploitation

of marine mammals and fish that is typical of the Yurok, Hoopa, and Karuk that currently inhabit northwest California and the Klamath Basin.

Ethnography

Karuk

Bright (1978) summarizes ethnographic information regarding Karuk primarily from information presented by Gifford (1939a, 1939b, and 1940) and Kroeber and Barrett (1960). Karuk occupy territory west of the Shasta, which stretches along the middle part of the Klamath River near the western boundary of Siskiyou County from Seiad to Bluff Creek just west of Orleans (Bright 1978). The Karuk Tribe has been federally recognized since 1979 and occupies territory along the middle section of the Klamath River. Karuk are members of the Hokan language family (Bright 1978). Karuk share similar cultural traits with the Yurok and Hoopa and regularly interact with each other.

Karuk were organized in villages with a relatively loose political structure. The acquisition of wealth is an important part of Karuk culture, and wealthy men assumed leadership roles because of their prestige. Villages varied in size and consisted of rectangular cedar plank houses and sweat houses. Karuk focused on the exploitation of fish and aquatic resources, but other terrestrial resources were also important supplements to their diet. Karuk also harvested acorns and hunted in upland areas around the Klamath River for deer, elk, birds, and fur bearing mammals. The hides of mammals were used for a variety of clothing and bird feathers and pelts were used for ceremonial regalia.

Plentiful fish resources facilitated the occupation of numerous villages along the Klamath and Salmon Rivers (i.e., Salter [2003] reports that 100 villages existed along the two rivers). The villages were in advantageous locations on bends of the Klamath River and bluffs above it, such as near the mouths of Camp Creek (Tishaniik), the Salmon River (Mashuashav), and Clear Creek (Inam).

Karuk tools reflect their emphasis on the acquisition of fish and other aquatic resources and include harpoons, nets, and hooks. Facilities constructed to harvest fish include weirs, dams, and fishing platforms. Karuk also constructed canoes from hollowed out logs for fishing and transportation along the Klamath River and its tributaries. Transportation along the river and streams was essential to Karuk ceremonial activity. Indeed, Karuk traditions state that the Klamath River was created to facilitate their interaction with Yurok and Hoopa and with salmon.

The political and social organization and material cultural of the Karuk are important topics, but their religious and ceremonial practices highlight their relationship to the Klamath River and its associated resources. Of particular importance are world renewal ceremonies and ceremonies for bountiful harvests of fish and other resources (Bright 1978). World renewal ceremonies include the White Deerskin and Jump ceremonies at which the earth and the creator are honored for providing food and facilitating the prosperity of the tribes. These ceremonies were and continue to be conducted at sites along the Klamath River such as Panaminik (Drucker 1936). Ceremonies to insure harvests of fish include the First Fish, First Salmon, and Fish Dam ceremonies. Other

ceremonies related to world renewal and curing are the Boat Dance and the Brush Dance. Karuk, Hoopa, and Yurok regularly attend each other's ceremonies and the ceremonies are conducted for the benefit of all the groups.

The White Deerskin and Jump ceremonies honor the earth and the creator for providing food resources and maintaining the tribes. The White Deerskin ceremony is held from late August into September, depending on the river and its waters. The Jump ceremony is conducted after the conclusion of the White Deerskin ceremony and is also held for the "good" of the world. Both the White Deerskin and the Jump ceremonies depend on a healthy Klamath River system for fish, basket materials, and bathing. The First Fish ceremony is conducted in spring and the Fish Dam ceremony is conducted to in mid-summer to celebrate the harvesting of fish and to pray for continuing prosperity and access to subsistence resources, primarily fish resources. The Boat ceremony forms part of the White Deerskin ceremony, celebrating the flows and health of the rivers. The Brush Dance is held to cure the sick, particularly children.

EuroAmerican settlement in the area of analysis accelerated as a result of the California Gold Rush. Conflicts between Indian Tribes and EuroAmericans were commonplace across Karuk territory. Consequently, Karuk welcomed cultural revivalist movements in the 1870s such as the Ghost Dance, but traditional cultural practices and numbers of Karuk continued to decline. Regardless, the Karuk persisted and contemporary Karuk continue to practice their traditional activities and are actively engaged in programs related to improving the health of the Klamath River and its fishery. (Refer to Section 3.12 Tribal Trust for additional information on traditional and current lifeways and the history of Federal recognition).

Quartz Valley Community

Most of the Quartz Valley Community includes descendants of people of Karuk ancestry, although a few members are also of Shasta ancestry. Their cultural history is similar to that described for the Karuk. The Quartz Valley Community is a federally recognized tribe representing people of middle Klamath (Karuk) and Shasta Indian ancestry. Their reservation is near the community of Fort Jones.

Yurok

Pilling (1978) summarizes ethnographic information regarding Yurok collected by Waterman (1920), Waterman and Kroeber (1934), and others. Sloan (2004, 2011) also presents a summary of the ethnography of the Yurok and the relationship to the tribe to the Klamath River. Yurok are members of the Algonquian language family. Yurok ancestral territory extends along the Pacific coast of California from Crescent City in the north to Trinidad in the south and along the Klamath River from the coast to a point near the confluence of the Klamath and Trinity Rivers and the town of Weitchpec (Pilling 1978). The Yurok Tribe's reservation consists of a strip of land beginning at the Pacific Ocean and extending a mile along each side of the Klamath River a distance of about 45 miles upriver, just above the confluence of the Klamath and Trinity rivers. The Yurok life, language, ceremonies, society, and economy are linked with the Klamath River. There are Yurok stories that reinforce the Yurok belief that the River was created in a

distinct way in order to provide Yurok people with the best of worlds (Sloan 2004, 2011). Yurok refer to the river as *HeL kik a wroi* or "watercourse coming from way back in the mountains". Contemporary Yurok often refer to the Klamath River as the "Yurok Highway" emphasizing its comparison to a blood vessel that provides the main flow of sustenance. Indeed, Karuk, Yurok, and Hoopa share similar cultural traits and traditional stories state that the Klamath River was created to facilitate their interaction with each other and with salmon.

Yurok were organized into villages and districts with a relatively loose political structure (Pilling 1978). The acquisition of wealth is an important part of Yurok culture, and wealthy men assumed leadership roles in the village, district, and family. Villages varied in size and consisted of rectangular cedar or redwood plank houses and sweat houses. Pilling (1978) cites 44 villages, 97 fishing spots, 82 significant cultural places (e.g., places used for ceremonies, gathering, and hunting), and 41 places of cultural significance along the Klamath River.

Yurok focused on the exploitation of fish and aquatic resources, but other terrestrial resources were also important supplements to their diet. Yurok harvested acorns and hunted in upland areas around the Klamath and Trinity River for deer, elk, birds, and fur bearing mammals. The hides of mammals were used for a variety of clothing and bird feathers and pelts were used for ceremonial regalia.

Yurok tools reflect their emphasis on the acquisition of fish and other aquatic resources and include harpoons, nets, and hooks. Facilities constructed to harvest fish include weirs, dams, and fishing platforms. Yurok also constructed canoes for fishing and transportation along the Klamath and Trinity Rivers and their tributaries. Transportation along the rivers and streams was essential to Yurok ceremonial activity.

One of the most important aspects of Yurok technology was the river- and ocean-going canoe or yoch, which were carved from selected redwood trees (Sloan 2004, 2011). The Yurok ocean-going canoe was from 30 to 40 feet in length, 6 to 8 feet in width and 3 feet deep. It could haul up to five tons of cargo (e.g., seal carcasses) and was customarily paddled by 5 to 20 paddlers and an oarsman who steered the boat from the back. There are historic accounts of expeditions traveling 180 miles along the coast (Sloan 2004, 2011). A typical river canoe measured 16 to 20 feet in length and 3 to 4 feet in width. River canoes were customarily paddled and/or pushed with a long pole. Yurok technology and facilities do not only serve utilitarian functions, but also include ceremonial aspects of Yurok culture. For example, facilities, such as fish weirs, were created specifically to signify the time of sacred ceremonies (e.g., the Deerskin and Jump ceremonies).

Fishing places along the Klamath River were owned by individuals, families, or groups of individuals. Fishing places were borrowed, leased, inherited, or bought and sold (Sloan 2004, 2011). Some ownership rights at fishing places depended on species of fish caught at the site, while others depended on the water level (i.e., individuals owned the right to fish at a place if the river was below or above a certain level). Yurok still

recognize this traditional form of resource management and use of the river. Families and individuals continue to use and own rights to fishing places on the Klamath River.

Like the Karuk, the religious and ceremonial practices highlight the Yurok's relationship to the Klamath River and its associated resources. Of particular importance were the Jump, Deerskin, Boat, and Brush ceremonies. The Jump and Deerskin ceremonies were held in late fall to give thanks for food resources abundance collected during the year and to insure a continued abundance of food resources for the next year (Sloan 2004, 2011).

Affluent individuals and religious leaders conducted most ceremonies, and wealthy individuals were expected to feed salmon to everyone attending the ceremonies. The Boat Ceremony was part of the Deerskin Ceremony. In this ceremony, several boats filled with participants traveled down the Klamath River. The participants thanked the river for continuing to flow and provide resources. The Brush Ceremony unfolded over a four-day period and highlighted the importance of Klamath River resources to Yurok. For example, baskets made of plant materials collected at the water's edge were used to hold food and ceremonial medicine; acorns were cooked in the baskets using hot rocks gathered at specific river bars; ceremonial regalia was made from various plant and animals that live along the river; ceremonial bathing was performed; and participants listened to the sounds made by the Klamath River.

The social and ceremonial significance of the Klamath River is evident in and reinforced by Yurok traditions. For example, there are at least 77 Yurok stories that make direct reference to the Klamath River (Sloan 2004, 2011). These Yurok stories reinforce the belief that the Klamath River was created to provide Yurok with a very good place to live.

Spanish explorers and vessels traveling from the Philippines may have interacted with Yurok along the coast in the late 1700s. Other explorers such as Peter Skene Odgen and Jedediah Smith certainly encountered Yurok along the Klamath River in the early 1800s. Regardless, EuroAmerican settlement and use of Yurok territory did not begin until after the discovery of gold in California. As a result of the discovery of gold in the Trinity River, gold prospectors inundated the region affecting Yurok traditional culture (Pilling 1978).

In 1851 a "Treaty of Peace and Friendship" was signed between the United States Government and the Klamath River Indians, but the United States Congress did not ratify this treaty. Subsequently, on November 16, 1855, the Klamath River Reserve, also known as the Klamath Indian Reservation, was established by Executive Order. The Order designated the reservation lands from the mouth of the Klamath River, one mile on each side extending approximately 20 miles upriver to Tectah Creek (Sloan 2004, 2011).

Escalating conflict between Yurok and EuroAmericans during the 1860s and 1870s over encroachment onto the Klamath Indian Reserve resulted in the gradual displacement of Lower Klamath Indians further upriver (Sloan 2004, 2011). EuroAmericans on the reserve resisted attempts to remove them, including eviction in 1879 by the United States

Army (Sloan 2004, 2011). After decades of struggle to regain their traditional homelands, the Yurok Tribe was re-organized and was granted its own reservation in 1988. As a result of the 1988 Hoopa-Yurok Settlement Act (PL-100-580), the Yurok Indian Reservation was established.

The ancestral lands of the Yurok Tribe extend unbroken along the Pacific Ocean coast (including usual and customary off-shore fishing areas) from Damnation Creek, its northern boundary, to the southern boundary of the Little River drainage basin, and unbroken along the Klamath River, including both sides and its bed, from its mouth upstream to and including the Bluff Creek drainage basin. The Yurok Tribe considers cultural resources sites along and associated with the Klamath River to be part of a larger ethnographic riverscape (Yurok Tribe 2012). Sites include over a thousand fishing holes; a fish dam (weir) site; many different types of gathering sites, including willow for basket weaving; complex trail systems that connect villages, camps, the river, prayer sites, gathering areas, and other Tribes; forty-seven villages; and graves/cemeteries. Uses of these sites include subsistence, habitation, medicinal, religious, and ceremonial purposes.

The Yurok Tribe is the largest tribe in California, with over 4,500 enrolled tribal members and over 200 tribal government employees. The Yurok Tribe is actively pursuing economic development and resource management both on the reservation and Yurok ancestral lands, including a fisheries program. (Refer to Section 3.12 Tribal Trust for additional information on traditional and current lifeways and the history of Federal recognition.)

Resighini Rancheria

The federally recognized Resighini Rancheria is located on the southern banks of the Klamath River, completely surrounded by the Yurok Reservation. The tribe is composed of Yurok Indians; therefore, their cultural history is the same as for the Yurok culture. (Refer to Section 3.12 Tribal Trust for additional information on traditional and current lifeways and the history of Federal recognition.)

Hoopa

Wallace (1978) summarizes ethnographic information regarding Hoopa primarily collected by Goddard (1903). Hoopa are members of the Athabascan language family. Hoopa ancestral territory is centered in Hoopa Valley and the area surrounding the Trinity River near its confluence with the Klamath River. Hoopa, Karuk, and Yurok share similar cultural traits and regularly interact with each other.

Hoopa were organized in villages with a relatively loose political structure. Villages typically consisted of family groups (Wallace 1978). Villages varied in size and consisted of rectangular cedar plank houses. Hoopa focused on the exploitation of fish and aquatic resources, but other terrestrial resources were also important supplements to their diet. Hoopa also harvested acorns and hunted in upland areas around the Trinity and Klamath River for deer, elk, birds, and fur bearing mammals. The hides of mammals were used for a variety of clothing and bird feathers and pelts were used for ceremonial regalia.

Hoopa tools reflect their emphasis on the acquisition of fish and other aquatic resources and include harpoons, nets, and hooks. Facilities constructed to harvest fish include weirs and dams. Hoopa used canoes for fishing and transportation along the Trinity and Klamath Rivers, but obtained their canoes from the Yurok. Transportation along the river and streams was essential to Hoopa ceremonial activity. Indeed, Hoopa believe that the Klamath River was created to facilitate their interaction with Yurok and Karuk and with salmon.

Like the Karuk and the Yurok, the Hoopa's religious and ceremonial practices highlight their relationship to a river, the Trinity River, and its associated resources. Of particular importance are world renewal ceremonies and ceremonies for bountiful harvests of fish and other resources (Wallace 1978). World renewal ceremonies include the White Deerskin and Jump ceremonies at which the earth and the creator are honored for providing food and facilitating the prosperity of the tribes. Ceremonies to ensure harvests of fish and acorns include the First Salmon ceremony and Acorn Feast (Wallace 1978). Hoopa, Karuk, and Yurok regularly attend each other's ceremonies and the ceremonies are conducted for the benefit of all the groups.

EuroAmerican settlement of the APE accelerated as a result of the Gold Rush, resulting in the establishment of the Hoopa Valley Reservation in 1864, which was then ratified by Congress. President Harrison expanded the existing Hoopa Valley Indian Reservation in 1891 to include lands within one mile on either side of the Klamath River from the Pacific Ocean to the Hoopa Valley (Salter 2003). This area included the Klamath Indian Reserve, not to be mistaken for the Klamath Tribe's reservation located in the Upper Klamath Basin.

The culture of Karuk, Hoopa, and Yurok is closely tied to the Klamath and Trinity Rivers. These tribes subsist wholly or in large part on the resources acquired from the river, most of their sacred sites are located along it, and their cultural traditions are related to it (Bright 1978; Pilling 1978; and Wallace 1978). Contemporary Hoopa practice their traditional activities and are actively engaged in programs related to improving the health of the Trinity River and its fishery. (Refer to Section 3.12 Tribal Trust for additional information on traditional and current lifeways and the history of Federal recognition.)

3.13.3.2 Historic Period

Before the influx of EuroAmericans that began in the 1840s, the APE was occupied primarily by Native Americans (as described in Section 3.13.3.1). EuroAmerican exploration of the Klamath Basin began in the early 19th century. Jedediah Strong Smith and Peter Skene Ogden explored current Siskiyou and Klamath County in 1826 and 1827 for beaver, and in 1829 a party of Hudson Bay Company trappers and explorers, led by Alexander Roderick McLeod, also passed through the area (Klamath Hydroelectric Project 2004). The fur trade ended in the mid-1840s. Largely, the area remained sparsely occupied by EuroAmericans until the late 1800s, when mining and logging attracted settlers to the area.

The discovery of gold at Sutter's Mill in Coloma in 1848 was the catalyst that caused a dramatic alteration of both Native American and EuroAmerican cultural patterns in California. A flood of EuroAmericans entered the region once news of the discovery of gold spread. Initially, the EuroAmerican population grew slowly, but soon exploded as the presence of large deposits of gold was confirmed. The population of California quickly swelled from an estimated 4,000 EuroAmericans in 1848 to 500,000 in 1850 (Bancroft 1888). The discovery of gold and the large influx of EuroAmerican immigrants had a positive effect on the growth and economic development of California, but a negative effect on Indian cultures. The discovery of gold in California marked the beginning of a relatively rapid decline of both Indian populations and culture. EuroAmericans displaced Native Americans from their traditional territory, discouraged the use of traditional languages and the practice of religious ceremonies, and EuroAmerican economic pursuits (e.g., gold mining, logging, ranching, and farming) limited the practice of traditional Indian subsistence activities.

Gold was discovered by Abraham Thompson and his party just north of the present-day location of the City of Yreka in 1851 (Hoover et al. 2002). Known as "Thompson's Dry Diggins", the population quickly exploded to 2,000 miners, and the town of Shasta Plains was established (Hoover et al. 2002). The town primarily included tents and brush shanties, but also included a saloon built out of shakes and canvas by Sam Lockhart. The first permanent house in the town was built by D.H. Lowry and his wife.

EuroAmerican settlement in the Klamath River watershed continued to grow through the 1850s due to the completion of roads such as the Southern Emigrant Road, also known as the Applegate Trail, in 1846 (Klamath Hydroelectric Project 2004). These roads brought prospectors to the region and helped to establish communities such as Henley (Cottonwood), Gottville, Happy Camp, and Somes Bar. Fertile soil and plentiful water sources provided opportunities for homesteading and the private development of agriculture and ranching by unsuccessful prospectors, particularly in the area around current Upper Klamath Lake. The expansion of EuroAmericans in southeastern Oregon resulted in execution of treaties with The Klamath Tribes and the relocation of groups of Indians in the area (Klamath Hydroelectric Project 2004).

Logging began in the Klamath Basin in the 1860s and sustained logging enterprises appeared in the 1880s (Klamath Hydroelectric Project 2004). Early companies were generally small, family-run operations managed by ranching families trying to supplement their income. In 1867, President Ulysses S. Grant signed legislation to create a land-grant subsidy for the construction of the Oregon & California Railroad (O&C) (Klamath Hydroelectric Project 2004). The grant allowed the O&C Railroad Company to select off-numbered sections from the public domain for the construction of the railroad. In 1887, the O&C Railroad Company claimed "lieu" lands on the Pekegama Plateau as compensation for other lands that had already been claimed by homesteader or military and wagon road companies. Title to these lieu lands were immediately (and illegally) transferred to the Pokegama Sugar Pine Lumber Company (PSPLC). To move the logs from the Pokegama Plateau, the PSPLC built a log chute on the rim of the Klamath River Canyon and the first railroad in Klamath County (Gavin 2003). During

this period, larger scale logging companies such as Pokegama Sugar Pine Lumber Company and Klamath River Lumber and Improvement Company were established on the north rim of the Klamath River Canyon.

The end of the nineteenth and beginning of the twentieth century witnessed an ongoing and growing immigration of EuroAmericans into the area, which was facilitated by the construction of the railroad through the region. The railroad provided a reliable means of transportation in the area and stimulated regional cultural and economic development. In addition to improving transportation, a railroad grade constructed at the northern end of Lower Klamath Lake functioned as a dike that facilitated drainage of wetlands for agriculture and control of the flow of water from the Klamath River.

The Oregon & California (O&C) Railroad constructed in 1877 was the first railway through the region (Klamath Hydroelectric Project 2004). It extended from Siskiyou County, California, to Jackson County, Oregon, and facilitated travel and the transport of goods between Sacramento and Portland. Subsequently, the Southern Pacific Railroad Company acquired the O&C Railroad, and by 1909 agricultural and lumber products of the Klamath Basin could be distributed to a nationwide market.

The first hydroelectric development in the Klamath Basin was established in 1891 in the Shasta River Canyon below Yreka Creek to provide electricity to the City of Yreka (Klamath Hydroelectric Project 2004). Four years later, in 1895, the Klamath Falls Light & Water Company built a power plant along the banks of the Link River and soon thereafter began power generation for the town of Klamath Falls (Klamath Hydroelectric Project 2004). The first decade of the 20th century brought a number of mergers and reorganizations of power companies in the APE. The California-Oregon Power Company (Copco) was one of the companies that emerged from this period of reorganization (Klamath Hydroelectric Project 2004). The Bureau of Reclamation's Klamath Project was developed by the DOI to supply farmers with irrigation water and farmland in the Klamath Basin. Link River Dam is the principle source of water for Reclamation's Klamath Project and the irrigation system and serviced areas are situated above stream of the APE.

Copco proposed to develop hydroelectric power facilities along the Klamath River. Residents in the Klamath Falls area were divided over Copco's proposal to dam and generate power on the river. Farmers feared the depletion of precious irrigation water while other businesses saw Copco operations as an addition to the local economy. Regardless, with the increasing power needs of both irrigation and lumber mills and a huge influx of military personnel stationed at Medford and Klamath Falls, it was only a matter of time before additional power generation facilities were needed in the area. Envisioned in 1911, the Klamath Hydroelectric Project was built in phases through 1962 (see Kramer [2003a, 2003b] for a detailed history of the Klamath Hydroelectric Project). Klamath Hydroelectric Project facilities were constructed by Copco beginning with Copco 1 (1918), followed by Copco 2 (1925), and reconstruction of the old East Side facility in 1924. After World War II, regional population growth prompted a new round of hydroelectric power expansion highlighted by Copco's Big Bend project (J.C. Boyle

Dam and powerhouse) in 1958 and the construction of the Iron Gate facilities in 1962. While the Iron Gate facilities were still under construction, Copco merged with Pacific Power & Light, currently PacifiCorp. PacifiCorp currently owns and operates the Klamath Hydroelectric Project.

The development of the Klamath Hydroelectric Project played a significant role in the area's economic development, both as part of a regionally significant, locally owned and operated private utility and through the role that increased electrical capacity played in the expansion of the timber, agriculture, and recreation industries during the first six decades of the 20th century. The Klamath Hydroelectric Project dams and associated facilities are recommended as eligible for inclusion on the National Register as the Klamath Hydroelectric Historic District (KHHD) under criterion a for its association with the industrial and economic development of southern Oregon and northern California from 1903-1962 (see Table 3.13.1 below) (Kramer 2003a, 2003b; Cardno Entrix 2012).

3.13.3.3 Known Cultural and Historic Resources in the APE

Record searches and archival research were conducted for the vicinity of the APE. Previously, 191 cultural resources surveys were conducted covering 30,746 acres (approximately 36 percent of the APE) and more than 680 sites were identified (Cardno Entrix 2012). Most of the surveys were conducted around Upper and Lower Klamath Lakes and on Yurok lands with very little survey coverage along the river itself. The majority of the sites within the APE are prehistoric sites associated with Indian occupation and use of the area. These sites include small lithic scatters, traditional fishing sites, ceremonial sites, and large village sites. The historic sites within the APE are mostly related to the development of agriculture and hydroelectric power.

Sixty-eight sites in the APE are recommended eligible for inclusion on the National Register. The Klamath Hydroelectric Project dams and other associated facilities also are recommended eligible for inclusion on the National Register as a historic district (Kramer 2003a, 2003b and Cardno Entrix 2012). Table 13.13-1 identifies key features of the hydroelectric system and their eligibility recommendation.

The review of ethnographic information for the study area identified TCPs and other culturally sensitive sites along and near the Klamath River. The TCPs and other sites include villages at traditional salmon fishing sites, villages associated with secondary resource procurement areas, ceremonial sites, and burial sites (cf., Daniels 2003; Deur 2004, 2011; Kreober and Barrett 1960; Sloan 2004, 2011; and Waterman 1920). Deur (2004, 2011) identified 11 TCPs along the Klamath River and Theodoratus et al. (1990) identified 3 sites along the river between J.C. Boyle Dam and Scott River that have "cultural value" to The Klamath Tribes. Daniels (2003) identified 47 ethnographic sites (e.g., habitation, hunting, fishing, gathering, and spiritual/ceremonial sites) along the Klamath River and at least 5 village sites submerged by the formation of Copco 1 Reservoir that have cultural value to the Shasta. Theodoratus et al. (1990) also identified 24 sites along the Klamath River between J.C. Boyle Dam and Scott River that have

Table 3.13-1. Klamath Hydroelectric Facilities Historic District National Register Eligibility Recommendation

J.C. Boyle	
Dam	Historic Contributing
Communications Building	Non-Contributing
Fire Protection Building	Non-Contributing
Red Barn	Non-Contributing
Maintenance Shop	Non-Contributing
Water Conveyance Features	Potentially Contributing
Steel Pipe	Historic Contributing
Flume Headgate	Non-Contributing
Open Flume/Concrete	Historic Contributing
Headgate	Historic Contributing
Forebay/Spillgates	Historic Contributing
Spillway House	Historic Contributing
Tunnel	Historic Contributing
Penstocks	Historic Contributing
Powerhouse	Historic Contributing
Substation	Historic Contributing
Armco Warehouse	Historic Contributing
Copco 1	
Dam	Historic Contributing
Gatehouse 1	Historic Contributing
Gatehouse 2	Historic Contributing
Gate Hoist System/Rails	Historic Contributing
Double Penstock	Historic Contributing
Single Penstock	Historic Contributing
Powerhouse	Historic Contributing
Copco 2	
Dam	Historic Contributing
Water Conveyance Features	Potentially Contributing
Headgate	Historic Contributing
Tunnel Intake	Historic Contributing
Concrete-lined Tunnel	Historic Contributing
Wood Stave Pipeline	Historic Contributing
Concrete Tunnel	Historic Contributing
Steel Penstocks	Historic Contributing
Timber Cribbing	Historic Contributing
Coffer Dam	Historic Contributing
Powerhouse	Historic Contributing
Iron Gate	
Dam	Historic Contributing
Spillway	Historic Contributing
Diversion Tunnel	Historic Contributing
Water Conveyance System	Historic Contributing
Water Way/Trash Racks	Historic Contributing
Pipeline	Historic Contributing
Penstock	Historic Contributing
Powerhouse	Historic Contributing
Dam Fisheries Facilities	Historic Contributing
Holding Tanks	Historic Contributing

"cultural value" to Shasta. Additionally, the Bureau of Land Management (BLM) has previously identified a culturally significant area along the Upper Klamath River for a proposed National Register District.

Gates (2003) and King (2004) identify the entire length of the Klamath River as a "riverscape," which they identify as a type of cultural or ethnographic landscape, because of the relationship between the Klamath Tribes, Shasta, Karuk, Hoopa, and Yurok and the river and its resources. Gates (2003) and King (2004) recommended the Klamath River as eligible for inclusion on the National Register as a riverscape and/or ethnographic landscape. In these recommendations, the riverscape includes both cultural resources (such as, fishing and ceremonial sites) and natural resources (such as, water and fish). The Klamath River is certainly sensitive to the present-day tribes, including the Klamath Tribes, Karuk, Hoopa, Resighini Rancheria, Quartz Valley Community, and Yurok, as well as, to other Native Americans, including the Shasta Nation and Shasta Indian Nation, and is an integral part of their traditional cultural practices, but its eligibility for inclusion on the National Register as a riverscape and/or ethnographic landscape requires formal review and concurrence by the Oregon and California SHPOs. Through consultations on the current undertaking, both the Yurok and Karuk THPOs stated support for the eligibility of the riverscape because of the importance of the river to these tribes. The riverscape and/or ethnographic landscape reports and eligibility determination have not been submitted by a Federal agency to the Oregon and California SHPOs for concurrence regarding their eligibility determination. Further research and consultations involving multiple parties is needed to fully define the "riverscape" cultural landscape as a historic property. For the current undertaking, these research and consultation efforts are identified as mitigation measures.

At least one site is known to have human remains exposed from erosion in the Upper Klamath River area. Actions by a Federal agency resulted in the reburial of the exposed remains and temporary stabilization of the river bank. Previous studies, surveys, and Federal actions, combined with ethnographic studies, indicates that there is a high probability for the presence of additional sites in unsurveyed areas, as well as, in currently submerged settings.

Based on the previously identified sites and ethnographic literature reviews, sites identified at each reservoir include primarily the historic dams and associated facilities and structures and prehistoric/ethnohistoric villages, fishing locations, and ceremonial sites. At the J.C. Boyle Reservoir, ten prehistoric sites have been identified along the shoreline. At the Copco Reservoir, eleven prehistoric sites and five ethnographic village sites (Heizer and Hester 1970) have been identified along the shoreline and within the reservoir. At Iron Gate Reservoir, twelve prehistoric sites and five ethnographic village sites have been identified along the shoreline and within the reservoir. Additional sites may be inundated and/or covered with sediment. Depending on the selected alternative for this EIS/EIR, further identification efforts would need to be taken to identify these sites.

3.13.4 Environmental Consequences

3.13.4.1 Effects/Impacts Determination Methods

Cultural resources investigations (e.g., records searches and reviews of archaeological, ethnographic, and historic information, along with consultations) resulted in the identification of more than 600 sites, one historic district, several TCPs, ethnographic villages, burials, and one potential ethnographic landscape within the APE. Identified sites will be treated as potentially eligible for the National Register and California Register for the analyses of potential effects/impacts for this EIS/EIR. In addition, certain site types likely to be identified in previously unsurveyed areas, including inundated areas, will be considered potentially eligible for potential effects/impacts analyses.

3.13.4.1.1 Studies on Effects of Reservoir Inundation on Cultural Resources

Lenihan, et al. (1981), conducted an interagency, interdisciplinary study on the effects of freshwater reservoirs on cultural resources in order to address conservation management of inundated resources. A hierarchical scheme composed of three levels of cultural resources was assessed for inundation effects: artifacts and artifact assemblages; archaeological site or loci; and regional environmental data base, settlement and resource utilization patterns. The use of the hierarchical scheme was intended to include cultural values beyond discrete sites or artifacts that include spatial, temporal, and organizational relationships between the entities within an environmental and cultural context.

This approach is particularly applicable to landscape level resources such as TCPs and ethnographic landscapes, even though these property type names came into use after the Lenihan, et. al. study. When a river with a long history of use is dammed and water is impounded, the cultural landscape is adversely affected through direct impacts to the archaeological or historic sites themselves and to the relationships of these properties to their environment and to each other on local and broader scales. Besides the changes to the environmental setting, processes of inundation that affect cultural resources are sediment transport and deposition, erosion processes of wave action along shorelines, and saturation and slumping of submerged strata (Lenihan, et. al. 1981). Environmental and biological changes are discussed in more detail in other sections of this document (Chapter 3.3, 3.5, 3.14 and others).

Four factors regarding the extent of impacts to archaeological sites by these processes include the characteristics of the reservoirs themselves (size and operation-fill rate and drawdown frequency); location of sites within the impoundment; geological foundation of a site; and characteristics of the site itself (Lenihan, et. al. 1981). Erosion processes are most damaging along the edges of the reservoirs in wave action zones that vary vertically with reservoir operations. In general, cultural resource sites located within the wave action zone are most heavily affected while inundated sites beyond the shore are less affected by erosion and may be capped with sediment. A multitude of other factors, such as, slope, vegetation coverage, substrate, soil and water chemistry, also influences the extent of the impacts to a cultural resource site from inundation. Surface artifact displacement from water movement results in an overrepresentation of heavier weight

artifacts (such as, groundstone) and an underrepresentation of lighter weight artifacts (such as, lithic flakes). Damage from vandalism, both intentional and unintentional, increases to sites exposed through erosion and reservoir fluctuations. All of these impacts limit the ability to reconstruct human behavior through artifactual, paleoenvironmental, and site analyses; through direct dating techniques and relative dating of vertical and horizontal placement; and through contextual relationships.

Surveys for previously inundated prehistoric Puebloan archaeological sites being exposed due to lowering lake levels as a result of drought at Lake Mead, the reservoir behind Hoover Dam, in Southern Nevada resulted in situations where inundation preserved the sites (Haynes 2008). Sites in shoreline locations were eroded as water regressed, resulting in extensive damage to architectural remains and in the removal of the surface artifact assemblages. In lower energy situations, inundation resulted in capping of the sites with sediment that enhanced preservation. Both architectural and non-architectural features and surface artifacts remained. In other situations, effects of inundation and drawdown resulted in differential artifact removal and secondary re-deposition. Factors contributing to impacts from inundation and later exposure include: energy levels of the reservoir at the site location; terrains upon which the sites sit; weight of artifacts; and artifact collecting once sites were exposed. The results of these surveys on lands exposed from natural drawdown at Lake Mead, a man-made reservoir, are directly applicable to the proposed drawdown of the reservoirs along the Klamath River.

3.13.4.1.2 General Effects/Impacts Application

The cultural resources section of this document considers potential effects/impacts from implementation of the Proposed Action and alternatives on historic properties and cultural resources within the APE. The findings of effects/impacts are based on criteria presented in 36 CFR Section 800.5 and in CEQA, as described in 3.13.2 Regulatory Framework. Through consultation (see Chapter 7), DOI has developed measures to avoid, minimize or mitigate adverse effects to historic properties and historical resources, including known effects and those effects for which DOI cannot fully understand at this time. Many of these measures would be offered as binding commitments in the ROD, and will help to coordinate future development through these decisions.

Additionally, due to the nature of the action being proposed, potential effects on all historic properties or historical resources cannot be fully determined prior to approval of either the Proposed Action or an alternative evaluated in this EIS/EIR. The identification and evaluation of certain resources, and the potential effects to those resources, can only be understood and addressed as particular details of how to carry out the selected affirmative alternative are developed. To address this uncertainty, DOI through consultation (see Chapter 7), is proposing measures that the designated Federal officials must follow as specific details are evaluated through future decisions that are required before the selected alternative in this EIS/EIR can be implemented. These measures, which are identified below, will be incorporated as binding stipulations in the ROD for this EIS/EIR. Further, DOI will also seek to develop additional measures through consultation with the ACHP, the SHPOs, THPOs, Indian Tribes, and other interested parties as part of the continuing NEPA process.

Under CEQA, potentially significant or significant impacts to historical resources may be mitigated to a less than significant level. If impacts cannot be mitigated or if implementation of mitigation would not reduce an impact to a less than significant level, the impacts are identified as significant and unavoidable.

3.13.4.2 Significance Criteria

The significance criteria used to assess effects/impacts to cultural resources (e.g., historic properties and historical resources) as a result of implementing the Proposed Action and alternatives include both Federal and California State criteria.

Cultural resource effects/impacts would be adverse and/or significant if implementation of the Proposed Action and alternatives result in any of the following:

- Under NHPA Section 106, "an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (36 CFR Section800.5(a)(1))."
- Under CEQA, a substantial adverse change in the significance of an archaeological resource or an historical resource is defined as physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource is materially impaired, as defined in PRC Section 21083.2 and CCR 15064.5; or
- Disturbance of any human remains, including those interred outside of formal cemeteries.

3.13.4.3 Effects Determinations

3.13.4.3.1 Alternative 1: No Action/No Project Alternative

Under the No Action/No Project Alternative, none of the actions under consideration would be implemented. The Klamath Hydroelectric Project would continue operations under the terms of an annual license until a long term license is finalized. Annual licenses would not include the actions associated with the Klamath Hydroelectric Settlement Agreement (KHSA) and Klamath Basin Restoration Agreement (KBRA).

Under the No Action/No Project Alternative current effects/impacts on historic properties/ historical resources, other cultural resources, and human remains will continue to occur. Under the No Action/No Project Alternative, the Klamath Hydroelectric Project on the Klamath River would continue to operate. The Klamath Hydroelectric Project introduced artificial water fluctuations that have resulted in inundation under reservoirs and erosion along the lower river terraces. Over the life of the Klamath Hydroelectric Project, cultural resources have been impacted by these changing water levels. Known impacts include exposing cultural materials to the public, sometimes leading to looting and illegal excavation of these sites. These circumstances are known to have exposed human remains at least one site. Actions by a Federal agency resulted in the reburial of the exposed remains and temporary stabilization of the river bank. Impacts to cultural resources also result from natural events such as increased

water flows during heavy rains and snow melt along the Klamath River and from its tributaries. Other potential ongoing impacts to cultural resources occur from development of recreation areas, housing, and other development along the river and reservoirs. Concerns regarding artificial fluctuating water levels and exposing cultural remains in the APE continue to be a concern of Federal agencies and Native Americans.

There are known ongoing effects/impacts on cultural resources due to operation of the Klamath Hydroelectric Project, natural events, and other ongoing activities. **Therefore, the No Action/No Project Alternative would result in no change from existing adverse conditions and effects/impacts on historic properties and/or historical resources in the APE.**

3.13.4.3.2 Alternative 2: Full Facilities Removal of Four Dams Alternative (Proposed Action)

Under the Proposed Action, four dams and their associated hydroelectric facilities along the Klamath River would be removed. Keno Dam would be transferred to the DOI, the KBRA would be implemented, and the City of Yreka Water Supply Pipeline would be relocated.

The Proposed Action would result in direct effects/impacts to J.C. Boyle Dam, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam, their associated hydroelectric facilities, and on the KHHD, which is considered eligible for inclusion on the National Register and California Register. The Proposed Action would include removal of J.C. Boyle Dam, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam and their associated hydroelectric facilities on the Klamath River (refer to Chapter 2 Proposed Action and Description of Alternatives for additional details). These four dams and a majority of their associated facilities are assumed to contribute to the KHHD, which is considered eligible for inclusion on the National Register and the California Register due to its role in early development of electricity and economy of the southern Oregon and northern California regions. All associated and related structures have yet to be evaluated but are likely to include such properties as miscellaneous structures that are associated with construction of the dams and transmission lines that may be eligible for listing on the National Register individually or as contributing to the KHHD. Under the Proposed Action all of the dams and associated facilities would be removed. Deconstruction and construction activities, including, but not limited to, construction of coffer dams, creating access roads, grading disposal sites and staging areas, recontouring slopes, etc., will directly impact the four dams and hydroelectric facilities and other associated properties. Removal of the four dams and all associated facilities under the Proposed Action would adversely affect each dam's eligibility for inclusion on the National Register and the California Register and the overall integrity of the KHHD because a large portion of this district would be removed.

Under this action, adverse effects, as described in Section 106 of the NHPA, to the dams and the KHHD cannot be avoided and will need to be mitigated. Eligibility of the entire KHHD would be finalized to identify all contributing properties and submitted with a determination of eligibility for listing on the National Register to the Oregon and

California SHPOs. Prior to demolition, the four dams and their associated facilities would be documented for the NPS Heritage Documentation Program (Historic American Building Survey (HABS)/Historic American Engineering Record (HAER)/Historic American Landscape Survey (HALS)) (National Park Service 1990, 2005, 2007, 2010). Construction-related activities for the removal of the dams and facilities may also directly impact as yet unidentified buried cultural resources, particularly ethnographic villages in the vicinity of J.C. Boyle and Copco 1 dams.

Under CEQA, for the purpose of this EIS/EIR, mitigation measures that include HABS/HAER/HALS documentation could be implemented for the removal of dams under the Proposed Action. However the intent of Alternative 2 is to fully remove the dams, the KHHD, and much of the context for these historic resources. Therefore documentation such as HABS/HAER/HALS is the only feasible form of mitigation because avoidance and minimization measures would not be possible. As part of a conservative analysis, it has been determined that implementation of mitigation measures would not reduce impacts to historical resources to a less than significant level.

Under NEPA and CEQA and for the purpose of this EIS/EIR, the Full Facilities Removal of Four Dams would cause a significant impact to J.C. Boyle Dam, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam, their associated hydroelectric facilities, and on the KHHD. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to the four dams and hydroelectric facilities and to the KHHD would remain significant and unavoidable.

Reservoir drawdown associated with the Proposed Action could affect/impact archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. The Proposed Action includes a drawdown of the reservoirs behind the dams. The deconstruction process would begin by gradually drawing down the reservoirs through a controlled process using existing spillway gates, conveyance pipelines and canals, and diversion conduit (refer to additional details in Chapter 2 Proposed Action and Description of Alternatives). Modeling studies indicate that drawdown would erode and flush stored sediment downstream during the 3 month drawdown period. Afterwards, the river bed in the reservoir reaches is expected to stabilize. Once eroded from the reservoir, the fine sediment would continue to be suspended in the river water during the short term following dam removal, flowing downstream to the ocean. Large quantities of sediment would remain in place in the reservoirs after dam removal, primarily on areas above the active river channel. The remaining sediments would consolidate by drying out, resulting in a decrease in thickness. Following drawdown of the reservoirs, revegetation efforts would be initiated to support establishment of native wetland and riparian species on newly exposed reservoir sediment. Impacts from the drawdown potentially affecting cultural resources include erosion, changes in sediment, and changes in river flows. Note that impacts to the dams and associated structures and features were previously discussed. Cultural resource surveys to identify cultural resources were not conducted prior to inundation, so

very little is known regarding the extent of cultural resources that would have been along the river and that would now be under water.

Most of the sediment in J.C. Boyle Reservoir is near the dam and expected to be eroded from the reservoir area. After drawdown, there would be minor amounts of sediment consolidation on the floodplain areas. Cultural resource sites identified along the edges of J.C. Boyle Reservoir include: seven prehistoric artifact scatters; one prehistoric rock shelter; one prehistoric house pit village; and the remains of one historic lumber mill (Cardno Entrix 2012). The ten sites situated along the reservoir edges are likely to already have impacts from wave action. As the drawdown proceeds, these sites would be exposed to direct impacts of erosion, artifact displacement, and slumping of sediments. Indirect impacts due to exposure are likely to include vandalism (unauthorized collecting and excavating) and unintentional damage from such activities as increased visitation to access the river. One prehistoric camp is situated at the dam and may be exposed to direct impacts of deconstruction.

Sites along the edges of the Klamath River reach between J.C. Boyle Dam and Copco Lake include: eleven prehistoric artifact scatters; two prehistoric artifact scatters with habitation debris; one prehistoric camp with a rock alignment; three prehistoric artifact scatters with rock features (two also with milling features); fifteen prehistoric sites with house pits; three prehistoric burial sites; two historic trash scatters; two historic hotel ruin sites; one historic ranch site; one historic ranch field; and one historic road (Cardno Entrix 2012). These sites may be impacted by increased flows during drawdown of J.C. Boyle Dam because they are situated right on the river's edge.

Among the reservoirs that would be removed, Copco 1 Reservoir (Copco Lake) is the widest of the reservoirs and contains the most sediment. Most of the erosion would be focused in the main channel of the reservoir where the thickness of the remaining sediment would be the greatest. Significant alluvial surfaces (the benches) would be exposed with drawdown of Copco 1. Cultural resource sites identified right at the edges of Copco Lake include: four prehistoric artifact scatters; six prehistoric artifact scatters with habitation debris (one also with a milling feature); the historic Copco Village dump; the Dam Vista homestead; and Copco Guest House (Cardno Entrix 2012). In addition, five ethnographic village sites were identified at and under Copco Lake (Heizer and Hester 1970). Native American burials and traditional use areas (for ceremonies) at and under Copco Lake have also been identified through ethnographic research and consultations. These sites are likely to be impacted from erosion, sediment shrinkage, artifact displacement, and effects of exposure. Depending on factors discussed previously on inundation impacts in general, some of these sites may remain covered in sediment, or capped, resulting in some degree of preservation.

The reservoir behind Copco 2 Dam is small with little sediment. Cultural resource sites identified below Copco 2 Dam to Iron Gate Reservoir include one prehistoric pictograph site; one historic trash and privies site; one historic canal/aqueduct; and one railroad feature (Cardno Entrix 2012).

The reservoir sediment at Iron Gate Reservoir is relatively thin since the river corridor is relatively narrow and the side slopes of the reservoir area are mostly steep. Cultural resources sites identified on the edges of Iron Gate Reservoir include: three prehistoric artifact scatters; three prehistoric artifact scatters with milling features and habitation remains; one historic field; one wall/fence; one historic architectural feature with privies, dumps and walls; and one historic homestead remains. Five ethnographic village sites were identified at and under Iron Gate Reservoir (Heizer and Hester 1970). Impacts to these sites would likely result from erosion and exposure during drawdown rather than from the effects of sediment changes.

The reservoir drawdown plans were made with consideration for minimizing flood risks downstream. Downstream flows would not be likely to increase flood risks because they would be within the range of historic flows. Should a large flood event occur during drawdown, the outlet capacity would be exceeded and the reservoir could partially refill. This would be similar to existing operations during a flood event. Because the flows would stay below historic peak flows, they would not change the floodplain or flood risks in comparison to existing conditions.

Few cultural resource surveys have been conducted along the Klamath River below Iron Gate Dam to Yurok lands at the mouth of the river. Sites identified along the river between Iron Gate Dam to its confluence with Shasta River include: one prehistoric artifact scatter; one prehistoric camp site; one prehistoric fishing locale; one prehistoric burial; one historic habitation debris site; one historic structural and landscaping remains site; and one historic bridge. Traditional use locations for ceremonies, fishing, and other purposes were identified along the river during consultations. Due to the controlled release of water flows during reservoir drawdowns, impacts to these sites are not expected, particularly below the confluence with the Shasta River, as increased river elevations will be minimal and these sites have been exposed to historic flows since their original use. Indirect impacts may result afterwards from changes in the water flows.

The riverscape, a potentially eligible or significant cultural landscape, includes villages, hunting, gathering, fishing, and spiritual locations on terraces and benches along the river, as well as the river itself and its natural resources. The overall riverscape/cultural landscape would likely benefit from dam removal by restoring the river more closely to its original setting and facilitating the practice of important Indian traditional customs, ceremonies, and economic activities. However, sites associated with it could be adversely affected through erosion, sediment changes, artifact displacement, exposure, and vandalism. Relationships between the elements of the riverscape would change as the environmental and cultural setting changes from one of dams and reservoirs back to one of a free-flowing river. The impacts of these changes are not easily assessed and will likely require surveys, research and consultations with Federal agencies, Indian tribes, Native Americans, and other interested parties to determine the effects. The same can be said of other TCPs and cultural landscapes, prehistoric or historic, which have been identified in general terms but not yet specifically identified or recorded.

Under this action, adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of reservoir drawdowns. These effects will need to be mitigated. Erosion and sediment changes resulting from drawdown of the reservoirs will likely expose and impact historic properties and cultural resources along reservoir edges and currently submerged under the reservoirs. Exposed properties will also be susceptible to vandalism and other unintentional damage. In certain situations, remaining sediment will continue to cover cultural resource sites, providing some protection from impacts. Planned revegetation will help to prevent erosion of those sediments. A cultural resources management plan would be developed, through consultations, to manage and protect endangered and exposed historic properties and cultural resources, both short term (during drawdown and construction) and long term (as the river course changes). Prior to drawdown, a plan for identifying additional, previously unknown historic properties through surveys and monitoring as land is exposed would be developed. Avoidance, minimization, and mitigation measures would be identified and implemented through consultations under Section 106 of the NHPA. Plans and agreements for the removal and disposition of human remains would be developed according to applicable Federal and State laws and regulations.

Under NEPA and CEQA and for the purpose of this EIS/EIR, reservoir drawdown would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly Native American and non-native human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, and cultural landscapes would be mitigated to a less than significant impact.

Construction activities including use of haul roads and disposal sites for demolition debris under the Proposed Action could affect/impact archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register or California Register. Ground disturbing activities associated with construction activities will likely have both direct and indirect effects/impacts on historic properties/historical resources. The debris from the demolition of the dams and facilities would be hauled to disposal sites. Modifications of the proposed haul roads and use of disposal sites could affect/impact sites that are located along the haul roads and/or at the disposal sites. As more exact locations of these haul roads and disposal sites are developed, identification of cultural resources that may be impacted can be determined. These impacts are also included in the earlier discussion on impacts of the Proposed Action on the four dams and their associated hydroelectric facilities.

Under this action adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of construction of haul roads and disposal sites. These effects will need to be mitigated. As future plans are developed for construction activities, modifications to haul roads, and identification of actual locations of disposal sites and associated staging/construction, additional identification and evaluation of historic properties/historical resources would be conducted. Opportunities to avoid historic properties/historical resources may be worked into the construction

plans. Avoidance, minimization, and/or mitigation measures would be taken as appropriate to manage those resources as a result of this action.

Under NEPA and CEQA and for the purpose of this EIS/EIR, construction activities including use of haul roads and disposal sites for demolition debris would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, and cultural landscapes would be mitigated to a less than significant impact.

Removal of the recreational facilities after reservoir drawdown may affect archaeological or historic sites that could be eligible for inclusion on the National Register or California Register or possibly prehistoric or historic human remains. The Proposed Action would change recreational opportunities from lake-based recreation to river-based recreation. Recreation facilities, such as campgrounds and boat ramps, currently located along the reservoir banks will need to be relocated down slope to be near the new river bed once the reservoir is removed. These facilities are not eligible for the National Register or California Register, and were not known to impact archaeological sites when they were built. Additional ground disturbance from removal of these facilities may affect/impact known and previously unidentified historic properties/historical resources along the river and currently submerged under reservoirs.

Under this action adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of removal and relocation of recreational facilities. These effects will need to be mitigated. Further identification and evaluation of historic properties/historical resources at facility relocation areas would be conducted. Avoidance, minimization, and/or mitigation measures would be taken as appropriate to manage those resources as a result of this action.

Under NEPA and CEQA and for the purpose of this EIS/EIR, removal of the recreational facilities would cause a significant impact to archaeological and historic sites that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites would be mitigated to a less than significant impact.

3.13.4.3.4 Keno Transfer

The Transfer of Keno Dam to the DOI could have adverse effects to historic properties or historic resources. The KHSA calls for transferring ownership and operation of Keno Dam from PacifiCorp to DOI. Upon transfer of privately owned facilities into Federal ownership, cultural resources and historic properties are then subject to Federal historic and cultural resources management laws.

Under Section 106 of the NHPA and under NEPA and CEQA for the purposes of this EIS/EIR, this action would not cause an effect/impact to historic properties or historical resources. The transfer would likely be a beneficial effect because the facilities would be subject to Federal regulation.

3.13.4.3.5 East and Westside Facilities – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects on historic resources or historic properties. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate the need for diversions at Link River Dam into the two canals. Following decommissioning of the facilities there would be no change in outflow from Upper Klamath Lake or inflow into Keno Impoundment/Lake Ewauna. Decommissioning does not typically involve deconstruction of the facilities. Instead, buildings and equipment that are too large to easily remove or fixed in place are usually fenced to prevent entry. Any deconstruction and removal of facilities would be analyzed in future environmental analyses.

Under this action, adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of changes to the facilities themselves, if they are found to be historic properties, or from associated construction activities. These effects would need to be mitigated. As plans develop for this action, identification of historic properties would need to be completed with resolution of any adverse effects developed through consultations under Section 106 of the NHPA.

Under NEPA and CEQA and for the purpose of this EIS/EIR, the decommissioning of the East and Westside Facility would have less than significant effects on historic properties or historical resources.

3.13.4.3.6 City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Installation of the City of Yreka Water Supply Pipeline could affect/impact archaeological and historic sites that are eligible for inclusion on the National Register or California Register and possibly prehistoric and historic human remains. The existing water supply pipeline for City of Yreka passes under the Iron Gate Reservoir and would have to be relocated prior to the decommissioning of the reservoir to prevent damage from deconstruction activities or increased water velocities once the reservoir has been drawn down. The pipeline would either be suspended from a pipe bridge across the river near its current location, or rerouted along the underside of the Lakeview Bridge just downstream from Iron Gate Dam. The pipeline itself may be a historic property or historical resource and would need to be evaluated for eligibility. Ground disturbance required for either method of relocating the pipeline could result in the discovery of and impacts to historic and/or archaeologically significant sites. The construction of footings to support the pipe bridge and the trenching and rerouting of the pipeline to reach Lakeview Bridge could uncover previously unknown sites.

Under this action adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of installation of the City of Yreka Water Supply Pipeline. These effects will need to be mitigated. The City of Yreka Water Supply Pipeline would be recorded and evaluated to assess its eligibility to the National Register or the California Register and surveys of the area of potential effects from the pipeline work would be conducted to identify any other historic properties/historical resources that may be impacted by this action. Avoidance, minimization, and/or mitigation measures would be taken as appropriate to manage those resources as a result of this action.

Under NEPA and CEQA and for the purpose of this EIS/EIR, installation of the City of Yreka Water Supply Pipeline would cause a significant impact to archaeological and historic sites that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites would be mitigated to a less than significant impact.

3.13.4.3.7 KBRA-Programmatic Measures

The KBRA has several programs that could result in impacts/effects to cultural and historic resources that are eligible for inclusion on the National Register and/or California Register. These resources include archaeological and historic sites, TCPs, cultural landscapes, and possibly Prehistoric or historic human remains. Specific KBRA programs potentially affecting cultural and historic resources include:

- Phases 1 and 2 Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration Project
- On-Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Klamath Tribes Interim Fishing Site
- Mazama Forest Project

Implementation of the Phase 1 and 2 Fisheries Restoration Plans, the Fisheries Reintroduction and Management Plan, the Wood River Wetland Restoration Project, the On-Project Plan, the Water Use Retirement Program, and the Fish Entrainment Reduction program, could result in impacts/effects to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly Prehistoric or historic human remains. Actions associated with the Fisheries Restoration Plans in the floodplain and river channel include: floodplain rehabilitation, large woody debris replacement, fish passage correction, cattle exclusion (fencing), riparian vegetation planting, mechanical thinning of upland areas to mimic natural forest conditions, fire treatment to mimic natural forest conditions, purchase of conservation easements/land, road decommissioning, gravel

augmentation, and treatment of fine sediment sources. The fisheries restoration actions are designed to improve aquatic and riparian habitat and potential changes in river hydraulics are intended to improve the habitats' ability to support river fisheries. These restoration actions would not occur at the same locations as construction activities for the hydroelectric facility removal. KBRA construction activities would not contribute to potential cultural and historic resource effects of facility removal actions.

Under this action, adverse effects, as described in Section 106 of the NHPA, archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric or historic human remains cannot be avoided and will need to be mitigated. Implementation of the KBRA programs listed above include ground disturbing activities that are likely to have a significant impact on cultural and historic resources that are eligible for inclusion on the National Register and/or California Register. Studies will be conducted to identify cultural resources and measures to reduce significant impacts to those resources. Implementation of specific plans and projects associated with Phase 1 and 2 Fisheries Restoration will require future environmental compliance as appropriate.

Under NEPA and CEQA and for the purpose of this EIS/EIR, implementation of the Phase 1 and 2 Fisheries Restoration Plans, the Fisheries Reintroduction and Management Plan, the Wood River Wetland Restoration Project, the On-Project Plan, the Water Use Retirement Program, and the Fish Entrainment Reduction program would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric or historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, and cultural landscapes would remain significant and unavoidable.

Establishment of the Klamath Tribes Interim Fishing Site could result in impacts/effects to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and possibly prehistoric or historic human remains. Actions associated with the Klamath Tribes Interim Fishing Site include establishment of an interim fishing site for Klamath Tribal members between Iron Gate Dam and Interstate-5. The location and timing of this project reduces the potential for any negative cultural and historic resource impacts generated by establishment of the Klamath Tribes Interim Fishing Site from contributing to the effects of the hydroelectric facility removal actions. Although negative short-term effects could occur, implementation of construction-related best management practices (BMPs) would occur.

Under this action, adverse effects, as described in Section 106 of the NHPA, archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric or historic human remains cannot be avoided and will need to be mitigated. Establishment of the Klamath Tribes Interim Fishing Site is likely to include

ground disturbing activities that could have a significant impact on cultural and historic resources that are eligible for inclusion on the National Register, if present. Studies will be conducted to identify cultural resources and measures to reduce significant impacts to those resources. Implementation of specific plans associated with the establishment of the Klamath Tribes Interim Fishing Site will require future environmental compliance as appropriate.

Under NEPA and CEQA and for the purpose of this EIS/EIR, establishment of The Klamath Tribes Interim Fish Site would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, cultural landscapes, and human remains would be mitigated to a less than significant impact.

Implementation of the Mazama Forest Project could result in impacts/effects to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and possibly prehistoric or historic human remains. Actions associated with the Mazama Forest Project include the purchase and management of 90,000 acres of timberland on former reservation land owned by the Klamath Tribe (Chui 2008; Kerr 2012). The 90,000 acres identified in the Mazama Forest Project are likely to include cultural and historic resources that are eligible for inclusion on the National Register. Forest management actions at the Mazama Forest would not be in the same location as the hydroelectric facility removal actions and there would be no negative cultural and historic resource impacts generated by these restoration actions that would contribute to the effects of facility removal actions.

Under this action, adverse effects, as described in Section 106 of the NHPA, archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric or historic human remains cannot be avoided and will need to be mitigated. While the Klamath Tribes Forest Management Plan has been developed, the specific location of management actions within the Mazama Forest have not been identified. It is assumed however that implementation of this plan is likely to have a significant impact on cultural and historic resources that are eligible for inclusion on the National Register and/or California Register. Studies will be conducted to identify cultural resources and reduce significant impacts to these resources. Implementation of specific plans and projects associated with the Mazama Forest Project will require future environmental compliance as appropriate.

Under NEPA and CEQA and for the purpose of this EIS/EIR, implementation of the Mazama Forest Project would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2,

CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, cultural landscapes, and human remains would be mitigated to a less than significant impact.

Finding of Effects Under NHPA Section 106

Under NHPA, adverse effects of the Proposed Action to known historic properties (including the KHHD) cannot be avoided. In addition, adverse effects to as yet unidentified or unevaluated historic properties expected to be identified during future identification efforts may result from this alternative. Avoidance, minimization, and/or mitigation measures would be taken as appropriate to manage those resources as a result of this action. Measures to avoid, minimize, or mitigate and resolve adverse effects, identified through consultations, will likely result in agreement documents per 36 CFR Part 800 for implementation of this alternative. **Under NHPA Section 106, Full Facilities Removal of Four Dams Alternative (Proposed Action) will have an adverse effect to historic properties.**

3.13.4.3.8 Alternative 3: Partial Facilities Removal of Four Dams Alternative

Under the Partial Facilities Removal of Four Dams Alternative, four dams and their

associated hydroelectric facilities would be partially removed to provide for volitional fish passage. Keno Dam would be transferred to the DOI, the KBRA would be implemented, and the City of Yreka water supply pipeline would be installed.

The Partial Facilities Removal of Four Dams Alternative would result in direct effects/impacts to J.C. Boyle Dam, Copco 1 Dam, Copco 2 Dam, and Iron Gate Dam and on the KHHD, which is considered eligible for inclusion on the National Register and California Register. The Partial Facilities Removal of Four Dams Alternative would include removal of enough of each dam to allow free-flowing river conditions and volitional fish passage at all times. Under this alternative, portions of each dam would remain in place, along with ancillary buildings and structures such as powerhouses, foundations, tunnels, and pipes. Some of these remaining features would likely require perpetual maintenance and security measures to prevent unauthorized entry. All tunnel openings would be sealed with reinforced concrete to eliminate trespass concerns. Table 2-21 provides a summary of facilities that would be removed or retained under the Partial Facilities Removal of Four Dams Alternative.

The four dams and most of their associated facilities and structures are presumed to be eligible for listing on the National Register as contributing to the eligibility/significance of the KHHD. The full effects to the four dams and facilities from partial removal cannot be determined until specific plans are made for the partial removal, identifying the extent of removal of the dams and facilities. Partial removal is likely to result in an adverse effect under Section 106 of the NHPA to the dams and possibly to the overall integrity of the KHHD. By following the Secretary of the Interior's Treatment of Historic Properties (National Park Service 1995), adverse effects to some of the structures may be avoided.

Under this action, adverse effects as described in Section 106 of the NHPA, and impacts under NEPA and CEQA to historic properties/historical resources are the same as for the Proposed Action. Potential effects/impacts to cultural and historic resources under the Partial Facilities Removal of Four Dams Alternative, including reservoir drawdown; relocation of the City of Yreka Water Supply Pipeline; construction activities; removal of recreational facilities; the Keno Transfer; and the East and Westside facilities decommissioning would be the same as those identified for the Proposed Action.

3.13.4.3.9 KBRA-Programmatic Measures

The KBRA has several programs that could result in impacts/effects to cultural and historic resources that are eligible for inclusion on the National Register and/or California Register. These resources include archaeological and historic sites, TCPs, cultural landscapes, and possibly prehistoric and historic human remains. Specific KBRA programs potentially affecting cultural and historic resources include:

- Phases 1 and 2 Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration Project
- On-Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Klamath Tribes Interim Fishing Site
- Mazama Forest Project

Under this action, adverse effects as described in Section 106 of the NHPA, and impacts under NEPA and CEQA to historic properties/historical resources are the same as for the Proposed Action.

Finding of Effects Under NHPA Section 106

Under the Partial Removal of Four Dams Alternative for NHPA, adverse effects to known historic properties (including the KHHD) cannot be avoided. Under this alternative, effects would be the same as those identified for the Proposed Action/Full Facilities Removal of Four Dams Alternative. Under NHPA Section 106, the Partial Removal of Four Dams Alternative will have an adverse effect to historic properties.

3.13.4.3.10 Alternative 4: Fish Passage at Four Dams Alternative

Under the Fish Passage at Four Dams Alternative operation of the existing dams and hydroelectric facilities would continue along the Klamath River and fish passage facilities would be constructed at the four dams. Keno Dam would not be transferred to DOI and the KBRA would not be implemented.

The Fish Passage at Four Dams Alternative could affect/impact the four dams and the KHHD, other historic properties/historical resources, TCPs, cultural landscapes, or human burials. The Fish Passage at Four Dams Alternative would continue operation of the existing dams and hydroelectric facilities along the Klamath River and could continue

to affect historic properties/ historical resources. Construction of fish passages would require modifications to the four dams and/or their associated facilities, resulting in effects/impacts to the KHHD. Construction activities required for the fish passages may affect/impact as yet unidentified historic properties/historical resources. Since no reservoir drawdown would occur, the City of Yreka water supply pipeline would not need to be installed, and recreation facilities would not need to be removed or relocated, no effects to historic properties/historical resources would occur as a result of these actions.

Under this action adverse effects, as described in Section 106 of the NHPA, to historic properties and to the dams and the KHHD would occur and will need to be mitigated. Changes to the dams, their associated facilities, and the KHHD that follow the guidance found in the Secretary of the Interior's Treatment of Historic Properties (National Park Service 1995), may result in no adverse effect to these properties. Construction activities may affect other historic properties, TCPs, and cultural landscapes. Further identification and evaluation of historic properties/historical resources would be conducted to identify as yet unknown significant resources. Measures to avoid, minimize, or mitigate adverse effects to historic properties would be identified through consultations and would be incorporated into implementation of the fish passages designs, as appropriate.

Under NEPA and CEQA and for the purpose of this EIS/EIR, implementation of the Fish Passage at Four Dams would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, cultural landscapes, and human remains would be mitigated to a less than significant impact.

Finding of Effects Under NHPA Section 106

Under the Fish Passage at Four Dams Alternative for NHPA, adverse effects to known historic properties (including the KHHD) would likely occur. In addition, adverse effects to as yet unidentified or unevaluated properties may result from this alternative. The adverse effects will need to be avoided, minimized, or mitigated. Additional consultations and identification and evaluation efforts will be conducted under consultations with ACHP, SHPOs, THPOs, Indian Tribes, and other interested parties, per 36 CFR Part 800. Measures to avoid, minimize, or mitigate and resolve adverse effects, identified through consultations, will likely result in agreement documents per 36 CFR Part 800 for implementation of this alternative. **Under NHPA Section 106, the Fish Passages at Four Dams will have an adverse effect to historic properties.**

3.13.4.3.11 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative

Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, two dams, their associated hydroelectric facilities, and fish hatchery facilities along the Klamath River would be removed and fish passage facilities would be constructed at two

dams. Under this alternative, Keno Dam would not be transferred to the DOI and the KBRA would not be implemented.

The Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would result in direct effects/impacts to Copco 1Dam and Iron Gate Dam and on the KHHD considered eligible for inclusion on the National Register and California Register. The Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would include removal of two dams, their associated hydroelectric facilities, and other facilities along the Klamath River. Installation of fish passages, including all associated construction activities, at J.C. Boyle Dam and Copco 2 Dam may affect/impact those dams and their associated facilities. Deconstruction and construction activities, including, but not limited to, construction of coffer dams, creating access roads, grading disposal sites and staging areas, recontouring slopes, etc., will directly impact Copco 1 and Iron Gate dams and their hydroelectric facilities and other associated properties. These facilities contribute to the KHHD, which is presumed eligible for inclusion on the National Register and the California Register due to its role in early development of electricity and economy of the southern Oregon and northern California regions. The removal of two dams and facilities would adversely affect each dam's eligibility and possibly the overall integrity of the KHHD.

Under this action, adverse effects, as described in Section 106 of the NHPA, to the dams and the KHHD, and other historic properties cannot be avoided and will need to be mitigated. Mitigation will likely include thorough documentation of the four dams and their associated facilities to HABS/HAER/HALS levels or similar. By following the Secretary of the Interior's Treatment of Historic Properties (National Park Service 1995), adverse effects to some of the structures may be avoided. Removal of the dams and facilities and construction of fish passages may also impact as yet unidentified buried cultural resources, particularly ethnographic villages. Additional efforts to identify and evaluate historic properties/historical resources would be conducted. Possible avoidance, minimization, and mitigation measures to other currently unidentified historic properties/historical resources would be identified through consultations as appropriate.

Under CEQA, for the purpose of this EIS/EIR, mitigation measures that include HABS/HAER/HALS documentation could be implemented, but implementation of mitigation measures would not reduce impacts to historical resources to a less than significant level.

Under NEPA and CEQA and for the purpose of this EIS/EIR, the fish passage at two dams, removal of Copco 1 and Iron Gate would cause a significant impact to Copco 1 Dam and Iron Gate Dam, their associated hydroelectric facilities, and on the KHHD. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to the two dams and hydroelectric facilities and to the KHHD would remain significant and unavoidable.

Reservoir drawdown associated with the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative could affect/impact archaeological and historic sites, TCPs,

and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric or historic human remains. The Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative includes a drawdown of the reservoirs behind Copco 1 and Iron Gate Dams. The effects of the drawdown of these two reservoirs and installation of the City of Yreka water supply pipeline will be the same as described for these reservoirs in the Proposed Action. Effects on TCPs and cultural landscapes would also be as described in the Proposed Action.

Under this action adverse effects, as described in Section 106 of the NHPA, could occur to historic properties as a result of reservoir drawdowns. These effects will need to be mitigated. Erosion and sediment changes resulting from drawdown of the reservoirs will likely expose and impact historic properties and cultural resources along reservoir edges and currently submerged under the reservoirs. Exposed properties will also be susceptible to vandalism and other unintentional damage. In certain situations, remaining sediment will continue to cover cultural resource sites, providing some protection from impacts. Planned revegetation will help to prevent erosion of those sediments. A cultural resources management plan would be developed, through consultations, to manage and protect endangered and exposed historic properties and cultural resources. Prior to drawdown, a plan for identifying additional, previously unknown historic properties through surveys and monitoring as land is exposed would be developed. Avoidance, minimization, and mitigation measures would be identified and implemented through consultations under Section 106 of the NHPA. Plans and agreements for the removal and disposition of human remains would be developed according to applicable Federal and State laws and regulations.

Under NEPA and CEQA and for the purpose of this EIS/EIR, the reservoir drawdown for the removal of Copco 1 Dam and Iron Gate Dam would cause a significant impact to archaeological and historic sites, TCPs, and cultural landscapes that are eligible for inclusion on the National Register and/or California Register and possibly prehistoric and historic human remains. After implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 impacts to archaeological and historic sites, TCPs, and cultural landscapes would be mitigated to a less than significant impact.

Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative, adverse effects as described in Section 106 of the NHPA, and impacts under NEPA and CEQA to historic properties/historical resources from relocation of the City of Yreka Water Supply Pipeline; construction activities; and removal of recreational facilities; are the same as for the Proposed Action. Effects and impacts to Copco 1 and Iron Gate Dams are the same as described for these dams in the Proposed Action. Since Keno Dam would not be transferred and the KBRA would not be implemented, there would be no effects to historic properties/historical resources from these activities.

Finding of Effects Under NHPA Section 106

Under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative for NHPA, adverse effects to known historic properties (including the KHHD) cannot be

avoided. In addition, adverse effects to as yet unidentified or unevaluated properties may result from this alternative. The adverse effects will need to be avoided, minimized, or mitigated. Additional consultations and identification and evaluation efforts will be conducted under consultations with ACHP, SHPOs, THPOs, Indian Tribes, and other interested parties, per 36 CFR Part 800. Measures to avoid, minimize, or mitigate and resolve adverse effects, identified through consultations, will likely result in agreement documents per 36 CFR Part 800 for implementation of this alternative. **Under NHPA Section 106, the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative will have an adverse effect to historic properties.**

3.13.4.4 Mitigation Measures[2]

3.13.4.4.1 Mitigation Measure by Consequences Summary

Implementation of the Proposed Action and alternatives will each have an adverse effect on historic properties under Section 106 of the NHPA. Mitigation measures CHR-1 to CHR-4 identify actions to avoid, minimize or mitigate adverse effects following the process in 36 CFR Section 800.8(c)(1)(v).

Mitigation Measures Applicable to All Action Alternatives

Under all of the action alternatives, the DRE or the designated lead Federal agency if the DRE is a non-Federal entity with authority over particular aspects of the detailed plans for the action alternatives, would continue consultation with ACHP, SHPOs, THPOs, Indian Tribes and other consulting parties. (All references to the DRE below assume that the DRE will be a Federal agency. In the event that the designated DRE is a non-Federal entity, the designated lead Federal agency will assume all responsibility to carry out the measures articulated herein.) Up to and immediately following a decision on the proposed undertaking analyzed in this EIS, consultation will continue and in the short-term focus primarily on the development and preparation of a Programmatic Agreement (PA). The DRE will seek to execute the PA within one year from the issuance of a decision by the Secretary of the Interior or as soon thereafter as is practicable. The purpose of the PA is to establish a process for the continued compliance with Section 106 of the NHPA wherein the DRE will carry out consultation for the definite plan on how to implement the action alternative selected in this EIS. Such consultation, which will be established by the PA, prior to the approval of any activities that may directly or indirectly adversely affect historic and cultural resources, shall undertake planning and actions as may be necessary to avoid, minimize or mitigate adverse effects. The PA will consider for inclusion as stipulations some or all of the following general measures:

- Identify consulting parties, including the lead Federal agency for NHPA Section 106 compliance and the DRE, if not the lead Federal agency, and their roles and responsibilities;
- Define the undertaking and the APE specific to the selected action alternative;

[2] The term “mitigation measures” here is as defined by NEPA/CEQA and does not preclude avoidance or minimization as defined for Section 106 of the NHPA (36 CFR Part 800).

- Establish a timeframe for consultation in accordance with the executed PA. The timeframe should include benchmarks for meeting the different aspects of the PA, such as final identification and evaluation of historic and cultural resources;
- Establish agreed upon forms of communicating with consulting parties, and possibly consultation guidelines. For example, each consulting party could express a preference for email communication or communication through letters. Agreed upon communication also could include provisions to address when the DRE should communicate with consulting parties or when consulting parties should communicate with the DRE or other agencies. The agreement for communication also could include identified points of contact, either specific representatives or staff offices;
- Establish a cultural resources working group or advisory group to coordinate PA implementation and development of associated plans;
- Establish benchmarks and/or timelines for consultation incorporating the details of the proposed plan associated with the selected alternative with the known historic resources to ensure opportunities to modify the design for carrying out the selected alternative, e.g., coordinate the cultural resource survey work with design of access road construction associated with dam removal to ensure the consideration of alternatives to avoid, minimize or mitigate adverse effects to such identified properties.
- Identify plans to assist in management, consultation, and compliance such as, Cultural Resources Management Plan for overall management of known, to be identified, and inadvertently discovered resources; a Plan of Action for management, treatment, identification, and disposition of human remains; a Monitoring Plan for monitoring conditions and impacts to known and unknown resources; Historic Property Treatment Plans for protection, avoidance, and recovery of data from historic properties; and a Heritage Education plan for public education regarding cultural resources along the Klamath River.

Additionally, the PA will include Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4, described in detail below, which are associated with specific resource types and may or may not be applicable depending on the action alternative analyzed in the EIS and selected in the ROD.

Mitigation Measure CHR-1

Continue consultations between DRE, other Federal agencies, ACHP, SHPOs, THPOs, Indian tribes, and other consulting parties to add stipulations to the PA that outline an approach for addressing avoidance, minimization, and mitigation measures for the removal of the dams and other dam-related facilities listed or eligible for the National Register;

- Update the Klamath Hydroelectric Project Request for Determination of Eligibility (Kramer 2003) to include Iron Gate as a historic property and to identify contributing elements to the KHHD; and

- Provide a framework and timeline for continuing consultation to reach a consensus on the eligibility determination for KHHD, contributing elements, and other dam facilities; and
- Proposed measures to resolve adverse effects through minimization or mitigation may be formalized through the execution of a Memorandum of Agreement pursuant to 36 C.F.R. § 800.6; and
- Documentation of the KHHD, including the four dams and associated facilities and structures, in accordance with the NPS HABS/HAER/HALS heritage documentation standards for historic architectural, engineering, and landscape documentation and submission to the NPS archives; and
- Follow the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (36 C.F.R. Part 68) as applicable for any remaining facilities or structures associated with the dams and found to be eligible either individually or as contributing properties to the National Register; and
- Consider markers, plaques, or other features to provide educational information about the historic character and importance of the dams to the area. Other forms of public outreach or educational information, including professional and public documents and other media, and Web sites, also should be considered as a component of the mitigation of the removal of the dams and KHHD.

Mitigation Measure CHR-2

Continue consultations between the DRE, other Federal agencies, ACHP, SHPOs, THPOs, Indian tribes, and other interested parties to add stipulations to the PA that outline an approach for addressing known historic properties (non-KHHD historic properties referenced in CHR-1 above) and cultural resources within the APE and as yet unidentified historic properties and cultural resources. These stipulations aim to provide a process to identify and evaluate cultural resources for eligibility for listing on the National Register and/or the California Register of Historic Places or through the Oregon National Register and Survey Program, as applicable; develop measures to avoid, minimize, or mitigate adverse effects to historic properties; and

- Establish general design guidelines for elements of dam removal and/or ladder construction that could avoid effects to historic and cultural resources, e.g., integrating design features that allow for re-use of preexisting facilities and coordinating the cultural resource survey work with design of access road construction associated with dam removal to ensure the consideration of alternatives to avoid, minimize or mitigate adverse effects to such identified properties; and
- Develop a history of human presence and use of this reach of the Klamath River and research themes for study (Historic Context and Research Design) for the identification and evaluation of historic properties/historical resources and unevaluated cultural resources, unsurveyed and previously surveyed areas, and inundated zones; and

- Develop methods to identify cultural resources and historic properties/sites of historical significance through in-field surveys, archival and historic research, consultations, and subsurface testing; ; and
- Establish an approach for considering when to submit formal nominations to the National Register for properties that meet the National Register criteria (36 C.F.R. § 60.4) and are worthy for preservation, or for the California Register of Historical Resources; and
- Develop Treatment Plans for the avoidance, minimization, and mitigation of adverse effects to historic properties/sites of historical significance, including protective measures, such as, installing riprap to prevent erosion or protective barriers. Mitigation measures would include excavation, collection, analytical, and reporting methods; and
- Develop and implement a site monitoring program to provide continued oversight of historic and cultural resources and to collect information on site conditions and effects or threats to these resources, including but not limited to erosion, recreational, agricultural and other encroachment, and looting and vandalism. Establish an entity responsible for oversight of the site monitoring program for those areas under Federal jurisdiction and direct the appropriate Federal agency to oversight over lands/sites within Federal jurisdiction. Based on the site monitoring program, the responsible entity or Federal agency shall prepare a Monitoring Plan to discuss the types and location of sites to be monitored, field methodology of monitoring and conditions recordation; data storage, retrieval and analysis; schedule; staffing and qualifications; actions to be taken for illegal activities; and other details. Set a schedule for consulting to establish a final monitoring plan. The Monitoring Plan should place an emphasis on those properties that are exposed during implementation of the selected alternative; and
- Prepare and implement an Inadvertent Discovery Plan for unanticipated discoveries of historic properties/historical resources and Prehistoric or historic human remains. The Inadvertent Discovery Plan should consider provisions that capture the exposure through erosion, reservoir drawdown, construction, or other project-related direct and indirect effects of previously inundated historic and cultural resources and sites; and
- Prepare and implement a Cultural Resources Management Plan (CRMP) to address the management and protection of historic properties/historical resources and significant cultural resources from direct and indirect effects/impacts from implementation of the selected alternative (such as, erosion, vandalism, and destruction), both short term (during drawdown and construction) and long term (as the river course changes). For those historic properties identified on Federal land or within the management authority of a Federal agency, include in the CRMP the possibility of conducting further proactive survey and evaluation opportunities pursuant to Section 110 of the NHPA as part of the Federal agency's on-going management responsibilities. The CRMP could be utilized by other entities to manage and protect historic properties and cultural resources along the Klamath River; and

- Develop a protocol document or enter into a Memorandum of Understanding, if appropriate, regarding consultations and involvement of Indian tribes, Native American organizations, and other interested parties; and
- Curate artifact collections, material, records, and data pursuant to 36 C.F.R. Part 79.1, except for resources meeting NAGPRA definitions.
- Respect and maintain the confidentiality of sensitive information following Section 304 of the NHPA, 16 U.S.C. § 470w-3, 36 CFR § 800.11(c), and the Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470hh).

Mitigation Measure CHR-3

Continue consultations between the DRE, other Federal agencies, ACHP, SHPOs, THPOs, Indian Tribes and other interested parties to add stipulations to the PA that outline an approach for identifying and evaluating TCPs and

cultural landscapes for eligibility for listing on the National Register and/or California Register, and seeking ways to avoid, minimize or mitigate adverse effects to such resources; and

- Incorporate the steps in CHR-2 for identification and evaluation, alternatives to avoid, minimize, or mitigate, and resolution of adverse effects; and
- Conduct further research, including ethnographic research, and consultation with consulting and interested parties to identify and evaluate the potential eligibility for listing on the National Register identified TCPs or the riverscape, as a landscape or TCP; and
- Develop a Cultural Resources Management Plan for the riverscape if it is found eligible for listing on the National Register; and
- Respect and maintain the confidentiality of sensitive information following Section 304 of the NHPA, 16 U.S.C. 470w-3, 36 C.F.R. § 800.11(c) and the Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470hh).

Mitigation Measure CHR-4

Develop plans and consult under Section 106 of the NHPA, NAGPRA, and other Federal and State laws, as applicable, between the DRE ACHP, SHPOs, THPOs, Indian Tribes and other interested parties to add stipulations and appendices to cover exposure, management, disposition, and treatment of human remains; and

- Consult with Indian Tribes and other Indian organizations on identification, treatment, disposition, and management of Prehistoric or historic human remains exposed and/or impacted by the selected alternative, developing protocols or agreement documents as needed; and
- Identify and consult with appropriate individuals and parties on identification and disposition of historic era human remains; and
- Prepare and implement a Plan of Action for the management, consultation, treatment, and disposition of human remains, following NAGPRA on Federal and

Indian tribal lands and California and Oregon State burial laws as applicable to other lands; and

- Prepare and implement an Inadvertent Discovery Plan for unanticipated discoveries of historic properties/historical resources and human remains; and
- Consult on discoveries of historic properties/historical resources in association with human remains as identified in Mitigation Measure CHR-2.

3.13.4.4.2 Effectiveness of Mitigation in Reducing Effects/Impacts

Under NHPA Section 106, Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 would be effective at addressing adverse effects to historic properties as a result of implementing the Proposed Action or other alternatives. Under CEQA, Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 would be effective at reducing most impacts to historical resources as a result of implementing the Proposed Action or other alternatives to less than significant. However, the mitigation measures would not be effective at reducing impacts on the four dams and the KHHD that is recommended eligible for inclusion on the California Register. The Proposed Action and other alternatives would have a significant and unavoidable impact on the Klamath River dams and KHHD. Mitigation measures could be implemented for the removal of dams under the Proposed Action, but implementation of the measures would not reduce impacts to these historical resources to less than significant.

3.13.4.4.3 Agency Responsible for Mitigation Implementation

The Dam Removal Entity or Hydropower Licensee, and State agencies would be responsible for implementing Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4. It is anticipated that a mix of Federal and State agencies would be responsible for implementing the mitigation measures because implementation of the Proposed Action and alternatives requires the involvement of various Federal and State permitting, licensing, and funding agencies.

3.13.4.4.4 Remaining Significant Impacts

Under CEQA, Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 would address most impacts on historical resources associated with the Proposed Action and alternatives. However, the mitigation measures presented in this EIR/EIS would not reduce impacts on the four Klamath River dams and the KHHD that is recommended eligible for inclusion on the California Register to less than significant. Under the Proposed Action and other alternatives impacts to the four Klamath River dams and the KHHD would be significant and unavoidable.

3.13.4.4.5 Mitigation Measures Associated with Other Resource Areas

Several other resources areas include mitigation measures to address construction related effects/impacts associated with implementation of the Proposed Action or other alternatives. These mitigation measures include Rec-1 (relocation of recreational facilities at reservoirs); H-2 (flood-proof structures); GW-1 (deepen or replace affected wells); WRWS-1 (modify or screen affected water intakes); PHS-4 (repair damaged roads); PHS-5 (construct water storage tanks for firefighting); TR-6 (assess and improve roads to carry construction loads); and TR-7 (assess and improve bridges to carry

construction loads). These mitigation measures could affect/impact historic properties/historical resources, other cultural resources, and prehistoric or historic human remains.

Under NHPA Section 106 actions associated with implementing mitigation measures associated with other resource areas could cause adverse effects to historic properties. Adverse effects to historic properties that are a result of these mitigation measures can be resolved through implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4. Under CEQA, actions associated with implementing mitigation measures associated with other resource areas could result in significant impacts to historical resources. Implementation of Mitigation Measures CHR-1, CHR-2, CHR-3, and CHR-4 would reduce impacts to historical resources as a result of these mitigation measures to less than significant.

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3.14 Land Use, Agricultural and Forest Resources

This section analyzes the land use, agricultural, and forest resources impacts of the Proposed Action and alternatives. For the land use analysis, the section describes current land use types, planned uses, and land ownership and management in the area of analysis, described below. For the agricultural and forest resources analyses, the section focuses on the direct changes to land uses that would occur as a result of removal of the J.C. Boyle Dam, Copco 1 and Copco 2 Dams, and Iron Gate Dam (the Four Facilities) as described in the Klamath Hydroelectric Settlement Agreement (KHSA) and alternatives. The Four Facilities are in the Lower Klamath Basin below Keno Dam, also owned by PacifiCorp. The indirect impacts on agricultural and forest uses that may occur from changes in the water distribution in the region from implementation of the Klamath Basin Restoration Agreement (KBRA) are also described. KBRA actions are primarily focused on the Upper Klamath Basin, but also include actions in the Lower Klamath Basin.

This section does not address the potential effects of removal of the Four Facilities on property values and changes in property tax revenues. See Section 3.15, Socioeconomics, for potential effects on property values. Additionally, removal of the dams would alter the flood regime for the portion of the river downstream from Iron Gate Dam. Changes in flood risk are described in Section 3.6, Flood Hydrology.

The public scoping process identified several questions that will not be addressed in the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIS/EIR). For instance, the public asked about establishing new property lines when reservoirs and the river channel reconfigure. Property line adjustments are not relevant to the EIS/EIR analysis and are not described in the KHSA (KHSA Section 7.6.4). The EIS/EIR does describe potential changes in land use that would occur if the dams were removed.

Participants in the scoping process also sought information regarding whether property owners would have first right to purchase property between the current reservoir shoreline and the newly established river channel boundary. The KHSA details that PacifiCorp's Parcel B lands including those currently inundated by the existing reservoirs will be transferred to the State of Oregon or the State of California, as applicable, or to a designated third party transferee, to be managed for public interest purposes such as fish and wildlife habitat restoration and enhancement, public education, and public recreational access (KHSA Section 7.6.4). This EIS/EIR includes an analysis of all potential property transfers outlined in the KHSA.

3.14.1 Area of Analysis

For this analysis, the land use area was defined as lands encompassed by the Federal Energy Regulatory Commission (FERC) boundary identified in the FERC EIS (2007), surrounding lands that could be affected by implementation of the KHSA and private

lands adjacent to the reservoirs and the Klamath River downstream from the reservoirs to the estuary that would be affected by the removal of the dams and loss of the reservoirs.

The Four Facilities that would be removed under the Proposed Action are in two counties, Siskiyou in California and Klamath in Oregon, and are not within any incorporated cities. The area of analysis includes the areas adjacent to the Four Facilities. The City of Yreka is included because its water supply facilities would be affected by the Proposed Action. In addition, lands downstream from the Iron Gate Dam that may be subject to flooding with or without the dams were identified (see Appendix J, "Modeled Changes to the 100 Year Flood Plain" for maps).

To account for the effects of KBRA implementation, the area of analysis includes the agricultural lands that receive water from the Bureau of Reclamation's (Reclamation) Klamath Project in Klamath, Siskiyou, and Modoc Counties, and two of the wildlife refuges in the Klamath Basin National Wildlife Refuge System, the Tule Lake National Wildlife Refuge (NWR) and the Lower Klamath NWR (Figure 3.14-1). These areas are all within the Upper Klamath Basin above Keno Dam. Reclamation's Klamath Project contains approximately 200,000 acres of farmland and 35,000 acres of wetlands in three counties along the California-Oregon border. Of the approximately 225,000 acres of irrigable land in the project, water deliveries are typically made to between 180,000 – 196,000 acres each year, depending on available water supplies (personal communication, Mike Green, March 23, 2011). Section 1.2.4 describes Reclamation's Klamath Project in more detail. Agricultural areas in the Lower Klamath Basin, downstream from Keno Dam, do not receive water from Reclamation's Klamath Project or irrigation water from any of the four reservoirs.

3.14.1.1 Klamath County, Oregon

Klamath County is in south central Oregon. The county is bordered on the south by California, on the east by Lake County, on the north by Deschutes County, and on the west by Jackson and Douglas Counties. The county, Oregon's fourth largest, has 6,135 square miles (Klamath County 2010a). Klamath County is home to about 66,380 people, with about 20,000 of those people residing in the city limits of Klamath Falls (U.S. Census Bureau 2000, U.S. Census Bureau 2000–2008). Approximately 73 percent of the County is managed by Federal and State agencies, including the United States Fish and Wildlife Service (USFWS), the United States Department of Agriculture Forest Service (USFS), the National Park Service (NPS), the Bureau of Land Management (BLM), and the Oregon Department of State Lands (ODSL).

3.14.1.2 Siskiyou County, California

Siskiyou County is in inland northern California, adjacent to the Oregon border. It is the fifth largest county in the State and has an area of approximately 6,340 square miles with a population of 44,328 (U.S. Census Bureau 2000–2008). More than 60 percent of the County is managed by Federal and State agencies, including USFS, BLM, the USFWS, and California Department of Fish and Game (CDFG). These lands are maintained in various National Forests, National Monuments, National Grasslands, NWRs, designated wilderness, other public lands and State Wildlife Areas (Siskiyou County 2010).

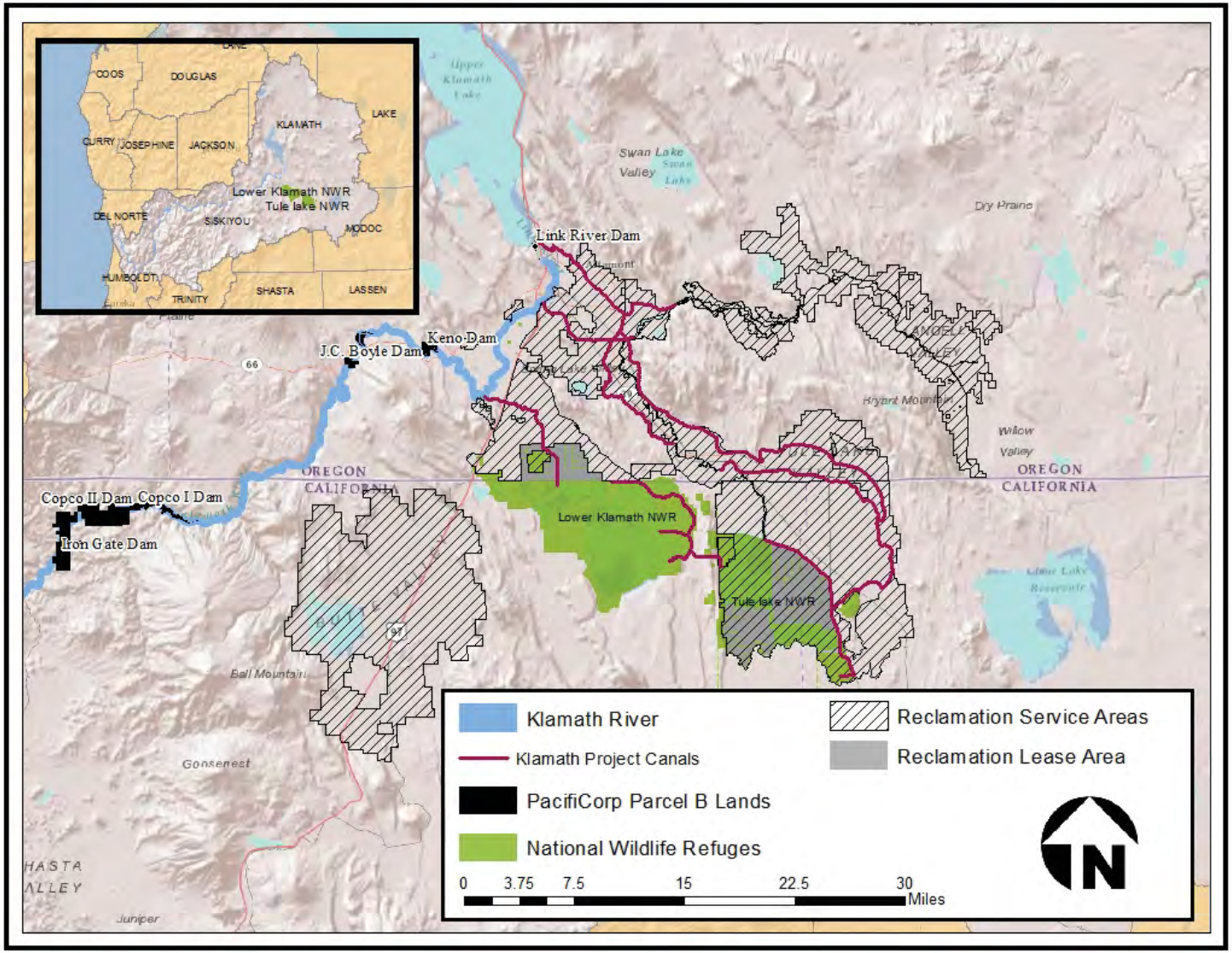

Figure 3.14-1. Reclamation's Klamath Project and National Wildlife Refuges in the Vicinity.

3.14.1.3 Modoc County

Modoc County is just east of Siskiyou County in the northeastern corner of California, where it borders Oregon to the north and Nevada to the east. The county is 4,203 square miles and has approximately 9,100 residents (Modoc County 2011). Almost 70 percent of the county is federally owned in the Modoc National Forest, the Modoc and Tule Lake National Wildlife Refuges, and BLM lands managed out of the Alturas Field Office (Modoc County 2011). Approximately 29 percent of the county is in private ownership, with the remaining one percent split between State lands, County managed property, City properties, and railroads and utility companies (Modoc County 2011). Part of the Tule Lake NWR and Reclamation's Klamath Project is in western Modoc County (Figure 3.14-1).

3.14.1.4 Klamath Basin National Wildlife Refuge System

The Tule Lake NWR and the Lower Klamath NWR are both managed for wildlife habitat and croplands. In 2009, the Lease Land Program leased 22,828 acres of the two refuges for crop production. Of this, 7,518 acres or approximately 33 percent were certified organic, up from 5,753 in 2006, and 1,584 acres were set aside for the walking wetland program, a long-term crop rotation program that alternates the land use between wetlands for wildlife uses and crops for agricultural leases (Department of the Interior [DOI] 2009a).

The Tule Lake NWR covers approximately 39,000 acres, of which 15,000 acres are dedicated to agricultural leases, in addition to another 2,300 acres dedicated to cereal grains and alfalfa cooperatively managed by the USFWS and local farmers (USFWS 2009). The farmland produces barley, oats, wheat, onions, potatoes, and alfalfa. Barley, wheat, and oats cover most of the acreage and potatoes dominate the row crops (USFWS 2010a). Not all of the land dedicated to agriculture in the NWRs is utilized each year, as some land is not leased (Personal Communication, Mike Green, March 23, 2011).

The Lower Klamath NWR is approximately 46,000 acres and straddles the California/Oregon border. Approximately 6,000 acres are leased to farmers through Reclamation's Public Lease Lands program for cereal grain and grass hay production, and another 5,000–7,000 acres are farmed under a cooperative agreement between area farmers and the USFWS (Table 3.14-1) (USFWS 2010b). The leasing and farming of the Tule Lake NWR and Lower Klamath NWR are governed by the Kuchel Act, which was signed into law in 1964. The law provides that Tule Lake NWR and Lower Klamath NWR would be set aside for wildlife habitat and leasing for agricultural use. Only 25 percent of the total land may be planted for row crops. The counties that contain the refuges are intended to receive approximately 25 percent of the net revenues collected during each fiscal year from the leasing of the Federal lands in Reclamation's Klamath Project. This revenue is paid annually to the counties that contain the refuges (Klamath, Siskiyou, and Modoc) in lieu of property tax.

The Kuchel Act also mandates that 13,000 acres of surface water area be maintained in Sumps 1A and 1B (Figure 3.14-1), areas in the refuges that are used to collect agricultural runoff and provide habitat for migrating waterfowl (Personal

Communication, Mike Green, March 23, 2011). In 1976, Congress amended the National Wildlife Refuge System Administration Act of 1966 and provided primary management responsibility to the USFWS. Following the passage of the amendment, Reclamation and the USFWS formed a cooperative agreement on the management of the public lease land. Essentially, Reclamation administers the agricultural leases on the refuge land and the USFWS manages wildlife and habitat, such as the water areas, buffer strips, wildlife use areas, and share crop land (Personal Communication, Mike Green, March 23, 2011).

Table 3.14-1. Kuchel Act Lands in Reclamation's Klamath Project, 2009

State	County	Refuge Area	Agricultural Acres	Marsh Acres	Total Acres
California	Modoc	Tule Lake	4,557	2,640.80	**7197.8**
		Lower Klamath	NA	NA	
	Siskiyou	Tule Lake	12,283.60	12,090.80	**24,374.40**
		Lower Klamath	9,529.70	28,664.50	**38,194.20**
Total Kuchel Acres, California			26,370.3	43,396.10	**69,766.40**
Oregon	Klamath	Lower Klamath	6365.9	0.0	**6365.9**
Total Acreage subject to Kuchel Act					**76,132.3**

Source: Reclamation's Payment to Counties In-Lieu-of-Taxes Report. DOI 2010a.

3.14.1.5 Land Ownership

The area at or near the Four Facilities includes lands owned by PacifiCorp, private owners, and lands managed by BLM, the State of Oregon, and Klamath County. The USFS also manages several parcels outside the Klamath Hydroelectric Project (KHP) boundary near Copco 1 Reservoir as does CDFG. Figure 3.14-2 shows land ownership around the Klamath River in the vicinity of the Hydroelectric Reach.

3.14.1.5.1 PacifiCorp Lands

PacifiCorp owns approximately 11,000 acres in Klamath County and Siskiyou County that are not directly associated with its Klamath hydroelectric facilities, and that are generally not included within the existing FERC project boundary. The KHSA describes this property as Parcel A lands (see Figure 3.14-2). Implementation of the KHSA would have no effect on disposition of Parcel A lands, which would be disposed of by PacifiCorp subject to applicable Public Utility Commission approval requirements (KHSA Section 7.6).

PacifiCorp also owns approximately 8,000 acres in Klamath County and Siskiyou County that are associated with the KHP and/or included within the FERC project boundary. The KHSA describes this property as Parcel B lands (see Figures 3.14-2 through 3.14-4). Of these lands, approximately 2,000 acres are currently inundated by the reservoirs.

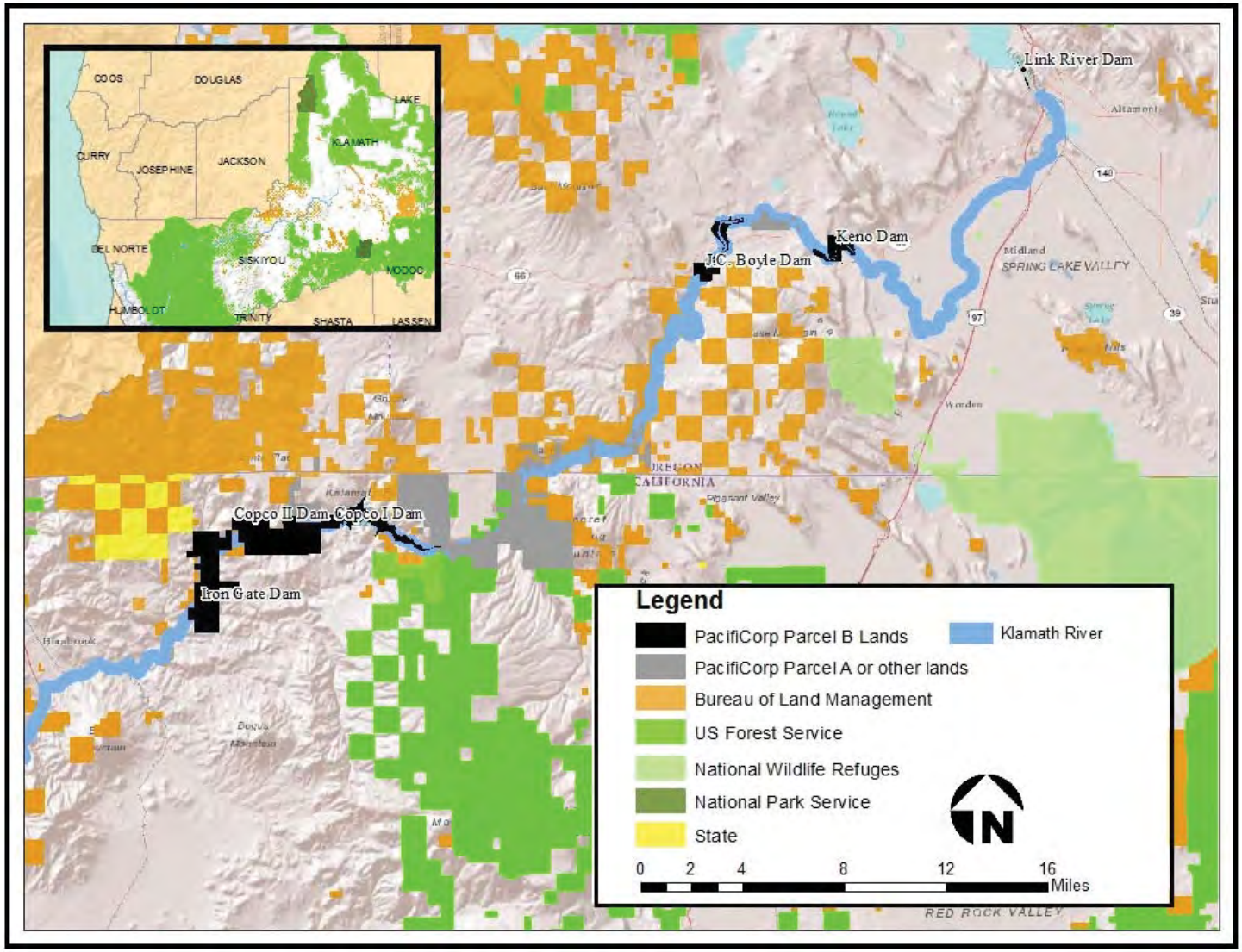

Figure 3.14-2. Land Ownership Around the Klamath River in the Vicinity of the Hydroelectric Reach.

According to the KHSA (Section 7.6.4), Parcel B lands would be transferred to the respective States (Oregon or California) or a designated third party, before facility removal. Lands owned by the State and Federal Government would not be subject to local zoning laws and regulations. The transferred lands would be managed for public interest purposes such as fish and wildlife habitat restoration and enhancement, public education, and public recreational access. The KHSA provides an option that would invoke the "meet and confer" provisions to allow for other uses. The States have no detailed plans but indicate that the approximately 2,000 acres of inundated lands would be restored to natural conditions consistent with the intent of improving fisheries in the Klamath Basin. PacifiCorp also owns electric transmission and distribution facilities, which will remain under its ownership (KHSA Section 7.6.1), and are not analyzed further in the EIS/EIR.

The land around the Keno Development would be transferred from PacifiCorp to the United States to be managed by DOI based on terms agreed to by both parties (KHSA Section 7.5). For purposes of this analysis, the transfer agreement was assumed to be complete by March 31, 2012, which is the target date for reaching an agreement (KHSA Section 7.5.2).

In addition to the above categories of lands, the KHSA identifies three parcels (East Side/West Side generating facilities lands) that may be transferred to DOI, near Klamath Falls, Oregon upon decommissioning (KHSA Section 6.4.1.C).

Ownership at or near the Four Facilities

Land ownership at or near the Four Facilities (Figures 3.14-3 and 3.14-4) is as follows:

- Keno Dam
  - The shoreline of Keno Impoundment is primarily in private ownership, with some Federal (managed by DOI) and State (Oregon) ownership, while the area near the dam is owned by PacifiCorp. The State of Oregon title extends upriver to approximately river mile 233 and includes the bed and banks of the river channel under Keno Dam and Keno Impoundment.
  - PacifiCorp and private entities own the lands along the Klamath River in the Keno Reach.

- J.C. Boyle Dam
  - PacifiCorp owns most of the land at J.C. Boyle Reservoir concentrated along the reservoir and at the dam. The FERC boundary encompasses a few acres of private property and large tracts of public and Oregon and California Railroad (O&C) land managed by the BLM including Topsy Campground and much of the land along the access road, power canal, tunnel, and bypass reach. The FERC boundary also encompasses State-owned land. The title of the State of Oregon extends upriver and includes the beds and banks of the river channel located under J.C. Boyle Dam and J.C. Boyle Reservoir.
  - Most of the land along the J.C. Boyle peaking reach of the Klamath River is public and O&C land managed by the BLM. It also includes some PacifiCorp

and other private property. A small amount of National Forest land managed by the Klamath National Forest lies near the Klamath Hydroelectric Project.

- Copco 1 & 2 Dams
  - PacifiCorp owns the lands around the powerhouses, dams, and Copco 2 Reservoir, while most of the land surrounding Copco 1 Reservoir is privately owned. The BLM also manages some public land near Copco 1 Reservoir and Copco 2 Dam.

- Iron Gate Dam
  - PacifiCorp owns the land adjacent to the Iron Gate Dam, Fish Hatchery, and Powerhouse, as well as most of the land along the Iron Gate Reservoir shoreline and the nearby transmission line right-of-way. The Iron Gate Dam vicinity also includes a small amount of private land.

3.14.1.5.2 Downstream from Iron Gate

The Klamath River passes through federally designated wilderness, National Forests, public land managed by the BLM, undeveloped private lands, and rural tribal reservations for most of its course downstream from Iron Gate Dam. There are no incorporated cities or large developed areas in the watershed downstream from Klamath Falls. Within a one-quarter mile buffer of the Klamath River downstream from Iron Gate Dam to the Estuary, there are approximately 40,500 acres of open space and public lands, 15,600 acres of agricultural lands, 290 acres of residential uses (of various densities), 24 acres of tribal reservation lands, 2,478 acres of urban reserve[1], and 26 acres of commercial use. In addition, the entire Klamath River is designated a wild and scenic river downstream from Iron Gate.

3.14.2 Regulatory Framework

Land use resources within the area of analysis are regulated by several Federal, State, and local laws and policies, which are listed below.

3.14.2.1 Federal Authorities and Regulations

- Farmland Protection Policy Act of 1981
- Federal Land Policy and Management Act of 1976
- Oregon and California Revested Railroad Grant Lands Act of 1937
- Oregon Public Lands Transfer and Protection Act of 1998
- BLM Redding Resource Management Plan and Record of Decision (1993)
- BLM Klamath Falls Resource Area Resource Management Plan and Record of Decision and Rangeland Program Summary (2008)

[1] The following communities have been designated "Urban Reserve" in their county's General Plans to accommodate future growth: Orleans, Humboldt County at RM 48; Weitchpec, Humboldt County at RM 43; Klamath Glen, Del Norte County at RM 6; Requa, Del Norte County located 0.75 miles north of RM 1.25; Requa, Del Norte County located 0.75 miles north of Estuary (General Plans – Land Use [computer file]. Sacramento, CA: California Resources Agency/ University of California, Davis, 2004.)

- BLM Medford District Resource Management Plan and Record of Decision (2008)
- Northwest Forest Plan (1994)[2]
- Fremont National Forest Land and Resource Management Plan (1989)
- Winema National Forest Land and Resource Management Plans (1990)
- Six Rivers National Forest Land Management Plan (1995)
- Kuchel Act of 1964
- Klamath Basin Compact of 1956
- Tribal Forest Protection Act of 2004
- National Wildlife Refuge System Administration Act of 1966

3.14.2.2 State Authorities and Regulations

- California Land Conservation Act of 1965 (Williamson Act)
- California's Farmland Mapping and Monitoring Program
- California Forest Practice Rules
- Oregon Exclusive Farm Use zoning program
- Oregon Forest zoning program
- Oregon Forest Practices Act
- Oregon Department of State Lands jurisdiction between river miles 208 and 233[3]

3.14.2.3 Local Authorities and Regulations

- Klamath Reservation Forest Management Plan (2008)
- Klamath County Land Use Code
- Klamath County Comprehensive Plan (2010b)
- Siskiyou County Land Development Code
- Siskiyou County General Plan (1980)
- Siskiyou County General Plan Land Use Policies (1997)
- Siskiyou County zoning ordinance
- Modoc County General Plan (1988)
- Modoc County zoning ordinance
- City of Yreka General Plan (2003)
- City of Yreka municipal code

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[2] The Northwest Forest Plan, Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, was signed April 14, 1994. The BLM Klamath Falls Resource Area incorporates direction from the Northwest Forest Plan ROD into the 1995 Klamath Falls Resource Area Record of Decision and Resource Management Plan and Rangeland Program Summary.

[3] The State of Oregon owns the Klamath River and submerged lands between river miles 208 and 233, at and below the ordinary high water mark of the original river channel. Following potential dam removal or implementation of any of the action alternatives, any structure remaining in, on, or over, and any facilities added to the submerged and submersible lands of the navigable waters of the State shall be authorized appropriately through the Oregon Department of State Lands.

3.14.3 Existing Conditions/Affected Environment

3.14.3.1 Land Use

3.14.3.1.1 Land Use Categories

Major land use categories in the area of analysis in Oregon are agriculture, non resource, forestry, rural industrial, and rural communities (see Figure 3.14-3). Major land use categories in the area of analysis in California are Agriculture – Grazing, Forestry Resources, Open Space – Natural Resources, Rural Residential and associated services with many parcels currently vacant (see Figure 3.14-4) The main urban areas are Klamath Falls and the City of Yreka. Most of the land in the area of analysis is devoted either to agriculture/grazing or to open space and conservation of natural resources. A small portion is devoted to hydroelectric operations and recreation sites. There are residential developments on private parcels adjacent to the Klamath River throughout the watershed from Iron Gate to the Pacific Ocean. These include residential developments in and around the community of Keno and the Keno Recreation Area, and along portions of Copco 1 Reservoir.

3.14.3.1.2 Inundated Lands

In Klamath County, lands currently inundated by J.C. Boyle Reservoir do not have land use designations or zoning, and would require a zoning change and plan amendment after the land is no longer inundated (Gallagher 2011). Lands currently inundated by the reservoirs in Siskiyou County have land use designations and zoning that correspond with the adjacent lands (generally agriculture or grazing). After the Proposed Action is complete, they would not require new land use designations or zoning because they run with the land and do not change with an ownership change until there is some action that triggers rezoning and land use amendment (Plucker 2011).

3.14.3.1.3 Open Space/Recreation/Public Lands

Federal and State agencies own and/or manage public lands in the area of analysis. These include public and O&C lands owned by the United States and managed by BLM, National Forests and Grasslands owned by the United States and managed by USFS, wildlife refuges owned by the United States and managed by USFWS, and other publicly-accessible reservoirs and State lands. These areas are used for public recreation and open space, as well as forest and mineral resources. Additionally, DOI manages lands near the Keno Dam that are operated by PacifiCorp for public recreation. Other privately-owned recreation facilities (e.g., Recreational Vehicle parks) operate along the Klamath River downstream from Iron Gate Dam.

3.14.3.1.4 Residential/Developed

In the area of analysis, there are residential developments in the city of Klamath Falls, in and around the community of Keno and the Keno Recreation Area, and along portions of Copco reservoir. These developments are mostly low-density rural residential (e.g., fewer than four units per acre). Many parcels are vacant and undeveloped. There are residential areas along the Klamath River between Iron Gate Dam and the Pacific Ocean, but the land uses and designations will not be affected or changed as a result of the Proposed Action.

3.14.3.1.5 Commercial/Industrial

Besides the dam facilities themselves (zoned industrial), industrial/undeveloped and urban uses occur in the City of Klamath Falls near the East Side and West Side powerhouse developments. In addition, the Klamath Falls co-generation plant, the Collins Products lumber facility, and Jeld-Wen millwork plant are located outside city limits adjacent to Klamath River. There are commercial and industrial developments in some rural areas downstream from Iron Gate Dam, but these developments will not be affected by the removal of the Four Facilities and will not be analyzed further.

3.14.3.1.6 Rural Industrial

Rural Industrial Centers are intended to provide areas for manufacturing, processing, or movement of raw materials in locations where industrial activities have the least potential to impact surrounding rural land uses (Klamath County 2006).

3.14.3.1.7 Rural Service Center or Commercial Services

Rural service centers are unincorporated areas that contain local commercial services to meet the needs of rural residents. These include general stores, limited commercial tourist oriented operations such as accommodations and restaurants, and campgrounds. These areas are located in the areas near the Keno Impoundment and Lake Ewauna. In addition to the areas shown in the Figures 3.14-3 and 3,14-4, there are areas between Iron Gate Dam and the Pacific Ocean that provide services to local residents. However, the Proposed Project will not affect land uses or designations downstream from the Four Facilities.

3.14.3.1.8 Forest/Timber lands

About 58,000 acres is designated forestry in the area of analysis as shown in Figures 3.14-3, and 3.14-4 . These lands are owned by the United States and managed by the USFS, BLM, and private landowners for the purposes of timber harvests and other forest management practices.

3.14.3.1.9 Non Resource

Non-Resource zoning is applied to lands in Oregon that have a low value for timber production, have soils that are unsuitable for agriculture, are not important habitat for fish and wildlife or watershed protection, have not been irrigated or are not irrigable, and are not necessary for permitting adjacent farm or forestry activities (Klamath County 2006).

3.14.3.1.10 Agriculture

Agriculture is an important part of the economy for Klamath, Siskiyou, and Modoc counties. Hay, alfalfa, vegetables, nursery crops, livestock, and various grains are all grown in the three-county area that receives water from Reclamation's Klamath Project in the Upper Klamath Basin. The Agricultural Commissions of each California county prepare crop reports that focus on production at the county level. Reclamation provides annual crop reports for Reclamation's Klamath Project.

According to the California Water Plan's 2009 update, 55 percent of Reclamation's Klamath Project is in Oregon in Klamath County, and the remaining 45 percent is in California in Siskiyou and Modoc Counties (see Figure 3.14-1).

Figure 3.14-3. Land Use at Keno and J.C. Boyle Dams.

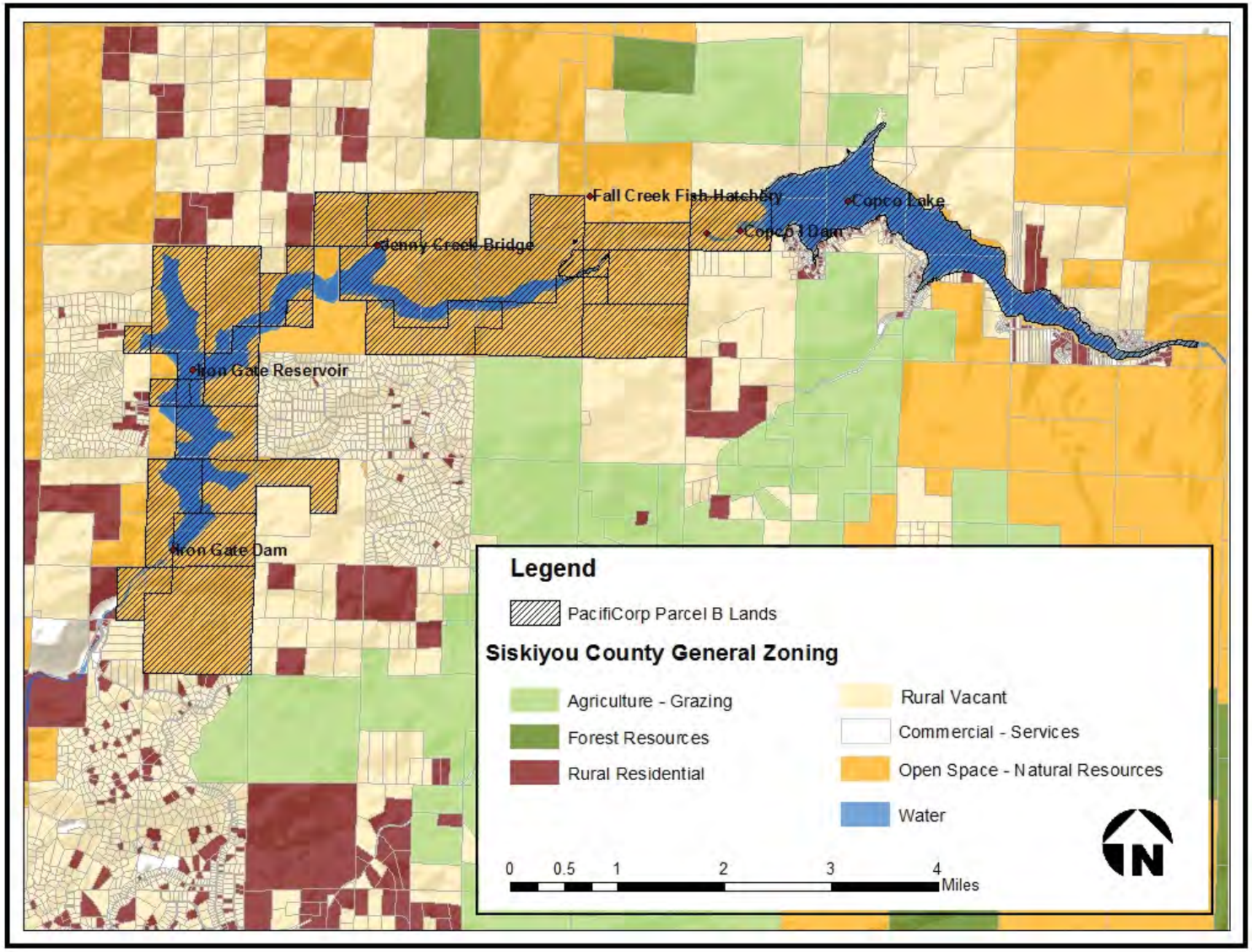

Figure 3.14-4. Land Use – Iron Gate and Copco Dams.

Reclamation's Klamath Project provides water to agricultural lands and wetlands in the upper Klamath River and Lost River Sub-basins in Klamath County, Oregon, and both Siskiyou and Modoc Counties in California. A large percentage of the 35,000 wetland acres are in California. Of the total land area in Reclamation's Klamath Project, 45 percent are in California and 55 percent are in Oregon; however, only 32 percent of the agricultural land within Reclamation's Klamath Project is located in California and 68 percent in Oregon (Personal Communication, Mike Green, March 23, 2011).

Table 3.14-2. 2009 Irrigable Lands in Reclamation's Klamath Project by State

State	Acres Irrigated	Fallow or Idle	Total Irrigable
California	65,321.30	6,313.80	71,635.10
Oregon	124,951.80	28,378	153,329.80
Total	190,273.10	34,691.80	224,964.90

Source: Reclamation's Klamath Project 2009 Crop Report. DOI 2010b.

Water is captured in the Clear Lake and Gerber Reservoirs and the Lost River for the Lost River or Eastside portion of Reclamation's Klamath Project and in Upper Klamath Lake and the Klamath River for the Klamath or Westside portion of the project (see Figure 3.14-1). The drainage area of the entire project is approximately 5,700 square miles (DOI 2009b). See Chapter 1.2.4 for additional detail regarding Reclamation's Klamath Project.

Klamath County

Agricultural land in Klamath County totals about 465,000 acres. About 33 percent of these agricultural lands are within Reclamation's Klamath Project boundaries. As shown in Figure 3.14-5, much of Klamath County's agriculture land in the area of analysis is zoned Exclusive Farming Use (Oregon Zoning (computer file) Oregon State Service Center for GIS, 1998).

Upper Klamath Lake is a major source of water through Reclamation's Klamath Project to the farmland in Klamath County as well as Siskiyou and Modoc Counties.

Siskiyou and Modoc Counties

The farmland in Siskiyou and Modoc Counties is a combination of Prime Farmland, Farmland of Statewide Importance, Unique Farmland and other classifications recognized by the State Department of Conservation (see Figure 3.14-5) (California Department of Conservation (CDC) 2010). Other classifications are farmland of local importance and grazing land which are designations made by the county. There are approximately 754,000 acres in farmland categories in Siskiyou County. Approximately 138,000 acres are in the primary categories of Prime Farmland, Farmland of Statewide Importance, or Unique Farmland. Modoc County has approximately 286,000 acres in farmland

categories. Approximately 138,000 acres are in the primary categories of Prime Farmland, Farmland of Statewide Importance, or Unique Farmland. Much of the Siskiyou County farmland is outside of the area of analysis, in the Scott River and Shasta River Sub-basins. Much of the agricultural lands in Modoc County is outside of the Klamath Basin. These areas do not receive water from Reclamation's Klamath Project, and would not be affected by changes in water allocation associated with the Proposed Action.

In California, agricultural or open space lands designated by the county may be enrolled under the Williamson Act for property tax assessment. There are no Williamson Act lands adjacent to the Four Facilities although there are Williamson Act lands in the Upper Klamath River Sub-basin. Most Williamson Act lands in the Lower Klamath Basin are in Shasta River Sub-basin and Scott River Sub-basin. In the Upper Klamath Basin, there are Williamson Act lands in the Butte and Lost River Sub-basins which are served by the Reclamation Klamath Project.

Reclamation's Klamath Project does serve lands in the Upper Klamath Basin within Siskiyou and Modoc Counties. Of the primary categories of Prime Farmland, Farmland of Statewide Importance and Unique Farmland, approximately 38,500 acres in Siskiyou County and approximately 41,500 acres in Modoc County. In the Klamath Project area, approximately 38,500 acres of these lands in Siskiyou County are considered irrigable. Approximately 33,000 acres in Modoc County are considered irrigable.

3.14.3.1.11 Lands Downstream from Iron Gate Dam Subject to Flooding

Certain lands along the Klamath River are subject to flooding. These include agriculture and grazing lands, recreation sites and unincorporated communities along the Klamath River. Flooding risk is described in Appendix J for a portion of the Klamath River downstream from Iron Gate Dam to Happy Camp as modeled for a 100 year event with and without the hydroelectric dams. Effects are discussed in Section 3.6, Flood Hydrology.

3.14.3.2 Existing Infrastructure

Existing infrastructure potentially affected by the Proposed Action are the City of Yreka water line, existing domestic wells, recreation sites and facilities, and roads. Details of utilities and public services are found in Section 3.18, Public Health and Safety, Utilities and Public Services, Solid Waste and Power, and recreation facilities are described in Section 3.20, Recreation. The existing roads are owned by PacifiCorp, the Federal Government, counties or private entities, details of which can be found in Section 3.22, Traffic and Transportation.

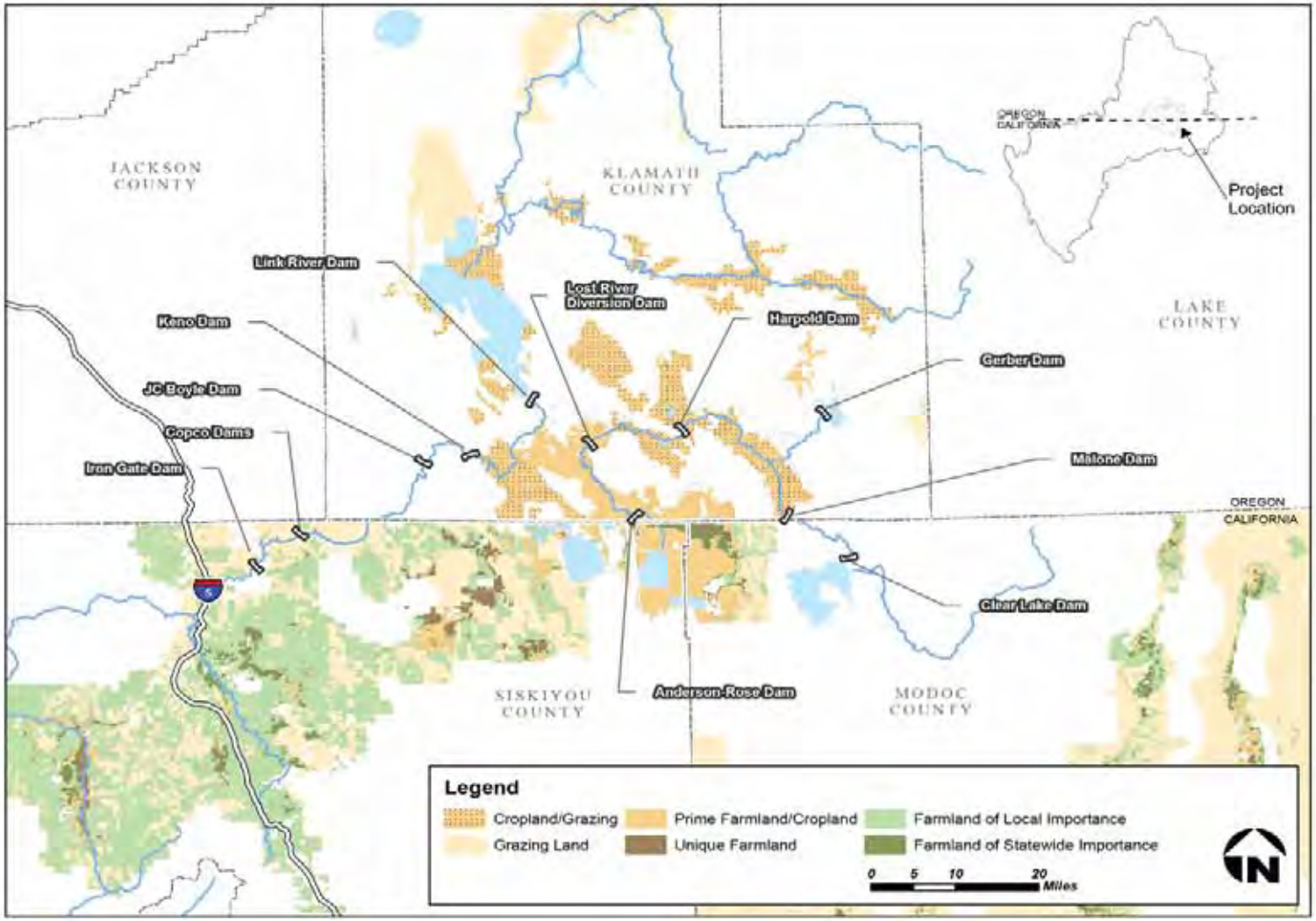

Figure 3.14-5. Upper Klamath Basin Agricultural Resources.

3.14.4 Environmental Consequences

3.14.4.1 Effects Determination Methods

The Lead Agencies reviewed the plans, codes, regulations and ordinances listed in Section 3.14.2 to aid this analysis. Existing land uses were identified from a variety of sources including Federal and State agencies and the respective counties. The effects analysis identifies direct and indirect effects on land use, agricultural and forest resources under the No Action/No Project Alternative, the Proposed Action, and the other alternatives. The types of land use effects that were analyzed included temporary effects associated with dam removal, demolition, and staging and permanent effects such as transfers of ownership, changes in land use, and required changes to local land use plans and zoning ordinances. The Lead Agencies also considered possible conflicts or inconsistencies between the proposed alternatives and Federal, State, regional, local, or tribal land use plans, policies, or controls relevant in the area of analysis. Temporary and permanent direct and indirect conversions of agricultural lands were also analyzed. In addition, the Lead Agencies examined the changes in land ownership, including the ownership and operation of Keno Dam. Section 3.20, Recreation, discusses roads and access to the new river channel, both for public access and for private owners adjacent to the reservoirs. The discussion below includes the effects on land use from new access roads for deconstruction activities. New roads that may be required to mitigate impacts from the removal of recreational facilities are discussed in the analysis of mitigation measures for other resource areas.

Changes in shoreline access are addressed in Section 3.20, Recreation, because they would not constitute a land use change. Effects on the property values of private lands adjacent to the reservoirs due to the loss of the reservoirs are addressed in Section 3.15, Socioeconomics, because the land use of those properties would not change.

This section includes an evaluation of potential conflicts between the existing and proposed land uses. Although conflicts with zoning or land use policies, in and of themselves, would not constitute a physical impact on the environment (California Environmental Quality Act (CEQA) Guidelines Section 15064(d)(1)), the act of decommissioning the dams would ultimately cause physical changes in the environment. Physical changes resulting from the Proposed Action and the various alternatives are addressed throughout this EIS/EIR. Where significant adverse environmental impacts would occur, this EIS/EIR offers mitigation measures for reducing the physical impacts on the environment that would be caused by the change in land use.

The No Action/No Project Alternative provides the baseline condition against which the alternatives were measured. In particular, under the No Action/No Project Alternative, allocations of water to the irrigators and KHP would continue as dictated under the existing agreements and the Biological Opinion's from the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service and the USFWS.

3.14.4.2 Significance Criteria

The proposed action and the alternatives analyzed in the EIS/EIR are in conformance with the Bureau of Land Management's 1995 Klamath Falls Resource Area Record of Decision and Resource Management Plan and Rangeland Program Summary and the 1993 Redding Resource Management Plan and Record of Decision. The BLM's planning regulations state that the term "conformity" or "conformance" means that "a resource management action shall be specifically provided for in the plan, or if not specifically mentioned, shall be clearly consistent with the terms, conditions, and decisions of the approved plan or amendment" (43 CFR 1601.0-5(b)).

For the purposes of this EIS/EIR, impacts would be significant if they would result in the following:

- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.
- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, or Exclusive Farm Zone land as defined by the Oregon Revised Statutes, Chapter 308, to non-agricultural use.
- Conflict with existing zoning for agricultural use, or a Williamson Act contract.
- Conflict with existing zoning for, or cause rezoning of, forestland (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g)).
- Result in the loss of forestland or conversion of forestland to non-forest use.
- Involve other changes in the existing environment that could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use.

3.14.4.3 Effects Determinations by Alternative

3.14.4.3.1 Alternative 1: No Action/No Project

Under the No Action/No Project Alternative, the KHSA would not be implemented and the KBRA would not be fully implemented. Under this alternative, resource management actions and restoration activities that are part of the KBRA and that are currently approved and on-going would continue to be implemented.

The No Action/No Project Alternative could conflict with applicable land use plans, policies, or regulations adopted for the purpose of avoiding or mitigating an environmental effect. The No Action/No Project Alternative would not conflict with applicable plans, policies, or regulations because no action would not result in any changes or actions that would conflict with land use, agriculture, or forest plans, policies, or regulations. **There would be no change from existing conditions to land use and agriculture from the No Action/No Project Alternative.**

The No Action/No Project Alternative could result in the conversion of farmland to non-agricultural use or conflict with Williamson Act land or agricultural zoning. No land uses would be converted directly as a result of the No Action/No Project Alternative. Under the No Action/No Project Alternative, there would be continued uncertainty for irrigators dependent on Reclamation's Klamath Project water because of allocation methods required under the Biological Opinions which make it difficult for farmers to plan for the next season. The 2001 Klamath Project Operations Plan that curtailed deliveries to project irrigators due to low water conditions and the flow requirements of the Biological Opinion's indicates potential future water allocations under the No Action/No Project Alternative. Continuing this uncertainty could indirectly result in local farmers retiring farmland to reduce their dependence on Reclamation's Klamath Project water, potentially by selling agricultural property for development or other non-agricultural uses. Irrigators would continue to respond to uncertain water allocations under the No Action/No Project Alternative. **There would be no change from existing conditions to land use and agriculture from the No Action/No Project Alternative.**

The No Action/No Project Alternative could result in the conversion of forest lands to non-forest use or conflict with forest zoning. The No Action/No Project Alternative would not directly conflict with existing zoning for, or cause rezoning of, forest land, timberland, or timberland zoned Timberland Production. **There would be no change from existing conditions in forest lands from the No Action/No Project Alternative.**

The No Action/No Project Alternative could indirectly convert farmland, to non-agricultural use or forest land to non-forest use. The No Action/No Project Alternative would not include making changes in forest land use and would not involve other changes in the existing environment which, due to their location or nature, would result in conversion of farmland to non-agricultural use or forest land to non-forest use. **There would be no change from existing conditions to farmland or forest land uses from the No Action/No Project.**

Under the No Action/No Project Alternative, ongoing restoration actions would continue to be implemented and could affect land use, agriculture, and forest resources. These actions include the Agency Lake and Barnes Ranches Project, and ongoing fisheries restoration actions. Reclamation purchased the Agency Lake and Barnes Ranches adjacent to Agency Lake in 1998 and is currently using portions of the ranches as pumped storage. These ranches have been transferred to the USFWS and are now part of the Upper Klamath NWR. USFWS is studying the possibility of breaching the dikes which would convert the 63,770 acre-feet of storage from pumped storage to passive storage in Upper Klamath Lake. The Agency Lake/Barnes Ranches Project would go through separate National Environmental Policy Act evaluations as plans are developed for future restoration activities. **Future changes would not substantively change the existing land uses or areas used for agriculture, and do not affect forest lands, and therefore, there would be no change from existing conditions.**

3.14.4.3.2 Alternative 2: Full Removal of Four Dams (the Proposed Action)

Implementation of the KHSA would include full removal of the Four Facilities, drawdown and removal of the associated reservoirs, and restoration of formerly inundated lands in the project area.

The Proposed Action could conflict with applicable land use plans, policies, or regulations adopted for the purpose of avoiding or mitigating an environmental effect. The Proposed Action would have no effect on the disposition of Parcel A lands. Activities defined in the Proposed Action would change current uses of the Parcel B lands in the vicinity of J.C. Boyle Dam from rural industrial to non-resource. Land use designations around the other reservoirs would not be changed as existing designations would be consistent with potential future land uses. Activities defined in the Proposed Action would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect. The plans and policies described in Section 3.14.2 would not be affected by the Proposed Action, because the inundated lands in Siskiyou County already have zoning and land use designations that would not change once they are no longer inundated (Plucker 2011). In Klamath County, formerly inundated lands would require new land use designations and zoning, the designation of which would likely not conflict with any adopted plans or policies (Gallagher 2011). Private lands adjacent to the reservoirs would not have a land use change; however, those lands would no longer be adjacent to inundated land with reservoir views and that is currently used for water-based recreational purposes. In the future other land-based recreational uses could occur on the publicly owned property. Although the land use designations and zoning would not change *per se*, the functional use of the area would change and would be noticeable to the private property owners. **The Proposed Action would not conflict with land use plans, policies or regulations adopted for the purpose of avoiding or mitigating an environmental effect, and therefore, there would be no change from existing conditions.**

The Proposed Action could result in the conversion of farmland to non-agricultural use or conflict with Williamson Act land or agricultural zoning. Implementation of the Proposed Action would not involve directly converting farmland to non-agricultural uses, and would not conflict with existing zoning or Williamson Act contracts. Certain programs of the KBRA may indirectly affect agricultural lands in Reclamation's Klamath Project. These programs are discussed below in the KBRA section. **The Proposed Action would not result in the conversion of farmland to non-agriculture use, nor would it conflict with Williamson Act land or agricultural zoning, and therefore, there would be no change from existing conditions.**

The Proposed Action could result in the conversion of forest lands to non forest use or conflict with forest zoning. Implementation of the Proposed Action would not affect the forest lands or forest uses surrounding the reservoirs or in the larger area of analysis. There would be no changes in land use under the Proposed Action that would conflict

with forest use or zoning. **There would be no change from existing conditions as a result of the Proposed Action.**

The Proposed Action could impact the existing environment resulting in changes that could result in conversion of farmland to non agricultural use or conversion of forest land to non forest use. Dam decommissioning and removal would require the creation of temporary roads, staging areas and construction sites. Although existing roads provide access to the KHP facilities, new roads would be needed during deconstruction activities. Temporary construction roads and staging sites would also be required during dam removal activity (see Chapter 2). Permanent disposal sites would be needed near the dams on lands currently designated open space and/or conservation. Site access for restoration activities would require construction of temporary gravel access roads and storage pads. Because these temporary roads would be built on lands designated for industrial (dam) or open space use or on currently inundated lands, and could be returned to their original or alternate use following deconstruction, construction of the roads would not conflict with applicable plans and policies or otherwise cause a significant land use impact. The need for new roads and the capacity and use of existing roads is addressed in Section 3.22, Traffic and Transportation. **The development of temporary roads and staging/construction sites would be a less than significant land use impact.**

New, permanent roads constructed to provide access to recreation areas could constitute a change in the existing environment. Permanent roads associated with achieving public access to the river would be addressed as part of the recreation plan (mitigation measure REC-1). However, those roads would not constitute a significant land use impact because they would not take agricultural or forest lands out of production. **The development of permanent roads for public access would be a less than significant land use impact because it would not result in changes that could result in conversion of farmland to non-agricultural use or conversion of forest land to non-forest use.**

A detailed discussion of the traffic impacts and road conditions concerns is provided in Section 3.22, Traffic and Transportation, and Mitigation Measure TR-1 addresses these concerns. Therefore, the Proposed Action would not conflict with policies or regulations within the City of Yreka. **There would be no change from existing conditions as a result of the Proposed Action and pipeline relocation.**

Under the Proposed Action, removal of recreational facilities currently located on the banks of the existing reservoirs could change land use classification. The existing recreational facilities provide camping and boating access for recreational users of the reservoirs. Once the reservoirs are drawn down, these facilities would be removed, an action that would not result in a change of forest land uses or convert forest lands to other uses. **There would be no change from existing conditions resulting from the removal of the recreational facilities.**

3.14.4.3.3 Keno Transfer

The transfer of ownership of Keno Dam from PacifiCorp to Reclamation could result in a change in land use. The Keno Transfer would not change the use or operation of the Keno Dam or the Keno Impoundment, nor directly result in a change of land use in the surrounding area. **There would be no change from existing conditions as a result of the Keno Transfer.**

3.14.4.3.4 East and West Side Facilities – Programmatic Measures

The decommissioning of the East and Westside facilities could impact land use. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate the need for diversions at Link River Dam into the two canals. Although the land used for hydropower would no longer be used for that purpose, the decommissioning would not directly change the current land use of the canal system. **Therefore, the decommissioning of these facilities would have no impact on land use, agriculture, or forest resources.**

3.14.4.3.5 City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The City of Yreka Water Supply Pipeline, currently under the Iron Gate Reservoir, would need to be relocated to avoid damage after the reservoir is removed, creating a change in the existing environment and surrounding environment. The Proposed Action would require the relocation, replacement, and/or burial of the existing 24-inch diameter water line and transmission facilities from the City of Yreka's Fall Creek diversion (KHSA Section 7.2.3). The Proposed Action calls for placing the City of Yreka's waterline on a pipe bridge across the river. This would require construction of footings and other infrastructure to support the pipe bridge, resulting in construction at the site. However, a structure for the purpose of water conveyance would not constitute a land use change and would not conflict with applicable regulations and codes, because the contractor would be required to obtain all building permits prior to construction. Impacts on visual resources from a pipe bridge are addressed in Section 3.19, Scenic Quality. **The relocation of the City of Yreka Water Supply Pipeline would have no impact on land use, agriculture, or forest resources.**

3.14.4.3.6 KBRA – Programmatic Measures

The KBRA has several programs that could affect land uses within the Klamath Basin:

- Fisheries Reintroduction and Management Plan
- Water Diversion Limitations
- Water Use Retirement Program
- Power for Water Management
- Mazama Forest Project

Fisheries Reintroduction and Management Plan

Construction of fish handling facilities for trap and haul operations within the Fisheries Reintroduction and Management Plan could change land use. The Fisheries Reintroduction and Management Plan includes trap and haul operations that move fish

around Keno Impoundment and Link River during times of poor water quality. Trap and haul operations would require construction of new fish handling facilities near Keno Dam and Link River Dam. Because these new facilities would be built on lands designated for industrial (dam) use, their construction would not conflict with applicable plans and policies or otherwise cause a significant land use impact. The potential land use conversions generated by development of trap and haul facilities would not be expected to contribute to any land use effects generated by the hydroelectric facility removal action analyzed above. **The development of new fish handling facilities would be a less than significant land use impact.**

On Project Plan and Water Diversion Limitations

The implementation of the Water Diversion Limitations could convert farmland to non-agricultural uses, a potentially significant effect. The Water Diversion Limitations is part of the On-Project Water Users Program and would limit water diversions to specific irrigators receiving water on Reclamation's Klamath Project, and could decrease the total acreage under cultivation or indirectly convert farmland to non-agricultural use. The Water Diversion Limitations and the On-Project Plan (KBRA 15.1 and 15.2, respectively) outline water diversion limitations to specific diversions that are intended to increase water availability for fisheries purposes, especially in drier years. Agricultural water diversion limitations would be based on annual water level forecasts for Upper Klamath Lake which could result in less available water for irrigators during drought years and result in the conversion of farmland to non-agricultural uses. Also included are allocation and delivery guidelines for water provided to the Tule Lake NWR and Lower Klamath NWR for both wildlife and agricultural interests, which include the Tule Lake Irrigation District and the Klamath Drain District.

Activities in the On-Project Plan and the Water Diversion Limitations that have the potential to impact agriculture in the region include:

- Creation of conservation easements, forbearance agreements, and/or land acquisitions intended to reduce water use for irrigation. This could result in land fallowing and/or a shift in crop types to dry land crops.
- Implementation of water use efficiency and conservation measures to reduce surface water use, including drip irrigation.
- Development of new groundwater sources, and the potential creation of new surface and groundwater storage areas.

Implementation would include the establishment of fixed, annual water diversion amounts to agricultural uses based on available water and forecast water levels in the Upper Klamath Lake. While the diversion could reduce the availability of irrigation water by up to 100,000 acre feet less than irrigators received in the past, these fixed volumes would provide a base level for agricultural diversions and establish an irrigation framework that would provide security and increased certainty for farmers, allowing

them to make decisions about the year's crops and activities based on the water forecast. This security would mitigate the effects of the lower delivery amount that may be expected in dry years.

The activities in the Water Diversion Limitations have the potential to reduce the amount of agriculture occurring on Reclamation's Klamath Project. Implementation of the On-Project Water Use Program will maximize the use of available water supplies, improve water supplies for the National Wildlife Refuges, and increase reliability for agricultural users. The conversion of farmland to non-agricultural uses that could occur as a result of agricultural diversion limitations would be a significant impact. However many of the actions described in the KBRA are anticipated to be beneficial to the environment and thus likely to have beneficial effects. The Diversion Limitations will also provide a more reliable water supply to the NWRs, a beneficial effect. The potential land use conversions generated by activities in the Water Diversion Limitations would not be expected to contribute to any land use effects generated by the hydroelectric facility removal action analyzed above. **The On-Project Plan and the Water Diversion Limitations would maximize the use of available water, increase reliability for irrigators, and benefit the long-term sustainability of agricultural practices in the Klamath Basin. Impacts are therefore expected to be less than significant and potentially beneficial in the long term.**

Water Use Retirement Program (WURP)

The WURP could result in the fallowing or conversion of agricultural land non agricultural uses, such as open space or wetland restoration areas. The WURP is part of the Off-Project Water Program and is intended to resolve the existing disputes between the Off-Project Irrigators, The Klamath Tribes, and the Bureau of Indian Affairs, and increase the stream flow into Upper Klamath Lake. The Off-Project Water Program applies to the Wood, Sprague, Sycan, and Williamson River sub-basins, all of which are upstream of Upper Klamath Lake and outside the boundaries of Reclamation's Klamath Project.

The increase of permanent inflow to Upper Klamath Lake would be accomplished through various methods outlined in the WURP. The program is intended to permanently retire 30,000 acre-feet of water rights from irrigators to permanently increase inflow to Upper Klamath Lake (KBRA Section 16.2.2). The description of the WURP program in the KBRA does not mandate how this 30,000 acre feet would be acquired, but it could include:

- Retirement of water rights and forbearance agreements
- Short-term water leasing and split season irrigation
- Upland management techniques, such as juniper removal and timber thinning
- Water efficiency measures and dry land cropping
- Natural storage improvements, such as wetlands or improved riparian areas.

While no part of KBRA implementation would directly convert agricultural land to other uses, the KBRA provisions discussed above could result in agricultural land being temporarily or permanently retired. However, the EIS/EIR cannot characterize the specific impact from the KBRA on the conversion of farmland to non-agricultural use as a result of these programs because the number of voluntary participants, acres of farmland, and the final use of the lands affected by the program is unknown. The KBRA programs would protect the sustainability of agricultural uses and communities by improving the reliability of the agricultural water supply and settling long standing disputes on the amount, timing, and other conditions of water diversion and delivery for agriculture. The potential land use conversions generated by activities in the WURP would not be expected to contribute to any land use effects generated by the hydroelectric facility removal action. The KBRA could result in the conversion of farmland to non-agricultural use or conflict with Williamson Act land or agricultural zoning, a potentially significant impact. **However, the other potential measures outlined in the WURP would improve operational efficiency and are expected to benefit the long-term sustainability of agricultural practices in the Klamath Basin. Implementation of these programs will require future environmental compliance as appropriate.**

Power for Water Management

The Power for Water Management could affect land use in Reclamation's Klamath Project area. The Power for Water Management program is intended to deliver power to eligible users at a cost that is targeted at or below the average cost for similarly situated Reclamation irrigation and drainage projects. The goals of the program include providing affordable electricity for efficient use, distribution, and management of water within Reclamation's Klamath Project and the Klamath Basin NWR System, facilitating the return of water to the Klamath River as part of the implementation and administration of the On-Project Plan, and facilitating the implementation of the WURP and Off-Project Water Settlement (OPWAS). There are three components of the Power for Water Management – the Interim Power Program, a Federal Power Program, and a Renewable Power Program. Under the KBRA a power management entity would be created to manage the delivery of affordable power to eligible users.

- The Interim Power Program is intended to maintain the power cost target for eligible users while other programs from the KBRA are implemented. The program will help to offset the impacts of rising power prices on agricultural producers, and could prevent some agricultural producers from selling their property and/or converting it to other users. The Interim Power Program is unlikely to have an adverse effect on land use, agriculture, or forest resources.
- The Federal Power Program is a management program intended to obtain and provide for the transmission and delivery of Federal preference power to eligible users. The implementation of the program is unlikely to have adverse effects on land use, agriculture, or forest resources.
- The Renewable Power Program is a combination of energy efficiency measures and renewable generation projects intended to reduce power costs for eligible power users. The Program includes development of a financial and engineering plan to identify efficiency measures and renewable energy resources. These

include solar arrays, wind farms, and biomass energy facilities. These green power projects could be constructed on land currently used for agriculture or zoned for non industrial uses, which would have an adverse effect on land use, agriculture, or forest resources.

Implementation of the KBRA would not include construction or other projects that would conflict with existing zoning or Williamson Act contracts. However, green power projects, such as solar arrays or wind farms, could be constructed to replace part of the power generation capacity lost with the removal of the Four Facilities on land currently used for agriculture or zoned for non industrial uses. This would result in a change of land use should these potential projects be sited on agricultural lands. The potential land use conversions generated by siting and construction of renewable power projects would not be expected to contribute to any land use effects generated by the hydroelectric facility removal action. The KBRA Power for Water Management would have beneficial effects on land use, agriculture, and forest resources in the short term by creating incentives for agricultural producers. Impacts associated with siting and construction of renewable energy generation projects in the Renewable Power Program could generate significant, adverse, long term effects on land use and agriculture. However, other KBRA measures analyzed in this section are expected to benefit the long-term sustainability of agricultural practices in the Klamath Basin. **When considered with other KBRA programs that would benefit agriculture, implementation of the Power for Water Management would be expected to generate a less than significant impact on land use. These effects will be analyzed in future environmental documents as necessary.**

Mazama Forest Project

The KBRA's Mazama Forest Project could result in the conversion of forest land to non-forest use or conflict with forest zoning. The Mazama Forest Project is a planned purchase of 90,000 acres of former reservation land by the Klamath Tribes (Chui 2008; Kerr 2012). The land would be managed under the Klamath Tribes Forest Management Plan. The management of the adjacent Fremont-Winema National Forest would be influenced by the Mazama Forest Project under collaboration language from the Federal Tribal Forest Protection Act. The project would allow for long term forest management and timber operations, and thus would not convert forest land to other uses or conflict with forest zoning. Implementation of specific plans and projects described in the KBRA would require future environmental compliance as appropriate. **The KBRA is not expected to convert forest land to non-forest use and would not conflict with forest zoning, therefore it is expected to result in no change from existing conditions.**

3.14.4.3.7 Alternative 3: Partial Facilities Removal of Four Dams

The effects of the Partial Facilities Removal of Four Dams Alternative would be similar to those described for the Proposed Action. However, the powerhouses at Copco 1, 2 and Iron Gate, and the warehouses and support buildings at Copco 2 would be left in place and shuttered for the foreseeable future. The shuttering would not constitute a change in land use, nor would it conflict with an applicable plan or policy. **Effects would be less than significant.**

3.14.4.3.8 Keno Transfer

The effects of the Keno Transfer would be the same as those described for the Proposed Action.

3.14.4.3.9 East and Westside Facilities – Programmatic Measures

The effects of the East and Westside Facilities removal would be the same as those described for the Proposed Action.

3.14.4.3.10 City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the City of Yreka Water Supply Pipeline relocation would be the same as those described for the Proposed Action.

3.14.4.3.11 KBRA – Programmatic Measures

Under this alternative, the KBRA would be fully implemented and the potential effects would be the same as described for the Proposed Action.

3.14.4.3.12 Alternative 4: Fish Passage at Four Dams

The effects of the Fish Passage at Four Dams Alternative would be the same as those described above for the No Action/No Project Alternative, except that it would require the creation of new permanent roads to access fish ladder facilities.

Construction of permanent access roads could change land use. The Fish Passage at Four Dams Alternative would require the creation of new permanent roads. Although existing roads provide access to the KHP facilities, new roads would be needed for the fish passage alternative to provide permanent access to those facilities. Because these new roads would be built on lands designated for industrial (dam) use, their construction would not conflict with applicable plans and policies or otherwise cause a significant land use impact. **The development of new permanent roads would be a less than significant land use impact.**

3.14.4.3.13 Trap and Haul – Programmatic Measures

Construction of fish handling facilities for trap and haul operations could change land use. Trap and haul operations would move fish around Keno Impoundment and Link River during times of poor water quality. Trap and haul operations would require construction of new fish handling facilities near Keno Dam and Link River Dam. Because these new facilities would be built on lands designated for industrial (dam) use, their construction would not conflict with applicable plans and policies or otherwise cause a significant land use impact. **The development of new fish handling facilities would be a less than significant land use impact.**

3.14.4.3.14 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

The effects of the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be the same as those described above for the Proposed Action with respect to removal of Copco 1 and Iron Gate Dams, and the same as the Fish Passage at Four Dams with respect to the new roads.

3.14.4.3.15 Trap and Haul – Programmatic Measures

Construction of fish handling facilities for trap and haul operations could change land use. The trap and haul measures around Keno Impoundment and Link River would have the same impacts under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as the Fish Passage at Four Dams Alternative. **The development of new fish handling facilities would be a less than significant land use impact.**

3.14.4.3.16 City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the City of Yreka Water Supply Pipeline relocation would be the same as described for the Proposed Action.

Mitigation Measures Associated with Other Resource Areas

Mitigation REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. The areas that would be used for the relocation are currently inundated and their development would not result in a land use conversion or change in forest land uses. **There will be no impact to forest or agricultural land uses resulting from the implementation of Mitigation Measure REC-1.**

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3.15 Socioeconomics

This section describes socioeconomic effects of the four action alternatives and No Action/No Project Alternative. Socioeconomic effects include potential changes to economic output, labor income, and employment in the area of analysis, as well as, fiscal effects on local governments. This section also describes socioeconomic effects on Indian Tribes in the Klamath Basin. The transfer of Keno Dam's ownership to the Department of the Interior (DOI) would not result in socioeconomic effects and is not further discussed in this section.

3.15.1 Area of Analysis

The socioeconomic study area includes Del Norte, Humboldt, Modoc, and Siskiyou Counties in California and Curry, Klamath, and Jackson Counties in Oregon. The Four Facilities are in Siskiyou and Klamath Counties. The remaining counties have local economies linked to the Klamath River through fishing, recreation/tourism, or agriculture industries. Indian Tribes' economic and social welfare is also closely linked to the Klamath River. Various economic regions have been developed for the economic analysis based on where the direct economic activity would likely occur. For example, changes to irrigated agriculture as a result of the action alternatives would occur on Bureau of Reclamation's (Reclamation's) Klamath Project lands in Modoc, Siskiyou, and Klamath Counties; therefore, the economic region for irrigated agriculture effects includes these three counties. Figure 3.15-1 shows all counties in the direct area of analysis. Some economic effects for commercial fishing may occur in counties further from the Klamath Basin, most notably Mendocino, Sonoma, Marin, San Francisco, and San Mateo Counties in California and Lane, Douglas, and Coos Counties in Oregon. Section 3.15.2 defines the regions (groups of counties) and potential span of effects for each economic effect analyzed.

3.15.2 Regulatory Framework

Socioeconomics within the area of analysis is regulated by several Federal laws and policies, which are listed below.

3.15.2.1 Federal Authorities and Regulations

- Magnuson Fishery Conservation and Management Act of 1976
- Federal Endangered Species Act (ESA)
- Pacific Coast Salmon Plan and Amendments
- 1993 Solicitor's Opinion Fishing Rights of the Yurok and Hoopa Valley Tribes
- 1994 Northwest Forest Plan[1]

[1] The Northwest Forest Plan, Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, was signed April 14, 1994. The BLM Klamath Falls Resource Area incorporates direction from the Northwest Forest Plan ROD into the 1995 Klamath Falls Resource Area Record of Decision and Resource Management Plan and Rangeland Program Summary.

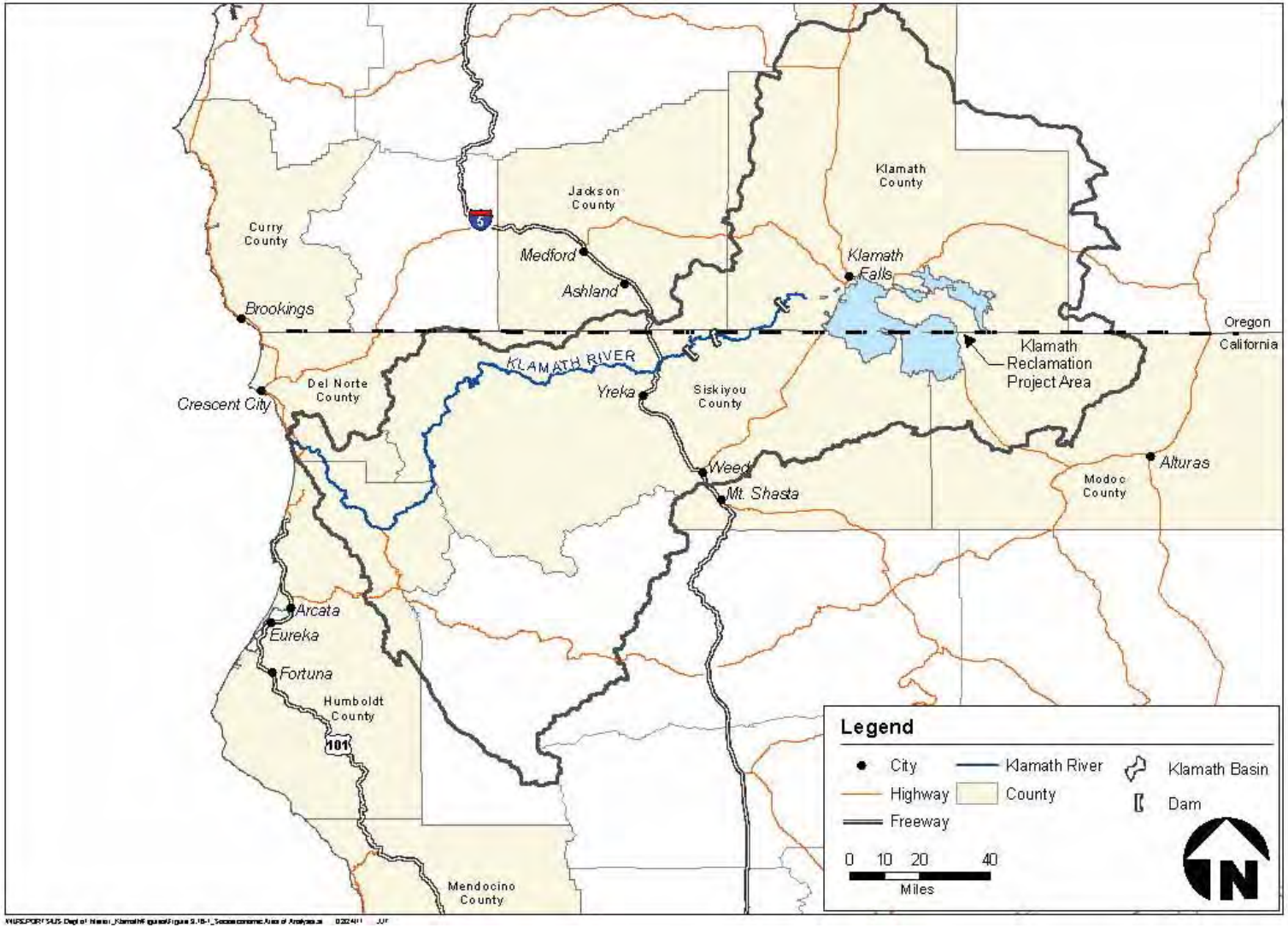

Figure 3.15-1. Socioeconomic Area of Analysis.

3.15.3 Existing Conditions/Affected Environment

This section describes regional economic conditions and economic information relevant to the specific industries in which potential economic effects could occur, such as fishing, recreation tourism, or agriculture. Much of the information in this section is taken directly from analyses contained in Reclamation (2012a and 2012b). The areas of potential effects, which for this analysis are groups of counties, vary depending on the industry and are identified below for each industry. In general, the counties in the area of analysis (except for counties in the San Francisco Bay area) are in rural areas of the States and have resource- and environmental amenity-based economies (e.g., timber, agriculture, fishing, recreation). Similar to many rural areas, the counties in the area of analysis have lower populations, incomes, and economic output and fewer employment opportunities than counties with larger urban centers in California and Oregon. Government entities and services are typically the largest employers in the counties. Appendix O includes detailed regional economic descriptions of each county. The nature and magnitude of economic effects depends on whether the economic industry is prevalent in a county.

Indian Tribes are also affected by the project alternatives. Tribes' cultural practices, subsistence, and economies are closely linked to the Klamath River. This section describes economic conditions of the tribes. Sections 3.12, Tribal Trust and 3.16, Environmental Justice describe Indian Tribes' social and cultural uses of the river in detail.

3.15.3.1 Four Facilities

The area of analysis for the Four Facilities includes Siskiyou and Klamath Counties. Table 3.15-1 summarizes the regional economy in the two counties aggregated into eight industry sector classifications for employment, labor income, and output. 2009 data is presented.

Employment is a measure of the number of jobs related to each industry. The service industry sector was 44 percent of the total regional employment in the region. The government and trade industry sector jobs provided 21 and 14 percent of regional employment, respectively.

Labor income is the sum of employee compensation and proprietor income. The largest portion of labor income in the region, 37 percent, was provided by the service industry sector. The government and trade industry sectors made up 28 and 11 percent of the total regional labor income, respectively.

Industry output represents the value of goods and services produced by businesses within a sector of the economy. The service sector produced the greatest level of output (42 percent) in the region. The manufacturing and government sectors each generated 14 percent of regional output, while the agricultural sector was 10 percent of total output.

Table 3.15-1. Summary of the 2009 Regional Economy for Klamath and Siskiyou Counties

Industry Sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ (million)	Percent of Total	$ (million)	Percent of Total
Agriculture	3,232	6.7	107.8	5.6	497.3	9.7
Mining	84	0.2	3.2	0.2	15.7	0.3
Construction	2,174	4.5	90.1	4.7	242.8	4.7
Manufacturing	2,621	5.4	135.7	7.0	703.6	13.7
Transportation, Information, and Public Utilities (TIPU)	1,920	4.0	109.3	5.7	394.6	7.7
Trade	6,886	14.3	220.5	11.4	455.4	8.9
Service	21,197	44.0	722.0	37.4	2,131.2	41.5
Government	10,091	20.9	539.8	28.0	697.9	13.6
Total	48,205	--	1,928.4	--	5,138.5	--

Source: Reclamation 2012b.
[1] Employment is measured in number of jobs.
[2] Income is the dollar value of total payroll (including positive effects) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Siskiyou County's unemployment rate has been higher than State averages from 1998 through 2010. Unemployment rates in 2009 and 2010 have been the highest the county has had in the past 20 years (California Employment Development Department [EDD] 2010). Klamath County has also had consistently higher unemployment rates than the State. The 2009 unemployment rate was the highest of the 12-year period (Oregon Employment Department 2010).

During the past 10 years, there has been a sharp decline in the Siskiyou County timber industry, which has been an economic base for the county historically. In 2009, the total value of the timber harvest in Siskiyou County was $11.6 million, about a $52 million decrease from 2000 (Board of Equalization [BOE] 2010b). The 2009 timber harvest was at its lowest value observed in the past 10 years. Reductions in timber harvesting have also reduced employment opportunities in the county. Similar to Siskiyou County, timber harvests in Klamath County have been declining in recent years. Timber harvests in 2008 and 2009 showed substantial decreases relative to previous years (Oregon Department of Forestry 2010). Appendix O further describes economic conditions in Siskiyou and Klamath Counties.

3.15.3.2 Commercial Fishing

The commercial fishing information provided here is taken directly from analyses contained in Reclamation (2012b) and National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service) (2012a). The area of analysis for

commercial fishing includes Curry, Coos, Douglas and Lane Counties in Oregon and Del Norte, Humboldt, Mendocino, San Mateo, San Francisco, Marin, and Sonoma Counties in California. Participants in the ocean commercial fishery potentially affected by the project alternatives consist of small, independently owned and operated trollers that land salmon south of Cape Falcon, Oregon. The fishery is a mixed stock fishery, that is, the commercial harvest includes salmon stocks from different rivers, including the Klamath River. The Pacific Fisheries Management Council (PFMC) manages the salmon fishery on the basis of 'weak stock management', whereby regulations are designed to protect weaker stocks, even if that means foregoing some harvest of the healthier stocks that comingle with the weaker ones in the ocean harvest. In the ocean, Klamath River fall Chinook salmon ranges from approximately Point Sur, California to Cape Falcon, Oregon. About 99 percent of the increase in commercial fishery revenue attributable to the project alternatives occurs in the following ocean management areas: (1) San Francisco, (2) Fort Bragg, (3) Klamath Management Zone (KMZ) (Figure 3.15-2) and (4) Central Oregon. The regional impact analysis focuses on these four areas. For purposes of this analysis, the KMZ (which straddles the Oregon-California border) is divided at the border into two areas: KMZ-OR and KMZ-CA. Tables 3.15-2 to 3.15-6 summarize the regional economy for San Francisco (San Mateo, San Francisco, Marin and Sonoma Counties), Fort Bragg (Mendocino County), KMZ-CA (Humboldt and Del Norte Counties), KMZ-OR (Curry County), and Central Oregon (Coos, Douglas and Lane Counties) in terms of employment, labor income, and output. Employment, labor income, and output related to commercial fishing are reflected in various sectors in the tables, including agriculture and services.

While Klamath River fall Chinook salmon abundance routinely constrains the troll fishery in the areas cited above, troll harvest in two additional areas (Monterey and Northern Oregon) may also become more constrained when Klamath River fall Chinook salmon is at low levels of abundance. Table 3.15-7 summarizes landings (numbers of fish) in the last three decades in all management areas south of Cape Falcon, Oregon. Tables 3.15-8 and 3.15-9 describe poundage and ex-vessel value of landings (gross landed value) over 1981-2010. Landings and value decreased from the 1980s to the 1990s. Factors contributing to this decline include more conservative management policies to protect weak stocks (including two Chinook salmon and three coho salmon stocks listed under the Endangered Species Act) and a 1993 opinion by the Department of the Interior Solicitor reserving 50 percent of Klamath-Trinity River salmon for the Yurok Tribe and Hoopa Valley Tribe. Landings are generally highest in San Francisco and lowest in KMZ-CA and KMZ-OR. Landing reductions began occurring in KMZ-CA and KMZ-OR in the mid-1980s to address conservation concerns for Klamath River fall Chinook; low landings remain persistent features in those areas. Landings in most areas rebounded during 2001-2005 but have since fallen to record lows in the past five years.

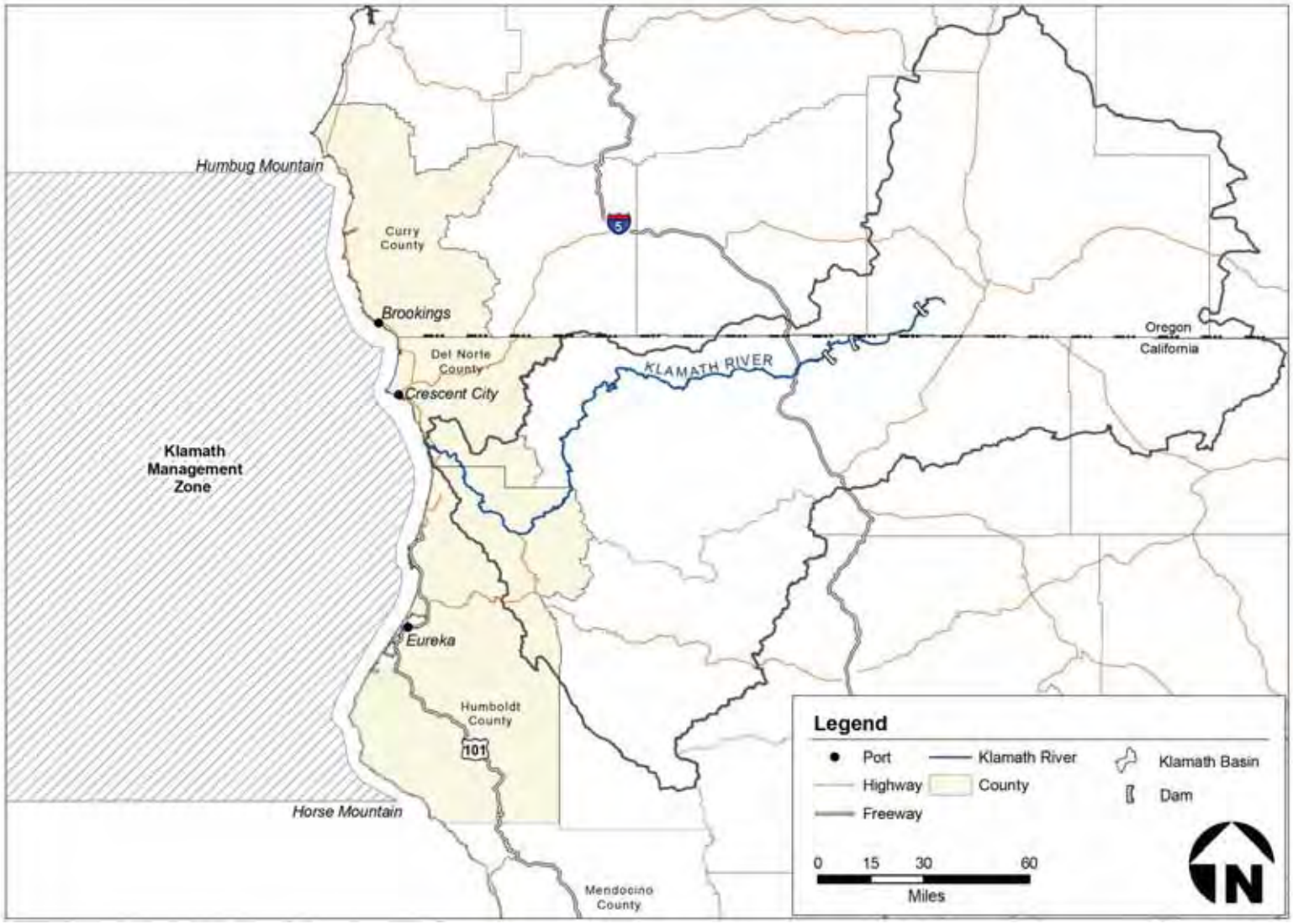

Figure 3.15-2. Klamath Management Zone Boundary and Ports.

Table 3.15-2. Summary of the Regional Economy for the San Francisco Management Area (San Mateo, San Francisco, Marin, and Sonoma Counties, CA)

Industry sectors	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	10,401	0.34	570.53	0.28	1,536.15	0.26
Mining	2,683	0.09	404.25	0.20	1,529.34	0.26
Construction	153,734	5.02	11,116.50	5.43	23,970.50	4.00
Manufacturing	149,053	4.87	17,552.96	8.58	151,443.53	25.28
TIPU	98,914	3.23	6,843.29	3.34	24,426.35	4.08
Trade	372,967	12.19	19,026.25	9.30	42,067.56	7.02
Service	1,933,85	63.19	121,200.87	59.21	318,440.96	53.15
Government	338,759	11.07	27,970.63	13.67	35,749.56	5.97
Total	**1,319,896**		**204,685.28**		**599,163.95**	

Source: Reclamation 2012b
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.15-3. Summary of the Regional Economy for the Fort Bragg Management Area (Mendocino County, CA)

Industry sector	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	2,339	5.83	118.11	6.82	312.39	6.49
Mining	66	0.17	1.80	0.10	9.14	0.19
Construction	2,233	5.57	115.93	6.70	281.60	5.85
Manufacturing	2,449	6.11	128.21	7.41	808.43	16.79
TIPU	1,093	2.73	58.26	3.37	346.44	7.20
Trade	6,304	15.71	250.07	14.45	520.20	10.81
Service	18,190	45.34	649.96	37.55	1,970.63	40.94
Government	7,442	18.55	408.64	23.61	564.71	11.73
Total	**40,116**		**1,730.98**		**4,813.54**	

Source: Reclamation 2012b
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.15-4. Summary of the 2009 Regional Economy for the KMZ-CA (Humboldt and Del Norte Counties, CA)

Industry sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	2,481	3.46	111.27	3.73	413.34	5.62
Mining	43	0.06	2.37	0.08	7.38	0.10
Construction	3,672	5.13	192.04	6.44	464.58	6.31
Manufacturing	2,465	3.44	126.28	4.23	798.32	10.85
TIPU	1,967	2.75	105.77	3.55	365.00	4.96
Trade	10,586	14.78	380.59	12.76	777.07	10.56
Service	32,462	45.32	1,113.71	37.34	3,327.87	45.21
Government	17,958	25.07	950.47	31.87	1,206.59	16.39
Total	**71,634**		**2,982.50**		**7,360.15**	

Source: Reclamation 2012b

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.15-5. Summary of the 2009 Regional Economy for the KMZ-OR (Curry County, OR)

Industry sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	676	7.81	20.60	6.61	53.21	6.20
Mining	25	0.29	1.26	0.41	4.39	0.51
Construction	673	7.78	21.94	7.04	67.28	7.84
Manufacturing	611	7.06	33.42	10.73	130.97	15.25
TIPU	180	2.08	11.33	3.64	43.17	5.03
Trade	1,252	14.47	38.04	12.21	74.43	8.67
Service	3,885	44.88	114.81	36.86	393.11	45.79
Government	1,354	15.64	70.07	22.50	91.97	10.71
Total	**8,656**		**311.47**		**858.53**	

Source: Reclamation 2012b

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.15-6. Summary of the Regional Economy for the Central Oregon Management Area (Coos, Douglas, and Lane Counties, OR)

Industry sector	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	8,718	3.38	273.06	2.68	865.38	3.11
Mining	449	0.17	23.57	0.23	92.68	0.33
Construction	12,681	4.91	547.94	5.39	1,451.52	5.22
Manufacturing	17,716	6.87	1,012.13	9.95	5,480.22	19.70
TIPU	6,726	2.61	332.09	3.27	1,070.39	3.85
Trade	37,815	14.65	1,259.06	12.38	2,657.42	9.55
Service	130,484	50.57	4,415.17	43.41	13,062.44	46.96
Government	43,459	16.84	2,307.17	22.69	3,134.82	11.27
Total	**258,048**		**10,170.19**		**27,814.87**	

Source: Reclamation 2012b
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.15-7. Landings of Troll-Caught Chinook Salmon and Coho Salmon (# fish), 1981-2010, by Management Area

Year(s)	Management Area							
	Monterey	San Francisco	Fort Bragg	KMZ-CA	KMZ-OR	Central OR	North OR	Total
81-85 Avg	85,260	186,680	124,320	124,020	61,320	170,560	190,200	942,360
86-90 Avg	146,460	360,480	278,380	56,120	33,920	385,940	351,700	1,613,000
91-95 Avg	137,720	205,480	14,760	1,540	1,000	36,820	128,240	525,560
96-00 Avg	156,305	195,662	12,529	3,505	3,542	36,042	89,479	497,064
01-05 Avg	64,827	210,228	96,466	12,401	5,245	117,529	151,698	658,393
06-10 Avg	5,330	24,806	7,906	1,752	1,188	7,736	11,598	60,315
2001	35,940	136,630	14,993	5,523	3,599	72,272	195,001	463,958
2002	69,980	242,872	65,336	13,467	6,803	122,174	162,415	683,047
2003	36,099	202,876	248,875	4,044	5,072	132,156	182,066	811,188
2004	64,707	298,229	107,259	31,915	8,484	140,142	100,965	751,701
2005	117,408	170,531	45,869	7,054	2,266	120,900	118,044	582,072
2006	11,204	47,689	10,835	0	738	1,979	21,759	94,204
2007	14,009	75,254	16,116	8,762	4,097	24,096	11,393	153,727
2008	0	0	0	0	236	208	76	520
2009	0	0	0	0	0	979	8,738	9,717
2010	1,435	1,086	12,577	0	869	11,418	16,022	43,407

Sources: PFMC as cited in Reclamation 2012b, NOAA Fisheries Service 2012a. 2010 data are preliminary.

Table 3.15-8. Landings of Troll-Caught Chinook Salmon and Coho Salmon (1000s of pounds dressed weight), 1981-2010, by Management Area

	Management Area							
Year(s)	Monterey	San Francisco	Fort Bragg	KMZ-CA	KMZ-OR	Central OR	North OR	Total
81-85 Avg	748	1,849	1,218	967	495	1,140	1,080	7,497
86-90 Avg	1,601	3,700	2,434	624	537	2,765	2,259	13,920
91-95 Avg	1,350	1,949	194	31	32	339	869	4,764
96-00 Avg	1,699	2,155	146	37	92	435	861	5,425
01-05 Avg	756	2,704	1,268	149	204	1,124	1,605	7,810
06-10 Avg	54	318	163	24	40	86	156	841
2001	418	1,735	192	64	152	776	1,898	5,235
2002	912	3,060	872	162	218	1,223	1,722	8,169
2003	498	2,753	3,096	45	142	1,353	1,890	9,777
2004	853	3,712	1,292	373	267	1,214	1,256	8,967
2005	1,098	2,258	889	102	239	1,054	1,259	6,899
2006	87	684	273	0	45	56	290	1,435
2007	165	888	357	115	101	246	160	2,032
2008	0	0	0	0	8	0	20	28
2009	0	0	0	0	5	5	82	92
2010	20	16	187	4	43	122	226	618

Sources: PFMC as cited in Reclamation 2012b, NOAA Fisheries Service 2012a. 2010 data are preliminary.

Table 3.15-9. Ex-vessel Value of Troll-Caught Chinook Salmon and Coho Salmon ($1000s, Base Year=2012), 1981-2010, by Management Area

	Management Area							
Year(s)	Monterey	San Francisco	Fort Bragg	KMZ-CA	KMZ-OR	Central OR	North OR	Total
81-85 Avg	3,671	9,170	5,881	4,536	2,426	4,637	3,965	34,286
86-90 Avg	7,003	16,751	10,884	2,736	2,219	10,983	8,128	58,704
91-95 Avg	4,095	6,097	670	104	98	899	2,349	14,312
96-00 Avg	3,755	4,912	340	81	217	1,038	1,950	12,293
01-05 Avg	2,129	7,422	3,371	440	608	3,206	4,280	21,456
06-10 Avg	307	1,797	925	134	243	500	834	4,740
2001	1,051	4,362	483	161	311	1,586	3,878	11,832
2002	1,766	5,927	1,689	314	420	2,354	3,309	15,779
2003	1,164	6,432	7,233	105	342	3,260	4,539	23,075
2004	2,912	12,672	4,411	1,273	1,096	4,982	5,096	32,442
2005	3,754	7,719	3,039	349	872	3,846	4,577	24,156
2006	497	3,911	1,561	0	275	342	1,757	8,343
2007	925	4,981	2,002	645	607	1,451	789	11,400
2008	0	0	0	0	62	0	150	212
2009	0	0	0	0	27	11	188	226
2010	114	91	1,063	23	245	696	1,286	3,518

Sources: PFMC as cited in Reclamation 2012b, NOAA Fisheries Service 2012a. 2010 data are preliminary.

In years where a stock fails to meet its conservation goal for three consecutive years, the PFMC declares a conservation concern, and the commercial fishery is closed or otherwise highly constrained, even in areas far removed from the stock's river of origin. Multiple conservation concerns over the past five years have led to record low landings and (in some years and management areas) unprecedented closures of the commercial fishery. In 2006, the failure of Klamath River fall Chinook salmon to meet its escapement floor[2] for the third consecutive year resulted in closure of the commercial salmon fishery in KMZ-CA and major restrictions elsewhere along the coast; landings in 2006 south of Cape Falcon fell to 14 percent of the 2001-2005 average. In 2008 and 2009, the commercial salmon fishery in California was closed Statewide (the first time this had occurred in California history) and the Oregon fishery was significantly curtailed due to low escapement of Sacramento River fall Chinook. In 2010, the California commercial fishery reopened, but continuing concerns about Sacramento River fall Chinook salmon prompted restrictive regulations in both California and Oregon. The drastic fishery restrictions associated with the conservation concerns led to the provision of disaster relief for salmon-dependent fishing communities, as described in Chapter 1.

3.15.3.3 Recreation

The area of analysis for recreation includes Curry, Jackson and Klamath Counties in Oregon and Del Norte, Humboldt, and Siskiyou Counties in California. The Klamath Basin offers a myriad of outdoor recreational opportunities. Section 3.20, Recreation, describes recreation activities within the Basin. Recreation is an important asset to the regional economy because it attracts visitors from outside the region that spend money and generate economic activity locally. Recreation expenditures and economic activity generally increase with visitation levels. If recreational opportunities are adversely affected, recreational expenditures may decrease and affect the local economy, unless recreational participants engage in substitute or alternative opportunities in the region. This section describes how existing recreational activities within the Klamath Basin contribute to the regional economy. The affected area for potential economic effects associated with recreation depends on the recreation activity. The following sections identify the potentially affected area for each activity.

3.15.3.3.1 Reservoir

In the area of analysis, economic effects could occur to reservoir-based recreation at J.C. Boyle, Copco 1, and Iron Gate Reservoirs in Klamath and Siskiyou Counties. Copco 2 Reservoir does not generate significant recreation activity. Table 3.15-1 summarizes the 2009 regional economy for Siskiyou and Klamath Counties. Employment, labor income, and output related to reservoir recreation are reflected in the services and trade sectors in the table. Section 3.20.3 describes existing recreation opportunities and existing use at the reservoirs. Visitors go to the reservoir areas for overnight and day uses, and activities generally include sightseeing, camping, boating, fishing, picnicking and hiking.

[2] Escapement floor is set by the PFMC as the minimum number of salmonids that are not harvested in ocean and in-river fisheries and return to the river for spawning.

Reservoir-based recreation attracts visitors from outside the region; these visitors spend money at local stores, gas stations, and other businesses, contributing to the local economy.

3.15.3.3.2 Ocean Sport Fishing

The ocean sport fishing information provided here is taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012h). The area of analysis for ocean sport fishing includes Curry County, Oregon and Del Norte and Humboldt Counties in California. Klamath River fall Chinook salmon is harvested in sport as well as commercial fisheries. About 91 percent of the increase in angler expenditures attributable to the project alternatives occurs in the KMZ-CA and KMZ-OR management areas; therefore, these two areas are the focus of this ocean sport fishing analysis. Tables 3.15-4 and 3.15-5 summarize the 2009 regional economy in those areas. Employment, labor income, and output related to ocean sport fishing are reflected in the services sectors in the tables.

While recreational fishery regulations such as closed seasons are generally more stringent in the KMZ, they may also become more constraining in other management areas south of Cape Falcon when Klamath River fall Chinook salmon is at low levels of abundance. Tables 3.15-10 and 3.15-11 summarize recreational effort (angler days) and landings in the KMZ and other management areas south of Cape Falcon. Effort and landings in all areas have generally declined from the 1980s to the 1990s. Factors contributing to this decline include more conservative management policies to protect weak stocks (including two Chinook salmon and three coho salmon stocks listed under the ESA), and a 1993 opinion by the Department of the Interior Solicitor reserving 50 percent of Klamath-Trinity River salmon for the Yurok Tribe and Hoopa Valley Tribe. Effort and landings rebounded during 2001-2005. However, regulation of the recreational fishery has been unusually restrictive over the past five years, due to the failure of Klamath River fall Chinook salmon to meet its conservation objective during 2004-2006 and failure of Sacramento River fall Chinook salmon to meet its conservation objective during 2007-2009. The restrictions triggered by Sacramento River fall Chinook salmon concerns were particularly stringent, including near-closure of the California fishery in 2008-2009 and additional restrictions in Oregon as well.

Angler trips occur on both private and charter vessels. Charter vessels are typically run by local companies that advertise and sell fishing trips to visitors or residents. Private vessels are privately owned boats and owners do not sell trips. The majority of trips from all ports are on private vessels. From 2001 to 2010, trips on charter vessels averaged 25 percent of total salmon angler trips south of Cape Falcon, 7 percent in the KMZ-CA (excluding 2008, when the KMZ-CA was closed), and 3 percent in the KMZ-OR.

Table 3.15-10. Ocean Sport Salmon Effort (# angler days) during 1981-2010, by Management Area

Year(s)	Management Area							
	Monterey	San Francisco	Fort Bragg	KMZ-CA	KMZ-OR	Central OR	North OR	Total
81-85 Avg	12,220	78,920	9,560	46,260	56,260	63,720	87,560	354,500
86-90 Avg	49,180	98,580	15,420	77,500	58,380	61,360	103,640	464,060
91-95 Avg	71,240	92,800	20,360	29,100	22,720	25,960	38,520	300,700
96-00 Avg	63,020	94,000	19,140	18,540	18,360	8,260	13,480	234,800
01-05 Avg	47,340	83,560	28,220	21,000	18,300	34,520	48,760	281,700
06-10 Avg	14,320	24,700	9,040	9,300	7,720	14,120	32,660	111,860
2001	38,100	71,500	30,800	24,700	26,100	31,100	40,100	262,400
2002	67,900	88,800	31,800	21,600	19,700	33,400	42,400	305,600
2003	28,500	66,600	23,700	15,800	14,800	42,900	67,500	259,800
2004	56,500	106,100	30,500	25,600	18,300	40,500	68,300	345,800
2005	45,700	84,800	24,300	17,300	12,600	24,700	25,500	234,900
2006	27,700	61,300	21,000	16,400	10,700	17,200	26,300	180,600
2007	25,200	43,100	17,100	20,500	11,100	22,900	41,900	181,800
2008	0	0	400	0	4,800	7,400	14,600	27,200
2009	0	0	0	5,400	6,000	14,400	52,000	77,800
2010	18,700	19,100	6,700	4,200	6,000	8,700	28,500	91,900

Sources: PFMC as cited in Reclamation 2012b, NOAA Fisheries Service 2012h. 2010 data are preliminary.

Table 3.15-11. Ocean Sport Chinook Salmon and Coho Salmon Landings (# fish) during 1981-2010, by Management Area

Year(s)	Management Area							
	Monterey	San Francisco	Fort Bragg	KMZ-CA	KMZ-OR	Central OR	North OR	Total
81-85 Avg	6,720	86,800	4,380	34,680	28,460	60,420	70,620	292,080
86-90 Avg	30,400	99,960	10,800	65,680	37,660	74,080	112,860	431,440
91-95 Avg	58,260	93,460	18,620	21,060	10,840	37,840	44,140	284,220
96-00 Avg	52,345	82,804	14,414	8,631	6,178	3,961	5,913	174,246
01-05 Avg	31,408	77,653	24,008	15,885	7,349	27,255	45,485	229,043
06-10 Avg	4,809	15,719	4,378	7,479	2,356	7,655	23,316	65,712
2001	20,256	40,345	26,501	13,010	7,277	28,849	43,613	179,851
2002	47,729	87,308	31,409	16,426	10,042	24,817	32,001	249,732
2003	13,286	56,823	16,289	8,889	5,499	39,125	77,588	217,499
2004	44,863	130,690	23,581	23,404	8,112	30,880	64,595	326,125
2005	30,905	73,097	22,259	17,695	5,817	12,606	9,627	172,006
2006	11,308	55,598	14,368	16,644	2,473	8,783	9,989	119,163
2007	6,381	17,000	5,772	19,297	4,619	14,150	29,834	97,053
2008	0	0	6	0	2,414	3,738	4,503	10,661
2009	0	0	0	680	1,392	9,979	59,417	71,468
2010	6,356	5,995	1,743	774	884	1,623	12,835	30,210

Sources: PFMC as cited in Reclamation 2012e, NOAA Fisheries Service 2011h. 2010 data are preliminary.

3.15.3.3.3 In-River Sport Fishing

The in-river sport fishing information provided here is taken directly from analyses contained in Reclamation (2011) and NOAA Fisheries Service (2011g). In-river Chinook salmon fishing on the Klamath River occurs in Siskiyou, Humboldt, and Del Norte Counties in California. Under the project alternatives, Chinook salmon would be reintroduced in the Upper Basin (Klamath County, Oregon). Table 3.15-12 summarizes the combined regional economy for these four counties. Employment, labor income, and output related to fishing are reflected in the services and trade sectors in the table.

Table 3.15-12. Summary of the Regional Economy for Del Norte, Humboldt and Siskiyou Counties in California and Klamath County, OR

	Employment[1]		Labor income[2]		Output[3]	
Industry sector	Jobs	Percent of total	$ million	Percent of total	$ million	Percent of total
Agriculture	5,713	4.77	219.03	4.46	910.68	7.29
Mining	127	0.11	5.58	0.11	23.06	0.18
Construction	5,845	4.88	282.12	5.74	707.41	5.66
Manufacturing	5,086	4.24	261.96	5.33	1,501.95	12.02
TIPU	3,887	3.24	215.09	4.38	759.63	6.08
Trade	17,471	14.58	601.06	12.24	1,232.50	9.86
Service	53,659	44.78	1,835.74	37.38	5,459.12	43.68
Government	28,049	23.41	1,490.23	30.35	1,904.47	15.24
Total	**119,837**		**4,910.81**		**12,498.82**	

Source: Reclamation 2012e.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.

Table 3.20-12 in the Section 3.20, Recreation, provides recent harvest and effort data for the Klamath River Chinook salmon fishery downstream from Iron Gate Dam. Angler days averaged about 23,809 per year during 2001-2005 and 16,792 during 2006-2010.

Another popular Klamath River recreational fishery is the steelhead fishery, which also occurs in Siskiyou, Humboldt and Del Norte Counties. Analysis of data from steelhead report cards collected by the California Department of Fish and Game (CDFG) suggest that approximately 17,155 angler trips occurred annually on the Klamath River during 2003-2008 (Table 3.20-13). This should be interpreted as a conservative estimate of effort, as the report card requirement extends only to steelhead greater than 16 inches and thus provides limited coverage of the half-pounder fishery.

A trophy fishery for redband trout occurs in Klamath County in Upper Klamath Lake, lower Williamson River, Wood River, and the Keno Reach of the Klamath River.

According to results of a statistical creel survey conducted by Oregon Department of Fish and Wildlife (ODFW), about 15,191 angler trips (6,109 bank trips, 9,082 boat trips) occurred in Upper Klamath Lake and Agency Lake during March 18-September 30, 2009. This estimate should be viewed as conservative, as the creel survey did not cover an entire year of lake fishing and did not include angler effort in the tributaries above Upper Klamath Lake or the mainstem Klamath River below Keno Dam.

3.15.3.3.4 Whitewater Boating

The affected region for whitewater boating on the Upper Klamath and Lower Klamath River reaches includes Jackson, Klamath, Siskiyou, and Humboldt Counties. Jackson County, which includes the urban Medford area, contributes substantially to the regional economy for whitewater boating. Many commercial outfitters are based in Jackson County. The Upper Klamath River is defined as the section of the Klamath River upstream of Iron Gate Dam and the Lower Klamath River starts downstream from the Iron Gate Dam. Table 3.15-13 summarizes the 2009 economy in the four-county region. Employment, labor income, and output related to whitewater boating are reflected in services and trade sectors in the table.

Table 3.15-13. Summary of the 2009 Regional Economy for Klamath, Jackson, Humboldt, and Siskiyou Counties

	Employment[1]		Labor Income[2]		Output[3]	
Industry Sector	Jobs	Percent of Total	$ (million)	Percent of Total	$ (million)	Percent of Total
Agriculture	8,337	3.7	306.8	3.5	1,078.2	4.6
Mining	324.7	0.1	12.5	0.1	54.8	0.2
Construction	16,545	7.4	632.9	7.3	1,782.0	7.6
Manufacturing	10,604	4.7	540.8	6.2	3,225.9	13.8
TIPU	7,746	3.4	411.9	4.7	1,400.3	6.0
Trade	37,272	16.6	1,187.9	13.7	2,591.3	11.1
Service	108,382	48.2	3,642.6	42.0	10,690.4	45.8
Government	35,456	15.8	1,946.5	22.4	2,507.6	10.7
Total	224,667	--	8,681.9	--	23,330.5	--

Source: Reclamation 2012b.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.

[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.

[3] Output represents the dollar value of industry production.

Section 3.20, Recreation, describes whitewater boating activities on the Klamath River, including annual estimates for number of visitors. Many visitors are from San Francisco Bay Area, southern California, northern Oregon, and other parts of the western U.S. (PacifiCorp 2004). Boating trips can be one- or multi-day trips and typically run from May through October. Multiple outfitters in the region organize and guide boating trips. Tables 3.15-14 and 3.15-15 provide an estimate of commercially guided whitewater boating trips on the upper and lower Klamath River, respectively. The estimate of

commercially guided trips is based on Bureau of Land Management and United States Forest Service trip card data files (2010). Trip cards are required to be submitted by permitted commercial outfitters when they provide a guided whitewater boating trip on the Klamath River. The whitewater boating outfitters provide jobs to people living in the region.

Table 3.15-14. Commercially Guided Whitewater Boating Trips on Upper Klamath River from 2001 to 2009

Year	Trip Length in Days				Total
	1 Day	2 Days	3 Days	4 Days	
2001	274	17	5	0	296
2002	283	20	2	0	305
2003	248	20	1	1	270
2004	306	31	2	0	339
2005	317	27	0	0	344
2006	243	27	4	0	274
2007	276	28	1	0	305
2008	248	20	1	0	269
2009	220	7	1	0	228
Total	2,415	197	17	1	2,630

Source: Bureau of Land Management 2010, United States Forest Service 2010 as cited in United States Department of the Interior (DOI) 2012b

Table 3.15-15. Commercially Guided Whitewater Boating Trips on Lower Klamath River from 2000 to 2009

Year	Trip Length in Days									Total
	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days	8 Days	9 Days	
2000	254	48	80	13	7	1	1	0	0	404
2001	309	68	68	28	3	1	0	0	0	477
2002	242	49	68	10	6	1	1	0	0	377
2003	301	55	57	21	6	1	2	0	0	443
2004	224	47	55	13	6	1	0	1	1	348
2005	366	48	58	15	5	0	0	0	0	492
2006	230	33	44	8	1	2	0	0	0	318
2007	255	47	45	12	1	0	1	3	0	364
2008	237	26	38	18	2	0	0	0	0	321
2009	235	27	44	11	4	1	1	0	0	323
Total	2,653	448	557	149	41	8	6	4	1	3,867

Source: Bureau of Land Management 2010, United States Forest Service 2010 as cited in DOI 2012b

Table 3.15-16 provides an estimate of whitewater boating user days for the Klamath River from 1994 through 2009. A user day is defined as one user engaging in whitewater boating for any part of a day. For example, three people taking a two day whitewater boating trip would equate to six user days (3 users x 2 days: 6 user days). Analysis of data presented in PacifiCorp (2004) show that on average an estimated 93 percent of the

total user days for the upper Klamath River are associated with commercial use and 70 percent of total user days for the lower Klamath River are associated with commercial use. These percentages were applied to the estimates of commercial use from 2001 through 2009 to derive estimates of total and private use over this same time period.

Table 3.15-16. Whitewater Boating User Days on the Klamath River from 1994 to 2009

Year	Upper Klamath River			Lower Klamath River			Klamath River		
	Commercial	Private	Total	Commercial	Private	Total	Commercial	Private	Total
1994	4,471	735	5,206	8,491	3,639	12,130	12,962	4,374	17,336
1995	5,763	602	6,365	12,203	5,230	17,433	17,966	5,832	23,798
1996	5,963	244	6,207	10,280	4,406	14,686	16,243	4,650	20,893
1997	5,509	317	5,826	10,529	4,512	15,041	16,038	4,829	20,867
1998	4,081	314	4,395	11,298	4,842	16,140	15,379	5,156	20,535
1999	4,614	283	4,897	11,885	5,094	16,979	16,499	5,377	21,876
2000	5,100	269	5,369	10,449	4,478	14,927	15,549	4,747	20,296
2001	3,290	243	3,533	10,744	4,605	15,349	14,034	4,848	18,882
2002	3,369	249	3,618	9,783	4,193	13,976	13,152	4,442	17,594
2003	3,075	228	3,303	11,143	4,776	15,919	14,218	5,003	19,221
2004	3,800	281	4,081	9,708	4,161	13,869	13,508	4,442	17,950
2005	3,638	269	3,907	10,695	4,584	15,279	14,333	4,853	19,186
2006	3,714	275	3,989	8,226	3,525	11,751	11,940	3,800	15,740
2007	3,505	259	3,764	8,879	3,805	12,684	12,384	4,065	16,449
2008	3,335	247	3,582	8,643	3,704	12,347	11,978	3,951	15,929
2009	2,405	178	2,583	8,230	3,527	11,757	10,635	3,705	14,340
Average (1994-2009)	4,102	312	4,414	10,074	4,317	14,392	14,176	4,630	18,806

Source: PacifiCorp 2004 for the Upper Klamath for 1994 to 2000 (based on figures reported in Table 2.7-41) and Payne 2009 Lower Klamath for 1994 to 1999 as cited in DOI 2012b

3.15.3.4 Indian Tribes

Section 3.16, Environmental Justice, presents demographic and socioeconomic conditions for Indian Tribes in the Klamath Basin. Five of the six federally recognized tribes in the Klamath Basin are potentially affected by the project alternatives. Table 3.15-17 summarizes income, poverty, and unemployment statistics for those tribes. The table and all other tribal information provided here are taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012b-f).

Table 3.15-17. Income, Poverty and Unemployment for Affected Federally Recognized Tribes

Tribes	1999 Median Personal Income (dollars)[1]	1999 Individuals below Poverty Level (percent)[1]	2005 Unemployment Rate (percent)[2]
The Klamath Tribes	8,646	40.4	21
Karuk Tribe	4,938	53.9	63
Hoopa Valley Indian Reservation	9,757	34.4	40
Yurok Reservation	6,839	39.7	74
Resighini Rancheria	6,925	NA	60

Based on the following sources, as cited in Reclamation 2012b and NOAA Fisheries Service 2012b-f:

1 - U.S. Census Bureau 2000. Income and poverty statistics based on available data as follows: Indians residing in Chiloquin, Oregon used to represent The Klamath Tribes; Resighini Rancheria residents (whether Indian or not) used to represent Resighini Rancheria members; Indians residing on the Karuk, Hoopa Valley and Yurok Indian Reservations used to represent members of the Karuk, Hoopa Valley, and Yurok Indian Tribes respectively.

2 - Bureau of Indian Affairs 2005. The unemployment rates provided by the Bureau of Indian Affairs (BIA) pertain to the percentage of adults who are available for work but unemployed, regardless of whether or not they have recently looked for work, These rates differ from and are therefore not comparable to the unemployment rates estimated by the U.S. Bureau of Labor Statistics for the general population.

Note: Quartz Valley Community is not included in the table because information available at the time of this analysis suggested that the project alternatives would have no direct effects on Quartz Valley Community and the Quartz Valley Community was not claiming any effects (positive or negative).

For the tribes of the Klamath Basin, fish are integral to a world view that emphasizes interconnectedness, balance, and mutual respect as guiding principles. The diversity, abundance, distribution, run timing and health of fish are important indicators of how well such balance is being maintained. The seasonal round of harvest provides sustained access to food that is synchronous with the cycles of nature. Fish are honored in rituals such as the First Salmon Ceremony and (for The Klamath Tribes) the Return of the C'waam, which traditionally precede the commencement of fishing for spring-run Chinook salmon and suckers respectively. Fishing itself is a social and cultural activity – an opportunity to meet with family and friends; to engage in traditional fishing practices; to strengthen community bonds, demonstrate respect and promote food security by sharing fish with elders and others who are unable to fish; and to transmit these traditions to the next generation. Trade and barter occur both within and between tribes as a means of increasing access to fish and other valued goods, and cementing social relationships.

Table 3.15-18 summarizes Chinook salmon harvests since 1981 by the Yurok Tribe and Hoopa Valley Tribe for commercial, subsistence and ceremonial purposes. The average harvest in the 1990s was much lower than the 1980s and 2000s. Annual harvests over the last decade were lowest in 2005 and 2006 and highest in 2001. For these two tribes, harvest opportunities over the last few decades are much lower than they were historically.

Table 3.15-18. Yurok and Hoopa Valley Reservation Indian Tribes Gillnet Chinook Salmon Spring and Fall Run Harvest (# fish) from 1981 to 2010

Year	Klamath River	Trinity River	Total
1981–1990 Average	26,466	4,527	30,992
1991–2000 Average	17,130	3,200	20,905
2001	49,460	9,224	58,684
2002	35,508	4,328	39,836
2003	33,973	5,170	39,143
2004	30,938	3,715	34,653
2005	5,754	4,295	12,277
2006	9,111	5,996	15,107
2007	29,790	3,653	33,443
2008	22,869	3,471	26,340
2009	26,040	6,087	32,127
2010[1]	26,620	5,814	32,434
2001-2010 Average	27,006	5,175	32,404

Sources: PFMC as cited in Reclamation 2012b, NOAA Fisheries Service 2012b, 2012f
Notes:
1. 2010 data are preliminary

For other tribes in the Klamath Basin (who fish for subsistence and ceremonial purposes), harvest opportunities for salmonids and other fish have declined to lower levels than those experienced by the Yurok and Hoopa Valley Tribes. For The Klamath Tribes, despite the Treaty of 1864 which reserved fishing rights, their anadromous fisheries were eliminated in 1917 when Copco 1 Dam was constructed without fish ladders. Two other fisheries that had sustained the Tribes were eliminated in 1986 when growing biological concerns prompted The Klamath Tribes to close their fisheries for c'wam (Lost River sucker) and qapdo (shortnose sucker); both fish were listed as Endangered in 1988. For the Karuk Tribe, current harvest opportunities are limited to a short season at Ishi Pishi Falls. Members of the Resighini Rancheria historically fished and continue to attach cultural and subsistence value to fishing, although their current fishing opportunities are minimal. Section 3.12, Tribal Trust, describes the cultural role of fisheries for the tribes.

3.15.3.5 PacifiCorp Hydroelectric Service

PacifiCorp operates and maintains hydroelectric power plants at the Four Facilities. Operation and maintenance of the facilities provides employment and incomes in Siskiyou and Klamath Counties.

PacifiCorp provides electricity to about 1.7 million customers in six western States, including residential and commercial customers in southern Oregon and northern California (PacifiCorp 2004). Section 3.18, Public Health and Safety, Utilities and Public Services, Solid Waste, and Power, further describes PacifiCorp hydroelectric facilities and service. PacifiCorp is subject to regulations established by utility authorities in each State, which influences operations, customer rates, and cost recovery. PacifiCorp sets customer rates based on multiple factors, including energy prices, future demands, resource adequacy, overhead costs, and long-term investments. PacifiCorp uses customer rates to recover a portion of operating and investment costs. If expenditures are not

directly offset by any associated project revenues or cost reductions, the utility's rates increase, subject to regulatory approvals.

3.15.3.6 Real Estate, Property Tax and Other County Revenues

Establishment of the Copco Dams in the early 1900's and the Iron Gate Dam in the 1960's created reservoirs behind the dams. The reservoirs were opened to the general public and are used for recreational purposes. These recreational uses over time have led to light residential development of some of the privately held real estate surrounding the reservoirs.

At Iron Gate Reservoir, the majority of the land around the reservoir is held by PacifiCorp, and much of the area along the shoreline is designated for recreation use. Private parties do not own any properties that front the reservoir. Iron Gate Lake Estates has five units that have full or partial views of the reservoir. Some parcels outside of Iron Gate Lake Estates have partial views of the reservoir.

Some parcels have views of Copco 1 and Copco 2 Reservoirs. Most of these sites are along the southern shore of the reservoir along Patricia Avenue and Ager Beswick Road. Of the properties that front the reservoir, a few properties have relatively level sites, but most are elevated from the lakeshore water level and have steep terrain to access the reservoir. Properties across the roads have obstructed views due to terrain and heavy tree cover. Where the Klamath River enters Copco Reservoir, some parcels front the river along Copco Road and have views of the river.

The literature on previous dam removals and impacts to private property values is limited. The most frequently cited case studies are from the Kennebec and Penobscot Rivers in Maine (Lewis, et al. 2008; Bohlen and Lewis 2008) as well as multiple dam removals in Wisconsin (Sarakinos and Johnson 2003; Provencher, et al. 2006). The majority of previous studies on the impacts of dam removals on private property values were done on small dams and small reservoirs, and several authors noted the general lack of data and studies about property value impacts from dam removal and draining reservoirs (Provencher, et al. 2006). In terms of the direct impacts to private property values, some studies reported increases in values following dam removal (i.e., Bohlen and Lewis, 2008). Increases in values were generally related to improvements in water quality, removal of dam structures, and enhancements to the natural riparian environment. Other studies cited by Kruse and Scholz (2006) described private property values decreasing briefly and regaining value by the end of two years. These previous studies should be interpreted with some caution due to the small size of the impoundments. The conclusion should not be extended to large impoundments where such activities as fishing, boating, and swimming are especially attractive. (Provencher et al. 2006).

Kruse and Ahmann (2009) is the only study to model the effects of lot size and proximity to the Klamath River, Copco 1 and Iron Gate reservoirs on private residential property values. This study was based on reported sales data between 1998 and 2006. Using the hedonic pricing method, this study developed a statistical relationship between sales

values and a set of variables that were modeled as "indicator variables" which took on values of 1 or 0 for the following categories:

- On the shore of the reservoir
- Across the road from the reservoir
- View of either Copco I or Iron Gate Reservoirs
- On the Klamath River

The authors found that in the case of the Klamath River, results of the hedonic pricing model demonstrate that lake adjacency does have a positive and significant impact on residential property values and that, all else being equal, properties on a lake, with lake proximity or with a lake view are worth more than properties without these characteristics. The study concluded that lake adjacency does have a positive and significant impact on residential property values and that, all things being equal, properties on a lake, with lake proximity or with a lake view are worth more than properties without these characteristics. The authors also attempted to look at property value impacts associated with river frontage; however, there was an insufficient sample size to estimate any positive effect associated with river front properties adjacent to the Klamath River downstream from Iron Gate Dam.

While property values based on proximity to the reservoirs can be expected to decline with dam removal, the amount and timing of these changes were not analyzed. Kruse and Ahmann's study did not address how property values would change if a different set of environmental values develops in the future should the dams be removed, and noted that the assumption of all else being equal is likely to be unrealistic both generally and in the context of the Klamath River, as areas currently inundated by lake(s) would become accessible with dam removal. Their quantitative findings did not take into account potential future access, uses, or amenities/dis-amenities of the reservoir lands and river after dam removal and full restoration, which could influence overall results.

PacifiCorp owns all land surrounding J.C. Boyle Reservoir in Klamath County; this land is zoned as rural industrial. Land outside of PacifiCorp's ownership boundary is zoned as forestry with some public lands. Figure 3.14-4 in Section 3.14, Land Use, Agricultural and Forest Resources, shows land ownership around J.C. Boyle Reservoir. There are no private properties with views of the reservoir; therefore, private property land values at J.C. Boyle Reservoir would not be affected by the Proposed Action and alternatives, and are not further analyzed.

Siskiyou and Klamath Counties' receive tax revenues from multiple tax accounts, including property taxes paid by PacifiCorp and landowners, and sales and use tax. The counties use tax receipts for the general fund, which funds many county programs, such as health, education, public assistance, fire and emergency services, and recreation. Siskiyou County provided tax revenue data to the Lead Agencies. Table 3.15-19 summarizes Siskiyou County revenues from tax accounts over a 10-year period, which accounts for normal market fluctuations. On average, from 2000 to 2010, Siskiyou County received a majority of the total Siskiyou County revenue from property tax and sales and use tax. The remaining accounts provided 0.1 to 3.4 percent of county revenue, on average.

Table 3.15-19. Siskiyou County Average Tax Revenues from 2000 to 2010

Account Description[1]	2000–2010 Annual Average	
	Revenues	Percentage of Total Revenue
Property Taxes		
Prior Secured	$532,851	3.4%
Prior Supplemental	$19,963	0.1%
Prior Unsecured	$10,529	0.1%
Secured	$8,745,403	53.0%
Current Unsecured	$535,829	3.3%
Supplemental	$333,962	2.0%
Property Transfer Tax	$198,111	1.2%
Race Horse Tax	$167	0.0%
Sales & Use Tax	$4,757,226	29.7%
Hotel – Motel Tax	$438,865	2.7%
Local Transportation	$276,582	1.7%
Timber Yield	$391,581	2.5%
Triple Flip	$207,857	1.1%

Source: Siskiyou County 2011a

1- Property taxes include the following accounts: secured, current unsecured, supplemental, prior secured, prior unsecured, and prior supplemental

PacifiCorp pays property taxes to Siskiyou County on land owned at the Klamath Hydroelectric Project facilities. Siskiyou County received an average of $1.4 million from PacifiCorp property taxes annually (Table 3.15-20) over 2000 to 2010. In 2008 and 2009, PacifiCorp indicated that $305,000 and $290,000 of property taxes were associated with hydroelectric facilities (PacifiCorp 2009). The variation in tax payments indicated between years in table 3.15-20 was driven by an increase in investment in operating property in Siskiyou County, which has lead to an increase in assessment on property subject to tax.

Table 3.15-20. Siskiyou County Annual Tax Amount Received from PacifiCorp from 2000 to 2011

Tax Year	Tax Amount
2000-2001	$1, 257,537
2001-2002	$1,187,891
2002-2003	$1,180,011
2003-2004	$1,178,678
2004-2005	$1,184,970
2005-2006	$1,210,490
2006-2007	$1,285,173
2007-2008	$1,513,189
2008-2009	$1,637,105
2009-2010	$1,798,210
2010-2011[1]	$1,746,074

Source: Siskiyou County 2011b

[1] Includes 2nd installment which County will receive in April 2011

In fiscal year 2009–2010, Siskiyou County dispersed property taxes to the following: schools (68.04 percent), county (21.33 percent), cities (6.03 percent), and special districts (4.60 percent). Special districts include cemetery, fire, recreation, community service, flood control, county service, and sanitary districts. Of the 6.03 percent that went to cities, the City of Yreka received 2.2 percent, Mt. Shasta received 1.2 percent, Weed received 0.9 percent, Dunsmuir received 0.6 percent, and the remaining cities all received less than 0.35 percent (Siskiyou County 2010).

In 2008, property taxes levied in Klamath County were about $57.2 million. The majority of taxes were from residential ownership ($28.5 million). Utilities contributed about 14.7 percent to total property taxes, about $8.4 million in 2008 (Klamath County Assessor 2008). PacifiCorp pays property taxes to Klamath County on land owned at the Klamath Hydroelectric Project facilities. In 2010-2011, Klamath County anticipates to receive about $519,000 in property tax revenues from PacifiCorp (Turner 2011).

In Klamath County, property taxes are used to finance local governments, such as cities, school districts, fire districts, park districts, vector control districts, road districts, cemetery districts, sanitary districts, and special districts.

Klamath and Siskiyou Counties also receive funding from Federal sources. The counties received American Reinvestment and Recovery Act funds to stimulate spending during the economic recession. As of February 2011, Siskiyou County received $63.5 million and Klamath County received $55.9 million (Recovery.Gov 2011). Appendix O includes a summary of Recovery Act funds.

3.15.3.7 Irrigated Agriculture

Reclamation's Klamath Project delivers water to approximately 200,000 farmland acres and 35,000 wetland acres in Klamath, Siskiyou, and Modoc Counties, primarily along the California-Oregon border. Table 3.15-21 provides a summary of the regional economy in Klamath County, Oregon and Siskiyou and Modoc Counties, California. The agricultural sector was 7.3 percent of total regional employment, 6.0 percent of the regional labor income and 10.2 percent of output.

Table 3.15-22 summarizes crops grown and acreages in Reclamation's Klamath Project. Alfalfa, pasture, and wheat have the most irrigated acreage.

For analysis purposes, crops in Table 3.15-22 are aggregated based on the availability of data on crop prices, production costs, and yields and each group is assigned a representative crop. Table 3.15-23 shows prices of the representative crops. Prices vary annually based on market conditions. Table 3.15-24 shows gross farm revenues, based on crop yields and prices. Alfalfa had the highest gross revenue of the crops, likely a

Table 3.15-21. Summary of the 2009 Regional Economy for Klamath, Modoc, and Siskiyou Counties

Industry Sector	Employment[1]		Labor Income[2]		Output[3]	
	Jobs	Percent of Total	$ (million)	Percent of Total	$ (million)	Percent of Total
Agriculture	3,803	7.3	124.2	6.0	560.9	10.2
Mining	85	0.2	3.3	0.2	16.1	0.3
Construction	2,358	4.5	99.3	4.8	265.5	4.8
Manufacturing	2,629	5.0	135.9	6.5	706.1	12.8
TIPU	2,122	4.1	118.1	5.7	426.3	7.8
Trade	7,272	13.9	237.7	11.4	491.6	8.9
Service	22,421	43.0	752.2	36.1	2,245.1	40.8
Government	11,452	22.0	611.8	29.4	785.7	14.3
Total	52,142	--	2,082.5	--	5,497.3	--

Source: Reclamation 2012b.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.

[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.

[3] Output represents the dollar value of industry production.

Table 3.15-22. Crop Acreage Summary for Irrigated Agriculture in Reclamation's Klamath Project Lands (acres)

Crops	2005	2006	2007	2008	2009	Average
Small Grains						
Feed Barley	10,962	13,674	14,083	11,827	8,430	11,795
Malt Barley	0	278	0	4,389	3,513	1,636
Wheat						
Wheat	31,716	24,163	22,172	27,290	31,563	27,381
Oats	2,679	3,334	2,947	2,774	2,809	2,909
Other Cereals	1,006	617	600	247	834	661
Corn	0	12	42	7	5	13
Alfalfa						
Alfalfa	55,197	61,619	65,851	63,701	61,336	61,541
Other Hay	21,032	18,968	17,082	15,710	15,918	17,742
Silage	875	1,000	0	150	400	485
Irrigated Pasture						
Irrigated Pasture	40,046	42,880	43,409	44,846	44,564	43,149
Other Forage	0	93	145	0	0	48
Potatoes						
Chip Potatoes	7,450	5,890	2,640	2,430	6,688	5,020
Fresh Potatoes	3,727	9,549	8,941	9,556	5,951	7,545
Potato Seed	250	430	280	140	150	250
Onions						
Onions	2,863	3,239	3,618	3,441	3,533	3,339
Peppermint	2,394	2,922	2,846	2,682	3,200	2,809
Horseradish	913	734	810	436	421	663
Strawberry	413	259	176	536	505	378
Other	72	423	591	345	258	338
Fallow	11,711	5,949	7,746	6,500	4,962	7,374
Total	193,306	196,033	193,979	197,007	195,040	195,073

Source: Reclamation 2012c.

result of the consistently high percentage of the land base dedicated to the crop and the relatively high price of alfalfa per ton. Potatoes and onions also had high gross revenues related to other crops. The onions group, as shown in Table 3.15-22, contains a number of other vegetables and specialty crops that have had increasing amounts of acreage in past years.

Table 3.15-23. Representative Crop Prices from 2005 to 2009

Year	Small Grains	Wheat	Irrigated Pasture	Potato	Onions	Alfalfa
	$/Ton	$/Ton	$/AUM	$/Ton	$/Ton	$/Ton
2005	82.00	103.47	14.50	159.89	99.00	128.94
2006	120.00	136.06	15.40	99.43	99.00	135.00
2007	164.99	272.00	16.50	129.36	110.00	140.00
2008	300.02	225.00	16.50	155.96	126.00	200.00
2009	300.02	200.24	17.80	127.57	128.60	154.71
Average	193.41	187.35	16.14	134.44	112.52	151.73

Sources: Reclamation 2012c.
Key:
AUM: annual unit month

Table 3.15-24. Average Gross Farm Revenue Generated on Reclamation's Klamath Project Lands from 2005 to 2009

Representative Crop	Gross Revenue ($1,000)	Gross Revenue per Acre ($/acre)[1]
Alfalfa Hay	$58,769.60	$736.76
Irrigated Pasture	$6,996.10	$161.96
Onions	$21,108.20	$2,804.33
Potato	$39,910.10	$3,114.33
Small Grain	$4,706.10	$350.39
Wheat	$17,119.20	$552.87
Total Gross Revenue	$148,609.40	--

Source: Klamath Basin Hydro-Economic Model (KB_HEM) , as cited in Reclamation 2012c
1 – Gross revenue per acre based on average acreages in Table 3.15-22

3.15.3.8 Refuge Recreation

Reclamation's Klamath Project provides water supply to the Tule Lake National Wildlife Refuge (NWR) and Lower Klamath NWR. The refuges attract visitors to Klamath and Siskiyou Counties for hunting and wildlife viewing. Table 3.15-1 presents a summary of regional economy in Klamath and Siskiyou Counties. Employment, labor income, and output related to refuge recreation are reflected in services and trade sectors in the table.

In 2009, the two refuges reported a combined total of 96,300 wildlife watching visits and 10,526 hunting visits. In general, visitation to the refuges has been declining over the past decade.

3.15.4 Environmental Consequences

For purposes of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR), economic or social effects must be discussed if they are inter-related to the natural or physical environmental effects of a project. Since economic effects of the project are related to physical environmental effects, a National Environmental Policy Act (NEPA) economic analysis is required. However, NEPA does not require that economic effects be judged for significance. The California Environmental Quality Act (CEQA) does not consider economic or social changes resulting from a project as adverse effects on the environment. If a physical change in the environment is caused by economic or social effects, the physical change may be regarded as an adverse effect. Physical effects of the project alternatives are evaluated separately and do not require economic analysis; therefore, CEQA analysis and associated significance criteria are not required. The following sections describe analysis methods and potential economic effects of the project alternatives.

3.15.4.1 Effects Determination Methods

The modeling package used to assess the regional economic impacts from the expenditures associated with each alternative was IMPLAN (IMpact analysis for PLANning). IMPLAN is a commonly used, industry accepted economic input-output modeling system that estimates the effects of economic changes in a defined analysis area. MIG, Inc. developed the IMPLAN modeling system. This analysis uses the current Version 3.0 system, which was released in November 2009.

IMPLAN is a static model that estimates impacts for a snapshot in time when the impacts are expected to occur, based on the makeup of the economy at the time of the underlying IMPLAN data (2009 data is used for this analysis). IMPLAN measures the initial impact to the economy but does not consider long-term adjustments as labor and capital move into alternative uses. This approach is used to compare the alternatives. Realistically, the structure of the economy will adapt and change; therefore, the IMPLAN results can only be used to compare relative changes between the No Action/No Project Alternative and the action alternatives and cannot be used to predict or forecast future employment, labor income, or output (sales).

Input-output models measure commodity flows from producers to intermediate and final consumers. Purchases for final use (final demand), or direct effects, are inputs into the model and drive the results. Industries produce goods and services for final demand and purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the analysis area (imports and value added) stop the cycle. These indirect and induced effects (the effects of household spending) can be mathematically derived using a set of multipliers. The multipliers describe the change in output for each regional industry caused by a 1-dollar change in final demand. Multipliers are built into IMPLAN.

This analysis used 2009 IMPLAN data for the counties which encompass the economic regions. IMPLAN data files for the analysis area are compiled from a variety of sources including, but not limited to, the U.S. Bureau of Economic Analysis (BOE), the U.S. Bureau of Labor (BOL), and the U.S. Census Bureau.

Methods and assumptions for the regional impact analysis are further described in Reclamation 2012b. Appendix P also includes further information about IMPLAN and the methods for the KBRA regional economic impacts analysis. The following sections identify specific technical reports as relevant. This section presents the total economic effects of the project alternatives. Total effects are equal to the sum of direct, indirect, and induced effects, described above.

Regional economic total effects are presented in terms of employment, labor income, and output. IMPLAN defines these parameters as follows:

- Employment – Number of jobs, a job can be full-time, part-time, or temporary.
- Labor Income - All forms of employment income, including employee compensation (wages and benefits) and proprietor income.
- Output - Value of industry production. In IMPLAN these are annual production estimates for the year of the data set.

Using IMPLAN, this section presents quantified results for regional economic effects from changes in expenditures or revenues associated with:

- Dam decommissioning, operation and maintenance (O&M), mitigation
- Commercial fishing
- Reservoir recreation
- Ocean sport fishing
- In-river sport fishing
- Whitewater recreation
- Klamath Basin Restoration Agreement (KBRA) Fisheries, Water Resources and Tribal Programs
- Irrigated agriculture related to KBRA actions
- Refuge recreation related to KBRA actions

The KHSA Section 3.2.1(iii), signed by Secretary of the Interior Ken Salazar on February 18, 2010, directs the Secretary to undertake environmental review in support of the Secretarial Determination. All alternatives carried forward for further analysis in the EIS/EIR were analyzed using existing studies and other appropriate data as suggested in KHSA Section 3.2.1 (i), where such analysis met criteria in (40 CFR 1502.22 and 43 CFR 46.125) to incorporate available information. As part of developing the basis for the Secretarial Determination, the KHSA requires in Section 3.3.2 that the Secretary prepare a Detailed Plan, including the identification, qualifications, management, and oversight of a non-Federal Dam Removal Entity (DRE), if any, that the Secretary may designate. KHSA Section 3.3.4.D requires that an estimate of costs be prepared as part of

the Detailed Plan. The Detailed Plan analysis provides most of the information for the project description for Alternatives 2 and 3, and this information was used to analyze these two action alternatives. As described in KHSA Section 3.2.1(i), the FERC record is used to form the project description for Alternatives 4 and 5. Alternatives 4 and 5 were analyzed to ensure that the review of reasonable fish passage alternatives was comprehensive. In addition, at the time of developing a reasonable range of alternatives, the Lead Agencies recognized that the inclusion of Alternatives 4 and 5 would provide an assessment of the short- and long-term effects from a broader range of reasonable alternatives. Alternatives 4 and 5 are outside the authority of the Department of the Interior, the four facilities proposed for removal are privately owned structures, and there was no provision in the KHSA to include them in the Detailed Plan. The result is differing levels of available information for alternatives carried forward in the EIS/EIR consistent with the elements of each action alternative.

Regional economic effects were quantified for the No Action/No Project Alternative, the Proposed Action, and the Partial Facilities Removal of Four Dams Alternative. These regional economic effects provide the broadest range of economic impacts expected from implementation of any of the alternatives and bookend the expected economic impact to the area of analysis. Once that information was developed, a comparative analysis of the Fish Passage at Four Dams Alternative and Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative provide the information required to evaluate the relative impacts of each action alternative within the identified range of economic effects. Specific economic effects for construction and changes in commercial fishing, recreation, and irrigated agriculture were not individually quantified for Fish Passage at Four Dams Alternative and Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative. The missing data is relevant to reasonable foreseeable significant adverse human effects on the environment. However, that unavailable data is not essential to a reasoned choice among alternatives because potential impacts can be compared to the data developed for the No Action/No Project Alternative, the Proposed Action, and Partial Facilities Removal of Four Dams Alternative. The range of impacts anticipated for the two alternatives for which data is missing falls within the range of impacts analyzed and data developed for the remaining alternatives, though the ratio of expenditures to impacts might not have the same proportional effect across the various economic sectors. The comparative analysis required by NEPA is achieved using this qualitative method.

The socioeconomic section of the EIS/EIR addresses primarily regional economic impacts on employment, income and output that occur within the Klamath region and related ocean areas, as well as qualitative information related to tribal effects, real estate, property tax revenues, and PacifiCorp's customers' energy rates. However, changes in some resources may have effects that take the form of economic benefits and costs that may extend to individuals or entities outside and inside the regional impact area and are separate and distinct from the regional impacts considered in the EIS/EIR. For example, economic effects on hydropower resources (beyond just the rates PacifiCorp charges to individual in the region) are not evaluated as part of the regional analysis. In addition, the EIS/EIR does not include an evaluation of any non-use values held by individuals both within and outside the region. In the context of the Klamath Basin, non-use values

accrue to members of the public who value Klamath Basin environmental restoration regardless of whether they consume Klamath River fish or visit the Basin. Both hydropower and non-use values - as well as other benefits and costs - are addressed in the Final Klamath Dam Removal Overview Report for the Secretary of the Interior (DOI and DOC [NOAA Fisheries Service] 2012), a separate document from the EIS/EIR.

3.15.4.1.1 Four Facilities

Deconstruction of the dams would result in economic effects in Siskiyou and Klamath Counties. Deconstruction or construction activities would create jobs and generate additional economic activity within the region during the period of construction. Direct effects represent equipment rentals, purchase of materials, and payment for labor.

An important consideration in evaluating regional economic effects is how much money is spent within the region for construction supplies and equipment, and how many workers are employed that originate from the region. Costs for dam decommissioning were divided into expenditures that would be made inside and outside of Siskiyou and Klamath Counties. The expenditures assumed to be spent within the counties were used in IMPLAN to estimate employment, labor income, and output from dam decommissioning. Dam decommissioning expenditures made outside the analysis area would have no impact on the local economy.

Reclamation estimated total dam decommissioning costs and allocated the costs associated to within-region expenditures. Dam decommissioning costs assumed to be spent within the region are described in more detail in the Benefit Cost and Regional Economic Development (RED) Technical Report (Reclamation 2012a).The analysis assumed that the onsite construction workforce would be hired from within the region. Some workers would be brought into the region from outside areas. Money from out-of-region workers spent on goods and services within Siskiyou and Klamath Counties contributes to regional economy, while money that originates from in-region workers is much less likely to generate regional economic effects because spending from sources within the region represents a redistribution of income and output.

O&M expenditures made in the region would generate positive economic effects to the regional economy. Annual O&M expenditures for each alternative are summarized in the Benefit Cost and RED Technical Report (Reclamation 2012b). Based on estimates from Reclamation, it was assumed that 80 percent of the O&M expenditures would be made inside the two-county area. This analysis measures annual O&M effects after dam removal in the year 2020. Like the dam commissioning expenditures, in-region O&M expenditures associated were placed into relevant sectors of the economy and run through IMPLAN to estimate effects to the regional economy. This analysis does not quantify the positive effects resulting from periodic replacement costs. O&M effects would occur annually.

The in-region mitigation costs associated with the action alternatives were also analyzed in IMPLAN to estimate employment, labor income, and output effects in the regional economy. The costs associated with the major dam mitigation activities were allocated to

within-region expenditures. Dam mitigation costs assumed to be spent within the region are described in more detail in the Benefit Cost and Regional Economic Development Technical Report (Reclamation 2012b). Like the dam decommissioning analysis, the onsite mitigation workforce would be hired from within Siskiyou and Klamath Counties. The regional economic effects associated with dam mitigation costs would be spread over the 2018-2025 period and would vary year-by-year proportionate to actual expenditures.

3.15.4.1.2 Commercial Fishing

The commercial fishing information is taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012a). The regional economic analysis evaluates effects from changes in commercial fishing in the area of analysis based on annual gross revenues projected under the project alternatives. Section 3.3, Aquatic Resources, evaluates effects to fish. Five of the seven management areas account for 99 percent of total gross revenue attributable to Klamath River Chinook salmon abundance under the No Action/No Project Alternative and project alternatives. Thus the regional economic analysis focuses on those five areas: San Francisco, Fort Bragg, KMZ-CA, KMZ-OR, and Central Oregon.

The estimates of gross revenue used in this analysis are based on relative projections of Klamath River Chinook salmon harvest provided by the Evaluation of Dam Removal and Restoration of Anadromy (EDRRA) model (Hendrix 2011). The EDRRA model is a simulation model that provides 50-year projections of Klamath River Chinook salmon escapement and harvest under the alternatives. The EDRRA harvest projections pertain to Klamath River Chinook salmon and do not distinguish between spring and fall runs. Harvest is estimated for each simulated year on the basis of a new Klamath River fall Chinook salmon harvest control rule recommended by the PFMC to the NOAA Fisheries Service in June 2011. The model allocates total Klamath River Chinook salmon harvest among fisheries as follows: 50 percent to tribal fisheries, 7.5 percent to the in-river recreational fishery (up to a maximum of 25,000 fish – with any surplus above 25,000 allocated to escapement), 34 percent to the ocean commercial fishery, and 8.5 percent to the ocean recreational fishery. The 50/50 tribal/non-tribal split is a “hard” allocation specified by the United States Department of the Interior (DOI) (1993). The remaining allocations are “soft” allocations as they represent customary practice rather than mandatory conditions.

For the No Action/No Project Alternative, fishery conditions are characterized in terms of average annual troll harvest of Klamath River fall Chinook salmon during 2001-05. The years 2001-05 were selected as the base period for the following reasons: Klamath River fall Chinook salmon fell within a ‘moderate’ range of abundance during those years, abundance of Sacramento River fall Chinook salmon (the other salmon stock targeted south of Cape Falcon) also fell within a ‘moderate’ range, and constraints and policies that are likely to continue into the future (e.g., the PFMC’s weak stock management policy, consultation standards for ESA-listed salmonids, 50-50 tribal/non-tribal harvest allocation) were well established by that time. For the project alternatives, harvest is estimated on the basis of the 43 percent increase in troll harvest projected by the

EDRRA model, scaled to average annual troll harvest of Klamath River fall Chinook salmon during 2001-2005.
The following steps were taken to estimate gross revenues and regional economic effects under the No Action/No Project Alternative and the project alternatives:

- Klamath River Chinook salmon harvest was expanded to account for total salmon harvest (all stocks) in the troll fishery due to the availability of Klamath River Chinook.
- Total salmon harvest (all stocks) was converted from numbers of fish to pounds dressed weight, using 2001-2005 data on average weight of troll-caught Chinook salmon (PFMC 2011).
- Total salmon harvest (all stocks) was converted from pounds to gross revenue, using 2004-2005 data on ex-vessel price per pound (PFMC 2011).

The analysis assumes that salmon troll revenues are spent in the management area where the landings occur. The gross revenue estimates by management area were used in IMPLAN to estimate employment, labor income, and output from commercial fishing.

3.15.4.1.3 Recreation

Depending on the recreation activity, visitors typically spend money on guide fees, food, hotels, restaurants, gasoline, equipment rentals, and/or other supplies required for outdoor activities. Any change to recreation opportunities that would result from implementation of the Proposed Action or alternatives would affect visitor spending and the region's economy. Increases in recreation spending would be considered a positive effect and decreases would be an adverse effect. This recreation economic impact analysis evaluates potential changes in direct visitor spending for recreation activities and subsequent, secondary economic effects. Estimates for changes in number of visitors and daily visitor spending are needed to calculate total reduction in recreation expenditures. IMPLAN is used to evaluate secondary effects in the regional economy. The economic effects presented in this section are directly related to the recreation effects discussed in Section 3.20, Recreation.

To estimate direct effects of visitor spending on a regional economy, it is important to consider the number of local visitors to the project area versus the number of visitors that originate from outside the region, or non-local visitors. If visitors are from the region, it is more likely that recreational spending intended for the project area would be spent elsewhere in the regional economy and there would be no net change in economic activity in the region. Non-local visitors bring money into the region that would not otherwise be there, and generate new economic activity. Changes in visits by non-locals largely drive the changes in recreational spending that would occur under the project alternatives. Therefore, this analysis requires data on the number of local visitors versus non-local visitors to estimate recreation-related economic effects.

Another important consideration is the availability and proximity of alternate recreation locations in the area. If visitors have multiple regional options for recreation similar to that available in the project area, they could substitute those areas for Klamath

Hydroelectric Project area recreation and continue to spend money within the regional economy. Section 3.20, Recreation, describes alternate recreation sites in the area.

Reservoir

The reservoir recreation information is taken directly from analyses contained in Reclamation (2012b) and Reclamation (2012d). The affected area is defined as Siskiyou and Klamath Counties, which include J.C. Boyle, Copco 1 and Iron Gate Reservoirs, where reservoir recreation occurs. Nonlocal visitors to the three reservoirs (J.C. Boyle, Copco 1, and Iron Gate) spend money in the region purchasing gas, food and drink, lodging, guide services, and other items. These expenditures generate economic activity measured in terms of total industry output, labor income, and employment within the two-county economic region. Economic activity could change under the project alternatives.

Within region reservoir recreation expenditures per visit were obtained from the recreation survey presented in the PacifiCorp (2004) report. The expenditure information was gathered by expenditure category such as accommodations, food, gas, supplies and guide fees. This analysis assumes an average of $15.35 per visit. Changes to average annual within region, nonlocal visitor expenditures were run through IMPLAN to estimate regional economic effects associated with the Full and Partial Facilities Removal Alternatives.

Ocean Sport Fishing

The ocean sport fishing information is taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012h). This analysis focuses on economic effects of expenditures for ocean sport fishing in the KMZ-CA and KMZ-OR (where the effects of Klamath River fall Chinook salmon abundance are largely felt). Expenditures within the region by resident and nonresident anglers generate economic activity measured in terms of industry output, labor income, and employment. A basic assumption underlying this analysis is that any increase in expenditures by resident anglers associated with expanded fishing opportunities would be accommodated by reducing expenditures on other locally purchased goods and services, with no net change in local economic activity. For nonresident anglers, however, increases in local expenditures associated with increases in local fishing opportunities would be accomplished by diverting money that they would otherwise spend in their area of residence. Thus the economic analysis focuses on nonresident angler expenditures, which represent ‘new money’ whose injection serves to stimulate the local economy.

For the No Action/No Project Alternative, fishery conditions are characterized in terms of average annual ocean recreational harvest of Klamath River fall Chinook salmon during 2001-2005. For the project alternatives, Klamath River fall Chinook salmon harvest is estimated on the basis of the 43 percent increase in ocean recreational harvest of Klamath River Chinook salmon projected by the EDRRA model (Hendrix 2011), scaled to average annual harvest during 2001-2005.

The following steps were taken to estimate nonresident angler expenditures and regional economic effects under the project alternatives:

- Klamath River Chinook salmon harvest was expanded to account for total salmon harvest (all stocks) in the ocean recreational fishery due to the availability of Klamath River Chinook.
- Total salmon harvest (all stocks) was converted to angler days, using 2001-2005 fishery data (PFMC 2011).
- Number of angler days by fishing mode (party/charter, private boat) was estimated by multiplying total effort by the proportion of effort attributable to each mode, estimated using 2001-2005 fishery data (PFMC 2011).
- Number of angler days by nonresident anglers was estimated by using zip code of residence data collected in ocean recreational creel surveys conducted by the CDFG and ODFW to estimate the proportion of effort in each mode and area attributable to nonresident anglers.
- Average expenditures per angler day by nonresident anglers (for lodging, food, gasoline, fishing gear, party/charter boat fees, private boat fuel, equipment rental, access fees, and bait/ice) was estimated to be $200.02 for party/charter mode and $54.66 for private boat mode (in 2012 dollars), based on data collected in a 2000 economic survey of saltwater anglers conducted by NOAA Fisheries Service.
- Total within region expenditures by nonresident anglers were estimated by multiplying nonresident angler days by average nonresident expenditures per angler day. Total within region direct expenditures were run through IMPLAN to estimate regional economic impacts.

In-River Sport Fishing

The in-river sport fishing information is taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012g). For the in-river salmon fishery, the affected area includes Klamath, Siskiyou, Humboldt, and Del Norte Counties. The three California counties cover the current location of the in-river salmon and steelhead fisheries; Klamath County covers the area above the dams where salmon and steelhead could potentially recolonize under the action alternatives. Details regarding the methods, assumptions, and conclusions underlying this analysis are in the In-River Sport Fishing Economics Technical Report (NOAA Fisheries Service 2012g).

Klamath River Chinook Salmon

For the No Action/No Project Alternative, fishery conditions are characterized in terms of in-river recreational harvest of Klamath River fall-run Chinook salmon during 2001-2005. For the project alternatives, Klamath River fall-run Chinook salmon harvest is estimated on the basis of the eight percent increase in in-river recreational harvest of Klamath River fall–run Chinook salmon projected by the EDRRA model (Hendrix 2011), scaled to average annual harvest during 2001-2005. For all alternatives, harvest was converted to angler days, using 2001-2005 data on the ratio of angler days to harvest (NOAA Fisheries Service 2012g).

The proportion of angler days attributable to nonresident anglers was calculated on the basis of location-of-residence data collected in the Klamath River creel survey conducted by CDFG (Borok 2009). Location of residence is reported in the creel survey as the first three digits of the angler's zip code of residence. Each three-digit location corresponds to a Sectional Center Facility (SCF) of the U.S. Postal Service – a processing and distribution center that serves zip code destinations beginning with those three digits. For purposes of this analysis, anglers identified with SCF 955 and SCF 960 are defined as resident anglers. Because these SCFs extend beyond the boundaries of the four-county regional economic impact area, the analysis provided here likely understates expenditures by nonresident anglers and their contribution to the regional economy. Average expenditures per angler day by nonresident anglers (for lodging, food, gasoline, fishing gear, private boat fuel, and guide services) is $105.02 (in 2012 dollars), based on data from a 2004 economic survey of in-river salmon and steelhead anglers sponsored by NOAA Fisheries Service.

Steelhead

Economic effects of the No Action/No Project Alternative on the in-river steelhead fishery were analyzed on the basis of current fishery conditions, as little change in the status of steelhead is anticipated under that alternative. Estimation of regional effects for the action alternatives was precluded due to data limitations; instead those effects are expressed in qualitative terms.

The No Action/No Project Alternative is characterized in terms of average annual 2003-2008 steelhead fishing effort on the Klamath River, estimated from CDFG steelhead report card data in collaboration with Terry Jackson (CDFG). The proportion of total effort attributable to nonresident anglers is based on report card data on city/State of residence. Average nonresident expenditures per angler day (for lodging, food, gasoline, fishing gear, boat fuel, guide fees) is assumed to be $105.98 (2012 dollars), based on data from a 2004 economic survey of in-river salmon and steelhead anglers sponsored by NOAA Fisheries Service.

Half-pounders are an important component of the steelhead fishery (Hopelain 1998). However, half-pounder catch is not included on steelhead report cards (Jackson 2007), and data for this fishery from other sources is sparse. Thus the regional effects estimated for the No Action/No Project Alternative should be viewed as conservative.

Redband Trout

The recreational redband trout fishery is a well-known trophy fishery. Major fishing sites include Upper Klamath Lake, the lower Williamson and Wood Rivers, and the Keno Reach of the Klamath River. Effort estimates for Upper Klamath Lake and Agency Lake are available from a statistical creel conducted by ODFW in 2009. However similar estimates are not available for the lower Williamson and Wood Rivers or for the Keno Reach – making it difficult to infer how much is spent on this fishery. Regional economic effects of this fishery are qualitatively assessed.

Sucker

The recreational sucker fishery is not considered in the regional analysis, as that fishery closed in 1987 and is unlikely to re-open under the No Action/No Project Alternative and action alternatives.

Whitewater Boating

The affected area for whitewater boating is defined as Jackson, Klamath, Siskiyou, and Humboldt Counties. Klamath River users that engage in whitewater boating recreation spend money in the region purchasing gas, food and drink, lodging, guide services, and other items. The expenditures associated with these trips generate economic activity measured in terms of total industry output, labor income, and employment within the four county economic region.

Reclamation (2012b) and the Whitewater Boating Recreation Economics Technical Report (DOI 2012b) discuss the methods and results of the whitewater boating recreation regional economic impact analysis summarized in this section. The technical report also provides estimates of average annual whitewater boating user days for the upper Klamath and lower Klamath River. The estimate of average annual total direct expenditures for whitewater boating was derived from expenditures per user day and the number of whitewater boating user days, and total number of user days are differentiated by local versus nonlocal and commercial versus private.

Johnson and Moore (1993) estimated 78 percent of total whitewater boating activity on the Upper Klamath River is by non-local users. This same percentage was applied for activity on the lower Klamath River. The number of local user days was further adjusted to account for those local users that would have engaged in a substitute activity outside of the local area if the Klamath River was not available. Following Johnson and Moore (1993), it was assumed that 11 percent of the local user days would have been substituted to an activity outside of the local region if the Klamath River was not available. Expenditures associated with these user days represent increased economic activity to the local region and are included in the estimation of total direct expenditures. The expenditures associated with the other 89 percent of local user days would have still occurred in the local area if the Klamath River was not available and therefore, do not represent an increase in economic activity to the local region and are not included.

Expenditures per user day are differentiated by private and commercial users, where commercial use is associated with the use of a whitewater boating outfitter. Table 3.15-15 shows annual and average private and commercial user days on the upper and lower Klamath River between 1994 and 2009. Whitewater boating outfitter fees vary among upper Klamath River and lower Klamath River trips and private and commercial trips. Table 3.15-25 shows average visitor expenditures per user day on whitewater boating trips. Expenditures other than outfitter fees (e.g., accommodations, food, gas, supplies, and shuttle services) were based on Johnson and Moore (1993) and inflated to 2012 dollars. Total whitewater boating expenditures were input in the IMPLAN model to determine total economic effects.

Table 3.15-25. Expenditures per User Day for Whitewater Boating on the Klamath River (2012 dollars)

Expenditure	Upper Klamath River		Lower Klamath River	
	Private	Commercial	Private	Commercial
Outfitter Fees	$0	$157	$0	$130
Gasoline/fuel	$26	$26	$26	$26
Meals/food	$59	$59	$59	$59
Accommodations	$59	$59	$59	$59
Retail/supplies	$21	$21	$21	$21
Shuttle Services	$11	$11	$11	$11
Total	$176	$333	$176	$306

Source: DOI 2012b

3.15.4.1.4 Indian Tribes

This analysis focuses on fishing opportunities, related cultural and social practices, standard of living, and health for five of the six federally recognized tribes in the Klamath Basin (Klamath Tribes, Karuk Tribe, Resighini Rancheria, Yurok Tribe, Hoopa Valley Tribe). Based on information available at the time of this analysis, the sixth tribe, the Quartz Valley Community, was not expected to be directly affected by the outcome of the Secretarial Determination. The tribal information is taken directly from analyses contained in Reclamation (2012b) and NOAA Fisheries Service (2012b-f). Sections 3.12, Tribal Trust, and 3.16, Environmental Justice, include more detailed analysis on potential social effects to Indian Tribes.

3.15.4.1.5 PacifiCorp Hydroelectric Service

The analysis qualitatively discusses potential effects to PacifiCorp customer rates.

3.15.4.1.6 Property Values

All else equal, the removal of the Four Facilities including loss of the reservoirs could impact real estate values of parcels surrounding Copco 1 and Iron Gate Reservoirs in Siskiyou County. Dam removal could also potentially affect the value of parcels near and adjacent to the Klamath River downstream from Iron Gate Dam due to improved water quality and more robust runs of anadromous fish. The discussion in this EIS/EIR considers potential effects on reservoir and riverine property values qualitatively. Studies have shown that amenities provided by proximity to a lake have a positive correlation with land values (See Section 3.15.3.6). Thus, the loss of reservoirs could result in declines in private land values. The net value of these changes, and the time over which such changes might be observed in market prices, is uncertain.

In concept, to evaluate impacts on real estate values, one would collect market sales data for different properties with different characteristics, which would include “view amenities.” This data would include market values for land that had reservoir views, river views, and no views. All else equal, the difference in the land values for properties with different amenities would represent the impacts of such amenities on real estate

values. This is a challenging exercise in thin markets, where limited data inhibit revelation of market preferences, and where other external factors affecting real estate markets may mask or overwhelm the effects of dam removal.

3.15.4.1.7 PacifiCorp Property Taxes

This analysis discusses effects to county property tax revenues qualitatively. PacifiCorp pays property taxes to Siskiyou and Klamath Counties. After dam removal, the States of California and Oregon would assume payment of property tax assessments in the form of in-lieu fees for the lands underneath and adjacent to the reservoirs that will come under State management. In-lieu fees would be equivalent to the current assessment paid by PacifiCorp for hydroelectric properties, as defined by California Fish and Game Code Section 1504 and Oregon Revised Statutes Section 496.340:

> California Fish and Game Code Section 1504. (a) When income is derived directly from real property acquired and operated by the State as wildlife management areas, and regardless of whether income is derived from property acquired after October 1, 1949, the department shall pay annually to the county in which the property is located an amount equal to the county taxes levied upon the property at the time title to the property was transferred to the State. The department shall also pay the assessments levied upon the property by any irrigation, drainage, or reclamation district.
>
> Oregon Revised Statutes Section 496.340. Except as provided in subsection (3) of this section, whenever real property owned by the State Fish and Wildlife Commission is exempt from taxation on January 1 of any year by reason of its ownership by the State, the commission shall pay to the county in which the property is situated an amount equal to the ad valorem taxes that would have been charged against the property if it had been assessed to a taxable owner as of January 1 of such year as provided in subsection (2) of this section. The county assessor shall determine the value of such property and shall notify the commission of the determination of the county assessor. Upon request of the commission, the Department of Revenue shall review the determination of value and shall re-determine the value if it concludes the value initially determined was substantially incorrect.

3.15.4.1.8 KBRA

The KBRA identified 112 actions that could result in new economic activity in the counties within the Klamath Basin. Actions focus on fisheries restoration, monitoring, reintroduction, water resources, agriculture, and economic development for tribes and counties in the Klamath Basin. Chapter 2 describes programs and actions included in the KBRA. Appendix P includes the detailed KBRA regional economic effects analysis.

KBRA actions would increase labor income, output and employment in the region through planning and implementation of local projects and funding to local governments.

The KBRA would be implemented over a 15 year period from 2012 to 2026. Federal and State agencies provided funding estimates for KBRA actions. This analysis uses funding estimates and the IMPLAN model to estimate regional economic effects of each KBRA action. Beyond the funding programmed in the KBRA in year 15, the expectation is that Federal financial support in the Klamath Basin would return to existing conditions. Additional funds would be subject to annual appropriations.

Federal agencies identified initial base funding values for actions listed in the KBRA. Base funding was provided on an annual basis for each year that the KBRA would be implemented (2012-2026). The base funding dollars are assumed to be spent whether the KBRA is implemented or not; therefore, the base funding values are assumed for the No Action/No Project Alternative. Base funding values were run in IMPLAN to determine effects of the No Action/No Project Alternative. The KBRA funding would be in addition to the base funding that would be spent under the No Action/No Project Alternative.

To estimate in-region spending for the KBRA, project experts from Federal and State agencies and tribes were interviewed regarding the percentage of total costs that would be spent in the region. Experts were from U.S. Fish and Wildlife Service (USFWS), Reclamation, NOAA Fisheries Service, United State Geologic Survey, U.S. Forest Service, DOI, CDFG, ODFW, Karuk Tribe, Yurok Tribe, and The Klamath Tribes. Appendix P summarizes personal communication records, which are referenced as personal communications at the end of this section. Project experts considered project requirements, similar past projects, existing industries and work force in the counties to determine a percentage for in-region costs. Percentages were applied to both base funding and KBRA funding.

Once in-region spending percentages were agreed upon, project experts helped identify the appropriate industry or institution that would experience the direct economic effect, or change in demand. For the majority of actions, money would be spent in the construction sector or in local and State governments to implement activities. This analysis uses the total funds over the 15-year period and does not evaluate effects on an annual basis. The KBRA effects shown in this analysis are not annual effects; instead, they are effects over the entire 15 year period.

Irrigated Agriculture

Some KBRA actions would change agricultural water supply, on-farm pumping costs, and water acquisitions in Reclamation's Klamath Project area, which would affect irrigated agriculture and farm revenues. Details on the methodology and results of the economic analysis are in Reclamation (2012a) and the Irrigated Agriculture Economics Technical Report (Reclamation 2012c).

Hydrology modeling was based on Biological Opinions for the No Action/No Project Alternative and incorporated KBRA criteria for the Full Facilities Removal Alternative,

including the On-Project Water Users Program (KBRA Section 15) and the Drought Plan (KBRA Section 19). The hydrology modeling drives the agricultural regional analysis (Reclamation 2012c). The Klamath Basin Hydro-Economics model (KB_HEM) evaluated effects to Reclamation's Klamath Project irrigators based on the hydrology. KB_HEM measures changes to cropping patterns and gross farm revenue. Gross farm revenue was used in IMPLAN to measure regional economic effects.

KB_HEM also evaluated current pumping rates for lands irrigated within Reclamation's Klamath Project, which were compared to estimates of reduced cost of electricity and the cost of pumping ground water for irrigation under the KBRA. IMPLAN was then used to estimate regional effects from pumping cost changes. Because KBRA does not provide enough information to quantify the effects from power rates to off-project irrigators, this analysis describes those effects in qualitative terms.

KBRA programs such as the Water Use Retirement Program, the Off-Project Reliance Program, and Interim Flow and Lake Level Program were also evaluated in IMPLAN. These programs encourage voluntary water right sales or short term water leasing. The regional economic impact of water right transfers or short term water leases are measured in two stages: (1) regional economic effects from the reduction in irrigated agricultural production and (2) the regional economic impact of the water transfer compensation or lease payment to growers. Water transfer/lease payments may offset negative economic effects from reduced irrigated crop production. The net regional economic impact is the sum of the stage one and stage two effects.

Refuge Recreation

Some KBRA actions would change water supply for refuges; therefore, refuge recreation is described under the KBRA. Visitors target the refuge primarily for one of two recreational purposes: wildlife viewing or waterfowl hunting. Visitation to refuges typically lasts for no more than one-half a day. Reclamation (2012b) and the Refuge Recreation Economics Technical Report (Maillett 2011) discuss in greater detail the methodology followed and results pertaining to the direct economic contribution to the local area associated with the economic expenditures of nonlocal refuge visitors.

Expenditures associated with visitation include lodging, food and beverages, transportation, and equipment. Expenditure data was obtained from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Expenditures were prorated to prevent over-estimation of the contribution based on the amount of time a typical visitor spends on the Refuge. Table 3.15-26 shows estimated daily expenditures by visitors to the NWRs for hunting and wildlife viewing activities (in 2012 dollars). Non-residents spend more on recreation than residents, and all visitors spend more on hunting than on wildlife viewing.

Table 3.15-26. Daily Expenditures per Person for Hunting and Wildlife Viewing (2012 dollars)

Economic Sector	Migratory Bird Hunting		Wildlife Viewing	
	Resident	Non-Resident	Resident	Non-Resident
Lodging	$2.54	$12.78	$9.12	$36.44
Food/drink	$16.75	$50.25	$11.74	$38.66
Air transport	$25.39	$107.57	$9.27	$33.09
Other transport	$ -	$11.95	$1.51	$3.59
Other	$13.25	$18.33	$3.13	$14.95
Total	$57.93	$200.87	$34.76	$126.73

Source: 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, U.S. Fish and Wildlife Service. Expenditures updated to 2012 dollars using Western Region Consumer Price Index, U.S. Census.

3.15.4.2 Effects Determinations

As described above, the following effects determinations comply with the required NEPA analysis of socioeconomic effects. Effects of the project alternatives are compared to the No Action/No Project Alternative.

3.15.4.2.1 Alternative 1: No Action/No Project Alternative

Four Facilities

The Four Facilities would be retained under the No Action/No Project Alternative; therefore, there would be no construction activities and short-term construction related effects associated with dam removal.

Annual O&M expenditures required to continue the operation of the existing facilities could result in long-term economic effects to jobs, labor income, and employment. Table 3.15-27 summarizes the regional effects from annual O&M expenditures. IMPLAN results indicate that existing O&M generates approximately 49 jobs. Labor income and output from O&M expenditures were estimated at $2.05 million and $5.19 million, respectively. Annual O&M expenditures and associated effects to employment, labor income, and output would remain the same under the No Action/No Project Alternative relative to existing conditions for the long term.

Table 3.15-27. Regional Economic Effects from Annual O&M Expenditures for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	49	2.05	5.19

Source: Reclamation 2012b presented in 2012 dollars
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Commercial Fishing

Changes in commercial fishing harvests could change fishing revenues and affect employment, labor income, and output in the regional economy. Under the No Action/ No Project Alternative, Klamath River fall Chinook salmon would continue to be the constraining stock for the troll fishery in San Francisco, Fort Bragg, KMZ-CA, KMZ-OR, and Central Oregon. Annual gross revenue projected for each of these five areas under average abundance conditions is described in Table 3.15-28 for the No Action/No Project Alternative. Revenues range from $266,900 in KMZ-OR to $9.126 million in San Francisco (Reclamation 2012b, NOAA Fisheries Service 2012a8). Due to the very modest contribution of Klamath fall Chinook salmon to commercial salmon revenues in Northern Oregon and Monterey, those areas are not included in Tables 3.15-28 and 3.15-29.

Table 3.15-28. Annual Ex-Vessel Revenue for Management Areas for the No Action/No Project Alternative

Management Area	Revenue (2012 dollars)
Central Oregon	6,847,058
KMZ-OR	266,894
KMZ-CA	328,574
Fort Bragg	4,202,992
San Francisco	9,125,553

Table 3.15-29 shows the regional economic effects from ocean commercial fishing under the No Action/No Project Alternative. Employment ranges from 26 to 510 jobs. Labor income ranges from $0.15 million to $6.10 million. Output ranges from $0.32 million to $15.52 million.

Table 3.15-29. Regional Economic Total Effects from Ocean Commercial Fishing under No Action/No Project Alternative

Management Area	Total Effects[1]		
	Employment[2] (Jobs)	Labor income[3] ($ millions)	Output[4] ($ millions)
Central Oregon	319	4.15	9.55
KMZ-OR	26	0.15	0.33
KMZ-CA	44	0.19	0.45
Fort Bragg	162	2.45	5.62
San Francisco	510	6.1	15.52

Source: Reclamation 2012b presented in 2012 dollars.
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Commercial fishing harvests and associated effects on employment, labor income, and output in the regional economy would be similar to current conditions for the long term.

It is important to note that in years of low Klamath Chinook salmon abundance, troll restrictions would be more widespread and affect Monterey and Northern Oregon as well as the five areas noted above. Historically (e.g., 2006), the severe regulatory restrictions associated with such low abundances resulted in economic hardship for the troll fishery and prompted Federal disaster assistance for affected fishing communities.

Recreation

Reservoir

Changes to reservoir recreation expenditures could affect jobs, labor income, and employment in the regional economy under the No Action/No Project Alternative. The reservoir recreation analysis assumes that 71,584 non-local visitors would recreate at Copco 1, Iron Gate and J.C. Boyle Reservoirs under the No Action/No Project Alternative. It should be noted that a substantial blue-green algae problem exists at Copco 1 and Iron Gate Reservoirs (but not at J.C. Boyle Reservoir) sufficient to warrant health advisories related to water ingestion or contact. These advisories suggest avoiding use of water for cooking and washing, as well as avoiding the consumption of fish. While these advisories have been in place for several years, no data exists as to their impact on recreation visitation. Should these algae problems under the No Action/No Project Alternative continue, a large percentage of visits at Copco 1 and Iron Gate Reservoirs may be lost. This could reduce the level of reservoir recreation visitation. At this point, the impact of the blue-green algae problem on visitation is unknown, therefore attempting to provide algae adjusted visitation estimates are speculative. Non-local recreation at Copco 1, Iron Gate, and J.C. Boyle Reservoirs would generate average annual spending of about $1.1 million per year, which would result in regional economic activity shown in Table 3.15-30. Reservoir recreation under the No Action/No Project Alternative would be the same as existing conditions for the long term.

Table 3.15-30. Regional Economic Effects from Reservoir Recreation for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	7	0.22	0.54

Source: Reclamation 2012b presented in 2012 dollars.

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.

[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.

[3] Output represents the dollar value of industry production.

[4] Total Effect = Direct + Indirect + Induced Effects

In-River Sport Fishing

Changes to in-river sport fishing opportunities could affect recreational expenditures and employment, labor income, and output in the regional economy. Annual salmon fishing effort on the Klamath River is estimated at 24,683 angler days under average abundance conditions for the No Action/No Project Alternative. The portion of this effort attributable to nonresident anglers is 15,822 angler days. Annual expenditures in the region by nonresident anglers would be $1.7 million (2012 dollars). Table 3.15-31 shows the regional economic effects from in-river salmon fishing trip expenditures for the No Action/No Project Alternative (Reclamation 2012b, NOAA Fisheries Service 2012g).

Table 3.15-31. Regional Economic Effects from In-river Salmon Fishing for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	34	0.93	2.01

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Annual steelhead fishing effort on the Klamath River is estimated at 17,155 angler days under the No Action/No Project Alternative, of which 11,103 were attributable to nonresident anglers. Annual expenditures by nonresidents in the region would be $1.2 million. Table 3.15-32 shows the estimated regional effects from in-river steelhead fishing trip expenditures for the No Action/No Project Alternative (Reclamation 2012b, NOAA Fisheries Service 2012g).

Table 3.15-32. Regional Economic Effects from In-river Steelhead Fishing for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	20	0.62	1.31

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

According to results of a creel survey conducted during May-September 2009, fishing effort for redband trout on Upper Klamath Lake totaled 15,191 angler days during that period (pers. comm. William Tinniswood, ODFW). County-of-residence data collected as part of the survey indicate that 24 percent of this effort was by nonresident anglers. Effort estimates for other major fishing sites (lower Williamson and Wood Rivers, Keno Reach of the Klamath River) are not available. A popular guide fishery occurs on the lower Williamson River. Given that demand for guide trips is generally higher among nonresident than resident anglers, the proportion of trips by nonresident anglers is likely higher on the Williamson River than in Upper Klamath Lake; however, data are lacking to verify this. The redband trout fishery would remain similar under the No Action/No Project Alternative relative to existing conditions (Reclamation 2012b, NOAA Fisheries Service 2012g).

In conclusion, in-river sport fishing opportunities and associated effects on employment, labor income, and output in the regional economy under the No Action/No Project Alternative would remain similar to existing conditions for the long term.

Ocean Sport Fishing

Changes to ocean sport fishing opportunities associated with dam removal could affect recreational expenditures in the regional economy. Table 3.15-33 summarizes annual ocean sport salmon fishing effort (in total and by nonresident anglers) and nonresident angler expenditures under average abundance conditions for the No Action/No Project Alternative. Annual nonresident expenditures total $981,500 in KMZ-CA and $223,500 in KMZ-OR (Reclamation 2012b, NOAA Fisheries Service 2012h).

Table 3.15-33. Total Annual Recreational Salmon Effort, Nonresident Effort and Nonresident Expenditures for the No Action/No Project Alternative

Management area	Angler days (Total)		Angler days (Nonresident)		Expenditures (Nonresident [2012 dollars])	
	Party/charter	Private	Party/charter	Private	Party/charter	Private
KMZ-CA	1,665	23,569	1,538	11,926	313,644	667,856
KMZ-OR	382	14,293	197	3,273	40,174	183,288

Table 3.15-34 shows the estimated regional economic effects from ocean sport fishing trip expenditures for the No Action/No Project Alternative for KMZ-CA and KMZ-OR, respectively.

Table 3.15-34. Regional Economic Effects from Ocean Sport Salmon Fishing for the No Action/No Project Alternative

Management Area	Total Effects[1]		
	Employment[2] (Jobs)	Labor income[3] ($ millions)	Output[4] ($ millions)
KMZ-CA	13	0.42	1.12
KMZ-OR	3	0.08	0.21

Source: Reclamation 2012b presented in 2012 dollars
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Whitewater Boating

Changes to whitewater boating opportunities could affect recreational expenditures and employment, labor income, and output in the regional economy. Regional economic activity under the No Action/No Project Alternative is based on the average annual whitewater boating use and in-region expenditures per user day for the upper Klamath River and lower Klamath River. Total average annual visitation for the Klamath River was estimated at 18,806 user days, where the associated within region expenditures were estimated at $4.2 million for the No Action/No Project Alternative. Table 3.15-35 displays estimates of whitewater boating recreation regional economic effects for the No Action/No Project Alternative. Whitewater boating under the No Action/No Project Alternative would remain similar to existing conditions for the long term.

Table 3.15-35. Regional Economic Effects from Whitewater Recreation for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	56	1.56	4.31

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Indian Tribes

The continuation of dam operations would contribute to existing fishing and water quality conditions of Indian Tribes in the area of analysis. Access to fish has declined relative to historical levels due to reductions in abundance and distribution and loss of

access to traditional fishing sites. Opportunities to utilize fish for subsistence and ceremonial purposes and trade and barter would continue to be limited under the No Action/No Project Alternative similar to existing conditions. Water quality conditions that affect tribal cultural practices would continue to be impaired until such time as beneficial effects of the Klamath Basin TMDLs are felt. Such beneficial effects are subject to considerable uncertainty and would not be fully realized for a number of decades. The information contained in this section is taken directly from Reclamation (2012b) and NOAA Fisheries Service (2012b-f).

The Klamath Tribes

The decline in spring-run Chinook salmon began prior to construction of Copco 1 Dam due to factors such as mining and unregulated cannery operations at the river mouth (Snyder 1931). Construction of Copco 1 Dam eliminated much of the spawning and rearing habitat for the spring run (Hamilton et al. 2010). For The Klamath Tribes, access to both fall- and spring-run Chinook salmon ceased completely with the construct of Copco 1 Dam. Out-of-area fishing and barter proved to be untenable as a regular practice due to the distances traveled, the relatively small amounts of salmon obtained, and the need to meet obligations closer to home. Moreover, salmon obtained elsewhere did not have the same cultural significance as salmon harvested by tribal members on their own fishing grounds. After almost a century without salmon, first salmon ceremonies have ceased and been replaced by ceremonies focused on other species or prayers for the return of salmon. Efforts by The Klamath Tribes to educate the younger generations regarding the cultural and social importance of salmon are challenged by the lack of direct experience with salmon in their daily lives (Deur 2011).

Lost River (c'waam) and shortnose (qapdo) suckers were also important sources of sustenance and became increasingly so after the loss of salmon harvest opportunities. Studies conducted by The Klamath Tribes, ODFW, and the USFWS in the early 1980s revealed the poor status of these populations. The Klamath Tribes drastically curtailed their sucker fishery in 1985 and closed it entirely in 1986 (Markle and Cooperman 2001). The only fish species currently available to The Klamath Tribes is redband trout. Klamath tribal regulations allow subsistence harvest of trout, five fish per day on the Williamson River and up to ten fish per day in other areas.

Karuk Tribe

The Karuk Tribe does not have federally recognized fishing rights. However, the California Fish and Game Commission allows members of the Tribe to fish with traditional hand-held dip nets at their indigenous fishing site at Ishi Pishi Falls. Karuk tribal fishing is bound by California sport fishing regulations, including bag and possession limits. The seasonal round at Ishi Pishi is much diminished and consists mostly of fall-run Chinook salmon, available in modest numbers and for a very limited period. The First Salmon Ceremony has not been practiced in traditional form in the spring for decades, due to the dramatic decline in spring-run Chinook salmon. Lamprey have also declined in abundance to such an extent that traditional family eeling spots are no longer used (Lewis 2009). Quantities of fish harvested are not sufficient to meet subsistence needs, engage in trade and barter, or even provide adequately for tribal elders.

The Karuk Tribe routinely participates in the posting of health warnings along the river in the summer that advise people to avoid contact with the water and ingestion of fish livers and to thoroughly wash fish before consumption. The Tribe's concerns extend not only to finfish but also to freshwater mussels, crayfish and food plants that contribute to their diet (Norgaard 2005). Water quality also affects cultural practices, as the Piky'avish ceremonies (which require some participants to ritually immerse themselves in the river) extend into the summer months, when water quality is at its worst. Other tribal activities (e.g., basket making, use of medicinal plants) also involve contact with the river. Basket makers wade in the river to collect basket materials such as willows and cottonwood, wash the materials in the river, and strip the willows with their teeth. Medicinal plants are often washed in the river and some water is consumed along with the plants (Karuk Tribe undated, Gates and Novell 2011).

Resighini Rancheria

The Resighini do not have tribal fishing rights but retain a strong affinity to fishing and other cultural practices such as basket weaving and use of medicinal plants. Resighini members regularly participate in World Renewal Ceremonies hosted by neighboring tribes. Today candlefish and sturgeon are rarely seen on the Klamath River, coho salmon has been listed as 'threatened' under the Endangered Species Act, and Pacific lamprey and spring-run Chinook salmon are at very low levels of abundance. The declines in fish abundances have impacted the modest fishing opportunities available to the Resighini Rancheria.

Poor water quality at certain times of year affects the quantity and quality of basket materials and also exposes basket makers (who wade in the river and also strip willows and other materials with their teeth) to adverse water conditions. Gathering and use of medicinal plants is also adversely affected by poor water quality.

Yurok Tribe

Historical declines in fish abundances have impaired the ability of Yurok tribal members to meet their subsistence needs and engage in trade and barter and commercial fishing. With the decline of spring-run Chinook salmon, the First Salmon Ceremony and the Cappell Weir have not been practiced for many decades. Water quality problems interfere with fishing operations by causing algae to become entangled in fishing nets.

The Yurok Tribe hosts the World Renewal Ceremonies, which include the Deerskin Dance and Jump Dance, every other year in the Lower Basin in rotation with the Hoopa Valley Tribe. When fish harvest is low, the Yurok Tribe must supplement the harvest with sources off the reservation to meet their obligation to share salmon and other food with ceremonial participants and attendees (USFWS et al. 1999, Gates and Novell 2011). The World Renewal Ceremonies, Brush Dance and Flower Dance involve the use of basket materials that grow along the river and immersion of some ceremonialists in the river. Poor water quality at certain times of year affects the quantity and quality of basket materials and also exposes basket makers (who wade in the river and also strip willows

and other materials with their teeth) and ceremonialists (who engage in ritual immersion) to adverse water conditions. Gathering and use of medicinal plants is also adversely affected by poor water quality.

Hoopa Valley Tribe

The decline in fish abundances on the Trinity River has impaired the ability of Hoopa tribal members to meet their subsistence needs and utilize fish for trade and barter. The Hupa incorporate traditional cultural understandings and ceremonies into their everyday life, including fish harvesting (USFWS et al. 1999). Due to the decline of spring Chinook, they have not had a First Salmon Ceremony in decades. However, they are active participants in the World Renewal Ceremonies, which they host every other year in the Lower Basin in rotation with the Yurok. When fish harvest is low, the Hupa must supplement the harvest with sources off the reservation to meet their obligation to share salmon and other food with ceremonial participants and attendees (USFWS et al. 1999, Gates and Novell 2011).

Ceremonial and cultural practices affected by Trinity River water quality include ritual immersion of some ceremonial participants in the river, basket making (which requires basket makers to wade in the river and also strip willows and other materials with their teeth), and gathering and use of medicinal plants.

In conclusion, under the No Action/No Project Alternative, the socioeconomic conditions of the Klamath, Karuk, Resighini Rancheria, Yurok and Hoopa Valley Indian Tribes would be the same as existing conditions.

PacifiCorp Hydroelectric Service

Energy rates for PacifiCorp customers would be uncertain under the No Action/No Project Alternative. Under the No Action/No Project Alternative PacifiCorp would continue to operate under the current annual license, PacifiCorp customers would stop paying surcharges associated with dam removal costs. Funds collected would be returned to rate payers or used for restoration actions. While the modified mandatory terms and conditions and prescriptions developed by the DOI and NOAA Fisheries Service in the FERC relicensing proceedings are not included in the No Action/No Project Alternative, the potential changes in customer energy rates that could be generated by implementation of these terms and conditions are characterized below in the analysis of Alternative 4. PacifiCorp considers many factors in setting customer rates which in turn are subject to Oregon Public Utilities Commission (OPUC) and California Public Utilities Commission (CPUC) approval; therefore, it is difficult to assess the size of potential rate effects or even the extent to which rates might increase at all under the No Action/No Project Alternative.

Property Values

Property values surrounding Iron Gate and Copco 1 Reservoirs could change under the No Action/No Project Alternative. Property values of parcels around the reservoirs and along the river would be subject to and fluctuate based on general economic conditions. Future values of parcels around Copco 1 and Iron Gate Reservoirs could be affected by

continued postings of health advisories for microcystin algal toxins. This analysis does not attempt to predict market conditions and future housing values. The No Action/No Project Alternative would not affect property values relative to existing conditions.

PacifiCorp Property Taxes

PacifiCorp's property tax payments to Siskiyou and Klamath Counties could change under the No Action/No Project Alternative. PacifiCorp would continue to operate the Klamath Hydroelectric Project and pay property taxes to Siskiyou and Klamath Counties. In 2008 and 2009, PacifiCorp indicated that $305,000 and $290,000 of property taxes were associated with hydroelectric facilities in Siskiyou County (PacifiCorp 2009). PacifiCorp would continue to pay a similar amount annually to Siskiyou and Klamath Counties under the No Action/No Project Alternative. There would be no substantial changes in property tax revenues to the counties under the No Action/No Project Alternative relative to existing conditions.

Ongoing Restoration Activities

Ongoing restoration activities could generate employment, labor income, and output in the regional economy. Federal agencies have identified funding for ongoing restoration actions under the No Action/No Project Alternative. Table 3.15-36 summarizes regional economic effects of ongoing restoration actions under the No Action/No Project Alternative. Effects would occur in Klamath, Siskiyou, Humboldt, and Del Norte Counties. The regional economic impacts associated with ongoing restoration actions would be spread over the 2012-2026 period and would vary year-by-year proportionate to actual expenditures. Spending on local actions would affect employment, labor income, and output in the regional economy. Impacts would mostly occur in local or State governments and the construction sector. Effects would be temporary and only occur during the implementation period.

Irrigated Agriculture

Changes in Reclamation's Klamath Project hydrology could affect farm revenues, employment, labor income, and output in the regional economy. Under the No Action/No Project Alternative, KB_HEM model results predict five drought years for Reclamation's Klamath Project. Table 3.15-37 shows the gross farm revenue by IMPLAN sector for drought years, which was used in IMPLAN to estimate the potential regional economic effects from on farm production in drought years. Table 3.15-38 summarizes regional economic effects from agriculture during drought years. The three-county region supports a total of approximately 52,000 jobs, $2,082.6 in labor income, and $5,497 million in output by comparison. Under the No Action/No Project Alternative, farm revenues would remain the same as existing conditions.

Table 3.15-36. Total Economic Effects over a 15 year period of In-Region Spending for Ongoing Restoration Actions under the No Action/No Project Alternative

Ongoing Action	Total In-Region Spending (1000$)	Total Economic Effects[1]		
		Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
Coordination and Oversight	$1,350	22	$1,024	$1,622
Planning & Implementation--Phase I and II Restoration Plans	$420	7	$319	$505
Williamson River aquatic habitat restoration	$3,735	50	$2,378	$5,277
Sprague River aquatic habitat restoration	$11,216	147	$7,000	$16,086
Wood River Valley aquatic habitat restoration	$2,997	39	$1,801	$4,420
Williamson & Sprague USFS uplands	$4,680	62	$2,921	$6,712
Upper Klamath Lake aquatic habitat restoration	$2,997	38	$1,770	$4,476
UKL watershed USFS uplands	$1,159	16	$724	$1,663
Keno Impoundment/Lake Ewauna wetlands restoration	$2,250	29	$1,325	$3,369
Keno to Iron Gate upland USFS	$504	8	$311	$732
Shasta River aquatic habitat restoration	$16,674	166	$7,991	$17,613
Shasta River USFS uplands	$606	9	$373	$878
Scott River aquatic habitat restoration	$18,720	241	$11,515	$27,139
Scott River USFS uplands	$958	14	$590	$1,389
Scott River private uplands	$2,100	29	$1,368	$3,205
Mid Klamath River & tributaries aquatic habitat restoration	$6,750	88	$4,152	$9,786
Mid Klamath tributaries USFS upland	$3,600	47	$2,215	$5,220
Mid Klamath tributaries private upland	$4,200	55	$2,585	$6,090
Lower Klamath River & tributaries aquatic habitat restoration	$18,200	234	$11,196	$26,385
Lower Klamath private uplands	$9,900	128	$6,090	$14,352
Salmon River aquatic habitat restoration	$1,650	23	$1,029	$2,400
Salmon River USFS upland	$2,082	28	$1,281	$3,018
Adult Salmonids	$7,400	115	$5,608	$8,890
Juvenile Salmonids	$4,110	64	$3,115	$4,938
Genetics Otololith	$2,055	35	$1,720	$2,719
Hatchery Tagging	$315	6	$240	$380
Disease	$316	6	$241	$380
Green Sturgeon	$2,480	39	$1,880	$2,979
Lamprey	$371	7	$282	$446
Geomorphology	$153	3	$116	$184
Water Quality	$1,545	26	$1,176	$1,985
UKL bloom dynamics	$1,545	26	$1,176	$1,985
UKL water quality/phytoplankton/zooplankton	$2,020	34	$1,537	$2,595
UKL internal load/bloom dynamics	$1,800	30	$1,370	$2,313
UKL external nutrient loading	$60	2	$46	$78
UKL listed suckers	$8,985	146	$6,834	$11,542
Tributaries listed suckers	$930	16	$708	$1,196
Keno Impoundment/Lake Ewauna water quality/algae/nutrients	$70	2	$54	$91

Source: Source: Barry 2011; Bird 2011; Hicks 2011; Mahan 2011; Nota 2011; Radford 2011; Stopher 2011; Wise 2011
2012 dollars as estimated using IMPLAN
UKL: Upper Klamath Lake USFS: United States Forest Service
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Table 3.15-37. Gross Farm Revenue for the No Action/No Project Alternative during Drought Years

IMPLAN Crop Sectors	Gross Farm Revenue for Drought Years (1,000 $)				
	2027	2043	2045	2052	2059
Grains	19,189	4,519	11,462	17,078	20,300
Vegetables	60,675	55,966	58,562	60,127	60,791
Other (Hay & Pasture)	58,387	27,640	47,250	55,815	60,457
Total	138,251	88,125	117,274	133,020	141,548

Source: KB_HEM estimated gross farm revenue by IMPLAN crop sectors as cited in Reclamation 2012c.

Table 3.15-38. Regional Economic Effects from Irrigated Agriculture for the No Action/No Project Alternative during Drought Years

Drought Year	Total Effect[1]		
	Employment[2] (Jobs)	Labor income[3] ($ millions)	Output[4] ($ millions)
2027	1,361	45.20	183.56
2043	766	33.21	118.30
2045	1,076	40.24	156.34
2051	1,286	43.97	176.78
2059	1,403	45.94	187.84

Source: Reclamation 2012c presented in 2012 dollars.
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Changes in on-farm pumping costs could affect farm revenues, employment, labor income, and output in the regional economy. Electricity costs and on farm ground water pumping costs would not be impacted under the No Action/No Project Alternative.

Water acquisitions could affect farm revenues, employment, labor income, and output in the regional economy. Under the No Action/No Project Alternative, water acquisitions would not impact the regional economy. The Klamath Water and Power Agency currently manages the Water Use Mitigation Program. This plan is similar to a water leasing mitigation program in which farmers are paid to idle land in exchange for the use of the water to reduce on project demand. This is a pilot project whose authorization ends in 2012; therefore it was assumed this program will not continue under the No Action/No Project Alternative. Thus, water acquisitions would have no effect under the No Action/No Project Alternative.

Refuge Recreation

Changes in water supply could affect visitor spending for refuge recreation and affect employment, labor income, and output in the regional economy. Water supply would be similar to historical water supply operations, and therefore recreation quality and opportunities would not change. Visitor expenditures for refuge recreation under the No Action/No Project Alternative would be the same as existing conditions. Table 3.15-39 shows the regional economic effects from refuge hunting trip expenditures for the No Action/No Project Alternative. Visitor spending for the long term would not change under the No Action/No Project Alternative, and the regional economy would not be affected relative to existing conditions.

Table 3.15-39. Regional Economic Effects from Refuge Hunting for the No Action/No Project Alternative

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	11	0.26	0.62

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Tribal Program

Ongoing fisheries and conservation management by The Klamath Tribes, Karuk Tribe, and Yurok Tribe could generate employment, labor income, and output in the regional economy. Federal agencies have identified funding for fisheries and conservation management actions to be implemented by tribes under the No Action/No Project Alternative. Table 3.15-40 summarizes in-region spending and regional economic effects of tribal program actions under the No Action/No Project Alternative. Effects would occur in Klamath, Siskiyou, Humboldt and Del Norte Counties where tribes are located. The regional economic impacts associated with tribal program actions would be spread over the 2012-2026 period and would vary year-by-year proportionate to actual expenditures. Spending on local actions would affect employment, labor income, and output in the regional economy. Most actions would be implemented by tribal staff and would positively affect the economic conditions of the tribes. A portion of the funding would result in positive effects in the construction sector and professional and technical services sector. Economic effects would be the same as existing conditions.

Table 3.15-40. Total Economic Effects over a 15-year Period of In-Region Spending for Tribal Program Under the No Action/No Project Alternative

		Total Economic Effects[1]		
Action	Total In-Region Spending (1000$)	Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
Fisheries Management, Karuk Tribe	$10,468	169	$7,505	$11,643
Fisheries Management, The Klamath Tribes	$8,997	118	$5,935	$9,717
Fisheries Management, Yurok Tribe	$8,934	141	$6,792	$12,108
Conservation Management, Karuk Tribe	$4,200	68	$3,012	$4,672
Conservation Management, The Klamath Tribes	$4,200	56	$2,771	$4,537
Conservation Management, Yurok Tribe	$4,200	67	$3,188	$5,724

Source: Dunsmoor 2011; Tucker 2011; Hillemeier 2011
2012 dollars as estimated using IMPLAN
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

3.15.4.2.2 Alternative 2: Proposed Action – Full Facilities Removal of Four Dams Four Facilities

Construction activities associated with dam removal would increase economic output, employment, and labor income during the construction period in Klamath and Siskiyou Counties. Effects from dam decommissioning expenditures would occur for one year in 2020. The costs for full facility removal would be approximately $178.4 million[3] in 2012 dollars. Not all dollars would be spent within the region. Approximately $114.3 million of $178.4 million would be spent in Klamath and Siskiyou Counties. For more detail on the cost estimates and in-region spending, see the Benefit Cost and RED Technical Report (Reclamation 2012a).

IMPLAN results for employment, labor income and output are shown in Table 3.15-41. Only in-region expenditures would generate positive regional economic effects. Dam decommissioning would support approximately 1,400 jobs and generate approximately $60 million in labor income and $163 million in output. Most economic effects would be in the sector where the direct impact occurs. For dam deconstruction expenditures, this analysis assumes direct effects would mostly occur in the construction sector.

[3] Dam removal as described in this EIS/EIR would occur from May 2019 through December 2020. For this socioeconomic analysis, all effects have been described in 2012 dollars to compare economic effects of alternatives. These costs for facilities removal should not be considered a most probable cost estimate for dam removal in 2020. For a more detailed analysis of the cost of dam removal please see Detailed Plan for Dam Removal – Klamath River Dams, July 2012.

Employment created in this sector would be full and part time jobs and include contractors and subcontractors directly engaged in construction operations (such as equipment operators, drillers, carpenters, electricians, mechanics, apprentices, skilled and unskilled laborers, truck drivers, on-site record keepers and security guards), and any of their related office or administrative staff (in executive, purchasing, accounting, personnel, professional, technical activities and routine office functions, and supervisory employees). The Proposed Action would result in short term positive effects to output, employment, and labor income in the region relative to the No Action/No Project Alternative. Effects would only occur during the construction period.

Table 3.15-41. Regional Economic Effects from Dam Decommissioning for Alternative 2, the Proposed Action

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	1,423	59.70	163.32

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production
[4] Total Effect = Direct + Indirect + Induced Effects

Dam removal would reduce annual O&M expenditures for the Klamath Hydroelectric Project and could affect employment, labor income, and output in the regional economy. The Proposed Action would not require any long term annual O&M expenditures for operation of hydroelectric facilities. As a result, there would be a decrease in expenditures in the region under the Proposed Action relative to the No Action/No Project Alternative. As shown in Table 3.15-42, the regional economy would lose 49 jobs, $2.05 million in labor income and $5.19 million in output relative to the No Action/No Project Alternative. For reduced O&M expenditures, this analysis assumes direct effects would occur in the construction sector. Employment created in this sector could be full time or part time and include various types of jobs, such as engineer, management, and administrative jobs. Reduction of O&M associated with the Four Facilities under the Proposed Action would result in adverse, long-term economic effect on employment, labor income, and output in the regional economy relative to the No Action/No Project Alternative.

Table 3.15-42. Change in Regional Economic Effects from O&M Expenditures between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
Total effect[4]	-49	-100.0	-2.05	-100.0	-4.61	-100.0

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Mitigation spending after the deconstruction period could increase economic output, employment, and labor income in the regional economy. Mitigation costs associated with the Proposed Action are presented on an annual basis in Table 3.15-43. Spending on mitigation would occur within the region after construction is complete. Mitigation would generally include repaving roads, replanting vegetation, restoring river banks, and monitoring. Not all mitigation dollars would be spent within the region. Klamath County has highway, street, and bridge construction companies that provide asphalt and asphalt products for road construction. Siskiyou and Klamath Counties also have county road crews. Much of the roadwork could be done by local workers and businesses. Local workers could also provide much of the replanting and habitat restoration required for mitigation. The Benefit Cost and RED Technical Report (Reclamation 2012a) includes percentages of mitigation costs assumed to be spent within the region.

Table 3.15-43. Mitigation Costs by Facility and Year (2012 $) for Alternative 2, the Proposed Action

Year	J.C. Boyle	Copco 1	Copco 2	Iron Gate	City of Yreka Water Supply	Total
2018	1,770,000	0	0	2,420,000	0	4,190,000
2019	2,080,000	4,200,000	3,340,000	5,400,000	0	15,020,000
2020	3,250,000	10,000,000	960,000	5,020,000	1,000,000	20,230,000
2021	2,290,000	4,700,000	0	2,790,000	0	9,780,000
2022	280,000	0	0	390,000	0	670,000
2023	280,000	0	0	390,000	0	670,000
2024	280,000	0	0	390,000	0	670,000
2025	280,000	0	0	390,000	0	670,000

Mitigation spending would be temporary and would vary year by year from 2018-2025. Spending would increase employment, labor income and output in the region, as presented in Table 3.15-44. Approximately 220 jobs, $10 million in labor income, and

$31 million in output between the years 2018-2025 would be generated by mitigation expenditures for the Proposed Action. For mitigation expenditures, this analysis assumes direct effects would occur in the construction sector. Employment created in this sector could be full time or part time and include construction, management, administrative and other types of jobs. The Proposed Action would result in positive, temporary effects to employment, labor income, and output during the mitigation period (2018-2025) relative to the No Action/No Project Alternative.

Table 3.15-44. Regional Economic Effects from Mitigation Expenditures for Alternative 2, the Proposed Action

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	217	10.01	30.86

Source: Reclamation 2012b data presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

After construction and mitigation activities are complete, there would no longer be increased spending or employment in the region as a result of the Proposed Action. Some longer term monitoring activities would continue, but it would be substantially less than spending during the construction period. Output, employment, and labor incomes within the region would largely return to levels prior to construction. Some wholesale suppliers, retail businesses, hotels, motels, and restaurants that served the influx of construction workers would have increased profits for potential investments, but sales would return to pre-construction levels. Mitigation activities would return most resources, such as roads and public utilities, to at least pre-construction conditions.

Commercial Fishing

Increases in commercial fishing harvests would increase fishing revenues and associated jobs, labor income, and output in the regional economy. The Proposed Action would restore a more natural Klamath River flow regime and improve and expand spawning and rearing habitat for salmon on the Klamath River, which would benefit salmon populations. Commercial fishing landings would increase because of increased salmon abundance, which would increase fishing revenues. Table 3.15-45 shows projected revenue under the Proposed Action and changes in revenues under the Proposed Action relative to the No Action/No Project Alternative in each management area. The differences range from about $114,000 in KMZ-OR to $3.9 million in San Francisco (Reclamation 2012b, NOAA Fisheries Service 2012a).

Table 3.15-45. Annual Ex-vessel Revenue by Management Area (2012 dollars)

Management area	Revenue under Proposed Action ($)	Change in Revenue relative to No Action/No Project Alternative ($)
San Francisco	13,028,998	3,903,445
Fort Bragg	6,000,817	1,797,825
KMZ-CA	469,121	140,547
KMZ-OR	381,058	114,164
Central Oregon	9,775,879	2,928,821

Table 3.15-46 summarizes regional economic effects from the change in ocean commercial fishing revenue between the No Action/No Project Alternative and the Proposed Action. Additional employment would range from 11 to 218 jobs, labor income would increase between $0.06 million to $2.56 million, and output would increase from $0.13 million to $6.6 million compared to the No Action/No Project Alternative. Most employment, labor income, and output effects would occur in the agricultural sector of the regional economy. Employment created in this sector could be full time or part time and include various types of services, such as fishing, provision of fuel, bait, and ice, and other supporting jobs. Increases in fish landings and revenues under the Proposed Action would have a long term, positive impact on employment, labor income and output in the regional economy relative to the No Action/No Project Alternative.

Table 3.15-46. Change in Regional Economic Effects from Ocean Commercial Fishing between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Total Effects					
	Employment[1]		Labor income[2]		Output[3]	
Management Area	Jobs	Percent Change	$ millions	Percent Change	$ millions	Percent Change
Central Oregon	136	42.6	1.74	42	4.07	42.6
Fort Bragg	69	42.7	1.05	42.8	2.41	42.8
KMZ-CA	19	41.7	0.07	42	0.19	42.6
KMZ-OR	11	43.8	0.06	42.8	0.13	42.8
San Francisco	218	42.7	2.56	42	6.6	42.6

Source: Reclamation 2012b presented in 2012 dollars.

[1] Total Effect = Direct + Indirect + Induced Effects.
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Tables 3.15-45 and 3.15-46 pertain to effects that reflect average abundance conditions projected for the No Action/No Project Alternative and the Proposed Action. It is also important to note that the Proposed Action would reduce the incidence of low abundances and associated adverse economic impacts on the troll fishery. Specifically, low abundances are expected to occur in 66 percent fewer years under the Proposed Action relative to the No Action/No Project Alternative, with the greatest decline (-79 percent) occurring in the post-dam removal years.

Recreation

Reservoir

Dam removal would eliminate in-reservoir recreation activities, which could reduce recreational expenditures and affect employment, labor income, and output in the regional economy. Under the Proposed Action, dam removal would eliminate reservoir recreation activities in the short and long term. This analysis assumes the loss of recreation at Copco 1, Iron Gate, and J.C. Boyle Reservoirs under the Proposed Action relative to the No Action/No Project Alternative.

This analysis assumes an average annual reduction of 40,901 visits under the Proposed Action relative to the No Action/No Project Alternative. The change in average annual expenditures would be a reduction of $627,838. Table 3.15-47 summarizes results that compare expenditures under the Proposed Action relative to the No Action/No Project Alternative. Most employment, labor income, and output effects would occur in the services sector. Employment affected in this sector could be full time or part time. Lost reservoir recreation would be a long term adverse effect to the regional economy under the Proposed Action relative to the No Action/No Project Alternative.

Table 3.15-47. Change in Regional Economic Effects from Reservoir Recreation between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
Total effect[4]	-4	-57.4	-0.13	-59.1	-0.31	-56.9

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Ocean Sport Fishing

Changes to ocean sport fishing recreation opportunities could affect recreational expenditures in the regional economy. Increased salmon populations would attract more ocean recreational fishing effort, which would increase spending in the regional

economy. Table 3.15-48 summarizes annual salmon fishing effort (in total and by nonresident anglers) and nonresident angler expenditures for the Proposed Action (Reclamation 2012b, NOAA Fisheries Service 2012h).

Table 3.15-48. Total Annual Recreational Salmon Effort, Nonresident Effort and Nonresident Expenditures by Fishing Mode and Management Area for Alternative 2, the Proposed Action

Management area	Angler days total		Angler days nonresident		Expenditures nonresident (2012 dollars)	
	Party/charter	Private	Party/charter	Private	Party/charter	Private
KMZ-CA	2,378	33,650	2,197	17,027	448,034	953,512
KMZ-OR	545	20,407	281	4,673	57,304	261,688

Table 3.15-49 summarizes regional economic effects of ocean sport fishing in the KMZ under the Proposed Action relative to the No Action/No Project Alternative. The Proposed Action would support and increase in regional activity because of increased angler expenditures. Most employment, labor income, and output effects associated with ocean sport fishing would occur in the services sector. Employment created in this sector could be full time or part time. Recreational expenditures for ocean sport fishing would increase under the Proposed Action relative to the No Action/No Project Alternative, which would increase employment, labor income and output in the region. Effects would be long term.

Table 3.15-49. Change in Regional Economic Effects from Ocean Sport Salmon Fishing between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Total Effects[1]					
	Employment[2]		Labor income[3]		Output[4]	
Management Area	Jobs	Percent change from No Action	$ millions	Percent change from No Action	$ millions	Percent change from No Action
KMZ-CA	5.5	42.3	0.18	42.8	0.48	42.8
KMZ-OR	1.2	41.4	0.02	42.7	0.09	42.7

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Tables 3.15-48 and 3.15-49 pertain to effects that reflect average abundance conditions projected for the No Action/No Project Alternative and the Proposed Action. It is also important to note that low abundances (and associated adverse economic impacts on the ocean recreational fishery) are expected to occur in 66 percent fewer years under the Proposed Action relative to the No Action/No Project Alternative, with the greatest decline (-79 percent) occurring in the post-dam removal years.

In-River Sport Fishing

Changes to in-river sport fishing opportunities associated with dam removal could affect recreational expenditures in the local economy. Annual salmon fishing effort on the Klamath River is estimated at 26,578 angler days under the Proposed Action. The portion of this effort attributable to nonresident anglers is 17,036 angler days. Expenditures in the region by nonresident anglers are estimated at $1.789 million (2012 dollars). The annual increase in nonresident expenditures under the Proposed Action relative to Alternative would be $127,000. Table 3.15-50 summarizes increased economic activity supported by the Proposed Action relative to the No Action/No Project Alternative (Reclamation 2012b, NOAA Fisheries Service 2012g).

Table 3.15-50. Change in Regional Economic Effects from In-river Salmon Fishing between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	Percent change from No Action	$ millions	Percent change from No Action	$ millions	Percent change from No Action
Total effect[4]	2.6	7.6	0.07	7.7	0.15	7.7

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects
Values do not include the contribution of any increase in steelhead and redband fishing under the Proposed Action due to lack of quantitative data.

Table 3.15-50 pertains to effects that reflect average abundance conditions projected for the No Action/No Project Alternative and the Proposed Action. It is also important to note that low abundances (and associated adverse economic impacts on the in-river recreational fishery) are expected to occur in 66 percent fewer years under the Proposed Action relative to the No Action/No Project Alternative, with the greatest decline (-79 percent) occurring in the post-dam removal years.

The Proposed Action would result in increased numbers of steelhead spawners and provide conditions conducive to establishment of a steelhead fishery above Iron Gate Dam (Hamilton et al. 2010). However, because these changes were not quantified, it is

not possible to quantify the effects of the Proposed Action on the steelhead fishery. However, expansion of that fishery would likely generate additional expenditures, jobs, labor income, and output in the regional economy.

The Proposed Action would result in increased abundance and distribution of redband trout in Upper Klamath Lake and its tributaries and a potential seven-fold expansion of the fishery below Keno Dam (Buchanan et al. 2011). The effects of this increase could not be quantified with available data but would likely yield a notable increase in economic impacts, given the size of the potential increase in the fishery noted.

Most employment, labor income, and output effects associated with in-river sport fishing would occur in the services sector. Employment created in this sector could be full time or part time. In conclusion, employment, labor income and output in the regional economy would increase as a result of increased in-river fishing expenditures under the Proposed Action relative to the No Action/No Project Alternative. Effects would be long term.

Whitewater Boating

*Changes to whitewater boating recreation opportunities associated with dam removal could affect recreational expenditures, employment, labor income and output in the regional economy***.** The primary area of whitewater boating on the upper Klamath River occurs on the Hell's Corner Reach, which is heavily dependent on releases from the J.C. Boyle Dam to provide sufficient and predictable whitewater flows. The lower Klamath River is not dependant on reservoir releases to maintain sufficient whitewater flow, and hydrologic modeling indicated that the average number of days with acceptable flow conditions suitable for whitewater boating on the lower Klamath River would not be impacted by dam removal (see Section 3.20, Recreation).

On the upper Klamath River, the average number of days with acceptable flow conditions for whitewater boating in the Hell's Corner Reach would decrease under the Proposed Action. The Hell's Corner Reach is somewhat unique in the project area in that it provides Class V rapids during the late summer months. Analysis of predicted hydrology modeling shows that the average number days with acceptable flows for primarily commercial whitewater boating on the Hell's Corner Reach are estimated to decline by 47.3 percent during the five month period from May through September (months when the majority of whitewater boating activity occurs annually) and decline by 29.5, 36.4, and 88.2 percent in June, July and August, respectively, relative to the No Action/No Project Alternative. In terms of private whitewater boating use on the Hell's Corner Reach, the predicted hydrology modeling shows that the average number days with acceptable flows are estimated to decline by 35.6 percent during the five month period from May through September and decline by 16.1, 49.4, and 57.8 percent in June, July and August, respectively, relative to the No Action/No Project Alternative. The combination of the decline in the number of days with acceptable flows, particularly during the three months when most of the use is observed (June, July, and August), and the lack of consistency and predictability of days with acceptable flows could make it more challenging for outfitters to continue offering trips for this reach of the Upper

Klamath River in the future, and to a lesser extent also make it more challenging for private users to engage in whitewater boating activities. Therefore, it is assumed whitewater boating activity on the upper Klamath River would be negatively affected under the Proposed Action for the long term.

The economic analysis for the lower Klamath River assumes that there would not be a measurable change in visitation levels for whitewater boating on the lower Klamath River after dam removal. Whitewater boaters would continue to spend money in the local economy. Expenditures would be similar to existing levels described for the No Action/No Project Alternative.

Table 3.15-51 summarizes estimates of the changes in whitewater boating recreation regional economic activity for the Proposed Action compared to the No Action/No Project Alternative. The loss of whitewater boating activity on the upper Klamath River (primarily the Hell's Corner Reach) would result in losses in expenditures and regional economic activity in the local region as compared to the No Action/No Project Alternative. Annual losses would begin in 2020. The difference in total average annual user days between the Proposed Action and the No Action/No Project Alternative was estimated at 2,706 user days. The difference in average annual lost expenditures between the Proposed Action and the No Action/No Project Alternative was estimated as $701,170. Most employment, labor income, and output effects associated with whitewater boating would occur in the services sector. Employment created in this sector could be full time or part time. Reduced whitewater boating expenditures would result in long term adverse effects to the regional economy under the Proposed Action relative to the No Action/No Project Alternative.

Table 3.15-51. Change in Regional Economic Effects from Whitewater Recreation between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
Total effect[4]	-14	-25.2	-0.43	-27.6	-0.89	-20.6

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Indian Tribes

Dam removal would increase fish harvest for subsistence, cultural practices and commercial uses that would be beneficial to Indian Tribes residing on the Klamath River (excluding the Hoopa Valley Tribe, who reside on the Trinity River. Tribal harvest

opportunities for Chinook, Pacific lamprey and steelhead are expected to increase in varying degrees under the Proposed Action relative to the No Action/No Project Alternative. Removal of the reservoirs behind the dams would reduce or eliminate the incidence of late-summer, toxigenic phytoplankton blooms that have prompted postings of public health advisories in the Hydroelectric Reach and further downstream on the Klamath River. These water quality improvements would have beneficial effects on tribal cultural practices in the affected areas. The information contained in this section is taken directly from Reclamation (2012b) and NOAA Fisheries Service (2012b-f).

The Klamath Tribes

The return of Chinook salmon to the Upper Basin (even in small numbers) would have great cultural significance for the Klamath Tribes, who have not experienced Chinook salmon in the Upper Klamath Basin for almost a century. Spring Chinook salmon is of particular importance, as it would allow for the revival of the First Salmon Ceremony. Should spring-run Chinook salmon become sufficiently abundant to support subsistence, it would also lengthen the duration of the seasonal round for salmon. Opportunities for subsistence harvest of suckers (which has not occurred since 1986) and redband trout are also likely to increase over the long term.

Benefits to be derived from this increased access to fish would include greater social and cultural cohesion associated with harvesting activities and associated ceremonies, greater opportunity to transmit cultural values and practices to the younger generation, and greater ability to provide food security, care for elders in the community, and engage in trade and barter. Poverty and rural isolation have constrained the ability of tribal members to replace fish with healthy food alternatives. Improved fishing opportunities would increase opportunities for healthy food consumption.

Karuk Tribe

Fish population effects would provide greater opportunities for the Karuk Tribe to engage in subsistence fishing and associated cultural practices (e.g., sharing fish with elders, transmitting values to the next generation, trade and barter). Spring-run Chinook salmon is of particular importance, as it could lead to revival of the traditional First Salmon Ceremony in the spring. Also, spring-run Chinook salmon are highly desirable for their fat content and would provide quality benefits to the subsistence fishery and lengthen the duration of the seasonal round for salmon. Improved fishing opportunities would increase opportunities for healthy food consumption. Late-summer water quality improvements associated with dissipation of toxigenic phytoplankton blooms would provide healthier conditions for ceremonies and other cultural practices that involve water contact (e.g., gathering of basket materials).

Resighini Rancheria

The Proposed Action may yield benefits to Resighini Rancheria members in terms of improved access to salmonids and other fish (through fishing and trade and barter). Improved fishing opportunities would increase opportunities for healthy food

consumption. Also, given their current dedication to attending ceremonies, it is likely that the Resighini would welcome a revival of the First Salmon Ceremony that may accompany improvements in the status of spring-run Chinook salmon. Late-summer water quality improvements associated with dissipation of toxigenic phytoplankton blooms would provide healthier conditions for ceremonies and other cultural practices that involve water contact (e.g., gathering of basket materials).

Yurok Tribe

Fish population effects would provide greater opportunities for the Yurok Tribe to engage in subsistence and commercial fishing and associated cultural practices (e.g., sharing of fish with elders, transmitting values to the next generation, trade and barter). Spring-run Chinook salmon is of particular importance and would allow for revival of the First Salmon Ceremony. Also, spring-run Chinook salmon are highly desirable for their fat content and would provide quality benefits to the subsistence and commercial fisheries and lengthen the duration of the seasonal round for salmon. The tribal guide fishery would benefit and also bring additional money into the community. Improved fishing opportunities would increase opportunities for healthy food consumption. Late-summer water quality improvements associated with dissipation of toxigenic phytoplankton blooms would provide healthier conditions for ceremonies and other cultural practices that involve water contact (e.g., gathering of basket materials).

Hoopa Valley Tribe

Demand for water exports from the Klamath and Trinity Rivers originates from two separate sources: the Reclamation's Klamath Project in the case of the Klamath River, and the Central Valley Project's Trinity River Division in the case of the Trinity River. Anadromous fish that return to the Trinity River are generally distinct from fish that return to the Klamath River, although Trinity River fish must first pass through 42 miles of the Klamath River before reaching the Trinity River.

To the extent that dam removal activities cause sedimentation in areas below the confluence with the Trinity River, such activities may adversely affect Trinity River fish and fisheries (including Hupa fisheries); however, these effects are expected to be short lived (Close *et al.* 2010, Dunne *et al.* 2011, Goodman *et al.* 2011). Potential long-term benefits to anadromous Klamath River fish populations associated with dam removal are likely to have little effect on Trinity River (including Hupa) fisheries, as beneficiaries of those actions are stocks that return to the Klamath River rather than the Trinity River.

Effects of implementation of the KBRA Tribal Program are described below in the section KBRA Effects.

PacifiCorp Hydroelectric Service

Removal of the Four Facilities could result in increased energy rates for PacifiCorp customers. PacifiCorp has added an approximately 2 percent surcharge to customer rates

in Oregon and California to cover costs of dam removal. Under the Klamath Hydroelectric Settlement Agreement (KHSA), ratepayer liability is capped at $200 million, prorated between PacifiCorp's customers in Oregon (up to $184 million) and California (up to $16 million). The OPUC and CPUC issued rulings that approved dam removal surcharges for PacifiCorp customers in Oregon and California (OPUC 2010, CPUC 2011). Under the Proposed Action, customer rates would not likely increase above the existing surcharges as a direct result of dam removal costs.

Property Values and Local Government Revenues

Removal of the Four Facilities could affect property values of parcels near Copco 1 and Iron Gate Reservoirs. Private parcels with partial reservoir views, frontage/access or with river views subsequent to the action could be affected by the Proposed Action.

To address issues specific to the Proposed Action, the two valuation impact studies for private parcels at Copco 1 and Iron Gate reservoirs were completed, one in March 2011 (Bender Rosenthal Inc. 2011) and a second in June 2012 (Bender Rosenthal Inc. 2012). The studies looked at three baseline dates of property values; the June 2012 study reported on December 2004 and December 2006 dates of value and the March 2011 study reported on an April 2008 date of value.

The studies included private parcels with reservoir views of Iron Gate Reservoir and private parcels with reservoir views and frontage on Copco 1 Reservoir. These two groups of properties could be affected by dam removal due to a change in either reservoir view or frontage after the dams are removed. Parcels were excluded from the initial list of potentially impacted properties if they were (1) publicly owned; (2) PacifiCorp owned; (3) had no assessed value; (4) in an area influenced by river (i.e., had river views prior to dam removal, and would therefore not be impacted by losing a reservoir view); and/or, (5) above the reservoir ridge (i.e., too far from the reservoirs to be affected by dam removal). Based on these criteria, the study identified 1,467 parcels that potentially could be affected by the removal of Iron Gate and Copco 1 reservoirs (Bender Rosenthal Inc. 2011). Of the 1,467 parcels, about 46 percent (668) were determined to have a measurable effect from dam removal. Parcels determined not to have a measurable impact from dam removal included those that were larger than 50 acres, located east of Copco Bridge (i.e., parcels with river frontage under existing conditions), determined unbuildable, or had no view of the reservoirs. Table 3.15-52 shows potentially affected private parcels by land use category. A majority of the applicable private parcels are vacant residential land and single-family residential. The assessed land value of the potentially affected parcels was about $9.0 million (Bender Rosenthal Inc. 2011).

Table 3.15-52. Evaluated Parcels by Land Use in Siskiyou County

Land Use Category	Private Parcels in Iron Gate and Copco Neighborhoods[1] (<50 acres)	Potentially Affected Parcels
Agricultural	7	0
Commercial	5	5
Rural Single-Family Residential[1]	3	0
Rural[1]	5	3
Single-Family Residential	163	127
Timber	1	0
Vacant Commercial	4	2
Vacant Residential Land[2]	1,246	518
Vacant Rural Land[3]	33	13
Total Parcels	1,467	668

Source: Bender Rosenthal Inc. 2011

1. Compiled based on a inspection of the general area, aerial mapping, conversations with a Siskiyou County appraiser, and with broker/agents in the area
2. Topography of the impacted parcels is varying, but a heavily sloped lot may increase the cost of development, but does not prevent development
3. 20 acre minimum

While the Bender Rosenthal Inc. reports (2011, 2012) used data from individual parcels, the appraisal was completed for groups of parcels based on common attributes and/or physical characteristics. Parcels were grouped according to water-frontage, access (property access by paved road as well as to utilities), and location. To evaluate the impact of dam removal on private properties around Iron Gate and Copco 1 reservoirs, this study used a before dam removal condition and a hypothetical after dam removal condition. The after dam removal condition assumed that the dams were removed and the river had returned to its original channel with the land under the reservoirs restored to its native condition. It is anticipated that land values would reach a low point soon after the reservoirs were drained and that they would progressively increase in value over time until the terraces above the river are revegetated and the river channel is fully recovered. The differences in land value through time in this interim period could not be quantified, and the amount of time it would take for a fully recovered river channel to develop is unknown, but would likely take years.

The valuation assessment considered reservoir frontage in the before dam removal condition to change to river view in the after dam removal condition. Similarly, reservoir view in the before dam removal condition was assumed to change to no reservoir view or river view in the after dam removal condition. Each of these comparisons was completed for 2004, 2006, and 2008. The study identified a discount in land value based on reservoir view to no view and reservoir frontage to river view. However there was only a very limited amount of data for the three years examined.

Riverine water quality improvements are likely to have little effect on the value of reservoir parcels, which are not generally expected to become riverfront properties after dam removal. Available data are insufficient to quantify such short- and long-term effects. Riverine parcels in areas downstream from Iron Gate Dam that experience detectable improvements in water quality and/or fish availability may experience positive changes in value. However, available data are insufficient to quantify such effects (DOI 2012a).

Reservoir real estate values are expected to decline in the short term due to adverse landscape changes associated with dam removal. This loss in value may be partially offset over the long term as barren landscape becomes revegetated open space. However, some of this loss would be permanent as a shift from reservoir view to no view or from reservoir frontage to river view would make a parcel less desirable.

Changes in real estate values around Copco 1 and Iron Gate Reservoirs and downstream from Iron Gate Dam could affect property tax revenues to Siskiyou County. In the short term, if reservoir property values decline, there could be adverse effects on property tax revenues to Siskiyou County. In the long term, if some reservoir land values permanently decline, Siskiyou County property tax revenues might decline relative to the No Action/No Project Alternative, assuming nothing else changes that might impact property tax revenues (e.g., tax rates). If riverine property values downstream from Iron Gate Dam increase in the long term, tax revenues to Siskiyou County could increase and at least partially offset the loss of tax revenues associated with the decline in reservoir property values. Effects on property values are uncertain in the long term; therefore, it is unknown how property tax revenues would be affected.

Removal of the Four Facilities could affect property tax revenues to Siskiyou and Klamath Counties from PacifiCorp. PacifiCorp owns property around the reservoirs and pays property taxes annually to Siskiyou and Klamath Counties. PacifiCorp pays in the range of $290,000 to $305,000 in property taxes on land attributable to hydroelectric facilities at Copco and Iron Gate Dams and about $132,000 in property taxes for land attributable to hydroelectric facilities at J.C. Boyle Dam. Under the Proposed Action, the States would assume ownership of these lands and PacifiCorp would not pay property taxes on the relinquished land to the counties.

The States of California and Oregon would pay in-lieu payments on the transferred land. In California, in-lieu fees would be equivalent to the current assessment paid by PacifiCorp for hydroelectric properties, as required by California Fish and Game Code Section 1504. To make in-lieu payments to counties, the California legislature has to authorize payments. It is unknown if the California legislature would authorize payments in future years. Lost tax revenues to Siskiyou County would be an adverse economic effect. Similar to California, Oregon law (State Wildlife Fund Section 496.340) requires the State to pay the current assessed value on transferred lands. The State Department of Revenue can review and revise assessed values if it is determined substantially incorrect.

The loss in tax revenue from PacifiCorp owned lands would impact the regional economy. However, if Siskiyou and Klamath Counties receive in-lieu payments of equal value to PacifiCorp property tax payment, there would be no net effect to county revenues under the Proposed Action relative to the No Action/No Project Alternative.

Construction worker spending could increase sales and use tax receipts in Siskiyou and Klamath Counties. Construction crews for dam removal in Siskiyou County would purchase goods and services from local restaurants and stores, which would increase sales tax revenues for the county. Sales and use tax revenues are an important receipt for Siskiyou County to fund general government, health, and social programs. In 2010, sales tax in Siskiyou County was 8.25 percent (BOE 2010a). Some workers that are brought to the area would stay in hotels, motels, or campgrounds, which could also produce additional sales tax for the county. For workers staying in hotels or motels, the county could receive additional hotel-motel tax. From 2000 through 2010, hotel-motel tax made up an average of 2.7 percent of Siskiyou County tax receipts. As a result of construction worker spending, county tax revenues would increase during the construction period. Oregon has a hotel-motel tax but does not have a general sales tax, so effects on tax receipts would be more limited in Klamath County. Construction worker spending would be a temporary and positive effect to Siskiyou County and to a lesser extent Klamath County under the Proposed Action relative to the No Action/No Project Alternative.

Changes in visitation for recreation activities could affect sales tax revenues. Similar to construction worker spending, increased visitation to the counties offering recreation activities would increase sale tax revenues within the counties. Any adverse effects on visitation expenditures would decrease sales tax revenues. Changes in sales tax revenues would affect funding for county programs, such as health, education, social services and other programs funded through sales taxes. For increases in in-river recreation activities and ocean fishing, increases in sales tax revenues would be a long-term and positive effect. Decreases in reservoir recreation in Siskiyou County could reduce sales tax revenues, which would be a long-term and adverse effect of the Proposed Action relative to the No Action/No Project Alternative. Reductions in whitewater boating expenditures would also be a long term, adverse effect to county sales tax. The net effect to sales tax revenues from changes in recreation expenditures is unknown.

East and Westside Facilities – Programmatic Measures

Decommissioning of the East and Westside facilities could result in economic effects. Minor construction would be required to decommission the facilities; therefore, there would not likely be any regional economic effects. PacifiCorp would no longer need to operate the facilities, which would reduce some employee hours required for operations and maintenance. This would not be a substantial effect. Effects as a result of lost hydropower are discussed in Section 3.18.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Construction activities associated with the City of Yreka Water Supply Pipeline could increase economic output, employment, and labor income during the construction period in Siskiyou County. Construction of the City of Yreka Water Supply Pipeline would

temporarily increase employment, labor income and output in Siskiyou County. Local construction firms would likely have the skills available for this construction effort; therefore, the majority of the regional economic effects would occur in the county. Increased employment and spending would have secondary impacts as inputs are purchased locally and construction workers spend a portion of their income in the region. This would be a temporary effect.

KBRA – Programmatic Measures

The KBRA has several programs that could have socioeconomic effects. Specific KBRA programs potentially affecting socioeconomics include:

- Phases I and II Fisheries Restoration Plans
- Fisheries Monitoring Plan
- Fisheries Reintroduction and Management Plan
- Agency Lake and Barnes Ranches
- Wood River Wetland Restoration
- Water Diversion Limitations
- On-Project Plan
- Future Storage Opportunities
- Water Use Retirement Program
- Power for Water Management
- Off-Project Water Settlement
- Off-Project Water Reliance Program
- Emergency Response Plan
- Climate Change Assessment and Adaptive Management
- Interim Flow and Lake Level Program
- Fish Entrainment Reduction
- Upper Klamath Lake and Keno Nutrient Reduction
- Tribal Fisheries and Conservation Management Program
- Tribal Programs Economic Revitalization
- Klamath River Tribes Interim Fishing Site
- Mazama Forest Project
- Klamath County Economic Development Plan
- California Water Bond Legislation
- Drought Plan

Fisheries Program

Fish habitat restoration for the Fisheries Program could affect employment, labor income, and output in the regional economy. The KBRA includes fishery restoration, reintroduction and monitoring actions in the Upper and Lower Basin. Restoration activities would involve some degree of construction including floodplain rehabilitation, large woody debris placement/replacement, fish passage correction, cattle exclusion fencing, and riparian vegetation planting. It is likely that much of the construction could

be done by local construction workers from the region. The KBRA also includes construction of new fish facilities, which may require more out of region contractors. State and local government workers in the region would likely implement many actions, including monitoring and administration. KBRA actions would provide new jobs and increase labor income within the region during the implementation period. Table 3.15-53 summarizes regional economic effects from implementation of the Fishery Program actions under the KBRA relative to the No Action/No Project Alternative. These effects are incremental to base funding being implemented under the No Action/No Project Alternative. Effects are based on funding levels identified by Federal agencies in a revised Table C-2 of the KBRA. Effects would occur over the KBRA implementation period (2012-2026) and would vary year-by-year proportionate to actual expenditures. Some actions would be completed in less than 15 years. Table C-2 (included in Appendix P) identified the timeline for action implementation.

Implementation of Fishery Program actions would increase employment, labor income, and output in the regional economy relative to the No Action/No Project Alternative. Effects would only last during the implementation period for each action. The increases in employment, labor income, and output in the regional economy generated by Fishery Program actions would add to economic effects generated by hydroelectric facility removal that are analyzed above during the years that the project implementation overlaps.

In the long term, the Fisheries Program could support increased fish abundance in the Klamath River and tributaries and improve regional economic conditions. The increased abundance could allow for increased catch limits and fewer catch-and-release requirements, and could decrease the potential for closures of entire fishing seasons. This would attract anglers to the region and increase economic activity. An increase in fish abundance would generate additional jobs, labor income and output and would be a long-term and positive economic effect. The increases in fish abundance generated by Fishery Program actions would be expected to build upon the fish abundance improvements generated by hydroelectric facility removal that are analyzed above.

Water Resource Program

Construction, analysis, and monitoring activities under the Water Resources Program could affect employment, labor income, and output in the regional economy. The KBRA includes water resource actions to improve water supply reliability in Reclamation's Klamath Project. Actions include monitoring, analysis, and construction. It is likely that much of the construction could be done by local construction workers from the region. State and local government workers in the region would likely implement many actions, including monitoring, analysis, and administration. KBRA actions would provide new jobs and increase labor income within the region during the implementation period. Table 3.15-54 summarizes regional economic effects from implementation of the Water Resources Program actions under the KBRA relative to the No Action/No Project Alternative. Some actions could affect irrigated agriculture or refuge recreation; these programs are evaluated below.

Table 3.15-53. Regional Economic Effects of KBRA Fishery Program Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (does not include Base Funds)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
1	Coordination and Oversight	$117	3	$90	$142
2	Planning & Implementation--Phase I and II Restoration Plans	$1,211	20	$918	$1,456
3	Williamson River aquatic habitat restoration	$890	12	$568	$1,258
4	Sprague River aquatic habitat restoration	$41,994	546	$26,206	$60,228
5	Wood River Valley aquatic habitat restoration	$10,777	136	$6,476	$15,892
6	Williamson Sprague Wood Screening Diversion	$2,232	28	$1,334	$3,306
7	Williamson & Sprague USFS uplands	$4,886	64	$3,049	$7,007
8	Upper Klamath Lake aquatic habitat restoration	$10,785	134	$6,365	$16,105
9	Screening of UKL pumps	$425	6	$255	$632
10	UKL watershed USFS uplands	$1,641	23	$1,024	$2,354
11	Keno Impoundment/Lake Ewauna water quality studies & remediation actions	$29,647	366	$17,443	$44,360
12	Keno Impoundment/Lake Ewauna wetlands restoration	$1,008	13	$594	$1,508
13	Keno to Iron Gate upland private & BLM	$0	0	$0	$0
14	Keno to Iron Gate upland USFS	$713	10	$440	$1,036
15	Keno to Iron Gate mainstem restoration	$951	13	$620	$1,321
16	Keno to Iron Gate tributaries - diversions & riparian	$1,141	16	$744	$1,585
17	Shasta River aquatic habitat restoration	$0	0	$0	$0
18	Shasta River USFS uplands	$0	0	$0	$0
19	Scott River aquatic habitat restoration	$0	0	$0	$0
20	Scott River USFS uplands	$460	6	$284	$668
21	Scott River private uplands	$0	0	$0	$0
22	Mid Klamath River & tributaries aquatic habitat restoration	$0	0	$0	$0
23	Mid Klamath tributaries USFS upland	$4,574	59	$2,815	$6,631
24	Mid Klamath tributaries private upland	$1,887	25	$1,162	$2,736
25	Lower Klamath River & tributaries aquatic habitat restoration	$0	0	$0	$0
26	Lower Klamath private uplands	$25,428	326	$15,641	$36,863
27	Salmon River aquatic habitat restoration	$1,959	26	$1,206	$2,840
28	Salmon River USFS upland	$2,701	35	$1,662	$3,916
29	Reintroduction Plan	$1,631	26	$1,236	$1,960
30	Collection Facility	$6,014	78	$3,700	$8,719
31	Production Facility	$6,113	79	$3,762	$8,865

Table 3.15-53. Regional Economic Effects of KBRA Fishery Program Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (does not include Base Funds)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
32	Acclimation Facility	$4,709	61	$2,898	$6,827
33	Transport	$826	13	$627	$994
34	Monitoring and Evaluation – Oregon	$29,828	461	$22,601	$35,828
35	Monitoring and Evaluation – California	$2,995	47	$2,270	$3,599
36	New Hatchery	$5,546	72	$3,412	$8,041
37	Adult Salmonids	$9,952	154	$7,542	$11,954
38	Juvenile Salmonids	$14,630	227	$11,086	$17,573
39	Genetics Otololith	$0	0	$0	$0
40	Hatchery Tagging	$0	0	$0	$0
41	Disease	$5,214	82	$3,952	$6,264
42	Green Sturgeon	$0	0	$0	$0
43	Lamprey	$1,837	29	$1,393	$2,208
44	Geomorphology	$1,608	26	$1,219	$1,933
45	Habitat Monitoring	$2,641	42	$2,002	$3,173
46	Water Quality	$86	2	$65	$110
47	UKL bloom dynamics	$0	0	$0	$0
48	UKL water quality/phytoplankton/zooplankton	$4,143	68	$3,153	$5,324
49	UKL internal load/bloom dynamics	$1,244	21	$947	$1,599
50	UKL external nutrient loading	$3,881	64	$2,952	$4,985
51	UKL analysis of long-term data sets	$652	11	$497	$838
52	UKL listed suckers	$4,331	71	$3,294	$5,564
53	Tributaries water quality/nutrients/sediment	$4,718	77	$3,589	$6,061
54	Tributaries geomorphology/riparian vegetation	$3,637	60	$2,767	$4,672
55	Tributaries physical habitat	$3,241	53	$2,466	$4,164
56	Tributaries listed suckers	$4,777	77	$3,634	$6,136
57	Keno Impoundment/Lake Ewauna water quality/algae/nutrients	$6,048	99	$4,601	$7,770
58	Keno Impoundment/Lake Ewauna to Tributaries: Meteorology (weather stations)	$3,044	50	$2,316	$3,911
59	Remote Sensing acquisition and analysis	--	No in-region spending, no regional economic effects		

Source: Barry 2011; Bird 2011; Hicks 2011; Mahan 2011; Nota 2011; Radford 2011; Stopher 2011; Wise 2011
2012 dollars as estimated using IMPLAN
UKL: Upper Klamath Lake
USFS: United States Forest Service
BLM: Bureau of Land Management
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Table 3.15-54. Regional Economic Effects of KBRA Water Resources Program Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (not including base funding)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
60	Keno Dam fish passage	--	No in-region spending, no regional economic effects		
61	Data Analysis and evaluation	$168	3	$126	$197
62	Development of predictive techniques	$391	7	$298	$471
63	Klamath Basin Wildlife Refuges: O&M North and P Canals	--	No funding identified in C2		
64	Klamath Basin Wildlife Refuges: Walking Wetland Construction	$2,500	40	$1,955	$3,799
65	Klamath Basin Wildlife Refuges: Big Pond Dike Construction	--	No funding identified in C2		
66	On Project water plan	--	Evaluated in Irrigated Agriculture		
67	Ground Water Technical Investigation	--	No in-region spending, no regional economic effects		
68	Costs Associated with Remedy for Adverse Impact	--	No funding identified in C2		
69	D Pumping Plant	--	Transfer of funds, no regional economic effects		
70	Water Use Retirement Plan	$0	Evaluated in Irrigated Agriculture		
71	Off Project Plan and Program: Use of 30,000 ac ft above UKL	$0	Evaluated in Irrigated Agriculture		
72	Interim Power Sustainability	$0	Evaluated in Irrigated Agriculture		
73	Federal Power	--	Transfer of funds, no regional economic effects		
74	Energy Efficiency and Renewable Resources	$4,402	54	$2,278	$6,211
75	Renewable Power Program Financial and Engineering Plan	--	No in-region spending, no regional economic effects		
76	UKL Wetlands Restoration: Agency/Barnes	$2,717	34	$1,576	$4,108
77	UKL Wetlands Restoration: Wood River	$2,717	34	$1,576	$4,108
78	Drought Plan Development	--	No funding identified in C2		
79	Drought Plan Restoration Agreement Fund	--	Evaluated in Irrigated Agriculture		
80	Emergency Response Plan	--	No funding identified in C2		
81	Emergency Response Fund	--	No funding identified in C2		
82	Technical Assessment of Climate Change	--	No in-region spending, no regional economic effects		
83	Off-Project Reliance Program	--	Evaluated in Irrigated Agriculture		
84	Real Time Water Management	--	No funding identified in C2		
85	Real Time Water Management: Water Flow Monitoring and Gauges	$3,239	51	$2,455	$3,892
86	Snowpack Gauges	--	No funding identified in C2		

Table 3.15-54. Regional Economic Effects of KBRA Water Resources Program Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (not including base funding)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
87	Adaptive Management: Science and Analysis	$1,087	17	$824	$1,307
88	Real Time Management: Calibration and improvements to KLAMSIM or other modeling and predictions	$109	3	$84	$131
89	Interim Flow and Lake Level Program	--	Evaluated in Irrigated Agriculture		

Source: Barry 2011; Hicks 2011
2012 dollars as estimated using IMPLAN
UKL: Upper Klamath Lake
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Regional economic effects would be in addition to base funding being implemented under the No Action/No Project Alternative. Effects are based on funding levels identified by Federal agencies in a revised Table C-2 of the KBRA. Effects would occur over the KBRA implementation period (2012-2026) and would vary year-by-year proportionate to actual expenditures. Some actions would be completed in less than 15 years.

Implementation of Water Resource Program actions would increase employment, labor income, and output in the regional economy relative to the No Action/No Project Alternative. Effects would only last during the implementation period. The increases in employment, labor income, and output in the regional economy generated by Water Resource actions would add to economic effects generated by hydroelectric facility removal that are analyzed above during the years that the project implementation overlaps.

Irrigated Agriculture

Changes in the Reclamation's Klamath Project hydrology could affect gross farm revenue and the regional economy. Model results indicated gross farm revenue would be equal in all years under the Proposed Action relative to the No Action/No Project Alternative except for five drought years 2027, 2043, 2045, 2051, and 2059 which correspond to the years 1975, 1992, 1994, 2001, and 2008 in the historical period of record. For the five drought years 2027, 2043, 2045, 2051, and 2059, the gross farm revenue increased under the Proposed Action from the No Action/No Project Alternative. Table 3.15-55 shows gross farm revenue under the Proposed Action and the change relative to the No Action/No Project Alternative. For all drought years, regional

employment, labor income and output increase over the No Action/No Project Alternative, shown in Table 3.15-56. This would be a long term, positive effect of the Proposed Action relative to the No Action/No Project Alternative. The increases in gross farm revenue and output in the regional economy would change hydroelectric facility removal effects because facility removal does not affect irrigated agriculture.

Table 3.15-55. Gross Farm Revenue by IMPLAN crop sectors between the No Action/No Project Alternative and Alternative 2, the Proposed Action for Drought Years (1,000 $)

Drought Years	Grains		Vegetables		Other (Hay & Pasture)		Total	
	Proposed Action	Change from No Action	Proposed Action	Change from No Action	Proposed Action	Change from No Action	Proposed Action	Change from No Action
2027	21,857	2,667	60,993	319	65,688	7,301	148,537	10,287
2043	21,664	17,145	60,966	5,000	64,439	36,798	147,069	58,944
2045	21,857	10,394	60,993	2,432	65,688	18,438	148,537	31,263
2052	21,857	4,779	60,993	866	65,688	9,872	148,537	15,517
2059	21,857	1,556	60,993	203	65,688	5,231	148,537	6,990

Source: KB_HEM estimated gross farm revenue by IMPLAN crop sectors as cited in Reclamation 2012c.

Table 3.15-56. Change in Regional Economic Effects from Gross Farm Revenue between the No Action/No Project Alternative and Alternative 2, the Proposed Action

Modeled Drought Years	Total Effects[1]					
	Employment[2]		Labor income[3]		Output[4]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
2027	112	8.2	2.3	5.2	13.0	7.3
2043	695	90.6	11.2	33.8	84.0	71.4
2045	397	36.9	7.3	18.1	41.0	26.0
2052	187	14.5	3.6	8.1	20.0	11.4
2059	70	5.0	1.6	3.5	9.0	4.8

Source: Reclamation 2012c data presented in 2012 dollars.
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Increases in on-farm pumping costs could affect household income and reduce employment, labor income, and output in the regional economy. Regional employment, labor income, and output under the Proposed Action are equal to the No Action/No Project Alternative in all non-drought years. The regional effects are the same in all drought years due to ground water substitution. Irrigators are pumping more ground water in the Proposed Action compared to No Action/No Project Alternative and therefore are paying more for electricity under the Proposed Action even with a decrease in electricity rates assumed in the Proposed Action (Reclamation 2012a and Reclamation 2012c). The average annual cost of pumping ground water would be $178,000 per year.

Table 3.15-57 shows the regional economic effects as result of increased pumping costs. Because farmers are paying more for electricity to pump ground water under the Proposed Action household income would reduce by the additional money spent to pump ground water. A reduced household income due to increased pumping costs would have a relatively small negative impact on the regional economy. The increased pumping costs under the Proposed Action would not change effects of hydroelectric facility removal because facility removal does not affect irrigated agriculture.

Table 3.15-57. Change in Regional Economic Effects from Increased Pumping Costs between the No Action/No Project Alternative and Alternative 2, the Proposed Action

Impact type	Employment[1] (Jobs)	Labor income[2] ($)	Output[3] ($)
Total effect[4]	-1	-40,907	-120,933

Source: Reclamation 2012b data presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Water acquisitions via permanent, voluntary water rights sales could affect farm revenues and reduce employment, labor income, and output in the regional economy. The water acquisition programs, including the Water Use Retirement Program (WURP) and the Off-Project Reliance programs, could result in a negative regional impact. WURP would be implemented to generate on an average annual basis an additional 30,000 acre-feet of inflow to Upper Klamath Lake. The KBRA states that WURP would provide for increased stream flow and inflow into Upper Klamath Lake through actions that could include the voluntary retirement of water rights or water uses. The KBRA states that "acquisition of water rights or uses to achieve the WURP purpose will be compensated, as applicable, through market mechanisms based upon values mutually agreed to by purchaser and seller, as informed by appraisals."

Water right transfers proposed as part of WURP could affect the regional economy. The land once irrigated with the surface water right would be converted to either dryland production or fallow. If all or part of the land is converted to dryland and/or fallow, the losses to economy would be the gross revenue produced on this land.

The second aspect of WURP that could potentially affect the regional economy is the compensation for the water right. Water right holders, or the growers, would be compensated for the value of the water right. However, no compensation would be paid to those in the regional economy who do not own the water right but are affected by the grower's activities. Farm workers, agribusiness firms such as fertilizer and chemical dealers, wholesale and agricultural service providers are examples of those who do not receive compensation but would be affected by the water right sale.

The land currently being irrigated by the water rights proposed to be acquired under the WURP program are off project in the Sprague River sub-basin, the Sycan River, the Williamson River sub-basin, and the Wood River sub-basin. This land is mostly used to grow irrigated pasture to support local livestock operations.

Table 3.15-58 presents the combined impact of the lost irrigated pasture production and the associated livestock forward linkage from the 30,000 acre-foot water right sale proposed under the WURP. However, it should be noted that a portion of these effects would be offset from household induced effects resulting from household wages that are spent as a result of the compensation made to the water right holder.

Table 3.15-58. Regional Economic Effects from Lost Agricultural Production for the WURP

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	-34	-0.86	-5.85

Source: Reclamation 2012c, results presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

More information is needed to measure the direct effect on household spending of payments for water purchases proposed in the KBRA. The direct household spending is determined after accounting for debt retirement and leakages related to outside investments, household savings, and household tax payments. It is unknown how much to account for debt retirement and leakages. It can be assumed that a small amount of the

regional effects shown in Table 3.15-67 would be offset by household spending (Howe and Goemans 2003). The water purchases proposed in the KBRA would not change any effects generated by hydroelectric facility removal given that facility removal does not affect irrigated agriculture.

Water acquisitions via short-term water leasing could decrease farm revenues and reduce employment, labor income, and output in the regional economy. Other programs in KBRA, like the Off-Project Reliance Program and the Interim Flow and Lake Level Program, suggest the use of water lease programs in drought years. Water lease programs are short term programs that may have negative effects to the regional economy during water short years. The programs allow farmers to sell or lease their water for fisheries programs on a short term basis when sufficient water is unavailable for fish. The regional economy would be affected by the loss in gross farm revenue generated on the land idled by farmers who voluntarily lease water. Some of these regional effects would be offset by household induced effects when farmers spend a portion of the compensation in the local area. Since the KBRA does not specify what crops would be idled, is not possible to use IMPLAN to measure these effects. Short-term water leasing is expected to have a short term, adverse effect on the regional economy. The short-term water leasing proposed in the KBRA would not change any effects generated by hydroelectric facility removal given that facility removal does not affect irrigated agriculture.

Refuge Recreation

Changes in water supply could affect refuge recreation expenditures and employment, labor income, and output in the regional economy. Additional water supply could improve hunting and wildlife viewing, which could attract more visitors to the area. Under the Proposed Action, there would be an additional 193,830 waterfowl and 3,634 hunting trips. The addition of these trips would result in a total of $255,500 in direct expenditures within the local economies. As shown in Table 3.15-59, the Proposed Action would create an estimated 5 additional jobs, increase labor income by $0.12 million and output by $0.27 million compared to the No Action/No Project Alternative. Increased refuge water supply under the Proposed Action would improve or maintain current recreational expenditures and would positively affect the regional economy relative to the No Action/No Project Alternative.

Table 3.15-59. Change in Regional Economic Effects from Refuge Recreation between the No Action/No Project Alternative and Alternative 2, the Proposed Action

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
Total effect[4]	5	47.2	0.12	47.0	0.27	47.0

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Regulatory Assurances

Implementation of regulatory assurances under the KBRA could support employment, labor income, and output in the regional economy. The KBRA includes regulatory assurance actions that generally include planning and construction. State and local government workers in the region would likely develop plans. There would be some local construction for the Keno Impoundment/Lake Ewauna Screening action. Actions would provide new jobs and increase labor income within the region during the implementation period. Table 3.15-60 summarizes regional economic effects from implementation of Regulatory Assurance action under the KBRA relative to the No Action/No Project Alternative.

Regional economic effects would be in addition to base funding being implemented under the No Action/No Project Alternative. Effects are based on funding levels identified by Federal agencies in a revised Table C-2 of the KBRA. Effects would occur over the KBRA implementation period (2012-2026) and would vary year-by-year proportionate to actual expenditures. The Keno Impoundment/Lake Ewauna Screening action would be complete in 4 years and the Federal General Conservation Plans/Habitat Conservation Plans would be implemented over 8 years. The regulatory assurance actions proposed in the KBRA would add to the effects generated by hydroelectric facility removal on employment, labor income, and output in the regional economy during years that the projects overlap.

Table 3.15-60. Regional Economic Effects of KBRA Regulatory Assurance Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (not including base funding)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
90	Keno Impoundment/Lake Ewauna Screening	$5,470	67	$3,170	$8,270
91	Federal GCP/HCP	$5,082	79	$3,851	$6,105

Source: Barry 2011 ; Hicks 2011
2012 dollars as estimated using IMPLAN
GCP/HCP: General Conservation Plan/Habitat Conservation Plan
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

The KBRA identified actions to develop laws for California and Oregon. The States would be responsible for implementing these actions. These actions would provide some local employment to State government staff in the region. Much of the work would occur by State workers outside of the region, which would not affect the regional economy.

County Programs

Implementation of the Klamath County Economic Development Plan could support long-term economic growth in Klamath County. The Klamath County Economic Development Plan would include a study and implementation of projects for economic development associated with fisheries restoration and reintroduction, tourism and recreational development, agricultural development, alternative energy development, and The Klamath Tribes economic development (KBRA 27.3.1). Appendix C-2 of the KBRA indicates $3.2 million of funding for the plan in 2016. Implementation of these actions would support long-term economic growth in Klamath County, by providing jobs, attracting visitors, attracting new businesses to establish in the area, supporting the agricultural economy, and supporting economic growth of tribes.

The Klamath County Development Plan also calls for Klamath County to be compensated for the loss of property tax revenues from reduced agricultural land values in Reclamation's Klamath Project due to a reduction of water deliveries and reduced agricultural land values in the areas upstream of Upper Klamath Lake due to the surrender of significant water rights. Compensation of property tax losses would allow Klamath County to continue funding county programs, including education, social services, emergency services, and to put money into the general fund. The Klamath County Development Plan would positively impact the regional economy and would allow the County to continue funding county programs. The long-term effects of implementation of the Klamath County Economic Development Plan proposed in the KBRA would add to the effects generated by hydroelectric facility removal on employment, labor income, and output in the regional economy.

Funds from the California Water Bond Legislation could be used by Siskiyou County to improve economic conditions in the County and to support future economic growth. California legislation passed in 2009 proposes a bond measure to fund an economic development plan for Siskiyou County and for hydroelectric facilities removal. The bond measure, if passed, would also fund other mitigation measures to reduce the potential effect of dam removal. The California Water Bond funding legislation must be approved by voters on a future ballot. If approved, bond funds would be used for economic development in Siskiyou County ($20 million) and for hydroelectric facilities removal including mitigation for CEQA effects and protection of the City of Yreka's water supply ($250 million). Humboldt and Del Norte Counties are not included in the economic development fund. Remaining funds may be used for fisheries restoration projects in Siskiyou, Humboldt and Del Norte Counties, including removal or improvement of bridges, culverts, diversions, or other obstructions to fish passage.

The economic downturn that began in 2008 has adversely affected Siskiyou County. Appendix O presents economic measures and trends for Siskiyou County. Siskiyou County's 2009 and 2010 unemployment rates are the highest in the county since the early 1990s, and unemployment and poverty rates are consistently well above State averages.

It cannot be determined at this time how Siskiyou would distribute funds from the California Water Bond Legislation; this is a general discussion. However, the bond funds

could assist Siskiyou County in addressing unemployment, poverty, bankruptcy, and social problems and continuing funding for other county programs. Typical programs to address economic stressors include adult education programs, job opportunity and skills services, financial support programs, and childcare subsidy programs. Some funds could be used for programs to address social problems, such as substance abuse prevention and treatment, teen pregnancy prevention, and crime prevention.

Funding could also be used for programs that have had recent budget cuts, including library, fire, museum, and farm advisor. Other county programs that have struggled with funding include public health, child support services, human services, and behavioral health. Special districts would also likely receive some additional funding. More teachers could be hired, fire stations could be upgraded, or fire staff could increase. Siskiyou County could also invest in redevelopment of commercial areas and improve recreation facilities to attract more tourism to the area. Increased tourism would bring additional money into the county's economy. Siskiyou County could spend the California Water Bond Legislation funds in many ways to improve economic conditions in the county and support future economic growth. Spending would likely increase employment opportunities and labor incomes in the county. This would be a long-term, positive economic effect. The long-term effects of the California Water Bond funding proposed in the KBRA would add to the effects generated by hydroelectric facility removal on employment, labor income, and output in the regional economy.

Some funds from the California Water Legislation may be left over for fishery restoration projects in Siskiyou, Humboldt and Del Norte Counties. Implementation of these projects would result in similar economic effects described for the Fisheries Restoration Program. Fishery restoration projects implemented by the California Water Legislation would result in a long-term and positive economic effect.

Tribal Program

This section describes effects of KBRA actions defined under the Tribal Program. Socioeconomic effects to tribes related to increased fish abundance and harvest are described above in the Indian Tribes Effects section.

Construction and monitoring activities associated with Tribal Program actions would increase jobs, labor income, and output for The Klamath Tribes, Karuk Tribe, and Yurok Tribe. Federal agencies have identified funding for fisheries and conservation management actions to be implemented by tribes under the Proposed Action. Table 3.15-61 summarizes in-region spending and regional economic effects of tribal program actions under the KBRA. Effects would occur in Klamath, Siskiyou, Humboldt and Del Norte Counties where tribes are located. The regional economic impacts associated with Fisheries and Conservation Management actions would be spread over the 2012-2026 period and would vary year-by-year proportionate to actual expenditures. Some actions would not be implemented in each year of the 15-year period. For example, the Economic Development actions would be completed in one year.

Table 3.15-61. Regional Economic Effects of KBRA Tribal Program Actions Relative to No Action/No Project Alternative over a 15-year period (2012 dollars)

Table C-2 Line #	KBRA Action	15 year KBRA In Region Spending (1000 $)	Total Effects[1] of KBRA Funding (not including base funding)		
			Employment[2] (Jobs)	Labor Income[3] (1000$)	Output[4] (1000$)
100	Fisheries Management Karuk	$4,032	66	$2,891	$4,485
101	Fisheries Management Klamath	$5,503	73	$3,630	$5,943
102	Fisheries Management Yurok	$5,566	89	$4,252	$7,581
104	Conservation Management Karuk	$3,050	50	$2,187	$3,393
105	Conservation Management Klamath	$3,050	41	$2,013	$3,296
106	Conservation Management Yurok	$3,050	49	$2,315	$4,156
108	Economic Development Study Karuk	$250	6	$197	$406
109	Economic Development Study Klamath	$250	6	$197	$406
110	Economic Development Study Yurok	$250	6	$197	$406
111	Klamath Tribes: Mazama Forest Project	--	Transfer of funds to private owner for land purchase for tribe. Regional effects not quantified. Tribes would benefit in future from use of forest lands.		
112	Fishing Sites	--	No funding in KBRA		

Source: Source: Dunsmoor 2011; Tucker 2011; Hillemeier 2011
2012 dollars as estimated using IMPLAN
[1] Total Effect = Direct + Indirect + Induced Effects
[2] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[3] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[4] Output represents the dollar value of industry production.

Spending on local actions would affect employment, labor income, and output in the regional economy. Most actions would be implemented by tribal staff and would positively affect the economic conditions of the tribes. A portion of the funding would result in positive effects in the construction sector and professional and technical services sector. Implementation of the Tribal Program actions would increase employment, labor income, and output in the regional economy relative to the No Action/No Project Alternative. The Tribal Program actions could add to the effects of the hydroelectric facility removal actions analyzed above if tribal members are employed for dam deconstruction activities. The additive effects would only occur in years that project implementation overlaps.

3.15.4.2.3 Alternative 3: Partial Facilities Removal of Four Dams Four Facilities

Construction activities could increase jobs, labor income, and output in the regional economy during the construction period in Klamath and Siskiyou Counties. Partial

facilities removal is estimated to cost approximately $135.4 million[4] in 2012 dollars (Reclamation 2012b). Expenditures associated with the Partial Facilities Removal of Four Dams Alternative spent within the region were estimated to be $84.7 million (Reclamation 2012b).

The effects of partial facility removal on employment, labor income, and output are shown in Table 3.15-62. Effects would be short term and occur only during dam decommissioning, which would occur in 2020 for the duration of one year. Most economic effects would be in the sector where the direct impact occurs. For dam deconstruction expenditures, this analysis assumes direct effects would mostly occur in the construction sector. Employment created in this sector could be full time or part time and include various types of jobs, similar to those described for the Proposed Action.

Table 3.15-62. Regional Economic Effects from Dam Decommissioning for Alternative 3

	Employment[1] (Jobs)	Labor income[2] ($ millions)	Output[3] ($ millions)
Total effect[4]	1,138	48.11	131.84

Source: Reclamation 2012b data presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Changes in annual O&M expenditures for the Partial Facilities Removal of Four Dams Alternative could reduce jobs, labor income, and output in the regional economy. Annual O&M expenditures for the Partial Facilities Removal of Four Dams Alternative were estimated at $129,000. These annual O&M expenditures would partially offset the lost O&M expenditures under the No Action/No Project Alternative. However, under the Partial Facilities Removal of Four Dams Alternative annual O&M expenditures would result in a long term loss to the regional economy compared to the No Action/No Project Alternative, shown in Table 3.15-63. For reduced O&M expenditures, this analysis assumes direct effects would occur in the construction sector. Economic effects under Partial Facilities Removal of Four Dams Alternative would be long term and adverse relative to the No Action/No Project Alternative.

[4] Dam removal as described in this EIS/R would occur from May 2019 through December 2020. For this socioeconomic analysis all effects have been described in 2012 dollars to allow comparison between economic effects and alternatives. These costs for facilities removal should not be considered a most probable cost estimate for dam removal in 2020. For a more detailed analysis of the cost of dam removal please see Detailed Plan for Dam Removal – Klamath River Dams, July 2012.

Table 3.15-63. Change in Regional Economic Effects from O&M Expenditures between the No Action/No Project Alternative and Alternative 3

	Employment[1]		Labor income[2]		Output[3]	
	Jobs	% Change from No Action	$ millions	% Change from No Action	$ millions	% Change from No Action
Total effect[4]	-47.4	-96.0	-1.98	-96.0	-5.00	-96.0

Source: Reclamation 2012b presented in 2012 dollars.
[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary.
[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.
[3] Output represents the dollar value of industry production.
[4] Total Effect = Direct + Indirect + Induced Effects

Mitigation spending after the deconstruction period could increase economic output, employment, and labor income. Effects from mitigation spending would be temporary, short-term effects and would vary year by year from 2018-2025. Partial facility mitigation costs by facility and year are shown in Table 3.15-64.

Table 3.15-64. Mitigation Costs by Facility Year (2012 $) for Alternative 3

Year	J.C. Boyle	Copco 1	Copco 2	Iron Gate	City of Yreka Water Supply	Total
2018	1,520,000	0	0	2,910,000	0	4,430,000
2019	1,790,000	3,800,000	2,020,000	6,500,000	0	14,110,000
2020	2,780,000	9,050,000	580,000	6,040,000	1,000,000	19,450,000
2021	1,970,000	4,250,000	0	3,360,000	0	9,580,000
2022	240,000	0	0	470,000	0	710,000
2023	240,000	0	0	470,000	0	710,000
2024	240,000	0	0	470,000	0	710,000
2025	240,000	0	0	470,000	0	710,000
					Total	50,410,000

Source: Reclamation 2012b

The regional economic effects related to dam decommissioning mitigation for the Partial Facilities Removal of Four Dams Alternative were assumed to be the same as the Proposed Action. For mitigation expenditures, this analysis assumes direct effects would occur in the construction sector. Economic effects under Partial Facilities Removal of Four Dams Alternative would be positive and short term relative to the No Action/No Project Alternative.

Commercial Fishing, Recreation, Indian Tribe, PacifiCorp Hydroelectric Service, Property Values and Local Government Revenues, PacifiCorp Property Taxes, and KBRA

Economic effects of the Partial Facilities Removal of Four Dams Alternative would be the same as the Proposed Action.

East and Westside Facilities – Programmatic Measures

The effects of the decommissioning the East and Westside facilities would be the same as those described for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of relocating the City of Yreka's Water Supply Pipeline would be the same as those described for the Proposed Action.

KBRA - Programmatic Measures

Economic effects of the KBRA under the Partial Facilities Removal of Four Dams Alternative would be the same as the Proposed Action.

3.15.4.2.4 Alternative 4: Fish Passage at Four Dams

The KHSA Section 3.2.1(iii), signed by Secretary of the Interior Ken Salazar on February 18, 2010, directs the Secretary to undertake environmental review in support of the Secretarial Determination. All alternatives carried forward for further analysis in the EIS/EIR were analyzed using existing studies and other appropriate data as suggested in KHSA Section 3.2.1 (i), where such analysis met criteria in (40 CFR 1502.22 and 43 CFR 46.125) to incorporate available information. As part of developing the basis for the Secretarial Determination, the KHSA requires in Section 3.3.2 that the Secretary prepare a Detailed Plan, including the identification, qualifications, management, and oversight of a non-Federal DRE, if any, that the Secretary may designate. KHSA Section 3.3.4.D requires that an estimate of costs be prepared as part of the Detailed Plan. The Detailed Plan analysis provides most of the information for the project description for Alternatives 2 and 3, and this information was used to analyze these two action alternatives. As described in KHSA Section 3.2.1(i), the FERC record is used to form the project description for Alternatives 4 and 5. Alternatives 4 and 5 were analyzed to ensure that the review of reasonable fish passage alternatives was comprehensive. In addition, at the time of developing a reasonable range of alternatives, the Lead Agencies recognized that the inclusion of Alternatives 4 and 5 would provide an assessment of the short- and long-term effects from a broader range of reasonable alternatives. Alternatives 4 and 5 are outside the authority of the DOI, the four facilities proposed for removal are privately owned structures, and there was no provision in the KHSA to include them in the Detailed Plan. The result is differing levels of available information for alternatives carried forward in the EIS/EIR consistent with the elements of each action alternative.

Regional economic effects were quantified for the No Action/No Project Alternative, the Proposed Action, and the Partial Facilities Removal of Four Dams Alternative. These regional economic effects provide the broadest range of economic impacts expected from implementation of any of the alternatives and bookend the expected economic impact to the area of analysis. Once that information was developed, a comparative analysis of the

Fish Passage at Four Dams Alternative and Fish Passage at Two Dams, Remove Copco 1and Iron Gate Alternative provide the information required to evaluate the relative impacts of each action alternative within the identified range of economic effects. Specific economic effects for construction and changes in commercial fishing, recreation, and irrigated agriculture were not individually quantified for Fish Passage at Four Dams Alternative and Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative. The missing data is relevant to reasonable foreseeable significant adverse human effects on the environment. However that unavailable data is not essential to a reasoned choice among alternatives because potential impacts can be compared to the data developed for the No Action/No Project Alternative, the Proposed Action, and Partial Facilities Removal of Four Dams Alternative. The range of impacts anticipated for the two alternatives for which data is missing falls within the range of impacts analyzed and data developed for the remaining alternatives, though the ratio of expenditures to impacts might not have the same proportional effect across the various economic sectors. The comparative analysis required by NEPA is achieved using this qualitative method.

Four Facilities

Construction of fish passage facilities, O&M expenditures, and mitigation spending could increase jobs, labor income, and output in the regional economy during the construction period. Expenditures would occur in the region to support construction of fish passage facilities. In-region spending would increase jobs, labor income and output in Klamath and Siskiyou Counties relative to the No Action/No Project Alternative. Positive regional economic effects would only occur during the construction period. Hydroelectric facilities would continue to operate under this alternative; therefore, O&M annual expenditures would continue similar to the No Action/No Project Alternative. Some mitigation would be required for this alternative, which would result in increased in-region spending relative to the No Action/No Project Alternative.

Commercial Fishing

Changes in commercial fishing harvests could change fishing revenues and affect employment, labor income and output in the regional economy. Construction of fish passage facilities would increase migratory fish habitat availability above Iron Gate Dam, and as described in Section 3.3, Aquatic Resources, would result in increased commercial fishery populations when compared to existing conditions. Positive effects related to increased fish harvests would increase relative to the No Action/No Project Alternative, but these effects would not be as great as Alternative 2 or 3.

Recreation (Reservoir, In-River Sport Fishing, Ocean Sport Fishing, Whitewater Boating)

Changes in recreational opportunities could affect the regional economy. The dams would remain in place and visitors could use the reservoirs for existing activities, including boating, water skiing, and fishing. Spending in the region related to reservoir recreation would continue at existing levels.

The development of fish passage facilities may have a positive effect on visitation levels and expenditures for in-river sport fishing trips relative to the No Action/No Project Alternative, but these effects would not be as great as Alternatives 2 or 3.

The fish passage facilities may also have a positive effect on visitation levels and expenditures for ocean sport fishing trips relative to the No Action/No Project Alternative, but these effects would not be as great as Alternatives 2 or 3.

Implementation of the Fish Passage at Four Dams Alternative would result in a loss of acceptable flows for whitewater boating opportunities in the Hell's Corner Reach as compared to existing conditions. The flow conditions and prescriptions outlined in Chapter 2 would reduce the current daily peaking flows, which support whitewater rafting in the Hell's Corner Reach, to a minimum streamflow of 1,500 cfs, which must be provided no more than once per week. This would result in an adverse reduction in rafting trips and recreation expenditures.

Indian Tribes

Fish passage at the four dams could affect the existing fishing conditions of Indian Tribes in the area of analysis. Implementation of the Fish Passage at Four Dams Alternative would generate a positive effect on fish populations and tribal harvests for subsistence, cultural practices and commercial uses relative to the No Action/No Project Alternative. The positive economic effects generated by the KBRA for the tribes would not be realized under this alternative, and the positive economic effects generated by the development of fish passage facilities would be smaller than the effects anticipated under the Proposed Action as a result. However, increased fish harvest for subsistence, cultural practices and commercial uses would represent a positive effect for Indian Tribes, although this effect would not be as great as under Alternatives 2 or 3. Tribal ceremonies and other cultural practices involving water contact would continue to be hindered by late-fall, toxigenic phytoplankton blooms in the Hydroelectric Reach and areas further downstream.

PacifiCorp Hydroelectric Service

Fish passage at four dams could result in increased energy rates for PacifiCorp customers. PacifiCorp estimated that costs to develop fish passage at the Four Facilities consistent with the Mandatory Conditions imposed by the DOI and the United States Department of Commerce (DOC) would cost more than implementation of the KHSA (OPUC 2010). In its ruling to approve KHSA surcharges, the OPUC concluded that PacifiCorp "has demonstrated that customer costs under the KHSA are capped below projected costs to relicense and continue operation of the Klamath dams." Further, the OPUC concluded the following:

> "Ratepayers will be responsible for significant future costs for the Klamath Project (regardless of the disposition of the dams). The nature and scope of these costs has been unclear, however, since 2000 when Pacific Power [PacifiCorp] first provided notice of the Company's need to seek Federal relicensing of the Project. We are persuaded that continued pursuit of the relicensing option would pose significant risks

to ratepayers. The nature and scope of the costs involved with relicensing would remain uncertain and subject to significant escalation for a considerable period of time.

The KHSA in contrast, offers a more certain path for the Project's future, providing a timeline for continued operation until December 31, 2010, followed by transfer of the facilities to a third party responsible for removing the dams. The KHSA also caps customer costs and liabilities for Klamath dam removal and the environmental restoration of the Klamath River at a reasonable level, while providing customers with renewable replacement power. Further, we believe that Pacific Power has reasonably estimated the cost of replacement power if the Klamath dams are decommissioned. Due to significant tangible and intangible benefits associated with the KHSA, we conclude it is in the best interest of customers and find the KHSA surcharges to be fair, just and reasonable.

We reviewed the detailed economic studies of the KHSA surcharges, we analyzed the projected costs of both relicensing and decommissioning of the dams, and we asked specific questions of Pacific Power, Staff and the parties at a workshop. We considered both the quantifiable and unquantifiable benefits and risks of the KHSA and relicensing options.

We are persuaded that Pacific Power carefully analyzed the nature and scope of projected costs for both futures for the dams. As Staff and others do, we believe that there are substantial unquantified risks associated with continued pursuit of a FERC license that is not captured in the economic analysis. Pacific Power and parties deeply involved in the relicensing process, such as the Intervenor State Agencies and the Joint Parties, all testified that the relicensing option analysis significantly underestimates the true cost of relicensing.

These parties indicate that the projected relicensing costs are subject to significant risk of escalation with no guarantee that a FERC license will ever be issued due, in particular, to great uncertainty about water quality certification. Yet, even though the full expected costs of the relicensing option is not captured in Pacific Power's analysis, the analysis still shows that the KHSA results in lower rates for Oregon customers, as well as all customers of Pacific Power. If the risks associated with the relicensing scenario could be quantified, we believe that the relative economic benefits of the KHSA would likely be great.

We observe that no party testified that the relicensing option would likely result in lower rates and better service for customers. Industrial Customers of Northwest Utilities (ICNU) criticizes the KHSA surcharge rates, but does so in comparison to hypothesized "normal" ratemaking for costs associated with removing a hydroelectric dam. Ten years into a process to resolve the future of the Reclamation's Klamath Project with no "normal" resolution in sight, we conclude that it's not reasonable to compare proposed solutions to so-called "normal" ratemaking scenarios.

> Because the KHSA limits costs and manages risk better than relicensing, we find the KHSA to be in the best interest of customers, and we determine that the KHSA surcharges are, therefore, fair, just and reasonable." (OPUC 2010).

Therefore, it is assumed that, under the Fish Passage at Four Dams Alternative, customer rates would likely increase above the existing surcharges as a direct result of construction, operations and maintenance costs for fish passage facilities. The degree to which the cost could be passed to the ratepayers is not known and would be subject to Oregon and CPUCs.

Property Values and Local Government Revenues

Property values could be affected by the fish passage at four dams near Copco 1 and Iron Gate Reservoir. The dams would remain in place under this alternative; therefore, the property values of parcels with full or partial reservoir views would not change. Land values would be the same as the No Action/No Project Alternative. Property tax revenues to Klamath and Siskiyou Counties would also not change relative to the No Action/No Project Alternative.

Fish passage at four dams could affect property tax revenues to Siskiyou and Klamath Counties from PacifiCorp. PacifiCorp would continue to own and operate hydroelectric facilities and would continue to pay property taxes. County tax revenues would not change relative to the No Action/No Project Alternative.

3.15.4.2.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Analysis of Alternative 5 was conducted in a similar approach to Alternative 4. See discussion of effects analysis approach under Alternative 4 above.

Four Facilities

Construction of fish passage facilities, O&M expenditures, and mitigation spending could increase jobs, labor income, and output in the regional economy during the construction period. Expenditures would occur in the region to support construction of fish passage facilities. In-region spending would increase jobs, labor income and output in Klamath and Siskiyou Counties relative to the No Action/No Project Alternative. Positive regional economic effects would only occur during the construction period. Hydroelectric facilities at J.C. Boyle and Copco 2 Reservoirs would continue to operate under this alternative; therefore, O&M annual expenditures would continue for these sites. Positive regional economic effects would increase relative to the No Action/No Project Alternative, but be less than the Proposed Action. Some mitigation would be required for this alternative, which would result in increased in-region spending relative to the No Action/No Project Alternative.

Commercial Fishing

Changes in commercial fishing harvests cold change fishing revenues and affect employment, labor income and output in the regional economy. Removal of the Copco 1 and Iron Gate dams and the construction of fish passage facilities at J.C. Boyle and

Copco 2 dams would increase migratory fish habitat availability above Iron Gate Dam, and as described in Section 3.3, Aquatic Resources, would result in increased commercial fishery populations when compared to existing conditions. Positive effects related to increased fish harvests would increase relative to the No Action/No Project Alternative, although this effect would not be as large as Alternatives 2 or 3.

Recreation (Reservoir, In-River Sport Fishing, Ocean Sport Fishing, Whitewater Boating)

Changes in recreational opportunities could affect the regional economy. Iron Gate and Copco 1 Facilities would be removed, eliminating in-reservoir recreation at these sites. Effects would be similar to the Proposed Action. Reservoir recreation at J.C. Boyle Reservoir would continue, which would have economic effects similar to the No Action/No Project Alternative.

Visitation levels and expenditures for in-river fishing would increase because of increased fish populations under this alternative relative to the No Action/No Project Alternative, although this effect would not be as great as Alternatives 2 or 3.

Ocean sport fishing trips could also increase relative to the No Action/No Project Alternative, which would increase employment, labor income, and output in the regional economy; however, this effect would not be as great as Alternatives 2 or 3.

The loss of peaking flows in the Hell's Corner Reach would result in the river returning to natural flow conditions, with no ability to re-regulate peaking flows. Thus, there would be diminished whitewater boating opportunities in this reach. This would result in fewer rafting trips and reduced recreation expenditures and be a long-term adverse effect.

Indian Tribes

Alternative 5 could affect the existing economic conditions of Indian Tribes in the area of analysis. Implementation of Alternative 5 would generate a positive effect on fish populations and tribal harvests for subsistence, cultural practices and commercial uses relative to the No Action/No Project Alternative. The positive economic effects generated by the KBRA for the tribes would not be realized under this alternative, and the positive economic effects to tribes would be smaller than the effects anticipated under the Proposed Action as a result. However, increased fish harvest for subsistence, cultural practices and commercial uses would represent an economically positive effect for Indian Tribes, although this effect would not be as great as with the Proposed Action or Alternative 3.

PacifiCorp Hydroelectric Service

Removal of two dams and fish passage at two dams could result in increased energy rates for PacifiCorp customers. The costs for the removal of two dams and fish ladders would not be covered under the KHSA agreement and would likely become the responsibility of PacifiCorp and its ratepayers. The cost for removal of the Iron Gate and Copco 1 Dams

is approximately $124 million[5] in 2012 dollars, as estimated for removal of these two dams for the Proposed Action (Reclamation 2012a). As described above for Alternative 4, PacifiCorp has estimated that fish passage would be more costly than dam removal; therefore, it is assumed that fish passage at Copco 2 and J.C. Boyle Dams would be more than dam removal costs. Therefore, under this alternative, customer rates would likely increase above the existing surcharges as a direct result of construction, operations and maintenance costs for fish passage facilities at two dams and the removal of Iron Gate and Copco 1 Dams. The degree to which the cost could be passed to the ratepayers is not known and would be subject to Oregon and California PUCs.

Property Values and Local Government Revenues

Property values could be affected by the fish passage at four dams near Copco 1 and Iron Gate Reservoir. Parcels with views of Copco 2 Reservoir would not be affected under this alternative. As described in the affected environment, there are no parcels with views of J.C. Boyle Reservoir. Property tax payments to Siskiyou County from affected parcels around Copco 1 and Iron Gate Reservoirs would decrease relative to the No Action/No Project Alternative. In the long term, river views associated with the parcels could increase property values.

Alternative 5 could affect property tax revenues to Siskiyou and Klamath Counties from PacifiCorp Changes in ownership of hydroelectric facilities could reduce county property tax revenues. PacifiCorp property tax payments to Siskiyou County from land ownership of Copco 1 and Iron Gate Reservoirs would discontinue relative to the No Action/No Project Alternative. Effects would be similar in magnitude to the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of relocating City of Yreka's Water Supply Pipeline would be the same as those described for the Proposed Action.

3.15.4.2.6 Summary of Economic Effects

Table 3.15-65 summarizes economic effects quantified in this section. Table 3.15-66 summarize effects of ongoing restoration actions and the KBRA under each alternative.

[5] Dam removal as described in this EIS/R would occur from May 2019 through December 2020. For this socioeconomic analysis, all effects have been described in 2012 dollars to compare economic effects of alternatives. These costs for facilities removal should not be considered a most probable cost estimate for dam removal in 2020. For a more detailed analysis of the cost of dam removal please see Detailed Plan for Dam Removal – Klamath River Dams, July 2012.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Dam Decommissioning **Economic Region:** Klamath County OR Siskiyou County CA **Regional Economy:** Employment (Jobs): 48,204 Labor Income: $1,928 million Output: $5,139 million	No dam decommissioning under Alternative 1.	Short-term effects during the one year decommissioning. Increase of approximately 1,400 jobs, $60 million in labor income, and $163 million in output.	Short-term effects during the one year decommissioning. Increase of approximately 1,100 jobs, $48 million in labor income, and $132 million in output.	Short-term effects during the construction period. Would increase jobs, labor income, and output relative to Alternative 1.	Short-term effects during the construction period. Would increase jobs, labor income, and output relative to Alternative 1.
Operation and Maintenance **Economic Region:** Klamath County OR Siskiyou County CA **Regional Economy:** Employment (Jobs): 48,204 Labor Income: $1,928 million Output: $5,139 million	O&M expenditures would support 49 jobs, $2 million in labor income and $5 million in output.	No long-term annual O&M expenditures. Decrease of approximately 49 jobs, $2 million of labor income, and $5 million in output.	Decrease of approximately 47 jobs. Labor income and output would remain the same compared to Alternative 1	O&M expenditures and effect on regional economy would be similar to Alternative 1.	Decrease O&M expenditures and adversely affect the regional economy.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Mitigation **Economic Region:** Klamath County OR Siskiyou County CA **Regional Economy:** Employment (Jobs)[1]: 48,204 Labor Income[2]: $1,928 million Output[3]: $5,139 million	None mitigation under Alternative 1.	Temporary, short-term effects from 2018-2025. Increase of approximately 220 jobs, $10 million in labor income, and $31 million in output.	Same as Alternative 2.	Some mitigation would be required. Increase relative to Alternative 1.	Some mitigation would be required. Increase relative to Alternative 1.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Irrigated Agriculture **Economic Region:** Klamath County OR Siskiyou and Modoc Counties CA **Regional Economy:** Employment (Jobs): 52,141 Labor Income: $2,083 million Output: $5,497 million	Effects equal for all years except drought years of 1975, 1992, 1994, 2001, and 2008. 2027 — Jobs 1,361 Labor Income $45 million Output $184 million 2043 — Jobs 766 Labor Income $33 million Output $118 million 2045 — Jobs 1,076 Labor Income $40 million Output $156 million 2051 — Jobs 1,286 Labor Income $44 million Output $177 million 2059 — Jobs 1,403 Labor Income $46 million Output $188 million	Effects equal for all years except drought years. Increased job, labor income, and employment in drought years relative to Alternative 1. 2027 — Jobs +112 Labor Income +$2 million Output +$13 million 2043 — Jobs +695 Labor Income +$11 million Output +$84 million 2045 — Jobs +397 Labor Income +$7 million Output +$41 million 2051 — Jobs +187 Labor Income +$4 million Output $20 million 2059 — Jobs +70 Labor Income +$2 million Output +$9 million	Same as Alternative 2	Same as Alternative 1.	Same as Alternative 1.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Commercial Fishing **San Francisco Management Area** Employment (Jobs): 3,060,366 Labor Income: $204,685 million Output: $599,164 million **Fort Bragg Management Area** Employment (Jobs): 40,117 Labor Income: $1,731 million Output: $4,814 million **KMZ-CA** Employment (Jobs): 71,633 Labor Income: $2,983 million Output: $7,360 million **KMZ-OR** Employment (Jobs): 8,656 Labor Income: $311 million Output: $859 million **Central Oregon Management Area** Employment (Jobs): 258,047 Labor Income: $10,170 million Output: $27,815 million	Regional economic effects supported by ocean commercial fishing **San Francisco Management Area** Jobs: 510 Labor Income: $6.10 million Output: $15.52 million **Fort Bragg Management Area** Jobs: 162 Labor Income: $2.45 million Output: $5.62 million **KMZ-CA** Jobs: 44 Labor Income: $0.19 million Output: $0.45 million **KMZ-OR** Jobs: 26 Labor Income: $0.15 million Output: $0.33 million **Central Oregon Management Area** Jobs: 319 Labor Income: $4.15 million Output: $9.55 million	Increased job, labor income, and employment relative to Alternative 1. **San Francisco Management Area** Jobs: +218 Labor Income: +$2.56 million Output: +$6.6 million **Fort Bragg Management Area** Jobs: +69 Labor Income: +$1.05 million Output: +$2.41 million **KMZ-CA** Jobs: +19 Labor Income: +$0.07 million Output: +$0.19 million **KMZ-OR** Jobs: +11 Labor Income: +$0.06 million Output: +$0.13 million **Central Oregon Management Area** Jobs: +136 Labor Income: +$1.74 million Output: +$4.07 million	Same as Alternative 2.	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
In-River Sport Fishing **Economic Region:** Klamath County OR Del Norte, Humboldt, and Siskiyou Counties CA **Regional Economy:** Employment (Jobs): 119,837 Labor Income: $4,911 million Output: $12,499 million	**Recreational Salmon Fishery** In-river salmon fishing trip expenditures support 34 jobs, $0.93 million of labor income and $2.01 million in output. **Recreational Steelhead Fishery** In-river salmon fishing trip expenditures support 20 jobs, $0.62 million of labor income and $1.31 million in output. **Recreational Redband Trout Fishery** Non-resident angler trips likely to remain similar to Existing Conditions. Insufficient data to quantify regional economic impacts.	**Recreational Salmon Fishery** Increase of 3 jobs and $0.07 million of labor income and $0.15 million in output. **Recreational Steelhead Fishery** Possible increase in steelhead abundance. Insufficient data to quantify regional economic impacts. **Recreational Redband Trout Fishery** Probable increase in Redband abundance and distribution. Insufficient data to quantify regional economic impacts.	Same as Alternative 2	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Ocean Sport Fishing **KMZ-OR** Employment (Jobs): 8,656 Labor Income: $311 million Output: $859 million **KMZ-CA** Employment (Jobs): 71,633 Labor Income: $2,983 million Output: $7,360 million	**KMZ-OR** Ocean sport fishing supports 3 jobs, $0.08 million of labor income, and $0.21 million in output. **KMZ-CA** Ocean sport fishing supports 13 jobs, $0.42 million of labor income, and $1.12 million in output.	**KMZ-OR** Increase of approximately 1 job, $0.02 million in labor income, and $0.09 million. **KMZ-CA** Increase of 5 jobs, $0.18 million of labor income, and $0.48 million in output.	Same as Alternative 2.	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.	Positive, long-term effects. Increase relative to Alternative 1, but less than the Proposed Action and Alternative 3.
Refuge Recreation **Economic Region:** Klamath County OR Siskiyou County CA **Regional Economy:** Employment (Jobs): 48,204 Labor Income: $1,928 million Output: $5,139 million	Refuge hunting expenditures supports 11 jobs, $0.26 million of labor income and $0.62 million in output.	Increase of 5 jobs, $0.12 million in labor income, and $0.27 million in output.	Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.

Table 3.15-65. Summary of Regional Economic Effects for Each Alternative

Category	Alternative 1 - No Action	Alternative 2 - Full Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 3 - Partial Facilities Removal of Four Dams Incremental changes from Alternative 1	Alternative 4 - Fish Passage at Four Dams Incremental changes from Alternative 1	Alternative 5 - Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Incremental changes from Alternative 1
Reservoir Recreation **Economic Region:** Klamath County OR Siskiyou County CA **Regional Economy:** Employment (Jobs): 48,204 Labor Income: $1,928 million Output: $5,139 million	Reservoir recreation expenditures supports 7 jobs, $0.22 million in labor income and $0.54 million in output.	Decrease of approximately 4 jobs, $0.13 million in labor income and $0.31 in output.	Same as Alternative 2.	Same as Alternative 1.	Same as Alternative 2 for recreation losses at Iron Gate and Copco 1 Reservoirs. Same as Alternative 1 because of maintained recreation at J.C. Boyle Reservoir.
Whitewater Recreation **Economic Region:** Klamath, Jackson Humboldt, and Siskiyou counties **Regional Economy:** Employment (Jobs): 224,667 Labor Income:$8,682 million Output: $23,330 million	Whitewater boating expenditures supports 56 jobs, $1.56 million in labor income and $4.31 million in output.	Decrease of approximately 14 jobs, $0.43 million in labor income and $0.89 million in output.	Same as Alternative 2.	Negative, long-term effects on the regional economy. Decrease relative to Alternative 1.	Negative, long-term effects on the regional economy. Decrease relative to Alternative 1.

Source: Reclamation 2012b for Alternatives 1, 2, and 3

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.

[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.

[3] Output represents the dollar value of industry production.

Table 3.15-66. Summary of Regional Economic Effects over 15 Years of Ongoing Restoration Activities and KBRA Implementation

KBRA Program	Alternative 1 - No Action/No Project Alternative	Alternative 2, Proposed Action, Incremental Changes to Alternative 1	Alternative 3 Incremental Changes to Alternative 1	Alternative 4 Incremental Changes to Alternative 1	Alternative 5 Incremental Changes to Alternative 1
Fisheries Program **Economic Region:** Klamath County OR Del Norte, Humboldt, and Siskiyou Counties CA **Regional Economy:** Employment (Jobs[1]): 119,837 Labor Income[2]: $4,911 million Output[3]: $12,499 million	Fishery restoration, reintroduction and monitoring expenditures supports 2,015 jobs, $95 million in labor income and $203 million in output.	Increase of approximately 3,917 jobs, $186.8 million in labor income and $380 million in output.	Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.
Water Resources Program **Economic Region:** Klamath County OR Del Norte, Humboldt, and Siskiyou Counties CA **Regional Economy:** Employment (Jobs): 119,837 Labor Income: $4,911 million Output: $12,499 million **Economic Region (related to Reclamation's Klamath Project):** Klamath County OR Modoc and Siskiyou Counties CA **Regional Economy:** Employment (Jobs): 52,140 Labor Income: $2,082 million Output: $5,498 million	No ongoing activities under the water resources program.	Water resources program expenditures supports 243 jobs, $11.2 million in labor income and $24.2 million in output. See for Irrigated Agriculture and Refuge Recreation Table 3.15-65 for effects of KBRA actions.	Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.

Table 3.15-66. Summary of Regional Economic Effects over 15 Years of Ongoing Restoration Activities and KBRA Implementation

KBRA Program	Alternative 1 - No Action/No Project Alternative	Alternative 2, Proposed Action, Incremental Changes to Alternative 1	Alternative 3 Incremental Changes to Alternative 1	Alternative 4 Incremental Changes to Alternative 1	Alternative 5 Incremental Changes to Alternative 1
Regulatory Assurances: **Economic Region:** Klamath County OR Del Norte, Humboldt, and Siskiyou Counties CA **Regional Economy:** Employment (Jobs): 119,837 Labor Income: $4,911 million Output: $12,499 million	No ongoing activities	Implementation of regulatory assurances would support 146 jobs, $7 million in labor income and $14.4 million in output.	Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.
County Program: **Siskiyou County CA** Employment (Jobs): 17,679 Labor Income: $755 million Output: $2,107 million **Klamath County OR** Employment (Jobs): 30,525 Labor Income: $1,174 million Output: $3,032 million	No ongoing activities	$20 million of funding for Siskiyou County would increase jobs, labor income and output. $3.2 million of funding for Klamath County would increase jobs, labor income and output.	Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.

Table 3.15-66. Summary of Regional Economic Effects over 15 Years of Ongoing Restoration Activities and KBRA Implementation

KBRA Program	Alternative 1 - No Action/No Project Alternative	Alternative 2, Proposed Action, Incremental Changes to Alternative 1	Alternative 3 Incremental Changes to Alternative 1	Alternative 4 Incremental Changes to Alternative 1	Alternative 5 Incremental Changes to Alternative 1
Tribal Program:			Same as Alternative 2.	Similar to Alternative 1.	Similar to Alternative 1.
Karuk Tribes: Siskiyou County CA Employment (Jobs): 17,679 Labor Income: $755 million Output: $2,107 million	Karuk Tribal Program expenditures supports 237 jobs, $10.5 million in labor income and $16.3 million in output.	Increase of approximately 122 jobs, $5.2 million in labor income and $8.3 million in output.			
Klamath Tribes: Klamath County OR Employment (Jobs): 30,525 Labor Income: $1,174 million Output: $3,032 million	Klamath Tribal Program expenditures supports 174 jobs, $8.7 million in labor income and $14.3 million in output.	Increase of approximately 120 jobs, $5.8 million in labor income and $9.6 million in output.			
Yurok Tribes: Humboldt County CA Employment (Jobs): 60,789 Labor Income: $2,529 million Output: $6,388 million	Yurok Tribal Program expenditures supports 208 jobs, $10 million in labor income and $17.8 million in output.	Increase of approximately 144 jobs, $6.8 million in labor income and $12.1 million in output.			

Source: Barry 2011; Bird 2011; Dunsmoor 2011; Hicks 2011; Hillemeier 2011; Lynch 2011;Mahan. L et al. 2011; Nota 2011; Radford 2011; Stopher 2011; Tucker 2011; Wise 2011

[1] Employment is measured in number of jobs. A job can be full-time, part-time, or temporary. Construction-related employment estimates include the in-field workforce plus all additional jobs generated by project construction expenditures, e.g., in retail, services, manufacturing, and other related sectors throughout the economy.

[2] Income is the dollar value of total payroll (including benefits) for each industry in the analysis area plus income received by self-employed individuals located within the analysis area.

[3] Output represents the dollar value of industry production.

3.15.5 References

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3.16 Environmental Justice

This section identifies minority and low income populations that exist within the Klamath Basin and evaluates whether the environmental impacts of each alternative would result in a disproportionately high and adverse impact on minority and low income populations (Executive Order 12898, February 11, 1994). See Section 3.12, Tribal Trust, for a detailed description of tribal history, and Section 3.13, Cultural and Historic Resources, for additional discussion of other cultural, tribal, and religious freedom issues. See Section 3.8, Water Supply/Water Rights, for a discussion of water rights in the area of analysis.

This section examines, consistent with National Environmental Policy Act (NEPA) regulations and guidelines, the Proposed Action's potential impacts on minority and low income people. As described in the Effects Determination Methods (Section 3.16.4.1), impacts were assessed to determine if any community would bear a disproportionate share of the adverse environmental consequences resulting from the Proposed Action.

The U.S. Environmental Protection Agency (USEPA) Office of Environmental Justice defines environmental justice as the following:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies (USEPA 2011).

3.16.1 Area of Analysis

The area of analysis includes Del Norte, Humboldt, and Siskiyou Counties in northern California and Klamath County in southern Oregon. In addition, all six of the federally recognized tribes with territory within the four counties are included in the area of analysis, specifically The Klamath Tribes, Quartz Valley Community, Karuk Tribe, Hoopa Valley Indian Tribe, Yurok Tribe, and the Resighini Rancheria. Environmental justice impacts from the Proposed Action and alternatives, including activities associated with implementation of the Klamath Hydroelectric Settlement Agreement (KHSA) and Klamath Basin Restoration Agreement (KBRA) would be limited to these areas.

3.16.2 Regulatory Framework

Environmental justice resources within the area of analysis are regulated by several Federal, State, and local laws and policies, which are listed below.

3.16.2.1 Federal Authorities and Regulations

- Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629)
- Department of the Interior (DOI) Environmental Justice Strategic Plan, 1995
- USEPA Environmental Justice Implementation Plan, 1996

3.16.2.2 State Authorities and Regulations

- California Government Code section 65040.12 (G.C. §65040.12)
- California Working Group on Environmental Justice, Senate Bill 89 (2000)
- California Interagency Environmental Justice Strategy, Senate Bill 828 (2001)
- California Environmental Protection Indicators for California, Assembly Bill 1360 (2003)
- Oregon Environmental Justice Task Force, Senate Bill 420 (2007)

3.16.2.3 Local Authorities and Regulations

- Siskiyou County General Plan (1973)
- Humboldt County General Plan (1984)
- Del Norte County General Plan (2003)
- Klamath County Comprehensive Plan (2010)

3.16.3 Existing Conditions/Affected Environment

3.16.3.1 Demographics, Income, and Employment

This section provides demographic information for the analysis of environmental effects and identifies low income and minority populations in the area of analysis.

3.16.3.1.1 Race and Ethnicity

Siskiyou, Humboldt, Del Norte, and Klamath Counties constitute the area that could experience direct or indirect effects from implementation of the Proposed Action and alternatives. While cities within these counties would also experience effects of the Proposed Action, demographic information from the counties is generally representative of the cities. Population, race, and ethnicity data from the Census 2005-2009 American Community Survey for California, Oregon, and the four counties are detailed in Table 3.16-1.

Table 3.16-1. Population, Race, and Ethnicity, 2005-2009 American Community Survey

Geographic Area	Total Population	White (percent)	Black or African American (percent)	American Indian and Alaska Native (percent)	Asian (percent)	Native Hawaiian and Other Pacific Islander (percent)	Some Other Race (percent)	Two Races Including Some Other Race (percent)	Two Races Excluding Some Other Race, and Three or More Races (percent)	Hispanic or Latino (of any race) (percent)
California	**36,308,527**	**61.3**	**6.2**	**0.8**	**12.3**	**0.4**	**15.5**	**1.1**	**2.4**	**36.1**
Del Norte County	28,729	74.1	3.4	5.1	2.9	0.6	7.7	2.6	0.5	16.1
Humboldt County	129,003	83.0	1.1	5.3	2.2	0.3	2.9	1.0	4.1	8.3
Siskiyou County	44,404	87.1	1.4	2.7	1.5	0.2	1.6	0.8	4.9	9.7
Oregon	**3,727,407**	**86.2**	**1.7**	**1.6**	**3.5**	**0.3**	**3.3**	**0.4**	**2.9**	**10.6**
Klamath County	66,170	88.9	0.5	3.6	0.9	0.2	1.8	0.4	3.8	9.4

Source: U.S. Census Bureau 2009a.

Caucasians (white) represent the highest percentage of the population in Siskiyou, Humboldt, Del Norte, and Klamath Counties. Black or African American, American Indian or Alaska Native, Asian, Pacific Islanders, other races and two or more races combined make a small percentage each county's population relative to white and are minority populations. The counties in the area of analysis all have greater percentages of American Indians than California and Oregon as a whole. Data indicate that any impacts from the Proposed Action and alternatives could disproportionately affect Indian Tribes in the area of analysis.

Table 3.16-2 shows the tribes in the area of analysis and the total tribal enrollment as of 2005. Tribal enrollment does not mean that all members live within the area of analysis, but it is still useful information for comparison purposes. The Yurok Tribe has the greatest number of tribal members, while the Resighini Rancheria has the fewest number enrolled.

Table 3.16-2. Tribal Enrollment within the Area of Analysis, 2005

Tribe	Tribal Enrollment (number of people)
The Klamath Tribes	3,579
Quartz Valley Community	222
Karuk Tribe	3,427
Hoopa Valley Indian Tribe	1,893
Yurok Tribe	4,912
Resighini Rancheria	111

Source: Bureau of Indian Affairs 2005.

3.16.3.1.2 Low Income

Low income populations in the area are identified by several socioeconomic characteristics. Specific characteristics used in this description of the existing environment, as categorized by Census 2000, are income (per capita and median family), percentage of the population below the poverty level (all persons and families), substandard housing, and unemployment rate. Census 2010 data for these categories had not been released at the time of this writing.

As shown in Table 3.16-3, based on income in 1999, as reported in Census 2000, all three California counties have greater percentages of persons and families living below the poverty level than the State of California. Klamath County also has higher percentages of persons and families living below the poverty line than the State of Oregon. All three California counties in the analysis area have lower per capita and median family incomes than the State of California. Similarly, Klamath County has lower per capita and median family incomes than Oregon.

Siskiyou and Klamath Counties output and income have also declined due to reductions in timber harvesting. During the past 10 years, there has been a sharp decline in the Siskiyou County timber industry, which has been an economic base for the county historically. In 2009, the total value of the timber harvest in Siskiyou County was $11.6 million, about a $52 million decrease from 2000 (Board of Equalization 2010). Timber harvesting also decreased and was at its lowest value in 2009 over the 10-year period. Reductions in timber harvesting have also reduced employment opportunities in the county. Similar to Siskiyou County, timber harvests in Klamath County have been declining in recent years. Timber harvests in 2008 and 2009 showed substantial decreases relative to previous years (Oregon Department of Forestry 2010). Appendix O further describes economic conditions in Siskiyou and Klamath Counties.

Table 3.16-3. Income and Poverty, 1999

Area	Per Capita Money Income (dollars)	Median Family Income (dollars)	Persons Below Poverty Level (percent)	Families Below Poverty Level (percent)
California	**22,711**	**53,025**	**14.2**	**10.6**
Del Norte County	14,573	36,056	20.2	16.4
Humboldt County	17,203	39,370	19.5	12.9
Siskiyou County	17,570	36,890	18.6	14.0
Oregon	**20,940**	**48,680**	**11.6**	**7.9**
Klamath County	16,719	38,171	16.8	12.0

Source: U.S. Census Bureau 2000a.

Table 3.16-4 shows census tract data of residents living around the Copco Reservoir in Siskiyou County. The data shows that a lower percentage of people living around the reservoir live below the poverty level relative to the county and State. As such, it is assumed that people living below the poverty level are not disproportionately represented in the areas directly around the reservoirs.

Table 3.16-4. Poverty in Siskiyou County

	Siskiyou County		Block Group 1, Census Tract 3. Siskiyou County	
Total Population	43,699		1,618	
Number of Persons with Income below poverty level in 1999	8,109	18.6%	198	12.24%

Source: U.S. Census Bureau 2000a

In 1989, 85 percent of The Klamath Tribes' population lived below the national poverty level, with a median family income of $8,750, compared to Klamath County's median family income of $27,000 (Tribal Council of Klamath Tribes 2000). Table 3.16-5 shows families living below the poverty level within the other five tribes included in the area of analysis. Except for the Resighini Rancheria, the median household income of the tribes is less than the counties and States in the area of analysis. The tribes also have more families living below the poverty level relative to the counties and States of California and Oregon.

Table 3.16-5. Income and Poverty in Tribes, 1999

Tribes	Median Household Income (dollars)	Families below Poverty Level (percent)		
		All Families	Families with Children under 18 Years of Age	Families with Children under 5 Years of Age
Quartz Valley Community	29,375	37.1	68.4	0.0
Karuk Tribe	18,000	60.0	62.1	73.0
Hoopa Valley Indian Reservation	23,384	29.0	36.9	40.5
Yurok Reservation	20,592	26.8	36.3	60.0
Resighini Rancheria	41,250	0.0	0.0	0.0

Source: U.S. Census Bureau 2000b and Federal Energy Regulatory Commission [FERC] 2007.
Note: Income and Poverty Level information is not available for The Klamath Tribes in the 2000 Census; therefore, a different source was used and relevant data is discussed above.

Other measures of low income, such as substandard housing and unemployment rate, also characterize demographic data (see Table 3.16-6) in relation to environmental justice. Substandard housing units are those that are overcrowded and lacking complete plumbing facilities. As presented in Table 3.16-6, in the area of analysis, the California counties have a smaller percentage of overcrowded housing units and/or units lacking complete plumbing facilities than the State of California. Similarly, the data show that Klamath County has a lower percentage of substandard housing units than the State of Oregon. Consequently, substandard housing is not disproportionately concentrated in the area of analysis and is not an environmental justice concern.

Table 3.16-6. Housing and Employment

Area	Housing Units			Civilian Labor Force
	Total Occupied - 2009 (number of units)	Substandard (1.01 or more occupants/ room) - 2009 (percent)	Substandard (incomplete plumbing) - 2009 (percent)	Unemployment Rate - January 2011 (percent)
California	**12,187,191**	**7.8**	**0.5**	**12.4**
Del Norte County	9,750	3	0.0	13.8
Humboldt County	52,520	2.6	0.8	12.3
Siskiyou County	19,838	2.8	0.7	21.0
Oregon	**1,464,196**	**2.6**	**0.6**	**10.4**
Klamath County	26,761	2.4	0.9	13.0

Source: U.S. Census Bureau 2009b; Employment Development Department 2011; and Oregon Employment Department 2011.

As presented in Table 3.16-6, the unemployment rate in Humboldt County was about the same as the State of California rate, while the rates in Del Norte and Siskiyou Counties were higher than those of the State. The unemployment rate in Siskiyou County was 21 percent in January 2011, which was much larger than California's 12.4 percent rate (Employment Development Department 2011). The unemployment rate in Klamath County was higher than the State of Oregon rate.

Table 3.16-7 includes labor force and unemployment rate data for each of the six tribes. All six tribes have a much higher unemployment rate than the counties and the States of California and Oregon. The counties in the study area have a substantially higher percentage of low-income population among the Indian population compared to the overall population.

Table 3.16-7. Housing, Labor, and Employment, 2005

Tribe	Available to Work (number of people)	Unemployment Rate (percent)
The Klamath Tribes	1,135	21
Quartz Valley Community	45	49
Karuk Tribe	915	63
Hoopa Valley Indian Tribe	1,043	40
Yurok Tribe	1,096	74
Resighini Rancheria	45	60

Source: Bureau of Indian Affairs 2005.

Farm laborers, which are often minority and low income persons, could be disproportionately affected by potential effects to agricultural production. Table 3.16-8 includes information about the farm labor force in the area of analysis. Due to the use of undocumented workers during harvests throughout California and Oregon, it is likely that farm labor is actually higher than numbers officially reported in the Census. Data on undocumented workers is not available for the counties; therefore, Census data is used for comparison purposes.

Table 3.16-8. Employment and Labor Force, 2005-2009, American Community Survey

Area	Civilian Labor Force (number of people)	Farm Labor (percent)
California	**16,550,706**	**1.4**
Del Norte County	10,357	3.3
Humboldt County	58,877	2.0
Siskiyou County	17,455	3.4
Oregon	**1,765,814**	**1.9**
Klamath County	28,101	2.6

Source: U.S. Census Bureau 2009c.

The above data shows that Indian Tribes are minority and low income populations that could be disproportionately affected by the project alternatives. In addition, counties in the area of analysis have lower incomes, higher unemployment rates, and more people and families living in poverty than California and Oregon and could also be disproportionately affected by project alternatives.

3.16.3.1.3 Social Programs

Tribes within the area of analysis receive Federal and State funds to run social programs, such as Medicaid, food stamps, and education. In addition, local county funds are available to tribal members for social programs, such as foster care and police protection. However, local county funds are not given directly to the tribal governments.
Table 3.16-9 shows Federal grants and direct payments made to individuals in each of the area of analysis counties. Table 3.16-10 shows the local funds that were distributed to social programs within each county in 2010. Data showing funds received by tribes in the area of analysis are not currently available.

Table 3.16-9. Federal Funds Distribution for Social Programs, 2010

Area	Grants (millions of dollars)				Direct Payments for Individuals (millions of dollars)		
	Medicaid and Other Health-Related	Nutrition and Family Welfare	Education	Other	Social Security and Government Retirement	Medicare	Food Stamps and Supplemental Security Income
California							
Del Norte County	36.5	7.0	2.2	29.4	81.7	41.3	14.5
Humboldt County	210.5	31.9	17.0	108.2	343.5	189.9	49.9
Siskiyou County	75.0	10.7	5.3	32.6	173.4	83.6	17.5
Oregon							
Klamath County	43.1	10.9	7.7	30.8	234.8	80.7	26.6

Source: U.S. Census Bureau 2010.

Table 3.16-10. Local Funds Distributed for Government Services, 2010

Area	Education (millions of dollars)	Health and Hospitals (millions of dollars)	Police Protection (millions of dollars)	Public Welfare (millions of dollars)	Highways (millions of dollars)
California					
Del Norte County	42.8	6.9	4.2	13.6	4.1
Humboldt County	44.3	9.3	4.1	10.8	4.0
Siskiyou County	44.3	6.8	6.1	9.0	9.7
Oregon					
Klamath County	50.0	7.5	3.3	0.3	6.9

Source: U.S. Census Bureau 2010.

Distribution of social services to tribal members varies greatly by tribe and geographic area. For instance, the Yurok Tribe provides social services of many types directly to its members, including general assistance, food distribution, Indian Child welfare, and other programs (Yurok Tribe 2011a); The Klamath Tribes provides health and wellness services, homeowner assistance, and drug and substance abuse programs, among other things (Klamath Tribe 2011). Other tribes may provide few or no services directly to their members. Social programs may be funded by the Federal government and provided by the tribe, or members may receive assistance directly from their local governments. For example, members of the Yurok Tribe may choose to receive the Temporary Assistance for Needy Families program from the tribe or directly from the county in which they reside (Yurok Tribe 2011b). Therefore, no generalized data are available for social programs for tribal members.

3.16.3.2 Tribal Environmental Justice Concerns

Information about tribal history and environmental justice issues in the area of analysis has been derived from the DOI's *Effects of PacifiCorp Dams on Indian Trust Resources and Cultural Values in the Klamath Basin: Background Technical Report* (DOI 2012) also referred to as *Background Technical Report Informing the Secretarial Determination Overview Report: Current Effects of Implementing the KHSA and KBRA on Indian Trust Resources and Cultural Values*. The Sociocultural/Socioeconomics Effects Analysis Technical Reports (National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries Service) 2012a-e) for each tribe further discuss potential economic effects to tribes related to the No Action/No Project Alternative.

As part of the study for the Background Technical Report, government-to-government consultations were conducted with the six Basin tribes to solicit input from the tribal

governments regarding their assessment of effects on Indian trust resources, tribal rights to take those resources, other resources traditionally used by tribes, and cultural values related to those resources and rights within the area resulting from the current operations of the four PacifiCorp dams on the Klamath River. The reader should note that inclusion of any claims and assertions put forth by these tribes does not necessarily imply that the U.S. Government endorses those views.

Three rounds of consultation meetings were held between the Cultural/Tribal Sub-team and each of the six tribal governments. The purpose of the first consultation meetings (Round 1) was for the Sub-team to describe the process of the Current Effects Background Technical Report, elicit information about the histories and backgrounds of the tribes, and discuss how the dams might be currently affecting their resources and rights and related cultural values. In response, the Yurok, Resighini, Karuk, and The Klamath Tribes provided comprehensive background documents. The Round 2 meetings were conducted to collect comments from the tribes concerning the Current Effects Background Technical Report and the potential effects of the Dams-In Scenario and the Dams-Out Scenario on their trust and other resources and rights. In Round 3, the Sub-team sought comments from the tribes on the first draft of the Potential Effects Background Technical Report.

3.16.3.2.1 Prior to Dam Installation

Six different tribal groups live within the area of analysis. Although the language groups and traditional practices vary among the tribes, all of them based their cultures, commerce, and subsistence primarily on the river and its aquatic and terrestrial resources. Salmon, steelhead, sturgeon, Lost River and shortnose suckers, and other fish (such as red band trout, eulachon and lampreys), as well as fresh water clams, fresh water mussels, and other aquatic species, occupy a central place in the diets and belief systems of the native people. Fish, particularly salmon, determined settlement patterns and have historically been the foundation of the daily and seasonal practices, subsistence, and culture of the native people (Federal Energy Regulatory Commission [FERC] 2007). The diverse indigenous peoples of the area of analysis have all retained close connections to the river and its resources and continue to rely on the river and its resources for cultural, economic and social survival (FERC 2007). Similarly, the suckers in Upper Klamath Lake, its tributaries, and nearby bodies of water are religiously and culturally important to The Klamath Tribes.

The Klamath Basin was once the third most productive salmon run on the U.S. west coast, exclusive of Alaska (Institute for Fisheries Resources and Pacific Coast Federation of Fishermen's Associations 2006), a feature that native people ritually managed for thousands of years (Karuk Tribe 2010, as cited in DOI 2012).The U.S. Court of Appeals for the Ninth Circuit recognized this importance when it concluded that the fish were "not much less necessary to the existence of the Indians than the atmosphere they breathed" (*Blake v. Arnett*, 663 F.2d 906, 909 (9th Cir. 1981), as cited in DOI 2012). The abundance of salmon has always been a measure of tribal well being (Gunther 1926, as cited in DOI 2012). Suckers were historically an important subsistence fish for The Klamath Tribes of the Upper Basin.

3.16.3.2.2 Installation of Dams

Dams were put in place on the upper Klamath River to generate electrical power and to supply water for newly established farmland in the Upper Basin (DOI 2012). Copco 1 Dam was completed in 1918, Copco 2 Dam in 1925, J.C. Boyle Dam in 1958, and Iron Gate Dam in 1962.

The tribes within the area of analysis were not consulted prior to dam construction at any of the four sites analyzed in this Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and had no political ability at the time of dam construction to actively oppose the dams. Additionally, none of the affected tribes were beneficiaries of these hydroelectric facilities but were adversely affected by their construction through the impacts to the Klamath River fishery.

3.16.3.2.3 Effects of Dams – Subsistence (Fishing, Hunting, and Gathering)

This section describes general effects of the dams that are similar across the tribes, then presents tribe-specific effects of the dams. Additional analysis of specific impacts of the dams to each tribe is presented in Section 3.12, Tribal Trust.

Tribes in the area of analysis have historically fished along the Klamath River and its tributaries for salmon and other anadromous fish at a subsistence level. Due to a decline in fisheries, tribes are currently unable to consistently fish at a subsistence level; however, some tribes continue using some fisheries for limited subsistence, economic and ceremonial purposes.. In addition to fish and other aquatic resources, tribes have historically relied on other plant and wildlife species for subsistence. Subsistence hunting has diminished over the decades, which can be attributed to many factors including the costs of hunting licenses required to comply with strict (State) regulations (Stercho 2006) and indirectly to dam construction. Tribal members still engage in traditional hunting, gathering, and resource management activities (DOI 2012); however, the current low abundance of wildlife and plant resources do not meet subsistence needs.

Water management has changed the patterns of water flows throughout the system, affecting the channel geomorphology and spawning and rearing habitat for salmonids, lamprey, and fresh water clams and mussels. The Klamath Hydroelectric Project dams block anadromous and native fish passage to and from the upper river and have converted portions of former riverine habitat to reservoir habitat, which has eliminated anadromous fish habitat and reduced the quality and quantity of salmonid habitat upstream of the dams. For example, although the magnitude of these anadromous fish migrations is unknown, historically, anadromous fish (such as fall and spring run Chinook salmon and winter and summer-run steelhead), lamprey, and Lost River and shortnose suckers could access the Klamath Basin all the way into the rivers that are tributary to Upper Klamath Lake. Currently they are limited to the area downstream from Iron Gate Dam.

The capacity of the mainstem Klamath River downstream from Iron Gate Dam to support the rearing and migration of anadromous species is limited by changes in river flow, high water temperatures, poor water quality, and disease outbreaks, especially during the summer months. The reduction in available habitat, impairment of water quality,

increase in water temperatures, changes in channel geomorphology downstream from the dams, water diversions, and factors outside the current operations (e.g., unfavorable ocean conditions) have led to a substantial decrease in salmonid populations in the Klamath Basin (NOAA Fisheries Service 2010, as cited in DOI 2012). See Section 3.3, Aquatic Resources, for additional information about current conditions and aquatic species found in the Klamath River and Section 3.2, Water Quality, for more information about water quality in the area of analysis.

Prior to construction of dams on the Klamath River, steelhead spawned freely not only in the Klamath and its tributaries, but in the Upper Klamath Lake and beyond. Hundreds of miles of salmon habitat were lost with the construction of four dams in the Klamath River. This is a significant amount of habitat no longer available for spawning and rearing.

Dam installation and operation has affected certain plant and wildlife species. Plant species in the Klamath/Trinity Region include the following: willow shoots, cottonwood, wild grape, bulrush, hazel sticks, tules, spearmint, and blackberries (Stercho 2006). An example of the affects of dam installation and operation on plant species includes, the growth pattern of willow shoots along the river banks are different than before dam installation, and firsthand accounts from tribal members indicate that the new shoots are not suitable for traditional basket weaving (Salter 2003). Wildlife species include bear, for subsistence purposes and bald eagle, blue heron, mallards, fox, otter, and fisher for ceremonial purposes, as well as deer and elk for both subsistence and ceremonial purposes (Stercho 2006). Subsistence wildlife species potentially affected by reduced salmon and steelhead populations include the black bear (DOI 2012). Other salmon and steelhead-dependent wildlife species significant to tribes beyond their subsistence value include the bald and golden eagles, coyote, and cougar (DOI 2012).

3.16.3.2.4 The Klamath Tribes

Resources (such as hunting, fishing, gathering, trapping, and water rights), especially fish, have played a central role in the physical, social and spiritual well-being of the Klamath people for millennia. The Klamath Basin from Link River to Iron Gate once had an almost continuous geographical distribution of traditional sites and activities.

The Klamath Tribes relied heavily on upland game (e.g., deer, elk, and pronghorn antelope) and plant foods (e.g., yampah, wild plum, and many other fruits and berries), but riverine and especially marsh resources were of equal importance. Salmon and multiple species of sucker, trout, eel, lamprey, and other fish were dietary staples, while marsh and riparian plants such as the yellow pond lily (Wocus), tule, cattail, and willow provided staple foods and materials as essential tools and crafts. Salmon were numerous throughout much of The Klamath Tribes' traditional territory. Historically, The Klamath Tribes fished not only for salmon and steelhead, but also for mullet (suckers), eels, and lamprey.

In 1889, the Klamath River Improvement and Lumber Company built a 10 to 12 foot high log crib, rock filled dam at Klamathon that created an obstacle for migrating fish. In 1910, the Bureau of Fisheries installed fish racks at Klamathon that further curtailed fish migration (Fortune et al. 1966). The construction of Copco 1 Dam (1918) completely blocked anadromous fish runs into the Upper Basin and abruptly ended The Klamath Tribes' access to anadromous fish. Two other major fisheries, resident salmonids (trout) and catostomids, could still be used by The Klamath Tribes after the demise of the anadromous fisheries. The catostomid fishery consisted primarily of c'waam (Lost River sucker) and koptu (shortnose sucker) until the Tribes closed their fishery in 1986 to protect it in the face of severe population declines (DOI 2012).

Quartz Valley Community

Most of the Quartz Valley Community's tribal members are descendants of people of Karuk ancestry, although a few tribal members are also of Shasta ancestry (DOI 2012).

Traditionally used fish resources of the Scott River include Chinook salmon, coho salmon, steelhead and Pacific lamprey. The Quartz Valley Community relies on these fish for sustenance and their spiritual wellbeing. These fish need to survive their migration through the Klamath River to and from the ocean. Therefore, the tribe has an interest in Klamath River health.

Since the construction of the dams on the Klamath River, the numbers of a variety of river species have plummeted. Some of these fish had traditionally been a source of food and cultural ceremonies and practices for the Quartz Valley Community. One of the most significant impacts of the Klamath River dams is the altered seasonal warming and cooling trends in the river. This translates into a shorter fishing season in the fall, in addition to limiting the number of fishing days available in the fall (DOI 2012).

Karuk Reservation

The Klamath and Salmon River fishery and other resources supported more than 100 ancestral Karuk villages along the Klamath and Salmon Rivers. The Karuk Tribe has effectively maintained its cultural identity and traditional practices. Tribal members still engage in traditional hunting, gathering, and resource management activities. This includes preservation and use of the Karuk language, basket-making, fabrication of regalia, practice of traditional religious ceremonies, and stewardship of natural resources through use of fire and harvest management techniques.

The Karuk diet traditionally consisted mostly of salmon, deer, and acorns. Fish, especially salmon, have always been a major food resource and the focus of ceremonies for the tribe. Fish important to the Karuk include spring-run Chinook or king salmon, fall-run Chinook, out-migrating Chinook smolt, Coho, or silver salmon (also called dog salmon), steelhead, trout, sucker, bullhead, sturgeon, and Pacific lamprey. Freshwater mussels also have cultural significance for the Karuk not only for food, but also as important tools.

Since the construction of the dams on the Klamath River, the numbers of a variety of river species have plummeted. Some of these fish had traditionally been a source of food and cultural ceremonies and practices for the Karuk Tribe. Karuk believe one of the most significant impacts of the Klamath River dams is the way that the natural process of seasonal warming and cooling trends in the river is altered by the presence of reservoirs. For Karuk, this translates into a shorter fishing season in the fall. In addition to limiting the number of fishing days available in the fall, the opportunity to harvest spring Chinook salmon has been completely lost to the Karuk since construction of Iron Gate Dam (DOI 2012).

Hoopa Valley Indian Reservation

The Trinity River is of prime importance to the Hoopa Valley Tribe because it is the river that runs through the Hoopa Valley Indian Reservation. Fish destined for the Trinity River must pass through the lower Klamath River and are therefore affected by Klamath River conditions.

Uses of the Trinity River by the Hupa people are highlighted by maintenance of fisheries and religious ceremonies. Many natural foods were available to the Hupa, with salmon and acorns providing the bulk of the native diet. Other important fish include steelhead, sturgeon, and lamprey eels (DOI 2012). The decline of the river, including decreased fisheries and water quality, has adversely affected the psychological health of the Hupa.

Yurok Reservation

Deterioration of the Klamath River affects Yurok ceremonial and traditional practices. The lives of the Yurok people have always been intricately tied to the river. Historically, they depend on the river for sustenance, and much of their world was defined in terms of their physical relation to the river. Many of the Yurok cultural sites on the Klamath and lower Trinity rivers are traditional fishing spots owned by families. These are places where the Yurok have lived, fished, gathered, prayed, and buried their dead for centuries.

Over time, as the rivers' flows have changed, so have the locations of these cultural sites. As with all tribes that identify as salmon people, fish have been the Yurok Tribe's most valuable asset and a mainstay of their economy. With fish in abundance, the Yurok could not only feed themselves and their families all year long, but the surplus could be used to acquire products from outside their territory.

Since 1990, tribal commercial harvests have been marginal and have not provided a comfortable standard of livelihood. The decreased harvests have had a significant adverse impact on the tribe's economies and health. Limited access to resources has restricted the ability of the Yurok to practice some of their most important traditions. This includes freely fishing the once-prolific semi-annual salmon runs and participating in the cycle of ceremonies initiated concurrently with salmon runs (DOI 2012).

Resighini Rancheria

The Indians of the Resighini Rancheria are Yurok people; consequently they share their cultural practices and values with the general culture described for the Yurok Tribe. Resighini tribal members recently participated in the Weitchpec Jump and Deerskin ceremonies (DOI 2012).

The general health and wellbeing and cultural values of the members of the Rancheria are affected by a lack of fish in the local economy and overall water quality. The lack of fish in the local economy also has secondary effects on general tribal health and cultural well being.

The people of the Resighini Rancheria bathe in the river and use its water for daily and ritualistic purposes. Because of their reliance on the river for so many aspects of their lives, they are concerned about the quality of its water. The Klamath Hydroelectric Project has effects on water quality and related environmental issues, such as watershed health, riparian habitats, erosion, sediment, turbidity, sources of pollution and temperature changes, algae blooms, low dissolved oxygen, high pH, and un-ionized ammonia. The cumulative effects may result in health problems.

Secondary effects of the Klamath River dams on the people of the Resighini Rancheria include emotional and physical health effects such as increased obesity, diabetes, heart disease due to loss of the traditional salmon diet, and depression, alienation, and suicide. Additionally, the tribal members experience a loss of opportunity for inter-generational transmission of traditional knowledge. These conditions result in tribal members, especially young people, leaving the reservation for opportunities elsewhere (DOI 2012, 2011b).

3.16.3.2.4 Effects of Dams – Water Quality

Tribal needs for high quality water in the Klamath River are not limited to the biological needs of the fishery. Water quality plays a significant role for tribes in the Klamath Basin because it affects culturally relevant fish, and many tribes rely on the Klamath River for water supplies and use of water in ceremonial activities, such as drinking or bathing. Many tribal ceremonies must be practiced near the river and at times when water quality is at its lowest. Ceremonial practitioners must ritually bathe, submerge and at times even ingest the water from the River. Roots, materials and tribal medicinal plants, and other plants are gathered from the riverbank and require exposure to river water. For example, basketry often requires the weaver to use their teeth to strip bark pulled from the river, offering an avenue of direct exposure to water born toxins.

Under current conditions, water quality in the mainstem of the Klamath River has been listed as impaired due to the following caused or induced conditions (North Coast Regional Water Quality Control Board 2010, as cited in DOI 2012): organic enrichment, low dissolved oxygen, water temperature impairment, nutrient impairment, and toxic algae (microcystin) impairment. There is a direct cause-and-effect link between current Klamath Hydroelectric Project dam operations and water quality; this link was established in the *Basin Plan for the Klamath River*, prepared by the North Coast

Regional Water Quality Control Board (as cited in DOI 2012). See Section 3.2, Water Quality, for additional information about the link between the Klamath Hydroelectric Project dams and degraded water quality.

Impoundment of water in the four reservoirs shifts the seasonal water temperature patterns, producing cooler than normal water temperatures in the springtime and warmer than normal temperatures in the fall. These water temperature shifts disrupt spawning cycles for salmon and at times can produce stressful or lethal water temperature conditions for aquatic resources. Water with high concentrations of nutrients and organic matter entering these reservoirs leads to low dissolved-oxygen concentrations as organic matter decomposes, algal populations bloom and crash, and organic matter settles to the deeper portions of the reservoirs. Release of this low-dissolved oxygen water from these reservoirs, particularly during the summer and fall, produces stressful or lethal conditions for aquatic resources, such as salmon.

These reservoir algal blooms include blue-green algae, such as *Microcystis aeruginosa*, which release a toxin that can cause skin irritation, sickness, or in extreme cases, death, to exposed organisms, including humans (World Health Organization 1999). These toxins have been measured in the reservoirs and in the Klamath River for many miles downstream from Iron Gate Dam. Algal blooms have reached levels thousands of times higher than those the World Health Organization says are safe for recreation (DOI 2012). A survey of aquatic resources (fish and mussels) in the Klamath River showed a bioaccumulation of microcystin in their tissue (Kann 2008).

In addition, preliminary evaluation of dioxin results from the 2009–2010 Klamath River sediment cores (DOI 2011) indicates that dioxin is present at levels greater than screening levels for sediment disposal. In the J.C. Boyle and Copco 1 Reservoirs, levels are slightly above available national and western United States background values for fish and birds (USEPA 2010). However, dioxin levels indicate no current public health concerns from direct human exposure and the measured levels indicate no current bioaccumulatory concerns (DOI 2011).

Additionally, PacifiCorp indicated that some of the fish tissue samples from Upper Klamath Lake, Keno Impoundment, J.C. Boyle Reservoir, and Copco 1 Reservoir exceed the suggested wildlife screening value for total dichlorodiphenyltrichloroethane (DDT). Samples also showed that total polychlorinated biphenyl (PCB) values exceed the screening level for subsistence fishing in black bullhead from Keno Impoundment and in largemouth bass from J.C. Boyle, Copco 1, and Iron Gate Reservoirs (PacifiCorp 2004). See Section 3.2, Water Quality, for additional discussion and Appendix Tables E-5 through E-7 for sediment values and screening levels.

Downstream from the hydroelectric facilities, water conditions are also ideal for promoting fish disease, in that they allow parasites to thrive. The stable flows and warm water on the Klamath River, especially between the Shasta River and Seiad, contain elevated levels of the parasites that carry the fish diseases *Parvicapsula minibicornis* and *Ceratomyxa shasta* (California Department of Fish and Game 2004, as cited in DOI

2012). In some years up to 80 percent of the juvenile salmon in the Klamath River become infected and most die from these diseases (California Department of Fish and Game 2004, as cited in DOI 2012).

Freshwater mussels have also been adversely affected by the degraded water quality in the Klamath River. Freshwater mussels are an important food source for the Klamath River tribes and an essential part of some tribal ceremonies. During the early 20th century, mussels were gathered for food and for use in rituals late in the season when the river flows were low; unfortunately, this is the time of year when the mussels are most contaminated. Even though there are few to be found, people continue to use freshwater mussels as a food source, but their use in ceremonial celebration has been greatly reduced (DOI 2012).

The Klamath Tribes

Water quality and flows in the Klamath River and its tributaries associated with current dam operations are an important issue to The Klamath Tribes. Water conditions affect the ability of anadromous fish species to survive. A number of ritual traditions of The Klamath Tribes depend on access to clean water from natural sources, which is used in ritual purification of people, places, and objects, as well as in rituals associated with drought abatement and other environmentally restorative activities. Although tribal members sometimes acquire water for these purposes from the Klamath River canyon area, the Klamath River is widely viewed as being of compromised quality for these ritual uses, in part due to the effects of the dams on water temperature, algae development, and other variables of water quality (DOI 2012).

Quartz Valley Community

The Indians of the Quartz Valley Community are related to Karuk people and thus share their cultural practices and values with the general culture described below for the Karuk Tribe (DOI 2012).

Water quality and flows in the Klamath River and its tributaries associated with current dam operations are an important issue to the Quartz Valley Community. Water conditions affect the ability of anadromous fish species to survive. A number of ritual traditions of the Quartz Valley Community depend on access to clean water from natural sources, which is used in ritual purification of people, places, and objects, as well as in rituals associated with drought abatement and other environmentally restorative activities.

Given current degraded water quality conditions, ingestion of water as a result of traditional cultural activities or use of materials harvested from the river may pose a potential health risk (DOI 2012).

Karuk Reservation

The Karuk Tribe only has two public water systems, one at Happy Camp and the other at Orleans, which requires most residents to rely on individual wells and/or surface waters for domestic use (Karuk Tribe 2001).

Water quality plays a very significant role in Karuk tribal culture because its effects on culturally relevant aquatic species. Water quality also affects the ability of *Fataveenan*, or World Renewal Priests, to conduct ceremonies. *Pikiavish* starts with the Spring Salmon Ceremony in early spring and continues throughout late summer into early fall. Key ceremonial participants bathe multiple times a day in the Klamath River for 10 days in a row. This is the time of year when the blooms of the toxic algae, *Microcystis aeruginosa*, are at their peak. Bathing in the river is an important part of most Karuk ceremonies. Bathing is also associated with funeral services, subsistence practices, recreational swimming, courtship, and individual hygiene.

Karuk tribal members collect willow roots, wild grape, cottonwood, and willow in the riparian zone along the Klamath River and use these materials to make baskets. Traditional collection of these basketry materials often involves wading in the water, and washing and cleaning the materials in the river. Willows are peeled by mouth following cleaning with river water, and plants are also collected for food, medicine, and other cultural functions. Given current degraded water quality conditions, ingestion of water as a result of traditional cultural activities or use of materials harvested from the river may pose a potential health risk (DOI 2012).

Hoopa Valley Indian Reservation

The Hoopa Valley Indian Reservation hosts a seasonal abundance of surface water for drinking water supply while in contrast, ground water aquifers are quite limited. Increased areas of ground water contamination are occurring, which makes it more difficult to use ground water as a source of drinking water. The tribe is now faced with the challenge of meeting the increase demands for drinking water supply, while maintaining quality surface water in streams to protect fish, wildlife and other beneficial uses (Hoopa Valley Tribe 2008).

Yurok Reservation

Limited access to resources has restricted the ability of Yurok to practice some of their most important traditions. This includes freely fishing the once-prolific semi-annual salmon runs and participating in the cycle of ceremonies initiated concurrently. In the past, the Yurok were not inclined to leave their territory; currently, several factors, including an inability to meet subsistence needs from the fishery and a perception that the rivers are dirty, prompt younger tribal members to leave the area to find work (DOI 2012).

Resighini Rancheria

The Indians of the Resighini Rancheria are Yurok people; consequently they share their cultural practices and values with the general culture described above for the Yurok Tribe.

Both the Yurok and the Yurok of the Resighini Rancheria bathe in the river and use its water for daily and ritualistic purposes. Because of their reliance on the river for so many aspects of their lives, they are concerned about the quality of its water. The Klamath Hydroelectric Project has effects on water quality and related environmental issues, such

as watershed health, riparian habitats, erosion, sediment, turbidity, sources of pollution and temperature changes, algae blooms, low dissolved oxygen, high pH, and un-ionized ammonia. The cumulative effects may result in health problems, not just for the people who live on the Rancheria, but also for the tourists who come and camp in the area every year, and for people who use the water for business purposes or who work for those businesses (DOI 2012).

3.16.3.2.5 Effects of Dams – Tribal Health

Secondary, or indirect, effects of the Klamath Hydroelectric Project dams on tribes within the area of analysis include physical and emotional health issues.

The loss of naturally occurring resources, such as fish, lamprey, freshwater clams, and mussels, can leave tribal members with no other option than to supplement their diets with government-provided subsidies and/or store-bought food. Studies have found that supplementing or replacing traditional diets of Indian people is often detrimental to their health, contributing to the widespread occurrence of obesity and related diabetes in Indian populations today (Norgaard 2004; Yurok Tribe 2006, Acton et al. 2003; California Rural Indian Health Board [CRIHB] 2010; Trafzer and Weiner 2001, as cited in DOI 2012.

Poor water quality, as demonstrated in recurring toxic algal blooms in the Klamath River has the potential to affect human health, as water from the river plays a central role in tribal ceremonies. Poor water quality also affects drinking water, fish, freshwater clams, and mussels that the tribes eat as discussed above. Bioaccumulation screening levels for DDT and dioxins were exceeded in sediment samples taken from the Klamath River. While levels now indicate no current public health concerns from direct human exposure, there is the potential for bioaccumulation to occur in the Klamath Hydroelectric Project reservoirs.

Emotional and social health of the individuals in the tribes has also been affected indirectly by dam installation. When a people's identity and cultural practices are closely associated with a species that no longer thrives, a sense of connection and belonging is lost (Norgaard 2004, as cited in DOI 2012. Young people may feel this loss of belonging because they have never experienced the Klamath River as previous generations once did. The decline of the resource makes seasonal celebrations of the salmon runs difficult to understand and to carry out. The Yurok and Hoopa Valley Tribes continue to perform down-river boat ceremonies; however, sometimes the water is so shallow it is necessary to call Federal agencies to request water flow increases to perform the ceremony. The NOAA Fisheries Service Biological Opinion sets flow requirements downstream from Iron Gate Dam that affect river flows available for ceremonies. Section 3.3, Aquatic Resources, and Table 3.3-4 summarize these flow requirements. The factors discussed in this section indirectly affect the emotional and social health of the tribes within the area of analysis (DOI 2012).

The Klamath Tribes

Because salmon was the first dietary staple to be lost to The Klamath Tribes, its depletion was said to have initiated dramatic dietary shifts among tribal members. For a time, this fostered increased consumption of deer and mullet (suckers), which some tribal members believe resulted in localized overuse of these resources when taken in combination with fish and game management practices of the State of Oregon. For some, the loss of the salmon was the catalyst for a dietary transition that led to the ultimate dependence of The Klamath Tribes on the purchase of processed foods and the use of supplementary commodity goods.

Tribal members attribute a number of historical health problems to the loss of salmon. Recent Indian Health Service studies endorsed by The Klamath Tribes concluded that a host of physical ailments plaguing members of The Klamath Tribes have been linked to the demise of the aboriginal diet. Diabetes, hypertension, obesity, and related cardiovascular ailments are particularly widespread, reflecting dramatic changes in food consumption and procurement patterns (DOI 2012).

Quartz Valley Community

The members of the Quartz Valley Community refrained from making any comments regarding health effects (DOI 2012).

Karuk Reservation

The Karuk have been denied traditional food sources such as salmon over the last 150 years, and have increasingly adopted western foods. The decrease in the availability of traditional foods, including salmon, trout, eel (various species of lamprey), mussels, and sturgeon, is responsible for many diet-related illnesses among Indians, including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney problems, and stokes (Joe and Young [1993] as cited by Nogaard2004). The estimated diabetes rate for the Karuk Tribe is 12 percent, nearly two times the U.S. average, and the estimated rate of heart disease for the Karuk is 39.6 percent, three times the U.S. average. These conditions result from the lack of proper nutrient content in foods consumed without fishing and gathering food.

Difficulty in meeting basic needs can result in overwhelming physical and psychological stress. Traditionally, fishing is done by Karuk men. With the loss of the salmon comes a loss of a man’s sense of pride in being able to provide food for his family and tribe. For a tribe that has called itself The People of the Fish, there is an indisputable loss of identity when there are no fish. For a people whose belief system includes their specific role on earth, that they have a predefined relationship with nature that needs to be honored, there is a sense of failure when they are unable to fulfill that role.

The changes that have caused wildlife to become scarce and the rivers to become polluted may make it hard for young people to understand the ways of their parents and grandparents. Never having seen it themselves, they do not understand that in the past there could be eight yearly runs of salmon in the Klamath when all they see is one-half of a fall run. Without tradition as an anchor, young people are sometimes drawn to gangs to establish a feeling of belonging, and leave Karuk territory for cities (DOI 2012).

Hoopa Valley Indian Reservation

The secondary effects of the Klamath River dams on the people of the Hoopa Valley Tribe include emotional and physical health effects such as increased obesity, diabetes, heart disease due to loss of the traditional salmon diet, and depression, alienation, and suicide. Additionally, the tribal members experience a loss of opportunity for intergenerational transmission of traditional knowledge. These conditions result in tribal members, especially young people, leaving the reservation for opportunity elsewhere (DOI 2012).

Yurok Reservation

Secondary effects of the Klamath River dams on the Yurok Tribe include emotional and physical conditions such as increased obesity, diabetes, and heart disease due to loss of traditional salmon diet, and depression and alienation that can result in suicide (DOI 2012).

Resighini Rancheria

Secondary effects of the Klamath River dams on the people of the Resighini Rancheria include emotional and physical health effects such as increased obesity, diabetes, heart disease due to loss of the traditional salmon diet, and depression, alienation, and suicide. Additionally, the tribal members experience a loss of opportunity for inter-generational transmission of traditional knowledge. These conditions result in tribal members, especially young people, leaving the reservation for opportunities elsewhere (DOI 2012).

3.16.3.2.6 Effects of Dams – Economy (Commercial Fishing)

Historically, and in contrast to the current situation, the commercial salmon fishery was a substantial component of the West Coast resource-based economies. The numerous local anadromous fisheries allowed tribes, such as the Karuk and Yurok, to develop subsistence economies highly specialized in fishing (Stercho 2006). The more recent history (1976 to the present) is characterized by poor ocean condition cycles, and adverse habitat alterations (including construction of hydroelectric facilities) for all regions along the West Coast of North America (FERC 2007). These trends have caused substantial decreases in the amount of income and jobs in economies where salmon and steelhead fishing have historically been important. Coastal communities and tribes have experienced the greatest losses in this regard (FERC 2007).

The Klamath Tribes

The current operations of the dams have had a range of secondary effects on The Klamath Tribes. Among these effects are the decline in fish and wildlife other than anadromous fish (DOI 2012). These declines have resulted in a diminished economy. The Klamath Tribes were forced to close their c'waam fishery in 1986 to protect it in the face of severe (fish) population declines (DOI 2001a).

The decline in fish populations has contributed to the decline of various fish dependent species. Several salmon-dependent wildlife species are of traditional cultural significance to members of The Klamath Tribes beyond their subsistence value. Many non-salmon species and ecologically linked plants are significant for the cultural and

economic well-being of The Klamath Tribes. The Klamath Tribes members traditionally used pelts, feathers, and other body parts from some of these animals in ceremonial regalia, traditional crafts, and for other purposes. In a few cases, tribal members relied on the sale of pelts from some of these species for supplemental income.

Large gatherings associated with the fish harvest once served as a venue for economic exchanges. The demise of the fish population has interrupted the performance of the important economic, social and cultural functions.

Although The Klamath Tribes have the most direct interest in resources upstream of the four hydroelectric dams, the current operations of the Klamath Hydroelectric Project have affected The Klamath Tribes' (through a complete end to the anadromous fishery) in the Upper Basin and resource interest in the footprint of the dams and impoundments, and downstream from the dams in lands ceded by The Klamath Tribes. Plants, animals, soil, and rocks are all of concern to The Klamath Tribes members, both economically and environmentally (DOI 2012).

Quartz Valley Community

The Indians of the Quartz Valley Community are related to Karuk people and thus share their cultural practices and values with the general cultural described for the Karuk Tribe below.

Karuk Reservation

The lack of fish in the local economy has secondary effects on general (Karuk) tribal health and cultural wellbeing. Since the construction of the dams on the Klamath River, the numbers of a variety of river species have plummeted. Some of these fish had traditionally been a source of food and cultural ceremonies and practices for the Karuk Tribe, as well as a means of trade and income.

The lack of migratory steelhead affects the local economy and the wellbeing of the Karuk Tribe. Steelhead fisherman from outside the area used to pay for the privilege of fishing for the Klamath steelhead, bringing money into the local economy to the benefit of the Karuk Tribe. Today, the number of steelhead is so low that the sport is no longer viable (DOI 2012).

Hoopa Valley Indian Reservation

The Hoopa Valley Tribe maintains a modest commercial fishery program (DOI 2012). The Trinity River, like most West Coast Rivers, has experienced a decline in Chinook salmon, steelhead, and Coho runs. The Trinity's Coho salmon is currently listed as threatened under the Endangered Species Act (Hoopa Valley Tribal Fisheries).

Yurok Reservation

Fish are the Yurok Tribe's most valuable asset and a mainstay of their economy. Abundant fish allow Yurok to feed themselves and their families and to acquire products from outside their territory through trade. Fish was a trading commodity available to any enterprising man. A young man who diligently fished and successfully traded fish for

other items could amass sufficient wealth to buy a boat, travel to collect all of the necessary items to fashion intricate ceremonial regalia, and to allow him to marry. Fish were the baseline resource that facilitated the acquisition of wealth and upward social mobility in Yurok culture.

The Yurok Tribe voluntarily closes its commercial fishery in critical years out of concern for the survival of Klamath River salmon. These closures adversely affect the tribal community which relies heavily on income from the short commercial season for harvesting fall Chinook salmon. In general, declines in total numbers of fish stocks have adversely affected the ability of the Yurok Tribe to harvest for commercial purposes. In the past, the Yurok were not inclined to leave their territory; currently, several factors, including an inability to meet subsistence needs from the fishery prompt younger tribal members to leave the area to find work (DOI 2012).

Resighini Rancheria

The original "Merin" proposal to create the Resighini Rancheria described the tract of land as "agricultural" with conditions that are "ideal for farming or dairying." However, the value of the land as agricultural was directly connected to the loss of traditional fisheries. In past years, commercial and subsistence fishing was a primary means of economic and subsistence support for the Yurok including the Resighini along the Klamath River. However, with the closure and restrictions on tribal fishing, this means of support was lost. While the "fish wars" and accompanying litigation of the 1970s and 1980s reinstated Yurok fishing rights and the Hoopa-Yurok Settlement Act further confirmed that the Yurok Tribe had fishing rights. Any Klamath River salmonid fishing rights and concomitant water rights to which the Resighini Rancheria may be entitled have not yet been determined [Solicitor's Opinion M-36979 October 4, 1993].

3.16.3.2.7 Effects of the Dams – Electricity Distribution

On February 24, 1917, the California Oregon Power Company (now PacifiCorp) entered into an agreement with the Klamath Water Users Protective Association (irrigators) to extend to the water users of the Klamath Hydroelectric Project certain preferential power rates (Klamath Water Users Association 2004). This agreement was amended and further extended for a 50-year period on April 16, 1956 (Klamath Water Users Association 2004). No similar power agreement was extended to the tribes located within the area of analysis because preferential power rates are normally provided only for on-farm agricultural use. To date, non-farm irrigating Tribes in the area of analysis still do not receive energy benefits from the Klamath Hydroelectric Project operations.

3.16.3.2.8 Summary of Environmental Justice Issues

Although many other historic and current factors, such as mining, timber extraction, agricultural production, and cattle grazing, affect the environmental integrity of the Klamath Basin, the current operations of the four Klamath Hydroelectric Project dams also substantially adversely affect water quality and fishing resources of the Klamath Basin tribes and, by extension, their way of life. Due to tribes' resource-based economy, culture, dam installation has directly and indirectly resulted in environmental concerns related to fishing, water quality, health, and the economy that disproportionately affects

tribes in comparison to the general population in the area of analysis. While the tribes experienced disproportionately greater adverse effects of dam installation and operation, they did not receive any benefits of the project, including fixed-price electricity.

Current dam operations substantially contribute to compromised water quality, loss of habitat for anadromous and other aquatic species, and altered riverine ecosystem functions. These contributing factors have led to the decline of the anadromous fishery and other inter-related aquatic populations important to the continuance of an Indian river-based way of life. The decline of the anadromous fishery is directly and indirectly linked to the decline and scattering of the people, culture and language of the "Salmon People" of the Klamath Basin. The decline is manifested particularly in physical illness, mental illness, the loss of traditional knowledge, and social conflict among native peoples and between native peoples and non-natives also residing in the Klamath Basin (DOI 2012).

3.16.3.2.9 Summary of Tribal Involvement in KHSA and KBRA

As described in Chapter 1 (Introduction), the KHSA and the KBRA were signed in February 2010 by representatives of 45 organizations, including three tribes: Karuk Tribe, the Klamath Tribes, and Yurok Tribe.

In addition, comments from the tribes were solicited during the scoping period for the EIS/EIR. Comment letters were received from the following tribes: The Klamath Tribes; Karuk Tribe; Hoopa Valley Tribe; Yurok Tribe; Resighini Rancheria; and Modoc Nation. Applicable scoping comments from the tribes have been addressed throughout the EIS/EIR.

The Klamath Tribes, Karuk Tribe, Hoopa Valley Tribe, Yurok Tribe and Resighini Rancheria have all signed a Memorandum of Understanding as a Cooperating Agency. As Cooperating Agencies they were all afforded a review of a Cooperating Agency Draft EIS/EIR. Comment letters were received and those comments are addressed in this Draft EIS/EIR.

3.16.4 Environmental Consequences

3.16.4.1 Effects Determination Methods

This discussion of environmental consequences focuses on evaluating potential disproportionate adverse effects (including social, health, economic, or other environmental impacts) on low income or minority populations. This section also identifies potential benefits to low income and minority populations. The analysis relies on demographic and income data obtained from the Federal and local governments to identify disproportionate low income and minority populations in the area of analysis. The analysis does not examine alternative locations for the Proposed Action that would reduce environmental justice effects on such populations because the dams are already in place and thus the Proposed Action to remove the dams cannot take place elsewhere.

Four factors were used to determine if there were a disproportionate number of low-income individuals in the area of analysis: income, poverty, substandard housing, and unemployment. It was found that the area of analysis does not have disproportionately more substandard housing than Oregon or California; therefore no low income individuals were identified on this basis. Data does show that there are disproportionately more individuals with low incomes, living in poverty, or unemployed at a county level relative to the State(s). As shown in Table 3.16-4, within Siskiyou County, there are not disproportionately more people living below the poverty level in the Census tract that contains the Copco Reservoir (the area adjacent to the potential project deconstruction activities). These data suggest that low income individuals are not represented in the immediate area of dam deconstruction and there would be no disproportionate effects. Therefore, this analysis instead focuses on potential environmental justice effects on county residents as a whole where there are a high proportion of low income and minority individuals relative to the State.

The Lead Agencies did determine that the percentage of persons identifying as Indian reflected minority and low income populations that could be disproportionately affected. Due to minority and low income status, as well as the past Klamath watershed history, existing qualitative reports (DOI 2012), and information gathered during scoping, it was determined that tribal communities might experience disproportionate impacts from the Proposed Action that might raise environmental justice concerns. While the area of analysis examines specific tribes located within the four counties, there is the potential for members of other tribal groups to live along the Klamath River.

The area of analysis also has a substantial population of farm workers, which are mostly minority and low income individuals. Because actions related to KBRA might disproportionately affect farmers, an analysis of potential environmental justice impacts on farm workers was conducted.

The analysis of social concerns, including environmental justice, is based on an understanding of how the resources in the area of analysis are used (e.g., for fishing, ceremonies, and cultural practices) and by whom, as well as the indirect economic effects on the local community. This includes the dependence of individuals and businesses on the Klamath River resources. Based on these parameters, a qualitative analysis of social and environmental justice concerns was conducted.

NEPA requires an analysis of social, economic, and environmental justice effects; however, there is no standard set of criteria for evaluating environmental justice impacts. According to the California Environmental Quality Act (CEQA), economic and social impacts are not considered significant effects on the environment. Therefore, there is no guidance in the Initial Study Checklist included in the CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387), and no significance determinations are made or mitigation measures required in the impact analyses.

For the purposes of this EIS/EIR, the No Action/No Project Alternative is the basis of comparison, as required by NEPA. The No Action/No Project Alternative also represents the continuation of past environmental justice issues for tribal people that occurred since the dams were constructed.

3.16.4.2 Effects Determinations

3.16.4.2.1 Alternative 1: No Action/No Project Alternative

Continued impoundment of water at the reservoir and decline in fisheries could disproportionately affect tribal people. The issue of dam removal has been brought forward by the affected Indian Tribes in response to the long-standing environmental concerns that are a direct result of the construction and continued operation of the four Klamath Hydroelectric Project dams. In the short and long term, the four subject dams would continue to operate along the Klamath River, thus continuing the historical environmental justice impacts to tribes resulting from dam construction and operation.

The river and its aquatic resources are a central part of cultural heritages of tribal communities. As such, tribes in the area of analysis have been disproportionately affected by the Four Facilities along the Klamath River. Under this alternative, an increase in salmonid populations and improvements in water quality and aquatic species populations in the Klamath Basin would not be likely. The Klamath Tribes would continue to suffer from lack of a salmon and steelhead fishery in the Upper Basin, which would prolong disproportionate adverse impacts to The Klamath Tribes' culture, subsistence and income. The Lost River and shortnose sucker fishery would also remain closed to protect severely decreased populations in the Upper Basin. This would also continue existing environmental injustices to The Klamath Tribes.

The Quartz Valley Indian Community, Karuk, Hoopa Valley, Yurok, and Resighini Rancheria Tribes in the Lower Basin would continue to experience a declined salmon and steelhead fishery in the Klamath River under the No Action/No Project Alternative. There would be continued disproportionate adverse effect on tribes' cultural and ceremonial practices with limited access to resources. Because of decreased fisheries and shorter or no fishing seasons, Indian Tribes would be unable to meet subsistence needs and tribal incomes would remain low from reduced fishing opportunities.

Therefore, in the long term, tribes in the area of analysis would continue to be disproportionately affected by the dams, and their situation would remain an environmental concern under this alternative.

Increased traffic, air quality emissions, and noise associated with construction could disproportionately affect county residents and tribal people. Under the No Action/No Project Alternative, no deconstruction or construction would be required. Therefore, no short term deconstruction- or construction-related impacts, such as increased traffic on local roads, air pollutants, or noise, would disproportionately affect county residents or tribal people in the area of analysis.

Release of sediment from reservoirs could cause disproportionate short term impacts on county residents and tribal people. Under the No Action/No Project Alternative, sediment would not be released from the reservoirs and there would be no disproportionate short term impacts on county residents and tribal people.

Continued impoundment of water at the reservoirs could cause disproportionate long term water quality impacts on county residents and tribal people. Under the No Action/No Project Alternative, water quality in the reservoirs and Klamath River would continue to be degraded with ongoing operation of the Klamath Hydroelectric Project facilities. Degraded water quality would affect recreation opportunities for county residents and tribal people, if there is reduced access to the reservoirs and rivers. All residents and out-of-region visitors would be affected equally by loss of access to recreation. As described in Section 3.20, Recreation, there are many other recreation sites within the region that could substitute for river and reservoir recreation activities. There would be no disproportionate effects to county residents and tribal people by long-term water quality impacts to recreation.

Degraded water quality under the No Action/No Project Alternative would extend an existing environmental justice impact on the tribal communities. Poor water quality would continue to affect culturally relevant fish, water supplies, and use of water in ceremonial activities that include drinking or bathing for all tribes in the area of analysis. For example, The Klamath Tribes would continue to not be able to perform rituals that rely on clean water from natural sources because of high water temperatures and algal development. Toxic algal blooms during the summer would also continue to affect annual work renewal ceremonies for the Karuk, Hoopa Valley, and Yurok Tribes. Similarly, the Resighini Rancheria would also be unable to bathe in the river and use its water for daily and ritualistic purposes under the No Action/No Project Alternative. Degraded water quality also affects salmon, steelhead, freshwater mussels, and other aquatic species that provide subsistence or commercial fishing revenues for the tribes. Continued seasonal and annual toxic algal blooms, high water temperatures, and other water quality impairments under the No Action Alternative would continue disproportionate effects and environmental justice concerns on the tribes in the Klamath Basin.

Changes in county revenues could decrease county funding of social programs used by county residents. The reservoirs and Klamath River would not be altered under the No Action/No Project Alternative. As such, no short or long term changes to property values or local tax revenues would occur under this alternative associated with dam removal. County residents would not be disproportionately affected.

Continued impoundment of water could disproportionately impact tribal health and social wellbeing in the long term. Under the No Action/No Project Alternative, the dams would remain and current conditions in the Klamath River would continue in the short and long term. Under this alternative, the ecosystem would not be improved and aquatic species populations would not increase. Consequently, tribes would not have increased access to fish and other aquatic resources. Without access to these traditional diets, tribal

members would be required to continue supplementing their diets with store-bought food or government-provided subsidies, most of which have high concentrations of sodium, sugar, and unhealthy fats. As such, high levels of diet-related diseases, such as diabetes, obesity, and heart disease in the tribal community have the potential to continue in the long term (Norgaard 2004; Yurok Tribe 2006, Acton et al. 2003; CRIHB 2010; Trafzer and Weiner 2001, as cited in DOI 2012). For example, a host of physical ailments plaguing members of The Klamath Tribes have been linked to the demise of the aboriginal diet. Diabetes, hypertension, obesity, and related cardiovascular ailments are particularly widespread, reflecting dramatic changes in food consumption and procurement patterns (DOI 2012). Reduced tribal health would likely reduce social wellbeing of tribes because of increased sickness, disease, and stress.

In addition, aquatic resources are a critical component of traditional culture, and without any improvement to these resources, tribal members could continue to suffer from emotional and social health issues due to a loss of access to traditional resources required for continued ceremonial and cultural lifestyle and practices in the long term.

Additionally, the No Action/No Project Alternative would not result in short term concentrations of inorganic and organic contaminants at levels that adversely affect beneficial uses or are toxic to humans in the area of analysis. However, there is the potential for continued long term bioaccumulation of dioxins and DDT to occur (see Section 3.2, Water Quality, for additional bioaccumulation discussion). Therefore, under the No Action/No Project Alternative, long term improvements in tribal health and social well being would not likely occur.

3.16.4.2.2 Alternative 2: Full Facilities Removal of Four Dams (the Proposed Action)

Dam removal activities could affect fisheries and disproportionately affect tribal people. Dam removal would begin in 2020. Effects until the dams are removed would be similar to the No Action/No Project Alternative. Once complete, dam removal would improve anadromous fisheries in the Klamath River and help recovery of the endangered sucker fisheries. Restored fisheries would help reverse the environmental justice impacts to the tribes that the dams created. The tribes would be able to rely on the river to provide fish for subsistence and some tribes could resume commercial fishing operations to increase revenues. Section 3.15 describes the economic effects to tribes, including commercial fishing. The Sociocultural/Socioeconomics Effects Analysis Technical Reports (NOAA Fisheries Service 2012a-e) for each tribe also discuss potential economic effects of increased fishing for commercial and subsistence purposes. The tribes would also be able to perform cultural practices and ceremonies without restrictions because of increased fish populations. The Proposed Action would be a benefit relative to environmental justice compared to the No Action/No Project Alternative.

Increased air pollutants and noise associated with dam removal activities could disproportionately affect county residents and tribal people. Full removal of all Four Facilities would require a large amount of construction equipment and personnel. Construction crews would be housed in towns near the reservoirs and staging of

equipment would need to occur in the months leading up to the removal. The Proposed Action would require a build-up of equipment and personnel prior to reservoir drawdown and a post-construction period after the removal is complete. Equipment, personnel, and activities directly related to the drawdown and removal could be needed for months before and after actual dam removal. Temporary, short term air quality and noise impacts from deconstruction would occur (See Sections 3.9, Air Quality, and 3.23, Noise and Vibration) that would disproportionately affect Siskiyou and Klamath County residents and tribal people, which as a whole are low income relative to California and Oregon. Implementation of mitigation measures in Sections 3.9, Air Quality, and 3.23, Noise and Vibrations, would reduce the severity of these short term construction impacts. Environmental justice effects on county residents and tribal people from deconstruction would be greater under the Proposed Action relative to the No Action/No Project Alternative.

The traffic on the associated haul roads could disproportionately affect county residents and tribal people. The Proposed Action would require heavy equipment, such as large excavators, bulldozers, large dump trucks, cranes, and support equipment, to be brought to the construction area. Construction workers driving to and from the deconstruction area would also increase traffic along local roads. Section 3.22, Traffic and Transportation, identifies short term traffic impacts along haul roads that would occur as a result of deconstruction activities. These impacts include traffic flow and safety impacts. Residents in Siskiyou and Klamath Counties would be disproportionately affected by increased traffic on local roads during the construction period. Residents would be subject to short term impacts, such as increased congestion, potential traffic delays, slow moving trucks and potential safety hazards. Section 3.22, Traffic and Transportation, identifies measures to be taken to reduce traffic effects of the Proposed Action.

Tribes could be similarly affected by increased traffic. Figure 3.16-1 shows haul routes relative to tribal lands. The Klamath Tribes are the only tribe within relative distance to any of the identified haul routes; however, they are not within close enough proximity to cause a disproportionate effect. Section 3.22, Traffic and Transportation, identifies measures to be taken to reduce traffic effects of the Proposed Action. There would be no adverse environmental justice effects from traffic on tribes within the area of analysis.

Dam removal activities could provide jobs for county residents and tribal people that are low income and minority. Deconstruction activities would generate jobs in the area of analysis. Approximately 90 construction workers would be hired locally during peak deconstruction period and about 60 workers would be hired locally on average during the deconstruction period from Klamath or Siskiyou Counties. Increased employment would support low income individuals, resulting in a beneficial effect. This short-term benefit of the Proposed Action would be greater than under the No Action/No Project Alternative, which would not create any new jobs in the area of analysis.

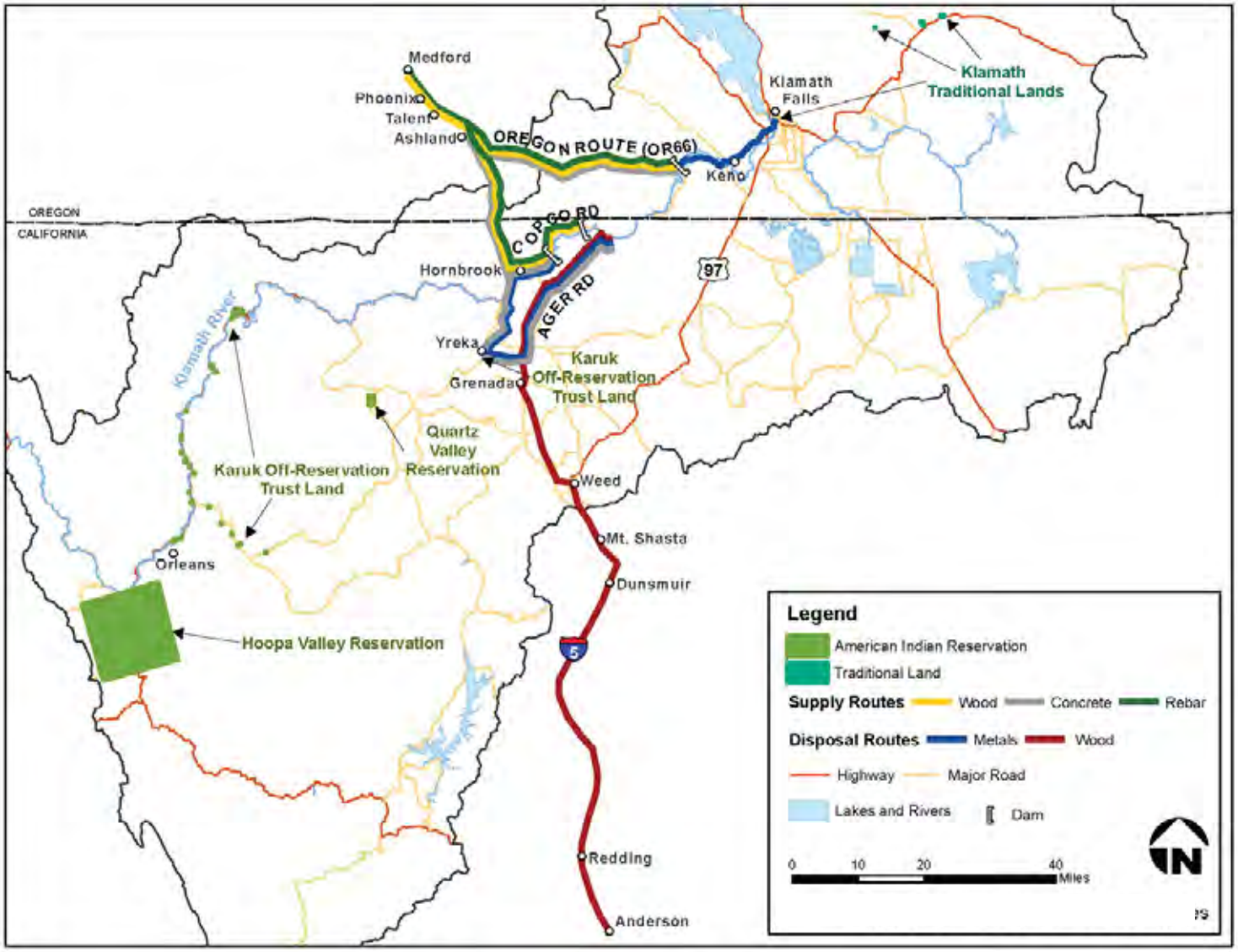

Figure 3.16-1. Tribal Lands near Haul Routes.

Section 3.15 estimates that approximately 49 jobs would be lost in the long term as a result of decreased annual operation and maintenance (O&M) from removal of the Four Facilities. These jobs losses would occur in Siskiyou and Klamath Counties. PacifiCorp may relocate employees to other jobs within the company. This would reduce some of the direct job losses as a result of the Proposed Action. Additionally, the Proposed Action would also create over 1,400 jobs within the two-county region related to short-term construction and more with KBRA implementation. These job creations would help offset losses related to O&M reductions.

Section 3.15 estimates that approximately 4 jobs related to reservoir recreation would be lost after dam removal. These jobs losses would occur in Siskiyou and Klamath Counties. As stated in the recreation section, there are multiple other recreation opportunities available within the region that could offer job opportunities, especially if visitors substitute recreation at these facilities and additional workers are needed to support new visitors. In addition, dam removal would create new recreation opportunities related to in-river sport fishing. The economic analysis estimates that approximately 3 new, long-term jobs would be created as a result of increased in-river fishing under the Proposed Action. Siskiyou County is also included in the economic region for in-river sport fishing. These new jobs would help offset the jobs lost related to reservoir recreation.

Section 3.15 also estimates that approximately 14 jobs related to whitewater boating would be lost after dam removal. The whitewater boating region (Jackson, Klamath, Siskiyou, and Humboldt Counties) supports about 5,762 jobs in the arts, entertainment, and recreation sector. Out of the total jobs in this particular job sector, the 14 jobs lost would represent approximately two-tenths of one percent (0.2 percent) of the job base.

Additionally, the loss in existing jobs would be offset by the more than 1,400 new jobs created during the decommissioning and deconstruction of the four dams. Given the location of the dams, the majority of that jobs creation would likely occur in Siskiyou County. Based on the above, the loss of jobs associated with the Proposed Action would not be a disproportionately high and adverse impact on low income populations.

Release of sediment from reservoirs could cause disproportionate short term impacts on county residents and tribal people. The Proposed Action would release sediment into the Klamath River during dam removal. Results from chemistry analysis and tests, discussed in Section 3.2, Water Quality, indicate that short term sediment release associated with the Proposed Action would not cause increases in concentrations of inorganic and organic contaminants that would adversely affect beneficial uses, be toxic to humans, or result in bioaccumulation in the Lower Basin. As such, county residents and tribal people would not be disproportionately affected by the release of sediment in the short term.

As described in Section 3.3, Aquatic Resources, the Proposed Action could reduce mussel populations in the short term as a result of sediment release. This would continue to affect subsistence for tribes that rely on freshwater mussels as a food source. Specifically, the Karuk Tribe depends on freshwater mussels for not only substance, but

also for cultural and economical value (DOI 2012). This would be a disproportionate adverse effect to the food source of tribal people in the short term. As described in Section 3.3, Aquatic Resources, implementation of Mitigation Measure AR-7 would reduce the short- and long-term effects of the Proposed Action on freshwater mussels. With implementation of Mitigation Measure AR-7 there would still be adverse affects on a portion of the freshwater mussel population and the disproportionate adverse effect to the food source of tribal people in the short term would be reduced but not completely avoided.

Dam removal activities could cause disproportionate long term water quality impacts on county residents and tribal people. Dam removal would begin in 2020. Effects until the dams are removed would be similar to the No Action/No Project Alternative. After dam removal, water quality would be expected to improve in the Hydroelectric Reach over the long term. Additionally, there would be long term beneficial effects on dissolved oxygen concentrations and decreased water temperatures downstream from Iron Gate Dam. Similar to improved fisheries, improved water quality would help reduce some of the environmental injustices that the dams have caused to Klamath Basin tribes. Improved water quality would further support restoration of anadromous and sucker fisheries, which would benefits tribes' cultural practices, subsistence, and economies. Based on proposed increased habitat availability and habitat quality, the Proposed Action would also have beneficial effects on mussels in the long term, further supporting subsistence for tribes. Reduced algal blooms would allow for contact recreation during the summer months, which would benefit tribes and county residents. The Proposed Action would be a benefit relative to environmental justice compared to the No Action/No Project Alternative.

Changes in county revenues associated with dam removal could decrease county funding of social programs. As described in Section 3.15, Socioeconomics, the Proposed Action could cause a short and long term decline in tax revenue to the counties associated with a discontinuation of tax revenue from PacifiCorp and a potential decrease in property values near the reservoirs. There could be an additional long term increase in property tax revenues resulting from increased property values near and adjacent to the Klamath River due to improved water quality. Counties use tax revenues to support programs for public health, public welfare, education and various other services. Decreases in tax receipts could reduce funding for these programs and adversely affect individuals in Siskiyou and Klamath Counties that rely on government support. Conversely increases in tax receipts could improve funding for these programs improving conditions for individuals in Siskiyou and Klamath Counties who rely on government support. It is speculative to quantify short- and long-term impacts on county social programs because many of these programs receive funding from the State and Federal Governments in addition to county funds. If funding to social programs is reduced, effects would disproportionately affect low income county residents.

Dam removal activities could disproportionately impact tribal health and social wellbeing in the long term. The Proposed Action would be beneficial to fall- and spring-run Chinook salmon, Coho salmon, and summer and winter steelhead, as described in

Section 3.3, Aquatic Resources, in the long term. Fish population increases would allow the tribes to increase subsistence fishing and once again make fish a larger component of their diet and ceremonies. Improved water quality would reduce effects to mussels, which could allow tribes to increase consumption of mussels. Consequently, they could rely less on store-bought and/or government-subsidized food (DOI 2012). In the long term, greater access to their traditional diet has the potential to positively affect the emotional, physical, and social health of the tribes (DOI 2012). Improved water quality and fish populations would also improve recreation on the Klamath River and potentially allow the Tribes to take advantage of potential recreation-tourism opportunities to improve economic welfare.

The increased flows in the Klamath River and increased fish populations could also allow ceremonies to become more relevant to younger tribe members, allow a greater sense of community within the tribe, and eventually positively affect the social wellbeing of the tribe. As such, implementation of the Proposed Action could beneficially affect tribal health in the long term. The Proposed Action could allow tribal people to gain increased self-reliance and self-sufficiency through increased subsistence and the restoration of the tribal commercial fishery.

Relocation of existing recreation facilities from the banks of the existing reservoirs down slope to the new river bed could disproportionately affect county residents or tribal people. Recreation facilities, such as campgrounds and boat ramps, currently located on the reservoir banks will need to be relocated down slope to be near the new river bed once the reservoir is removed. Impacts specific to the relocation of the recreation facilities are discussed in Section 3.20, Recreation. There would be no environmental justice impacts as a result of the relocation of the recreation facilities.

3.16.4.2.3 Keno Transfer

The Keno Transfer could have adverse effects on environmental justice issues. The Keno Transfer is a transfer of title for the Keno Facility from PacifiCorp to the Bureau of Reclamation. This transfer would not result in the generation of new environmental justice effects impacts compared with existing facility operations. Following transfer of title, Bureau of Reclamation would operate Keno in compliance with applicable law and would provide water levels upstream of Keno Dam for diversion and canal maintenance consistent with agreements and historic practice (KHSA Section 7.5.4). Therefore, the Keno Transfer would have no effect on environmental justice.

East and Westside Facilities – Programmatic Measures

The East and Westside Facilities decommissioning could have adverse effects on environmental justice issues. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would stop diversions of water flows at Link River Dam into the two canals, back in to Link River. Following decommissioning of the facilities there would be no change in outflow from Upper Klamath Lake or inflow into Keno Impoundment/Lake Ewauna. Therefore, the decommissioning of these facilities would have no effect on environmental justice issues.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The installation of the City of Yreka Water Supply Pipeline could disproportionately affect county residents or tribal people. The existing water supply pipeline for the City of Yreka would be relocated prior to the decommissioning of the Iron Gate Reservoir. This relocation effort would not require major construction efforts and would not disproportionately impact tribes or county residents. There would be no environmental justice impacts as a result of the City of Yreka Water Supply Pipeline relocation.

KBRA – Programmatic Measures

The KBRA has several programs that could disproportionately affect low income and minority populations. Specific KBRA programs potentially affecting environmental justice include:

- Phases I and II Fisheries Restoration Plans
- Fisheries Monitoring Plan
- Fisheries Reintroduction and Management Plan
- Water Use Retirement Program
- Interim Flow and Lake Level Program
- Tribal Fisheries and Conservation Management Program
- Tribal Programs Economic Revitalization
- Klamath River Tribes Interim Fishing Site
- Mazama Forest Project
- Klamath County Economic Development Plan
- California Water Bond Legislation

Implementation of the Phases I and II Fisheries Restoration Plans, the Fisheries Monitoring Plan, the Fisheries Reintroduction and Management Plan, and the Klamath River Tribes Interim Fishing Site could disproportionately affect tribal populations. The Fishery Programs of the KBRA include restoration, monitoring, and reintroduction projects. Similar to dam removal, projects under the Fishery Programs would help restore anadromous fisheries and the sucker fishery in the Klamath Basin. Additionally the improvements in anadromous fisheries and the sucker fishery generated by the restoration, monitoring, and reintroduction projects would contribute to the effects of hydroelectric facility removal analyzed above. Tribes would be able to fish for cultural, subsistence, and commercial purposes similar to condition before the dams were installed. Fisheries restoration would help reverse past environmental injustices to the tribes.

Implementation of the Water Use Retirement Program and Interim Flow and Lake Level Program could disproportionately affect low income and minority farm workers. The KBRA proposes voluntary land fallowing and permanent water right sales which could disproportionately affect farm workers in Klamath, Siskiyou and Modoc Counties. Loss of farm labor jobs could disproportionately affect low-income, minority farm workers, who could lose a portion of their income if farms no longer required their labor. This would be a disproportionate effect on farm workers. Actions associated with hydroelectric facilities removal would not be expected to generate any farm labor jobs

and would not be expected to contribute to this short term disproportionate effect. The loss of farm jobs as a result of voluntary land fallowing and permanent water right sales would not be influenced by hydroelectric facility removal above given that facility removal does not affect irrigated agriculture and would not cause any farm job losses.

However, the core of the KBRA is to provide water reliability to farmers, which would ensure continuation of agricultural jobs in the area of analysis. In the long term, the KBRA has the potential to offset the loss of agricultural jobs and would not result in a long term environmental justice issue for farm workers.

Implementation of the Tribal Fisheries and Conservation Management Program could disproportionately affect the tribes. Implementation of the Tribal Fisheries and Conservation Management Program would provide funding to assist the tribes in developing their capacity to participate in resource management activities within the Klamath Basin, particularly relating to tribal fishing and revitalization of tribal subsistence and other economic activities. The program would provide job opportunities to tribal members, which could help reduce unemployment and increase income. Fisheries and conservation projects would also support fisheries restoration to increase fish abundance. Restored fisheries would help reverse the environmental justice impacts to the tribes that the dams created. The tribes would be able to rely on the river to provide fish for subsistence and some tribes could resume commercial fishing operations to increase revenues. The tribes would also be able to perform cultural practices and ceremonies without restrictions. The timing of and specific locations where these resource management actions could be undertaken is not certain but they would contribute to environmental justice benefits related to hydroelectric facility removal. This would benefit tribes relative to environmental justice.

Implementation of the Tribal Programs Economic Revitalization could disproportionately affect the tribes. This action includes funding for the Klamath, Karuk, and Yurok Tribes to develop economic revitalization plans, programs and projects. Implementation of the plan could potentially increase jobs and income for the Tribes. This would help reduce high poverty and unemployment rates among the Tribes. The timing of and specific locations where these economic revitalization plans, programs and projects could be undertaken is not certain but the improvements they are anticipated to support relative to environmental justice would contribute to the positive effects of hydroelectric facility removal. This would be a benefit relative to environmental justice.

Implementation of the Mazama Forest Project could disproportionately affect the tribes. The Mazama Forest Project would transfer 90,000 acres of privately owned timberland, which were formerly owned by the Klamath Tribes, back to the Klamath Tribes(Chui 2008; Kerr 2012). With ownership of the lands, the tribe could hunt, harvest timber, or use the land for other purposes. The improvement in environmental justice generated by the Mazama Forest Project would contribute to the effects of hydroelectric facility removal. This would be a beneficial effect to the Klamath Tribes relative to environmental justice concerns.

Implementation of the Klamath County Economic Development Plan could disproportionately affect low income and minority people in Klamath County. This action would provide $3.2 million of funding to Klamath County. Funding would support long-term economic growth in Klamath County and could create new job opportunities and improve public programs for county residents. The improvement in environmental justice generated by the Klamath County Economic Development Plan would contribute to the effects of construction activities associated with the hydroelectric facility removal activities. Depending on how funding is used within the county, this action could benefit low income and minority populations.

Implementation of the California Water Bond Legislation could disproportionately affect low income and minority people in Siskiyou County. If approved, bond funds would provide $20 million to Siskiyou County to use for economic development. It cannot be determined at this time how Siskiyou would distribute funds from the California Water Bond Legislation; this is a general discussion. The bond funds could assist Siskiyou County in addressing unemployment, poverty, bankruptcy, and social problems and continuing funding for other county programs. The improvement in environmental justice generated by the California Water Bond Legislation would contribute to the effects of construction activities associated with the hydroelectric facility removal activities. Programs could benefit low income and minority populations in Siskiyou County.

3.16.4.2.4 Alternative 3: Partial Facilities Removal of Four Dams

Short and long term impacts under the Partial Facilities Removal of Four Dams Alternative would be the same as those described under the Full Facilities Removal Alternative. This alternative would include the full implementation of the KBRA, the Keno Transfer, the East and Westside Facilities decommissioning, and the City of Yreka Water Supply Pipeline relocation. Environmental justice effects of KBRA would be the same as described for the Proposed Action.

3.16.4.2.5 Alternative 4: Fish Passage at Four Dams

This alternative does not include implementation of the KBRA.

Fish passage at the four dams could affect fisheries and disproportionately affect tribal people. Tribes would benefit from increased anadromous and native fish populations as a result of this alternative. Restored fisheries would help reverse the environmental justice impacts to the tribes that the dams created. This alternative would not result in disproportionate effects to tribal people relative to the No Action/No Project Alternative.

Increased air pollutants and noise associated with fish passage construction activities could disproportionately affect county residents and tribal people. Environmental justice impacts to county residents and tribal people associated with increased air pollutants associated with dam removal would be similar to those discussed under the Proposed Action. Environmental justice impacts on county residents and tribal people would be greater under the Fish Passage at Four Dams Alternative relative to the No Action/No Project Alternative.

The traffic on the associated haul roads could disproportionately affect county residents and tribal people. Environmental justice impacts to county residents or tribal people associated with traffic on associated haul roads would be similar to those discussed under the Proposed Action. Fish Passage at Four Dams Alternative would not result in adverse long term environmental justice impacts from traffic on county residents or tribes within the area of analysis.

Construction of fish passage could provide jobs for county residents and tribal people that are low income and minority. Construction activities would generate jobs in the area of analysis. Increased employment would support low income individuals, resulting in a beneficial effect. This short-term benefit to low income and minority populations of the Fish Passage at Four Dams Alternative would be greater than under the No Action/No Project Alternative.

Continued impoundment of water at the reservoirs could cause disproportionate long term water quality impacts on county residents and tribal people. Environmental justice impacts to county residents and tribal people associated with continued impoundment of water at the reservoirs causing disproportionate long-term water quality impacts would be similar to those discussed under the No Action/No Project Alternative. Fish Passage at Four Dams would degrade water quality for aquatic species that provide subsistence or commercial fishing revenues for tribes, and would continue to create disproportionate effects and environmental justice concerns on the tribes in the Klamath Basin.

Changes in county revenues could decrease county funding of social programs used by county residents. Environmental justice impacts to county residents associated with county revenues and funding for social programs would be similar to those discussed in the No Action/No Project Alternative. Fish Passage at Four Dams would not create short or long term changes to property values or local tax revenues relative to the No Action/No Project Alternative, thus county residents would not be disproportionately affected.

Fish passage and continued impoundment of water could disproportionately impact tribal health and social wellbeing in the long term. Fish passage would increase fish abundance for tribes to practice cultural traditions and to catch fish for commercial and subsistence purposes. Fish passage would improve tribal health and social wellbeing relative to the No Action/No Project Alternative. However, continued impoundment of water under the Fish Passage at Four Dams Alternative would not improve water quality in the long term, which would result in ongoing effects to fish, mussels, and habitat. Continued impoundment of water in the reservoir would not improve tribal health and social well being. Therefore, fish passage combined with continued impoundment of water would continue existing environmental injustices to the tribes and the tribes would continue to be disproportionately affected relative to the No Action/No Project Alternative.

3.16.4.2.6 Alternative 5: Fish Passage at Two Dams, Remove Copco 1 and Iron Gate

This alternative does not include implementation of the KBRA. This alternative includes the City of Yreka Water Supply Pipeline relocation; effects of this action would be the same as the Proposed Action.

Dam removal activities could affect fisheries and disproportionately affect tribal people. Tribes would benefit from increased anadromous and native fish populations as a result of this alternative. Restored fisheries would help reverse the environmental justice impacts to the tribes that the dams created. This alternative would not result in disproportionate effects to tribal people relative to the No Action/No Project Alternative.

Increased air pollutants and noise associated with fish passage and dam removal activities could disproportionately affect county residents and tribal people. Environmental justice impacts to county residents and tribal people associated with increased air pollutants associated with dam removal would be similar to those discussed under the Proposed Action. Environmental justice impacts on county residents and tribal people would be greater under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative relative to the No Action/No Project Alternative.

The traffic on the associated haul roads could disproportionately affect county residents and tribal people. Environmental justice impacts to county residents or tribal people associated with traffic on associated haul roads would be similar to those discussed under the Proposed Action. Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would not result in adverse long term environmental justice impacts from traffic on county residents or tribes within the area of analysis.

Construction of fish passage could provide jobs for county residents and tribal people that are low income and minority. Construction activities would generate jobs in the area of analysis. Increased employment would support low income individuals, resulting in a beneficial effect. This short-term benefit to low income and minority populations of the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would be greater than under the No Action/No Project Alternative.

Continued impoundment of water at the reservoirs could cause disproportionate long term water quality impacts on county residents and tribal people. Section 3.2, Water Quality, concludes that continued impoundment of water under the Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would result in similar water quality effects as the Proposed Action. This alternative would not result in disproportionate effects to tribal people and county residents relative to the No Action/No Project Alternative.

Changes in county revenues could decrease county funding of social programs used by county residents. Environmental justice impacts to county residents or tribal people associated with changes in county revenues associated with dam removal would be the

same as discussed under the Proposed Action. Fish Passage at Two Dams, Remove Copco 1 and Iron Gate Alternative would disproportionately affect low income county residents, if funding to social programs is reduced.

Fish passage and continued impoundment of water could disproportionately impact tribal health and social wellbeing in the long term. Fish passage would increase fish abundance for tribes to practice cultural traditions and to catch fish for commercial and subsistence purposes. Fish passage would improve tribal health and social wellbeing relative to the No Action/No Project Alternative. However, continued impoundment of water under the Fish Passage at Four Dams Alternative would not improve water quality in the long term, which would result in ongoing effects to fish, mussels, and habitat. Continued impoundment of water in the reservoir would not improve tribal health and social well being. Therefore, fish passage combined with continued impoundment of water would continue existing environmental injustices to the tribes and the tribes would continue to be disproportionately affected relative to the No Action/No Project Alternative.

3.16.4.3 Mitigation Measure Analysis

3.16.4.3.1 Mitigation Measure by Consequence Summary

Implementation of mitigation measures in Section 3.9, Air Quality, and Section 3.23, Noise and Vibration, would reduce environmental justice effects related to construction.

3.16.4.4 Mitigation Measures Associated with other Resources

Mitigation measure REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. These developments would take place on lands that are currently inundated and would not create environmental justice issues for tribal members or farm workers. There would be no impact to environmental justice as a result of implementing REC-1.

3.16.4.5 Summary of Beneficial Effects

Table 3.16-11 summarizes the beneficial effects of the Proposed Action and alternatives.

Table 3.16-11. Beneficial Effects of the Proposed Action and Alternatives

Effect	Alternatives				
	1	2	3	4	5
Dam removal could improve fisheries and benefit tribes' cultural practices, subsistence and commercial fishing	NE	B	B	B	B
Construction could create jobs for county residents and tribal people	NE	B	B	B	B
Dam removal could reverse long term water quality impacts on tribal people	NE	B	B	NE	B (partial)
Dam removal could decrease disproportionate effects to tribal health and social well being	NE	B	B	NE	B (partial)
Fisheries restoration could improve fisheries and benefit tribes' cultural practices, subsistence and commercial fishing	NE	B	B	NE	NE
Improve water supply reliability to agriculture could increase farm revenues	NE	B	B	NE	NE
Funding to Klamath and Siskiyou Counties could improve county economic and social conditions	NE	B	B	NE	NE
Funding to tribes for conservation management, fisheries management, and economic revitalization would improve economic and social conditions of tribes	NE	B	B	NE	NE

Key:
Alternative 1 = No Action/No Project Alternative
Alternative 2 = Full Facilities Removal of Four Dams (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
B = Beneficial
NE = No effect

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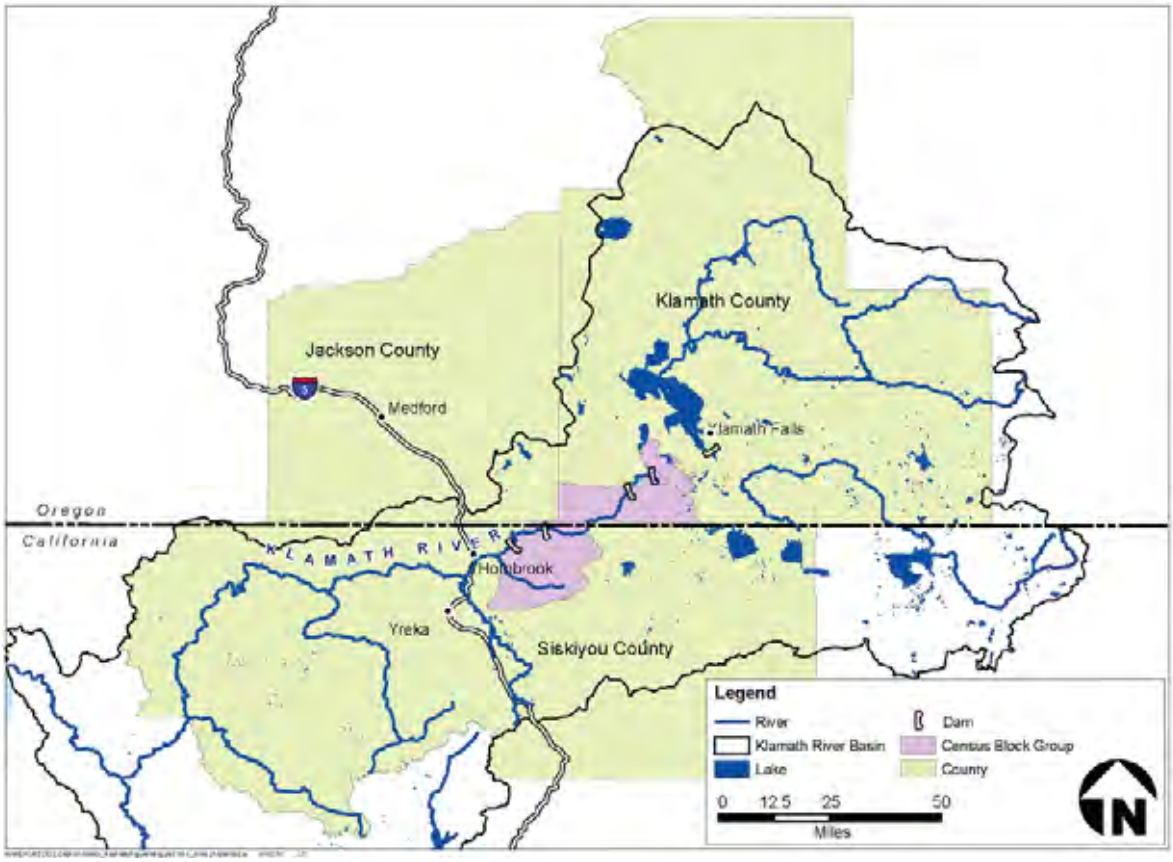
3.17 Population and Housing

The population and housing section of the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIS/EIR) assesses the potential effects of the temporary worker population required for construction activities of the Proposed Action and action alternatives on housing in the Klamath Basin. The effect of the Klamath Hydroelectric Settlement Agreement (KHSA) on population and housing is determined by comparing projected housing needs with projected housing availability. No displacement of existing housing units would be anticipated from any of the alternatives. This analysis uses data from the U.S. Census, county and city plans, and other sources for projected housing availability.

No impacts on population and housing are anticipated as a result of the transfer of Keno Dam's ownership to the Department of the Interior (DOI). Potential relocation of PacifiCorp employees as a result of the alternatives is not discussed in the population and housing section. This effect to PacifiCorp employees is not anticipated to take place until 2020 and would be at the discretion of PacifiCorp. Thus, any impact is too speculative to evaluate at this time. The population and housing section of this EIS/EIR does not discuss relocation of PacifiCorp employees that would occur as a result of the alternatives. As described in Section 3.15, Socioeconomics, dam removal could result in the loss of PacifiCorp jobs. It is assumed that PacifiCorp may transfer some employees to other positions within or outside of Klamath and Siskiyou Counties. This section also excludes discussion of potential indirect economic impacts that the alternatives could have on population and housing, as any such discussion would be speculative. For an assessment of potential effects on property values and employment resulting from the alternatives, see Section 3.15, Socioeconomics.

3.17.1 Area of Analysis

The area of analysis for the population and housing section consists of communities with the potential to house workers migrating into the area for construction activities of the action alternatives. The area of analysis includes a combination of urban and rural communities: Hornbrook and the City of Yreka in California and Klamath Falls and Medford in Oregon. The area of analysis also includes the residential rural areas immediately near the Copco 1 and 2 Dams and just upstream of the J.C. Boyle Dam. The Lead Agencies analyzed these communities for their potential to temporarily house workers using California Department of Finance housing and population data where available, in addition to city level and Census Block Group level 2010 U.S. Census data (U.S. Census Bureau 2010a – 2010d) and 2008-2010 American Community Survey (ACS) data (U.S. Census Bureau 2010e; 2010f), and county and city plans where available. Table 3.17-1 lists all communities included in the population and housing area of analysis. Figure 3.17-1 depicts the counties and cities/communities within the analysis scope.



Source: U.S. Census Bureau, Geography Division, 2010Census Block Groups [computer file]. Washington, DC.

Figure 3.17-1. Population and Housing Area of Analysis.

Table 3.17-1. Cities Included for Analysis

Community	County	State
City of Yreka	Siskiyou	CA
Hornbrook	Siskiyou	CA
Siskiyou County Unincorporated Areas	Siskiyou	CA
Klamath County Unincorporated Areas	Klamath	CA
Klamath Falls	Klamath	OR
Medford	Jackson	OR

3.17.2 Regulatory Framework

Regulations at the Federal, State, and local levels regarding housing are generally concerned with the proper construction, provision, and siting of housing for a variety of

incomes. Neither the Proposed Action nor other alternatives call for the construction of new homes, or the demolition of existing homes, and therefore the regulations pertaining to housing do not apply.

3.17.3 Existing Conditions/Affected Environment

The affected environment for population and housing reflects the existing populations and housing conditions within the area of analysis. This section presents the available data on population characteristics, including trends in in-migrations and demographics. The housing characteristics presented indicate the overall economic health of the housing market in the area of analysis, which helps assess the capacity for communities in the area of analysis to accommodate population growth that could result from the alternatives. This section presents demographic and housing information from the U.S. 2010 Census at the city and Census block group level, and from the ACS at the county and State level. While more recent data is available for many locales, the 2010 Census dataset remains the most comprehensive data available at the community level for all cities in the area of analysis. More recent data, where available, are included in the discussions.

This discussion presents data for all Census-designated communities and counties included in the area of analysis by county. Unincorporated areas near the dams are discussed separately. Demographic, economic and housing data are discussed on a community, county and State level. County sections include Siskiyou County in California and Klamath and Jackson Counties in Oregon.

3.17.3.1 Klamath County, Oregon

Klamath County is in the area of analysis because the unincorporated area near J.C. Boyle Dam and Klamath Falls could temporarily house workers needed for construction associated with the alternatives. The City of Klamath Falls data are presented along with data for Klamath County. Data representing the unincorporated area near J.C. Boyle Dam, which includes the community of Keno, a small unincorporated community approximately 12 miles upstream of the J.C. Boyle Reservoir, are discussed in Section 3.17.3.4. While Keno lies within Klamath County, the data are presented separately because it represents a non-census designated community.

According to the 2009 Klamath Falls Economic Opportunities Analysis (Johnson and Gardner 2009), about two thirds of Klamath County's population is within the Klamath Falls Urban Growth Boundary (UGB). Klamath Falls proper (not including rural areas in the UGB) is a city of almost 21,000 people. Housing statistics presented in this section for Klamath Falls *exclude* the unincorporated areas in the Klamath Falls UGB. Including the unincorporated areas in the UGB approximately doubles the total population of Klamath Falls. Klamath County's annual average unemployment rate in 2009 was 13.9 percent (Bureau of Labor Statistics (BLS) 2011a).

3.17.3.1.1 Demographic Data

Klamath County age demographics are consistent with the State of Oregon. In Klamath County, 25.2 percent of the population was under 19 years of age according to the U.S. 2010 Census, and 46.4 percent is over 45. Similarly, in the State of Oregon 25.4 percent of the population was below 19 years of age, with 41.2 percent over 45.

3.17.3.1.2 Housing Data

The U.S. 2010 Census reported 32,774 housing units in Klamath County with 83 percent occupied and 17 percent vacant. In Klamath Falls proper, 104 out of 1,053vacant units were for seasonal use in the 2010 Census. Table 3.17-2 contains housing estimates for Klamath Falls and Klamath County. The ACS estimates that median monthly rent in Klamath Falls and Klamath County was $706, from 2008 to 2010.

Table 3.17-2. Klamath Falls and County Housing Estimates, 2010

	Klamath Falls		Klamath County	
	Estimate	**Percent**	**Estimate**	**Percent**
Total Housing Units	**9,595**		**32,774**	
Occupied Housing Units	8,542	89.0%	27,280	83.2%
Owner-Occupied	4,076	47.7%	18,037	66.1%
Renter-Occupied	4,466	52.3%	9,243	33.9%
Vacant Housing	1,053	11.0%	5,494	16.8%

Source: U.S. Census Bureau, 2010b.
Summary File 1, Tables H3, H4, H5 and HCT1

3.17.3.2 Jackson County, Oregon

The City of Medford could temporarily house workers needed for construction associated with the alternatives. Medford's estimated population was 74,907 in 2010 (U.S. Census Bureau 2010d). This population estimate accounts for more than a third of the population of Jackson County. The City of Ashland is not explicitly included in the area of analysis due to uncertainties of housing availability during the Ashland Shakespeare Festival's peak season in the summer and early fall (Oregon Shakespeare Festival 2011); however, it is possible that some workers could find housing in Ashland, as well.

The Medford Metropolitan Statistical Area had an unemployment rate of 11.6 percent in December 2009 (BLS 2011b). Jackson County's annual average unemployment rate in 2009 was only 6.7 percent (BLS 2011b).

3.17.3.2.1 Demographic Data

Like Klamath County and Oregon overall, Jackson County has a high older age population. According to the U.S. 2010 Census, 46.7 percent of the population in Jackson County was reported as over the age of 45. Only 24.4 percent of the popultation in Jackson County is under 19 years of age.

3.17.3.2.2 Housing Data

According to the ACS, housing units in Medford increased by approximately 2,400 units between 2005 and 2010; however, there is still a shortage of affordable housing in Medford (City of Medford 2010). The city is composed of mostly single-family housing, with pockets of higher density and multi-family units. A walk-by was completed in 2004 (City of Medford 2010). There are neighborhoods in Medford with more than 50 percent renter-occupied units. The 2010 Census reports a housing vacancy rate in Medford of 7.2 percent, but in 2007, the vacancy rate was only 2.7 percent (City of Medford 2010). Table 3.17-3 contains housing estimates for Medford and Jackson County.

Table 3.17-3. Medford and Jackson County Housing Estimates, 2010

	Medford		Jackson County	
	Estimate	Percent	Estimate	Percent
Total Housing Units	**32,430**		**90,937**	
Occupied Housing Units	30,079	92.8%	83,076	91.4%
Owner-Occupied	16,606	51.9%	52,045	62.6%
Renter-Occupied	14,473	48.1%	31,031	37.4%
Vacant Housing	2,351	7.2%	7,861	8.6%

Source: U.S. Census Bureau, 2010b.
Summary File 1, Tables H3, H4, H5, and HCT1.

There is a lack of affordable housing in the City of Medford, which contributes to an elevated homelessness rate (City of Medford 2010). According to the ACS, approximately 61 percent of all renters in Medford were cost-burdened, defined as paying more than 30 percent of household income on housing (U.S. Census Bureau, 2010f). The median monthly rent in Medford was 796 dollars, compared with 706 dollars in Klamath Falls. Barriers to developing affordable housing in Medford include permitting constraints, lack of land properly zoned for low-income housing, development codes that discourage mixed-use development, among others (City of Medford 2010).

3.17.3.3 Siskiyou County, California

Siskiyou County data is presented along with data for the City of Yreka and the community of Hornbrook. The City of Yreka and Hornbrook could temporarily house workers required for construction associated with the alternatives. Section 3.17.3.4 covers other unincorporated residential areas near the dams. While the residential area surrounding Copco 1 Reservoir, referred to as Copco Village, lies within Siskiyou County, Census Block Group Data more specifically representing Copco Village is presented separately (see Section 3.17.3.4) because it represents a non-census designated community.

According to the U.S. 2010 Census, the City of Yreka was a city of nearly 7,800 people, and Hornbrook was a community of approximately 250. Siskiyou County's annual

average unemployment rate in 2009 was 14.8 percent, higher than either Klamath or Jackson Counties (BLS 2011a).

3.17.3.3.1 Demographic Data

Similar to Jackson and Klamath Counties, Siskiyou County has a high older population. According to the U.S. 2010 Census, Siskiyou County had a population where almost 53 percent were over 45 years of age. , Approximately 54 percent of Hornbrook's population and approximately 47 precent of the City of Yreka's population was over 45 years old.

3.17.3.3.2 Housing Data

Table 3.17-4 shows housing and occupancy estimates for Siskiyou County. Siskiyou County's overall vacancy rate (18.4 percent) is slightly higher than Klamath County (16.8 percent) and much higher than Jackson County (8.6 percent). Hornbrook has a high vacancy rate, at 30.8 percent, out of 156 total units in 2010. However, because the absolute number of housing units in Hornbrook is so small (156), the total number of vacant units (48) is also small. The City of Yreka and its surrounding area has a relatively low housing availability; according to the U.S. 2010 Census, only 119 housing units were available for rent in the City of Yreka. Siskiyou County's gross vacancy rate in 2010 was 18.4 percent and the City of Yreka's gross vacancy rate was 7.6 percent (U.S. Census Bureau 2010b).

Table 3.17-4. Siskiyou County Housing Estimates, 2010

	Hornbrook		City of Yreka		Siskiyou County	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	**156**		**3,675**		**23,910**	
Occupied Housing Units	108	69.2%	3,394	92.4%	19,505	81.6%
Owner-Occupied	72	66.7%	1,751	51.6%	12,629	64.7%
Renter-Occupied	36	33.3%	1,643	48.4%	6,876	35.3%
Vacant Housing	48	30.8%	281	7.6%	4,405	18.4%

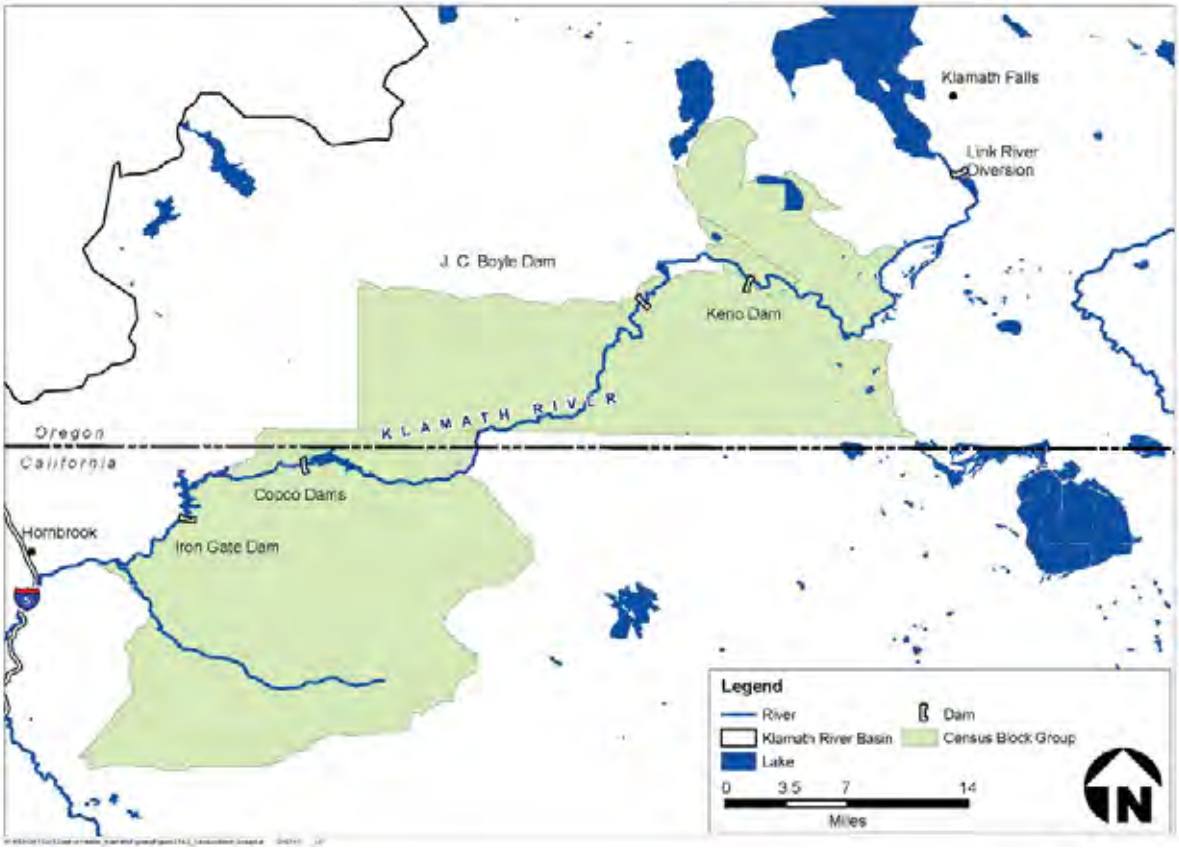
Source: U.S. Census Bureau, 2010b
Summary File 1, Tables H3, H4, H5, and HCT1.

The Yreka Housing Element reports 2008 rental costs ranging from $525 to $900 per month (City of Yreka 2009). According to the 2006-2010 American Community Survey 5-year estimate, the median rent in the City of Yreka was $841 (U.S. Census Bureau 2010e).

3.17.3.4 Unincorporated Areas

The unincorporated areas discussed in this section represent Keno (12 miles from Klamath Falls) and the residential areas surrounding Copco 1 Reservoir (26 miles from the City of Yreka). These two communities are closest to the Four Facilities, and could have possible housing impacts from worker displacement. The affected environment for Keno is presented as a compilation of the U.S. 2010 Census results from Oregon Census Tract 9703, Block Groups 2, 3, and 4. Because these block groups include Keno and its

surrounding area, this discussion refers to them as the Klamath unincorporated area. The Copco 1 Reservoir Area is described using U.S. 2010 Census results from California Census Tract 3, Block Group 1. Because this block group encompasses not only the residential area around Copco 1 Reservoir, but also other unincorporated areas around the Iron Gate Dam and surrounding areas, including the communities of Ager and Logan, this block group is referred to as the Siskiyou unincorporated area. The geographic areas encompassed by these census block groups are shown in Figure 3.17-2.



Source: U.S. Census Bureau, Geography Division, 2010Census Block Groups [computer file]. Washington, DC.

Figure 3.17-2. Census Block Groups.

3.17.3.4.1 Demographic Data

U.S. 2010 Census demographic data on age was not yet available at the block group level at the time of the writing of the EIS/EIR; therefore, U.S. 2000 Census data was used for this anaylsis.According to the U.S. 2000 Census, both the Oregon and California unincorporated areas have large populations over 45 years in age. In the

Klamath unincorporated area, 44 percent of the population is over 45 years of age, and in the Siskiyou unincorporated area 49 percent of the population is over 45 years of age.

3.17.3.4.2 Housing Data

Table 3.17-5 contains housing estimates for the unincorporated areas. The Siskiyou unincorporated area vacancy rate in 2010 was fairly large (24.6 percent, or 226 units). The vacancy rate in the Klamath unincorporated area was much lower, at 9.6 percent or 110 units.

Table 3.17-5. Unincorporated Areas Housing Estimates, 2010

	Siskiyou Unincorporated Area		Klamath Unincorporated Area	
	Estimate	Percent of Total	Estimate	Percent of Total
Total Housing Units	**918**		**1,144**	
Occupied Housing Units	692	75.4%	1,034	90.4%
Owner-Occupied	552	79.8%	881	85.2%
Renter-Occupied	140	20.2%	153	14.8%
Vacant Housing	226	24.6%	110	9.6%

Source: U.S. Census Bureau, 2010b. Summary File 1

3.17.4 Environmental Consequences

3.17.4.1 Effects Determination Methods

This analysis used both qualitative and quantitative methods to determine the effects that implementation of the alternatives would have on population and housing. Significance criteria were used to qualitatively assess the impacts of each alternative. Effects considered for this resource area would be related to availability of housing for non-local construction workers and whether the use of housing by construction workers would impact the local housing market. Implementation of the alternatives would not require any land acquisition that would require housing units to be relocated. The project description includes preliminary estimates of the numbers of workers required for construction actions. This analysis compared the housing needs associated with these workers with existing demographics and housing statistics described in the Affected Environment.

3.17.4.2 Significance Criteria

Significant impacts on population and housing would result if the project resulted in substantial population growth in the area of analysis. For the purposes of this EIS/EIR, population growth in a community is “substantial” if it would result in housing needs exceeding the number of housing units projected to be available and affordable.

3.17.4.3. Effects Determinations

This section presents the effects of each of the alternatives on population and housing. For all alternatives except for the No Action/No Project Alternative, some level of construction or deconstruction would be involved at all Four Facilities. Construction labor would require up to 250 workers during the peak construction period. As described in Section 3.15, Socioeconomics, peak construction at J.C. Boyle, Copco 2, and Iron Gate Facilities generally overlap; peak construction at the Copco 1 Facility would occur separately. Peak number of workers required to implement the alternatives range from 175 to 195 workers at one time for Copco 1, Copco 2 and Iron Gate Dams (in California), and from 30 to 55 workers at one time for J.C. Boyle Dam (in Oregon). Potential mitigation measures increase these estimates by as much as 20 workers. Workers that could not be provided by the local communities would need to commute from a near-by community, either a more rural, unincorporated community such as Keno or Hornbrook, or a more urban area such as the City of Yreka, Medford, or Klamath Falls. Table 3.17-6 lists approximate travel distances to the dams from each of these communities for the J.C. Boyle Dam. For the Copco 1, Copco 2, and Iron Gate Dams, the City of Yreka and Medford are communities that might house workers, along with Hornbrook and the rural areas immediately around Copco 1 Reservoir. The capacity of each of these communities to house the workers needed for each of the alternatives is discussed below.

It is likely that some of the workforce required for the deconstruction alternatives could be satisfied with local residents; however, some non-resident workers are likely to be necessary for specialized tasks. Section 3.15, Socioeconomics, assumes that about 90 percent of the unskilled labor and 20 percent of the skilled labor could be supplied locally from Klamath and Siskiyou Counties during peak construction (approximately 98 workers). The remaining approximate 150 workers needed during peak construction would have to be brought into Klamath and Siskiyou Counties. During non-peak construction, all unskilled as well as skilled workers could be provided locally. It is further assumed that one housing unit would be required per non-local worker.

Table 3.17-6. Approximate Commute Distances[1] (miles)

	Klamath Falls	Medford	City of Yreka	Hornbrook	Keno
J.C. Boyle	20	55	70	55	8
Copco 1 & 2	50	50	27	21	40
Iron Gate	60	44	22	8	50

[1] Distances were approximated using Google Maps, and are only accurate to within 5 miles.

There are a limited number of PacifiCorp-owned housing units at the dam sites. Because the noise analysis in this EIS/EIR estimates high noise levels at these housing facilities resulting from the alternatives (see Section 3.23, Noise and Vibration), these facilities are not included as potential housing sources for the population and housing section.

It is assumed that relocation of the City of Yreka's water supply pipeline and new construction or demolition of recreation facilities would occur during non-peak construction (before and after dam deconstruction activities, respectively). Therefore, the workers required for these construction activities would not add to the peak housing needs in Klamath and Siskiyou Counties. Additionally, the number of workers required to complete these construction activities would be less than the peak number required for implementation of the action alternatives. Thus, it is assumed that the housing units described in the analysis of the action alternatives would accommodate workers necessary for water supply pipeline relocation and relocation or demol**ition of recreation facilities.**

3.17.4.3.1 Alternative 1: No Action/No Project Alternative

Under the No Action/No Project Alternative, there would be no change to the Four Facilities and associated facility operations and no impacts on population and housing. The No Action/No Project Alternative would not result in construction activities taking place at the sites of the Four Facilities. There would be no influx of temporary workers and no impacts on population and housing. Population and housing would follow current trends. **There would be no change from existing conditions to population and housing under the No Action/No Project Alternative.**

Ongoing Resource Management Actions

Ongoing resource management actions and programs would continue to take place under the No Action/No Project Alternative. Construction, implementation, and monitoring activities associated with these ongoing activities could result in increases in new jobs throughout the Klamath Basin and a demand for more workers.

Ongoing actions considered for impact to population and housing under the No Action/No Project Alternative include:

- Fish Habitat Restoration
- Williamson River Delta project
- Agency Lake and Barnes Ranches project

Construction, restoration, and monitoring activities associated with ongoing activities could create new jobs and could employ non-local workers, who would need housing for the duration of their employment. Construction activities necessary for ongoing resource management include floodplain rehabilitation, large woody debris placement, fish passage correction, cattle exclusion, riparian vegetation planting, mechanical thinning to promote conifers, and channel construction. As described in Section 3.15, Socioeconomics, effects would occur in Klamath, Siskiyou, Humboldt, and Del Norte Counties and regional impacts would be spread over the 2012-2026 period. Employment-related effects would vary by year proportionate to actual expenditures to carry out ongoing restoration activities. Effects from spending on local actions and related changes in employment would mostly occur in local or State governments and the construction sector. **While it is anticipated that the majority of these jobs could be filled with local workers, some amount of workers (both skilled and unskilled) may**

need to be hired from outside of the local areas. It is anticipated that the effects on population and housing would be less than significant.

3.17.4.3.2 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

Construction activities involved in dam removal could employ non-local workers, who would need housing for the duration of their employment. During peak deconstruction periods, implementation of the Full Facilities Removal of Four Dams Alternative would require up to 250 total workers with 195 working at the Copco and Iron Gate Facilities combined, and up to 55 workers at the J.C. Boyle Facility. Both of these numbers include administrative and management staff. At the Copco and Iron Gate Facilities, 78 workers would be provided from within the region and 117 would be required from outside of the region. At J.C. Boyle, 20 workers would come from within the region and 35 from outside of the region. Therefore, the housing need would be up to 117 housing units for the California facilities and 35 housing units for the Oregon facility. Peak worker needs would occur between November 2019 and September 2020.

For J.C. Boyle Dam, communities that could possibly house workers include the Klamath unincorporated areas and Klamath Falls. In 2010, only 110 housing units were vacant in the Klamath unincorporated areas. Recent Klamath County plans (Johnson and Gardner 2009) do not include growth projections for the Klamath unincorporated areas, but a sudden increase in 35 workers could stress the housing market in the Klamath unincorporated areas since not all vacant properties are available for rent. However, an increase of 35 workers in Klamath Falls on a temporary basis could likely be absorbed by that city. With a current population of approximately 21,000 people and a projected increase in population of more than an additional 10,000 people by 2030 due to in-migration (Johnson Gardner 2009), these 35 workers in Klamath Falls would result in a 0.1 percent population increase. It is likely that, workers required for full removal of the J.C. Boyle Dam could be accommodated between the Klamath unincorporated areas and the City of Klamath Falls.

For the Copco 1, Copco 2, and Iron Gate Dams, large communities that could house workers include the City of Yreka and Medford. In 2010, there were more than 2,351 vacant housing units in Medford, or approximately 7 percent. . The high total number of housing units available indicates a strong likelihood that Medford could accommodate most, if not all, housing needs associated with the Proposed Action.

The City of Yreka's housing market has limited available housing. For example, in 2008 only 41 housing units were available for rent. Projecting the City of Yreka's current planned housing expansion to 2019 would result in 202 more housing units in the City of Yreka in 2019 (the beginning of construction) than are present in 2010. Because these new units are planned to accommodate anticipated growth regardless of the project alternative chosen, it is uncertain how many of the planned units would be available to non-local workers for the alternatives.

There are several other potential housing possibilities that could accommodate housing needs both in California and Oregon, including:

- *Hornbrook*. According to the 2010 Census, Hornbrook had 88 vacant housing units not for seasonal use. *Copco 1 Reservoir*. In 2010, in the Siskiyou unincorporated area, the vacancy rate was approximately 25 percent. Vacant units used for seasonal or recreational use may become available for rent since dam removal could lead to decreases in the number of non-local visitors to the region due to losses of reservoir recreation activities and loss of access to recreation sites at the dam (described in Section 3.15, Socioeconomics). Additionally, Section 3.15, Socioeconomics, assumes that losses in recreation spending would directly affect accommodation services in Klamath County. Recreational use of vacation homes near the reservoirs could decrease, making these seasonal homes available to workers.
- *Campgrounds and Recreational Vehicle (RV) Parks*. It is also likely that the local campgrounds near the dams would be available as temporary housing. In addition to campgrounds at Iron Gate and Copco 1 Reservoirs, the Bureau of Land Management maintains a campground along the Klamath River in Oregon, and another near the State line (Bureau of Land Management (BLM) 2011a and 2011b). RV parks in Hornbrook and the City of Yreka may also be available (Siskiyou County Visitor's Bureau 2011).
- *Hotels*. Among the various hotels in the City of Yreka, there are more than 600 rooms available via a simple internet search.[1] In addition, Klamath Falls contains more than 1,000 hotel rooms. Non-local temporary workers who have short contracts may prefer this housing option to renting a more permanent housing unit.

Peak workforce estimates apply to a several-month period. Because of the short duration of workforce needs, temporary housing may be desirable to non-local workers. Hotels and RV/camping options would very likely compensate for any shortage of more permanent housing in Medford, the City of Yreka and Klamath Falls. For the purposes of this EIS/EIR, population growth in a community is "substantial" if it would result in housing needs exceeding the number of housing units projected to be available and affordable. **Because the housing needs associated with construction activities could be met with resources in the area of analysis**, **these housing impacts would be less than significant**.

Dewatering of the reservoirs would result in recreational facilities currently located on the banks of the existing reservoirs to be removed following drawdown. The existing recreational facilities provide camping and boating access for recreational users of the reservoirs. Once the reservoirs are drawn down, these facilities will be removed. This facility removal will be done following the deconstruction of the dams, but will not require large crews or specialized labor that would need to be brought in from out of the area. **There would be no change from existing conditions for population and housing resulting from the removal of the recreational facilities.**

[1] Information collected using www.expedia.com on January, 26, 2011.

Keno Facilities Transfer

The transfer of the Keno Facility to DOI could result in additional workers. Keno Dam is an unmanned facility which requires minimal operations and maintenance. Recreation facilities owned by PacifiCorp in the vicinity of Keno Dam will also be transferred to either the State or county as described in the KHSA Section 7.5. Operation of Keno Dam and of the recreation areas are expected to continue in the current fashion. **The transfer of the facility and recreation lands would result in no change from existing conditions for population and housing.**

East and Westside Facilities Removal – Programmatic Measures

The decommissioning of the East and Westside Facilities could result in additional workers. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA will eliminate the need for the current diversion of water at Link River Dam into the two canals. Following decommissioning of the facilities there will be no change in outflow from Upper Klamath Lake or inflow into Keno Impoundment/Lake Ewauna. The number of workers required for the decommissioning will be fewer than those required for the Proposed Action. **Therefore, there would be no change from existing conditions for population and housing as a result of the decommissioning.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Dam removal at Iron Gate would require the relocation of the City of Yreka Water Supply Pipeline. The construction of the pipeline would take place during the deconstruction period and would not require an increase in construction workers or construction time. The relocation would occur after drawdown of the reservoir was complete and would not interfere with the deconstruction schedule. **There would be a less than significant impact to population and housing as a result of the pipeline relocation.**

KBRA – Programmatic Measures

Construction activities associated with implementation of several Klamath Basin Restoration Agreement (KBRA) programs could result in increases in new jobs throughout the Klamath Basin and a demand for more workers. The following programs could cause these impacts:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration
- On- Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Klamath River Tribes Interim Fishing Site
- Power for Water Management Program
- Additional Water Conservation and Storage

Construction and monitoring activities associated with the above-listed KBRA programs could employ non-local workers who would need housing for the duration of their employment. The creation of jobs and potential need to employ non-local workers could strain local housing availability and result in short and long-term increases in population in communities with the potential to house workers migrating into the area. It is anticipated that the majority of workers could be satisfied locally. The timing of and specific locations where these KBRA programs could be undertaken is not certain but it is assumed that some of these actions could occur at the same time and in the vicinity of the hydroelectric facility removal actions analyzed above. However, as described in Section 3.17.3, it is assumed that there is sufficient housing supply in the current stock to accommodate non-local workers. **Thus, it is expected that population and housing effects from construction and monitoring of KBRA programs would be less than significant. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

3.17.4.3.3 Alternative 3: Partial Facilities Removal of Four Dams

Construction activities involved in dam removal could employ non-local workers, who would need housing for the duration of their employment. Implementation of the Partial Facilities Removal of Four Dams Alternative would result in less facility removal. However, during peak deconstruction periods, implementation of the Partial Facilities Removal of Four Dams Alternative would require the same number of workers at each facility as described for the Proposed Action. These numbers include administrative and management staff. This would require the same number of workers from within and outside of the region as described for the Proposed Action. Peak worker needs would occur between November 2019 and September 2020.

Peak housing requirements for deconstruction at the Iron Gate and Copco Facilities could be met with housing available in Medford, the City of Yreka, Hornbrook, Copco Village, and other options as described above for the Proposed Action. Peak housing requirements for the J.C. Boyle Dam construction could be met by housing available in Klamath Falls and the Klamath unincorporated areas. Because the Partial Facilities Removal of Four Dams Alternative would require the same number of workers as the Proposed Action, the detailed discussion of housing availability provided in the Proposed Action section also applies to this alternative.

For the purposes of this EIS/EIR, population growth in a community is “substantial” if it would result in housing needs exceeding the number of housing units projected to be available and affordable. **Because the housing needs associated with construction activities could be met with resources in the area of analysis, these housing impacts would be less than significant**.

Keno Facilities Transfer

The transfer of the Keno Facility to DOI could result in additional workers. Potential impacts for the Keno Facilities Transfer would be the same as those described under the Proposed Action. **The transfer of the facility and recreation lands will have no change from existing conditions for population and housing.**

East and Westside Facilities Removal – Programmatic Measures
Potential impacts from the decommissioning of the East and Westside Facilities would be the same as under the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures
Potential impacts from the City of Yreka Water Supply Pipeline relocation would be the same as under the Proposed Action.

KBRA – Programmatic Measures
Implementation of the KBRA would have the same effects as the Proposed Action.

3.17.4.3.4 Alternative 4: Fish Passage at Four Dams

Construction activities involved in fish passage creation could employ non-local workers, who would need housing for the duration of their employment. Implementation of the Fish Passage at Four Dams Alternative would result in fish passage installation at the Four Facilities. During peak construction periods, implementation of the Fish Passage at Four Dams Alternative would require up to 75 workers at the Copco and Iron Gate Facilities combined, and up to 20 workers at the J.C. Boyle Facility. These numbers include administrative and management staff. Because detailed schedules for this alternative are not available, work force estimates assume that an average work force level at each facility would be required throughout construction actions at each facility. Of the workers at Copco and Iron Gate Facilities, it is assumed that 36 would come from within the region and 59 would come from outside of the region. Of the workers at J.C. Boyle, it is assumed that 10 would come from within the region and 20 would come from outside of the region. These housing requirements for construction at the J.C. Boyle Dam could be met by housing available in Klamath Falls and the Klamath unincorporated areas, while the housing requirements for construction at the Iron Gate and Copco Facilities could be met with housing available in Medford, the City of Yreka, Hornbrook, Copco Village, and other options described above for the Proposed Action. Because the Fish Passage at Four Dams Alternative would require fewer workers than Proposed Action, the detailed discussion of housing availability provided in the Proposed Action also applies to this alternative.

For the purposes of this EIS/EIR, population growth in a community is "substantial" if it would result in housing needs exceeding the number of housing units projected to be available and affordable. **Because the housing needs associated with construction activities could be met with resources in the area of analysis, housing impacts from this alternative would be less than significant**.

3.17.4.3.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Construction activities involved in dam removal and fish passage creation could employ non-local workers, who would need housing for the duration of their employment. Implementation of Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would result in full removal of the Copco 1 and Iron Gate Dams and fish passage construction at J.C. Boyle and Copco 2 Dams. During peak deconstruction/

construction periods, implementation of the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would require a total peak construction workforce of up to 205 workers. This includes up to 175 workers at the Copco and Iron Gate Facilities combined, and up to 30 workers at the J.C. Boyle Facility. These numbers include administrative and management staff. At the Copco and Iron Gate Facilities, 69 workers would be provided from within the region and 106 would be required from outside of the region. At J.C. Boyle, 9 workers would come from within the region and 21 from outside of the region. Therefore, the housing need would be up to 106 housing units for the California facilities and 21 housing units for the Oregon facility. Peak worker needs would occur between November 2019 and September 2020.

Peak housing requirements for construction at J.C. Boyle Dam could be met by housing availability in Klamath Falls and the Klamath unincorporated areas. Peak housing requirements for activities at the Copco and Iron Gate Facilities could be met with housing available in Medford, the City of Yreka, Hornbrook, Copco Village, and other options as described above for the Proposed Action. Because the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would require fewer workers than the Proposed Action, the detailed discussion of housing availability provided in the Proposed Action section also applies to this alternative.

The housing needs associated with construction activities could be met with resources in the area of analysis. **Because this alternative would not result in a substantial increase in population growth or in housing unit needs, the housing impacts from this alternative would be less than significant**.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures
Potential impacts from the City of Yreka Water Supply Pipeline relocation would be the same as under the Proposed Action.

3.17.4.4 Mitigation Measures

3.17.4.4.1 Mitigation Measure by Consequence Summary

No mitigation measures are proposed.

3.17.4.4.2 Mitigation Measures Associated with other Resources

Construction of new recreation facilities could require additional workers affecting population and housing. Mitigation REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the reservoir banks will need to be relocated down slope to be near the new river bed once the reservoir is removed. Impacts specific to the relocation of the recreation facilities are discussed in Section 3.20, Recreation. The planning and construction of these sites would take place after the deconstruction of the dams and would require a much smaller work force than the Proposed Action. Most, if not all of the labor required to replace the recreational facilities could be drawn from the local work

force. **Therefore, the implementation of REC-1 would have a less than significant impact on population and housing.**

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3.18 Public Health and Safety, Utilities and Public Services, Solid Waste, Power

This section presents the Public Health and Safety, Utilities and Public Services, Solid Waste, and Power analyses. Public health and safety includes potential impacts associated with construction-related health and safety risks, including fires and emergencies, and disease vectors. Another safety issue, the potential for changes in flooding downstream from the reservoirs, is discussed in Section 3.6, Flood Hydrology. Utilities and public services include potential impacts on electricity, natural gas, water supplies, stormwater management, wastewater, solid waste, telecommunications, public roads, police, and fire services. The power analysis examines the potential impacts on existing power facilities and the resulting loss of power production. The economic impacts from changes in PacifiCorp customer rates as a result of dam removal costs are discussed in Section 3.15, Socioeconomics.

3.18.1 Area of Analysis

The area of analysis differs based upon the specific resource being analyzed. The primary area of analysis includes the Klamath Hydroelectric Project (KHP), the Klamath River downstream from Iron Gate Dam, counties and communities in the area, and areas in the Upper Klamath Basin that could be affected by implementation of the Klamath Basin Restoration Agreement (KBRA) (see Figure 3.18-1). As shown in Figure 3.18-1 the Klamath Basin includes lands managed for public use, including health and safety and public services, by both the US Forest Service (USFS) and the Bureau of Land Management (BLM).

3.18.1.1 Public Health and Safety Area of Analysis

The area of analysis for public health and safety includes the area in the immediate vicinity of the Klamath Hydroelectric Project as well as areas identified as construction/demolition areas and staging areas for the alternatives. These areas will have construction and physical changes to the environment that may result in public health and safety concerns.

3.18.1.2 Utilities and Public Services Area of Analysis

The area of analysis for utilities and public services includes the counties and communities where both permanent residents and temporary workers would live and use community resources and services, and the areas where substantial construction activities would occur. Some of the major communities in the area of analysis potentially affected by the alternatives are listed below in Table 3.18-1.

3.18.1.3 Solid Waste Area of Analysis

The area of analysis for solid waste includes the landfills and waste management facilities in Siskiyou County, California and Klamath County, Oregon.

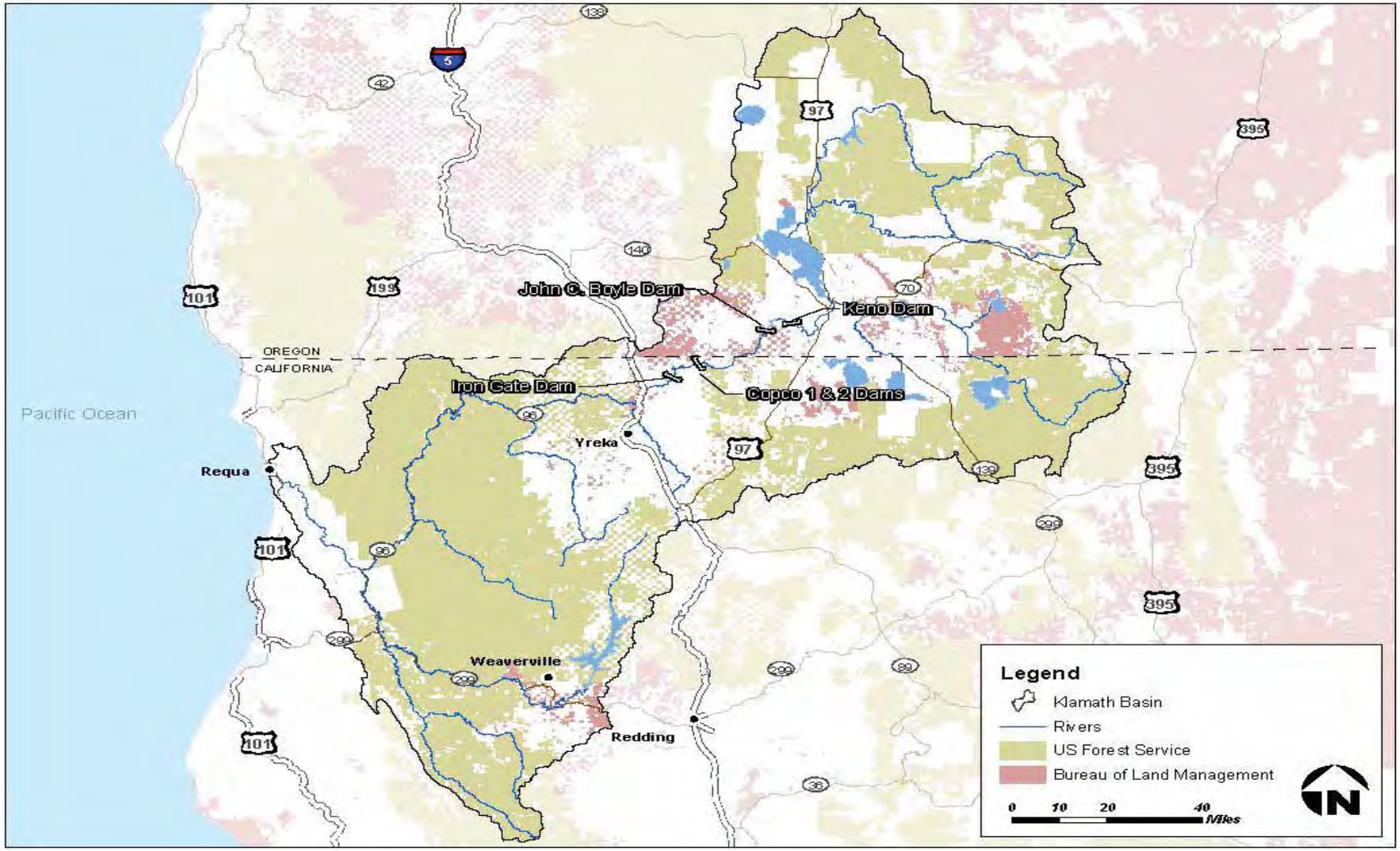

Figure 3.18-1. Klamath Basin.

Table 3.18-1. Example Communities in the Area of Analysis with Utilities and Public Services Potentially Affected by Alternatives

County	Community	State
Siskiyou	City of Yreka	CA
	Hornbrook	CA
	Copco Village	CA
	Beswick	CA
	Weed	CA
Klamath	Malin	OR
	Merill	OR
	Klamath Falls	OR
	Chiloquin	OR
	Keno	OR

3.18.1.4 Power

The area of analysis for power includes the Klamath Hydroelectric Project (KHP), which is owned by PacifiCorp and covers 64 river miles from the Link River Dam in Oregon to Iron Gate Dam in California, and the PacifiCorp service area within the Klamath Basin.

3.18.2 Regulatory Framework

Public Health and Safety, Utilities and Public Services, Solid Waste, and Power within the area of analysis are regulated by Federal, State and local laws, authorities and regulations, which are listed below.

3.18.2.1 Federal Laws, Authorities and Regulations

- Federal Energy Regulatory Commission (FERC) Founding Legislation: Title 42, chapter 84, Subchapter IV, Section 7171
- United States Department of Energy Organization Act of 1977
- Resource Conservation and Recovery Act; 42 U.S.C Section 6901 et seq. (1976)
- 29 CFR Part 1910: Occupational Safety and Health Standards
- 29 CFR Part 1925: Safety and Health Standards for Federal Service Contracts
- 29 CFR Part 1926: Safety and Health Regulations for Construction
- 29 CFR Part 1952: Approved State Plans for Enforcement of State Standards

3.18.2.2 State Authorities and Regulations

- California Public Utilities Commission (CPUC)
- Oregon Public Utilities Commission (Oregon PUC)
- Oregon Administrative Rules (OAR) Chapter 860
- California Code of Regulations (Title 14, Chapter 3)
- California Integrated Waste Management Act (AB 239)

- Oregon Department of Environmental Quality (ODEQ), OAR Chapter 340, Division 94 (OAR-340-94), and by adoption, 40 CFR Part 258 (2009).
- State Occupational Safety and Health Programs, certified under Section 18 of the Occupational Safety and Health Act of 1970 (California, certified 1973; Oregon, certified 2005)
- ODEQ, Water Quality Control. OAR Chapter 340, Division 41 (OAR-340-41) (2010).

3.18.2.3 Local Authorities and Regulations

- Siskiyou County General Plan (Siskiyou County 1993).
- Siskiyou County Source Reduction and Recycling Element (Siskiyou County 1997)
- The Yreka General Plan 2002–2022 (City of Yreka 2003).
- The Klamath County Comprehensive Plan (County Solid Waste Management Plan) (Klamath County 2010a).

3.18.3 Existing Conditions/Affected Environment

This section describes the existing conditions/affected environment for public health and safety, utilities and public services, solid waste, and power.

3.18.3.1 Public Health and Safety

This section analyses the potential impacts of the alternatives on police, fire, and other emergency response times and effectiveness; whether the alternatives and construction activity would restrict access to emergency centers or evacuation routes, and whether the project or its construction would directly create or increase the risk posed by an existing hazard. An analysis of the potential affects in geologic hazards including seismology, earthquakes, and landslides in the project area is appears in Section 3.11, Geology, Soils, and Geologic Hazards. The potential for changes in flood risk downstream from the Four Facilities is described in Section 3.6, Flood Hydrology.

3.18.3.1.1 Emergency Centers

Figure 3.18-2 shows the locations of the hospitals and fire stations within the area of analysis. No hospitals and only one fire station (Copco Lake Fire Department Station 210), at Copco 1 Reservoir, lie directly within the area of analysis. The nearest hospitals are Sky Lakes Medical Center in Klamath Falls, Oregon (roughly 20 miles east northeast of J.C. Boyle Dam), Ashland Community Hospital in Ashland, Oregon (roughly 35 miles north northwest of Iron Gate Dam), and Fairchild Medical Center in the City of Yreka, California (roughly 18 miles southwest of Iron Gate Dam).

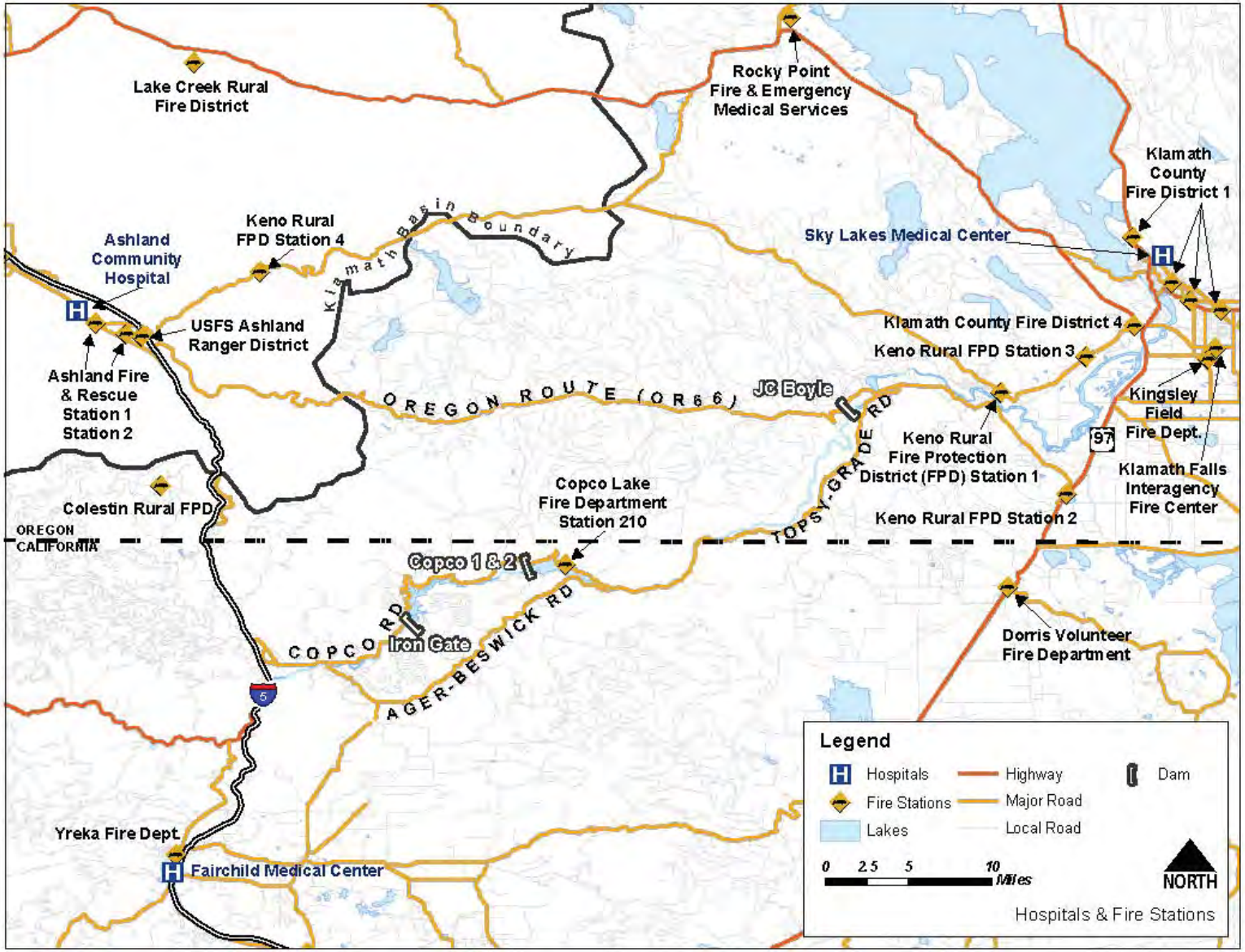

Figure 3.18-2. Hospitals and Fire Stations near the Project Area.

3.18.3.1.2 Fire Risk and Protection

Figure 3.18-3 shows fire hazard in the project area as mapped using MODerate-resolution Imaging Spectroradiometers by the United States Department of Agriculture Forest Service (United States Department of Forest Service (USFS), Remote Sensing Applications Center, 2010). During the dry season, areas surrounding reservoirs are at risk for fires, particularly at the interface between residential development and open space. As shown in the figure, the fire threat is high to very high in the areas surrounding the Four Facilities (CalFire 2007, Oregon Department of Forestry 2006).

Fire protection in the action area is provided by Federal agencies, the State forestry and fire prevention agencies, and a variety of city, county and volunteer fire stations. Federal agencies include the USDA Forest Service, which is responsible for wildland fire protection on National Forest lands and providing assistance to other Federal entities when requested; and the BLM, which is responsible for wildland fire protection on land managed by the BLM and providing assistance to other Federal, State, and local agencies when requested.

Fire protection at the State level is provided by CalFire in California, who, in conjunction with county and volunteer fire departments, is also responsible for fire protection throughout the unincorporated areas of the State. There are CalFire stations in the project vicinity, including the City of Yreka and Hornbrook. In Oregon, the Department of Forestry responds to wildland fires in the State resource areas and on federally managed lands. The ODF works with the BLM and the Forest Service to prevent and fight wildfire on the federally managed lands as well.

City-operated fire stations include the Yreka Fire Department, and the Mount Shasta Fire Department. There are also a number of county fire stations throughout the project area, including the Copco Fire Department, Happy Camp, Seiad Valley, Etna, Fort Jones, Montague, Butte Valley, McCloud, Dunsmuir, and Mount Shasta (Fire Department Directory 2010).The nearest fire stations to the project area are the Copco Fire Department, Keno Rural Fire Protection District Station in Oregon (east of Keno Dam), Yreka Fire Department (City of Yreka, California), and Colestin Rural Fire Protection District (in Oregon northwest of Iron Gate Dam). The Colestin Rural Fire Protection District and the Hilt Fire Company in Northern California operate as one agency out of geographic necessity. Legally, however, they are two separate entities (Colestin Rural Fire District 2005). The Hilt volunteer fire department jurisdiction includes the California side of the Colestin valley, and also covers part of northern Siskiyou County, down to the Hornbrook boundary (Colestin Rural Fire District 2011).

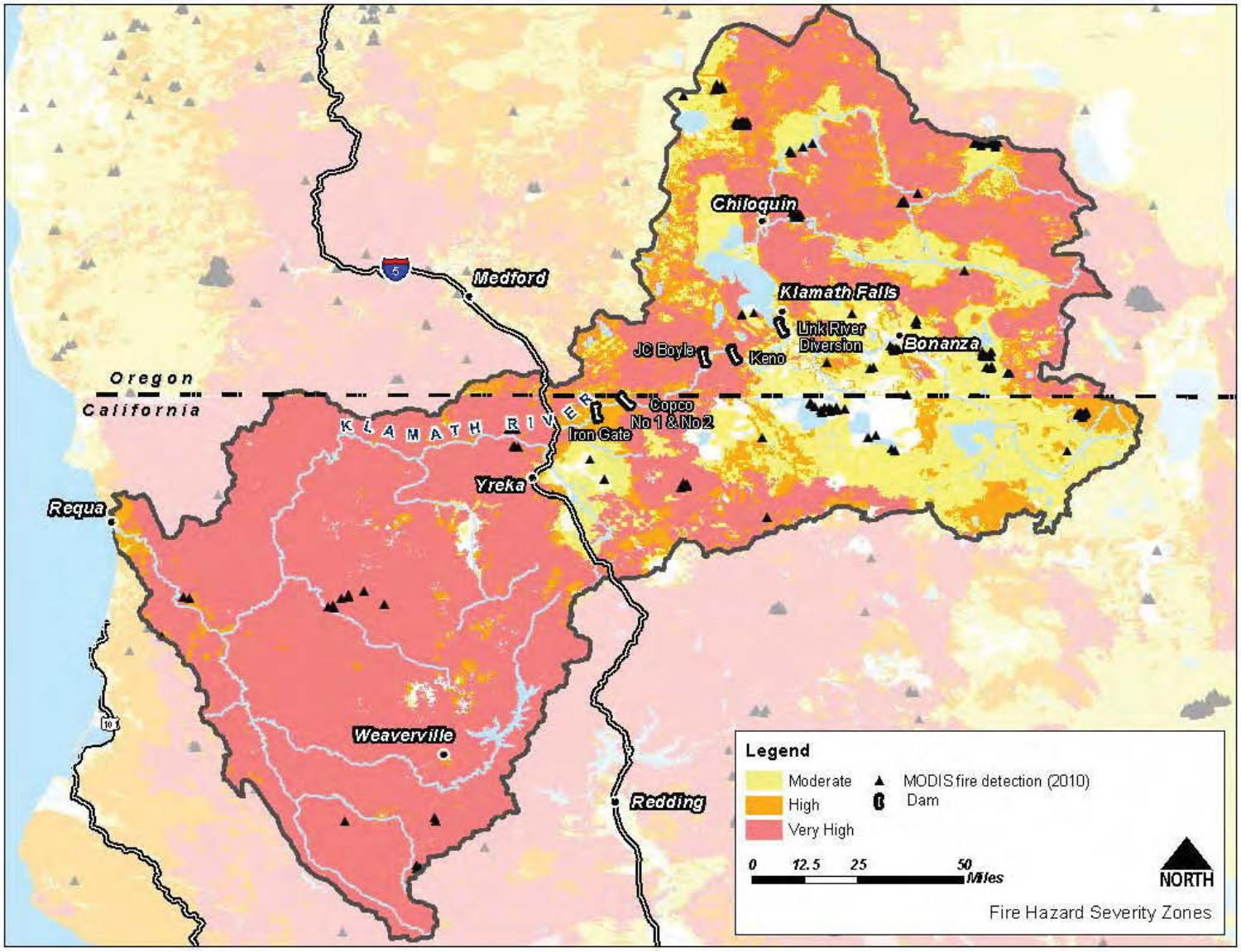

Figure 3.18-3. Fire Hazard in the Area of Analysis.

Table 3.18-2 below lists the fire protection entities and the areas they serve.

Table 3.18-2. Fire Protection Agencies in the Project Area

Agency	Federal/State/Local	Jurisdiction
USDA Forest Service	Federal	National Forests, federally managed land
Bureau of Land Management	Federal	Bureau of Land Management lands, federally managed land
CalFire	State of California	State Resource Lands, California,
Oregon Department of Forestry	State of Oregon	State Resource Lands, Oregon
Klamath County Fire District	Local, County of Klamath	Unincorporated County lands and the City of Klamath Falls
Colestin Rural Fire District	Local, County of Jackson	County Fire District in Jackson County, Oregon
Siskiyou County Fire Protection Districts: Copco Lake, Hornbrook, Montague, South Yreka, Tulelake, Etna, Ft. Jones, Weed	Local, County	Unincorporated County Lands throughout Siskiyou County
Mount Shasta Fire Department	Local, City of Mount Shasta	Mt. Shasta Municipal Boundaries
Yreka Fire Department	Local, City of Yreka	City of Yreka Municipal boundaries

No region or State-wide fire plans were identified for the action area. However, Siskiyou County began developing a Multi-Jurisdictional Hazard Mitigation Plan in July of 2010. As of the writing of this document, that plan has not been adopted. A Community Wildlife Preparedness Plan was completed in 2008. The document identifies "…most County, State, and Federal roads in the region" as emergency evacuation routes (Firesafe Council of Siskiyou County 2008). The Community Wildfire Protection Plan also identifies a number of locations as evacuation sites, including the Hornbrook School and Grange.

3.18.3.2 Utilities and Public Services

Utilities and public services are provided in the area of analysis by PacifiCorp, Pacific Gas and Electric (PG&E), AT&T, a number of cellular telephone companies, and through the local municipalities. The municipalities in the area (including the City of Yreka, Mount Shasta, and Klamath Falls) provide water and solid waste collection within their borders. Public schools are operated through the county school districts in both Siskiyou and Klamath Counties, which provide kindergarten through high school education throughout the project area. There are a number of private schools in the project area as well, serving students in the small towns throughout the counties, such as Dorris, Mount Shasta, Tulelake, Chiloquin, the City of Yreka, and Klamath Falls A full list of these utility and public service providers are presented in Table 3.18-3 by county and community.

Table 3.18-3. Utilities and Public Services in the Study Area

County	Electricity	Natural Gas	Water Service	Wastewater	Stormwater	Telecommunications	Police and Fire	Schools
Siskiyou County	Siskiyou County is served primarily by PacifiCorp.[1] Currently, electricity supplies generated in the area of analysis are primarily hydropower, with the closest PacifiCorp generation facilities in Siskiyou and Klamath Counties located on the Klamath River. Given the interconnected design of the regional power grid electricity generated at the Four Facilities may be used for local demand or it may be used to meet demands in other communities. Likewise, power generated by PacifiCorp and other generators in other communities may be used in Siskiyou and Klamath Counties.	Natural gas is supplied by PG&E (California Energy Commission (CEC) 2010b).	Municipal and Industrial water supply is not provided by the county; it is provided by cities and towns in the county (Dean 2010). Areas in Siskiyou County not served by local municipalities obtain water from private wells.	The county does not provide wastewater treatment. Residences in the unincorporated county are served by on-site septic systems (Dean 2010). Cities, as described below, are responsible for wastewater treatment.	Stormwater management is done by the individual municipalities within the county.	Wired telephone services are provided by AT&T and Pac-West (Wise 2010).Multiple cellular companies also provide wireless service in the area,	Police services are provided by the Siskiyou County Sheriff's Department (Siskiyou County 2010b). Fire protection is provided by 12 fire protection districts: Happy Camp District, Copco Lake District, Hornbrook District, South Yreka District, Scott Valley District, Callahan District, Montague District, Gazelle District, Butte Valley District, Tulelake District, Mount Shasta District, and the Dunsmuir District (Siskiyou County 1975).	The Siskiyou County Office of Education oversees the school districts and educational programs (Siskiyou County Office of Education, 2010). The county has charter schools, elementary schools, high schools, and a unified school district (Siskiyou County Office of Education 2010). There are a number of private schools in the county, located within the incorporated cities and larger settlements in the County, including Dorris, Mount Shasta, the City of Yreka, and Tulelake,
City of Yreka	PacifiCorp provides electrical power (CEC 2010a).[1]	Natural gas is provided by PG&E (CEC 2010b).	The City of Yreka currently receives its municipal water supply from Fall Creek (City of Yreka 2010a). The City of Yreka's main transmission line runs under Iron Gate Reservoir upon the lakebed (City of Yreka 2010b). The City of Yreka's water supply is piped from the Fall Creek Pumping Station near Copco 1 Reservoir through a 24-inch pipe for 23 miles to the City of Yreka (City of Yreka 2003). Current water use in the winter is approximately 1 mgd; however, in the summer this use increases up to approximately 6 mgd (City of Yreka 2003). The City of Yreka obtains its water based on a State water right allowing withdrawal of up to 15 cfs (9.7 mgd) (City of Yreka 2010a).	The city has one wastewater treatment plant that treats and disposes of both domestic and industrial sewage generated within the city's boundaries (City of Yreka 2010c). The facility is designed to accommodate up to 1.3 mgd of average dry weather flow. The City of Yreka's general plan reported that average dry weather flow in 2003 was between 0.7 and 0.9 mgd (City of Yreka 2003).	Stormwater management is the responsibility of the City of Yreka's Public Works Department.	Wired telephone service is provided by AT&T and Pac-West. Multiple cellular companies also provide wireless service in the area,	Police services are provided by the City of Yreka Police Department and Fire services are provided by the Yreka Fire Volunteer Department (City of Yreka 2010d; City of Yreka 2010e).	The City of Yreka is served by the Yreka Union Elementary School District and the Yreka Union High School District (Siskiyou County Office of Education, 2010). There is a private Bible academy in the City of Yreka that serves students from Kindergarten through 11th grade.
Hornbrook	Electricity is provided by PacifiCorp (Wise 2010).	Natural gas in the county is supplied by PG&E (CEC 2010b).	Water supply in Hornbrook comes from private ground water wells (Wise 2010).	Residents use on-site septic systems for wastewater treatment (Dean 2010).	Stormwater runoff is conveyed through natural drainages (Dean 2010).	Wired telephone services are provided by AT&T (Dean 2010). Multiple cellular companies also provide wireless service in the area,	The Siskiyou County Sheriff provides police protection services to the community of Hornbrook (Wise 2010).	Yreka Union School District serves the community of Hornbrook (Wise 2010).

Table 3.18-3. Utilities and Public Services in the Study Area

County	Electricity	Natural Gas	Water Service	Wastewater	Stormwater	Telecommunications	Police and Fire	Schools
Copco Village	Electricity is provided by PacifiCorp (Wise 2010).	Natural gas in the county is supplied by PG&E (CEC 2010b).	Water supply in Copco Village comes from private ground water wells (Wise 2010).	Wastewater service is provided by on-site septic systems (Dean 2010).	Stormwater runoff is conveyed through natural drainages (Dean 2010).	Wired telephone services are provided by AT&T (Dean 2010). Multiple cellular companies also provide wireless service in the area,	The Siskiyou County Sheriff provides police protection services to the community of Copco Village (Wise 2010).	Yreka Union School District serves the community of Copco Village (Wise 2010).
Beswick	Electricity is provided by PacifiCorp (Wise 2010).	Natural gas in the county is supplied by PG&E (CEC 2010b).	Water supply in Beswick comes from private ground water wells (Wise 2010).	Wastewater is treated in on-site septic systems (Dean 2010).	Stormwater runoff is conveyed in natural drainages (Dean 2010).	Wired telephone services are provided by AT&T and Pac-West (Wise 2010). Multiple cellular companies also provide wireless service in the area,	The Siskiyou County Sheriff provides police protection services to the community of Beswick (Wise 2010).	Yreka Union School District serves the community of Beswick (Wise 2010).
Klamath County	PacifiCorp provides electric power to the county (Dobry 2010).	Avista Utilities provides natural gas services to the county (Dobry 2010).	Water supplies in the unincorporated county come from private ground water wells as well as numerous private water companies that serve some community subdivisions (Dobry 2010). Additionally, some water is provided by the City of Klamath Falls (Dobry 2010).	Wastewater in the county is provided by the Klamath County Community Development On-Site Sanitation Division (Klamath County 2010b).	Stormwater flows through roadside ditches and natural drainages (Gallagher 2010).	Wired telephone service is provided by USWest. Multiple cellular companies also provide wireless service in the area, (Gallagher 2010).	The Klamath County Sheriff Department provides police protection in the county (Klamath County 2010c). Klamath County is served by 17 fire districts: Bly Fire District, Bonanza Fire District, Chemult Fire District, Chiloquin Fire District, Crescent Fire District, Central Cascades Fire District, Harriman Fire District, Keno Fire District, Klamath County Fire Districts numbers 1 through 5, La Pine Fire District, Malin Fire District, Merrill Fire District, and North Klamath Fire District (Klamath County 2010c).	The Klamath County School District includes 20 schools, including elementary, junior high, and senior high schools (Klamath County School District 2010). Schools serving the project area include Chiloquin Elementary and Junior and Senior High Schools, Keno Elementary, and Merrill Elementary. A number of private schools are located throughout the county, including Bonanza, Chiloquin, and Klamath Falls.
Merrill	PacifiCorp provides electric power to Merrill.	There is no natural gas supplied to Merrill (Fuller 2010).	Water supply comes from city ground water wells on Front Street (Fuller 2010).	Wastewater is treated in Merrill's wastewater treatment plant (Fuller 2010).	Stormwater flows through natural drainages; Merrill does not maintain any constructed stormwater infrastructure (Fuller 2010).	Wired telephone service is provided by Century Link (Fuller 2010). Multiple cellular companies also provide wireless service in the area,	The Merrill City Police Department provides police protection services in the city (Fuller 2010). Fire protection services are provided by the Merrill Rural Fire Protection District, a primarily volunteer fire company serving the town and surrounding area.	Merrill Elementary School and Lost River High School serve the City of Merrill. Both schools are within the Klamath County School District (Fuller 2010).

Table 3.18-3. Utilities and Public Services in the Study Area

County	Electricity	Natural Gas	Water Service	Wastewater	Stormwater	Telecommunications	Police and Fire	Schools
Klamath Falls	PacifiCorp provides electricity to Klamath Falls.	Amerigas and Klamath Natural Gas Services provide natural gas in Klamath Falls	Klamath Falls' Water Division is responsible for providing water to more than 40,000 residents in the urban area. The division operates and maintains 13 ground water wells, 21 pumping stations, and 22 water reservoirs with a total storage capacity of 16 million gallons (City of Klamath Falls 2010a). Klamath Falls' water supply comes from ground water wells.	Wastewater collection and treatment service is provided by the City of Klamath Falls Wastewater Division. The division services nearly 20,000 city residents and Klamath Basin area customers (City of Klamath Falls 2010b). In addition to sewage collection and treatment, the division provides stormwater collection services, and sewage treatment for a major residential development and a major resort/residential development outside of the city limits (City of Klamath Falls 2010b). Equipment and facilities include two wastewater treatment plants, 11 wastewater pumping stations, four stormwater pumping stations, and stormwater collection lines. Wastewater treatment facilities process an average combined 4.2 mgd of wastewater from over 7,100 service connections (City of Klamath Falls 2010b). Within the Klamath Falls Urban Growth Boundary, wastewater treatment is provided by the South Suburban Sanitary District.	The City of Klamath Falls Wastewater Division manages the stormwater infrastructure in the city (City of Klamath Falls 2010b).	Wired telephone service in the city is provided by Qwest. Multiple cellular companies also provide wireless service in the area,	The Klamath Falls Police Department is responsible for police services in the city (City of Klamath Falls 2010b). Fire protection is provided by the Klamath County Fire District No. 1. The existing fire district serves an area of 201 square miles containing approximately 52,000 residents (Klamath County Fire District 2010).	Klamath Falls City Schools oversees a mix of elementary, junior high and high school, and alternative education schools in the city (Klamath Falls City Schools 2010). There are 11 schools in the district.
Chiloquin	PacifiCorp provides electricity in Chiloquin.	Chiloquin does not use natural gas resources (Foreman 2010).	The City of Chiloquin supplies water to all city residents as well as some residents that are outside of the city but within the urban service area. Municipal water supplies come from one ground water well (Foreman 2010).	Chiloquin has a city wastewater treatment plant (Foreman 2010).	Chiloquin maintains roadside drainages for stormwater runoff (Foreman 2010).	Wired telephone service is provided by Century Link (Foreman 2010). Multiple cellular companies also provide wireless service in the area,	Police and public safety in Chiloquin is provided by the Klamath County Sheriff and the Oregon State Police (City of Chiloquin 2010a). Fire service is provided by the Chiloquin-Agency Lake Rural Fire Protection District, a volunteer fire department that serves a 105-square-mile area that encompasses the city and the areas to the north and east (Klamath Fire 2005).	Three county schools in the city serve children living in Chiloquin: Chiloquin Elementary and Chiloquin Junior and Senior High Schools (City of Chiloquin 2010b; Foreman 2010).

Key:
CEC: California Energy Commission
PG&E: Pacific Gas and Electric

3.18.3.3 Solid Waste

County and local landfill and waste processing facilities are described below.

3.18.3.3.1 Siskiyou County

Solid waste in the Siskiyou County is handled by the General Services Sanitation Department (Siskiyou County 2010a). Siskiyou County has transfer stations in Mount Shasta, Happy Camp, Tulelake, the City of Yreka, and in the Salmon River Area (Siskiyou County 2010a). Yreka Sanitary Landfill is a Class III landfill 2 miles southwest of the City of Yreka, California. It is owned by the City and County of Siskiyou and operated by the City of Yreka. Class III landfills accept construction debris, most household garbage, greenwaste, carpet, and other types of non-hazardous waste. Hazardous wastes, such as batteries, paints, and hazardous materials must be disposed of in Class I facilities which are lined to prevent the contamination of underlying soils and ground water.

3.18.3.3.2 Klamath County

The Klamath Falls Landfill is a demolition only, unlined landfill 2 miles northeast of Klamath Falls, Oregon. It is owned by the County of Klamath and operated by the Klamath County Community Development-Solid Waste Division. A second waste transfer station is located on the south side of Klamath Falls. The Keno Transfer station is located south of the community of KeNo. Hazardous waste, soils contaminated by hazardous materials, and lead acid batteries are all prohibited at County Solid Waste Disposal Sites. There are numerous other transfer stations located throughout the county, but it is unlikely these would be used for deconstruction debris as they have limited capacity and restrictions on the types of materials that may be disposed of at the transfer station.

3.18.3.3.3 Shasta County

The Anderson Landfill is located in the city of Anderson in Shasta County, and is a hazardous waste disposal site that will accept a variety of construction and demolition related wastes, including creosote-treated wood. While the landfill is located just over 100 miles from Iron Gate Dam, the remaining capacity and materials accepted make it a likely recipient of dam materials from the deconstruction activities (Table 3.18-4).

3.18.3.3.4 Lane County

The Delta Sand & Gravel Demolition Landfill located in Eugene, Oregon, accepts dirt, rock, concrete, building demolition materials, and green waste. The landfill is over 200 miles from Iron Gate Dam, but may be used for some of the building debris removed from the project sites (Table 3.18-4).

The Ecosort Material Recovery Facility is also located in Eugene, and accepts wood, concrete, asphalt, metal, and aluminum. This is a recycling center that has no set capacity as materials are recycled and reused elsewhere.

3.18.3.3.5 Jackson County

The Dry Creek Landfill in Eagle Point has approximately 165,000,000 cubic yards of remaining capacity and accepts construction/demolition debris, mixed municipal refuse, and contaminated soils (Table 3.18-4). Located only 54 miles from Iron Gate Dam, it is likely this facility would receive some share of the materials generated by dam deconstruction from the proposed project.

3.18.3.3.6 Summary of Local Landfills and Transfer Facilities

Several landfills in the project area could receive solid waste from deconstruction activities. Table 3.18-4 summarizes regional landfills and recycling centers closest to the Iron Gate Dam.

Table 3.18-4. Regional Landfills and Recycling Centers and Type of Waste Accepted

Facility Name	Address	City, State/ County	Remaining Capacity (yd^3)	Wastes Accepted	Distance from Iron Gate (mi)
Yreka Solid Waste Landfill	Off Oberlin Rd; 2 mi SE of the City of Yreka	The City of Yreka, CA/ Siskiyou	3,924,000	Construction/demolition, mixed municipal	26.7
Dry Creek Landfill	6260 Dry Creek Road	Eagle Point, OR/ Jackson	165,000,000	Construction/demolition, mixed municipal, contaminated soils	54.0
Klamath Falls Landfill	801 Old Fort Road	Klamath Falls, OR/ Klamath	435,000	Construction/demolition, contaminated soils	89.0
Yreka Med. Vol. Transfer Station	Off Oberlin Rd; 2 mi SE of the City of Yreka	the City of Yreka, CA/ Siskiyou	Recycling facility	Inert, metals, mixed municipal	26.7
Ecosort Material Recovery Facility	3425 E 17th Avenue	Eugene, OR/ Lane	Recycling facility	Wood, concrete, asphalt, metal, aluminum	209
Delta Sand & Gravel Demolition Landfill	999 Division Street	Eugene, OR/ Lane	1,000,000 of general excavation and 200,000 of concrete	Dirt, rock, concrete, building demolition, clearing debris and brush removal.	215
Anderson Landfill, Inc	18703 Cambridge Road	Anderson, CA/ Shasta	11,914,025	Construction/Demolition (including creosote treated wood), green waste, mixed municipal, tires	134

Source: CalRecycle 2010, Loeschen 2010, Oregon Department of Environmental Quality 2007, Sorensen 2010, United States Environmental Protection Agency 2006

Key:
yd3 = cubic yards
mi = miles
SE = southeast

3.18.3.4 Power

The KHP, operated by PacifiCorp, provides power to residential, industrial, and agricultural customers across the PacifiCorp service area (Figure 3.18-4). The KHP consists of seven hydroelectric facilities and one reregulating facility with an installed capacity of approximately 169 megawatts (MW) and a total average annual electric output of 716,800 megawatts hours (MWh), as shown in Table 3.18-5 (FERC 2007). Six of the generating facilities are on the Klamath River, with the seventh on Fall Creek, a tributary to the Klamath River that enters at River Mile 196.3, between Iron Gate and Copco 2 Reservoirs. Keno Dam is a reregulating facility with no generating capacity. The KHP covers 64 river miles, from the Link River Dam in Oregon to Iron Gate Dam in California (California Energy Commission [CEC] 2003).

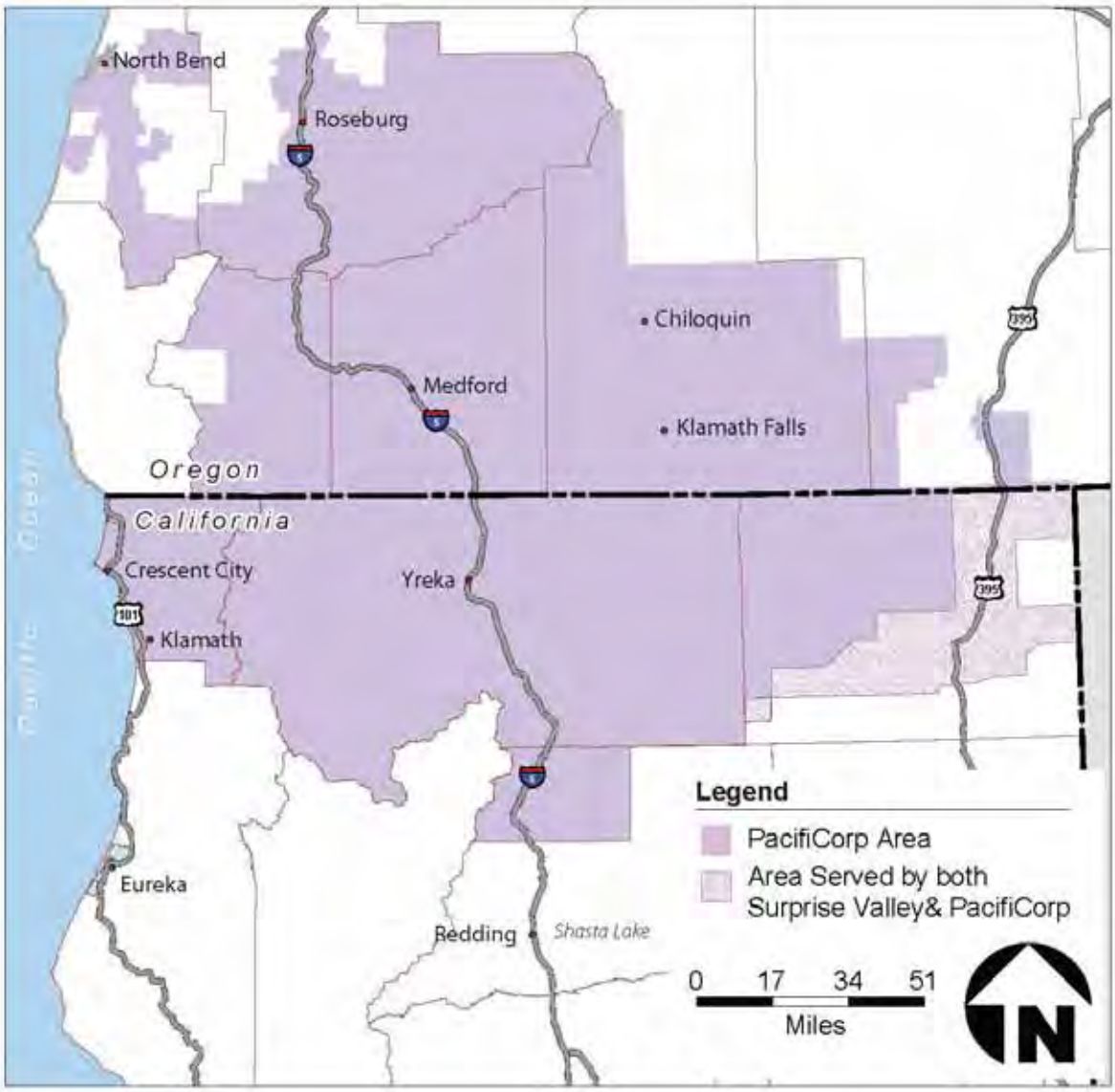

Figure 3.18-4. PacifiCorp Service Area.

Table 3.18-5. Klamath Hydroelectric Project Facilities

Facility Name	Generating Facility	Total Authorized Generating Capacity (MW)	Average Annual Generation (MWh)	Location	River Mile (RM)
Link River Dam	East Side Power canal	3.19 MW	15,400	Klamath Falls, OR	RM 254
	West Side Power canal	0.6 MW	3,400	Klamath Falls, OR	RM 254
Keno Dam and Impoundment	None (Re-regulating facility with no power generation capabilities)	None	None	20 miles downstream from East Side and West Side Powerhouses	RM 233
J.C. Boyle Dam and Reservoir	J.C. Boyle Powerhouse	97.98 MW	329,000	OR	RM 224.7 (Dam) RM 220.4 (Powerhouse)
Copco 1 Reservoir	Copco 1 Powerhouse	20.0 MW	106,000	CA	RM 198.6
Copco 2 Reservoir	Copco 2 Powerhouse	27.0 MW	135,000	CA	RM 196.8
Iron Gate Dam and Reservoir	Iron Gate Dam Powerhouse	18.0 MW	116,000	CA	RM 190
Fall Creek (On Klamath River tributary that flows into upper Iron Gate Dam Reservoir)	Fall Creek Powerhouse	2.2 MW	12,000	CA	196.3
Total:		**168.97**	**716,800**		

Key:
MW = megawatts
Source: FERC 2007

PacifiCorp has, in its 2004 relicensing submission to FERC, described plans to decommission the East Side and West Side Powerhouses. These two facilities are located at the Link River Dam, and as shown in Table 3.18-4, have a combined nameplate capacity of less than 4 MW. The cost to install screening on these facilities to protect the federally listed suckers in Upper Klamath Lake would be prohibitive given the small amount of power they produce (FERC 2007). The Proposed Action would remove four of the eight facilities (J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams). These Four Facilities under consideration for removal have a nameplate generation capacity of approximately 163 MW of electricity, and produce an average of 686,000 MWh annually (see Table 3.18-5). J.C. Boyle is able to produce peaking power during periods of high demand (FERC 2007); but, due to a number of factors, such as limited storage capacity in the reservoirs and flow restrictions imposed by the Biological Opinions for coho salmon and the sucker species, the rest of the project is operated more as a “run of the river” facility (CEC 2006).

While an excess of generation capacity exists in the Northwest sub region, transmission constraints prevent much of the power generated in the Northwest Power Pool from being used south of the project area in areas that are constrained by electrical supply (North American Electric Reliability Corporation 2010). PacifiCorp's 2008 Integrated Resource Plan provides an overview of the company's available generation and transmission capacity. According to the Integrated Resource Plan, which assumes relicensing of all of the company's hydroelectric facilities, PacifiCorp will be "summer peak resource deficit" in 2011 (PacifiCorp 2008). This deficit was to be met in the short term with additional renewable, demand-side programs, market purchases from other generating companies, and improvements to the efficiency of coal fired plants (PacifiCorp 2008). PacifiCorp outlined a series of actions in the plan to meet this deficit, including the addition of 144 MW of wind resources in 2009 through company owned resources and purchases, and the addition of 269 MW of wind resources in 2010 with company owned resources and 119 MW of power purchases (PacifiCorp 2008). These improvements and purchases will allow PacifiCorp to meet the expected load across their service area.

3.18.4 Environmental Consequences

3.18.4.1 Environmental Effects Determination Methods

3.18.4.1.1 Public Health and Safety

The impact analysis for public health and safety focuses on proposed deconstruction activities surrounding the Four Facilities and associated reservoirs and how these would affect the health and safety of the general public and construction workers. Other sections in the Klamath Facilities Removal Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) describe several public health and safety impacts. Section 3.11, Geology, Soils, and Geologic Hazards discusses Geologic stability of nearby soils (i.e., slumping and landslides) and geologic hazards such as seismology and volcanology. Section 3.3, Aquatic Resources, and Section 3.2, Water Quality, discuss water quality impacts. Changes in hydrology and flooding are discussed in Section 3.6, Flood Hydrology, and Section 3.8, Water Supply/Water Rights. Section 3.22, Traffic and Transportation, discusses the impact to area roads and bridges, and safety issues associated with the Proposed Action and vehicular traffic. Impacts on the recreational areas, with the exception of potential impacts to visitors using the areas, are discussed in Section 3.20, Recreation. Impacts to visitors as a result of the proposed deconstruction are discussed in this section.

3.18.4.1.2 Utilities and Public Services

The Lead Agencies determined the impacts on utilities by examining utilities and services in the project area and how they would be affected by demolition activities. The discussion of utilities also covers the demands for electricity and natural gas that would result from deconstruction and construction activities. Removal of hydropower facilities and resulting changes in hydropower production are addressed below in the hydropower section. The Proposed Action and alternatives do not have the potential to affect schools in terms of additional students or longer bus routes. However, if the Proposed Action is carried out, there could be reduced tax revenue available to fund local schools.

Section 3.15, Socioeconomics, discusses impacts to local tax revenues. The Proposed Action would not require new or expanded stormwater or wastewater facilities; therefore, these services and utilities are not discussed further. Geothermal resources have been identified in the area, but no plans exist to develop these resources as part of the Proposed Action. Any future development of geothermal resources would require focused environmental compliance and review, and development of these resources is not discussed further.

3.18.4.1.3 Solid Waste

The Lead Agencies determined the solid waste impacts by assessing the ability of local facilities to accept non-hazardous materials that could not be disposed of at the dam sites. Deconstruction of the dams is anticipated to generate solid waste comprising earth, concrete, metal, wood planks, and asphalt. It is assumed that most of this material that cannot be safely disposed of on-site would be considered inert material and could be disposed of in Class III landfills (See Table 3.18-3, Regional Landfills and Recycling Centers and Type of Waste Accepted). In addition, a large portion of deconstruction and construction debris, such as the asphalt, concrete, rebar, metal from the powerhouses and transmission infrastructure, and reclaimed lumber, would be diverted from landfills through reuse and recycling. No solid waste would be generated after deconstruction is complete.

3.18.4.1.4 Power

The analysis for power focuses on changes to existing hydropower facilities and the potential need for replacement power production after the Proposed Action and alternatives have been implemented.

3.18.4.2 Significance Criteria

3.18.4.2.1 Public Health and Safety

For the purposes of this EIS/EIR, impacts on public health and safety would be significant if an alternative would do the following:

- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.
- Expose people or structures to a significant risk of loss, injury or death involving construction safety hazards, emergency routes, or wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

3.18.4.2.2 Utilities and Public Services

For the purposes of this EIS/EIR, impacts on utilities and public services would be significant if the alternative would do the following:

- Result in substantial adverse physical impacts that create the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services: fire protection; police protection; schools; parks; other public facilities.
- Result in increased demand for utilities that could exceed the capacity and outputs of existing facilities/infrastructure, and require new or expanded facilities/infrastructure that could result in significant environmental impacts.
- Be served by a landfill with insufficient permitted capacity to accommodate solid waste disposal needs.
- Not comply with Federal, State, and/or local statutes and regulations related to solid waste.

3.18.4.2.3 Power

For the purposes of this EIS/EIR, impacts on power would be significant if an alternative would do the following:

- Require or result in the construction of new facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.
- Result in insufficient power supplies available to serve existing customers.

3.18.4.3 Effects Determinations

3.18.4.3.1 Alternative 1: No Action/No Project

Under the No Action/No Project Alternative, no deconstruction or construction would occur at the Four Facilities. Thus, no change to risk of public safety as a result of construction related safety risks, emergency routes, or wildland fires would occur under the No Action/No Project Alternative. Because no deconstruction or construction activities would occur under the No Action/No Project Alternative, no changes in the provision of public services and utilities would result from the No Action/No Project Alternative.

Under the No Action/No Project Alternative, hydropower generation would continue subject to the conditions of the Bureau of Reclamation (Reclamation) Biological Opinions, which could have the potential to decrease hydropower production. Hydropower generation is controlled by the allowed ramping rates in the J.C. Boyle Bypass Reach and the minimum flow requirements downstream from Iron Gate Dam allowed by the annual license (see Chapter 2 for a description of these requirements). Until a new license is issued, operations would continue under the annual license terms and the terms of the Biological Opinions issued by Reclamation with consultation from National Oceanic and Atmospheric Administration Fisheries and the U.S. Fish and Wildlife Service (Reclamation 2010). The flows downstream from Iron Gate Dam are governed by the 2010 Biological Opinion, which supersede the terms of the annual license. However, the flows and ramp rates downstream from J.C. Boyle Dam are still governed by the FERC project license. Peaking generation would continue, but the flow limitations would not allow “no load to full two-unit peaking events” which is able to

increase flows by up to 3,000 cfs (PacifiCorp 2006). Two- unit operations would only be done when inflows to J.C. Boyle are high enough to run both units, or run one unit in continuous operation and use the second unit for peaking generation. PacifiCorp estimates that power generation would be reduced by 40 percent over the long term at J.C. Boyle, and by up to 100% during summer time peak demand periods due to the daily flow change limits discussed above. However, PacifiCorp maintains adequate power supplies to provide service to its customers in the Project Area. **There would be no change from existing conditions for the provision of hydropower from the No Action/ No Project Alternative.**

Ongoing Management Activities

Construction activities related to the ongoing restoration and management activities could impact public health and safety. Under the No Action/No Project Alternative, there would be some limited construction activities associated with ongoing habitat restoration projects. Construction associated with these projects would be short term and an applicable public health and safety plan would be developed for each project to ensure construction workers and the public were not adversely affected during construction and operation. **There would be no impact to public health and safety from these ongoing management activities**.

3.18.4.3.2 Alternative 2: Full Facilities Removal of Four Dams (the Proposed Action)

The Proposed Action involves removal of all features, with the exception of buried features, at the Four Facilities.

Construction activities could result in public health and safety risks. Earthwork and blasting have the potential to cause injuries from flying rock and other debris. Large construction vehicles and other equipment used for deconstruction and activities (referred to in this document as construction equipment) operating in and around the project area would pose a safety hazard to the general public. Work within waterways would pose hazards to boaters, if boating were allowed in the construction zone. **Construction impacts on public health and safety would be significant, but Mitigation Measure PHS-1 would reduce this impact to a less-than-significant level.**

Construction activities could increase public hazards by placing construction equipment in waterways, roadways, and other areas accessible by residents, recreational visitors, and potential spectators of the deconstruction activities. The dam demolition and construction areas (referred to in this sub-section as construction areas) would be closed off to the public while they are under construction to reduce hazards; however, the use of the roadways for truck hauling of materials could interfere with existing emergency evacuation plans and increase response times for emergency vehicles. Due to the rural nature and the low concentration of roads in the area, most roads are used as evacuation routes in the event of fire or other emergencies. Figure 3.18-2 shows the locations of the hospitals and fire stations within the area of analysis. Figure 3.23-1 in Section 3.23, Noise and Vibration shows potential haul routes that would be used for transporting materials as part of the Proposed Action. Although the dams are not directly on major

roadways (Route 66, Copco Road, and Interstate 5), these roads would likely need to be accessed to transport materials and equipment to and from the dam sites and to landfills or nearby borrow areas for disposal. **The placement of construction equipment in areas potentially accessible by residents and recreational visitors would be a significant impact. The use of the roadways for truck hauling of materials could also be a significant impact on public safety. Implementation of Mitigation Measures PHS-1 and PHS-2 would reduce these impacts to a less-than-significant level.**

Construction and demolition activities could increase the risk of wildfires. As shown in Figure 3.18-3, the fire threat in the areas surrounding the Four Facilities is categorized as high to very high (CalFire 2007). During the dry season, the areas surrounding J.C. Boyle, Copco 1, Copco 2, and Iron Gate Reservoirs are at risk for wildfires, particularly at the interface between residential development and open space. Deconstruction activities, particularly those that may result in accidental spills of flammable liquids or use of equipment that generates heat, such as welding, grinding, torch-cutting, gas and diesel generators, and other construction activities could result in open sparks or flame in vegetated open space could further aggravate the risk of fire. **The risk of fire would be a significant impact to public health and safety, but implementation of Mitigation Measure PHS-2 would reduce this impact to a less-than-significant level.**

Removal of the dams could eliminate a water source for wildfire services and could increase response times. Currently, helicopter fire crews use water from the reservoirs and the Klamath River to fight wildfires in the project vicinity (Dodds 2010). Under the Proposed Action, removal of the J.C. Boyle, Copco 1, Copco 2, and Iron Gate Reservoirs would remove a potential water source for fire fighting. The Klamath River would remain after dam removal, and surface water modeling (described in Section 3.6, Flood Hydrology and Section 3.8, Water Supply/Water Rights) indicates that flows in the Klamath River downstream from the removed dams would remain unchanged. As such, helicopter fire crews could still obtain water from the Klamath River, Ewauna Lake, or Upper Klamath Lake.

The loss of the reservoirs could increase turnaround times for helicopters fighting wildfires in the project area. While it is possible for some specialized equipment to fill the water tanks from water bodies with depths as little as 18 inches, others require depths in excess of 36 inches, depending on the equipment used and the discretion of the pilot (personal communication, Henderson Aviation, January 19, 2011). Therefore, use of the Klamath River as an alternate source of water might be possible after removal of the reservoirs. However even in remote areas wildfires originate in the wildland urban interface. As discussed, the loss of the reservoirs could increase turn-around time for helicopters refilling buckets but the presence of the Klamath River and nearby reservoirs would still provide a water source for fighting fire in the wildlands surrounding the Copco area. Initial response times would not be changed by the loss of the reservoirs, and existing fire fighting assets, such as the air tankers in Klamath Falls, and the water

source of Lake Ewauna, would still be in place and available. **The loss of the reservoirs would have a less than significant impact on fire suppression in the area.**

Removal of the reservoirs could eliminate a water source for residential firefighting in and around Copco Village, potentially increasing the risk to homes from fire. Comments received during the scoping period expressed concern that the loss of the reservoirs, particularly Copco 1 Reservoir, could endanger the existing residential areas by removing an easily accessible water source for both engines and helicopters. As discussed, the loss of the reservoirs would increase turn-around time for helicopters refilling buckets, and could eliminate easily accessible water sources for trucks, and increase turn-around times for trucks operating in the Copco Village. The presence of the Klamath River, existing water systems, and existing fire fighting resources ensures that assets for firefighting are present in the area. **The loss of Copco 1 Reservoir would have a less than significant impact on the water supply for residential firefighting in and around Copco Village.**

Implementation of the Proposed Action could affect police services. Construction activities would involve staging and stockpiling areas and equipment that would be kept on-site for the duration of construction. Security services would be provided by the construction contractor and would not increase the need for police services or the number of police personnel. **There would be no change from existing conditions in police services.**

Implementation of the Proposed Action could require the use of electricity and natural gas supplies in the study area. Implementation of the Proposed Action would require the use of heavy equipment to draw down and deconstruct the dams. The Dam Removal Entity (DRE) would supply power for these activities using gasoline and diesel-powered generators; power for these activities would not originate from the grid. No natural gas would be used for implementation of the Proposed Action. Thus, there would be no demand for municipal electricity or natural gas supplies during deconstruction as part of the Proposed Action, and would be no resulting increase in demand on these utilities. **There would be no change from existing conditions for electricity or natural gas supplies in the study area due to construction activities.**

Under the Proposed Action, recreational facilities currently located on the banks of the existing reservoirs would be removed following drawdown and could affect public health and safety. The existing recreational facilities provide camping and boating access for recreational users of the reservoirs. Once the reservoirs are drawn down, these facilities will be removed. The deconstruction could have health and safety impacts as a result of the construction equipments and work site safety issues. **The removal of the recreational facilities could impact public health and safety. The implementation of Mitigation Measures PHS-1 and PHS-2 would reduce these impacts to less-than-significant**

Implementation of the Proposed Action could affect public services and utilities in the counties and cities in the study area. Construction of the Proposed Action would result

in short-term population increases in the area from construction workers. There could be a maximum of 100–220 workers during overlap in construction schedules for removal of all four dams. Construction workers could remain in the area for the duration of deconstruction, a period of approximately 1 year. While many of these workers might already live in the surrounding communities described under the affected environment, the need for construction workers could result in an influx of people in the area as out of area workers and their families move in for the duration of the project. Because deconstruction activities would occur temporarily, no permanent population increases would be expected. Therefore, no permanent increase in demand of public services or utilities would occur. There would not be a need for the construction of new government facilities such as water supply, wastewater treatment, or stormwater drainage.

Construction workers working at the deconstruction sites would require restroom facilities which would be provided by portable units. No other utilities would be required at the construction site. Construction workers would not deteriorate service ratios and would not require any new utilities. **Public service and utility impacts would be temporary and less than significant.**

Implementation of the Proposed Action could result in the need for new roads. Transportation of dam waste materials would require the development of haul roads. All new roads would be temporary and would be developed and maintained by the DRE. The DRE would remove temporary roads and return the road areas to their previous conditions after deconstruction is complete. No new public roads would be required for the Proposed Action; therefore, there would be no impact on local government services responsible for road maintenance. **The construction of new haul roads would result in less than significant impacts on local roads and government services.**

Implementation of the Proposed Action could affect road conditions. Construction equipment could stress road beds, causing cracking and settling, and increase the amount of maintenance and repairs that would be required to keep the roads in serviceable condition (see Section 3.22, Traffic and Transportation for more details). Indicators of road impacts, such as rutting and unevenness in the road surface, surface cracking, and road bed slumping could occur. Roadway effects would vary based on climate, the weight of the trucks and their loads, the composition of traffic, and other variables. However, the DRE would be responsible for repairing any road damage under the terms of the construction contract. **Impacts on road conditions would be less than significant given the terms of the construction contract.**

Activities associated with the Proposed Action could generate a substantial amount of solid waste that would exceed capacity of facilities to receive the waste. The Proposed Action would involve removal of all appurtenant features, with the exception of buried features, at the Four Facilities. Although activities associated with deconstruction would generate a substantial amount of solid waste, material recycling would reduce the amount of waste disposed in landfills in the surrounding counties. At J.C. Boyle Dam, waste concrete and earth materials would be used to refill the original borrow pits on the right

abutment of the dam and also would be placed into the eroded scour hole through the hillside below the forebay spillway structure. For Copco 1 and Copco 2 Dams, concrete rubble would be buried on the right abutment within an on-site disposal area at Copco 1 Dam. At Iron Gate Dam, excavated embankment materials would be disposed of 1 mile upstream of the dam on the left abutment at the original borrow site. Approximately 300,000 cubic yards (yd^3) of excavated embankment material would be used to fill the concrete-lined side channel spillway, chute, and flip-bucket terminal structure[1]. Concrete rubble from Iron Gate Dam would be buried within an on-site disposal area.

All mechanical and electrical equipment from the J.C. Boyle Dam would be hauled to the Klamath Falls Landfill, while mechanical and electrical equipment waste from Iron Gate, Copco 1, and Copco 2 Dams would be hauled to the Yreka Transfer Station. At both the Klamath Falls Landfill and the Yreka Transfer Station, mechanical and electrical equipment and scrap metal would be salvaged and recycled.

As shown in Table 3.18-6, the total amounts of inert solid waste generated under the Proposed Action would be 1,241,500 yd^3 of earth, 126,000 yd^3 of concrete, 4,500 tons of rebar, and 7,200 tons of metals. As described above, all of the waste concrete and earth are expected to be disposed of in on-site disposal areas or in the original borrow pits. A portion of the metals would be recycled, in accordance with relevant construction debris recycling regulations, at the Yreka Transfer Station, the Yreka Sanitation Landfill, and the Klamath Falls Landfill. Given that the combined remaining permitted Class III landfill capacity available at the Klamath Falls Landfill and the Yreka Solid Waste Landfill is 4.3 million yd^3, the regional landfills in the surrounding counties would be capable of handling the additional waste generated by the Proposed Action. In addition, Dry Creek Landfill, also in the vicinity of the project area, has 165 million yd^3 of disposal capacity, and could be utilized for disposal.

With the majority of the earth and concrete to be disposed of on-site, and the availability of recycling facilities for the metals and rebar removed from the Facilities, the landfills described in Table 3.18-3 will receive less than the total amount of debris described in Table 3.18-6. The disposal capacities of the existing surrounding landfills are anticipated to be sufficient for the waste generated by the Proposed Action, and the waste generated would not conflict with the solid waste policies and objectives of AB939. **The solid waste impacts associated with the Proposed Action would be less than significant.**

[1] A Flip-Bucket is a type of energy dissipater that takes excess water from the reservoir and directs it downstream at a sufficient distance to prevent the spillover from creating a plunge pool or otherwise eroding the footing of the dam (Bureau of Reclamation, Development of Hydraulic Structures, Thomas J. Rhone, 1988. http://www.usbr.gov/pmts/hydraulics_lab/history/Rhone/index.html)

Table 3.18-6. Summary of Solid Waste Generation for Each Action Alternative

Dam Location	Earth[2] (yd^3)	Concrete[2] (yd^3)	Metal (tons)	Wood – Hazmat[1] (tons)	Rebar (tons)
Proposed Action - Full Facilities Removal					
J.C. Boyle	140,000	40,000	3,000	-	2,400
Copco No. 1	-	62,000	1,200	-	900
Copco No. 2	1,500	12,000	2,000	550	600
Iron Gate	1,100,000	12,000	1,000	-	600
Total	**1,241,500**	**126,000**	**7,200**	**550**	4,500
Partial Facilities Removal of Four Dams					
J.C. Boyle	140,000	20,000	2,000	-	1,200
Copco No. 1	-	57,500	200	-	600
Copco No. 2	0	4,500	500	550	200
Iron Gate	1,100,000	8,000	500	-	400
Total	**1,240,000**	**90,000**	**3,200**	**550**	2,400
Fish Passage at Four Dams					
J.C. Boyle	-	2,800	-	-	90
Copco No. 1	-	5,800	-	-	190
Copco No. 2	-	1,000	-	-	30
Iron Gate	-	7,000	-	-	230
Total	-	**16,600**	-	-	**540**
Fish Passage at Two Dams					
J.C. Boyle	-	2,800	-	-	90
Copco No. 1 (removed)	-	62,000	1,200	-	900
Copco No. 2	-	1,000	-	-	30
Iron Gate (removed)	1,100,000	12,000	1,000	-	600
Total	**1,100,000**	**77,800**	**2,200**	-	**1,620**

Source: Reclamation 2012
Notes:
[1] Wood power poles not included. See Section 3.21, Toxic/Hazardous Materials for further information regarding wood waste.
[2] In-place volumes shown. Increase volumes by 20 percent for earth and 30 percent for concrete for transportation purposes.
Key:
yd^3: cubic yards

The Proposed Action would remove existing hydropower facilities, resulting in a loss of hydropower. Under the Proposed Action, four of the seven power generating facilities of the KHP would be removed. PacifiCorp would continue to own its Fall Creek Facility, and its continued operation is not part of the Secretarial Determination. Also, as noted above, PacifiCorp proposed to decommission its East Side and West Side facilities as part of relicensing (FERC 2007). The installed capacity of the Four Facilities that would be removed is approximately 163 MW and FERC rates the project's dependable capacity as

42.7 MW[2] (CEC 2006). As shown in Table 3.18-4, the Klamath Hydroelectric Project has a total average annual electric output of 716,800 MWh, while the Four Facilities under consideration have an annual average output of 686,000 MWh (FERC 2007).

Dam decommissioning would require replacement power to serve the customers in the project area. According to the Western Electricity Coordinating Council's (WECC) 2009 Power Supply Assessment, the Northwest region has a large surplus power supply resulting from increased generating resources and a demand reduced due to the economic downturn; however, this surplus may be overstated based on the way the power supply model solves supply deficits (WECC 2009).

In addition to the surplus, the power is generated in the Northwest with hydroelectric facilities, which are able to provide peaking power, but not sustained heavy load production (WECC 2009). Nevertheless, all energy forecasts show the Northwest region having an energy surplus at the beginning of the 2010 forecast period that, while in decline over the study period (2010 – 2018), are sufficient to meet the needs of the sub region through 2018 (WECC 2009). The surplus capacity may not be able to be sustained over a prolonged cold spell or heat wave, due to the nature of hydro generation.

Removal of the Four Facilities would result in the loss of 163 MW of nameplate capacity, or 686,000 MWh from the Northwest Power Pool. This accounts for approximately 1.8 percent of PacifiCorp's power portfolio. While the loss of the power generated may have some impact to the local area, the effects of the loss to the Northwest Power Pool, in light of the scale of the additional generation needed to meet demand over the next 10 years, is minimal.

With the generation capacity of most of the KHP gone, PacifiCorp would be required to buy replacement power on the open power market (PacifiCorp 2004). Given the loss of the KHP, PacifiCorp would need to purchase at least 42.7 MW from other sources to meet their obligations (PacifiCorp 2004).

PacifiCorp's Integrated Resource Plan for 2008 discusses a number of different technologies for meeting the power needs in the Northwest Region forecast for 2018: geothermal, wind, natural gas, coal, and cogeneration (PacifiCorp 2010). Each of the replacement power options would involve some uncertainty specific to the power source.

[2] Dependable capacity is the MW output of a generator or group of generators during a period of low water or other operational constraints that coincide with a peak electrical system load -- essentially a worst case scenario for generation capacity, where low water coincides with peak demand. The dependable capacity is the number of megawatts that can be produced for at least four to six hours under these conditions. This is generation based on real world operations at a hydropower generating facility, whereas nameplate capacity is the amount of power that the turbines are capable of generating with all other conditions being perfect (CEC 2003).

Natural gas plants would require a large amount of fuel, and the future costs and availability of gas supplies are uncertain (PacifiCorp 2004). Cogeneration facilities use excess steam from industrial plants, and the technology is a common form of power generation; however, cogeneration would require an industrial partner and the siting of a potential cogeneration plant (PacifiCorp 2004). Coal plants would require longer construction times and cost more than natural gas plants, but would have much lower operational costs (PacifiCorp 2004). The major issue associated with coal fired plants would be the uncertainty of future carbon tax prices, which could increase the overall cost of the power. The climate change and green house gas emission consequences of these replacement power alternatives are addressed in Section 3.10, Greenhouse Gases/Global Climate Change.

In addition to replacement power, the electrical transmission system that delivers power from existing generation plants in the northwest to the Klamath area is in need of investment. PacifiCorp is planning a series of transmission system upgrades and additions (PacifiCorp 2011a). This project, called the Energy Gateway Transmission Expansion, is intended to upgrade the western electrical transmission system, which has not received a major upgrade in nearly 20 years (PacifiCorp 2011a). Transmission constraints remain an impediment to delivering replacement power to the KHP area. PacifiCorp is currently planning a new transmission line that will connect eastern Idaho to Southern Oregon at the Captain Jack substation outside of Klamath Falls, Oregon (PacifiCorp 2011b). The line would help to balance and transfer the power generated in PacifiCorp's East Side region with the demand in the West (PacifiCorp 2011b).

In addition to the replacement power options and the planned transmission upgrades, PacifiCorp acquired the 520 MW Chehalis gas plant (PacifiCorp 2010). In 2006, MidAmerican Energy Holding Company purchased PacifiCorp from ScottishPower. As a condition of the purchase, MidAmerican agreed to PacifiCorp's preexisting commitment to obtain an additional 1400MW of renewably sourced energy by 2015 if cost effective, and to bring 400MW of renewable energy online by the end of 2007 (Oregon Public Utilities Commission 2006).

Under the Klamath Hydroelectric Settlement Agreement, the United States Department of the Interior would acquire power from the Bonneville Power Administration (Klamath Basin Signatories 2010). The power would be delivered to the Captain Jack or Malin substations, and transferred by PacifiCorp to customers throughout the company's service area (Figure 3.18- 4, PacifiCorp Service Area). In summary, even without implementation of the Proposed Action, there would be a need to build more generating capacity generally across the Northwest over the next 10 years; PacifiCorp's plans to upgrade transmission capacity; and the KHP's capacity is relatively small in relation to

the overall demand and generation capacity in the Northwest region. **The loss of electrical generating capacity/ hydropower from the Proposed Action would be a less than significant impact[3].**

The loss of the reservoirs could increase available mosquito habitat and increase the risk of disease transmission. During scoping, members of the public raised a concern that the loss of the lakes would result in an increase in swampy lands and standing water in the footprint of the current reservoirs. The additional standing water could provide mosquito breeding habitat, increasing mosquito population numbers and the chances of disease transmission through insect bites. However, the removal of the reservoirs will reduce the amount of standing water in the vicinity of the existing lakes by returning the river to its free flowing condition. The removal of the reservoirs, the increase in flow to the Klamath River, and the restoration of the river channel will result in less standing water than currently exists in the long term. **The removal of the reservoirs would increase the amount of mosquito breeding areas in the short term, and would have a less than significant impact on disease transmission.**

Keno Transfer

Under the Proposed Action, the Keno Facility would be transferred to the DOI, which could cause adverse effects to Public Health and Safety. The Keno Transfer is a transfer of title for the Keno Facility from PacifiCorp to the DOI. This transfer would not result in the generation of new impacts on Public Health and Safety, Utilities and Public Services, Solid Waste, or Hydropower compared with existing facility operations. Following transfer of title, DOI would operate Keno in compliance with applicable law and would provide water levels upstream of Keno Dam for diversion and canal maintenance consistent with agreements and historic practice (KHSA Section 7.5.4). **Therefore, the Keno Transfer would result in no change from existing conditions and would have no impact on public health and safety and public utilities.**

East and Westside Facilities- Programmatic Measures

Under the Proposed Action, the East and Westside Facilities will be decommissioned, resulting in the loss of generated power. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate the need for diversions at Link River Dam into the two canals.

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[3] This lost hydropower analysis significance determination relies on facility production rates provided in the 2007 FERC Final EIS. As noted these production rates currently account for approximately 2% of PacifiCorp's total production portfolio (CEC 2006). Potential upgrades that would improve the efficiency and maximum capacity of the hydroelectric project have been estimated to provide 22% improvements in power production efficiency (Auslam et al 2011). While a number factors influence power production, if this 22% increase in power production efficiency were directly applied to the project's annual average electric output of 716,800 megawatts hours, the Klamath Hydroelectric Project output would increase to approximately 860,160 megawatts hours which would account for approximately 2.5% of PacifiCorp's total production portfolio, assuming no other changes in the portfolio. As noted in this section PacifiCorp has system wide efficiency and power production upgrades planned to meet forecasted power shortages in 2018. These upgrades are assumed to replace the power production lost from dam removal even with the potential efficiency upgrades and the determination that this impact would be less than significant would not change.

Following decommissioning of the facilities there will be no change in outflow from Upper Klamath Lake or inflow into Keno Impoundment/Lake Ewauna. As shown in Table 3.18-4, the total combined power generating capacity of the facilities is approximately 3.8 MW. The loss of these facilities would not impact PacifiCorp's ability to provide power to the region. The complete decommissioning of the facilities, according the terms of the appropriate public health and safety plan would have no impact to Public Health and Safety. **The impact to public health and safety and public utilities from the decommissioning of the East and Westside Facilities would be less than significant.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The Proposed Action deconstruction could affect the City of Yreka's municipal water supply. As described in the environmental setting, the City of Yreka's municipal water supply pipeline passes under Iron Gate Reservoir and could be affected during construction activities. To avoid potential disruption to the city's water supply, the DRE would construct a pipe bridge to suspend the pipeline above the river during and following construction. The work on the pipeline would be planned and implanted in such a way that the pipe would be disconnected for only a short period of time, as dictated by the existing storage capacity, to avoid disrupting water service to the City of Yreka. Thus, there would be no disruption in municipal water supply under the Proposed Action. **The deconstruction of Iron Gate Dam would have a less than significant impact on the City of Yreka's water supply.**

The proposed above-ground location of the City of Yreka water supply pipeline could increase the risk of vandalism to the pipeline. The proposed pipeline would be suspended from a pipe bridge over the Klamath River, increasing the risk of vandalism to the exposed pipe. PacifiCorp has an above-ground pipeline at J.C. Boyle, and they have found that the pipeline has occasionally been the target of vandalism (including shooting). The vandalism, however, has not penetrated the pipe or disrupted the use of the pipe. During the design process, the Lead Agencies would work with the City of Yreka to design the pipe walls and coating to be bullet resistant, thereby reducing the potential public health impact. The areas around the pipeline would be fenced to prevent physical access to the pipe from the river bank. **With the proposed fencing and design elements, the risk of a disruption in service or damage to the City of Yreka Water Supply Pipeline due to vandalism would be less than significant.**

KBRA – Programmatic Measures

The KBRA includes several programs that could affect utilities and public services, solid waste, and power, including:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration
- On-Project Plan
- Water Use Retirement Program

- Power for Water Management Program
- Emergency Response Plan
- Fish Entrainment Reduction

Prescribed burning and mechanical thinning under the Phases I and II Fisheries Restoration Plans could affect public services and utilities. Prescribed burning and mechanical thinning in forests are KBRA actions associated with the Fisheries Restoration intended to mimic natural fire regimes. The efforts reduce the potential for catastrophic fires and subsequent erosion by reducing the available fuel sources for wild fire.

Prescribed burning can affect public services by using public resources to monitor and manage burning which can leave other areas more vulnerable during the prescribed burn. Mechanical thinning has limited effects on utilities and public services. There is some potential for damage to utility lines from falling trees and branches, but these are minimal and addressed through project level plans and environmental analysis. Adverse effects are short term and less than significant and addressed through proper project planning.

Burning and thinning also have long term beneficial effect to public services. These fuel reduction treatments help to slow wildfires, provide defensible areas, and increase the natural resistance to wildfire by removing excess fuels that can help increase the chance that a wildfire will have catastrophic impacts. The long term benefits of fuel reduction in terms of fire prevention outweigh the adverse effects of the actions. The timing of and specific locations where these burning and thinning actions could be undertaken is not certain but it assumed that some of these actions could occur at the same time and in the vicinity of the hydroelectric facility removal actions analyzed above. The short term effect burning and thinning actions could contribute to the significant impact to public services and utilities of construction activities associated with hydroelectric facility removal. As described above the affect of facility removal on fire risk could be reduced to a less than significant level with mitigation reducing the severity of any interaction with burning and thinning actions. **The effects of prescribed burning and mechanical thinning could be potentially significant in the short term, but implementation of Mitigation Measure PHS-2 would reduce this impact to a less than significant level. The long term effects of fuel reduction are beneficial. Implementation of Prescribed Burning and Mechanical Thinning under the Phases I and II Fisheries Restoration Plans will require future environmental compliance as appropriate.**

Construction activities associated with the KBRA programs could result in public health and safety impacts. Potential construction activities could include a variety of restoration actions and habitat improvements. The Fisheries Reintroduction and Management Plan, the Wood River Wetland Restoration, and elements of the On-Project Plan contain construction components that could have distinct health and safety issues related to the construction activities. Prior to implementing construction, an applicable public health and safety plan would be developed to ensure construction workers and the public would not be adversely affected during construction and operation. **Impacts from the**

restoration and habitat improvement action in the KBRA on public health and safety and public utilities are expected to be long term and beneficial. Some short-term impacts related to construction activities could occur during the implementation of the restoration and habitat improvement projects. Implementation of these restoration and habitat improvement actions will require future environmental compliance as appropriate.

Implementation of the Power for Water Management Program could create new renewable energy sources. Implementation of the Power for Water Management Program (KBRA Section 17) would provide affordable electricity to eligible users to allow efficient use, distribution, and management of water. This could also involve the development of renewable energy sources, which would provide green energy. This would be a beneficial effect on public utilities. Implementation of the Power for Water Management Program will require future environmental compliance as appropriate. **The Power for Water Management Program would have long term, beneficial effects to public utilities.**

Completing the Emergency Response Plan could have beneficial effects on Public Services and Public Safety. The Emergency Response Plan is intended to prepare water managers and emergency responders for potential failure of Reclamation's Klamath Project dikes or other facilities that affect the storage and delivery of water to Reclamation's Klamath Project irrigators. The plan will include a process to prepare for potential emergencies, identify available funding sources for responding to emergencies, a prioritization method for funding emergency responses, and a process to implement emergency responses. The response plan will create new protocols for emergency responders in the area, but new funding sources would offset the costs of training and planning required to prepare effectively for the emergencies covered in the plan.

The Emergency Response Plan could rely on alternative sources of water to meet the irrigation requirements of Reclamation's Klamath Project irrigators. This could reduce local water supplies and effect public utilities in the event of an emergency. These effects would be short term, until the emergency was addressed and supplies rebounded after the use of emergency supplies was finished. **The effects of the Emergency Response Plan on public health and safety would be beneficial as the Plan is intended to address impacts from a failure of the levies and other infrastructure that could adversely affect health and safety. Any impacts to utilities and public services from creating the plan would be beneficial by improving the capacity of local agencies to respond to emergencies.**

3.18.4.3.3 Alternative 3: Partial Facilities Removal of Four Dams

Under the Partial Facilities Removal of Four Dams Alternative, certain project features would be retained, while meeting the requirements for a free-flowing river and for volitional fish passage through all four dam sites. There would be no appreciable difference between the impacts of the Partial Facilities Removal of Four Dams and the Proposed Action Alternatives, except as noted below. As it would be for the Proposed

Action, implementation of Mitigation Measures PHS-1 and PHS-2 would mitigate the impacts of the Partial Facilities Removal of Four Dams Alternative to a less-than-significant level.

Retained structures could have the potential to result in public health and safety risks. The presence of powerhouses, tunnels, penstocks and other equipment would have the potential to cause injuries resulting from entrapment and falls. Implementation of this alternative would include installing appropriate fencing and blocking access to retained facilities. **These safety hazards would be a less than significant impact given that fencing and access restrictions are part of the construction activities associated with the project.**

Construction activities could generate a substantial amount of solid waste that would exceed the capacity of facilities to receive the waste. Under the Partial Facilities Removal of Four Dams Alternative, certain project features would be retained, while meeting the requirements for a free-flowing river and for volitional fish passage through all four dam sites. As with the Proposed Action, construction and demolition activities would produce solid waste. As shown in Table 3.18-5, the total amount of inert solid waste that would be generated under the Partial Facilities Removal of Four Dams would be 1,240,000 yd^3 of earth, 90,000 yd^3 of concrete, 2,400 tons of rebar, and 3,200 tons of metals. As with the Proposed Action, all the waste concrete and earth would be disposed in on-site disposal areas or in the original borrow pits, and a portion of the metals would be recycled, in accordance to relevant construction debris recycling regulations, at the Yreka Transfer Station, the Yreka Sanitation Landfill, and the Klamath Falls Landfill. In addition, Dry Creek Landfill, also in the vicinity of the project area, has 165 million yd^3 of disposal capacity, and could be utilized for disposal. The disposal capacities of the existing surrounding landfills are anticipated to be sufficient for the waste generated by activities associated with the Partial Facilities Removal of Four Dams Alternative, and the waste generated would not conflict with the solid waste policies and objectives of AB939. **The solid waste impacts associated with the Partial Facilities Removal of Four Dams Alternative would be less than significant.**

East and Westside Facilities – Programmatic Measures

The effects of the decommissioning of the East and Westside Facilities would be the same as those described for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The Proposed Action deconstruction could affect the City of Yreka's municipal water supply. As described in the environmental setting, the City of Yreka's municipal water supply pipeline passes under Iron Gate Reservoir and could be affected during construction activities. To avoid potential disruption to the city's water supply, the DRE would construct a pipe bridge to suspend the pipeline above the river during and following construction. The work on the pipeline would be planned and implanted in such a way that the pipe would be disconnected for only a short period of time, as dictated by the existing storage capacity,

to avoid disrupting water service to the City of Yreka. Thus, there would be no disruption in municipal water supply under the Proposed Action. **The deconstruction of Iron Gate Dam would have a less than significant impact on the City of Yreka's water supply.**

The proposed above-ground location of the City of Yreka Water Supply Pipeline could increase the risk of vandalism to the pipeline. The proposed pipeline would be suspended from a pipe bridge over the Klamath River, increasing the risk of vandalism to the exposed pipe. PacifiCorp has an above-ground pipeline at J.C. Boyle, and they have found that the pipeline has occasionally been the target of vandalism (including shooting). The vandalism, however, has not penetrated the pipe or disrupted the use of the pipe. During the design process, the Lead Agencies would work with the City of Yreka to design the pipe walls and coating to be bullet resistant, thereby reducing the potential public health impact. The areas around the pipeline would be fenced to prevent physical access to the pipe from the river bank. **With the proposed fencing and design elements, the risk of a disruption in service or damage to the City of Yreka Water Supply Pipeline due to vandalism would be less than significant.**

KBRA – Programmatic Measures

The KBRA would be fully implemented under this alternative. The public health and safety, public services, and hydropower impacts of the KBRA under the Partial Facilities Removal of Four Dams Alternative would be the same as for the Proposed Action.

3.18.4.3.4 Alternative 4: Fish Passage at Four Dams

Under the Fish Passage at Four Dams Alternative, no facilities removal would be conducted at the Four Facilities. Fish passageways will be built at each of the Four Facilities in the form of pool & weir, vertical slot, ice harbor, or hybrid fish ladder with auxiliary water systems. The impacts associated with the Fish Passage at Four Dams Alternative would be similar to those of the Proposed Action, except as noted below. As it would be for the Proposed Action, implementation of Mitigation Measures PHS-1 and PHS-2 would mitigate the impacts of the Partial Facilities Removal of Four Dams Alternative to a less-than-significant level.

Construction activities could generate solid waste that would exceed the capacity of facilities to receive the waste. Under this alternative, construction of fish passageways would generate solid waste. As shown in Table 3.18-5, the total amount of inert construction solid waste generated under the Fish Passage at Four Dams Alternative would be 16,600 yd^3 of concrete and 540 tons of rebar from demolition and replacement of the existing fish ladder at J.C. Boyle Dam. As with the Proposed Action, all of the waste concrete is expected to be disposed of in on-site disposal areas or in the original borrow pits and a portion of the metals would be recycled, in accordance to relevant construction debris recycling regulations, at the Yreka Transfer Station, the Yreka Sanitation Landfill, and the Klamath Falls Landfill. In addition, Dry Creek Landfill, also in the vicinity of the project area, has 165 million yd^3 of disposal capacity, and could be utilized for disposal. The disposal capacities of the existing surrounding landfills are anticipated to be sufficient for the waste generated by activities associated with the Fish

Passage at Four Dams Alternative, and the waste generated would not conflict with the solid waste policies and objectives of AB939. **The solid waste impacts associated with the Fish Passage at Four Dams Alternative would be less than significant.**

Impacts on Hydropower resulting from the Fish Passage at Four Dams Alternative would reduce power generation compared to the No Action/No Project Alternative. Providing fish passage at the Four Facilities would allow the hydroelectric facilities to remain in place, but hydropower generation would be subject to significant reduction from additional bypass flows, changes to flows in the peaking reaches, and flows required for fish passage structures as compared with the No Action/No Project Alternative. These additional flow releases would be needed to support fish migration in the J.C. Boyle and Copco 2 bypass reaches and peaking reaches. All dams would require flows to support fish bypass structures.

Although the hydropower loss would vary from 100 percent to 73 percent in the peak demand summer months with additional bypass and fish flows (PacifiCorp 2006), the loss of this power would not require the construction of additional electrical generating facilities or infrastructure, as described under the discussion of Proposed Action effects. **The loss of power would be less than significant.**

3.18.4.3.5 Alternative 5: Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate

Under the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative, facilities would be removed at Copco 1 and Iron Gate Dams, and fish passage facilities would be constructed at J.C. Boyle and Copco 2 Dams. Because only Copco 1 and Iron Gate Dams (and not J.C. Boyle or Copco 2 Dams) would be removed under this alternative, there would be less demolition than under the Proposed Action. As it would be for the Proposed Action, implementation of Mitigation Measures PHS-1 and PHS-2 would mitigate the impacts of the Partial Facilities Removal of Four Dams Alternative to a less-than-significant level. The impacts of the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be similar to those of the Proposed Action, except as noted below.

Construction activities could generate solid waste that would exceed capacity of facilities that receive the waste. Under the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative, facilities would be removed at Copco 1 and Iron Gate Dams. Fish passage facilities would be constructed at J.C. Boyle and Copco 2 Dams. As with the other action alternatives, construction and demolition activities would produce solid waste.

As shown in Table 3.18-5, the total amount of inert construction and demolition solid waste generated under the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be 1,100,000 yd^3 of earth, 77,800 yd^3 of concrete, 2,200 tons of metals, and 1,620 tons of rebar. As with the Proposed Action, all of the waste concrete and earth would be disposed of in on-site disposal areas or in the original borrow pits and a portion of the metals would be recycled, in accordance to relevant construction debris

recycling regulations, at the Yreka Transfer Station, the Yreka Sanitation Landfill, and the Klamath Falls Landfill. Given that the combined remaining permitted Class III landfill capacity available at the Klamath Falls Landfill and the Yreka Solid Waste Landfill is 4.3 yd^3, the regional landfills in the surrounding counties should be capable of handling the additional waste generated by the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative. In addition, Dry Creek Landfill, also in the vicinity of the project area, has 165 million yd^3 of disposal capacity, and could be utilized for disposal. The disposal capacities of the existing surrounding landfills are anticipated to be sufficient for the waste generated by activities associated with the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative, and the waste generated would not conflict with the solid waste policies and objectives of AB939. **The solid waste impacts associated with the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be less than significant.**

Impacts on Hydropower resulting from the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would reduce power generation compared to the No Action/No Project alternative. Under this alternative, Iron Gate and Copco 1 Dams would be removed, leaving Copco 2 and J.C. Boyle Dams. The total authorized power production that would be lost under this alternative would be 38 MW, or 0.4 percent of PacifiCorp's total generating capacity. Additionally, operations of the remaining dams would require bypass flows and fish passage structure flows further decreasing hydropower production, as noted for the Fish Passage at J.C Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative. This alternative would result in a small amount of power lost compared with PacifiCorp current generating capacity and planned generating and transmission capacity upgrades. As discussed for the Proposed Action, PacifiCorp will acquire surplus power from other existing facilities to serve the project area and no additional facilities or infrastructure would be necessary. **The reduced power impacts would be less than significant.**

3.18.4.4 City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The Proposed Action deconstruction could affect the City of Yreka's municipal water supply. As described in the environmental setting, the City of Yreka's municipal water supply pipeline passes under Iron Gate Reservoir and could be affected during construction activities. To avoid potential disruption to the city's water supply, the DRE would construct a pipe bridge to suspend the pipeline above the river during and following construction. The work on the pipeline would be planned and implanted in such a way that the pipe would be disconnected for only a short period of time, as dictated by the existing storage capacity, to avoid disrupting water service to the City of Yreka. Thus, there would be no disruption in municipal water supply under the Proposed Action. **The deconstruction of Iron Gate Dam would have a less than significant impact on the City of Yreka's water supply.**

The proposed above-ground location of the the City of Yreka Water Supply Pipeline could increase the risk of vandalism to the pipeline. The proposed pipeline would be suspended from a pipe bridge over the Klamath River, increasing the risk of vandalism to

the exposed pipe. PacifiCorp has an above-ground pipeline at J.C. Boyle, and they have found that the pipeline has occasionally been the target of vandalism (including shooting). The vandalism, however, has not penetrated the pipe or disrupted the use of the pipe. During the design process, the Lead Agencies would work with the City of Yreka to design the pipe walls and coating to be bullet resistant, thereby reducing the potential public health impact. The areas around the pipeline would be fenced to prevent physical access to the pipe from the river bank. **With the proposed fencing and design elements, the risk of a disruption in service or damage to the City of Yreka Water Supply Pipeline due to vandalism would be less than significant.**

3.18.4.5 Mitigation Measures

3.18.4.5.1 Mitigation Measure by Consequences Summary

Mitigation Measure PHS-1: A public safety management plan will be prepared and implemented to maintain public safety during all phases of construction and demolition. Components of the plan will include the following:

- Public notification of the location and duration of construction and demolition activities, pedestrian/bicycle path/trail closures, and restrictions on reservoir use (i.e., boating, water skiing, fishing, swimming).
- Verification with local jurisdictions that construction blockage of existing roadways will not interfere with existing emergency evacuation plans.
- Verification with local jurisdictions that construction use of existing roadways for truck hauling of materials will not substantially interfere with response times of emergency vehicles.
- Adequate signage will be installed regarding the location of construction and demolition sites and warning of the presence of construction equipment.
- Fencing of construction staging areas and of construction and demolition areas if dangerous conditions exist when construction and demolition are not occurring.
- Temporary walkways (with appropriate markings, barriers, and signs to safely separate pedestrians from vehicular traffic) and detour signage where an existing sidewalk or pedestrian/bicycle path/trail will be closed during construction and demolition.

Mitigation Measure PHS-2: Prior to initiating construction and demolition activities, the Dam Removal Entity, in consultation with the appropriate city, county, and State fire suppression agencies will prepare and implement a Fire Management Plan. The plan will include fire prevention and response methods including fire precaution, pre-suppression, and suppression measures consistent with the policies and standards in the affected jurisdictions. Additionally, fire suppression equipment will be required on-site at all times and emergency contact numbers will be posted in case of a fire. This plan will include provisions that areas of construction and deconstruction work involving welding, grinding, torch-cutting, gas and diesel generators and other construction activities that could result in open sparks or flame be cleared of dried vegetation or wetted-down to prevent wildfires.

3.18.4.5.2 Effectiveness of Mitigation in Reducing Consequence

Implementation of PHS-1 and PHS-2 would reduce potential public health and safety risks to a less than significant level.

3.18.4.6.3 Agency Responsible for Mitigation Implementation

The DRE would be responsible for implementing mitigation measures PHS-1 and PHS-2.

3.18.4.6.4 Remaining Significant Impacts

Following implementation of Mitigation Measures PHS-1 and PHS-2, no significant adverse impacts associated with public health and safety, utilities and public services, solid waste, and power are anticipated.

3.18.4.6.5 Mitigation Measures Associated with Other Resource Areas

Several other mitigation measures require construction, including mitigation measures H-2 (flood-proof structures), GW-1 (deepen or replace affected wells), WRWS-1 (modify or screen affected water intakes), REC-1 (develop new recreational facilities and access to river), TR-6 (assess and improve roads to carry construction loads), and TR-7 (assess and improve bridges to carry construction loads). Construction required for the mitigation measures would not require substantial equipment or materials and would not pose risks to public health or safety. **Construction associated with these mitigation measures would have temporary and less-than-significant effects on public health and safety, solid waste, and public utilities and services. There would be no change from existing conditions for power.**

Mitigation REC-1 would develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. Impacts specific to the relocation of the Recreation Facilities are discussed in Section 3.20, Recreation. The facilities would be built to current standards, and maintained by the final title holder of the exposed land. **The replacement of recreational facilities would have a less than significant impact on public health, safety, solid waste, and public utilities and services. There would be no change from existing conditions for power.**

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3.19 Scenic Quality

This section analyzes the effects on scenic quality from implementation of the Proposed Action and alternatives to the Proposed Action. The analysis primarily entails the identification and description of changes to scenic resources in the landscape. Scenic quality is the essential resource that supports the recreational activity of "sightseeing" discussed in Section 3.20, Recreation. Other potential aesthetic impacts associated with odor, noise and physical contact are described in Sections 3.2, Water Quality, 3.4, Algae, 3.9, Air Quality, 3.20, Recreation, and 3.23, Noise and Vibration.

3.19.1 Area of Analysis

The area of analysis for the evaluation of scenic quality includes the vicinities and the areas within sight lines of the Four Facilities, as well as areas identified as construction/ demolition areas and staging areas for the Proposed Action and alternatives. The area of analysis also includes the Upper Klamath Basin where activities associated with the implementation of the Klamath Basin Restoration Agreement (KBRA) could occur. Because retention or removal of these dams could affect scenic quality aspects such as water clarity, fish viewing opportunities, and riparian and channel characteristics of the river below the dams, the area of analysis also includes the Klamath River from Iron Gate Dam to the Pacific Ocean.

3.19.2 Regulatory Framework

Scenic resources within the area of analysis are regulated by several Federal, State, and local laws and policies, which are listed below.

3.19.2.1 Federal Laws, Authorities and Regulations

- Federal Land Policy and Management Act (43 U.S.C. 1701 et seq.)
- Clean Water Act (CWA) (33 USC § 1251 et seq.)
- Bureau of Land Management (BLM) Draft Upper Klamath River Management Plan Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and Resource Management Plan (RMP) Amendments (2003)
- BLM Klamath Falls Resource Area RMP and Rangeland Program Summary and Record of Decision (1995)
- BLM Visual Resource Management Methodology (1980)
- U.S. Forest Service (USFS), Klamath National Forest Land and RMP (1995)
- Wild and Scenic Rivers Act (WSRA) (16 U.S.C. 1271 et seq.)
- Redding Resource Area RMP and Record of Decision (ROD) (BLM, 1993)
- Klamath Falls Resource Area RMP, ROD, and Rangeland Program Summary (1995)
- U.S. Forest Service (USFS), Six Rivers National Forest Land and RMP (1995)
- USFS Scenery Management System (1995)
- National Park Service (NPS) River Administering Agency

3.19.2.2 State Laws, Authorities and Regulations

- Oregon Parks and Recreation Department, Klamath River Scenic Waterway Rules (Oregon Revised Statute [ORS] 390 et seq.)
- California WSRA (California Public Resources Code [CPRC] Section 5093.54)

3.19.2.3 Local Authorities and Regulations

- Siskiyou County General Plan (1973)
- Siskiyou County Zoning Ordinance (1994)
- Klamath County Comprehensive Plan (2010)
- City of Klamath Falls Comprehensive Plan (1981)
- City of Klamath Falls Community Development Ordinance (1980)
- City of Klamath Falls Parks Recreation and Open Space Master Plan (1998)

3.19.3 Existing Conditions/Affected Environment

This section provides an overview of the basin's scenery resources and how these resources are identified and analyzed through the Visual Resource Management (VRM) process. A description of scenic resources, as defined by the BLM, will be used as the No Action basis for comparison. Per the BLM VRM system, impacts to the affected environment will be evaluated by measuring potential impacts to the current Visual Resource Inventory (VRI) (scenery conditions) as well as perceivable contrast with the characteristic landscape when viewed from Key Observation Points (KOPs).

In response to the Federal Land Policy and Management Act and subsequent agency-specific regulations, Federal land management agencies such as the BLM and USFS developed systems specifically designed to inventory, evaluate and manage for scenic (visual) resources on public lands. To evaluate scenic resources under BLM jurisdiction and to develop management objectives for those resources, the BLM developed the VRM system. Bothe the USFS and BLM's scenery resource goal is to conserve the landscape's natural appearing "characteristic landscape". The BLM's VRM policy consists of three primary components; 1) Maintaining an up-to-date VRI, 2) Establishing VRM Classes as part of RMPs, and 3) Evaluating Project Planning for physical impacts and plan conformance (BLM 2007).

VRI consists of three data components; scenic quality, visual sensitivity, and distance zones (BLM 2007), with a foundational emphasis on protection of the landscape's natural appearing "characteristic landscape". Together, these three elements comprise a final VRI class that reflects the current naturally occurring physical condition of the visual resource within a geographic area. This information defines the existing condition/ affected environment for visual resources. Current state of BLM VRI will be described under the Affected Environment section.

VRI information is considered along with other resource conditions and goals during RMP analysis in order to delineate final VRM Classes for every acre of BLM land. These management classes are not equivalent to the physical condition of the visual resource, but instead, equate to the management goal for a particular area. All BLM

lands are assigned one of four VRM Classes, ranging from Class I, which reflects the highest value and protection for scenery, to Class IV, which reflects the least value and protection for scenery. The VRM Classes represent the baseline for determining plan conformance during project planning. The nature of VRM Class designations applicable to the area of analysis are described later in this section.

BLM uses the contrast-rating system process (BLM 2007) to help assess the degree of visible contrast within primary landscape features, with respect to landscape character elements of form, color, line, and texture. The contrast-rating system is utilized to not only assess the potential physical impacts from ground disturbing activities (and thus impacts to the visual resource inventory, or existing conditions. Degrees of contrast in a range of none/weak/moderate/strong roughly coincide with VRM Class I, II, III, and IV, accordingly.

The USFS has a parallel system, known as the Scenery Management System (SMS). The primary components of the SMS are similar to BLM's VRM system (e.g., BLM's scenic quality versus SMS' inherent scenic attractiveness; visual sensitivity/public concern levels, and distance zones/seen areas and distance zones).

Ownership of lands varies geographically across this Project (see Figure 3.19-1). While the description of the scenic resources within a particular land management agency's jurisdiction will be referenced in respect to agency system terminology, to obtain consistency, the BLM's VRM methodology is used for the entire Project area in terms of describing the potential physical effects to scenic quality, even though only a portion of the project area is actually subject to BLM VRM management objectives.

3.19.3.1 Applicable Visual Resource Management Class Designations within the Area of Analysis

The area surrounding the Four Facilities contains no Class I visual resources. The lands in the area of analysis primarily fall under two classes:

- **Class II** The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

- **Class III** The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 2007).

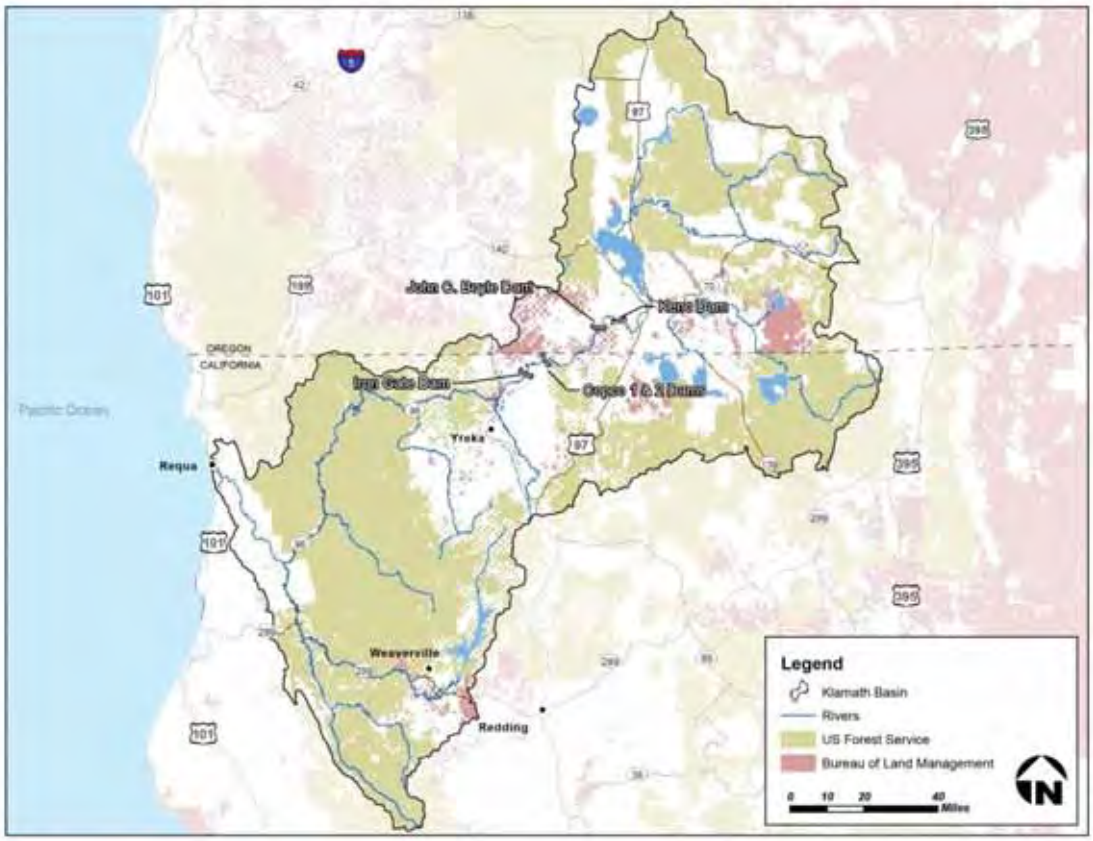

Figure 3.19-1. Project Area Land Ownership for BLM and USFS.

Currently, there is no up-to-date VRI record on file for the BLM lands within the area of analysis, but there is final VRM Class guidance for the area. For the purposes of this document, the site-specific, project level inventory would be limited to the area of analysis as defined in Section 3.19.1 and based upon a combination of original data from the 2004 PacifiCorp Technical Report with additional analysis from several KOPs.

The following represent the conclusions for the baseline VRI within the area of analysis, according to the three components (scenic quality, visual sensitivity, distance zones).

In terms of scenic quality, BLM's VRM methodology classifies public land as either Class A, B, or C scenic quality (inherent scenic attractiveness), with A being the most distinctive and Class C being the most common, in terms of variety of key factors such as; color, water, vegetation, landform, influence of adjacent scenery, scarcity, and cultural modifications (BLM 2007). Analysis by the Lead Agencies concluded that all of the project area would be contained within Class A landscapes because of the following key factors:

- **Color -** Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element
- **Water –** Water flowing or still, dominant in the landscape when viewed from most KOPs, but not always clear and clean appearing
- **Vegetation -** A variety of vegetative types as expressed in interesting forms, textures, and patterns
- **Landform -** Steep canyons, some interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional
- **Influence of adjacent scenery -** Adjacent scenery moderately enhances overall visual quality
- **Scarcity -** Distinctive, though somewhat similar to others within the region
- **Cultural modifications –** Some modifications add favorably to visual variety while other add little or no visual variety or may be discordant

Based on the point system assigned to each of these key factors, the scenery in the project area scores within the range of Class A scenic quality.

In terms of visual sensitivity, BLM's VRM methodology rates landscapes as either High, Moderate, or Low visual sensitivity to document the public's relative level of concern for visual quality. The Lead Agencies concluded that all of the area of analysis would be considered High visual sensitivity because recreational sightseers are highly sensitive to changes in visual quality, public interest and controversy created in response to proposed activities, portions of the area of analysis are within the viewshed of residential areas, and most of the Klamath River has been designated under the National WSRA.

In terms of distance zone analysis, BLM's VRM methodology classifies public lands as either a Foreground-Middleground, Background, or Seldom Seen. The Lead Agencies concluded that all of the area of analysis would be located with the foreground-middleground distance zone because of the proximity of views from recreational access sites along the river, campgrounds, KOPs along scenic highways, riverside and/or reservoir communities and residences, rivers, or other viewing locations are less than 3 to 5 miles away.

Thus, in combining these three layers according to BLM's VRI Matrix the area of analysis would be classified as a VRM II (Class A scenic quality of high visual sensitivity as viewed from a foreground/middleground distance zone – see highlighted cells in VRI Matrix (Table 3.19-1), from an inventory context.

3.19.3.1.1 Wild and Scenic River Designated Rivers in the Area of Analysis

Several river segments within the Klamath Basin have been designated under the WSRA. Four of these Wild and Scenic River (WSR) segments could potentially be affected by dam removal: the Klamath River (Oregon and California segments), the Sprague River

Table 3.19-1. Visual Resource Inventory Matrix

		Visual Sensitivity						
		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III* IV*	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
		f/m	b	s/s	f/m	B	s/s	s/s
		DISTANCE ZONES						

Source: BLM 2007
Notes:
Highlighted cells indicate visual resource inventory determinations for the affected environment
*If adjacent area is Class III or lower assign Class III, if higher assign Class IV
Key:
b: background
f/m: foreground/middleground
s/s: seldom seen

and the Sycan River. The Sprague River and Sycan River are in the Fremont-Winema National Forest. Potential scenic impacts to the Sprague and Sycan rivers could result from KBRA project implementation.

When the California portion of the Klamath River was designated under the National WSRA in 1981, “outstandingly remarkable” recreational or scenic values were not identified, only “outstandingly remarkable” fisheries values. Scenic values along WSRs are protected by the WSRA to various degrees but all segments have requirements to maintain at least a generally natural appearance along their waterways. The natural appearing scenic quality within the more immediate and prominent portions of these rivers is protected along these segments by both the National WSRA and applicable Federal agency Land and Resource Plans.

In 1990, BLM found the 5.3-mile section of the Klamath River from the Oregon-California State line to the slack water of Copco 1 Reservoir to be eligible and suitable for WSR designation. The river segment is free-flowing and possesses outstandingly remarkable scenic, recreational, fish, and wildlife values. This river segment is not a designated WSR and is not protected under the National WSRA and its Section 7(a) requirements. BLM is required within its authorities, to protect this suitable river segment’s free-flowing character, water quality, and outstandingly remarkable river values. This segment of the Klamath River is also listed on the Nationwide Rivers Inventory to insure protection of its river values (NPS 2009).

For the Federal Energy Regulatory Commission (FERC) Final EIS (2007), PacifiCorp conducted a detailed visual evaluation of the project vicinity as summarized in the Final EIS (2007) and documented it in the *Land Use, Visual, and Aesthetic Resources Final Technical Report* (PacifiCorp 2004). This evaluation involved identifying and photographing KOPs during different seasons and the reservoirs at different water levels in 2002 and 2003. Figure 3.19-2 shows the locations of the KOPs in the PacifiCorp report (PacifiCorp, 2004). The results of this study are used in the Klamath Facilities

Figure 3.19-2. Key Observation Points from PacifiCorp (2004) Report.

Removal EIS/EIR to establish the existing environmental setting of the area of analysis, and are described below. To verify that current conditions are similar to 2003 conditions, photographs taken from selected locations in October 2010 were compared to the 2003 photographs. Appendix Q presents this comparison. In addition, photographs from the Final FERC EIS (2007) are included in Appendix Q to identify typical scenic/ landscape character along the Klamath River, including its elements of canyon-walled enframement, channel configuration, water clarity, bank and riparian appearance.

3.19.3.1.2 Klamath Basin

The Klamath Basin contains widely varied scenic resources, including wetlands, upland, rangeland, National Wildlife Refuges (NWRs), farmland, timberlands, and urbanized areas. Section 3.5, Terrestrial Resources, provides detailed descriptions of the landscape along the Klamath River throughout the area of analysis. Sightseeing opportunities to enjoy the scenic resources are widely available in the Klamath Basin generally, and more specifically within its three segments (above, between and below the reservoirs created by the Four Facilities). The Upper Klamath Basin includes the headwaters of the Klamath River in south-central Oregon and north-central California, agricultural areas and the Upper Klamath Basin NWR Complex, which comprises six refuges and contains Reclamation's Klamath Project. Scenery in the area served by Reclamation's Klamath Project. Regionally, a variety of public lands contain notable scenic resources. Table 3.20-1 in Section 3.20, Recreation, lists locations in the area of analysis and surrounding region that offer wildlife viewing, and opportunities for sightseeing, leisure driving, photography, and other forms of recreation that benefit from scenic quality within the area of analysis. Section 3.20, Recreation, discusses recreation resources and includes the activity of sightseeing as a key element of the recreation experience.

The Upper Klamath Basin is the area of analysis for scenic resource effects that would be associated with implementation of the KBRA. However, specific locations for actions associated with implementation of the KBRA have yet to be identified, so no specific analysis is possible regarding the effects that would be associated with KBRA implementation in the Upper Klamath Basin. Instead, general effects of the multiple components of the KBRA on scenic resources in the Klamath Basin will be discussed.

The area of analysis for the Klamath Hydroelectric Settlement Agreement (KHSA) includes the Klamath River from J.C. Boyle Dam and reservoir to the Pacific Ocean and the Four Facilities. The following subsections describe scenic resources in the area of analysis.

3.19.3.2 Klamath River

PacifiCorp (2004) viewed seven KOPs from Keno Impoundment to the J.C. Boyle Reservoir, nine KOPs in the J.C. Boyle bypass reach, eight KOPs in the Hell's Corner Reach (the river between J.C. Boyle Powerhouse and Copco 1 Reservoir), seven in the Copco 1 Reservoir area, twelve in the area of Iron Gate Reservoir, and three downstream from Iron Gate Dam. Many of the reaches have similar general characteristics with the aesthetic differences between high flows and low flows varying depending on the

individual physical features (e.g., rocks, vegetation, bends, width of channel, depth of water) of each reach. During low flows, more rocks and vegetation were visible at the river edges than at high flows.

These KOPs are not intended to be comprehensive, but were selected to represent typical views (including scenic overlooks) for members of the public from riverside and/or reservoir communities and residences, recreational access sites, campgrounds, Scenic Byways (Highway [HWY] 96/State of Jefferson Scenic Byway and HWY 96/Bigfoot Scenic Byway), State HWYs 96, 169, and 101. Other "sightseeing areas" below Iron Gate Dam could have potential scenery effects to sensitive public viewpoints.

Klamath River components are part of the National Wild and Scenic Rivers System (NWSRS) because of their free-flowing condition and "outstandingly remarkable" values. Scenery associated with WSRs is protected by the WSRA. Scenery within two WSR segments of the Klamath River could be affected by the project alternatives:

- Oregon Klamath River Component. The segment of the Klamath River beginning immediately downstream from the J.C. Boyle Powerhouse and flowing eleven miles to its terminus at the Oregon-California State Border is classified as scenic and possesses outstandingly remarkable scenic use values. The Upper Klamath River (upstream of Iron Gate Dam) was evaluated by BLM in 1977 and 1981, and received a Class A scenic quality rating, the highest scenic quality classification. The 2006 Preliminary Determination Report (completed for the Section 7 WSR requirement during FERC relicensing of the PacifiCorp facilities) stated that the Upper Klamath WSR increased the visual variety in the canyon flowing through diverse topography and dropping to form a series of pools and rapids. The unique landforms, water, and vegetation create an ever-changing landscape from desert to more mountainous terrain, and steep canyons and vertical cliffs with diverse vegetation (Bonacker et al. 2007).
- California Klamath River Component: The mainstem segment of the Klamath River beginning 3,600 feet downstream from Iron Gate Dam and flowing 189 miles to the Pacific Ocean mainstem is classified as recreational with portions of the tributaries classified as scenic and wild. Scenery within the California Klamath WSR is dominated by natural settings. Its characteristic river flows, water appearance, anadromous fish and riparian vegetation within a forested river canyon are the primary scenic aspects. Since 1981, flow regimes have varied moderately in response to water resource competition within the Klamath Basin. During summer months, these have typically been caused by water diversions (Van de Water et al. 2006). As described in Sections 3.2, Water Quality, and 3.20, Recreation, reduced water clarity and discoloration resulting from algae blooms has impaired the scenic character of reaches downstream from Iron Gate Dam (River Mile [RM] 190.1) to the mouth of the Klamath River (RM 0.0).

3.19.3.3 Four Facilities Setting

3.19.3.3.1 Reservoirs

PacifiCorp (2004) described the area landscape from 11 KOPs in the vicinity of the reservoirs, including 3 in the J.C. Boyle Reservoir area, 2 in the Copco 1 Reservoir area, and 6 in the Iron Gate Reservoir area. All reservoirs were viewed under high pool and low pool conditions, and at J.C. Boyle Reservoir and Copco 1 Reservoir the maintenance condition was also observed. In general, the reported visual observations of the reservoirs indicated that under normal operating conditions, the four reservoirs share the visual characteristics of open expanses of relatively flat water. Also, as described in Sections 3.2, Water Quality, and 3.20, Recreation, reduced water clarity and discoloration from algae blooms occur seasonally, typically peaking in late summer to early fall (Karuk Tribe of California 2009).

3.19.3.3.2 PacifiCorp's Hydroelectric Project Facilities

PacifiCorp viewed the hydroelectric project area scenic characteristics at the following 10 KOPs of the project facilities (alphanumeric designations refer to KOP designations and accompanying photographs in the PacifiCorp (2004) report):

- BB1: J.C. Boyle Dam
- BB8: J.C. Boyle Powerhouse and Penstocks
- BB9: J.C. Boyle Transmission Line
- C3 Copco 1 Dam and Powerhouse
- C4: Copco 2 Dam
- C6: Copco 2 Powerhouse
- C7: Copco Transmission Line
- IG8 Iron Gate Transmission Line
- IG9 Iron Gate Dam and Powerhouse from Iron Gate Fish Hatchery
- IG10 Iron Gate Fish Hatchery and Fish Ladder

In the PacifiCorp (2004) report, the views of the Four Facilities from these KOPs were characterized using the BLM VRM system. The report describes each of the Four Facilities in the context of the BLM VRM classification for the surrounding area. These observations may be summarized by facility as follows:

- **J.C. Boyle Facilities -** The PacifiCorp report concluded that the J.C. Boyle Dam, Powerhouse, penstocks, and transmission line were not consistent with VRM Class II and III of the surrounding area. Although the line of the dam follows the site's topography, its large size makes it very noticeable against the natural setting. The powerhouse and penstocks have prominent colors and strong lines, which make them also apparent in the landscape. Although the transmission line is distant from the viewer, it rises above other features in the distance and is visible for its length and height.
- **Copco 1 Facilities -** Copco 1 Dam and Powerhouse were not considered to be consistent the VRM Class III of the surrounding area. The size and prominence of these facilities were considered to dominate the view from the KOP. However, the Copco transmission line was typically at a distance from the viewing points

and would blend into the sky and not obstruct views of other parts of the landscape. Thus, the transmission line was considered to be consistent with VRM Class III objectives.

- **Copco 2 Facilities -** Copco 2 Powerhouse was not considered to be consistent with of the VRM Class III of the surrounding area because its size and prominence dominates the view from the KOP. On the other hand, although the Copco 2 Dam is large, it has been designed with colors and lines that blend with the landscape, and when viewed in isolation, could hence be considered to be consistent with VRM Class III objectives.
- **Iron Gate Facilities -** The Iron Gate Dam, Powerhouse, and transmission lines were considered to be consistent with the VRM Class III objectives of the surrounding area in detailed visual evaluation of the project vicinity as summarized in the Final EIS (2007) and documented it in the *Land Use, Visual, and Aesthetic Resources Final Technical Report* (PacifiCorp 2004). Although the dam and powerhouse are large, their colors and lines blend with the landscape. Similarly, the transmission line was typically at a distance from the viewing points and would blend into the sky and not obstruct views of other parts of the landscape. In instances where the support poles of the transmission lines were prominent, it was only for a short time while a viewer walks or drives by.

3.19.4 Environmental Consequences

3.19.4.1 Effects Determination Methods

To determine the significance of effects on scenic resources, the Lead Agencies inventoried the scenery that would be affected by the Proposed Action and alternatives; identified the changes that would occur to those scenic resources in terms of degree of contrast, relative size or scale, distance, and visibility; and the magnitude of the potential changes. The effects method involves two stages: inventory and analysis.

3.19.4.1.1 Inventory

In the inventory stage, the Lead Agencies identified sensitive sightseeing areas within the watershed using maps of the Klamath Basin that identify land ownership, zoning, existing land use, roads, floodplains, notable scenic features and KOPs. Areas considered for sightseeing included riverside and/or reservoir communities and residences, recreational access sites, campgrounds, National Forest Scenic Byways (HWY 96/State of Jefferson Scenic Byway and HWY 96/Bigfoot Scenic Byway), State HWYs 96, 169, and 101. The Lead Agencies determined the relative visibility from travel routes or observation points, or specific points with views of the Klamath River and the Four Facilities to show the characteristic landscape types found at significant viewpoints. A detailed discussion of the VRI process is provided in Section 3.19.3, Affected Environment.

The area of analysis experiences four distinct seasons. Flows in the Klamath River, water levels in the reservoirs, and the appearance of vegetation vary seasonally. The Lead Agencies used the detailed visual evaluation of the project vicinity as summarized in the Final FERC EIS (FERC 2007) and documented in the *Land Use, Visual, and Aesthetic Resources Final Technical Report* (PacifiCorp 2004) to characterize the area of analysis

because this report included viewing the KOPs during different seasons and at different water levels over an extended time period. This PacifiCorp report provided an assessment of a baseline measure of the scenic appeal of the Project area through a Scenic Quality Evaluation consistent with the BLM inventory process. Scenic quality and sensitivity information were delineated and/or inventoried and documented spatially, in a manner that follows physical features in the landscape in the PacifiCorp (2004) report.

3.19.4.1.2 Analysis

For this EIS/EIR, the contrast rating worksheets provided in the BLM VRM process were not completed for the KOPs. Although the contrast rating forms were not filled out for this EIS/EIR, the scenic quality impact analysis is built on the premise that many of the scenery conservation design principles identified in the forms would be applied by the Definite Plan.

In the analysis stage, the Lead Agencies identified changes in scenic quality by establishing a level of contrast [i.e., no effect (visual contrast is imperceptible), weak, moderate, and strong (contrast caused by the action would be substantial)] considering effects on form, line, color, texture, and comparing to approved VRM objectives for the area (Class). The Lead Agencies also determined whether the techniques that would be used in the Proposed Action and alternatives would ensure that surface-disturbing activities would harmonize with the surrounding natural environment. The Lead Agencies also considered light pollution effects that could be generated during construction.

It should be noted that a significance in visual contrast as defined under the BLM VRM system is not the same as a significance determination for the purposes of this EIS/EIR. The BLM VRM process is used as guidance for assessing the impacts of the Proposed Action and alternatives. The significance criteria used for significance determination for the purposes impact analyses are defined in the following section.

3.19.4.2 Significance Criteria

For the purposes of this document, an alternative would result in significant impacts if it would do any of the following:

- Cause a landscape to be inconsistent with the VRM classification of the surrounding area as defined for the purposes of this analysis.
- Result in a substantial adverse change to scenic resources, including, but not limited to landforms, trees, and rock outcroppings viewed from a river segment, community, recreation site area, trail, scenic highway, or designated wild and scenic river reach, by altering the characteristic (i.e., natural, pre-development) state.
- Remove historic properties.
- Create a new source of light or glare that would adversely affect day or nighttime views in the area.

3.19.4.3 Effect Determinations

This section describes the potential effects of the alternatives on scenic resources. Although the Proposed Action and alternatives could result in substantial short-term and long-term scenery disturbances associated with the hydroelectric project area, the broader, historic "characteristic landscape" would still remain. Several project features would improve the characteristic landscape's key features (e.g., historic river segments, canyons and water quality appearance). The following discussion provides specific details on the impacts. The analysis considers the existing scenic character/landscape character, degree of existing disturbance and resulting scenic disturbance resulting from the proposed activity.

3.19.4.3.1 Alternative 1: No Action/No Project

Under the No Action/No Project Alternative, no construction or physical changes would occur; thus, there would be no changes in the short term to the existing scenic quality of the dams, reservoirs, surrounding areas and adjacent river reaches.

Continued impoundment of water at the Four Facilities could result in water quality impacts that could have long-term impacts on scenic quality. As described in Section 3.2, Water Quality, degradation of water quality could continue in the long term, if the dams are not removed. **The No Action/No Project Alternative would not change this existing condition**.

Not removing the facilities could have the impact that they would remain inconsistent with the VRM classification of the surrounding area (where such inconsistency is defined as a criteria of significance). PacifiCorp's analysis (2004) identified the following project features as being currently inconsistent with their VRM classification. Under the No Action/No Project Alternative, these features would remain inconsistent with their VRM classification:

- Class II VRM classification–the J.C. Boyle powerhouse and penstocks, J.C. Boyle Dam, bypass canal, and transmission line.
- Class III VRM classification–Copco No. 1 Dam and powerhouse, Copco No. 2 powerhouse and substation, and Iron Gate Hatchery and fish ladder.
- While not identified as being inconsistent with the surrounding area by PacifiCorp's 2004 analysis, Iron Gate Dam, bypass spillway, powerhouse, penstock, and associated landform and vegetation disturbances are also inconsistent with their Class III VRM classification and would remain so under the No Action/No Project Alternative (personal communication with J. Mosier, Klamath National Forest, April 26, 2011). **The No Action/No Project Alternative would not change this existing condition.**

Ongoing Restoration Actions

Under the No Action/No Project Alternative a number of Ongoing Restoration Actions are currently underway and would be implemented regardless of the Secretarial Determination on the removal of the Four Facilities.

Fish Habitat Restoration Actions

These actions would result in short-term impacts on scenic resources during construction. Ongoing restoration activities for fish habitat would occur throughout the Klamath Basin. These activities may include floodplain rehabilitation, large woody debris replacement, fish passage correction, cattle exclusion fencing, riparian vegetation planting, mechanical thinning of upland areas to mimic natural forest conditions, fire treatment to mimic natural forest conditions, purchase of conservation easements/land, road decommissioning, gravel augmentation, and treatment of fine sediment sources. **During construction, impacts on scenic resources would be potentially significant, albeit temporary. No mitigation measures could be implemented to lessen the impact on scenic resources; therefore it would be significant and unavoidable in the short term.**

These actions could result in long-term impacts on scenic resources. Restoration activities would be anticipated to result in scenery more consistent with the naturally established, characteristic landscape. **Therefore, they have the potential to be beneficial to scenic resources in the long term.**

3.19.4.3.2 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

The Proposed Action involves removal of dams and all appurtenant features, with the exception of buried features, at the Four Facilities. The Proposed Action would include reservoir drawdown and removal of four dams. This would expose the former inundated areas to view. After drawdown, the Dam Removal Entity (DRE) would perform restoration activities of the exposed areas. Restoration plans would include stabilizing and revegetating the newly exposed reservoir areas with various herbaceous species through hydroseeding, aerial hydromulching, and planting. Various woody species would also be planted. Invasive and non-native species would be controlled. The hard lines of the dam and large expanses of water in the reservoirs would be changed to a more historic, characteristic scenery displaying natural river canyon landforms with vegetation enframing a continuous river. This scenic change would be visible for a very long distance around the reservoir sites and most reservoir KOPs, and would be permanent. Figures 3.19-3, 3.19-4, and 3.19-5 show aerial photos of the existing reservoirs with an overlay of historic river channels. The historic channel represents what the extent of the Klamath River is expected to be in the long term following removal of the Four Facilities. However, until the restoration is complete, the area would appear barren and/or sparsely vegetated.

In addition, the existing water supply pipeline for the City of Yreka passes under the Iron Gate Reservoir and would be relocated prior to decommissioning to prevent damage from deconstruction activities or increased water velocities once the reservoir has been drawn down. The pipeline would be suspended from a pipe bridge across the river near its current location. Surveys are still required to determine if the bridge is adequate to support the construction traffic from the decommissioning activities. If the existing wooden bridge is not adequate to support the construction traffic, it will be replaced in the same location with a concrete bridge. In addition, the Proposed Action includes removal of existing and construction of new recreation facilities, such as campgrounds and boat ramps, currently located on the reservoir banks down slope to be near the new river bed once the reservoir is removed. Activities described in the KBRA are included in the Proposed Action as connected actions.

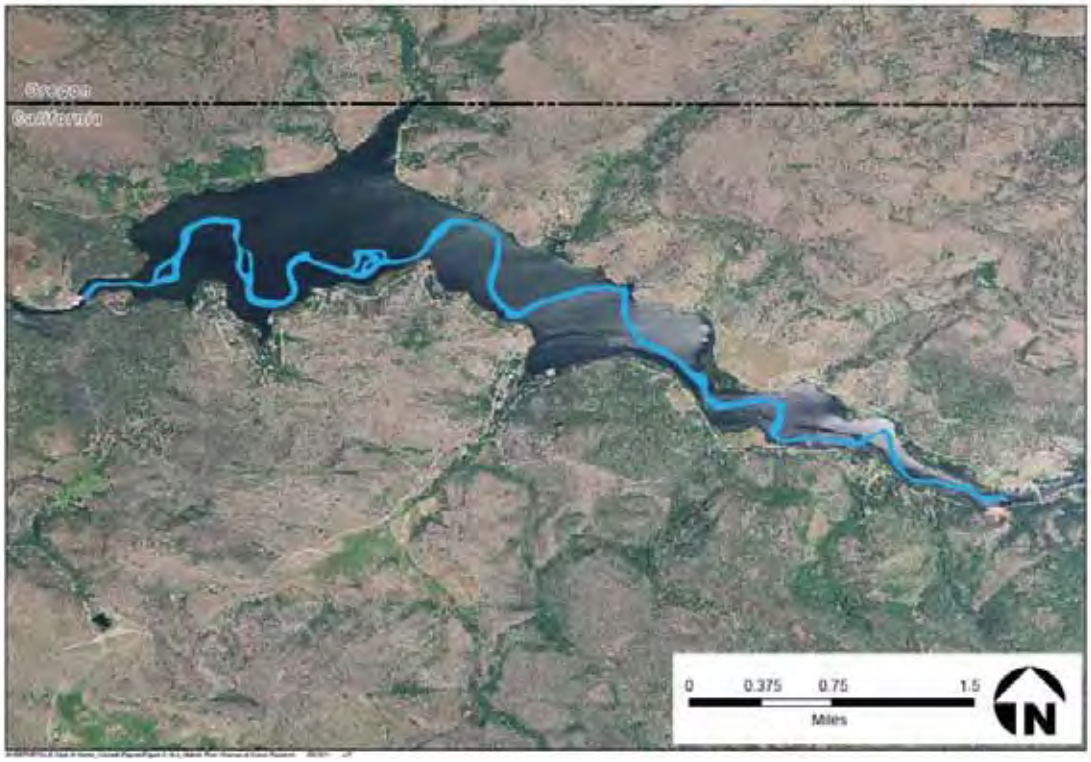

Figure 3.19-3 Historic River Channel for J.C. Boyle Reservoir.

Figure 3.19-4 Historic River Channel at Copco I Reservoir.

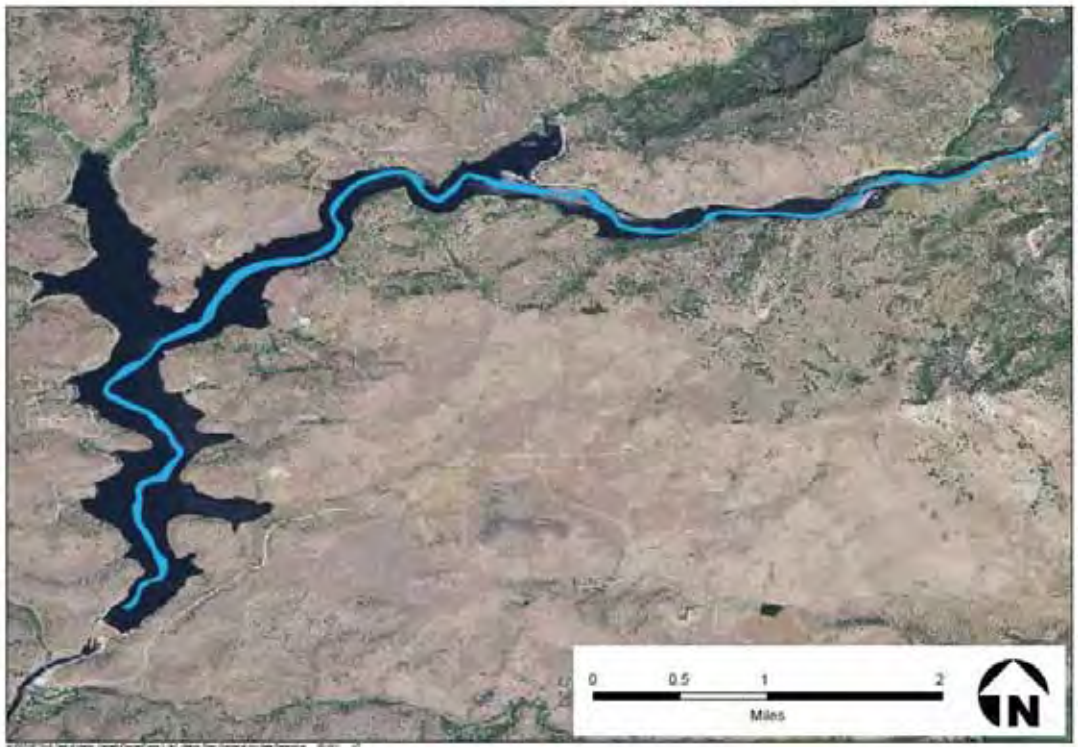

Figure 3.19-5. Historic River Channel at Iron Gate Reservoir.

The Proposed Action would result in impacts on scenic resources from removal of the Four Facilities. Under existing conditions, some of these facilities do not blend with the natural landscape and can dominate views due to their form, line, color, size or locations, particularly those that appear taller than other natural features from a distance. Since the facilities are inconsistent with the VRM classification for the surrounding area, their removal would result in a landscape that would appear more similar to the surrounding characteristic natural landscape. Figures 3.19-6 and 3.19-7 show photo-simulations of the removal of Iron Gate Dam and Copco 1 Dam, respectively. **Removal of the facilities as part of the Proposed Action would be a beneficial effect.**

The Proposed Action would result in impacts on scenic resources from the removal of some historic properties. Some of the facilities (the Copco 2 facilities shown in Figure 3.19-8, for example) are considered historic properties (FERC 2007), and their removal would require consultation with the Oregon and California State Historic Preservation Office (see Section 3.13, Cultural and Historic Resources). In general, the BLM VRM process is based upon the premise that natural appearing landscapes are more highly valued by the public than modified landscapes. Therefore, the removal of the Four Facilities which would then be replaced by natural landscape would be preferred. However, some historic scenery elements may be considered socially valued and their elimination from the scenic character would be considered a significant scenery impact of the project. **The impact on historic properties would be a permanent significant impact. No mitigation measures could be implemented to lessen the visual impact of the loss of historic properties; therefore it would be significant and unavoidable.**

Figure 3.19-6. Iron Gate Dam before removal (top) and a simulation of what the facility could look like after full removal (bottom) except for Landform/Vegetation restoration details which cannot be fully depicted until completion of the Definite Plan.

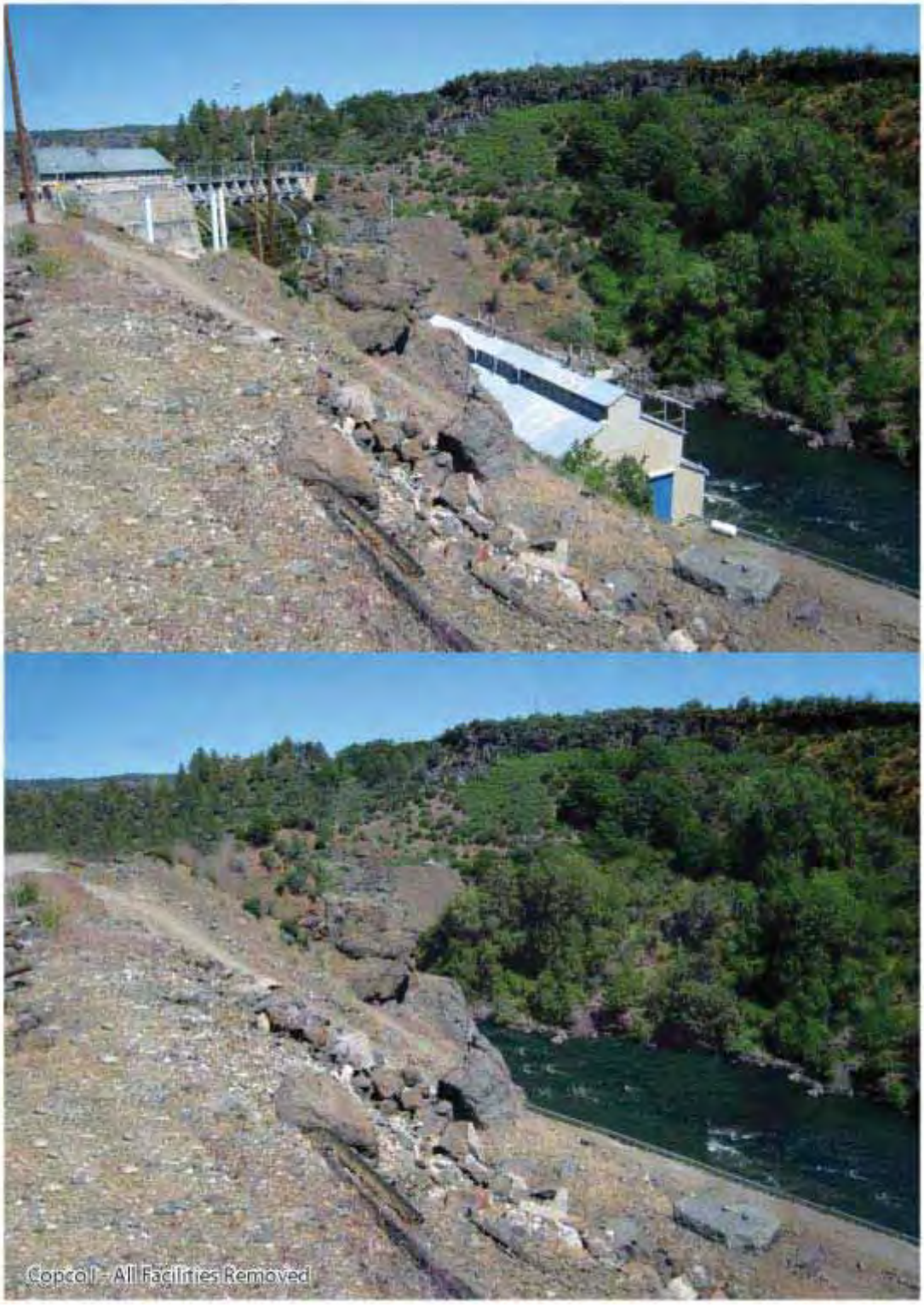

Figure 3.19-7 Copco 1 Dam before removal (top) and a simulation of what the facility could look like after full removal (bottom) except for Landform/Vegetation restoration details which cannot be fully depicted until completion of the Definite Plan.

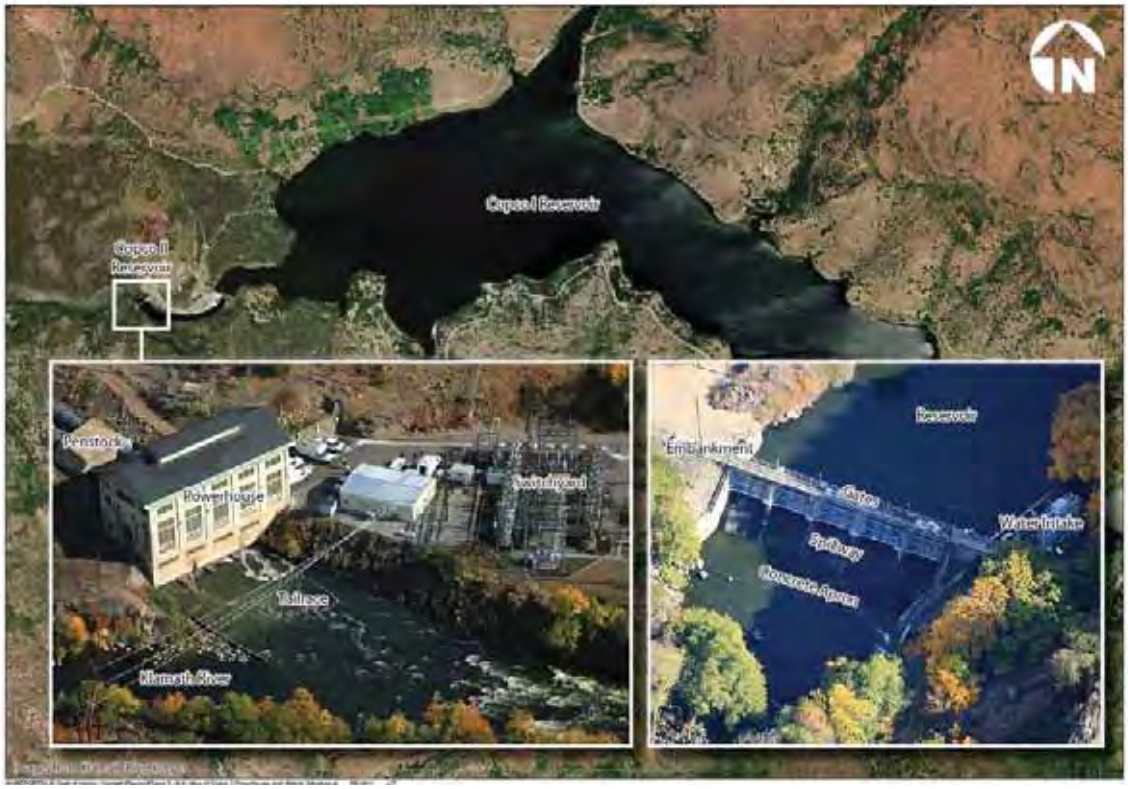

Figure 3.19-8. View of Copco 2 Powerhouse and Historic Structure.

Removal of the Four Facilities could result in short and long-term impacts on scenic resources in formerly inundated reservoir areas. The Proposed Action would include removal of the dams' associated reservoirs, and substantial changes would occur in the former reservoir area during drawdown and until restoration is complete. The Klamath River in the vicinity of the reservoirs would be restored to its historic channel width and depth (see Section 3.6, Flood Hydrology), exposing all previously inundated areas except the historic river channel. The receding water would expose reservoir sediments at the bottom of the reservoir. Since sediment in the reservoirs is less than five feet deep in general, the river channel would not appear to be entrenched or flowing through mud, but rather, would appear very similar to conditions before the river was impounded (with exception of vegetation not yet becoming established). Depending on the sediment, odors may be evident while the reservoir bottoms dry out and new vegetation is established (riverside revegetation planned as part of the project is described below). Erosion of the reservoir sediment and slumping of the sediment is anticipated, followed by drying, cracking, and hardening of the sediment prior to the establishment of vegetation. Existing wetland vegetation on the reservoir shorelines may also die off temporarily, though it may repopulate the newly formed exposed banks (Bureau of Reclamation 2011).

The Proposed Action would involve stabilizing and revegetating the newly exposed reservoir areas with herbaceous and woody vegetation. Until the restoration was complete, however, the area would appear barren and/or sparsely vegetated. The facilities removal schedule estimates that removal of the facilities and appurtenant structures would be completed in stages and would take approximately a year and a half with the objective of revegetation of 75 percent of the reservoir area by desirable vegetation that would provide minor and temporary scenery improvements within three years following dam removal. As discussed, establishment of woody vegetation with cover and density similar to adjacent natural woodlands would take many years to attain. This schedule translates to approximately four and a half years during which the area of analysis would be in a highly visible state of transition, and several more years where contrast from adjacent natural woodlands would be evident. The exposure of previously inundated areas would be considered a moderate contrast from the existing condition because it would dominate the landscape and would encompass a large area surrounding the river. It would likely be visible from various KOPs around each of the reservoirs.

Although revegetation of herbaceous species in barren and/or sparsely vegetated areas may be achieved in the short term (1 to 3 years), it should be noted that this is not necessarily consistent with restoration of natural appearing vegetation patterns below and above the reservoir line. Natural appearing vegetation patterns with woody riparian vegetation may take long term (10 to 50+ years) to develop. Although the condition is considered temporary because the characteristic landscape is expected to be rehabilitated, some adverse scenery impacts would be extensive and long term. In a report prepared for the California State Coastal Conservancy, Philip Williams and Associates, LTD estimated that it will take 30 years for the river corridor habitats to fully recover from the dam removals (Phillip Williams and Associates [PWA] 2009). **The impact on scenic resources would be a significant impact that would occur in both the short and long term, until vegetation has become established. No mitigation measures could be implemented to lessen the impact on scenic resources; therefore it would be significant and unavoidable.**

Deconstruction and restoration activities could result in short-term impacts on scenic resources in the immediate vicinity of the Four Facilities. Removal of the Four Facilities and associated structures would be completed in stages over one year, with primary deconstruction activities occurring over a three-month period. During the deconstruction, the area of analysis would have large construction vehicles and equipment, temporary structures (e.g., trailers, portable toilets, security fencing, temporary power supply, fueling stations), temporary access roads, equipment storage areas, material stockpiles, piles of demolition materials (rock, concrete, steel), and other common construction items that would detract from the natural surroundings. The construction activities would be considered weak to strong contrasts, depending on the amount of vehicles, equipment, and materials in any given area. Some stockpiling areas may be visible but may not stand out in some areas because the color and form of the materials may blend in to the surrounding landscape. However, typically temporary stockpiling of dam fill materials, larger vehicles, and equipment would be a moderate to strong contrast as the color and form would stand out substantially from the existing landscape. Some scenic resources,

such as trees, rocks, and vegetation, particularly in the immediate vicinity of the dams, would need to be removed. Dust emissions from project activities may also temporarily impact views and enjoyment of the river. However, as part of the decommissioning plan, prior to initiation of deconstruction or construction activities, the contractor will be required to prepare and implement a worker Health and Safety Plan prior to the start of construction activities. The Health and Safety Plan will include proper housekeeping and best management practices (BMPs) to keep the construction areas orderly and suppress dust emissions, as required.

During deconstruction, the area would be inconsistent with the VRM classification for the surrounding area. After construction, all vehicles, equipment, and stockpiles would be removed and the area would be restored. **The impact on scenic resources would be significant; this impact would occur temporarily, until deconstruction was complete. No mitigation measures could be implemented to lessen the impact on scenic resources; therefore it would be significant and unavoidable in the short term. As described above, removal of the facilities would benefit scenic resources in the long term through the restoration of the characteristic natural landscape.**

Replacement of the existing wooden Lakeview Bridge just downstream from Iron Gate Dam with a concrete bridge could result in short and long-term impacts on scenic resources. If it is determined that the Lakeview Bridge is not adequate to support the construction traffic from the decommissioning activities, it would be replaced with a concrete bridge in the same location. There would be short-term significant impacts on scenic quality during construction from the presence of construction equipment. Long-term impacts on scenic quality from the change from a wooden to concrete bridge would be less than significant. **The impact on landscape would be a temporary significant and unavoidable impact; however, in the long-term impacts on scenic quality would be less than significant.**

Demolition of existing recreation facilities, such as campgrounds and boat ramps, from the reservoir banks would result in short and long-term impacts on scenic resources. Due to the presence of construction equipment and temporary loss of vegetation, there would be short-term significant impacts on scenic quality during demolition of some of the existing recreation facilities at the reservoirs. In the long term, impacts on scenic quality would be less than significant given implementation of Mitigation Measure REC-1 (the development of a plan to provide similar recreational resources and infrastructure) as well as the revegetation of the drained reservoir lands. ***The impact on landscape would be a temporary significant and unavoidable impact; however, in the long-term impacts on scenic quality would be less than significant.***

Deconstruction could create a new source of light or glare that could adversely affect nighttime views in the area. Temporary lighting would be erected for nighttime activities, and security lighting might be required during deconstruction. This light could cause glare that would adversely affect day or nighttime views in the area, particularly for visitors and residents whose homes are near the dam sites, such as the residences near the

Copco Development. **The impact on nighttime views would be a significant impact that would occur temporarily, until deconstruction was complete. Mitigation Measure SQ-1 would reduce this impact to less than significant.**

Drawdown and removal of the four reservoirs could cause temporary changes in the appearance of the Klamath River in the area of the Four Facilities and downstream from Iron Gate Dam. As part of the Proposed Action, the reservoirs would be drawn down, allowing the Klamath River to return to a natural channel depth and width. Hydrologic modeling (see Section 3.6, Flood Hydrology) indicates that the flows in the Klamath River would not be expected to be substantially different from historic conditions after the effects of the initial drawdown passed. Water flow levels are expected to remain very similar to current flow levels and the existing river channel configuration patterns would likely be continued. In the short term, water aesthetics (clarity, turbidity (depth of view), and color) in the receding reservoir and downstream river reaches would likely be affected as the sediment behind the dams erodes and washes downstream (see Section 3.2, Water Quality). In addition to reducing water clarity for a few weeks, the temporary pulse of sediment could also cause possible short term deposition in eddies and slack water pools until subsequent annual flood events move the sediment to the ocean. Depending on the severity of the color change, this would represent a weak to moderate contrast from the existing condition and could be visible from quite a distance, especially from higher elevation viewpoints along the river canyon. **The impact on the appearance of the Klamath River would be a temporary significant impact. No mitigation measures could be implemented to lessen the impact on scenic resources; therefore it would be significant and unavoidable. The impact on scenic resources would be temporary but remain significant and unavoidable.**

Removal of the Four Facilities could result in long-term impacts on scenic resources from changes to water quality. As described in Section 3.2, Water Quality, removal of the dams at the Four Facilities is expected to improve water quality in the long term. The changes are expected to reduce the river's summer algae concentrations, resulting in changes in both water clarity and coloration. An improvement in water quality could result in some improvement in scenic resources, such as water clarity or fish viewing opportunities. These improvements would be most noticeable from on-river and riverside viewpoints, and much less noticeable from river canyon roadway and community viewpoints. **Improvements to water quality would have a beneficial effect on scenic resources.**

Keno Transfer

The Keno Transfer could have adverse effects to scenic quality. The Keno Transfer is a transfer of title for the Keno Facility from PacifiCorp to the DOI. This transfer would not result in the generation of new impacts on scenic quality compared with existing facility operations. Following transfer of title, DOI would operate Keno in compliance with applicable law and would provide water levels upstream of Keno Dam for diversion and canal maintenance consistent with agreements and historic practice (KHSA Section 7.5.4). **Therefore, the transfer of Keno to the DOI would result in no change from existing conditions.**

East and Westside Facilities – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects on scenic quality. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate the need to divert water at Link River Dam into the two canals. There would be temporary visual resource effects during facility deconstruction activities. Long-term effects would be dependent on future land use, which is not identified at this time. **Therefore, the decommissioning of the East and Westside Facilities would have a less then significant effect on scenic quality.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Construction of a new, elevated City of Yreka Water Supply Pipeline and steel pipeline bridge to support the pipe above the river could result in short and long-term impacts on scenic resources. The new prefabricated steel pipe bridge would likely be three spans with a center span of 200 feet and two end spans of 100 feet. The spans would be supported on concrete piers. The new pipeline would be connected to the existing buried pipeline at each end of the bridge. New structures would be painted (or manufactured) to blend with the natural color of the landscape. **The impact on scenic quality would be a significant impact that would occur in both the short and long term. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.**

KBRA – Programmatic Measures

The KBRA, which is a connected action to the Proposed Action, includes several programs that could result in impacts on scenic resources, including:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management
- Fish Entrainment Reduction
- Wood River Wetland Restoration
- Water Diversion Limitations
- On-Project Plan
- Water Use Retirement Program (WURP)
- Interim Flow and Lake Level Programs
- Klamath Tribes Interim Fishing Site
- Power for Water Management Program
- Additional Water Conservation and Storage

Phases I and II Fisheries Restoration Plans

Construction activities associated with the Fisheries Restoration Plan - Phase I and Phase II could result in impacts on scenic resources. The Fisheries Restoration Plan would include measures to restore riparian and floodplain vegetation throughout the Klamath Basin. Actions that could have impacts on scenic resources within the project

area include those where construction or restoration activities would occur, due to the presence of construction equipment and temporary loss of vegetation. These actions include the following:

- Floodplain rehabilitation
- Wetland and aquatic habitat restoration
- Woody debris placement
- Fish passage correction
- Cattle exclusion fencing
- Mechanical thinning and prescribed burning
- Road decommissioning
- Gravel augmentation

These actions would result in temporary impacts on scenic resources within localized construction areas. The restoration actions would not occur in the same location or at the same time as the hydroelectric facility removal actions to contribute to or change potential effects of dam removal on scenic resources. **Therefore, impacts on scenic resources would be less than significant during construction.**

The Fisheries Restoration Plan- Phase I and Phase II could result in long-term impacts on scenic resources. These programs are intended to benefit fish populations and therefore increase fish viewing opportunities, which would result in beneficial effects to scenic resources. In addition, actions are anticipated to result in scenery more consistent with the naturally established, characteristic landscape**.** These actions would not occur in the same location as hydroelectric facility removal actions and would not affect any scenic improvements as a result of dam removal. **However, they are anticipated to result in beneficial effects to scenic resources.**

Fisheries Reintroduction and Management Plan

Construction activities associated with fish collection facilities would introduce new features into the landscape. Trap and haul operations within the Fisheries Reintroduction and Management Plan would require construction of fish collection and handling facilities below Keno and near Link River Dams to seasonally move fish around Keno Impoundment/Lake Ewauna during times of poor water quality. Constructing these facilities would result in temporary impacts on scenic, and the fish handling facilities would remain in the long term to change the visual landscape. The handling facilities would not be in the same visual area as the Four Facilities; therefore, construction of fish handling facilities would not compound the effects of facility removal actions. **The impacts on scenic resources would be less than significant during construction. However, the impact to scenic resources from the addition of the fish management structures could be a significant, permanent impact. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.**

Wood River Wetland Restoration

The Wood River Wetland Restoration Project could result in long-term impacts on scenic resources. This project would be a new project designed to provide additional water storage for a total of 16,000 AF of storage in or adjacent to Agency Lake (see Section 2.4.3.8). Depending upon the final outcome of the project design it could provide additional wetland habitat with naturally established, characteristic landscapes beneficial to scenic resources. However, if changes result in more open water storage only (no wetlands), this is not consistent with the naturally established, characteristic landscape. **Open water storage views would be a less than significant impact to scenic resources. Water Diversion Limitations, On-Project Plan, WURP, and Interim Flow, Lake Level Program Power for Water Management Program, and Additional Water Conservation and Storage**

Construction activities associated with the WURP could result in impacts on scenic resources. Construction actions would include removal of juniper trees. This could result in temporary impacts on scenic resources within localized areas. Juniper removal actions would be in a different location from the removed Four Facilities, which would reduce the potential for any scenic quality impacts generated by juniper removal actions from contributing to the effects of facility removal. **Therefore, impacts on scenic resources would be less than significant during construction.**

The Water Diversion Limitations, On-Project Plan, WURP, and Interim Flow, Power for Water Management Program, Additional Water Conservation and Storage, and Lake Level Programs could result in long-term impacts on scenic resources. Changes in land uses, including changes from ranchland to water storage areas, could occur under these programs. These actions would not occur at the same location or time as hydroelectric facility removal, which would reduce the potential for any scenic quality impacts generated by these programs from contributing to the effects of facility removal. **These changes have the potential to be beneficial if they result in landscapes (wetlands) that are consistent with the naturally established, characteristic landscape. However, if changes result in more open water storage only (no wetlands), this is not consistent with the naturally established, characteristic landscape and would be a less than significant impact to scenic resources.**

Fish Entrainment Reduction

Construction activities associated with Fish Entrainment Reduction could result in impacts on scenic resources. Construction actions would result in temporary impacts on scenic resources within localized construction areas. Fish entrainment reduction construction actions would not occur at the same location or time as the hydroelectric facility removal actions. As a result, scenic quality impacts generated by these construction actions would not contribute to or change the scenic quality effects of facility removal actions. **Therefore, impacts on scenic resources would be less than significant during construction.**

Fish Entrainment Reduction could result in long-term impacts on scenic resources. This action is anticipated to benefit fish populations and therefore increase fish viewing opportunities, which would result in beneficial effects to scenic resources. However, the entrainment reduction facilities would likely be inconsistent with the naturally established, characteristic landscape, which would be an adverse effect. The installation of fish screens would occur at various existing water diversion structures for the Reclamation's Klamath Project and would not result in a substantial change from existing inconsistencies with natural landscapes. Entrainment reduction facilities would not be near the Four Facilities and would not contribute to or change any scenic quality impacts of facility removal. **Impacts on scenic resources would be less than significant.**

Klamath Tribes Interim Fishing Site

Construction activities associated with the Klamath Tribes Interim Fishing Site could result in impacts on scenic resources. Construction actions would result in temporary impacts on scenic resources within localized construction areas. This construction action would not occur in the same location as the Four Facilities removal actions. As a result, it would not contribute to or change any scenic quality impacts of facility removal. **Impacts on scenic resources would be less than significant during construction. In the long-term changes generated by the presence of the interim fishing site would be anticipated to retain consistency with the naturally established, characteristic landscape and would be a less than significant.**

3.19.4.3.3 Alternative 3: Partial Facilities Removal of Four Dams

Under the Partial Facilities Removal of Four Dams Alternative, certain project features would be retained, while providing the requirements for a free-flowing river and for volitional fish passage through all Four Facilities. Table 3.19-2 summarizes which facilities would be retained under the Partial Facilities Removal of Four Dams Alternative.

Figures 3.19-6 and 3.19-7 show photo-simulations of the removal of Iron Gate Dam and Copco 1 Dam, respectively.

The Partial Facilities Removal of Four Dams Alternative could result in impacts on scenic resources from the removal of the Four Facilities and some appurtenant facilities. Impacts on scenic resources would be similar to the Proposed Action. The facilities which remain could continue to be inconsistent with the VRM classification for the surrounding area. Removal of some facilities would result in a landscape that would appear more similar to the surrounding characteristic natural landscape. **Therefore, there would be a beneficial effect on scenic resources. For facilities that stay in place, there would be no change from existing conditions.**

Table 3.19-2. Summary of Features that Would Be Removed under the Proposed Action Alternative and that would be Retained under the Partial Facilities Removal Alternative

Feature	Proposed Action - Full Facilities Removal	Partial Facilities Removal
J.C. Boyle		
- Steel Pipeline and Supports	Remove	Retain
- Powerhouse	Remove	Retain
- Tailrace Channel Area	Remove	Retain
- Power Conveyance Intake	Remove	Retain
- Canal Intake (Screen) Structure	Remove	Retain
- Canal Spillway Channel Area	Remove	Retain
- Tailrace Flume Walls	Remove	Retain
Copco 1		
- Powerhouse	Remove	Retain
- Powerhouse intake structure	Remove	Retain
- Penstocks	Remove	Retain
- Diversion Intake and Gate Structure	Remove	Retain
Copco 2		
- Steel Penstock, Supports and Anchors	Remove	Retain
- Powerhouse	Remove	Retain
- Embankment Section	Remove	Retain
- Switchyard	Remove	Retain
- Tunnel Intake Structure	Remove	Retain
Iron Gate		
- Powerhouse	Remove	Retain
- Fish Hatchery	Retain	Retain

Source: River Design Group. 2010a.

Under the Partial Facilities Removal at Four Dams Alternative the DRE would remove some of the historic properties. (see Section 3.13, Cultural and Historic Resources) In general, buildings are considered visually dominant modifications to the naturally established "characteristic landscape," however, some facilities could be identified as positive scenery attributes valued for their appearance as historic and cultural features. Therefore, the effects related to the removal of historic properties could be positive, negative, or neutral to scenic resources depending on the historic building. For example, the Copco 2 powerhouse is often perceived as a positive scenery attribute while the J.C Boyle powerhouse is not (compare Figures 3.19-8 with 3.19-9). Under the Partial Facilities Removal at Four Dams Alternative, the J.C. Boyle powerhouse, Copco No. 1 powerhouse, and Copco No. 2 powerhouse would remain as visually dominant modifications to the naturally established "characteristic landscape". The facilities which remain could continue to be inconsistent with the VRM classification for the surrounding

Figure 3.19-9. View of J.C. Boyle Powerhouse.

area. The condition of the remaining structures could degrade over time, particularly the facilities that would no longer be in use (J.C. Boyle powerhouse and Copco No. 2 powerhouse), and would likely not receive as much maintenance as the facilities still in use. **The impact on historic properties would be a permanent significant impact. No mitigation measures could be implemented to lessen the visual impact of the loss of historic properties; therefore, it would be significant and unavoidable.**

Partial Removal of the Four Facilities could result in short and long term impacts on scenic resources in formerly inundated reservoir areas. The effects would be similar to the Proposed Action**. The impact on scenic quality would be a significant impact that would occur in both the short and long term, until vegetation has become established. No mitigation measures could be implemented to lessen the impact on scenic quality; therefore it would be significant and unavoidable.**

Deconstruction and restoration activities could result in short-term impacts on scenic resources in the immediate vicinity of the Four Facilities. Deconstruction activities would not meet the VRM classification for the surrounding area. **This impact would occur temporarily, until deconstruction was complete. No mitigation measures could be implemented to lessen the impact on scenic quality; therefore it would be significant and unavoidable in the short term.**

*Construction of a new, elevated of a City of Yreka water supply pipeline and steel pipeline bridge could result in impacts on scenic quality***.** The impact on the scenic quality would be the same as the Proposed Action. **It would be a significant impact that would occur in both the short and long term. No mitigation measures could be implemented to lessen the impact on scenic quality; therefore it would be significant and unavoidable.**

Replacement of the existing wooden Lakeview Bridge could result in impacts on scenic quality. The impact on the scenic resources would be the same as the Proposed Action. **The impact on the landscape would be a temporary significant impact; however, the long term impact on scenic quality would be less than significant.**

Relocation of existing recreation facilities could result in impacts on scenic quality. The effects on scenic resources would be the same as for the Proposed Action. **The impact on the landscape would be a temporary significant impact; however, the long term impact on scenic quality would be less than significant.**

Deconstruction could create a new source of light or glare that would adversely affect nighttime views in the area. The effects would be the same as the Proposed Action**. This would be a significant impact that would occur temporarily, until deconstruction was complete. Mitigation Measure SQ-1 would reduce this impact to less than significant.**

Drawdown and removal of the four reservoirs could cause temporary changes in the appearance of the Klamath River in the area of the dams and downstream from Iron Gate Dam. The effects would be the same as those described for the Proposed Action. **The impact on the Klamath River would be a temporary significant impact. No mitigation measures could be implemented to lessen the impact on scenic resources; therefore, the impact on scenic quality would be temporary but significant and unavoidable**.

The Partial Facilities Removal at Four Dams Alternative could result in water quality impacts that could have long-term beneficial effects on scenic resources. The effects would be the same as those described for the Proposed Action. **Restoring the river's water quality would have a beneficial effect on scenic quality.**

Keno Transfer

The effects of the Keno Transfer to visual resources would be the same as under the Proposed Action.

East and Westside Facilities – Programmatic Measures

The effects of East and Westside Facilities decommissioning would be the same as for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures
The effects of the City of Yreka Water Supply Pipeline relocation would be the same as for the Proposed Action.

KBRA – Programmatic Measures
Under the Partial Facilities Removal of Four Dams Alternative, the KBRA would be fully implemented and the effects would be similar to those described for the Proposed Action.

3.19.4.3.4 Alternative 4: Fish Passage at Four Dams
Under the Fish Passage at Four Dams Alternative, no facilities removal (except for demolition of existing fish ladders) would be conducted at the Four Facilities. Fishways would be built at each of the four dams in the form of pool and weir, vertical slot, ice harbor, or hybrid fish ladder with auxiliary water systems.

Continued impoundment at the reservoirs would result in water quality impacts that could have long-term impacts on scenic quality. As described in Section 3.2, Water Quality, water quality conditions would remain the same as the under the No Action Alternative. **There would be no change from the existing condition.**

Continued existence of the Four Facilities could have the impact that some areas would remain inconsistent with the VRM classification of the surrounding area. In general, retained structures and facilities would not benefit scenic quality since they are visually dominant modifications to the naturally established "characteristic landscape". In addition, under the Fish Passage at Four Dams Alternative, PacifiCorp's analysis (2004) identified some project features as being currently not consistent with the VRM classification of the surrounding area. Therefore, the areas with these structures would not be able to achieve consistency with the VRM classification of the surrounding area. **There would be no change from the existing condition.**

Demolition, construction, and restoration activities for the fishways could cause short-term adverse effects on the scenic vistas in the immediate vicinity of the Four Facilities. Under the Fish Passage at Four Dams Alternative, selective demolition would be required to accommodate modifications for the fishways and appurtenances. During construction, the area of analysis could have large construction vehicles and equipment, temporary structures (e.g., trailers, portable toilets, security fencing, temporary power supply, and fueling stations), temporary access roads, equipment storage areas, material stockpiles, and other items that would detract from the natural surroundings in terms of scenery, noise, and smells. Bare soil expanses would be visible where temporary roads were constructed, and where excavated soil was moved. Some scenic resources, such as trees, rocks, and vegetation in the work area could be removed. The construction activities would be considered moderate contrasts as the color and form of vehicles and equipment would stand out from the existing landscape but would be unlikely to be visible from great distances. **The impact on scenic resources would be significant; this impact would occur temporarily, until construction was complete. No mitigation measures could be implemented to lessen the impact on scenic quality; therefore it would be significant and unavoidable.**

Construction could create a new source of light or glare that could adversely affect nighttime views in the area. Temporary lighting would be erected for nighttime activities, and security lighting might be required during deconstruction. This light could cause glare that would adversely affect day or nighttime views in the area. This effect could affect visitors and residents whose homes are near the dam sites, such as the residences near the Copco Development. **The impact on nighttime views would be a significant impact that would occur temporarily, until deconstruction was complete, but Mitigation Measure SQ-1 would reduce this impact to less than significant.**

Construction of fishways could cause changes in the appearance of the Klamath River in the area of the Four Facilities and downstream from Iron Gate Dam. No long-term changes to the water levels in the reservoirs and downstream river reaches would be expected with the construction of the fishways. In the short term, water aesthetics (clarity, turbidity (depth of view), and color) in the reservoir and downstream river reaches could be affected by construction in the waterways. It is anticipated that gravity diversions, coffer dams, physical barriers (e.g., sand/gravel bag berms, sheetpiling, concrete blocks), and pumps would be required to isolate and/or dewater work areas for the water intakes and construction of the V-screens within the reservoirs. In addition, nets or screens would be required to prevent aquatic organisms from entering the work area. All of this equipment could cause short-term scenic and water quality impacts while employed. Any change in color from increased sediment would represent a weak contrast from the existing condition because it would likely not be visible for long distances and would occur on a small scale. Additionally, implementation of a Stormwater Pollution Prevention Plan and other measures described in Water Quality would reduce the impacts associated with clarity and color changes. **The impact on the appearance of the Klamath River would be a less than significant, temporary impact**.

Fishways could cause substantial long-term impacts on scenic resources. The addition of the fishways would change the scenic character in the vicinity of the dams by adding hardscape elements that would blend with the facility features but would not blend with the natural landscape and could dominate views due to their size. At Copco 1 and Iron Gate Dams, the fishway structures would be particularly large (see Table 3.19-3) in order to accommodate the vertical drops, which would be 124 feet and 157 feet, respectively. Figures 2-23 (J.C. Boyle), 2-24 (Copco 1), 2-26 (Copco 2), and 2-286 (Iron Gate) from Chapter 2, Proposed Action and Description of the Alternatives, show conceptual layouts for the fishways.

Although the fishways have not yet been designed, they likely could display angular geometry, continuous straight lines, and flat surfaces that may moderately contrast with the colors, forms, and textures of the surrounding characteristic landscape, or may be insignificant compared to scenery impacts of the existing dam facilities. Installation of V-screens at J.C. Boyle, Copco 2 and Iron Gate and a floating surface bypass collector at

Table 3.19-3. Minimum Structure Footprint for Fish Ladders under the Fishway Alternatives

Dam	Minimum Structure Footprint (sq. ft.)
Fishway at Four Dams	
J.C. Boyle	8,712
Copco 1	17,928
Copco 2	3,168
Iron Gate	22,608
Total	52,416
Fishway at Two Dams	
J.C. Boyle	8,712
Copco 2	3,168
Total	11,880

Source: River Design Group 2010b.

Copco 1 would introduce new permanent facilities near the existing intakes visible from the surface of each reservoir but would not be anticipated to dominate the landscape given their relative scale when compared to the dam facilities. Example cast in place pool and weir fish ladders that are proposed for use at the four dams are shown in Figures 3.19-10 and 3.19-11. **The impact to scenic resources from the addition of the fishways could be a significant, permanent impact. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as Fishway design, coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.**

Trap and Haul – Programmatic Measures

Construction activities associated with fish collection facilities would introduce new features into the landscape. Trap and haul operations would require construction of fish collection and handling facilities at below Keno and near Link River Dams to seasonally move fish around Keno Impoundment/Lake Euwana during times of poor water quality. Constructing these facilities would result in temporary impacts on scenic resources at Keno and Link River Dams, and the fish handling facilities would remain in the long term to change the visual landscape. **The impacts on scenic resources would be less than significant during construction. However, the impact to scenic resources from the addition of the fish management structures could be a significant, permanent impact. The impacts on scenic resources would be less than significant during construction. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.**

Figure 3.19-10. Example of cast in place pool and weir fish ladder used for fish passage, similar to that proposed for upstream fish passage for all four dams under this alternative.

Figure 3.19-11. Example of fish ladder built into steep bedrock similar to Copco 1 option (photo courtesy of GEI Consultants).

3.19.4.3.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative, all facilities would be removed at Copco 1 Dam and Iron Gate Dam, and fish passage facilities would be constructed at J.C. Boyle and Copco 2 Dams.

The effects of the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be similar to those of the Proposed Action and the Fish Passage at Four Dams Alternative.

As with the Proposed Action, demolition of Copco 1 and Iron Gate Dams could have long-term scenic effects, including the removal of two dams and reservoirs, and changes from reservoir to river views in the areas near Copco 1 and Iron Gate Dams. **Restoring natural riverine scenery would be a beneficial effect.**

As with the Fish Passage at Four Dams Alternative, the addition of fishways at the J.C. Boyle and Copco 2 Developments could have long-term impacts on scenic resources. **The impact to scenic resources from the addition of the fishways could be a significant, permanent impact. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as Fishway design, coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.**

Temporary deconstruction and construction scenic impacts would be similar to those under the Proposed Action for Copco 1 and Iron Gate Dams sites and could be significant. **No mitigation measures could be implemented to lessen these temporary impacts on scenic quality; therefore they would be significant and unavoidable.**

Some areas would remain inconsistent with the VRM classification of the surrounding area. The project features that are currently inconsistent with their VRM classification and would remain as visually dominant modifications to the naturally established "characteristic landscape" are: the J.C. Boyle powerhouse and penstocks, J.C. Boyle Dam, bypass canal, and transmission line and Copco No. 2 powerhouse and substation, and the Iron Gate Dam, bypass spillway, powerhouse, penstock, and associated landform and vegetation disturbances. **There would be no change from the existing condition**.

Lighting impacts would be the same as those under the Proposed Action at the J.C. Boyle and Copco 2 sites and could be significant. **Mitigation measure SQ-1 would reduce this impact to less than significant.**

Trap and Haul – Programmatic Measures

Construction activities associated with fish collection facilities would introduce new features into the landscape. The trap and haul measures around Keno Impoundment and Lake Euwana would have the same impacts under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as the Fish Passage at Four Dams Alternative. **The impacts on scenic resources would be less than significant during**

construction. However, the impact to scenic resources from the addition of the fish management structures could be a significant, permanent impact. Implementation of Mitigation Measure SQ-2, as determined by the Definite Plan, including measures such as coloration, screening from sensitive viewpoints, etc. would reduce impacts on scenic quality; however these impacts could still be significant and unavoidable.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the City of Yreka Water Supply Pipeline relocation would be the same as for the Proposed Action.

3.19.4.4 Mitigation Measures

The following mitigation measures would reduce the scenic quality impacts associated with the Project.

3.19.4.4.1 Mitigation Measure by Consequences Summary

Mitigation Measure SQ-1 - When practical, as determined by the Definite Plan, scenic quality measures/mitigations (location, design, coloration, screening, etc) shall be identified for all structural, landform and vegetation-altering components of the Project Alternatives. These measures would include one or more of the following: 1) determining the most aesthetically beneficial location and configuration of constructed facilities to reduce visual disturbance; 2) development of scenically harmonious design components into constructed facilities such as edges, borders, and surface textures that blend with surrounding topography and landscape; 3) coloration of constructed facilities, such as colored concrete that mimics as closely as practical the adjacent native soil, bedrock, or vegetation; and 4) screening of constructed facilities, or portions thereof, from sensitive viewpoints through the planting of native riparian or upland vegetation. The application of one or more of these measures, where feasible, will minimize scenery disturbances as needed to either achieve the Project's Visual Resource Management (VRM) classes, or achieve the most natural appearing scenic quality possible while meeting other Project objectives.

Mitigation Measure SQ-2 - To reduce nighttime light and glare on surrounding residences during construction, the DRE will require the use of reflectors, shields, directional lighting, or other appropriate methods to reduce glare. All lighting will be turned off when not in use and/or motion-controlled lighting will be used, where feasible. Permanent lighting needed for security will be selected to be "dark sky friendly[1]" to reduce glare to the surrounding area. "Dark sky friendly" lighting accessories or alternatives to typical lighting systems will be used, where feasible.

[1] http://www.darksky.org/mc/page.do?sitePageId=118983&orgId=idsa

3.19.4.4.2 Effectiveness of Mitigation in Reducing Consequences

Implementation of mitigation measure SQ-1 would reduce nighttime light and glare on surrounding residences to less than significant.

Implementation of mitigation measure SQ-2 would reduce Project associated scenery disturbances to the most natural appearing conditions possible and achieve the highest consistency with Project VRM Classes.

Agency Responsible for Mitigation Implementation

The DRE will be responsible for implementing mitigation measures SQ-1 and SQ-2.

Remaining Significant Impacts

The temporary, short-term impacts from deconstruction, construction, and restoration remain significant and unavoidable as no feasible mitigation can reduce all impacts to less than significant. Some long-term changes in scenic resources, including scenery disturbances due to removal of historic facilities, changes from reservoir to river views, and the construction of fishways and fish handling facilities under some alternatives would be significant and unavoidable.

Mitigation Measures Associated with Other Resource Areas

Several other mitigation measures involve construction work, including mitigation measures H-2 (flood-proof structures), GW-1 (deepen or replace affected wells), WRWS-1 (modify or screen affected water intakes), PHS-4 (repair damaged roads), PHS-5 (construct water storage tanks for firefighting), REC-1 (develop new recreational facilities and access to river), TR-6 (assess and improve roads to carry construction loads), and TR-7 (assess and improve bridges to carry construction loads). Construction equipment associated with the mitigation measures would detract from the natural surroundings. The construction activities would be considered weak to moderate contrasts, depending on the amount of vehicles, equipment, and materials in any given area. Effects would be temporary and would not disrupt large expanses of the natural setting. The impact on scenic quality from implementation of mitigation measures listed above would be less than significant.

3.19.5 References

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3.20 Recreation

3.20.1 Area of Analysis

The recreational setting within the Klamath Basin is characterized by an expansive rural landscape that offers a myriad of outdoor recreational opportunities. Within the basin, there are five national forests (Klamath, Fremont, Winema, Six Rivers, and Modoc), one joint national and State park (Redwood), one national park (Crater Lake), two national monuments (Lava Beds and Cascade - Siskiyou) and five National Wildlife Refuges (NWRs) (Klamath Marsh, Tule Lake, Clear Lake, Upper Klamath, and Lower Klamath) that make up the Klamath Basin NWR System. There are 297 miles of Klamath River Wild and Scenic Rivers (WSR) which include segments of the Klamath, Scott and Salmon Rivers and Wooley Creek. These segments are analyzed as those WSR segments most likely to be affected by the proposed alternatives. There are also extensive public and private recreational opportunities along the Klamath River and its reservoirs. Federal and State agencies, including the United States Forest Service (USFS), Bureau of Land Management (BLM) (including the Northern California District, and Lakeview and Medford Districts in Oregon), United States Fish and Wildlife Service (USFWS), the National Park Service (NPS), and California Department of Fish and Game (CDFG), are responsible for managing these lands which are located in Klamath and Jackson Counties, Oregon, and Siskiyou County, California. Figure 3.14-1 in Section 3.14, Land Use, Agriculture and Forest Resources, shows the management of lands in the Klamath Basin. The analysis of potential effects on the Oregon and Klamath WSRs is also included in this section.

The area of analysis includes recreation areas and access along the Klamath River from its headwaters in Oregon to the mouth of the river at the Pacific Ocean. Recreational areas within and directly adjacent to the Klamath Basin are described to provide an overview of regional opportunities. Impacts on recreation opportunities as a result of the alternatives would be limited to those within the Klamath River corridor; therefore, the analysis focuses on those recreational facilities and opportunities adjacent to the Klamath River. Descriptions of recreational opportunities, activities, and settings are presented here by geographic location, including within the Klamath Basin, upstream of J.C. Boyle Reservoir, between J.C. Boyle Reservoir and Iron Gate Dam, and downstream from Iron Gate Dam. Section 3.20.4.3 presents an assessment of potential impacts of the alternatives, including the Proposed Action to remove J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams (the Four Facilities), on recreational resources.

3.20.2 Regulatory Framework

Recreation within the area of analysis are regulated by several Federal, State, and local policies, which are listed below.

3.20.2.1 Federal Authorities and Regulations

- BLM Redding Resource Management Plan and Record of Decision (1993)
- BLM Klamath Falls Resource Area Resource Management Plan and Rangeland Program Summary and Record of Decision (1995)
- BLM Klamath Falls Record of Decision and Resource Management Plan (2008)
- BLM Medford District Resource Management Plan and Record of Decision (2008)
- Wild and Scenic Rivers Act (WSRA) (16 U.S.C. 1271 et seq.)
- Federal Land Policy and Management Act (43 U.S.C. 1701 et seq.)
- U.S. Forest Service Six Rivers National Forest Land and Resource Management Plan
- U.S. Forest Service Fremont National Forest Land and Resource Management Plan
- U.S. Forest Service Klamath National Forest Land and Resource Management Plan
- National Park Service (NPS) General Management and Strategic Plan, Redwood National Park
- Federal Endangered Species Act (ESA)
- Federal Wild and Scenic Rivers Act, October 2, 1968

3.20.2.2 State Authorities and Regulations

- California Wild and Scenic Rivers Act
- Oregon Parks and Recreation Department, Oregon State Scenic Waterways Act, Klamath River Scenic Waterway Rules

3.20.2.3 Local Authorities and Regulations

- City of Klamath Falls Parks Recreation and Open Space Master Plan

3.20.3 Existing Conditions/Affected Environment

3.20.3.1 Regional Opportunities

Rivers, streams, and lakes are common throughout the mountainous landscape, and grasslands exist in the high plateau areas of the region. A large number of public lands are in the region, including five national forests, five NWRs, one national park, one joint national and State park, and two national monuments. These areas provide sightseeing, camping, hiking, fishing, wildlife viewing, and other recreational opportunities (Figure 3.20-1). In addition, a number of the lands have rivers or river segments designated as WSRs. Table 3.20-1 provides a summary of the opportunities offered on public lands within and adjacent to the Klamath Basin.

3.20.3.1.1 River-Based Recreation

A number of rivers cross the region, including four rivers designated as Wild and Scenic under the WSRA (Sprague River, Sycan River, Smith River, and Trinity River). Portions of the Klamath River (generally described above in Section 3.20.1), are designated as Wild and Scenic under Section 2(a)ii of the WSRA. Other rivers in the Klamath Basin, as shown on Figure 3.20-1 include the Salmon River, Scott River, and Clear Creek. These rivers provide a variety of recreational opportunities, including sightseeing, fishing, and whitewater boating. Figure 3.20-1 shows the location of these rivers relative to the Klamath River. Table 3.20-2 provides a summary of the rivers, the fish species caught,

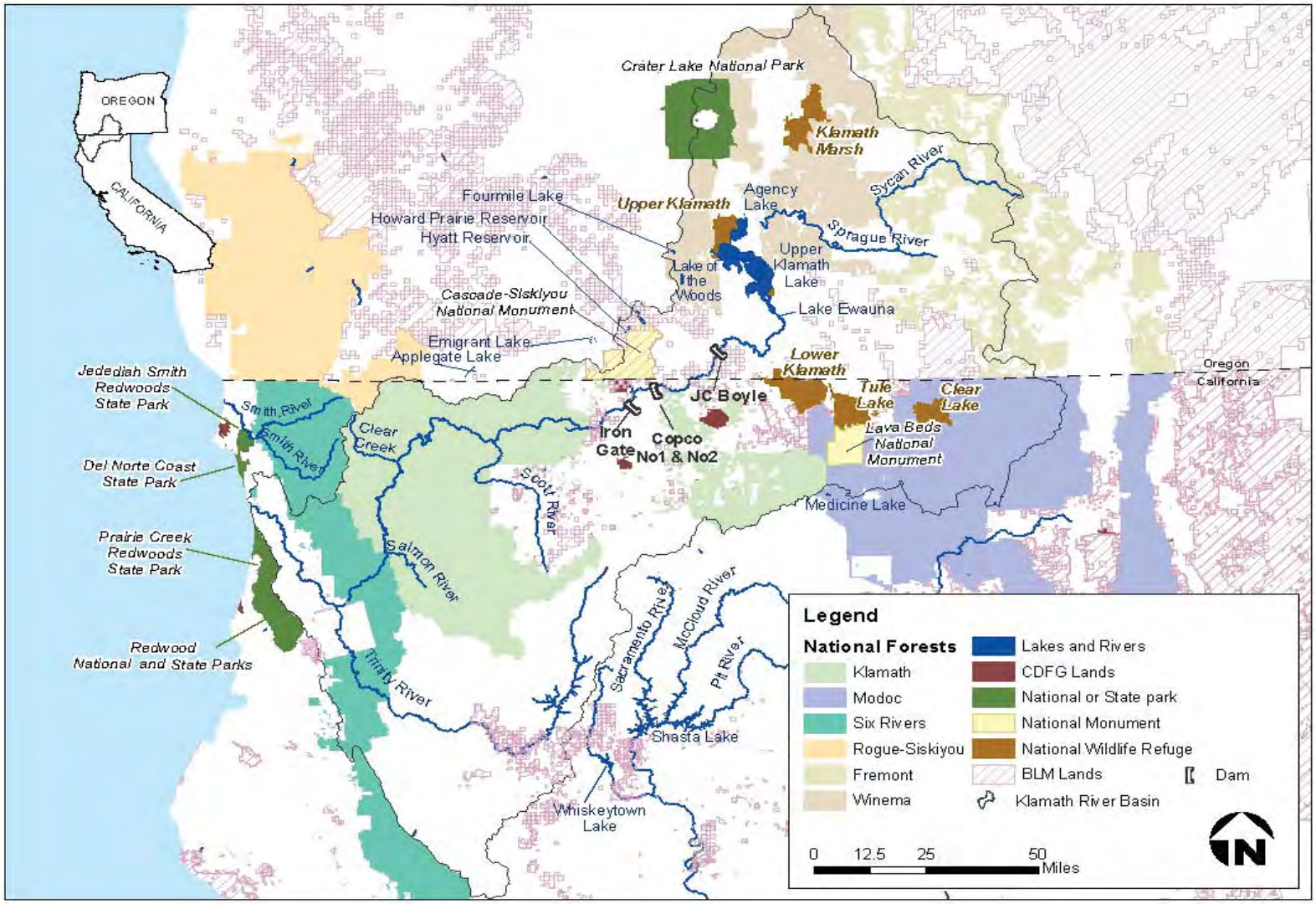

Figure 3.20-1. Regional Recreation Areas.

Table 3.20-1. Public Lands Offering Recreational Opportunities in the Vicinity of the Klamath River

Name	Size	No. of Campgrounds	Recreational Activities Available											
			Sightseeing	Hiking	Picnic Areas	Fishing	Boating	OHV	Wildlife viewing	Skiing	Rock climbing	Mountain biking	Snow play	Other
Klamath National Forest	1.7 million acres	28	X	X		X	X	X	X	X	X	X	X	hunting, equestrian use, spelunking, golf
Fremont National Forest	1.2 million acres	1	X	X		X				X		X		hunting, equestrian use, backpacking, leisure driving
Winema National Forest	1.1 million acres	6	X	X	X	X	X			X			X	backpacking, snowmobiling
Six Rivers National Forest	1 million acres	5	X	X		X	X		X					hunting, backpacking
Lava Beds National Monument	46,500 acres	1	X	X					X			X		caving
Crater Lake National Park	183,000 acres	2	X	X						X		X		swimming, snowshoeing, snow camping
Klamath Marsh NWR	40,600 acres	0	X						X					waterfowl hunting, photography

Table 3.20-1. Public Lands Offering Recreational Opportunities in the Vicinity of the Klamath River

Name	Size	No. of Campgrounds	Recreational Activities Available											
			Sightseeing	Hiking	Picnic Areas	Fishing	Boating	OHV	Wildlife viewing	Skiing	Rock climbing	Mountain biking	Snow play	Other
Lower Klamath NWR	53,600 acres	0	X						X					waterfowl hunting, photography, automobile touring
Upper Klamath NWR	14,900 acres	0	X		X		X		X					waterfowl hunting, photography
Redwood National and State Parks	133,000 acres	4	X	X	X	**X**	**X**		**X**			X		backpacking, equestrian trails, scenic drives
BLM - Cascade-Siskiyou National Monument	53,000 acres	3	X	X		X	X		X	X	X	X		snowmobiling, equestrian use, hunting
BLM - Klamath Falls Resource Area	215,000 acres	5	X	X	X	X	X	X	X				X	rafting, swimming, snowmobiling

Key:
OHV: off-highway vehicle
NWR: National Wildlife Refuge
BLM: Bureau of Land Management

Table 3.20-2. Rivers Providing Recreational Fishing Opportunities in the Region

River	Fish Species Caught[1]	Common Types of Fishing
McCloud River	Native trout	Fly fishing, bank fishing
Pit River	Native trout; brown trout; smallmouth bass; rough fish	Fly fishing, bank fishing
Rogue River	Chinook salmon, steelhead	Drift boat, powerboat, fly fishing
Salmon River	Chinook salmon, steelhead, resident trout	Fly fishing, bank fishing
Scott River	Chinook salmon, steelhead, resident trout	Fly fishing, bank fishing
Smith River	Chinook salmon, steelhead	Drift boat, powerboat, fly fishing, bank fishing
Trinity River	Chinook salmon, steelhead, sturgeon, American shad, lamprey	Drift boat, powerboat, fly fishing, bank fishing
Upper Sacramento	Chinook salmon, native and stocked trout, American shad	Fly fishing, bank fishing
Klamath River	Redband trout, salmon	Fly fishing, bank fishing, drift boat

Source: FERC 2007

[1] Information is based on species caught within the 2003-2004 time period.

and the typical types of fishing methods (e.g., boat, bank, fly). Table 3.20-3 summarizes the whitewater boating opportunities in the region. The Oregon WSRs, in particular, have outstanding recreational and/or scenic values along the length of the designated segments. The California WSRs are classified as wild, scenic, and recreational along the length of the designated segments (National Wild and Scenic Rivers 2009).

3.20.3.1.2 Reservoir-Based Recreation

Numerous opportunities for reservoir and lake-based recreation are available in the vicinity of the Proposed Action area. Table 3.20-4 provides a summary of the lakes and reservoirs in the region, including facilities and use levels. Within Klamath County and Jackson County, Oregon and Siskiyou County, California, there are more than 85 boatable lakes, containing nearly 40 boat ramps (Boat Escape Web site 2002). The area also has more than 180 high-elevation and wilderness lakes in Siskiyou County (Federal Energy Regulatory Commission [FERC] 2007). In addition to boat ramps, these lakes provide nearly 2,300 developed campsites within less than a two-hour drive from the subject reservoirs. Some reservoirs in the region are also stocked with trout or warm water fish such as perch or bass. Angling occurs at the many lakes and reservoirs in the region and many are known for having excellent fisheries.

3.20.3.1.3 Federal- and State-Managed National Forests, Public Lands, and Parks

Klamath National Forest

The Klamath National Forest consists of about 1.7 million acres, and the 300 miles of rivers within the forest include 202 miles of designated WSR segments (see Section 3.20.3.5). The Klamath River flows for 107 miles through the Klamath National Forest west of Interstate 5 (I-5) to the National Forest's border with the Six Rivers National Forest at Ishi Pishi Falls. The Klamath National Forest provides uncrowded, high quality opportunities for sightseeing, fishing, wildlife viewing, whitewater and flat water boating, hiking and horseback riding along 1,100 miles of trails, hunting, mountain biking, cross-country skiing, off-highway vehicle (OHV) and snowmobile use, mountain

Table 3.20-3. Rivers with Whitewater Boating Opportunities in the Region

River	Generalized Use Levels	Boating Class Type[1]	Miles of Boatable Whitewater	Factors Affecting Use Levels
Clear Creek	Low	III-V	7	Difficult access
Klamath River (above CA/OR State line)	Moderate	III-IV+	31	Remote, not suited for beginner or intermediate boaters, unless accompanied by a commercial outfitter
Klamath River (downstream from Iron Gate Dam)	Moderate	II-V	122	Most skill levels, easy access, 186 miles support multi-day floats, shoreline camping, scenery, many outfitters, commercial use
North Umpqua River	Moderate	II-IV	32	Easy access, most skill levels, scenery, boatable year round, shoreline suitable for camping
McCloud River	Moderate	II-IV	35	Proximity to I-5, most skill levels, low flows in summer
Pit River	Low	IV-V	34	Fragmented/short runs with long stretches of flat water between, remote location
Rogue River	High	II-V	100+	Easy access, most skill levels, scenery, boatable year round, shoreline suitable for camping, many commercial outfitters
Salmon River	Moderate	II-V	44	Requires advanced/expert boating skills, commercial use
Scott River	Low	III-V	20	Recommended for expert boaters only
Smith River	Low	II-V	100+	Requires advanced/expert boating skills, low summer flows
Upper Sacramento River	Low	III-V	36	Proximity to I-5, average solitude
Trinity River	Moderate	II-V	100+	Most skill levels, easy access, commercial use

Source: FERC 2007

[1] As rated by the American Whitewater International Scale of Difficulty (American Whitewater 1998).

climbing, and spelunking. There are 34 developed campgrounds within the forest, and dispersed day and overnight use occurs in various locations throughout the forest (FERC 2007; U.S. Department of Agriculture [USDA] 2010).

Six Rivers National Forest

The Six Rivers National Forest encompasses more than 1 million acres of land located east of the redwood belt of northwestern California and the Hoopa Valley and Yurok Indian Reservations, extending from the Oregon border south through Del Norte, Siskiyou, Humboldt, and Trinity Counties. The Klamath River runs for 20 miles through the Six Rivers National Forest from west of Ishi Pishi Falls to the boundary of Hoopa Tribal lands. Recreational opportunities in the Six Rivers National Forest include 24 developed campgrounds, 400 miles of trails for hiking and sightseeing along 365 miles of designated WSRs, backpacking, whitewater boating on 100 miles of the Smith River and approximately 50 miles of the Trinity River, world-class salmon and

Table 3.20-4. Comparison of Subject Reservoirs with Lakes and Reservoirs in the Region

Lake or Reservoir	Distance from Nearest Subject Reservoir (mi)	Surface Water (acres)	Number of Developed Campsites	Number of Developed/ Improved Boat Launches	Number of Developed Picnic Areas	Generalized Use Levels
Subject Reservoirs						
J.C. Boyle	N/A	420	16	2	4	Low
Copco 1	N/A	1,000	0	2	2	Low
Copco 2	N/A	40	0	0	0	Low
Iron Gate	N/A	944	37	3	6	Moderate
Other Lakes and Reservoirs in the Region						
Hyatt Reservoir	15	1,250	172	2	1	Moderate
Emigrant Lake	16	806	110	2	2	Moderate
Howard Prairie Reservoir	17	2,000	303	4	1	Moderate
Upper Klamath Lake	20	85,120	269	6	1	Moderate
Lake of the Woods	21	1,113	190	3	1	High
Fourmile Lake	26	740	25	1	0	Low
Agency Lake	28	5,500	43	3	0	Low
Applegate Reservoir	36	988	66	3	1	Low
Medicine Lake	46	408	72	1	1	Low
Gerber Reservoir	62	3,830	50	2	1	Moderate
Trinity Lake Unit	73	16,535	500	7	2	Moderate
Whiskeytown Lake	87	3,200	139	3	1	Moderate
Shasta Lake	87	29,500	320	7	7	High
Lost Creek Reservoir	178	3,430	202	1	2	N/A
Willow Lake	31	927	66	7	8	N/A
Willow Valley Reservoir	69	200	1	1	1	N/A
Lake Siskiyou	46	160	1			N/A
Juanita Reservoir	14	55	23	2		N/A
McCloud Reservoir	58	520	6	1	1	N/A

Source: PacifiCorp 2004a; Jackson County Parks 2010; VisitUsa.com 2010.

Key:
mi: miles
N/A: not available

steelhead fishing and hunting opportunities. The Six Rivers National Forest is also home to many rare and endangered plants and flowers that are attractive for botanical tours (USDA 2009).

Redwood National and State Parks

Redwood National Park is one of four park units jointly managed as Redwood National and State Parks under a cooperative management agreement between the NPS and the California Department of Parks and Recreation (California State Parks). Together with three State parks-Prairie Creek Redwoods, Del Norte Coast Redwoods, and Jedediah Smith Redwoods State Parks-the parks encompass 133,000 acres. These parks preserve the largest remaining sections of ancient coast redwood forest, including some of the world's tallest and oldest trees and provide forest and stream habitat for threatened and endangered birds and salmonids (NPS 2005). Recreational opportunities include four developed campgrounds, hiking, backpacking, horseback riding, scenic drives, visitor centers, and ranger-led programs designed to inform and inspire the public on this unique ecosystem (NPS 2009).

Fremont-Winema National Forest

The Fremont-Winema National Forest is located in south-central Oregon on the eastern slopes of the Cascade Mountain range. The combined forest area consists of 2.3 million acres. The lowest elevations of the forest adjoin Upper Klamath Lake where there are marshes, lakes, forested slopes, and wide basins. There are 22 developed campgrounds and 9 day-use areas across the forest. Recreational opportunities include sightseeing, fishing, wildlife viewing, hiking, downhill skiing, and hang gliding (FERC 2007).

Modoc National Forest

The Modoc National Forest is located along the California-Oregon State Line and is the most northeasterly of the national forest units in the Pacific Southwest Region. The forest consists of approximately 2 million acres. The Modoc National Forest does not draw as large a volume of recreational travel compared to other forests closer to population centers, with the exception of the one-month open deer season which is known to attract as many as 10,000 hunters. Other recreational opportunities include fishing, camping, hiking, and sightseeing (USFS 2011).

BLM Klamath Falls Resource Area

Located in the BLM Lakeview District, the public lands administered by the Klamath Falls Resource Area are in southern Klamath County on the eastern slope of the Cascade Range. In addition to BLM-administered land (212,000 acres), there are 21,000 acres of non-federally owned surface land underlain by subsurface Federal mineral estate within the Resource Area that are also administered by the BLM (BLM 1995). The two main recreation areas located in the Klamath Falls Resource Area include the Klamath WSR and the Wood River Wetland (BLM 2011). The Klamath WSR area is located 30 miles southwest of Klamath Falls. While travel is limited to rough gravel roads and jeep trails, the area is utilized for wildlife viewing, hunting, fishing, biking, hiking, and camping, among other recreational activities (BLM 2011). The Klamath Falls Resource Area Management Plans (BLM 1995 and 2008) list 15 developed and semi-developed

recreation sites including day-use and campsites, and four developed trails. The Wood River Wetland area is open to the public year-round for day-use only, and includes paved parking, a trail, a canoe launch, picnic areas, toilets, and interpretive signs (BLM 2011).

Recreational activities that take place at the Wood River Wetland area include wildlife viewing, botanical sightseeing, hunting, fishing, canoeing, hiking, and biking (BLM 2011).

Cascade-Siskiyou National Monument

Located in the BLM Medford District, the Cascade-Siskiyou National Monument was designated a national monument by presidential proclamation in 2000. The national monument is located where the Cascade, Klamath and Siskiyou mountain ranges converge and consists of 54,000 acres of BLM-administered lands (BLM 2011). The area is recognized for its remarkable biological diversity and varied landscape, as well as important archaeological and historical resources. The Hyatt Lake Recreational Area is the only developed recreational site within the monument and includes many developed campgrounds (BLM 2008). The major recreational activities within the monument include camping, hiking, horseback riding, sightseeing, hunting, fishing, cross-country skiing, snowmobiling, rock climbing, and nature study (BLM 2008). The majority of the monument is undeveloped and visitor use is estimated as light to moderate throughout. The Hyatt Lake Recreational Area receives moderate use during April through October. In 2003, records show that over 14,000 people visited the recreational area (BLM 2008).

3.20.3.2 Recreation Opportunities along the Klamath River Segment Upstream of J.C. Boyle Reservoir

3.20.3.2.1 Recreation Facilities and Opportunities

Upstream of J.C. Boyle Reservoir, a small number of developed recreation facilities exist. The following paragraphs provide brief descriptions of each facility and the recreational opportunities available.

Agency Lake is connected to the northern arm of Upper Klamath Lake. Although Agency Lake has no marina, there are two public boat launches and it has a fishery that features trophy redband trout. Other popular recreational activities at the lake are sightseeing, including wildlife viewing of waterfowl, otter, mink, deer, and bald eagles (and waterfowl hunting) (Southern Oregon Directory and Guide 2010). The BLM's Wood River Wetland Management Area is on Agency Lake. As shown in Table 3.20-4, a number of campgrounds surround the lake.

Upper Klamath Lake is the largest freshwater body of water in Oregon. In the northern portion of the lake, Pelican Bay is known for its population of redband trout and is an extremely popular destination for fly-fishing. The bay is also a popular location for canoeing and kayaking, as well as sightseeing and wildlife viewing. Other popular

activities in Upper Klamath Lake include sailing and waterfowl hunting. As shown in Table 3.20-4 above, there are numerous campgrounds and boat launches surrounding the lake.

The Link River segment of the Klamath River, an approximately 1-mile stretch downstream from Link River Dam, has only one developed recreational facility, the Link River Nature Trail. This 1.4-mile trail is for pedestrian use only and follows a gated access road on the west side of the Link River Bypass Reach. The Link River Nature Trail is popular for sightseeing, hiking, walking, jogging, trout fishing, and bird watching (FERC 2007).

The Keno Impoundment/Lake Ewuana provides various recreational opportunities, including fishing, picnicking, boating, camping, sightseeing, and wildlife viewing. In the fall, waterfowl hunting is a popular activity at Keno Impoundment/Lake Ewuana. Although most of the land adjacent to the reservoir is privately owned, Lake Ewauna has several public access areas, including the City of Klamath Falls Veterans' Memorial Park/Boat Launch, Miller Island Boat Launch, the Klamath Wildlife Viewing Area, and the Keno Recreation Area and Campground (PacifiCorp 2004). Table 3.20-5 provides a summary of the facilities and estimated annual visitation and capacity as assessed by PacifiCorp as part of relicensing studies for the Klamath Hydroelectric Project (KHP) (PacifiCorp 2004).

Table 3.20-5. Keno Impoundment/Lake Ewauna Developed Recreation Facilities

Site Name	Facilities	2001/2002 Est. Annual Use (Recreation Days[1,2])	Est. Facility Use vs. Capacity
Klamath Falls Veterans' Memorial Park/Boat Launch	Boat launch, day use area	42,500	Exceeding capacity
Miller Island Boat Launch and Klamath Wildlife Viewing Area	Boat launch, wildlife viewing trail, and a portable toilet	7,300	Approaching capacity
Keno Recreation Area and Campground	Campsites (26), day use area, restrooms, boat launch and boarding dock	6,000	Below capacity

Source: PacifiCorp 2004; FERC 2007.

Notes:

[1] Recreation days are defined as one visitor to a recreation area for any reason in a 24-hour period.

[2] Data for PacifiCorp Reservoir use was collected by PacifiCorp in 2001 and 2002. No more recently collected data exists or is available.

The Klamath Falls Veterans' Memorial Park provides a boathouse and boat launch ramp on the northern shoreline of Keno Impoundment/Lake Ewuana and is managed by the City of Klamath Falls, Department of Parks and Recreation. Along the northwestern end of the lake, the Klamath Wingwatchers Lake Ewauna Nature Trail provides opportunities

for bird watching and hiking. This 1.8-mile trail connects Veterans' Memorial Park to the Link River trail, along the Link River to the north. Another trail is currently under construction on the northeastern side of the lake (Klamath Birding Trails 2010).

The Miller Island Boat Launch is on the east shore of Keno Impoundment/Lake Ewuana about 6 miles south of Klamath Falls, and is managed by the Oregon Department of Fish and Wildlife. The facility is accessed by Miller Island Road, which runs three miles through the Klamath Wildlife Area and Miller Unit, which provides an entrance station area, parking area, wildlife viewing trail, and a portable toilet. The Keno Recreation Area and Campground on the southwestern shore of the Keno Impoundment/Lake Ewuana provides a campground, day use area, and boat launch. The campground has 26 developed campsites, restrooms, and a recreational vehicle (RV) dump station. Recreational opportunities in this area include camping, fishing, picnicking, sightseeing, and boating. The Keno Recreation Area consists of upper and lower use areas, with the upper area adjacent to the campground and the lower area adjacent to the boat launch (FERC 2007).

3.20.3.2.2 Whitewater Boating Opportunities

The Klamath River downstream from Link River Dam provides approximately one mile of river suitable for whitewater boating and other river-based activities. Recreational studies of this reach have not detected whitewater boating use; however, there are anecdotal accounts of boating use occurring in the reach (FERC 2007). There is one short Class III/IV rapid and one Class II/III ledge drop in this segment of the river.

The Klamath River downstream from Keno Dam provides approximately five miles of river suitable for whitewater boating, although not much boating use is reported for this reach, perhaps due to its level of access and short run length, including a flat water paddle above J.C. Boyle. The reach is rated Class III difficulty, and flows acceptable for whitewater boating opportunities range from 1,000 to 4,000 cubic feet per section (cfs). Table 3.20-6 provides a summary of acceptable flow ranges for whitewater boating and other flow-dependent recreational activities in the Klamath River (from the Keno Reach to the ocean).

Fishing Opportunities

Fishing is allowed from September 30 until June 16 on the Klamath River downstream from Link River Dam. The highest use in this area occurs from late winter through spring; this area is mainly used by City of Klamath Falls local residents. At lower flow times, anglers use the river at a few sites where there is access for bank fishing through thick riparian vegetation. Catch records indicate that although angler success is consistently low, there is a greater percentage of larger fish caught in this reach than between J.C. Boyle Dam and the State line. Table 3.20-6 below summarizes flows acceptable for fishing opportunities in the various reaches of the Klamath River.

Table 3.20-6. Acceptable Flow Ranges for Various River-Based Activities for Reaches of the Klamath River

River Reach (Length of Reach)	Activity	Low Value (cfs)[1]	High Value (cfs)[1]
Keno Reach (5.0 miles)	Whitewater Boating – Standard	1,000	4,000
	Play Boating	1,100	1,800
	Fishing	200	1,500
J.C. Boyle Bypass Reach (4.3 miles)	Whitewater Boating – Standard	1,300	1,800
	Fishing	200	1,000
Hell's Corner Reach (16.4 miles)	Whitewater Boating/Kayaking[2]	1,000	3,500
	Whitewater Boating/Commercial Rafting[2]	1,300	3,500
	Fishing[3]	200	1,500
Copco 2 Bypass Reach (1.3 miles)	Whitewater Boating	600	1,500
	Fishing	50	600
Iron Gate to Scott River (47 miles)	Whitewater Boating/Fishing	800	4,000
Scott River to Salmon River (76 miles)	Boating	800	7,000
	Fishing	800	4,000
Salmon River to Trinity River (23.1 miles)	Whitewater Boating/Fishing	800	10,000
Trinity River to Ocean (43.4 miles)	Whitewater Boating/Fishing	1,800	18,000

Source: Recreation Sub-Team 2010 (See Appendix R of this EIS/EIR); PacifiCorp 2004; FERC 2007.

Notes:

[1] Values were determined by the recreation sub-team (2010) from relicensing documents (PacifiCorp 2004; FERC 2007) and consultation with USFS and BLM representatives.

[2] Flows are within the desirable range during the daily peak hydroelectric operations period (between 10:00 AM and 2:00 PM).

[3] Flows are within the desirable range for at least 4 hours during the daily non-peak hydroelectric operations period (either between 5 AM and 11 AM or between 3 PM and 9 PM).

Key:
cfs: cubic feet per second

3.20.3.3 Recreation Opportunities in the Klamath River Segment Between J.C. Boyle Reservoir and Iron Gate Dam

3.20.3.3.1 Recreation Facilities and Opportunities

The subject dams impound four water bodies on the Klamath River: J.C. Boyle, Copco 1, Copco 2, and Iron Gate Reservoirs. In addition to these reservoirs, there is a stretch of unimpounded river between J.C. Boyle Reservoir and Copco Reservoir. Figures 3.20-2(a), (b), and (c) show the locations of these reservoirs, and the following sections describe recreational opportunities at each of these areas.

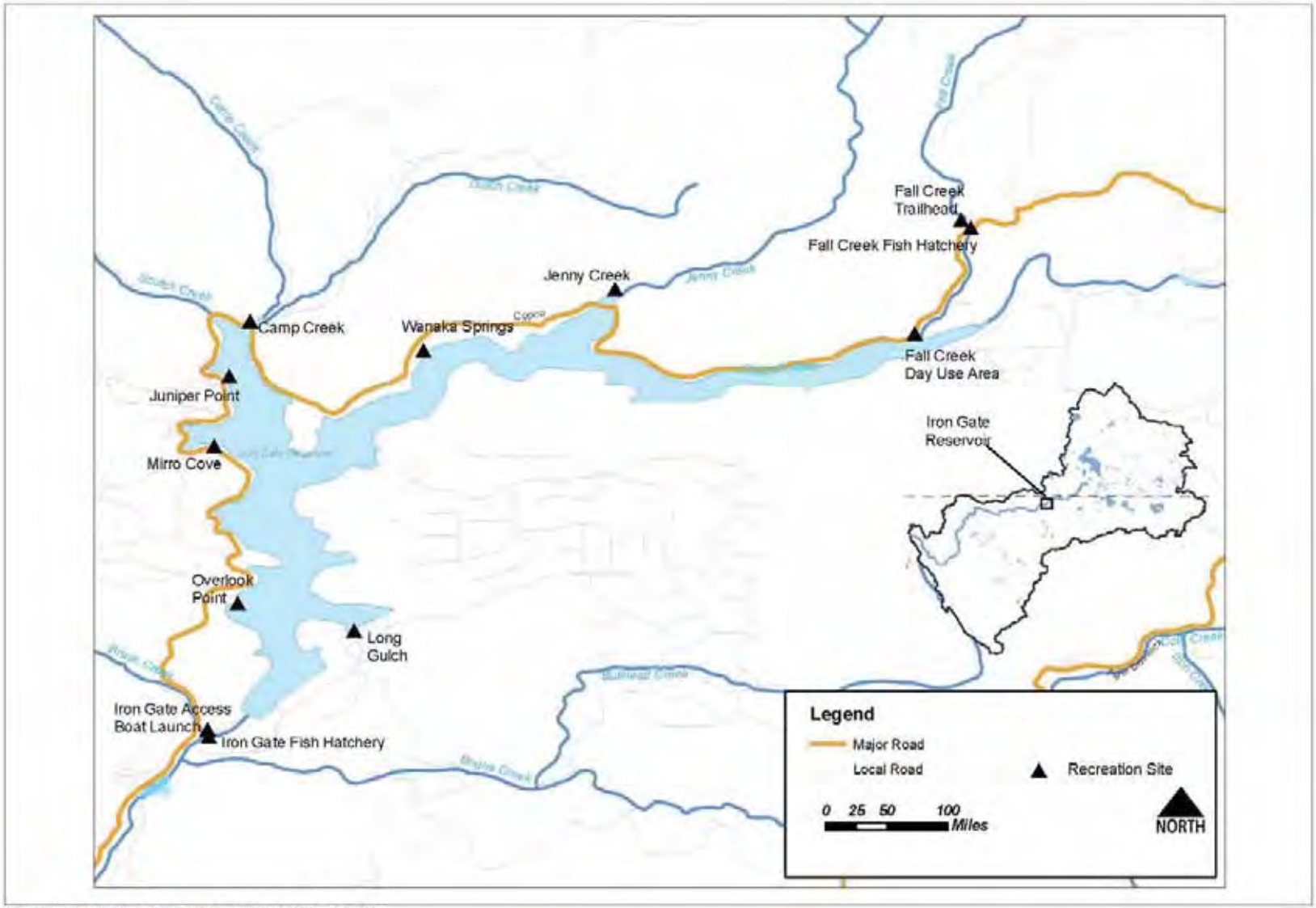

Figure 3.20-2a. Iron Gate Recreation Areas.

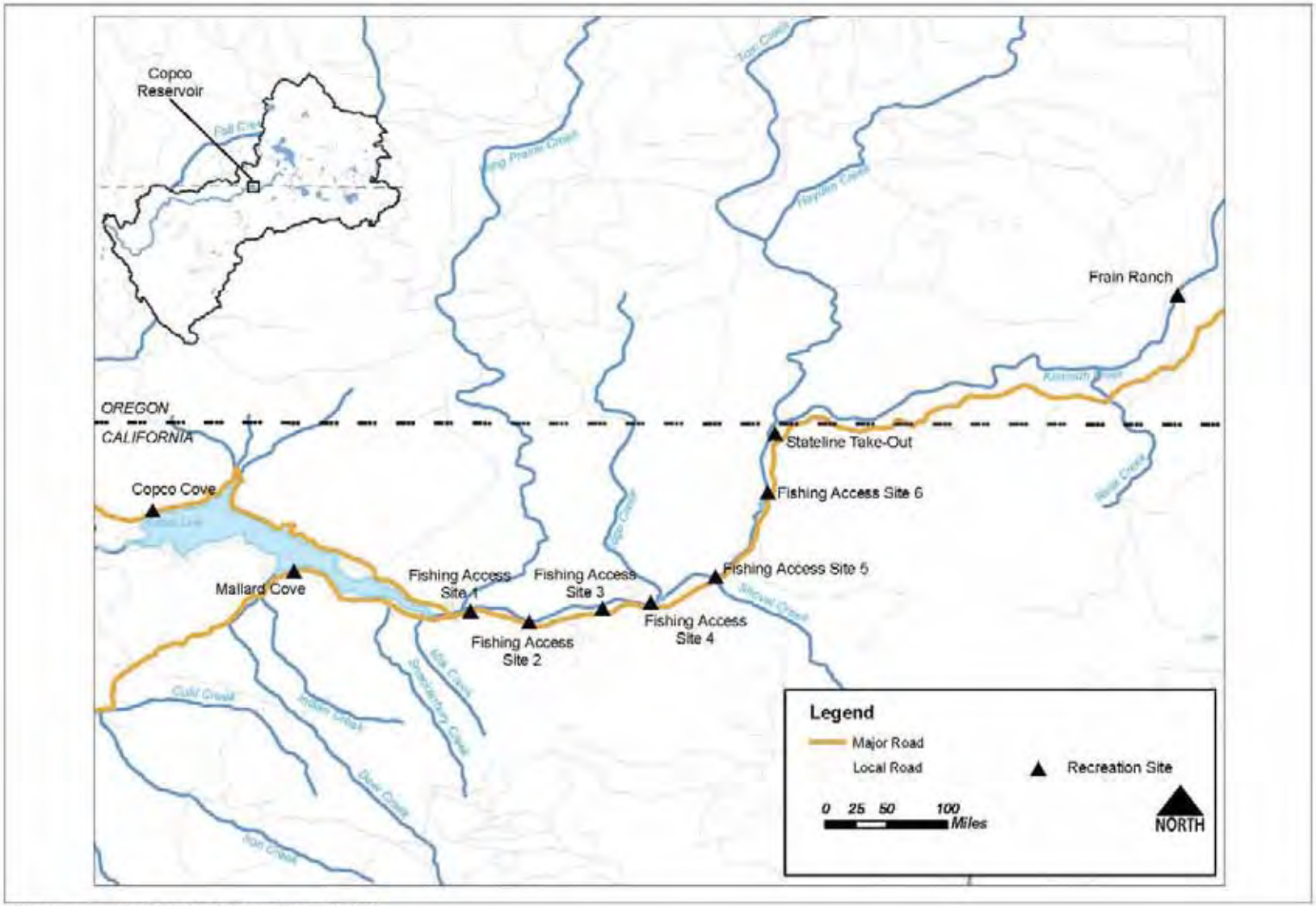

Figure 3.20-2b. Copco Recreation Areas.

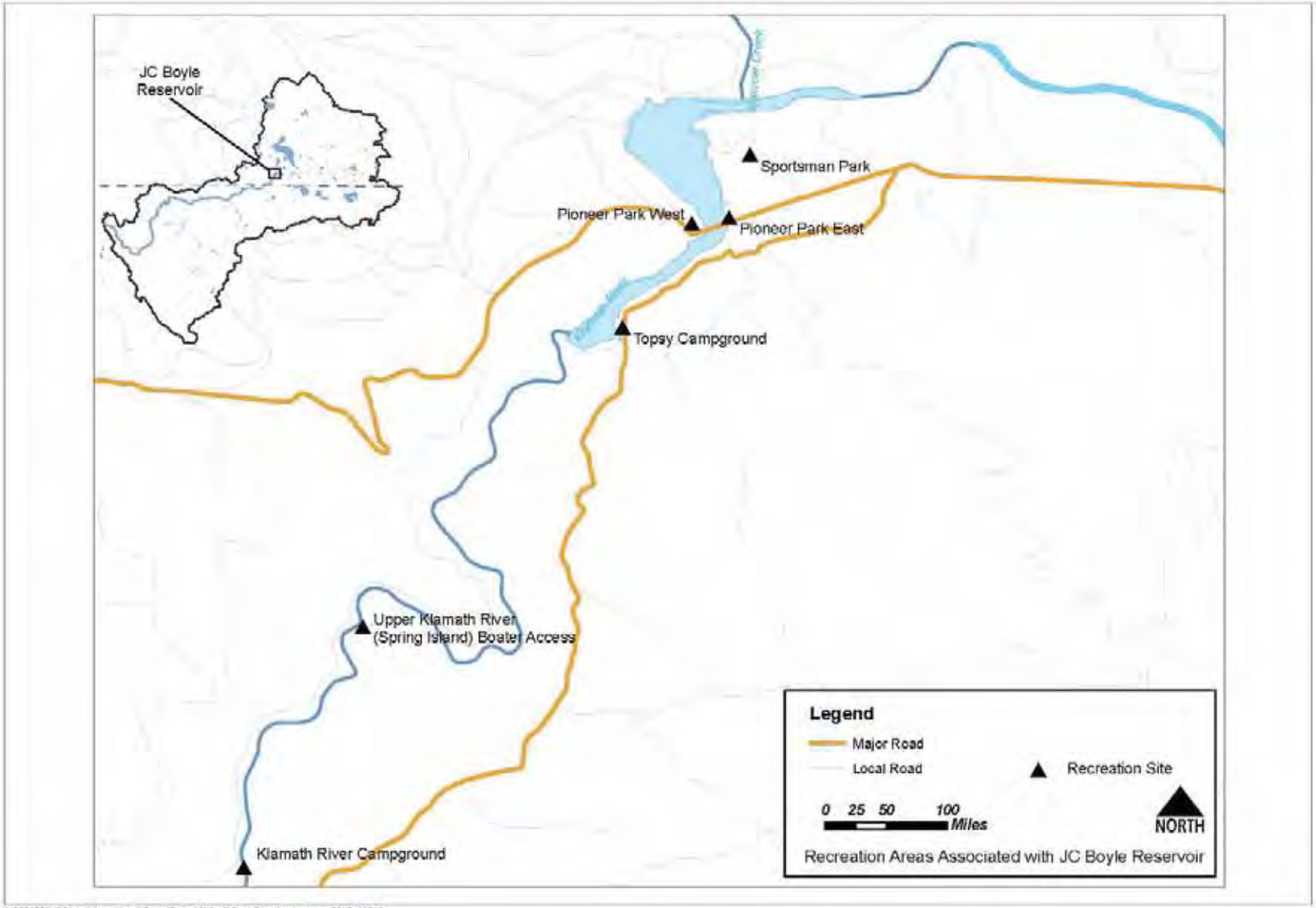

Figure 3.20-2c. J.C. Boyle Recreation Areas.

J.C. Boyle Reservoir

J.C. Boyle Reservoir encompasses about 420 surface acres and is about 3.6 miles long. Developed public recreational facilities at the reservoir include Pioneer Park, Sportsman's Park, and Topsy Campground (Table 3.20-7).

Table 3.20-7. J.C. Boyle Reservoir Developed Recreation Facilities

Site Name	Ownership	Facilities	2001/2002 Est. Annual Use	Est. Facility Use vs. Capacity
Pioneer Park	PacifiCorp	Picnic areas, boat launches, interpretive signs, restrooms	16,700	Below capacity
Topsy Campground	BLM	Campsites (16), an RV dump, two day use areas, a boat launch with boarding dock, an accessible fishing pier, restrooms	5,600	Below capacity
Sportsman's Park	Klamath County	Shooting ranges, dirt racetracks, archery courses, a model aircraft flying field, OHV area, restrooms	12,600	Below capacity

Source: PacifiCorp 2004; FERC 2007.

Pioneer Park is owned and operated by PacifiCorp and it lies off Oregon State Highway 66 (State Highway 66) east and west of Spencer Bridge. Pioneer Park is a day use area that provides picnic areas, boat launches, interpretive signs, and two restroom facilities. It has an improved boat ramp on the east shore just off State Highway 66, and a picnic area and unimproved boat launch on the west shore. Popular activities at this location include sightseeing, boating, fishing, swimming, and picnicking (PacifiCorp 2004).

Topsy Campground is managed by the BLM. The campground is south of State Highway 66 off Topsy Grade Road, a gravel road maintained on an as-needed basis by BLM, private owners, timber companies, and PacifiCorp. This site features a campground with 16 sites, an RV dump, two day use areas, a boat launch with boarding dock, an accessible fishing pier, and two restroom facilities. The campground is available to the public and BLM charges fees for day use and camping at this facility (PacifiCorp 2004).

Sportsman's Park, approximately 0.25 mile east of the reservoir, is a multi-use recreation area owned by Klamath County and leased long term to Klamath Sportsman's Park Association. The facility does not provide developed reservoir access, but does provide river access for fishing. The park contains shooting ranges, dirt racetracks, archery courses, and a model aircraft flying field. The park also has facilities for self-contained RVs and some tent camping. Annual membership passes and single-day passes for use of the park are available to the general public for a fee (PacifiCorp 2004; Klamath Sportsman's Park 2010).

Hell's Corner Reach

The Hell's Corner Reach of the Klamath River from J.C. Boyle Reservoir to Copco Reservoir extends about 16.4 river miles. Several public fishing and boat access areas exist along this reach, as summarized in Table 3.20-8.

Table 3.20-8. Hell's Corner Reach Developed Recreation Facilities

Site Name	Facilities	2001/2002 Est. Annual Use (Recreation days)	Est. Facility Use vs. Capacity
Spring Island Boater Access	Launch area, shoreline fishing access, restrooms	5,200	Below capacity
Klamath River Campground	Campsites (3), shoreline fishing and boating access, restrooms	1,000	Below capacity
Stateline Take-out	Boat put- in/take-out, shoreline fishing access, restrooms	2,700	Approaching capacity
Fishing Access Sites1-6	Shoreline fishing access, parking	3,600	Below capacity

Source: PacifiCorp 2004; FERC 2007.

The Spring Island boater access is adjacent to (downstream from) the J.C. Boyle Powerhouse and is managed by BLM. This site provides car-top whitewater boat launching and shoreline fishing access. The Klamath River Campground, managed by BLM, is about three miles downstream from the J.C. Boyle Powerhouse. The campground has three developed campsites and the shoreline which can be used for fishing and boater access. The State line take-out access area, at the Oregon/California State line, includes upper and lower areas and is co-managed by BLM and PacifiCorp. The facility provides shoreline fishing and boat launching access. The fishing access sites provide access to the Klamath River in six locations between the State line take-out access area and Copco Reservoir.

Copco 1 Reservoir

Copco 1 Reservoir, which covers about 1,000 water surface acres and is about 4.5 miles long, has two publicly available day use facilities: Mallard Cove and Copco Cove that are owned and operated by PacifiCorp. These facilities provide day use access, and although they are not official campgrounds, camping occasionally occurs at both locations. Table 3.20-9 summarizes the facilities and estimated use during 2001/2002 at both of these areas.

Table 3.20-9. Copco 1 Reservoir Developed Recreation Facilities

Site Name	Facilities	2001/2002 Est. Annual Use[1]	Est. Facility Use vs. Capacity
Mallard Cove	Picnic area, restrooms, boat launch with boarding dock	7,600	Below capacity
Copco Cove	Picnic area, restrooms, boat launch with boarding dock	1,250	Below capacity

Source: PacifiCorp 2004; FERC 2007.

Note:

[1] Recreation days are defined as one visitor to a recreation area for any reason in a 24-hour period. Estimated use was during the 2001/2002 study period (PacifiCorp 2004).

Mallard Cove, on the south shore of Copco Reservoir, is accessed off Ager-Beswick Road and includes day use facilities, two restrooms, and a boat launch with boarding dock. Copco Cove, on the western shoreline of Copco Reservoir, off of Copco Road, has a small picnic area, two restrooms, and a boat launch with boarding dock (PacifiCorp 2004).

Copco 2 Reservoir

Copco 2 Reservoir is relatively small (approximately 40 water surface acres and about 0.3 mile long) and has a narrow configuration with steep and difficult shoreline access. Copco 2 Reservoir has no recreation facilities and no public access (FERC 2007).

Iron Gate Reservoir

Iron Gate Reservoir is approximately 944 water surface acres and 6.8 miles long. The reservoir has the highest concentration of recreation sites of all the developments associated with the PacifiCorp facilities. The developed facilities at Iron Gate Reservoir are owned and managed by PacifiCorp and include a trail (Fall Creek Trail), five combination day use and campground areas (Jenny Creek, Camp Creek, Juniper Point, Mirror Cove, and Long Gulch), three day use areas (Fall Creek, Overlook Point, and Wanaka Springs), and a fish hatchery and associated day use area (Iron Gate). Recreational opportunities include sightseeing, swimming, fishing, boating, and day and overnight use. Summer and weekend use is quite high at the reservoir, due to the popularity of bass tournaments, waterskiing, and camping. Table 3.20-10 summarizes the facilities at these sites and PacifiCorp's estimated annual recreation visitation and capacity during the 2001/2002 study period.

The Fall Creek Day Use Area is at the upper end of the reservoir and includes a picnic area, boat launch access, and restroom facilities. This small day use area is adjacent to the CDFG Fall Creek Fish Hatchery and provides access to Fall Creek Trail. Fall Creek Trail is a short (0.1 mile) trail located adjacent to the Fall Creek Fish Hatchery where visitors can hike up to Fall Creek Falls.

Wanaka Springs Day-Use Area provides picnic areas, a fishing dock, and restroom facilities, and some informal camping occurs in the area.

Table 3.20-10. Iron Gate Reservoir Developed Recreation Facilities

Site Name	Facilities	2001/2002 Est. Annual Use (Recreation days)	Est. Facility Use vs. Capacity
Fall Creek Day Use Area and Fall Creek Trail	Picnic area, boat launch access, restrooms, hiking trail	4,150	Below capacity
Overlook Point	Restrooms	1,900	Below capacity
Wanaka Springs Day Use Area	Fishing dock, restrooms	4,150	Exceeding capacity
Jenny Creek Day Use Area and Campground	Campsites (6), restrooms	3,700	Approaching capacity
Camp Creek Day Use Area and Campground	Campsites (13), boat launch, boarding and fishing docks, swimming area, a RV dump station, sports field, interpretive display restrooms	15,250	Exceeding capacity
Juniper Point Day Use Area and Campground	Campsites (9), a fishing dock, restrooms	4,700	Exceeding capacity
Mirror Cove Day Use Area and Campground	Campsites (10), a boat launch, restroom	11,140	Exceeding capacity
Long Gulch Day Use Area and Campground	Picnic sites, boat launch, restrooms	5,200	Below capacity
Iron Gate Fish Hatchery	Picnic area, picnic shelter, visitor center/interpretive kiosk, restrooms, trail to river	2,200	Below capacity

Sources: PacifiCorp 2004; FERC 2007.

Overlook Point is on the west side of the reservoir, approximately 0.75 mile upstream of the dam. The facility has picnic sites on moderately steep topography, providing a good view of the reservoir and surrounding landscape.

Jenny Creek Day Use Area and Campground includes six sites and a restroom facility. Jenny Creek is on the north side of the reservoir and provides a creekside setting for picnicking and bank fishing.

Camp Creek is along a narrow reach on the north side of Iron Gate Reservoir. The surrounding hilly, semi-arid landscape and the reservoir provide pleasant views. Camp Creek has several campsites designed primarily for RV campers, with a large overflow RV camping area. Juniper Point Day Use Area and Campground has several picnic areas that are occasionally used as campsites, a fishing dock and restroom facilities.

Mirror Cove is a day use area and campground centrally located on the west side of the reservoir. The site offers several picnic sites that are occasionally used as campsites, a boat launch, and restroom facilities. This particular location is popular for group camping and is used extensively by local water-ski clubs. This boat launch is the nearest access to a competitive water-ski course placed in the western area of the reservoir.

Long Gulch Day Use Area and Campground is on the east side of the reservoir directly across from Overlook Point. Facilities at this location include picnic sites, restroom facilities, and a boat launch. Land along an adjacent ridge is occasionally used for dispersed camping and day use (PacifiCorp 2004).

Below Iron Gate Dam, the Iron Gate Fish Hatchery is operated by CDFG and includes a public day use area adjacent to the hatchery and an undeveloped boat launch across the river from the hatchery. The day use area includes a picnic area, a picnic shelter, visitor center/interpretive kiosk, restroom facilities, a trail to the river, and seasonal interpretive tours. Fishing is prohibited in this area, in addition to 3,500 feet downstream from the dam.

Visitor Use and Perception

PacifiCorp conducted a visitor survey in 2004 to assess recreational use and visitor perceptions of facilities associated with the Four Facilities, including the subject reservoirs. The majority of visitors surveyed (approximately 60 percent) were from Klamath County and Jackson County, Oregon. The remaining visitors were from California, approximately half of which came from Siskiyou County. When asked to indicate all activities participated in while visiting the subject reservoirs, more than half of the visitors surveys included resting/relaxing as one of the activities. When surveyed on their perception of crowding at the reservoirs, the mean score of respondents was 3.2 (on a 9-point scale from 1 – not crowded to 9 – extremely crowded), indicating that visitors did not feel overly crowded while participating in recreation activities. Further, approximately 39 percent of respondents had changed their visits to the subject reservoirs from other lakes in the area to avoid crowding. When surveyed regarding management options of the reservoirs, survey respondents indicated opposition to the collection of user fees at either day use sites or facility campgrounds (PacifiCorp 2004).

In response to the survey question “Has water quality ever affected your visit to the Klamath River area?” approximately two-thirds of recreational users of the subject reservoirs had negative perceptions of water quality, commenting on its color, turbidity, and odor. The source of visitor concerns was primarily the brown, foamy water in free-flowing reaches and regular, extensive algae blooms that occur throughout the reservoirs. Visitors reported that the algae produces bad odors, fouls fishing lines, and reduces the area available for fishing, swimming, and wading (FERC 2007).

Whitewater Boating Opportunities

Whitewater boating opportunities are provided on the J.C. Boyle Bypass Reach, the Hell’s Corner Reach, and the Copco 2 Bypass Reach. The J.C. Boyle Bypass Reach includes about 5 miles of the Klamath River downstream from J.C. Boyle Dam and upstream of the J.C. Boyle Powerhouse. This reach provides Class III to IV+ rapids, and acceptable whitewater boating flows range from 1,300 cfs to 1,800 cfs; however, this reach is typically dewatered with only 100 to 300 cfs base flow. Therefore, the majority of the year there is almost no boating use on this stretch of the river.

BLM manages whitewater boating use in the Hell's Corner Reach, a 16.4-mile reach from below J.C. Boyle Reservoir to the Fishing Access Site 1 take-out (see Figure 3.20-2b). This reach provides Class III to IV+ rapids during daily peaking flows from the PacifiCorp hydropower operations (between 10AM and 2PM), and acceptable whitewater boating flows range from 1,300 cfs to 3,500 cfs for commercial rafting and heavier loaded boats. Acceptable minimum flows for kayaking and private boaters are 1,000 cfs. Outside of the daily peaking flows, flow rates within this reach do not meet the acceptable range to create or enhance whitewater boating opportunities.

The average estimated annual whitewater boating use from 1994 through 2009 on this reach was 4,414 recreation days, peaking in the mid-1990s at around 6,000 recreation days per year. Whitewater boating use occurs typically during April through October, with about 80 percent of the commercial rafting use occurring during July through September. Commercial boating use accounted for about 93 percent of the whitewater boating use on this reach (United States Department of the Interior [DOI] 2011).

Commercial boating use is allowed by permit only. There is a set commercial capacity of 10 outfitters or 200 clients per day on this reach. There is no limit for private boating capacity, although BLM has established 250 persons per day as the overall whitewater boating carrying capacity of the reach. Factors that constrain the carrying capacity of the reach are vehicle congestion at the take-out locations near Copco 1 Reservoir and the limited size and number of areas that are available to scout rapids (FERC 2007). Rafting use in this area, above Copco 1 Reservoir in particular, depends upon operation of the J.C. Boyle Powerhouse upstream (FERC 2007).

The Copco 2 Bypass Reach is approximately 1.3 miles long, extending from Copco 2 Dam to the Copco 2 Powerhouse and whitewater boating opportunities are limited due to lack of flow. However, the reach could provide Class IV whitewater opportunities at acceptable flows range from 600 to 1,400 cfs.

3.20.3.3.2 Fishing Opportunities

PacifiCorp conducted a visitor use survey in 2002 to obtain information on existing visitor demand, needs, and recreational activities within the area between J.C. Boyle Reservoir and Iron Gate Dam. The results of the survey indicated that 33 percent of visitors to the area participate in bank fishing, both along the river and reservoirs. Survey respondents also indicated that fishing for trout on river reaches in this area is considered very good, and the two most popular reaches for fishing opportunities are Keno Reach downstream from Keno Dam and J.C. Boyle Bypass Reach downstream from J.C. Boyle Dam. Further downstream, opportunities for trout fishing exist below J.C. Boyle Powerhouse (Hell's Corner Reach). This reach (between J.C. Boyle Powerhouse and the State line) is popular with anglers, and catch records indicate good angler success, although fish size is typically smaller than fish caught below Keno Dam and rarely exceeds 16 inches (FERC 2007).

Recreational opportunities downstream from Hell's Corner Reach, between the California/ Oregon State border and Iron Gate Dam, are also quite popular, especially for

angling. In 1974, a 6-mile reach of the Klamath River, from the California/Oregon State line to Copco 1 Reservoir, was designated as Wild Trout water by the State of California and is managed under the Wild Trout Program (CDFG 2010) (see also Section 3.3, Aquatic Resources). Demand for recreational angling is high in this area. The Klamath River between the Copco 1 and Iron Gate Developments has poor public access and no documented fishing activity.

3.20.3.4 Recreation Opportunities along the Klamath River Segment Downstream from Iron Gate Reservoir

3.20.3.4.1 Recreation Facilities and Opportunities

The USFS (Klamath and Six Rivers National Forests) manages the majority of the river corridor from downstream from Iron Gate dam to the confluence with the Trinity River. Other areas downstream from Iron Gate area are also managed by the NPS, BLM, tribes and private land owners. Table 3.20-11 summarizes the river-based recreational opportunities available on the Klamath River downstream from Iron Gate Dam.

Table 3.20-11. River-Based Recreation Opportunities below Iron Gate Dam

Reach	Length (miles)	Current Recreation Opportunities
Iron Gate Dam to Shasta River	13	Sightseeing, Fishing (especially from boats), tubing and swimming, whitewater boating (rare), waterplay
Shasta River to Scott River	34	Sightseeing, Fishing, canoeing, whitewater boating, locational playboating, waterplay
Scott River to Indian Creek	36	Sightseeing, Fishing, canoeing, whitewater boating, waterplay
Indian Creek to Salmon River	40	Sightseeing, Fishing, whitewater boating, canoeing, hiking, waterplay
Salmon River to Trinity River	40	Sightseeing, Fishing, waterplay

Source: PacifiCorp 2004.

There are two privately developed recreation facilities along the river below Iron Gate Dam. One is R Ranch, near Hornbrook. The R Ranch is a large private recreation complex used by RV campers and day users who are members of the R Ranch Landowners' Association. The R Ranch has two separate campgrounds. Cottonwood Campground is just off of I-5, farther away from the Klamath River and offers full RV hookup sites and an RV dump station. Klamath Campground is a few miles east of Cottonwood and I-5 and 2 miles downstream from Iron Gate Dam along 1.7 miles of the Lower Klamath River. This campground contains a large lodge and provides opportunities to fish, hunt and view natural scenery and wildlife.

The Klamath Ranch Resort is a private recreation complex open to the public. It is located ¼ mile below Iron Gate dam and consists of a barn, private residence, historic restaurant, RV park and boat launches.

There are also private land areas near the I-5 corridor, in Seiad Valley, at Happy Camp, and near the mouth of the Salmon River at Somes Bar. In general, these areas have several homes and associated, sparsely populated, rural development. These areas have considerable opportunities to camp, swim, picnic, or relax along this portion of the river. There are also some opportunities for sightseeing, hiking, walking, or biking along the river. In addition, there are some popular short hikes from the river up the tributaries, such as Ukonom and Clear Creek. Land-based recreation points along the river are generally near developed access points for boaters and anglers and a few developed USFS and private campgrounds (PacifiCorp 2004). In addition, there are two National Scenic byways located along this segment of the river and within the Klamath and Six Rivers National Forests. The "State of Jefferson" National Forest Scenic Byway is located primarily on California State Highway 96 (State Highway 96) between Shasta River to Happy Camp, and the "Bigfoot" National Forest Scenic Byway is located on Highway 96 from Happy Camp to California State Highway 299 (State Highway 299). These byways provide excellent views for sightseers within the Klamath and Six Rivers National Forests and access to numerous other recreational activities (America's National Scenic Byways 2010). Downstream from the Trinity River confluence, the Klamath River flows through the Yurok, Hoopa and Resighini Indian Reservations and Redwood National Park, as well as public land managed by the BLM and privately owned lands. A number of private RV and tent campgrounds are along the river in Redwood National Park, and just outside of the park in the City of Klamath. These campgrounds provide opportunities for bank fishing, camping, and picnicking. Other recreation opportunities in the area are associated with the national park and the adjacent State parks (Jedediah Smith, Del Norte Coast, and Prairie Creek Redwood State Parks), which offer hiking, hunting, and wildlife viewing. Table 3.20-4 provides a summary of the facilities associated with these parks.

Public Health Issues

As discussed in Section 3.2, Water Quality, concentrations of chlorophyll-a and *Microcystis aeruginosa* have exceeded World Health Organization (WHO) guidelines for protection from adverse effects in recent years, in both Copco 2 and Iron Gate reservoirs, as well as reaches of the Klamath River downstream from Iron Gate Dam. In 2005 and 2008, the North Coast Regional Water Quality Control Board (NCRWQCB), Karuk Tribe, United States Environmental Protection Agency (USEPA) and other local, State, and Federal agencies issued a warning to residents and recreational users of the river to use caution when near these algal blooms due to possible health effects of exposure to *Microcystis aeruginosa* and its microcystin toxin. Effects range from mild, non-life threatening skin conditions to permanent organ impairment and death, depending upon exposure time and intensity (FERC 2007). As identified in comments received during the scoping period for this Klamath Facilities Removal EIS/EIR, these water quality issues and public health warnings have resulted in reduced recreational activity in affected river segments in recent years.

3.20.3.4.2 Whitewater Boating Opportunities

Extensive whitewater boating opportunities exist downstream from Iron Gate Dam. Depending on the river segment and level of flow, there are opportunities for play, standard, and big water boating on Class II and III waters.[1] These runs are boatable in rafts, kayaks, inflatable kayaks, and open canoes. Table 3.20-6 summarizes the acceptable flow ranges for reaches downstream from Iron Gate Dam.

Although not as challenging as the Hell's Corner Reach upstream, there are a few rapids that are sometimes rated Class IV, including Hamburg and Upper Savage on the Otter's Playpen run, Rattlesnake on the day-use run below Happy Camp, and Dragon's Tooth between Ferry Point and Coon Creek Access. There is also a well-known kayak playboating wave known as the "School House Wave" between Skehan Bar and Gottville. This wave is typically available during low to moderate summer flows and is popular with local kayakers from the Mount Shasta, Klamath Falls, and Ashland areas (PacifiCorp 2004). There is also a Class VI rapid at Ishi Pishi Falls (Somes Bar) that boaters are strongly advised to portage around (Cascade Outfitters 2010).

The primary whitewater boating season is in summer (June through August), when water temperatures are warm; however, the river can be boated in most months of the year (PacifiCorp 2004). There is less whitewater rafting downstream from the Trinity River confluence after the river turns northwest into strong prevailing winds. There are fewer developed river access points along this reach than in the reaches upstream. This reach is located within the boundaries of the Yurok Tribe Indian Reservation. Data collected by the USFS and BLM indicate that substantially more whitewater boating occurs on the Klamath River below Iron Gate Dam than in the Klamath River upstream to J.C. Boyle Dam. From 1994 through 2009, the average annual number of user days was 14,392 per year. However, whitewater boating in this portion of the Klamath River has decreased somewhat in recent years. In part, this decline is due to the presence of microcystin blooms in the river. Total user days from 2000 through 2003 ranged from 13,976 to 15,349 per year, whereas from 2005 through 2009, total user days ranged from 11,751 to 15,279 per year (DOI 2011).

3.20.3.4.3 Fishing Opportunities

The Klamath River downstream from Iron Gate Dam has high quality angling opportunities extending nearly 200 miles to the Pacific Ocean and is open to fishing year-round. This reach, designated a national WSR (see Section 3.20.3.5 below) attracts and supports several fishing outfitter services that focus on salmon, steelhead, and trout fisheries. A review of outfitters conducted as part of the Secretarial Determination process identified over 50 outfitters providing sport fishing, boat fishing, and/or fly fishing trips on the Klamath River. Twenty-seven river access sites within the Klamath National Forest provide access for fishing in this section of the river. Use at the sites varies; however, most are rated as light usage (Klamath National Forest 2010). Tables 3.20-12 and 3.20-13 provide recent use data for Chinook salmon and steelhead fishing on the Klamath River. As shown in the table, angler success varied annually, but

[1] As rated by the American Whitewater International Scale of Difficulty (AW 1998).

Table 3.20-12. Estimated Number of Recreational Salmon Angler Days and Chinook Salmon Harvest on the Klamath River (excluding the Trinity River), 2001-2010

Year	# Angler Days	Chinook Salmon Harvest (# Fish)		
		Adults	Grilse	Total
2001	28,251	9,621	1,365	2,904
2002	24,993	9,769	651	4,942
2003	23,259	7,322	589	10,986
2004	24,751	3,463	2,293	10,420
2005	17,789	1,029	912	7,911
2006	12,141	57	5,202	5,756
2007	19,597	4,975	257	1,941
2008	15,249	1,560	4,039	5,259
2009	20,755	4,820	2,033	5,232
2010	16,219	2,610	1,570	5,599
01-05Avg	23,809	6,241	1,162	7,403
06-10Avg	16,792	2,804	2,620	5,425

Source: CDFG 2011

Table 3.20-13. Estimated Number of Recreational Steelhead Angler Days on the Klamath River (excluding the Trinity River), 2003-2008

Year	# Angler Days
2003	19,183
2004	14,345
2005	13,216
2006	19,371
2007	15,622
2008	21,192
03-08Avg	17,155

Source: NOAA Fishery Service 2011

was much greater in the first half of the decade than in the latter half. The USFS reported that the decline in fish production in the past few decades triggered a similar decline in the guide and resort industry, as well as sport fisheries (FERC 2007) (see also Section 3.15, Socioeconomics).

In addition, decreased abundance of anadromous fish species resulted in restrictions on the fishing seasons for certain runs of Chinook salmon in 2006 and 2008 (National Oceanic and Atmospheric Administration [NOAA] Fisheries Service 2006).

Downstream from the Trinity River confluence, angling in the Klamath River is dependent on the annual status of the fall-run Chinook salmon run, so the number of businesses that offer angling guide services changes from year to year. The main run of

Klamath River Chinook salmon peaks in late fall and is normally over by mid-January each year; the steelhead season normally starts in November (see also Section 3.3, Aquatic Resources).

Anglers fish from boats and the bank. Most of the boat fishing occurs from drift boats or rafts. Fishing regulations allow anglers to keep up to five trout per day and most of the fishing activity occurs in summer and fall. Limits on salmon and steelhead have varied over the years, and regulations depend on whether the fish is wild or from the Iron Gate Hatchery. Most anglers catch and release steelhead (PacifiCorp 2004).

3.20.3.5 Wild and Scenic Rivers Conditions

Two segments of the mainstem Klamath River are designated WSRs, one in Oregon and one in California (Figure 3.20-3). The reach in Oregon, between the J.C. Boyle Powerhouse and the Oregon/California State line was designated a WSR in 1994. In California, the entire river beginning 3,600 feet below Iron Gate Dam to the estuary was designated a WSR in 1981 because of the outstandingly remarkable anadromous fisheries, including that of salmon and steelhead trout. WSR boundaries include variable-width linear corridors which typically include not more than 320 acres per linear mile (averaging up to approximately 0.5 miles in width along the river corridor); however, some protections for designated outstanding remarkable values can extend beyond the designated boundaries.

3.20.3.5.1 Oregon Klamath River WSR Component

The Oregon Klamath WSR , beginning immediately downstream from the J.C. Boyle Powerhouse and flowing 11 miles to its terminus at the Oregon/California State line, was added to the NWSRS through Section 2(a)(ii) of the WSR Act. The river is classified as scenic and possesses outstandingly remarkable scenic, recreational, fish, wildlife, pre-history, history, and American Indian Traditional Use values. The following subsections summarize the existing conditions in the Klamath River at the time of the WSR designation (1994) of the Oregon component.

Scenic

The Upper Klamath River (upstream of Iron Gate Dam) was evaluated by BLM in 1977 and 1981, and received a Scenic Quality Class A rating, the highest scenic quality classification. The 2006 Preliminary Determination Report (completed for the Section 7 WSR requirement during FERC relicensing of the PacifiCorp facilities) stated that scenery associated with the 11 mile Upper Klamath WSR is the main visual element in the region and exhibits more landform variety than the surrounding plateau (Bonacker et al. 2007). As the river canyon cuts across the plateau, it is characterized by cliffs, steep slopes, upland benches, alluvial terraces and the meandering river channel, “which can all be encompassed in a single view” (Bonacker et al. 2007). The unique landforms, water, and vegetation create an ever-changing landscape from desert to more mountainous terrain, and steep canyons and vertical cliffs with diverse vegetation (Bonacker et al. 2007).

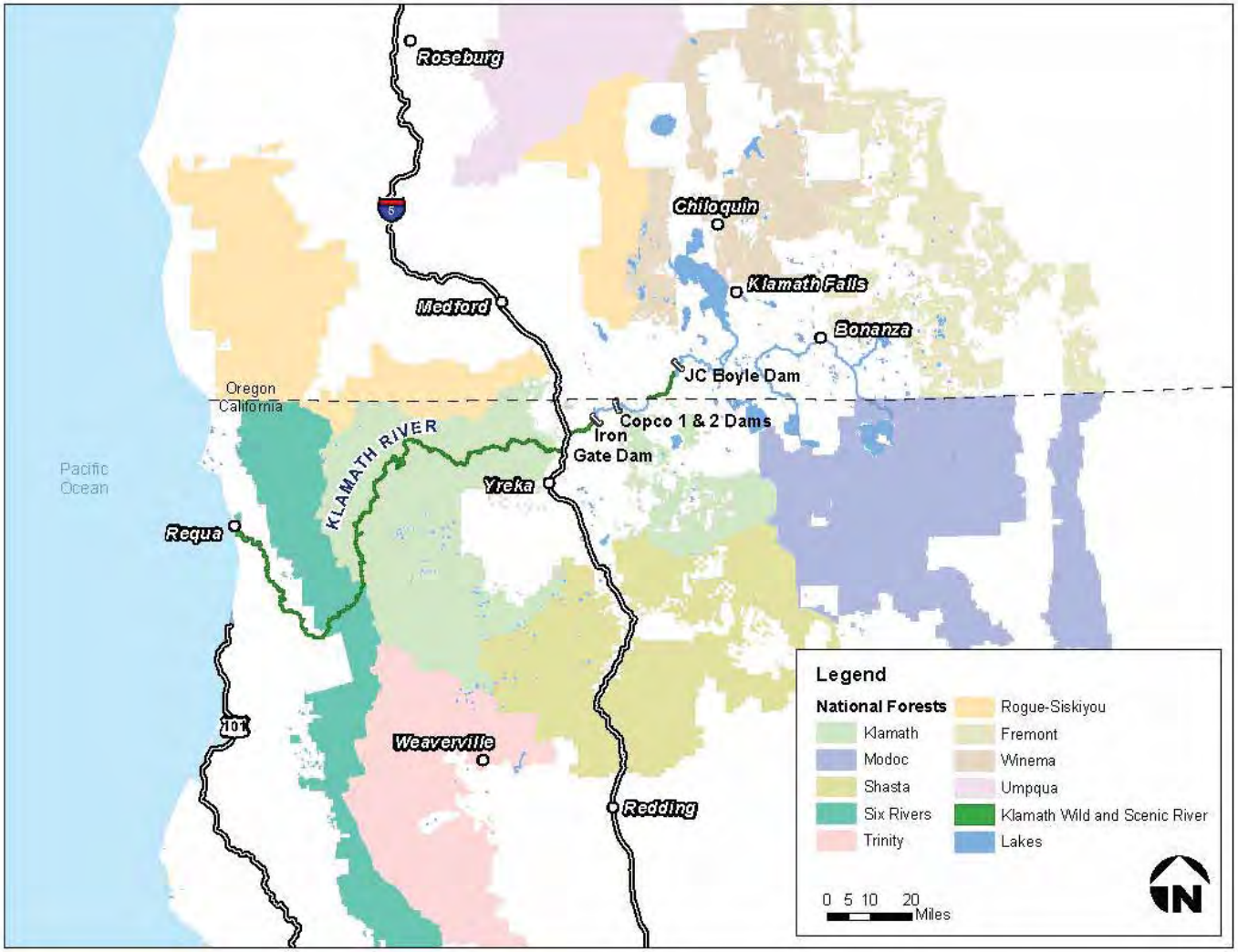

Figure 3.20-3. Klamath Wild and Scenic River Corridor.

Recreation

In the WSR designation, whitewater boating and recreational fishing were specifically mentioned by the Secretary as outstandingly remarkable values of the Upper Klamath WSR. Other popular recreation activities that occurred and continue within the recreation settings along the WSR reach include sightseeing, camping, hunting, OHV use, river swimming and water play, and upstream reservoir fishing and power boating (Bonacker et al. 2007). However, poor water quality conditions have adversely affected water play and river swimming within the WSR area (see section below). In 1994, at the time of the designation, the typical flow regime consisted of reliable and predictable daily hydropower peaking as provided by the KHP. Releases typically peaked in the mid-morning hours, and base flows typically occurred during the hours from late afternoon/early evening until morning. These releases provide whitewater boating opportunities throughout the summer and fall.

Water Quality

As stated in the 2006 Preliminary WSR Determination Report for the FERC relicensing EIS, during the fall, winter, and spring, at base flow, the water appearance is not influenced by the addition of spring water because water released from the reservoir has less algae, nutrients, and turbidity. However, at the time of designation, summer base flow resulted in shallow, slow-moving waters with large amounts of visibly algae-covered rocks.

Peaking operations from the KHP change the relative proportions of cool spring water from the Bypass Reach and warm water from the reservoir and powerhouse, which causes large artificial diurnal temperature fluctuations with higher daily maximum temperatures during power generation as compared to a run-of-river scenario. During peaking events, water appearance changes to a brownish, murky color; it is difficult to see to any depth; and large quantities of algal foam are produced and coalesce in river eddies below major rapids. During off-peak periods the relative contribution of cold clear spring discharge from the bypass reach dominates the flow (Bonacker et al. 2007).

Fisheries

The Upper Klamath River supports a genetically unique population of redband trout and two endangered species, the Lost River and shortnose suckers. The WSR designation report specified redband trout as an outstandingly remarkable value and also listed federally endangered Lost River and shortnose suckers, Klamath largescale suckers, and slender sculpin as “notable species.” At the time of designation, native fish species known or suspected to occur in the Upper Klamath WSR included redband/rainbow trout; Klamath smallscale, Klamath largescale, shortnose, and Lost River suckers; tui and blue chubs; lampreys (perhaps Klamath and Klamath pit brook); sculpins (perhaps marbled only); and Klamath speckled dace (Bonacker, et al. 2007).

Wildlife

The eligibility report identified that the WSR component provided a diversity of habitats for national, regional, and locally important populations of indigenous wildlife species, including exceptional populations of birds of prey, game and other birds, ringtail cats,

river otters, and other species. Numerous Federal and/or State-designated threatened or endangered species (including Federal and State species of concern) including peregrine falcons (*Falco peregrinus*), western pond turtles (*Clemmys marmorata marmorata*), and Townsend's big-eared bats (*Corynorhinus townsendii*) are dependent on the Klamath River. In addition, a high percentage of the wildlife species found in the Oregon Klamath WSR were identified to be directly dependent upon, or disproportionately use, riparian habitat for breeding, foraging, resting, and migration (Bonacker et al. 2007).

3.20.3.5.2 California Klamath River WSR Component

The segment of the Klamath River in California, beginning 3,600 feet below Iron Gate Dam and flowing 189 miles to the Pacific Ocean, as well as portions of three tributaries (Salmon and Scott Rivers and Wooley Creek) were added to the NWSRS in 1981 through Section 2(a)(ii) of the WSR Act. The mainstem California Klamath WSR is classified as recreational with portions of the tributaries classified as scenic and wild. The anadromous fishery is the outstandingly remarkable value for the entire 286 miles of the designated component, which includes the tributaries. The following subsections summarize the existing conditions in the Klamath River at the time of the WSR designation.

Scenic

Scenery within the California Klamath WSR is dominated by natural settings. Its characteristic river flows, water appearance, anadromous fish and riparian vegetation within a forested river canyon are the primary scenic aspects. Since 1981, flow regimes have varied moderately in response to water resource competition within the Klamath Basin. During summer months, these have typically been caused by water diversions (Van de Water et al. 2006). Also, as described in Sections 3.2, Water Quality, and 3.19, Scenic Quality, reduced water clarity and discoloration resulting from algae blooms has impaired the historic scenic character of reaches downstream from Iron Gate Dam. The level of reduced water clarity and discoloration and resulting scenic quality effects is dependent on viewer location. Views from on-river, in-river, or riverside viewpoints are most likely to display substantial changes to scenic quality indicators, while these changes are less likely to be noticed as viewed from nearby river canyon roadways and communities.

The river’s lowest historic flows since the WSR designation can be identified by gage data from United States Geological Survey (USGS) gage no.11516530 near Iron Gate Dam. The lowest monthly summer time flows within the 21-year historical record at Iron Gate Dam before 1981 represents the lower limits of characteristic flow variability, which still expresses its historic scenic character. Before 1981, USGS records show no Iron Gate Dam flow releases of less than 700 cfs; however, flows of less than 700 cfs occurred during 17 months between 1981 and 2004 (Van de Water et al. 2006). Since 2004, no flows of less than 700 cfs have occurred. The lowest monthly mean flows occur in summer (July and August) and have ranged from 823 to 1,373 cfs (USGS 2011). Similar to the scenic quality changes related to water quality conditions described above,

seasonal and project-induced changes in flow and resulting scenic quality changes are more likely to be observed by on-water, in-water and riverside viewpoints than nearby river canyon roadways and community viewpoints.

Recreation

The flows released from Iron Gate Dam greatly influence the river's summer recreation season's whitewater boatability, challenge levels, safety hazards, potential for equipment damage, and the opportunity to access and experience the river's full range of rapids and channels. Exceptionally low summer time flow releases are especially adverse to California Klamath WSR boating activities. Table 3.20-14 compares flows at the time of the 1981 designation to flow conditions required for whitewater boating and recreational fishing (see Table 3.20-6 for optimal flow ranges) (Van de Water et al. 2006).

Table 3.20-14. Comparison of 1981 Flows to the Acceptable Range for Whitewater Boating and Fishing

Month	Flows (cfs)	Whitewater Boating	Fishing
January	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
February	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
March	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
April	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
May	1,000	In acceptable boating flow range/optimal playboating range	In optimal range
June	710	Does not meet minimum boatable flow or playboating opportunities	Does not meet minimum fishing flow
July	710	Does not meet minimum boatable flow or playboating opportunities	Does not meet minimum fishing flow
August	1,000	In acceptable boating flow range/optimal playboating range	In optimal range
September	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
October	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
November	1,300	In acceptable boating flow range/optimal playboating range	In optimal range
December	1,300	In acceptable boating flow range/optimal playboating range	In optimal range

Source: Van de Water et al. 2006.
Key:
cfs: cubic feet per second

Although precise estimates of available recreation days in 1981 are not available, commercial recreational whitewater boating activity on the Klamath National Forest portion of the California Klamath WSR increased by approximately 34 percent between

1981 and 2005 (Van de Water et al. 2006). However, commercial activity on the lower Klamath River has decreased somewhat since 2005 from a recorded 10,695 user days to 8,230 user days in 2009, a trend consistent with other western rivers. Private recreational whitewater boating activity has followed a similar pattern, with the greatest number of user days between 1995 and 2005 (ranging from 4,193 to5,230) and decreasing somewhat since 2005 to a low of 3,525 user days in 2009, as summarized in Section 3.15, Socioeconomics (DOI 2011).

Water Quality

Water quality issues have existed since the time of WSR designation and there is evidence indicating that these issues may have increased since that time, and even more progressively over the past 5 years (Kann and Corum 2009). Water quality issues in the Klamath, including algae blooms and microcystin toxin from one species of blue-green algae, affect river recreation users (see discussion of Public Health Issues in Section 3.20.3.4 above). Results of the toxic algal monitoring program conducted by the Karuk Tribe between 2005 and 2007 at 16 near shore stations in the Klamath River below Iron Gate Dam indicate that nearly 60 percent of samples taken between June and September exceeded the moderate risk level as defined by the WHO (Kann and Corum 2009). Additional sampling conducted in 2007 shows that the microcystin toxin is found as far downstream as the Yurok Reservation, near the river mouth (Kann 2006). In addition, the entire length of the California WSR currently does not meet NCRWQCB water quality objectives for temperature (NCRWQCB 2007). A detailed description of existing water quality is provided in Section 3.2, Water Quality.

Fisheries

The Klamath River was designated a WSR because of its free-flowing condition and its outstandingly remarkable anadromous fisheries, including that of salmon and steelhead trout. Even at the time of designation, decreasing salmonid trends in the Klamath River system were identified as being affected by various factors, including dam construction and operations related to hydropower generation in the Klamath River. Such factors have resulted in increased summer water temperatures, changed the natural flow regime, decreased dissolved oxygen levels in portions of the river, and blocked access to more than 350 miles of spawning, incubation, and rearing habitat. Scientific evidence shows that Chinook salmon, coho salmon, cutthroat trout, and steelhead trout were historically present above Iron Gate Dam (Hamilton et al. 2005).

According to a 1981 California Department of Water Resources (CDWR) study, spawning conditions in the reach immediately downstream from Iron Gate Dam were already impaired due to a coarsening of the bed below the dam. Although the reach below Iron Gate Dam was historically a prime spawning area, by 1981 the reach produced few salmon and the riffles within the reach contained cobbles too large for salmon to move. Prior to the 1981 WSR designation, the reach between Iron Gate Dam and Shasta River was scoured by daily peak flows from Copco 1 and Copco 2 operations prior to the construction of Iron Gate Dam (Van de Water et al. 2006).

Streambed armoring as a result of low flows and reduced gravel recruitment can decrease habitat diversity within channels, making the river less hospitable to juvenile salmonids. Armoring can also lead to the cementation of spawning gravels, impairing the ability of spawning adults to make redds. Armoring can also decrease the amount of habitat available (interstitial spaces) to macroinvertebrates, an important food source for fish. Given the findings of the 2006 study, it appears that much of the riverbed coarsening had occurred prior to the WSR designation (Van de Water et al. 2006). However, impacts from dams progress over time so one would expect that continued sediment depletion (by the retention of sediment behind the dams) would continue to worsen spawning habitat below the dam (Ligon et al. 1995; Kondolf 1997; and Grant et al. 2003).

River flows also affect fisheries' population and abundance. Table 3.20-14 shows the monthly flows at the time of the WSR designation. Flows are a key component of cumulative effects from water management on the aquatic environment. The flow regime downstream from Iron Gate Dam affects aquatic resources through instream flow influences on physical habitat (depth, velocity, substrate, and cover) and on water quality that may affect the prevalence of disease pathogens (Bartholow et al. 2005).

Estimates of abundance for anadromous fisheries at the time of the WSR designation are not available for all species. Table 3.20-15 provides estimates of abundance at the time of designation, or as near as possible to the time of designation for those species for which data is available. As discussed in Section 3.3, Aquatic Resources, the abundance of anadromous fisheries has decreased since the time of the WSR designation. Specific units of coho salmon in the Klamath River were listed as threatened under the ESA in 1997. Similarly, the green sturgeon was listed by NOAA Fisheries Service as a Species of Concern in 2005 and designated as threatened under the ESA in 2010. The Lost River and shortnose sucker were designated as endangered in 1988 after the WSR designation in California and after the designation in Oregon.

Table 3.20-15. Estimated Abundance of Fish Species at the 1981 WSR Designation

Species	Estimated Abundance
fall Chinook salmon	Natural spawners – 4,000 (1981)
	Iron Gate hatchery spawners – 21,595 (1981)
coho salmon	3,400 (1984)
summer Steelhead	110,000 (average 1977-1991)
winter Steelhead	20,000 (average 1977-1991)

Source: Van de Water et al. 2006

Wildlife

Wildlife populations have not been systematically surveyed on the Klamath River. Baseline data were not collected in 1981; therefore, population numbers or trends are not available for most species in specific areas like the WSR corridor.

Riparian vegetation provides habitat for feeding, breeding, and sheltering for willow flycatchers, western pond turtles (a species of special concern in California) and various other wildlife species along the river. There is no reference condition for the riparian vegetation in 1981 (Van de Water et al. 2006). The project area includes a large number and diversity of wildlife species. Surveys conducted by PacifiCorp in 2002 and 2003 identified five amphibian species, numerous bird species, including 19 species of birds of prey, and numerous mammal species, including black-tailed jackrabbit, mule deer, and California ground squirrels. See Section 3.5, Terrestrial Resources, for further discussion of wildlife populations within the Klamath River corridor.

3.20.3.5.3 Eligible and Suitable WSR Section on the Klamath River

In 1990, BLM found the 5.3-mile section of the Klamath River from the Oregon/ California State line to the slack water of Copco 1 Reservoir to be eligible and suitable for WSR designation under Section 5(d)(1) of the Act. The river segment is free-flowing and possesses outstandingly remarkable scenic, recreational, fish, and wildlife values. This river segment is not a designated WSR and is not protected under the WSRA and its Section 7(a) requirements. The BLM is required within its authorities, to protect this suitable river segment's free-flowing character, water quality, and outstandingly remarkable river values. This segment of the Klamath River is also listed on the Nationwide Rivers Inventory (NRI) (NPS 2009). If a river is listed in the NRI, the Federal agency involved with the action must consult with the land managing agency in an attempt to avoid or mitigate adverse effects of any proposed water resources projects. This consultation is required pursuant to a directive from the Council on Environmental Quality.

3.20.4 Environmental Consequences

3.20.4.1 Effects Determination Methods

This discussion of environmental effects considers the implications of the Proposed Action and identified alternatives on the potential changes to river- and reservoir-based recreation opportunities, activities, and settings within the study area. The relocation of the City of Yreka's water supply pipeline is not expected to result in any impacts to recreational resources; therefore, it is not addressed in this section of the EIS/EIR. The analysis presented below includes an assessment of both short-term and long-term effects on access, flow-dependent recreational activities, recreational fishing, and other recreational activities associated with the existing Klamath River corridor and reservoir recreational facilities within the study area.

3.20.4.1.1 Recreational Setting, Facilities, and Access

Likely changes to recreational use and access under each identified alternative were assessed qualitatively, including changes from reservoir-based recreational opportunities to more river-based opportunities in the areas where the dams, recreational facilities, and/or PacifiCorp facilities would be removed. The short-term effects analysis includes a discussion of potential areas where recreational access would be restricted due to

construction activities. The assessment of long-term effects discusses potential changes in the recreational setting and experience, changes in water quality and reservoir area revegetation.

3.20.4.1.2 Whitewater Boating Opportunities

Optimal and acceptable flows for whitewater boating opportunities along reaches of the Klamath River were assessed as a part of the technical review completed for the Secretarial Determination. The range of acceptable flows resulted from the Final Technical Report, Klamath Hydroelectric Project (PacifiCorp 2004b). Flow values that fall within these ranges are considered acceptable flow levels for the various activities (see Table 3.20-6).

The Lead Agencies conducted hydrologic modeling to assess changes in the availability of acceptable flows under the various alternatives. The Lead Agencies subjected the modeling results for each water year type to a statistical analysis (paired T-tests) to determine whether the difference in number of days meeting the acceptable range of flows following dam removal (both on an annual and monthly basis) would be statistically significant. The Lead Agencies used a qualitative approach to assess the effects of the identified alternatives on whitewater boating access and existing whitewater boating opportunities.

3.20.4.1.3 Recreational Fishing Opportunities

The Lead Agencies used the results of the hydrologic modeling to; determine whether changes in flow would affect recreational fishing opportunities (i.e., number of days with optimal flows for recreational fishing), qualitatively assess potential changes in fisheries populations and abundance; and determine effects of changes from reservoir-based fishing opportunities to river-based opportunities.

3.20.4.1.4 Other Recreational Opportunities

The analysis also includes an assessment of other recreational activities, such as sightseeing, swimming/wading/tubing, fish and wildlife viewing, and camping that occur within the river corridor and a qualitative discussion of the effects of the various alternatives on these activities. The discussion here covers both anticipated short-term effects, such as construction-related effects, and long-term effects, such as changes in reservoir-based swimming opportunities.

3.20.4.2 Recreation Significance Criteria

For the purposes of the EIS/EIR, the following Recreation impacts would be significant if they would result in the following:

- Substantial restrictions on recreational access or reduction in the quality of recreational experiences in the vicinity of the subject reservoirs;
- Substantial decreases in the availability of reservoir/lake-based recreational opportunities;
- Substantial reduction in the quality of water-contact-based recreational activities;
- Substantial decreases in access for whitewater boating opportunities;

- Substantial changes in the amount of days providing acceptable flows for recreational activities.

3.20.4.3 Effects Determinations

3.20.4.3.1 Alternative 1: No Action/No Project

The No Action/No Project Alternative would not change existing recreation access and opportunities. Under the No Action/No Project Alternative, no change to existing conditions, recreational facilities or opportunities at J.C. Boyle, Copco 1, or Iron Gate Reservoirs would occur. Similarly, whitewater boating and recreational fishing opportunities in reaches between J.C. Boyle Dam and Copco Reservoir and downstream from Iron Gate Dam would remain as described in the Affected Environment. As described in the Affected Environment, recreation activities in the reaches between J.C. Boyle Dam and Copco Reservoir (e.g., Hell's Corner Reach) are flow-dependent and rely on daily peaking hydropower operations.

Under the No Action/No Project Alternative, these operations would continue and opportunities for whitewater boating and fishing in these reaches would remain as described. Within the subject reservoirs and downstream from Iron Gate Dam, poor water quality conditions and decreased abundance of anadromous fish species have resulted in adverse existing conditions for recreational activities, including complete closures of fishing seasons for certain species and public health warnings against water-contact-based activities during algal blooms in the summer. **Under the No Action/No Project Alternative, existing impacts on recreational fishing within the river and water-contact-based activities at the subject reservoirs would have no change from existing conditions.**

3.20.4.3.2 Ongoing Restoration Actions

Ongoing restoration actions would continue to take place under the No Action/No Project Alternative. Construction and implementation activities associated with these ongoing projects could result in effects to recreational resources and opportunities in the areas where construction takes place.

Ongoing actions considered for impact to recreational resources under the No Action/No Project Alternative include:

- Ongoing restoration actions
- Agency Lake and Barnes Ranches project

Construction activities associated with ongoing programs could temporarily restrict access to recreational opportunities. Construction activities including channel construction, floodplain rehabilitation, fish passage and facilities construction, and breaching levees would likely involve the use of heavy equipment along floodplain and riparian areas and could result in restrictions to public access for recreational activities, such as sightseeing, bank fishing, swimming, and wading. Because restoration activities would occur throughout the entire basin, specific sections of the river could be closed for a period of time throughout implementation of the ongoing restoration programs.

However, as described in the Affected Environment section, there are a number of recreational areas offering similar activities and settings throughout the basin. It is likely that for any particular project, there would be an alternative recreational area nearby that could be used during temporary closures. **Thus, potential impacts to recreational opportunities would be less than significant. Implementation of specific projects will require future environmental compliance as appropriate.**

Construction activities could result in short-term water quality impacts which could affect recreational opportunities. Erosion and sedimentation during construction activities has the potential to temporarily decrease water quality and reduce water visibility for boaters, swimmers, and fisherman. These short-term water quality impacts would be anticipated to occur throughout the basin where construction activities take place. Specific sections of the river could be affected for a period of time throughout implementation of the ongoing restoration programs. However, following implementation and related construction activities for ongoing restoration programs water quality and clarity in Upper Klamath Lake would be expected to improve. Additionally, as described above, short-term impacts would be offset by the ability of visitors and local recreationalists to use recreational areas with similar activities and settings throughout the basin. **Potential impacts would be short term and, with implementation of construction best management practices (BMPs), would cause less than significant water quality related recreational impacts. Implementation of specific projects will require future environmental compliance as appropriate.**

Ongoing actions correcting fish passage issues, reintroducing and monitoring fish species, and restoring aquatic habitat could increase recreational fishing and wildlife viewing opportunities in the basin. It is expected that correction of fish passage issues throughout the basin would restore fish access to new and historic habitats and result in increased fish populations. Ongoing restoration programs could continue to improve fish passage and habitat conditions in the basin which could benefit recreational fishing opportunities. **It is expected that continued implementation of restoration programs would benefit recreational experiences throughout the Klamath Basin. Implementation of specific projects will require future environmental compliance as appropriate.**

3.20.4.3.3 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

Demolition activities could temporarily restrict recreational access in the vicinity of the reservoirs. Short-term demolition activities associated with dam removal would result in temporary loss of access to recreational facilities at the subject reservoirs and associated reservoir-based recreational opportunities. Access could remain restricted for an additional period following completion of dam removal as restoration activities are conducted on the former reservoir area and existing recreational areas are modified to accommodate the new river channel. However, as described in Section 3.20.3.1, Regional Opportunities, a number of reservoirs and lakes are present within and adjacent to the Klamath Basin and provide similar opportunities for recreational activity. **Therefore, temporary impacts on recreational access in the vicinity of the subject reservoirs would be less than significant.**

Temporary impacts from demolition activity (i.e., increased noise and dust) could decrease the quality of recreational experiences in the vicinity of the reservoirs. As described in Section 3.9, Air Quality, and Section 3.23, Noise and Vibration, the use of heavy vehicles and equipment during dam removal would result in a temporary increase in dust and ambient noise in the vicinity of the subject reservoirs. These increases could indirectly result in a decrease in the quality of recreational experiences at nearby facilities that would not have restricted access during construction (e.g., trails and private parks not directly affected by construction). Specific effects related to noise and dust are discussed in detail in their respective sections; with regard to recreational activities, increases in ambient noise and air pollutants could impede visitors' ability to rest and relax, and disrupt bird and wildlife viewing opportunities. These effects would last for the duration of demolition activity; however, as shown in Figures 3.20-2(a-c), the majority of recreation facilities and access points at the subject reservoirs are located a distance away from the dams and would continue to provide opportunities for recreation until drawdown is completed. Further, as described in Section 3.20.3.1, Regional Opportunities, numerous other recreational areas are available within the vicinity of the subject reservoirs that provide similar recreational opportunities. **Therefore, these temporary noise and dust impacts would be less than significant.**

Dam removal could permanently decrease the availability of reservoir/lake-based recreational opportunities in the area of analysis. The removal of the Four Facilities would eliminate existing opportunities for reservoir-based recreation activities, such as power boating, waterskiing, lake swimming, and flat water boat angling, provided at J.C. Boyle, Copco 1, and Iron Gate Reservoirs. As discussed in the Affected Environment section, the subject reservoirs are popular recreational areas for sightseeing, fishing, camping, swimming, boating, and wildlife viewing and attract visitors primarily from the surrounding communities in Klamath and Jackson County, Oregon and Siskiyou County, California. As indicated in the responses to visitor use surveys conducted by PacifiCorp, the reservoirs are popular recreation areas in part because they are uncrowded relative to other lakes in the area and do not require user fees. Some activities associated with reservoir recreation could still be possible in the newly created river channel (e.g., swimming and wading). However, due to increased flows, certain reservoir-based recreation such as swimming opportunities and flat water boating may be limited in the newly formed river channel during certain times of year and in wet water years. Additionally, the types of river-based recreational opportunities available following dam removal including camping in a river setting as opposed to camping in a lake/reservoir setting, may not appeal to the same recreational users who currently visit and recreate at J.C. Boyle, Copco 1, and Iron Gate Reservoirs. Thus, there would be a permanent loss of reservoir-based recreational opportunities at the project reservoirs. While new recreation opportunities would exist along the newly formed river, there could be a change in user type. People specifically seeking lake or reservoir-based recreation would have to travel to and use other lakes and reservoirs in the region.

As shown in Table 3.20-4, a number of other lakes and reservoirs are in the vicinity of the subject reservoirs and provide similar opportunities for recreation in an uncrowded

setting. Specifically, Table 3.20-4 shows that Fourmile Lake, Agency Lake, Applegate Reservoir, and Medicine Lake, located from 26-46 miles away from the subject reservoirs, each have low generalized use levels as well as similar or greater surface area, number of developed campsites, and number of improved boat launches. These four regional lakes have fewer developed picnic areas (PacifiCorp 2004). Given the presence and proximity of these regional lakes as well as the other lakes and reservoirs summarized in Table 3.20-4, the loss of the subject reservoirs would not result in a substantial decrease in regional lake-based recreational opportunities. Further, recreational opportunities would remain available on and along the newly created river channel. **Therefore, impacts on the regional availability of reservoir-based recreational opportunities would be less than significant**.

Dam removal could permanently remove recreational facilities associated with the reservoirs. Under the Proposed Action, the recreational facilities constructed to accommodate reservoir recreation, with the exception of Topsy Campground, Fall Creek and Jenny Creek Day Use Areas, and the Iron Gate Fish Hatchery Day Use Area, would be completely removed and the former recreation areas, parking areas, and access trails would be regraded and revegetated (Reclamation 2011). This would result in a permanent decrease in river access points. Dam removal would permanently decrease the availability of reservoir recreational opportunities (as described above), and the removal of existing recreational facilities would limit access to recreational opportunities along and within the newly formed river channel. However, as described in Section 3.20.3.1 Regional Opportunities, a number of reservoirs and lakes are present within and adjacent to the Klamath Basin and provide similar opportunities for recreational activity. **These impacts on recreational facilities associated with the subject reservoirs would be considered permanent; however, implementation of Mitigation Measure REC-1, while providing for a different type of use would ensure that these impacts in the long term would be less than significant.**

Dam removal could adversely affect developed recreational facilities upstream and downstream from the subject reservoirs. No impacts on recreational facilities upstream of the dam removal sites would occur as a result of removal of the Four Facilities because any changes to flow and water quality would occur downstream from J.C. Boyle Dam and Topsy Recreation site on J.C. Boyle Reservoir will be reconfigured to provide river access. However, as discussed in Section 3.3, Aquatic Resources, removal of the dams would help restore the presence of anadromous fish to the Klamath River above J.C. Boyle reservoir which would beneficially affect recreational fishing at these upstream facilities. Removal of the dams is expected to result in water quality improvements downstream from Iron Gate Dam (see Section 3.2, Water Quality), which could improve visitor perceptions and attract a greater number of visitors to existing recreational facilities. However, land-based facilities would not be physically affected by removal of the dams and drawdown of the reservoirs, since, as discussed in Section 3.11, Geology, Soils, and Geologic Hazards. The river is largely confined by bedrock and there would be little change to floodplain areas or the river channel itself. **Any impacts on upstream and downstream recreational facilities would be less than significant.**

Sediment release downstream during reservoir drawdown could decrease the quality of water-contact-based recreational opportunities. As discussed in Section 3.2, Water Quality, drawdown of the reservoirs would result in short-term increases in turbidity downstream from the PacifiCorp reservoirs. Turbidity would be most pronounced immediately downstream from Iron Gate Dam (between Iron Gate Dam and Bogus Creek), and less so farther downstream, and is expected to be flushed through the system quickly (less than 2 years). This increase in turbidity would reduce visibility for boaters, swimmers, and fisherman during the sediment flushing period and could result in reduced public draw for these activities (e.g., swimmers might be less likely to enter the river and fisherman might be less successful due to the reduced water clarity). Increased turbidity would also affect safety considerations during swimming if swimmers are unable to see the river bottom or navigate around obstacles, such as large boulders or logs beneath the water surface. However, impacts would be temporary; following completion of reservoir drawdown activities, water quality and clarity would be expected to improve as sediments are flushed downstream and into the Pacific Ocean. Impacts would not be widespread throughout the river; opportunities for fishing and swimming in non-turbid waters would remain available during the drawdown period.

Sediment release could also decrease the quality of water-contact-based recreational opportunities if sediment released downstream resulted in longer-term deposition in pools, eddies, slack water, and beaches and decreased the availability of these areas for recreational activity. As discussed in Section 3.11, Geology, Soils, and Geologic Hazards, modeling was conducted to determine the potential for such deposition following dam removal. The results of the modeling indicated that following dam removal, deposition would occur primarily between Iron Gate Dam and Cottonwood Creek and there would be no substantial change in river bed elevation. The Proposed Action was developed to allow reservoir drawdown to occur during winter months when precipitation, river flows, and turbidity are naturally highest. Suspended sediments would be highest during the period of greatest reservoir drawdown (January through Mid March 2020), as erodible material behind the dams is mobilized downstream (Reclamation 2012). During normal to dry water years, suspended sediment concentrations would begin to decline in late March 2020 and would continue declining through early summer 2020 (Reclamation 2012). If it is a wet year, it may take longer to drain the reservoirs and the high concentrations may extend until June. Suspended sediments will be near background conditions for all water year types within the first year following removal. (Aquatic Resources Section 3.4.3.2.1.1) Therefore, it is unlikely that sediment release would decrease the availability of pools, eddies, or beaches for recreational activity, even temporarily. **Therefore, impacts on the quality of water-contact-based recreational opportunities would be short term and less than significant.**

Changes in water quality associated with dam removal could positively affect water-contact-based recreational opportunities. Dam removal is expected to result in long-term improvements in water quality, notably decreased prevalence of microcystin toxin (see Section 3.2, Water Quality). As discussed in Section 3.2, Water Quality and

3.20.3.2 above, microcystin toxin has been associated with public health risks for recreational bathing waters and health warnings issued in 2005 and 2008 by the USEPA and other agencies warned recreation visitors to use caution due to potential health effects. In addition, about two-thirds of recreation visitors to the subject reservoirs had negative perceptions of water quality, stating concerns of bad odors and algae blooms, which restrict areas available for fishing, swimming and wading. These adverse effects related to water quality negatively influenced the quality of the recreational experience for visitors and also resulted in safety risks to the recreational visitors. **Because existing conditions for water-contact-based recreational activities are considered adverse due to water quality, improved water quality conditions would result in long-term beneficial effects.**

Dam removal could impede access for whitewater boating opportunities. Dam removal would not affect whitewater boating access locations, as access areas are at established areas along the Klamath River channel, outside of the subject reservoirs and would not be affected by dam removal. As discussed in the impact analysis above and in Section 3.11, Geology, Soils, and Geologic Hazards, drawdown of the reservoirs would not result in substantial changes to the floodplain or river channel. Thus, no impacts to land-based recreational facilities are expected. **Therefore, there would be no adverse impacts on whitewater boating access downstream from Iron Gate Dam.** However, in the reaches between the existing dams, particularly in the Hell's Corner Reach, whitewater boating access would likely be affected due to dam removal activities and sedimentation, as discussed previously. **Impacts in reaches between the existing dams would be short term and less than significant**.

Dam removal could increase the number of days with acceptable flows for various whitewater boating and recreational fishing in the Keno Reach and reaches downstream from Iron Gate Dam. The Lead Agencies modeled the average number of days providing acceptable river flows in specific reaches each month for specific recreational activities, both with and without dam removal (full modeling data is presented in Appendix R; DOI 2011). Table 3.20-16 presents a summary of the model results, and Figures 3.20-4 through 3.20-11 show the results for each of the river reaches. For the Keno Reach (see Figure 3.20-4) and the reaches downstream from Iron Gate Dam (Figures 3.20-8 through 3.20-11), the changes in the availability of flows within the acceptable flow ranges for whitewater boating and fishing opportunities would be negligible. However, as described in Section 3.20.3.2, existing difficult access to the Keno Reach, including a flat water paddle above J.C. Boyle Dam, currently limits recreational use of this area. Dam removal would likely improve access to the Keno Reach and would benefit whitewater boating and fishing opportunities in this area. **Given negligible changes in flows and improvements in access, there would be long-term beneficial effects on whitewater boating and fishing opportunities in the Keno Reach. Impacts in reaches downstream from Iron Gate Dam would be less than significant.**

Table 3.20-16. Estimated Number of Days Meeting the Range of Acceptable Flows for Recreational Activities on the Klamath River

River Reach	Activity	Acceptable Flow Range		Total Avg. No Days Annually		
		Low Value (cfs)	High Value (cfs)	Dams In	Dams Out	Percent Change
Keno Reach	Whitewater Boating	1,000	4,000	151	139	-7.9%
	Fishing	200	1,500	246	238	-3.5%
J.C. Boyle Bypass Reach	Whitewater Boating	1,300	1,800	5	41	793.6%
	Fishing	200	1,000	107	142	32.6%
Hell's Corner Reach	Whitewater Boating/Kayaking	1,000	3,500	332	189	-43%
	Whitewater Boating/Rafting	1,300	3, 500	278	119	-57.1%
	Fishing	200	1,500	234	228	-2.7%
Copco 2 Bypass Reach	Whitewater Boating	600	1,500	10	223	2,083.8%
	Fishing	50	600	14	3	-79.4%
Iron Gate to Scott River	Whitewater Boating/Fishing	800	4,000	278	281	1.0%
Scott River to Salmon River	Boating	800	7,000	243	246	1.4%
	Fishing	800	4,000	175	182	4.2%
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	207	211	1.8%
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	239	238	-0.2%

Source: Reclamation 2012b; Reclamation 2012c; PacifiCorp 2004; FERC 2007; Greimann 2012
Key:
cfs: cubic feet per second

Dam removal could increase the number of days with acceptable flows for whitewater boating and recreational fishing in the J.C. Boyle and Copco 2 Bypass Reaches. There would be a substantial increase in the availability of whitewater boating flows within the acceptable flow range for the J.C. Boyle Bypass Reach, particularly during the May through July time period. Based on the modeling results, under the dams out scenario, there would be a shift from the availability of acceptable fishing flows during July/August time period to March through May time period (see Figure 3.20-5 and Appendix R for full data). For the Copco 2 Bypass Reach there would be a substantial increase in whitewater boating opportunities during the July through September time period (see Figure 3.20-7 and Appendix R for full data) and a slight reduction in length of time for Copco 2 for fishing, primarily a reduction during May time period in the availability of acceptable flows. **Therefore, there would be long-term beneficial effects on whitewater boating in the J.C. Boyle and Copco 2 Bypass Reaches. In regards to fishing opportunities in these reaches, the impacts would be less than significant.**

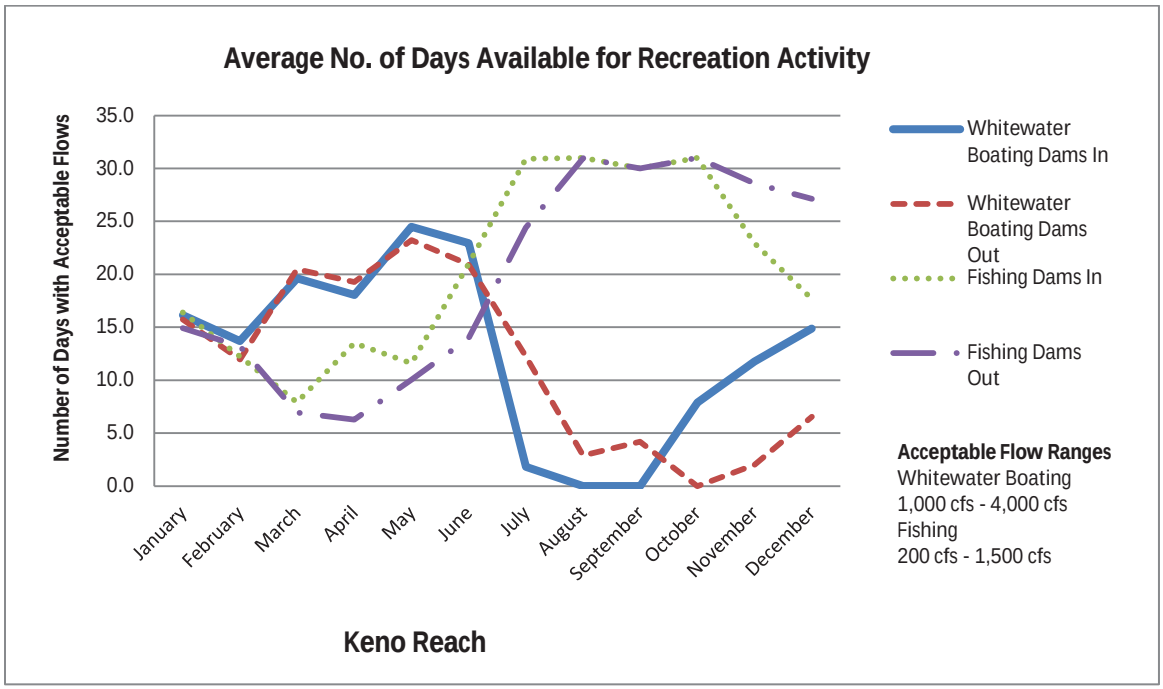

Figure 3.20-4. Comparison of Available Recreation Flows - Keno Reach.

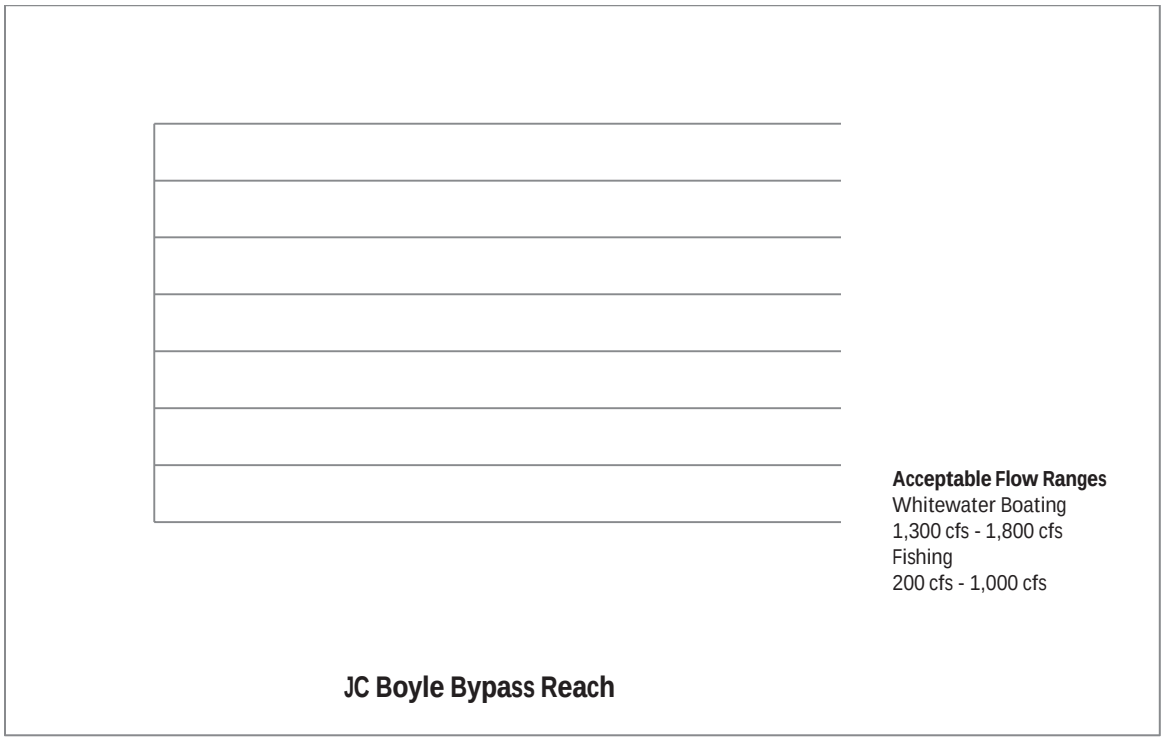

Figure 3.20-5. Comparison of Available Recreation Flows - JC Boyle Bypass Reach.

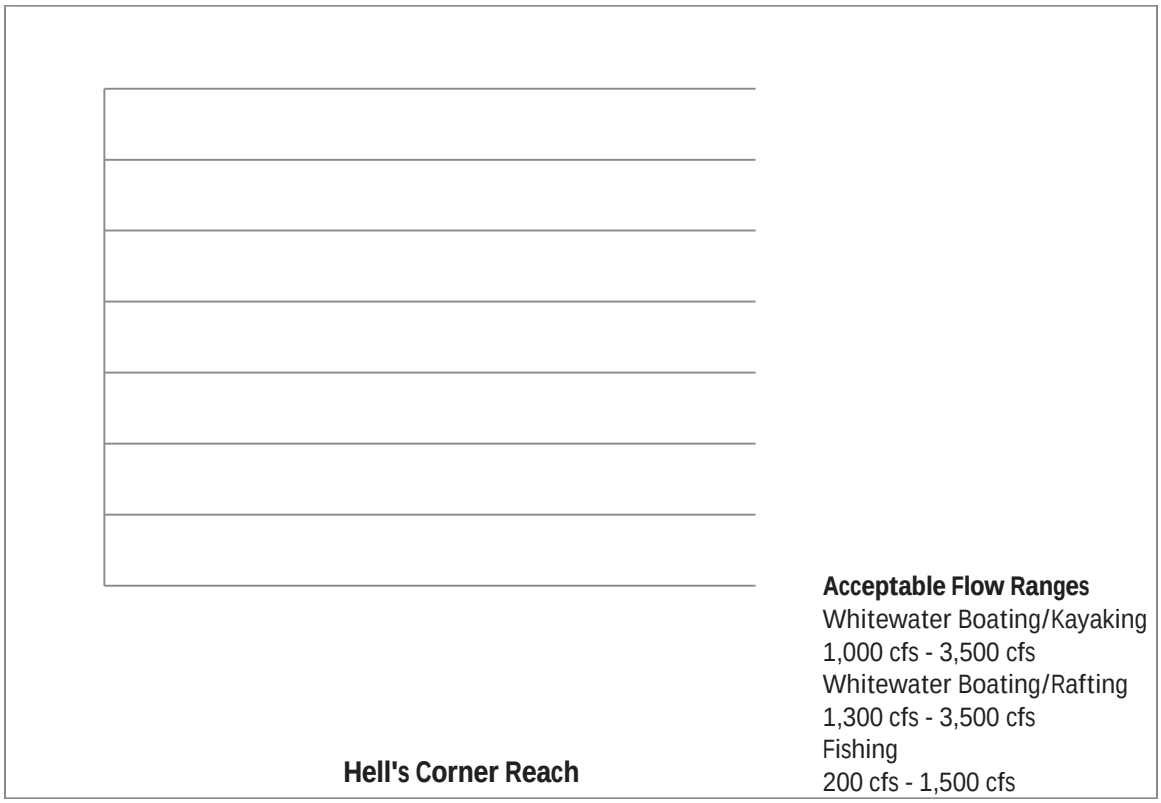

Figure 3.20-6. Comparison of Available Recreation Flows - Hell's Corner Reach.

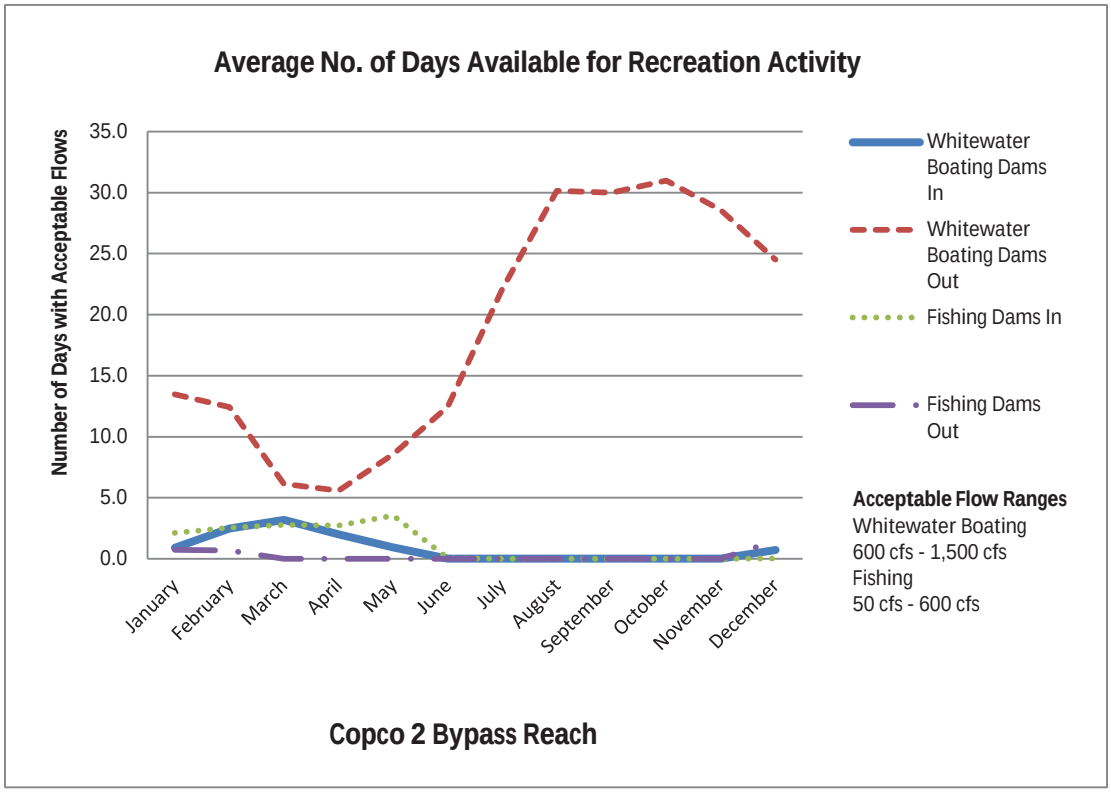

Figure 3.20-7. Comparison of Available Recreation Flows - Copco 2 Bypass Reach.

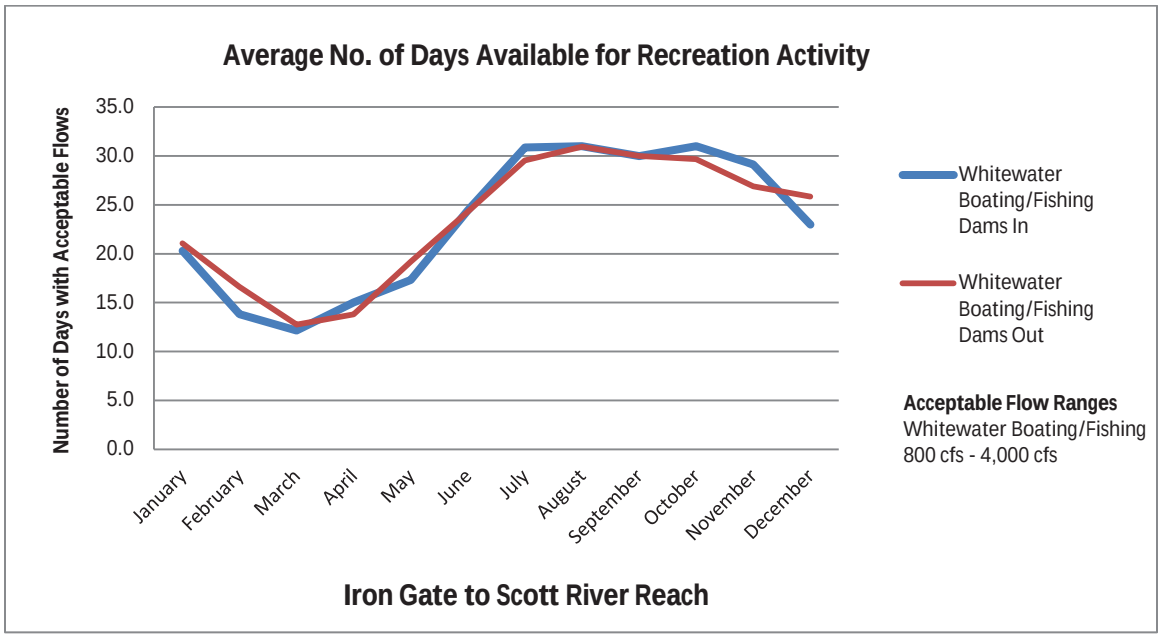

Figure 3.20-8. Comparison of Available Recreation Flows - Iron Gate to Scott River Reach

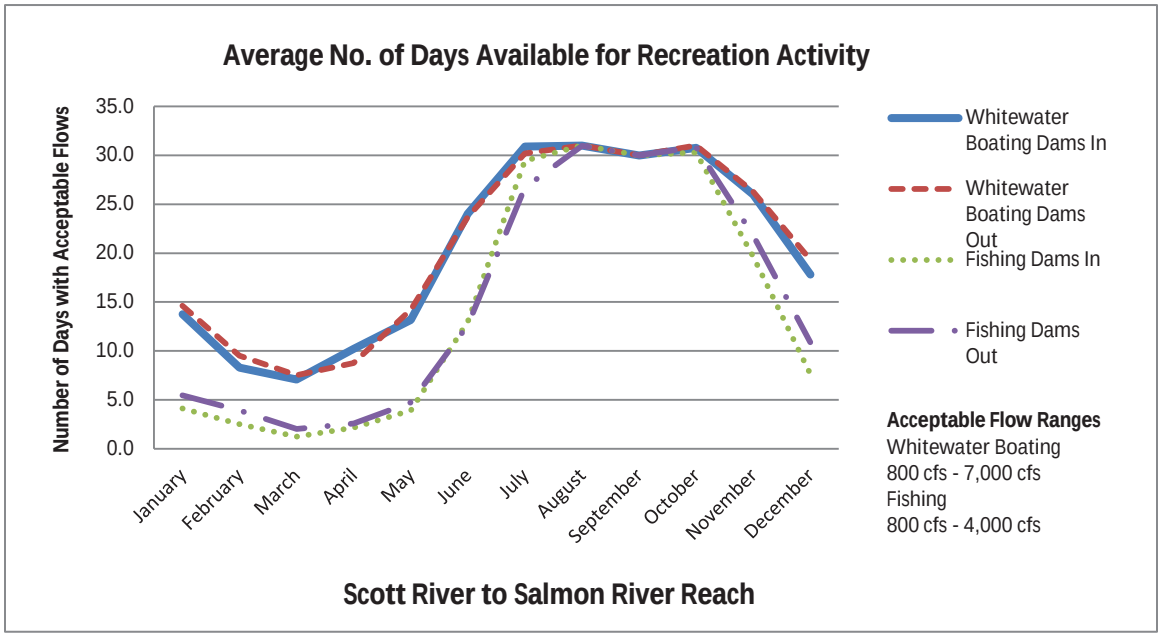

Figure 3.20-9. Comparison of Available Recreation Flows - Scott River to Salmon River Reach

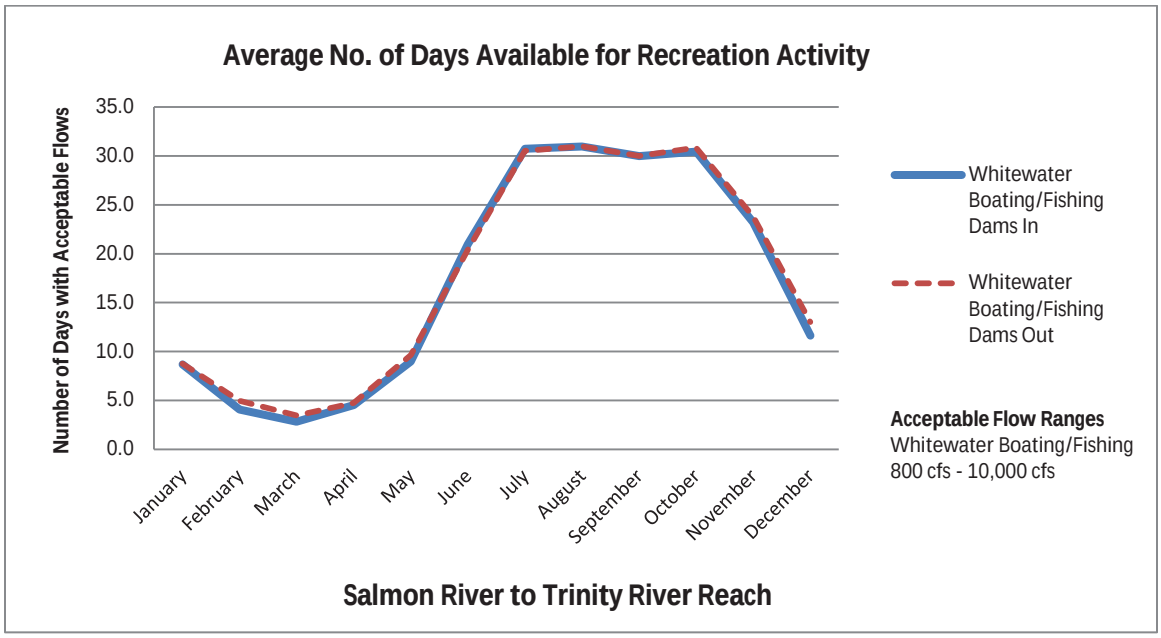

Figure 3.20-10. Comparison of Available Recreation Flows - Salmon River to Trinity River Reach

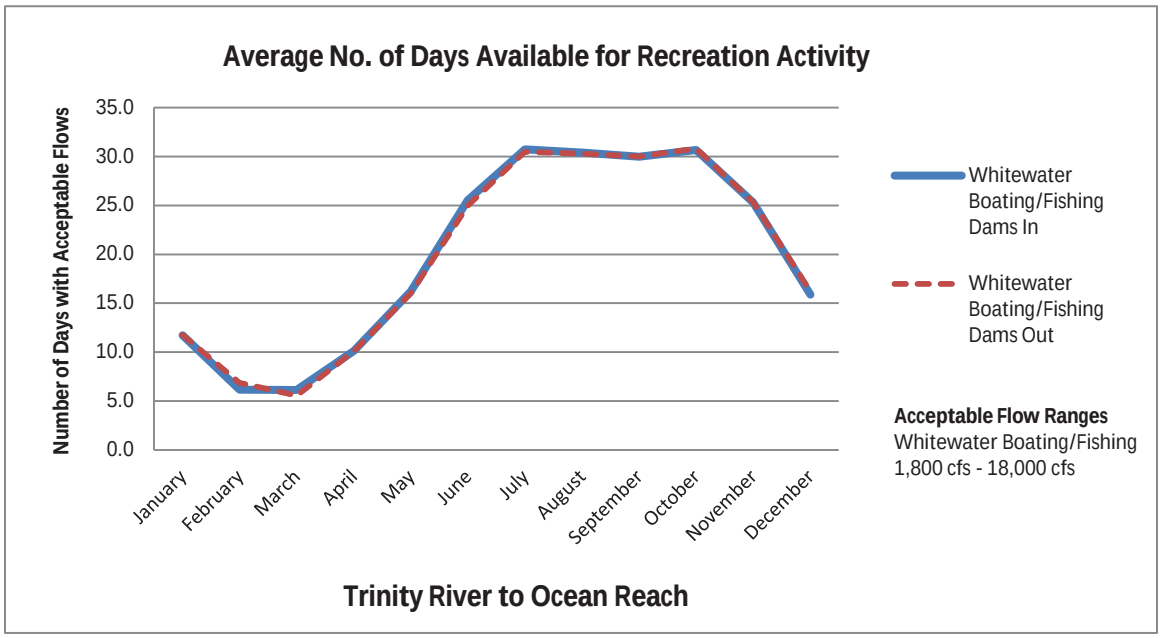

Figure 3.20-11. Comparison of Available Recreation Flows - Trinity River to Ocean Reach

Dam removal could decrease the number of days with acceptable flows for whitewater boating in the Hell's Corner Reach. For the Hell's Corner Reach (see Figure 3.20-6), there would be loss of acceptable flows for whitewater boating opportunities as compared to existing conditions For flows in the range of from 1000-3500 cfs there are modeled decreases of 49%, 58% and 35% respectively in the high demand months of July, August and September. Similarly, for flows from 1300-3500 cfs the reductions would be 36%, 88% and 76% for the same months (Recreation Sub-Team 2010; PacifiCorp 2004b; FERC 2007; Greimann 2012). See Appendix R.

Currently, the Hell's Corner Reach is the only Class IV+ rapids in the region with late summer flows. Whitewater rafters can boat on the Hell's Corner Reach from April through October due to hydroelectric peaking power and flows historically generated by J.C. Boyle Powerhouse to meet high power demand periods. In terms of fishing opportunities, there would be a reduction in the availability of acceptable flows during April; however, overall, the impacts would be minor. **Impacts on whitewater boating opportunities in the Hell's Corner Reach would be significant and unmitigable**. **Impacts on fishing would be less than significant.**

Dam removal could result in increased fisheries populations and abundance, which would improve recreational fishing along the river. As discussed in Section 3.3, Aquatic Resources, removal of the dams would improve habitat conditions for anadromous fish species and redband trout and is expected to result in increased populations of these species. The increased fisheries populations and abundance would beneficially affect recreational fishing opportunities. More specifically, the increased abundance and extent would allow for enhanced fishing opportunities and could decrease the number of closures of entire fishing seasons over the long term. Species specific analysis of the economic effects of increased recreational fishing is presented in Section 3.15, Socioeconomics. **These effects on recreation-based fisheries would be long term and beneficial.**

Implementation of Mitigation Measure REC-1could permanently reduce recreational opportunities in the Klamath Basin. As described below in Section 3.20.4.4, Mitigation Measure REC-1 involves the development of a plan to develop new recreational facilities and river access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam following dam removal. However, replacement of recreation facilities would not necessarily be like for like but rather would be designed to accommodate a similar level but different type of use. This would require the creation of new gravel roads for vehicle and visitor access to the new recreation sites. While there would be a permanent loss of some recreation areas in the vicinity of the existing reservoirs, the combination of the implementation of REC-1 and the presence of regional recreation areas and opportunities (Table 3.20-4) would compensate for the loss of recreation areas at the subject reservoirs. **The impact from implementing Mitigation Measure REC-1, would be less than significant.**

3.20.4.3.4 Wild and Scenic River Assessment

The following section provides an assessment of the effects of Alternative 2 - full facilities removal on each of the four resources specified in the WSR Act Section 7(a) (fish, wildlife, scenery, and recreation river values). The following evaluation criteria were used to assess the effects of the proposed project as compared with conditions present at the time of WSR designation.

Evaluation Criteria for each of the four protected resources specified in the WSR Act Section 7 (a) (scenic, recreational, fish, and wildlife) criteria have been developed to assess the effects of the alternatives as compared with conditions at the date of the river's designation into the NWSRS (see Section 3.20.3.5 for conditions discussion). For each designated river component, the type (positive or negative) and duration (short term or long term) of the effects are described. The magnitude of these effects are analyzed in the Preliminary Section 7(a) Wild and Scenic Rivers Act Determination. The effects are characterized as unchanged, increased, or decreased (or similar conclusion), by value (scenic, recreational, fisheries, and/or wildlife), for that resource.

Scenery was evaluated using the following criteria:

- Water flow character (river flows and accompanying river width, depth and channel inundation or exposure)
- Water appearance (clarity, turbidity, depth of view, color, prominence of algae)
- Fish and wildlife viewing
- Riparian vegetation
- Natural appearing landscape character (the visual effects of facilities and structures as viewed from within the designated W SR corridor)

Recreation was evaluated using the following criteria:

- Whitewater boating
- Recreational fishing
- Other recreational activities (water play, swimming, camping)
- Recreational setting (water quality related aesthetic odors, tastes, contacts and public health and safety aspects)

Fishery was evaluated using the following criteria:

- Stream flow regime
- Water temperature
- Water quality (physical, biological and chemical)
- Aquatic habitat (geomorphic condition sediment transport regime and substrate quality)
- Fish species population conditions, specifically:
    a. Anadromous salmonid fish species
    b. Resident fish species
    c. Species traditionally used and culturally important to Native Americans

Wildlife was evaluated using the following criteria

- Changes in habitat for affected species

Scenic Evaluation

Dam removal could result in changes to water flow character (river flows and accompanying river width, depth, and channel inundation or exposure) compared with conditions present when the Oregon Klamath WSR was designated as a National WSR. Short-term effects would result in a period of increased flows during the time of reservoir drawdown. The changed character of the river width would include areas of exposed substrate where water elevations recede. As modeled by Reclamation (see Section 3.6, Flood Hydrology), dam removal would eliminate the daily hydropower peaking releases with their associated large daily river level fluctuation(Reclamation 2012). This will reduce the appearance of sediment deposition and changes in turbidity and clarity of the water on a daily basis. River width and depth are defined by the geology of the region and the surrounding bedrock. As discussed in Section 3.11, Geology, Soils, and Geologic Hazards, river elevation and form downstream from J.C. Boyle dam are primarily controlled by large boulders and bedrock, and only limited adjustment is possible. As described in Section 3.20.3.5, above, the degree of visibility of these scenic quality effects is dependent on viewer location. Views from on-river, in-river, or riverside viewpoints are most likely to display changes to these scenic quality indicators, while views from river canyon roadways and communities are less likely to find these scenic quality changes to be as noticeable or substantial. **Therefore, for these reaches, the long-term scenic quality impacts would be positive due to the reestablishment of free-flowing water conditions.**

Dam removal could result in changes to water flow character (river flows and accompanying river width, depth, and channel inundation or exposure) compared with conditions present when the California Klamath WSR was designated. Downstream, in the California Klamath WSR, as discussed in Section 3.11, Geology, Soils, and Geologic Hazards, any substantial adjustment in river elevations or geomorphology would have already occurred in previous floods and no substantial changes to river morphology would occur following removal of the Four Facilities. Further, modeling conducted by Reclamation indicates that no long-term impacts would occur with regard to sediment deposition in pools, eddies, slack water, or beaches, and short term effects would be limited to the area immediately below Iron Gate Dam. **Free flowing river conditions as well as re-establishment of a more natural river channel would result in long-term scenic quality benefits for the California WSR component.**

Dam removal could result in changes to water appearance (clarity, turbidity, depth of view, color, and prominence of algae) compared with conditions present when the California and Oregon components were designated as National WSRs. As discussed in Section 3.2, Water Quality, removal of the PacifiCorp facilities would eliminate the major sources of water quality problems associated with the dams (i.e., the reservoirs). Removal of the dams and reservoirs would enhance downstream water appearance for the Oregon and California Klamath WSR scenery through its benefits of superior mixing and

oxygenation of waters upstream of the WSR, renewal of streambeds through more frequent, high flow flushing events, and reversal of suspected nutrient increases within J.C. Boyle, Copco 1, and Iron Gate Reservoirs. Section 3.2, Water Quality, provides a detailed discussion of improvements to water quality, including reduced floating algae, and increased water clarity. Although removal of the dams would likely result in short-term increases in turbidity and decreased water clarity due to high suspended sediment concentrations during the year following reservoir drawdown, particularly in the California Klamath WSR, long-term impacts would result in improved water appearance.

As discussed in Section 3.3, Aquatic Resources, spawning gravels released downstream from within the retired reservoirs would restore some natural sediment processes and contribute to scour of attached downstream algae. The deposited sand and gravel on the downstream reaches would be a less favorable habitat for the algae because of greater particle mobility during high-flow events. This would result in positive long-term impacts on scenic water appearance (improved clarity and algae reduction) within the river between Iron Gate Dam and the Shasta River confluence, and would likely have similar but reduced downstream benefits.

At the time of the Oregon Klamath WSR designation, the water appearance during summer base flow conditions was of slow-moving waters with large amounts of visible algae-covered rocks, and during peaking events the water appearance was altered to brown and murky colors with large quantities of algal foam. Information about scenery water appearance condition at the time of California Klamath WSR designation is lacking; however, it is likely that the trend of increasing habitat for attached algae with its associated water coloration, cloudiness, and limitations on depth of view was already underway at the time of WSR designation (Van De Water et al. 2006). Removal of the dams would restore natural sediment movement in the streambed and would reduce opportunities for algae attachment, to a degree not possible in 1981 and 1994 due to the presence of the Four Facilities. **Thus, while there would be short-term negative water clarity impacts on scenic quality due to turbidity and silt which could be exposed on river banks, long-term effects to scenic quality would be beneficial for both the California and Oregon Klamath WSR components.**

Dam removal could result in changes in opportunities for fish and wildlife viewing compared with conditions present when the California and Oregon Klamath WSRs were designated. As discussed in Section 3.3, Aquatic Resources, removal of the Four Facilities would increase the abundance of anadromous fish in the Klamath River. The potential restoration of the anadromous fish populations would largely be the result of the increase of anadromous fish habitat within the Upper Klamath Basin, along with water quality improvements within the Oregon and California Klamath WSRs downstream from the Four Facilities. The increased population of fish species would improve scenic fish viewing attractions in both the California and Oregon Klamath WSRs. Increased fish viewing would be most prominent during fish migration, spawning, or holding periods, when the fish concentrate at particular reaches, pools, riffles, and falls. **Fish and wildlife**

viewing impacts to scenic quality would be long-term and beneficial as compared to the conditions at the time of the 1981 and 1994 designations for the Oregon and California Klamath WSRs.

Dam removal could result in changes in opportunities for river-dependent wildlife viewing compared with conditions present when the California and Oregon Klamath WSRs were designated. Specific effects on river-dependent wildlife populations and scenic viewing opportunities are unknown. As discussed in Section 3.5, Terrestrial Resources, riparian habitat within the Oregon Klamath WSR and potentially beyond, in the Iron Gate Dam to Shasta River segment of the California Klamath WSR, would be improved by removal of the dams, and proportional increases in wildlife presence related to the increase in abundance of anadromous fish in the river and scenic wildlife viewing would be expected. **Therefore, impacts on river-dependent wildlife populations and scenic viewing opportunities would be long term and beneficial as compared to the conditions at the time of the 1981 and 1994 designations.**

Dam removal could result in changes to riparian vegetation compared with conditions present when the Oregon Klamath WSR was. As discussed in Section 3.5, Terrestrial Resources, removal of the Four Facilities would result in elimination of the reservoirs and associated aquatic habitat. However, following dam removal and downstream sediment flushing, the new river channel would conform to the pre-dam channel alignment (Gathard Engineering Consultants 2006). Riverbank stabilization and re-vegetation of riverbank with native plantings would be conducted at each reservoir after the drawdown is complete. Thus, riparian habitat at reservoirs would increase with restoration following drawdown. PacifiCorp estimated that decommissioning and removal of the Four Facilities would add about 184 acres of riparian vegetation. This estimate was based on the assumption of an average riparian corridor width of 100 feet along the 3.6-mile length of the J.C. Boyle Reservoir, the 4.5-mile length of the Copco Reservoir, the 0.3-mile length of the Copco 2 Reservoir, and the 6.8-mile length of the Iron Gate Reservoir (FERC 2007). **Establishment of woody species along the newly formed riparian corridor is expected to take several years; however, these changes to vegetation would result in long-term, beneficial effects on riparian vegetation aspects of scenic quality within the areas immediately upstream and downstream from the Oregon Klamath WSR component as compared to conditions at the time of the 1994 designation.**

Dam removal could result in changes to riparian vegetation compared with conditions present when the California Klamath WSR was designated . Removal of the Four Facilities would result in a more natural riparian vegetative community immediately downstream from Iron Gate Dam due to sediment deposition and scour and gravel transport. Improved riparian vegetation would increase the presence and scenic variety of the vegetation within the WSR. **This would likely increase overall scenic riparian vegetation aspects of scenic quality over conditions present at the California Klamath WSR's 1981 date of designation and result in long-term beneficial effects.**

Dam removal could result in changes to the natural appearing landscape character as compared with conditions present when the Oregon Klamath WSR was designated. As discussed in Section 3.19, Scenic Quality, removal of J.C. Boyle Dam would result in a more natural setting and character in the areas immediately upstream and downstream from the Oregon Klamath WSR. **J.C. Boyle dam was present at the time of the 1994 WSR designation of the Oregon component, its removal would restore the Oregon Klamath WSR to a more natural flow regime and landscape character and would result in long-term beneficial scenic quality effects.**

Dam removal could result in changes to the natural appearing landscape character as compared with conditions present when the California Klamath WSR was designated. The California Klamath WSR is downstream from the Four Facilities; therefore, removal of the dam and associated facilities would not result in any changes to the overall landscape character in this segment of the river. However, as discussed in Section 3.2, Water Quality, water clarity in the WSR component is expected to improve, as is the quality of the riparian vegetation. **These improvements would result in a more natural flow regime and landscape character for the California Klamath WSR and result in a long term positive scenic quality effect.**

Recreation Evaluation

Dam removal could improve opportunities for whitewater boating compared with conditions present when the California and Oregon Klamath River WSRs were designated. Whitewater boating opportunities relating to river flow following removal of the Four Facilities would likely be similar to conditions in 1981 for the California Klamath WSR. As discussed in the impact analyses above, and as shown in Table 3.20-6 the number of days acceptable for commercial whitewater boating during the popular summer months would decrease for the Oregon Klamath WSR in the Hell's Corner Reach, following removal of the dams(Appendix R). For the California Klamath WSR downstream from Iron Gate Dam, following removal of the dams, the number of days available for whitewater boating would be very similar to the number of days currently available. **Therefore, long-term whitewater boating impacts due to changes in flow would be negative for the Oregon Klamath WSR. No impacts to whitewater boating opportunities due to flow would occur for the California Klamath WSR. Removal of the dams would also result in long-term improvements to water quality conditions over existing conditions and the 1981 and 1994 conditions. With improved water quality, the whitewater boating recreation experience would improve in both the Oregon and California Klamath WSRs. Therefore, long-term whitewater boating impacts due to improved water quality would be beneficial for both the California and Oregon WSR components.**

Dam removal could increase opportunities for recreational fishing compared with conditions present when the California and Oregon Klamath River WSRs were designated. As discussed in the impact analyses above, removal of the Four Facilities would not affect water flow such that days with acceptable flows for recreational fishing would substantially increase or decrease. However, as described in Section 3.3, Aquatic Resources, the geographic extent of the Klamath River fish habitat would be substantially

expanded compared to 1981 and 1994 conditions. It is also expected that water quality conditions would improve, thereby reducing fish disease. Increased fish populations would likely result in fewer catch and keep fishing restrictions. **Thus, recreational fishing impacts would be long term and beneficial for both the California and Oregon WSRs.**

Dam removal could result in changes to opportunities for other recreational activities (water play, swimming, camping) compared with conditions present when the California and Oregon Klamath River components were designated as National WSRs. During the period of dam removal and shortly afterwards, sediment release could decrease the quality of water contact activities. However, initial reservoir drawdown will occur in the coldest high flow months of winter and early spring when recreation uses is at its lowest. This impact would be short term. In the long term, dam removal would improve water quality and thus water contact-based recreation activities. Short-term, negative impacts would occur as a result of the construction activities and staging areas and likely restricted access and use of recreation facilities and opportunities during the period and in the areas where dam removal occurred. **Thus for the Oregon Klamath WSR there would be short term negative impacts to other recreational activities due to construction activities and increased sediment in the river. In the long term dam removal would be long term and beneficial as compared to the 1994 conditions. For the California Klamath WSR, dam removal would not affect recreational activities access downstream from the dams. However dam removal would result in improved water quality in the long term thus there would be long-term beneficial effects on recreational activities in these areas as compared to the 1981 conditions.**

Dam removal could improve the recreational setting (water-quality related aesthetics, odors, tastes, contacts, and public health and safety aspects) compared with conditions present when the California and Oregon Klamath WSRs were designated. Although there would be short-term, negative impacts on water quality due to the increased sediment load in the river during initial drawdown activities, particularly in the Oregon Klamath WSR, as discussed in Section 3.2, Water Quality, following completion of reservoir drawdown, dam removal would improve water quality conditions as compared with conditions present at the time of the 1981 and 1994 designations. There could be short-term, negative impacts (lasting less than two years) during reservoir drawdown due to the potential for sediment to clog fishing holes, or possibly make the river less navigable, or even less accessible along shorelines temporarily blocked by sediment deposits.

Alternatively, new beaches and riparian areas may become established to increase the variety of shoreline settings. Most of these effects would be temporary and many aspects of the WSR's recreation setting would be considerably improved once the river stabilizes. The improved water quality conditions following completion of drawdown activities would improve the recreational setting overall (i.e., with improved clarity during swimming and fishing and reduced malodors and tastes [Bartholow et al 2005]). With regard to public health, improved water quality would also reduce potential human health

risks associated with water-contact-based activities. **Therefore, impacts on the recreational setting would be long term and beneficial for both the California and Oregon Klamath WSR.**

Fisheries Evaluation

Dam removal could alter stream flow regime compared with conditions present when the California and Oregon Klamath WSRs were designated. Section 3.6, Flood Hydrology, discusses historic flow rates and discharge statistics for each of the reservoirs. The proposed drawdown rates are consistent with the historic discharge rates from the reservoirs and would be adjusted depending on the water year; therefore, flow rates downstream from the dams are not anticipated to increase substantially above historic rates, if at all. As such, conditions during the drawdown period are expected to remain largely unchanged as compared to stream flow regimes at the time of the 1981 and 1994 designations.

Following removal of the Four Facilities, the Klamath River would return to a natural flow regime in the reaches where the reservoirs currently exist. Restoration of the natural flow regime would improve water quality conditions, likely reducing the occurrence of myxozoan parasites (*Ceratomyxa shasta* and *Parvicapsula minibicornis*) that are known to negatively affect salmonids. Removal of the hydroelectric reservoirs would eliminate populations of blue-green algae that produce toxins that can result in acute and chronic effects on fish, including increased mortality, reduced fecundity, reduced feeding, and habitat avoidance. **Stream flow regime impacts would be long term and beneficial for both the California and Oregon Klamath WSR.**

Dam removal could decrease fall water temperature and increase spring water temperature compared with conditions present when the California and Oregon Klamath WSRs were designated. Removal of the Four Facilities would improve water quality conditions over existing conditions and the 1981 and 1994 conditions. As described in Sections 3.2, Water Quality, and 3.3, Aquatic Resources, following dam removal, the temperature regime downstream from Iron Gate Dam would be more suitable for salmon. As part of its relicensing procedure, PacifiCorp modeled changes in water temperature that could result following removal of the dams. The modeling results show that from Iron Gate Dam to Clear Creek temperatures in the spring and early summer would be as much as 5°C warmer, but cooler in later summer and fall than under existing conditions. Temperatures currently remain greater than 20°C in dry years with little variability in July and August. Although summer temperatures would likely be more variable following dam removal, the median temperatures would be substantially lower than current conditions. Summer and fall temperatures would therefore be more conducive to salmon rearing, migrating, and spawning than the conditions that were probable at the date of designation (Van de Water et al. 2006). However, as discussed in Section 3.2, Water Quality, in reaches above J.C. Boyle Reservoir and downstream from Clear Creek, there would be little to no change in the existing temperature regime. **Water temperature impacts would therefore be long term and beneficial for the California Klamath WSR, and there would be no change from existing conditions in the Oregon Klamath WSR.**

Dam removal could improve water quality characteristics (physical, biological, and chemical) compared to conditions present when the California and Oregon Klamath WSRs were designated. Removal of the Four Facilities would eliminate the major sources of water quality problems in the Upper Klamath Basin and enhance downstream water quality for salmonids. Removal of the dams would also reduce conditions that foster fish disease outbreaks.

As discussed in Section 3.2, Water Quality, following dam removal, long-term dissolved oxygen levels would be anticipated to meet applicable Basin Plan objectives. However, modeling indicates that nitrogen loading downstream from Iron Gate Dam would increase slightly above existing levels due to the release of sediments from the reservoirs, but the removal of a lacustrine environment in the reservoir area would reduce the abundance of algae that form habitat for the intermediate host for at least two salmon pathogens. The improved water quality conditions would reduce fish crowding, which, as discussed in Section 3.3, Aquatic Resources, would result in reduced temperature-induced stress and could allow for spawning to begin earlier in the fall. **Impacts on water quality characteristics would therefore be long term and beneficial for both the California and Oregon Klamath WSRs.**

Dam removal could alter geomorphic conditions, sediment transport regime, and substrate quality compared with conditions present when the California and Oregon Klamath WSRs were designated. As discussed in Section 3.11, Geology, Soils, and Geologic Hazards, and Section 3.3, Aquatic Resources, sediment stored in the subject reservoirs would be released downstream. The released sediment would have short-term, negative effects on aquatic habitat, but following completion of reservoir drawdown, the increased spawning gravel released from upstream could enhance spawning habitat. Restoring natural sediment processes would contribute to scour of attached algae (e.g., *Cladophera* spp.), and deposited sand and gravel would be a less favorable substrate for the algae because of greater particle mobility during high-flow events than the existing armored substrate. A reduction in such algae would lead to reduced habitat for the fish pathogen's alternate host.

Information about habitat conditions at the time of WSR designation is lacking; however, it is likely that trends of river coarsening, increasing habitat for attached algae, and reduced recruitment and maintenance of riparian vegetation were already underway at the time of WSR designation due to PacifiCorp facilities and operations. The Proposed Action would reduce those trends in the long term, and restore natural sediment transport processes, which were no longer in place by 1981 and 1994. Following the initial drawdown period and flushing of reservoir sediment downstream, aquatic habitat conditions would be expected to be improved from conditions in 1981 and 1994 in the long term. **Therefore, impacts on aquatic habitat conditions would be long term and beneficial for both the California and Oregon Klamath WSRs.**

Dam removal could improve conditions for anadromous fish species compared with conditions present when the California and Oregon Klamath WSRs were designated. As discussed in Section 3.34.3.2.2.3, Aquatic Resources, dam removal would result in

beneficial long-term effects on anadromous salmonids. Dam removal would also restore connectivity to hundreds of miles of potentially usable habitat in the Upper Klamath Basin and would create additional spawning and rearing habitat within the Hydroelectric Reach. However, sediment released during dam removal could be sufficient to cause substantial smothering of spawning gravels, pool infilling, gill abrasion, and changes to holding and migration patterns in the river reaches immediately below Iron Gate Dam. These impacts would be short term (lasting less than two years), as sediment is expected to be flushed through the river system relatively quickly. In the long term, dam removal is expected to eliminate the source of most of the water quality issues on both the California and Oregon Klamath WSRs that are influenced by the presence of the PacifiCorp facilities. In particular, dam removal would reduce late summer and fall heating, summertime dissolved oxygen depletion, and in-reservoir nutrient cycling with resultant summer releases of nitrogen downstream. Removal of the Four Facilities would also eliminate a fish barrier and allow fish to spawn in a greater number of areas. Consequently, fish disease outbreaks could be diminished. Removal of the Four Facilities would also result in habitat conditions that more closely resemble natural conditions (e.g., flow and temperature ranges would be more reflective of climatic forces than of water regulation). However, continuation of the operation of the Iron Gate Fish Hatchery would reduce some of the beneficial effects of dam removal by continuing pressures on natural stocks that would improve with dam removal. Even so, Chinook salmon, coho salmon, and steelhead abundance would still be expected to increase over 1981 and 1994 levels in the long term. **Long-term beneficial effects on conditions for anadromous fish species would result for both the California and Oregon Klamath WSRs.**

Dam removal could improve conditions for native resident fish species compared with conditions present when the California and Oregon Klamath WSRs were designated. As discussed in Section 3.3, Aquatic Resources, removal of the Four Facilities would improve conditions for native resident fish species by restoring connectivity between the Lower and Upper Klamath River, and by returning a natural flow regime to the reaches where the reservoirs currently exist, thereby improving water quality. Dam removal would also likely result in diminished non-native fish habitat and populations, reducing competition for space and resources with native resident fish. Because the non-native fish were introduced and occur in other nearby water bodies, their loss would not be considered significant from a biological perspective and is not included in this effect evaluation. **Therefore these impacts on the conditions for native resident fish species would be long term and beneficial in both the California and Oregon Klamath WSRs.**

Dam removal could improve conditions for species traditionally used and culturally important to Indian Tribes compared with conditions present when the California and Oregon Klamath WSRs were designated. As discussed in Section 3.3, Aquatic Resources, removal of the Four Facilities would improve conditions for culturally important fish species (e.g., Chinook salmon, coho salmon, steelhead, and lamprey) by restoring connectivity between the Lower and Upper Klamath River, and by returning a

natural flow regime to the reaches where the reservoirs currently exist and downstream from Iron Gate Dam, thereby improving water quality. Dam removal would also likely result in diminished non-native fish habitat and populations, reducing competition for space and resources with native resident fish. **Impacts on the conditions for species traditionally used and culturally important to Indian Tribes would be long term and beneficial in both the California and Oregon Klamath WSRs.**

Wildlife Evaluation

Dam removal could result in changes to habitat for special status species compared with conditions present when the California and Oregon Klamath WSRs were designated. Elimination of hydropower peaking flows in the Oregon Klamath WSR would result in beneficial establishment of riparian vegetation over the long term due to fine sediment released into this section would allow the establishment of such vegetation.

Riparian vegetation in the California Klamath WSR downstream from the Iron Gate Dam would also benefit from dam removal, especially in the reach between the Iron Gate Dam and the Shasta River confluence. Special status species that are dependent on riparian habitat, such as the willow flycatcher, northwestern pond turtle, and yellow breasted chat, would benefit greatly from successful riparian habitat recovery from Iron Gate Dam downstream to the Klamath River's confluence with the Shasta River. Downstream from that point, the riparian-dependent wildlife would still benefit from increased diversity and amounts of riparian vegetation, but these benefits might be offset by some potential short-term impacts as the released sediment moves downstream into areas that are currently in better condition.

In addition to improving riparian habitat, the Proposed Action would result in improvements in fish resources in the long term following dam removal, thus providing increased forage for wildlife species that depend upon fish as a food source. The area currently blocked by dams would provide additional available habitat for anadromous fish. The increase in habitat quality and quantity should allow the number of anadromous fish to increase substantially. Increased numbers of fish would also create greater foraging opportunities for riparian and riverine species such as bald eagle, river otter, osprey and black bear. **Therefore, there would be long-term, beneficial effects on habitat for special status species in both the California and Oregon Klamath WSRs.**

3.20.4.3.5 Eligible and Suitable WSR Section on the Klamath River

In addition to the designated WSR segments, the reach from the Oregon and California State-line to Copco was found eligible and suitable and is a candidate for WSR designation, but has not been designated into the National WSR System. The potential outstandingly remarkable values are scenic, fish, wildlife, recreation (whitewater boating and fishing), and historic. This candidate WSR reach is included in the project area and effects are evaluated as part of this EIS. This section summarizes the main effects of the Proposed Action on this segment's river values. Short terms negative effects on water quality, scenic, recreation, fishery, and wildlife river values are likely due to the high suspended sediment concentrations during reservoir drawdown. These effects are expected to last less than two years. In the long term, dam removal would return this

reach of river to a more natural river flow, improve water quality, enhance habitat for fish and wildlife, and restore riparian vegetation. **Thus, dam removal would result in long-term beneficial effects to this candidate WSR reach's free-flowing condition, water quality, scenic, wildlife, fishery, and recreation river values.**

Keno Facilities Transfer

Transfer of the Keno Facility from PacifiCorp to DOI could affect recreational opportunities. Keno Dam is an unmanned facility which requires minimal operations and maintenance. Recreation facilities owned by PacifiCorp in the vicinity of Keno Impoundment/Lake Ewauna will also be transferred to DOI as described in the KHSA Section 7.5. Operation of Keno Dam and of the recreation areas are expected to continue in their current fashion. **The transfer of the facility and recreation lands will result in no change from existing conditions.**

East and Westside Facilities Decommissioning – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects on recreational resources. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a connected action to the Klamath Hydroelectric Settlement Agreement (KHSA) would terminate the diversion of water flows currently diverted at Link River Dam into the two canals. Following decommissioning of the facilities there will be no change in outflow from Upper Klamath Lake or inflow into Keno Impoundment/Lake Ewauna. **Therefore, there will be no change from existing conditions caused from decommissioning the East and Westside Facilities.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The City of Yreka Water Supply Pipeline, currently under the Iron Gate Reservoir, would need to be relocated to avoid damage after the reservoir is removed, creating a change in existing recreational resources. As a connected action to the Proposed Action, the relocation, replacement, and/or burial of the existing 24-inch diameter water line and transmission facilities from the City of Yreka's Fall Creek diversion would be required (KHSA Section 7.2.3). This connected action would involve placing the City of Yreka's waterline on a pipe bridge across the river. This would require construction of footings and other infrastructure to support the pipe bridge, resulting in construction at the site. The relocation of the pipeline would not impact recreational resources. In coordination with the City of Yreka, measures such as installation of fencing to protect the water supply intake maybe considered. **There would be no change from existing conditions.**

Another option under consideration is to place the pipeline along the Lakeview Bridge at Iron Gate Dam rather than creating a new span for the pipeline. The pipe would be relocated from its current route and cross the river along the underside of the bridge. Surveys are still required to determine if the bridge is adequate to support the pipeline and the construction traffic from the decommissioning activities. This option would not affect recreational resources. **There would be no change from existing conditions as a result of the Proposed Action and pipeline relocation.**

3.20.4.4 KBRA – Programmatic Measures

The Klamath Basin Restoration Agreement (KBRA) has several programs that could result in short-term and long-term changes to recreational opportunities in the Klamath Basin. Such changes would be the result of temporary construction activities as well as long-term increases in aquatic habitat and fish populations, improvements to water quality, and improvements to terrestrial resources. Specific KBRA programs potentially affecting recreational opportunities include:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration
- Water Diversion Limitations
- On-Project Plan
- Water Use Retirement Program (WURP)
- Climate Change Assessment and Adaptive Management
- Interim Flow and Lake Level Program

Construction activities associated with the KBRA programs could temporarily restrict access to recreational opportunities. Construction activities including channel construction, fish passage and facilities construction, breaching levees, and fish hauling would likely involve the use of heavy equipment along floodplain and riparian areas and therefore could result in restrictions to public access for recreational activities, such as sightseeing, bank fishing, swimming, and wading. Because restoration activities would occur throughout the entire basin, specific sections of the river could be closed for a period of time throughout implementation of the KBRA programs. However, as described in the Affected Environment section, there are a number of recreational areas offering similar activities and settings throughout the basin. It is likely that for any particular project, there would be an alternative recreational area nearby that could be used during temporary closures. Construction related to KBRA programs could occur in the same location and time as construction actions for the hydroelectric facility removal and affect access to or availability of recreation resources. However, because of the multitude of resources in the region, effects to recreation under both the KBRA and KHSA would be less than significant. **Thus, potential impacts to recreational opportunities are anticipated to be less than significant. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

Construction activities associated with KBRA programs could result in short-term water quality impacts which could affect recreational opportunities. Erosion and sedimentation during construction activities has the potential to temporarily decrease water quality and reduce water visibility for boaters, swimmers, and fisherman. These short-term water quality impacts would be anticipated to occur throughout the basin where construction activities take place. Specific sections of the river could be affected for a period of time throughout implementation of the KBRA programs. However, following implementation and related construction activities for KBRA programs including the Wood River

Wetland Restoration, and the Interim Flow and Lake Level Program, WURP, water quality and clarity would be expected to improve. Additionally, as described above, short-term impacts would be offset by the ability of visitors and local recreationalists to use the recreational areas with similar activities and settings throughout the basin. Construction related to KBRA programs could occur in the same location and time as construction actions for the hydroelectric facility removal and affect water quality at recreation resources. However, because of the multitude of resources in the region, effects to recreation under both the KBRA and KHSA would be less than significant. **Potential impacts would be short term and, with implementation of construction BMPs, are anticipated to result in less than significant water quality related recreational impacts. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

Fire treatment proposed in the Fisheries Restoration Plan could alter the visual setting and result in decreased recreational visitors to the Klamath Basin. As described above for the No Action/No Project Alternative, it is expected that landscape scale prescribed fire treatments would result in a short-term adverse effect of the visual quality of the burned area, which could directly affect the number of recreational visitors to the area. In the short term, prescribed fire treatments would be less than significant. Prescribed fire treatment actions would not occur in the same location and at the same time as hydroelectric facility removal actions; therefore, potential for any visual quality improvements generated by these prescribed fire treatment actions would not change effects of facility removal. **The return of forests to a more natural condition is anticipated to result in long-term beneficial effects. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

KBRA actions correcting fish passage issues, reintroducing and monitoring fish species, and restoring aquatic habitat could increase recreational fishing and wildlife viewing opportunities in the basin. It is expected that correction of fish passage issues throughout the basin would restore fish access to new and historic habitats and result in increased fish populations. KBRA programs such as the Fisheries Reintroduction and Management Plan, include actions to restore and create fish habitat and wetlands for endangered fish species. Additionally, projects such as Water Diversion Limitations would increase water availability for fisheries. It is anticipated that these programs and projects would result in increased fish populations and abundance, which would beneficially affect recreational fishing opportunities. More specifically, the increased abundance would allow for increased catch limits and fewer catch and release requirements, as well as decrease the potential of closures of entire fishing seasons as those that occurred on the Klamath River in the recent past. Correction of fish passage issues as a result of the KBRA would support the positive improvements to recreation from increased fish populations due to hydroelectric facility removal. **These changes are anticipated to result in beneficial effects to recreational experiences throughout the Klamath Basin. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

KBRA programs resulting in long-term water quality improvements could increase recreational opportunities throughout the Klamath Basin. KBRA programs including the Fisheries Restoration Plans Phase I and II; Fisheries Reintroduction and Management Plan; WURP; and, Interim Flow and Lake Level Program would result in long-term benefits to water quality throughout the Klamath Basin. As described in Section 3.2, Aquatics Resources, improvements in water quality would enhance fisheries habitat in the Klamath River and tributaries. Improvement of water quality as a result of KBRA actions would support positive improvements to recreation from improved water quality due to hydroelectric facility removal. **It is anticipated that improvements in fish habitat and abundance would result in beneficial effects to recreational opportunities in the Klamath Basin. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

KBRA programs that enhance terrestrial wildlife and plant resources could increase recreational opportunities throughout the Klamath Basin. KBRA programs including Fisheries Restoration Plans Phase I and II; Water Diversion Limitations; On-Project Plan; WURP; and, Interim Flow and Lake Level Programs would result in long-term benefits to terrestrial species as a result of restored floodplain and riparian vegetation and habitat areas. While short-term construction activities involved in the implementation of some of these programs would result in short-term adverse impacts on terrestrial resources, the long-term effects of habitat restoration would be expected to benefit terrestrial species in the Klamath Basin. Improvement of terrestrial wildlife and plant resources as a result of the KBRA would support positive improvements to wildlife viewing due to hydroelectric facility removal. **It is anticipated that improvements and increases in terrestrial wildlife habitat would result in beneficial effects to recreational wildlife viewing and recreational hunting opportunities in the Klamath Basin. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

3.20.4.4.1 Alternative 3: Partial Facilities Removal of Four Dams

Under this alternative, short-term demolition activities and drawdown of reservoirs would still occur; however, demolition would consist only of in-stream facilities and select ancillary facilities; other ancillary facilities associated with the KHP would remain in place. Recreation facilities would be removed with the exception of Topsy Campground, Fall Creek and Jenny Creek Day Use Areas, and the Iron Gate Fish Hatchery Day Use area, as under the Proposed Action and the impact would therefore be the same as described previously.

Keno Facilities Transfer

Transfer of the Keno Facility from PacifiCorp to DOI could affect recreational opportunities. Keno Dam is an unmanned facility which requires minimal operations and maintenance. Recreation facilities owned by PacifiCorp in the vicinity of Keno Impoundment/Lake Ewauna will also be transferred to DOI as described in the KHSA Section 7.5. Operation of Keno Dam and of the recreation areas are expected to continue

in their current fashion. **The transfer of the Keno Facility and recreation lands would result in no change from existing conditions in relation to recreational resources or facilities.**

East and Westside Facilities Removal – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects on recreation. The effects of the East and Westside Facilities removal would be the same as those described for the Proposed Action. **Therefore, the decommissioning activities would result in no change from existing conditions in relation to recreation resources or facilities.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The City of Yreka's Water Supply Pipeline would need to be relocated to avoid damage after the removal of Iron Gate Reservoir; this action could create a change in existing recreational resources. The effects of relocating the City of Yreka's Water Supply Pipeline would be the same as those described under the Proposed Action. **There would be no change from existing conditions.**

KBRA – Programmatic Measures

Under this alternative the KBRA would be fully implemented; therefore, impacts on recreation facilities and opportunities would be the same as described for KBRA under the Proposed Action.

Wild and Scenic Rivers

With regard to WSRs, impacts would be similar as for the Proposed Action.

3.20.4.4.2 Alternative 4: Fish Passage at Four Dams

The Fish Passage at Four Dams Alternative could change existing recreation access and opportunities. Impacts under this alternative would be similar to those described under the No Action/No Project Alternative. Because the dams would remain in place, none of the expected beneficial changes to water quality would occur; therefore, beneficial effects with regard to water-contact-based activities described under the Proposed Action would not occur. The recreational setting (campgrounds, day use areas, and water access areas) would remain as described in the Affected Environment section. **Under the Fish Passage at Four Dams Alternative, existing conditions for recreational fishing within the river and water-contact-based activities at the subject reservoirs would not change from existing conditions.**

Implementation of the prescriptions provided by the USFWS, DOI, and United States Department of Commerce in the FERC 2007 EIS could change whitewater boating opportunities in the Hell's Corner Reach. There would be a loss of acceptable flows for whitewater boating opportunities in the Hell's Corner Reach as compared to existing conditions. The prescriptions set minimum streamflow requirements for the Peaking Reach downstream from J.C. Boyle Powerhouse. A minimum streamflow of 1,500 cfs must be provided no more than once per week as opposed to existing conditions where acceptable whitewater flows are maintained a majority of days. In addition, there would

no longer be predictable flows in terms of known timing for flow releases as under the existing conditions. **Impacts on whitewater boating opportunities in the Hell's Corner Reach would be significant and unavoidable**.

Fish passage facilities could result in increased fisheries populations and abundance, which could improve recreational fishing along the river. As discussed in Section 3.3, Aquatic Resources, installation of fish passage at the dams would likely beneficially affect anadromous fisheries in the Klamath River, although not to as great a degree as under the Proposed Action. Increased abundance and population of recreational fishery species would likely result in beneficial effects on recreational fishing downstream from Iron Gate Dam. More specifically, the increased abundance would allow for increased catch limits and fewer catch and release requirements, and would decrease the number of potential fishing season closures such as those that occurred on the Klamath River in the recent past. Species specific economic analysis of the effects of increased recreational fishing is presented in Section 3.15, Socioeconomics. **Impacts with regard to recreational fishing opportunities would be long term and beneficial.**

3.20.4.4.3 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Dam removal could permanently remove recreational facilities in the area of Copco 1 and Iron Gate Reservoirs. Under this alternative, Copco 1 and Iron Gate Dams would be removed, but Copco 2 Dam and J.C. Boyle Dam would remain in place. The impacts would be similar to those described for the Proposed Action for the areas surrounding the Copco 1 and Iron Gate Reservoirs; recreation facilities at these sites would be removed. **Impacts on recreational facilities at Copco 1 and Iron Gate reservoirs would be considered permanent and significant; however, implementation of Mitigation Measure REC-1 would reduce these impacts in the long term to less than significant.**

Dam removal could permanently decrease the availability of reservoir/lake-based recreational opportunities. Reservoir-based recreational opportunities (e.g., swimming, bathing, wading, and reservoir-fishing) would be lost at Iron Gate and Copco 1 Reservoirs, although visitors would still be able to travel to J.C. Boyle Reservoir for these activities; thus, adverse impacts would be fewer and smaller in scale than those described for the Proposed Action. **Impacts on the regional availability of reservoir-based recreational opportunities would be less than significant**.

Dam removal could change whitewater boating opportunities in the Klamath River. With regard to changes in whitewater boating opportunities, the existing Copco 1 and Iron Gate Reservoirs would be converted to free-flowing riverine reaches over the long term, and depending on the river channel and access, could provide additional opportunities for whitewater boating in these reaches (Appendix R). However, as noted under the Proposed Action impact analysis, flows following dam removal were not modeled for areas currently inundated by reservoirs. While it could be expected there would be additional opportunities for whitewater boating in these reaches, no records exist of the condition or suitability of the presently inundated areas for whitewater boating activities. With details of the condition of these areas lacking, it is too

speculative to determine the quality and quantity of whitewater boating opportunities that could be realized due to dam removal in areas currently inundated by reservoirs. **Thus, while new whitewater boating opportunities would likely exist in the areas previously inundated by the reservoirs, impacts would be less than significant.**

Loss of peaking flows in the J.C. Boyle Peaking Reach could affect whitewater boating opportunities in the Hell's Corner Reach. The loss of peaking flows in the Hell's Corner Reach would result in the river returning to natural flow conditions, with no ability to regulate for peaking flows. Thus, there would be diminished whitewater boating opportunities in this reach. **Impacts on whitewater boating opportunities in the Hell's Corner Reach would be significant and unmitigable**.

Changes in water quality associated with dam removal could positively affect water-contact-based recreational opportunities. As discussed in Section 3.2, Water Quality, improvements in water quality are expected; however, these improvements would be less than as described under the Proposed Action. Therefore, beneficial effects on water-contact-based recreation would occur as described for the Proposed Action, in the river channel below Copco 1 Dam. Beneficial effects would not be anticipated to occur in or below the J.C. Boyle Reservoir (as described above, there are little to no recreational facilities at Copco 2 Reservoir). Also, as discussed in Section 3.3, Aquatic Resources, populations and abundance of anadromous fish would increase under this alternative (although not to the same degree described for the Proposed Action); therefore, beneficial effects on recreational fishing would be similar, but less than those described for the Proposed Action. **Because existing conditions for water-contact-based recreational activities are considered adverse due to water quality, improved water quality conditions would result in long-term beneficial effects.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The City of Yreka's Water Supply Pipeline would need to be relocated to avoid damage after the removal of Iron Gate Reservoir; this action could create a change in existing recreational resources. The effects of relocating the City of Yreka's Water Supply Pipeline would be the same as those described under the Proposed Action. **There would be no change from existing conditions.**

3.20.4.5 Mitigation Measures

3.20.4.5.1 Mitigation Measure by Consequences Summary

REC-1 – At least one year before starting dam removal activities, the dam removal entity (DRE) will prepare a plan to develop new recreational facilities and river access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. The purpose of the plan is to mitigate for recreational facilities that will be removed during dam removal. The intent is to provide resources and infrastructure which will support similar levels yet different types of use. The plan will be developed in consultation with appropriate State and Federal agencies, counties (e.g., BLM, CDFG,

Siskiyou and Klamath Counties) and stakeholder groups, and will include an implementation schedule for construction of recreational facilities and river access areas.

3.20.4.5.2 Effectiveness of Mitigation in Reducing Consequences

Implementation of Mitigation Measure REC-1 will ensure that access to the Klamath River at and near the location of the removed reservoirs will remain available following dam removal. The potential for fewer recreational opportunities than currently exist would be less than significant (See Section 3.20.4.3)

3.20.4.5.3 Agency Responsible for Mitigation Implementation

The DRE would be responsible for implementing mitigation measure REC-1.

3.20.4.5.4 Remaining Significant Impacts

Changes in flows in the Hell's Corner Reach and decreases in whitewater boating along this part of the river would be a significant and unavoidable impact.

3.20.4.5.5 Mitigation Measures Associated with Other Resource Areas

Mitigation Measures AR-1, 2, 5-7 could interfere with river based recreation downstream from Iron Gate Dam. These mitigation measures involve trap and haul of fish and mollusks to protect them from the reservoir drawdown and dam deconstruction activities. These mitigation measures would include trapping activities in the Klamath River that could interfere with river based recreation between February and April 2020. However, as described in Section 3.20.3.1, Regional Opportunities, a number of other river recreation areas are present within and adjacent to the Klamath Basin and provide similar opportunities for recreational activity. **Temporary impacts on recreational access from Mitigation Measures AR-1, 2, 5-7 would be less than significant.**

Mitigation Measure TR-1 could interfere with reservoir based recreation in Iron Gate Dam. The bridge crosses Jenny Creek at the point it enters Iron Gate Reservoir. Relocation of the Jenny Creek Bridge and culverts would occur before the other construction phases of dam removal. In comparison to the dam removal, equipment and time required for this construction would be minimal, but it could affect reservoir based recreation near the bridge. However, it will not restrict reservoir based recreation in other areas of the reservoir from other access points. **Impacts on recreational access from Mitigation Measure TR-1 would be less than significant.**

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3.21 Toxic/Hazardous Materials

This section describes impacts related to the presence and/or use of hazardous, toxic, and radiological waste (HTRW) within the area of analysis for the Proposed Action and alternatives.

3.21.1 Area of Analysis

The area of analysis includes the area in the immediate vicinity of Keno, J.C. Boyle, Copco 1, Copco 2, and Iron Gate Dams, including their associated reservoirs, and areas identified as construction/demolition and staging areas for the alternatives. This section also addresses impacts related to HTRW at a programmatic level within the Klamath Basin Restoration Agreement (KBRA) area of analysis because specific locations of potential construction sites have not been identified.

3.21.2 Regulatory Framework

Hazardous materials, substances, and waste within the area of analysis are regulated by several Federal, State, and local laws and policies, which are listed below.

3.21.2.1 Federal Laws, Authorities and Regulations

- Resource Conservation and Recovery Act (42 USC 6901 et seq.)
- Hazardous Materials Transportation Act (49 USC Section 1801 et seq.)
- Clean Water Act (33 USC 1251 et seq.)
- Comprehensive Environmental Response Compensation and Liability Act and Superfund Amendment Reauthorization Act (43 USC 9601 et seq.)
- 40 CFR 260-279 Federal Regulations on hazardous waste management
- 42 USC 11001 et seq. Emergency Planning and Community Right to Know Act
- Toxic Substances Control Act (15 USC 2601 et seq.)

3.21.2.2 State Laws, Authorities and Regulations

- California Hazardous Waste Control Law (California Health and Safety Code [HSC] Section 25501 et seq.)
- Carpenter-Presley-Tanner Hazardous Substances Account Act (HSC Section 25300 et seq.)
- Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (HSC Section 25404 et seq.)
- Solid Waste Management (Oregon Revised Statute [ORS] 459, and Oregon Administrative Rule [OAR] 340-093)
- Hazardous Waste and Hazardous Materials (ORS 465 and 466, and OAR 340 Divisions 100 to 106, 109, 111, 113, 120, 124, 135, and 142)
- General Environmental Quality (ORS 468, 468a, and 468b)

3.21.3 Affected Environment/Environmental Setting

3.21.3.1 Sites with Potential HTRW Concerns

As described in Section 3.21.4.1, Effects Determination Methods, a database search was conducted by consultant Environmental Data Resources (EDR) of sites within a 1-mile radius of the area of analysis where there is potential concern for the presence of HTRW (EDR 2010a and 2010b). Potential HTRW sites included spill sites, sites with leaking underground storage tanks, emergency response to releases sites, brownfields (urban development sites previously built upon), hazardous material incidents, and voluntary cleanup sites, among others. No recorded reviews or site inspections were performed on these sites identified from the database searches. Four potential HTRW sites within the area of analysis were identified by the EDR search. Two of the listings only indicated the presence of underground and aboveground storage tanks at the Copco Lake Store and the "Pacific Power – Iron Gate,"; but there was no evidence of spills. One listing referenced health limit exceedences in water samples from the Copco Lake Municipal Water Company for radium-228, arsenic (total), bromodichloromethane, dichloroacetic acid, and total haloacetic acids between 2004 and 2006, and for aluminum in water samples collected since 2004. The remaining listing resulted from a minor spill which was remediated and is no longer a site of concern, as described below:

- **21630 Copco Road (Map Location #2 – 21630 Copco Road, Hornbrook, CA)**. This site, which is the Copco 2 powerhouse, had a spill of non-polychlorinated biphenyl (PCB) transformer oil and is listed in the California Hazardous Material Incident Reporting System and the Emergency Response Notification System databases. According to the EDR report, in 1999, a bushing failed at a transformer adjacent to the Klamath River releasing transformer oil. Most of the non-PCB transformer oil was contained, and less than 1 quart made it to the Klamath River. According to PacifiCorp, Siskiyou County conducted the site review and approval of the transformer fire spill cleanup (EDR 2010a).

In addition to the four sites described above, the EDR database research identified 162 "orphan sites," which are those sites that could not be mapped or "geocoded" due to inadequate address information, along the two corridors of the Klamath River. After further research, seven orphan sites were identified within the area of analysis. Two of these seven were listings of National Pollutant Discharge Elimination System-permitted facilities and a Waste Discharge System facility, which do not present concerns related to HTRW. Another two of the listings indicated the presence of both aboveground and underground storage tanks at Iron Gate Salmon & Steelhead Hatchery and the J.C. Boyle Power Plant, in addition to the Copco 2 tank discussed above. There is no database-documented evidence of spills at Iron Gate or J.C Boyle. One site, listed on the Emergency Response Notification System, is the Copco 2 powerhouse minor spill described above. The remaining two sites were listed on the California Facility and Manifest Database and the leaking underground storage tank (LUST) databases. No

additional information was available on the Regional Water Quality Control Board Geotracker database or the California Department of Toxic Substances Control Envirostor database regarding these sites:

- **DFG Iron Gate Fish Hatchery (Hornbrook, CA).** This site is listed in the California EnviroStor Database (DTSC 2012). No additional information on the presence of HTRW at the site is available.
- **Weyerhaeuser Co., Klamath Mill Site (Highway 66 West, Klamath Falls, OR).** This site is listed in the underground storage tank (UST) and Geotracker databases (SWRCB 2012). No additional information on the presence of HTRW at the site is available.

In addition to the EDR database search, the following items were found from other sources:

- In 2009, at the Copco 1 Warehouse, soil known to be contaminated by petroleum products was removed from a former lube rack area. The final report and site cleanup were approved by a letter from Siskiyou County in 2010 (personal communication with R. Dean, Siskiyou County, March 30, 2011).
- In 2009, a former landfill site at Copco 2 Dam was removed per Siskiyou County review and approval (personal communication with R. Dean, Siskiyou County, March 30, 2011).
- Copco 2 Dam's fueling facility has two aboveground storage tanks (1,000-gallon gasoline and 500-gallon diesel). No known spills or cleanups occurred at this facility.

3.21.3.2 HTRW at PacifiCorp Dams and Associated Facilities

The existing dams and hydroelectric facilities have components that contain potentially hazardous materials. This analysis assumes that all painted structures, equipment, and metalwork in the project area contain heavy metals, such as lead. Window caulking, electrical wiring and components, building materials, and some coatings may contain asbestos. Tests for lead paint and asbestos are usually performed to characterize material and equipment prior to equipment removal and structure demolition. While PacifiCorp has tested their facilities for lead paint and asbestos in the past, the Lead Agencies have not verified the presence or absence of these materials as part of the development of this EIS/EIR or the Detailed Plan. In addition, surrounding soils may contain heavy metal contaminants where coatings have flaked off of the painted structures, equipment, and metalwork.

In the mid-1980s, PacifiCorp tested all of its accessible oil-filled electrical equipment for the presence of PCB materials (personal communication with T. Hepler, Reclamation, December 23, 2010.). All accessible power generation equipment was certified by PacifiCorp as "PCBs-free", if it had concentrations of PCBs that were less than 50 parts per million. Certain closed systems, such as transformer bushings, cannot be tested until time of disposal. Thus, small quantities of PCBs may be present in hydraulic fluids,

soils, and in older fluorescent light fixtures. Old light switches may contain mercury. Other hazardous materials at the dams and hydroelectric facilities may include transformers, batteries, bushings, oil storage tanks, bearing and hydraulic control system oils, lead bearings, and creosote-treated wood in the wood-stave penstocks.

It is unlikely that the dams themselves include naturally hazardous materials such as fibrous chrysotile asbestos that is a common mineral component found in serpentine rock. Serpentine is a rather weak metamorphic rock that would not typically be used in the manufacture of concrete which is what makes up the Copco dams. J.C. Boyle and Iron Gate dams are earthfill dams that are underlain by relatively young volcanic rocks of the Cascade Range geomorphic province. It is assumed that the earthen fill of those dams was derived locally from quarries excavated into the volcanic rock. The closest exposures of ultramafic rocks (i.e., serpentinized rocks) with reported occurrences of asbestos (Van Gosen and Clinkenbeard, 2011) lie approximately 18 miles due west of Iron Gate dam in the Round Mountain vicinity of the Klamath Mountains geomorphic province. Due to the distance and the relative weakness of serpentine rock compared to young volcanic rock in an engineered fill, it is unlikely that serpentine rock from the Round Mountain area was used in the construction of the dams. However, based on the age of the structures at Iron Gate and J.C. Boyle dams the concrete in the structures may contain fly ash, which has raised concerns about the presence of mercury or other toxic substances. However, the United States Environmental Protection Agency (USEPA) recognizes the beneficial uses of fly ash and considers it safe when it is encapsulated in concrete or other building materials (USEPA 2011). There is also a potential for changes to pH in river water during demolition of concrete.

As part of the Secretarial Determination studies, reservoir sediment cores were analyzed for a suite of inorganic and organic contaminants to assess the potential environmental and human health impacts of sediment release. Sediment contaminant levels in samples from the Klamath River were collected at multiple sites and at various sediment depths per site in J.C. Boyle Reservoir, Copco Reservoir, Iron Gate Reservoir, and the Klamath River Estuary, for a total of 77 samples (Department of the Interior (DOI) 2010)., The sediment evaluation process followed screening protocols of the Sediment Evaluation Framework (SEF)[1] for the Pacific Northwest, issued in 2009 by the interagency Regional SEF Team.

The SEF sediment chemistry screening process indicated that the sediment deposits in the Klamath River reservoirs are not highly contaminated. There are few positive exceedances of relevant screening values, and therefore little positive indication that substantial aquatic toxicity, or ecological or human health risk, would likely result from exposure to the sediments. Results from elutriate and sediment toxicity bioassays and sediment bioaccumulation tests carried out for the Secretarial Determination studies are used to provide additional information beyond simple comparisons of sediment contaminant levels to individual-contaminant regional or national screening levels. The

[1] The SEF is a regional guidance document that provides a framework for the assessment and characterization of freshwater and marine sediments in Idaho, Oregon, and Washington (Regional Sediment Evaluation Team 2009).

results of sediment and elutriate toxicity bioassays provide a direct assessment of potential toxicity that takes into account possible interactive effects of mixtures of multiple contaminants, and of potential contaminants that may be present but were not individually measured. Each of these biological testing approaches have been conducted on the same reservoir sediment samples evaluated in the chemistry screening described above. The results of the study are presented in Section 3.2. See Section 3.2.4.3.1.7 and Appendix C.

3.21.3.3 School Sites in the Project Area

As shown in Figure 3.21-1, the closest existing schools to the area of analysis are Hornbrook Elementary School, Willow Creek Elementary School, Bogus Elementary School, and Keno Elementary. All four of these schools are located more than a mile away from the dam facilities. Keno Elementary is 0.25 miles from the Keno Impoundment at its nearest point.

3.21.3.4 Hazardous Waste Disposal Facilities

Any hazardous waste generated from the demolition of the dams and associated hydroelectric facilities would need to be disposed of in designated hazardous waste landfills. This would include treated wood waste, PCBs present in transformers and other electrical equipment, asbestos-containing materials in building materials, fuels and oils, concrete dust (if it generates high pH waste) and soils or other material contaminated with lead from the use of lead-based paint.

The Anderson Landfill in Anderson, California, located 122 miles from Hornbrook, California, is permitted to accept hazardous waste, including treated wood waste. The Anderson Landfill had an estimated remaining capacity of 4,925,975 cubic yards (70 percent of capacity remaining) in 2000, with an anticipated closure date of 2055.

3.21.4 Environmental Consequences

3.21.4.1 Effects Determination Methods

To evaluate whether the construction/demolition areas contain existing hazardous materials, EDR conducted a search of regulatory databases to identify facilities within the vicinity of the dams where hazardous materials are known to be present based on regulatory records of investigation and/or remediation conducted under the oversight of Federal, State, or local agencies. The area of analysis was divided into three corridors along the Klamath River within Oregon and California (EDR 2010a, 2010b, and 2011). The first corridor starts where Keno Impoundment/Lake Ewauna meet in Oregon and follows approximately 18 miles of the Klamath River within south central Oregon to the Keno Dam in Keno, Oregon. The second corridor includes the northeastern point of the J.C. Boyle Reservoir to the J.C. Boyle Powerhouse, and covers approximately 8 miles of the Klamath River within south central Oregon. The third corridor includes the northeastern point of the Copco 1 Reservoir, Copco 1 Dam, Copco 2 Dam, Iron Gate Reservoir, and Iron Gate Dam, and covers approximately 12.5 miles of the Klamath

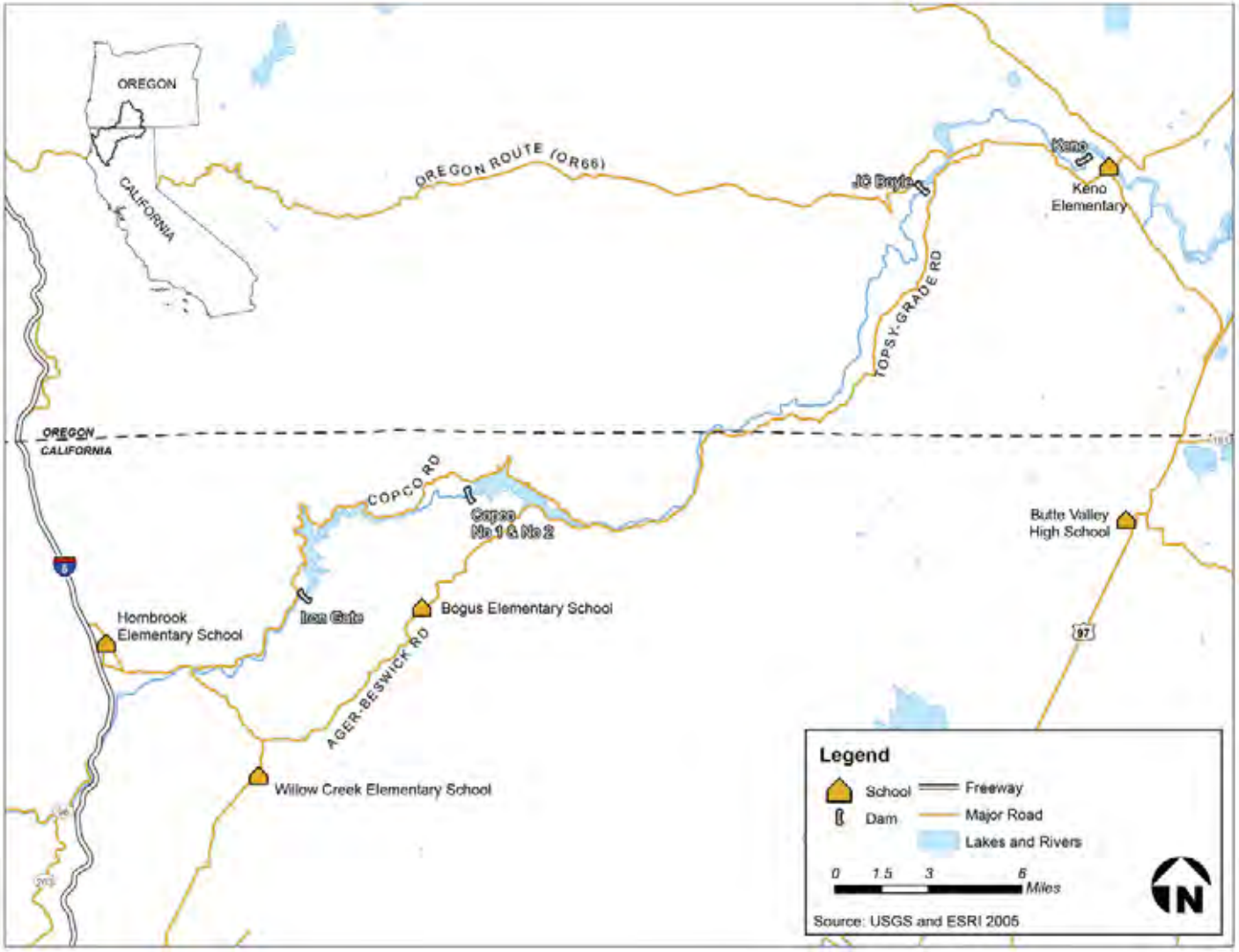

Figure 3.21-1. School Sites in the Project Area.

River within northern California. A 2-mile buffer was added for the records research to account for ground water migration and contaminant transport and to account for the width of the reservoirs. Figures 3.21-2, 3.21-3, and 3.21-4 show the area searched and an overview of the identified HTRW sites.

Database information on these sites was augmented by searching online databases of regulatory agencies to verify the closure status of sites or obtain information on the type and extent of contamination at the sites. Information on hazardous materials associated with existing dam components was obtained from PacifiCorp.

Although the databases search by EDR are updated regularly, there may be contaminated sites that have not yet been identified and are absent from the databases. A complete Phase I Environmental Site Assessment was not performed because such investigations tend to remain valid for only 6 months and, as a result, are typically done closer to the time of construction.

3.21.4.2 Significance Criteria

For the purposes of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR), impacts related to HTRW would be significant if an alternative would result in any of the following:

- Creation of a significant hazard to the public or the environment through the transport, use, or disposal of hazardous materials;
- Creation of a significant hazard to the public or the environment through reasonably foreseeable accident conditions involving the release of hazardous materials into the environment;
- Generate hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school; or
- Be located on a site which is included on a list of hazardous materials sites and, as a result, create a significant hazard to the public or the environment.

3.21.4.3 Effects Determinations

The following sections contain descriptions of the hazardous waste effects that would occur under each alternative.

There are no schools located within one quarter mile of construction areas; the nearest schools are located more than 3 miles away. Therefore, there would be no impacts related to emissions or handling hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. For this reason, the third significance criterion listed above does not apply to any of the alternatives and will not be considered further in this analysis.

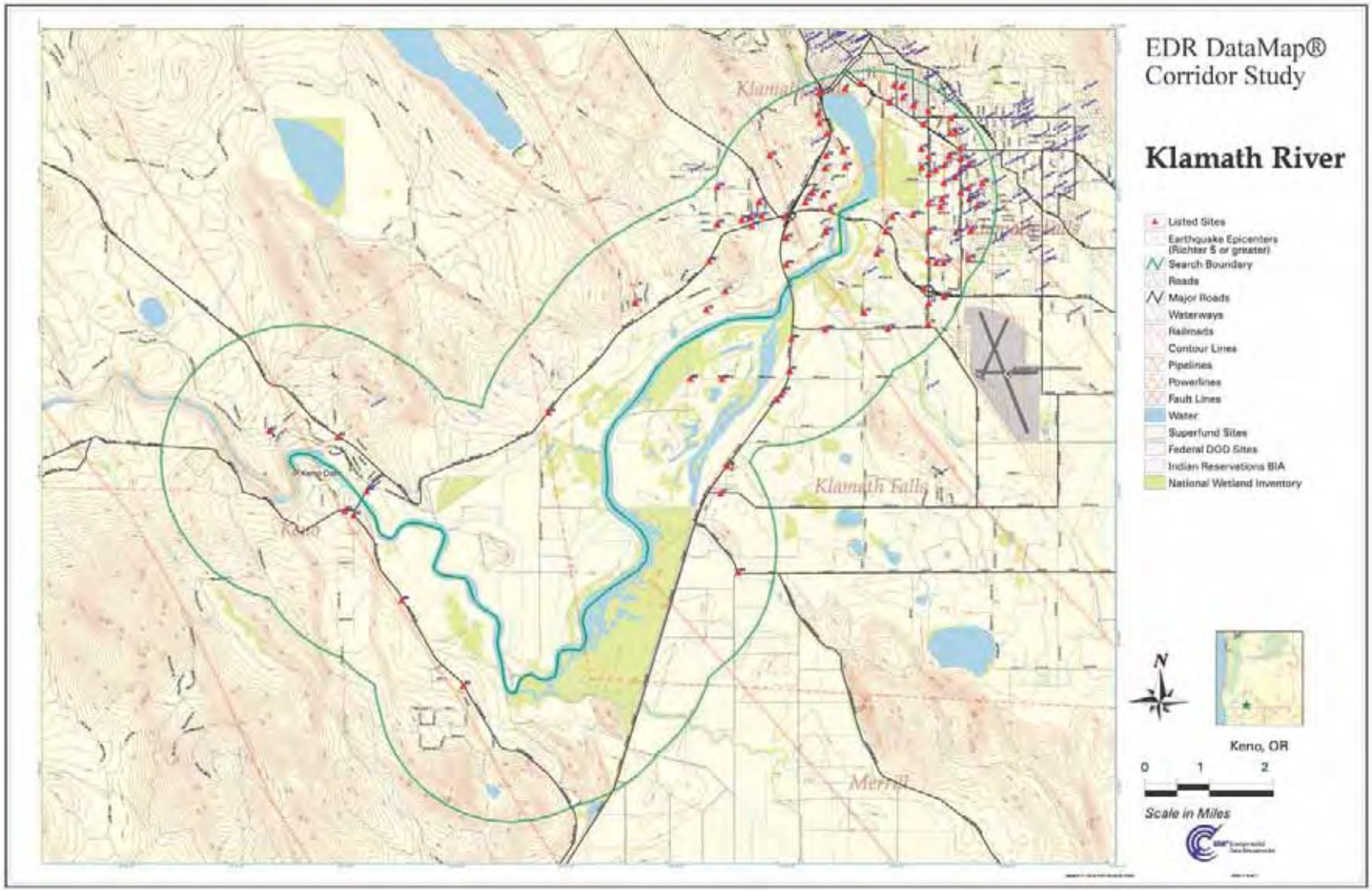

Figure 3.21-2. HTRW Sites, Keno Dam and Keno Impoundment/Lake Ewauna.

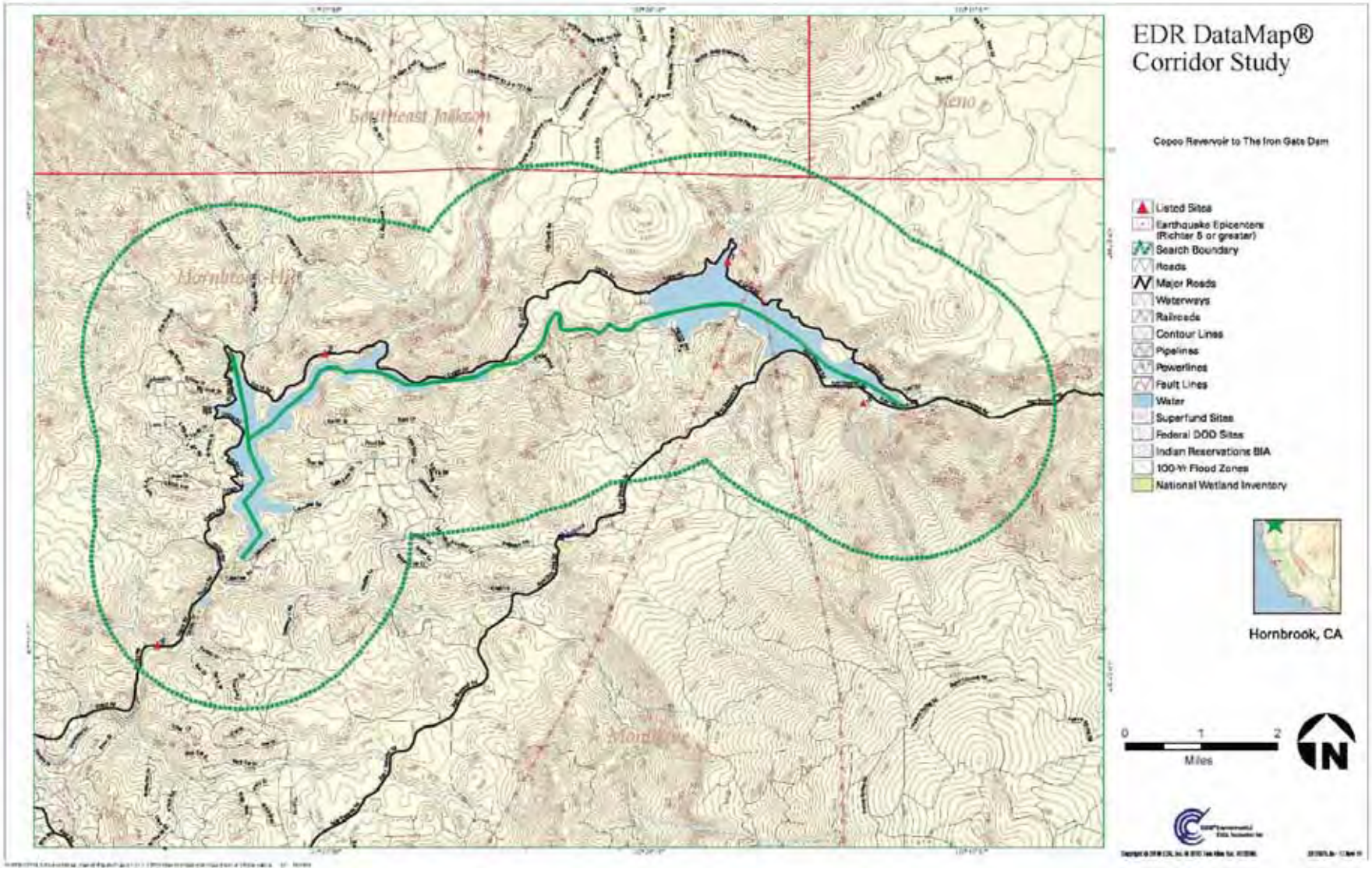

Figure 3.21-3. HTRW Sites, Iron Gate and Copco Dams and Reservoirs.

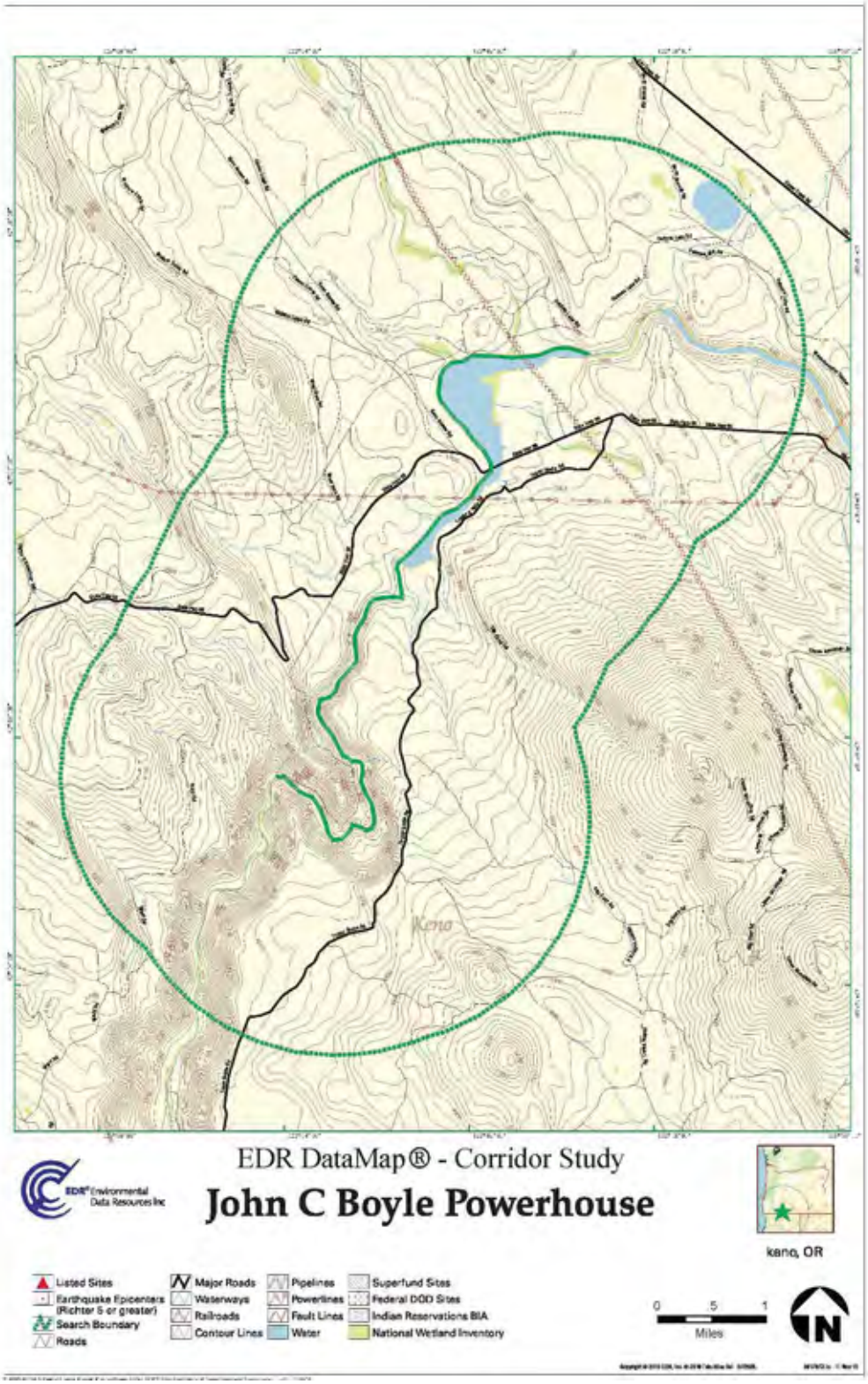

Figure 3.21-4. HTRW Sites, J.C. Boyle Dam and Reservoir.

To assess hazardous waste effects that could occur under each alternative, the analysis focused on potential hazards that could be encountered during deconstruction of the dam facilities, construction of fish passageways, and resultant restoration of the deconstruction/construction areas. The potential resulting risk to the public from these activities are described qualitatively. To identify potential hazards to the public from the alternatives, the inventory of existing hazardous materials at the dams and associated facilities was reviewed to assess potential risks associated with their deconstruction and removal. In addition, the EDR database search was used to identify known hazardous material sites within the area of analysis that could be disturbed during deconstruction/ construction activities.

According to the information provided in the EDR search, construction areas for the Proposed Action and the other action alternatives are not located near sites where hazardous materials are known to occur. Since the EDR report identified a very small number of sites of concern located within one mile of the construction areas, the potential for hazards related to encountering contaminated soil or ground water from these sites is low, however, this risk is discussed below.

3.21.4.3.1 Alternative 1: No Action/No Project

The No Action/No Project Alternative could create a hazard to the public or the environment through the handling, transport and disposal of HTRW. Under the No Action/No Project Alternative, no new construction or demolition would occur at the four Klamath dams so existing known hazardous sites would not be disturbed and would not pose a threat to public safety. Hazardous components of the existing dams, such as transformers, bushings, tanks, lead bearings, creosote-wood staves, and asbestos-based insulating products, would not be disturbed. Any hazardous waste generated or used during operation of the existing dams and hydroelectric facilities and during construction of the Ongoing Restoration Actions (e.g., at Wood River, Barnes, etc.) would be the same as under existing conditions. **Therefore, there would be no change from existing conditions related to HTRW under the No Action/No Project Alternative.**

3.21.4.3.2 Alternative 2: Full Facilities Removal of Four Dams (the Proposed Action)

The Proposed Action involves removal of all appurtenant features, with the exception of buried features, at the Four Facilities.

Facility deconstruction could occur on sites included on a list of hazardous materials sites and, as a result, create a significant hazard to the public or the environment. As summarized in Section 3.21.3.1, the EDR database search identified two listed hazardous sites within one mile of the area of analysis. One site involved a spill of non-PCB transformer oil on Copco Road in 1999, but less than one quart reached the Klamath River. Siskiyou County conducted the site review and approval of the transformer fire spill cleanup. The other reported site was the Copco Lake Municipal Water Company reporting health limit exceedances of radium-228, arsenic (total), bromodichloromethane, dichloroacetic acid, and total haloacetic acids in 2004 and 2006 and detections of aluminum exceeding both the health and legal limits since 2004. Due to the distance of

these two sites from the Four Facilities and construction areas, there is no potential to encounter HTRW from these two sites during construction and demolition activities under the Full Facilities removal of Four Dams alternative. . The EDR database search did not identify any other reported spills within the area of analysis; however, the databases searched by EDR are constantly being updated and require reporting by others to be complete. As such, there is the possibility that an unknown (i.e., unreported and unlisted) contaminated site could be encountered. **There would be no change from existing conditions related to posing a hazardous chemical risk from materials currently at the dam sites.**

Facility deconstruction could create a significant hazard to the public or the environment through the transport, use, or disposal of HTRW during construction. Hydroelectric facilities operate using a variety of chemicals (e.g., lubricants, transformer oils, bearing oils, etc.) that would be removed under decommissioning. The presence of a UST at the J.C. Boyle Power Plant does not indicate a spill; however, care should be exercised when conducting work in these areas. As part of the decommissioning plan, prior to initiation of deconstruction or construction activities, the contractor will be required to prepare a Hazardous Material Management Plan (HMMP) for review by the Dam Removal Entity in case contaminated media are encountered. The purpose of this plan is to have an established plan of action if known or unknown hazardous materials (e.g., soil or ground water contamination, asbestos and hazardous coatings requiring abatement, high pH generated during demolition of concrete, etc.) are encountered during construction/ deconstruction and to establish best management practices (BMPs) to reduce the potential for exposure to hazardous wastes. The HMMP will contain the following:

- Definition of a protocol for proper handling, transport, and disposal of hazardous materials (e.g., creosote-treated wood staves, high pH concrete particles) if they are encountered during construction or deconstruction.
- Definition of a protocol for proper emergency procedures and handling, transport, and disposal of hazardous materials if an accidental spill occurs during construction.
- Establishment of BMPs to reduce the potential for spills of HTRW. Typical BMPs to reduce the potential for spills may include, but are not limited to:
    - Having a spill prevention and control plan with a designated supervisor to oversee and enforce proper spill prevention measures;
    - Providing spill response and prevention education for employees and subcontractors;
    - Stocking appropriate clean-up materials onsite near material storage, unloading and use areas;
    - Designating hazardous waste storage areas away from storm drains or watercourses;
    - Minimizing production or generation of hazardous materials on-site or substituting chemicals used on-site (e.g., herbicides during restoration) with less hazardous chemicals;

- Designating areas for construction vehicle and equipment maintenance and fueling with appropriate control measures for runon and runoff; and
- Arranging for regular hazardous waste removal to minimize onsite storage.

Hazardous materials at the dam settings could include creosote-treated wood staves, asbestos, batteries, transformers, bearing and hydraulic control system oils, oil storage tanks, mercury light switches, and PCBs. In addition, coatings containing heavy metals in the powerhouse and on the exterior surfaces of the steel penstock and air vent pipes, surge tanks, bulkhead gates, and generator gantry crane would require specialized abatement and disposal. The volumes of most of these materials requiring special disposal (e.g., asbestos insulation and lead-based paint) have not been estimated because they cannot be easily quantified before abatement activities have been conducted.

Removal of Copco 2 Dam would generate an estimated 725 tons of treated wood material (creosote wood staves) that would require transport and disposal (analysis of impacts to regional waste facility capacity is presented in Section 3.18, Public Health and Safety, Utilities and Public Services, Solid Waste, and Power). In addition, if it is determined that the Lakeview Bridge just downstream from Iron Gate Dam is not adequate to support construction traffic from the decommissioning activities and needs to be replaced, creosote-treated wood from the bridge would require transport and disposal. Because the Anderson Landfill has an estimated remaining capacity of 4,925,975 cubic yards, the regional landfills in the surrounding counties should be capable of handling the additional generated waste hazardous waste. Licensed contractors would be selected to transport any waste designated as hazardous. The contractors would be required to comply with all hazardous waste laws for transport and disposal of hazardous materials. **With implementation of the HMMP during construction, impacts from the transport, use, and disposal of HTRW from dam removal would be less than significant.**

Facility deconstruction could create a significant hazard to the public or the environment through the abatement and disposal of asbestos and lead-based paint during construction. In addition, as noted under existing conditions, paint coatings on the buildings and structures may have flaked off into the surrounding soil, creating localized areas of soil contamination that would need to be properly excavated and disposed of. However, as part of the decommissioning plan, the demolition contract will require evidence be provided to the responsible Federal agency prior to issuance of demolition permits that a qualified asbestos and lead-based paint removal contractor/specialist has been procured to remove or otherwise abate asbestos and lead-based paint prior to or during demolition activities in accordance with Federal, State, and local regulations. In addition, evidence will be provided to the responsible Federal agency that the demolition contract provides for construction contracts and/or land/building leases, provisions shall be included requiring continuous compliance with all applicable government regulations and conditions related to hazardous materials and waste management. **Therefore, impacts associated with abatement and disposal of asbestos and lead-based paint would be less than significant.**

Facility deconstruction could create a significant hazard to the public or the environment through the accidental release of hazardous materials into the environment during construction. Construction equipment would require the use of hazardous materials (e.g., diesel and gasoline fuels, hydraulic oil). Restoration activities under the Proposed Action would require trucks for hauling equipment and raw materials including spawning-size pea gravel, aircraft for applying hydromulch, discing equipment, backhoes, and other equipment. Restoration could also include the application of herbicides or pesticides. Fuels, oils, and other hazardous materials used during construction could be accidentally released within construction, staging, and access areas through spills, fueling, and equipment repair.

As part of the decommissioning plan, the contractor will be required to prepare and implement a worker Health and Safety Plan (HASP) prior to the start of construction activities. The HASP will, at a minimum, identify the following:

- All contaminants that could be encountered during excavation activities
- All appropriate worker, public health, and environmental protection equipment and procedures
- Proper housekeeping and BMP procedures to prevent spills or migration of herbicides/pesticides
- Emergency response procedures
- Most direct route to a hospital
- Site Safety Officer

The plan will require documentation that all workers have reviewed and signed the plan**.**

With implementation of the HMMP and the HASP during construction of the Proposed Action, impacts from the accidental introduction of hazardous materials would be less than significant.

Drawdown of the reservoirs would require removal of recreational facilities currently located on the banks of the existing reservoirs. The existing recreational facilities provide camping and boating access for recreational users of the reservoirs. Once the reservoirs are drawn down, these facilities will be removed. Construction equipment used for the removal would require the use of hazardous materials (e.g., diesel and gasoline fuels, hydraulic oil). Fuels, oils, and other hazardous materials used during removal could be accidentally released within construction, staging, and access areas through spills, fueling, and equipment repair. An HMMP and HASP would be prepared, as described above. **With implementation of the HMMP and the HASP during construction of the Proposed Action, impacts from the accidental introduction of hazardous materials during the removal of the recreational facilities would be less than significant.**

Keno Transfer

The transfer of the Keno Facility to DOI could result in affects to HTRW. The Keno Transfer would result in a transfer of ownership of the Keno facility to DOI. There

would be no changes in operations or land use of the Keno Facility with the Keno Transfer. In addition, the EDR search did not identify any sites of concern related to HTRW that would change ownership under the Keno Transfer. Due diligence would be required prior to the Keno Transfer to ensure that any hazardous or toxic wastes and materials present on the properties are identified and fully disclosed. Should any be discovered, proper management would be necessary for PacifiCorp or DOI to manage the materials. **Therefore, the implementation of the Keno Transfer would result in no change from existing conditions.**

East and Westside Facilities – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects in terms of toxics and hazardous materials. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp is a part of the Klamath Hydroelectric Settlement Agreement (KHSA). Currently, PacificCorp diverts water at Link River Dam into the two canals. These diversions would cease with the decommissioning of the East and Westside facilities. Following decommissioning of the facilities there would be no change in outflow from Upper Klamath Lake or inflow into the Link River. Appropriate health and safety plans would be created to limit the potential of toxic releases during decommissioning. **Therefore, there would be less than significant effects from the decommissioning activities.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Removal of Iron Gate Reservoir would require the relocation of the City of Yreka Water Supply Pipeline, which could create a significant hazard to the public or the environment through the accidental release of hazardous materials into the environment during construction. The existing water supply pipeline for City of Yreka passes under the Iron Gate Reservoir and would be relocated prior to the decommissioning of the reservoir to prevent damage from deconstruction activities or increased water velocities once the reservoir has been drawn down. The pipeline would either be suspended from a pipe bridge across the river near its current location, or rerouted along the underside of the Lakeview Bridge just downstream from Iron Gate Dam. Construction equipment used for the relocation would require the use of hazardous materials (e.g., diesel and gasoline fuels, hydraulic oil). Fuels, oils, and other hazardous materials used during construction could be accidentally released within construction, staging, and access areas through spills, fueling, and equipment repair. An HMMP and HASP would be prepared, as described above. **With implementation of the HMMP and the HASP during construction of the Proposed Action, impacts from the accidental introduction of hazardous materials during the pipeline relocation would be less than significant.**

KBRA – Programmatic Measures

The following KBRA programs would entail construction, and therefore could result in impacts related to HTRW:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration Project

- On-Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Power for Water Management Program
- Additional Water Conservation and Storage

Construction activities associated with the KBRA programs could create a hazard to the public or the environment through the transport, use, or disposal of hazardous materials encountered during construction. Exact locations and construction plans have not yet been determined for the KBRA construction activities. Impacts related to creating a hazard through routine transport, use, and disposal of hazardous materials would be comparable to those described above for the Proposed Action. The potential for encountering contamination during construction activities for KBRA programs and the extent and frequency of excavation, transport, and disposal are unknown. At the time of implementation of KBRA programs, the entity implementing a KBRA program would follow environmental compliance guidelines with regards to applicable toxic and hazardous material laws. These construction actions would not be in the same location or occur at the same time as the hydroelectric facility removal actions. As a result, KBRA construction actions would not contribute to the potential hazardous material effects of facility removal actions. **Therefore, impacts from hazardous materials encountered during construction for KBRA would be less than significant.**

Construction activities associated with the KBRA programs could create a significant hazard to the public or the environment through the accidental release of hazardous materials during construction activities. Construction could require the use of equipment that use hazardous materials (e.g., fuels and oils) and an accidental release of these hazardous materials could occur. BMPs described in the affected environment would reduce any likelihood of accidental release. As noted above, at the time of implementation of KBRA programs, the implementing entity would follow environmental compliance guidelines with regards to applicable toxic and hazardous material laws. These construction actions would not occur in the same place or at the same time as the hydroelectric facility removal actions. As a result, these actions would not contribute to the effects of facility removal actions. **With implementation of standard BMPs during construction for the KBRA, impacts from the accidental introduction of hazardous materials would be less than significant.**

3.21.4.3.3 Alternative 3: Partial Facilities Removal of Four Dams

The Partial Facilities Removal of Four Dams Alternative could create a significant hazard to the public or the environment through the transport, use, or disposal of hazardous materials encountered during construction or the accidental release of HRTW during construction. Under the Partial Facilities Removal of Four Dams Alternative, certain project features at the Four Facilities would be retained. Impacts related to HTRW for the Partial Facilities Removal of Four Dams Alternative would be the same as that associated with the Proposed Action. Table 2-22 in Chapter 2, Proposed Action and Description of the Alternatives, lists features that would be removed under the Proposed

Action, but would remain in the Partial Facilities Removal of Four Dams Alternative that could potentially reduce the amount of hazardous waste requiring abatement or disposal. Although all of the specifically identified powerhouse hazardous materials (transformers, batteries, and insulation) would be removed under both alternatives, some materials that contain hazardous coatings could be retained under the Partial Facilities Removal of Four Dams Alternative and would be stabilized through ongoing maintenance activities (e.g., painted penstocks that are left in place under this alternative would be recoated periodically as maintenance). **With implementation of the HMMP and the HASP during construction, impacts associated with the handling, transport, and disposal of hazardous materials and the accidental release of hazardous materials during construction of the Partial Facilities Removal of Four Dams Alternative would be less than significant.**

Keno Transfer

The effects of the Keno Transfer would be the same as those described for the Proposed Action.

East and Westside Facilities – Programmatic Measures

The effects of the East and Westside Facilities removal would be the same as those described for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the relocation of the City of Yreka Water Supply Pipeline would be the same as the Proposed Action.

KBRA – Programmatic Measures

The KBRA would be fully implemented under this alternative. Effects would be the same as the Proposed Action.

3.21.4.3.4 Alternative 4: Fish Passage at Four Dams

Under the Fish Passage at Four Dams Alternative, no facilities removal would be conducted. This alternative would include the construction of fish passageways at each of the Four Facilities. Known hazardous materials associated with the facility structures would remain in place and there would be no anticipated handling, transport, or disposal of HTRW.

The Fish Passage at Four Dams Alternative could create a significant hazard to the public or the environment through the accidental release of hazardous materials into the environment during construction. Construction would require the use of hazardous materials (e.g., fuels and oils) within construction areas. The scale of the construction would be much smaller for the construction of the Fish Passage at Four Dams Alternative than it would be under the Proposed Action and Partial Facilities Removal of Four Dams Alternatives. **With implementation of the HMMP and the HASP during construction, impacts from the accidental release of hazardous materials would be less than significant.**

3.21.4.3.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

The Fish Passage at Two Dams Alternative could create a significant hazard to the public or the environment through the transport, use, or disposal of hazardous materials encountered during construction or the accidental release of HRTW during construction. Under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative, the Dam Removal Entity would remove the facilities at Copco 1 and Iron Gate Dams. Fish passage facilities would be constructed at J.C. Boyle and Copco 2 Dams. Impacts related to hazardous materials for the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would be the same as for the Proposed Action at the Copco 1 and Iron Gate Dams, and would be the same as for the Fish Passage at Four Dams Alternative at J.C. Boyle and Copco 2 Dams. **With implementation of the HMMP and the HASP during construction, impacts associated with the handling, transport, and disposal of hazardous materials and the accidental release of hazardous materials would be less than significant.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of the relocation of the City of Yreka Water Supply Pipeline would be the same as the Proposed Action.

3.21.4.4 Mitigation Measures

3.21.4.4.1 Mitigation Measure by Consequence Summary

Impacts associated with hazardous materials under each of the alternatives would be less than significant with the implementation of the HMMP and HASP; therefore, no mitigation measures would be required.

3.21.4.4.2 Mitigation Measures Associated with Other Resource Areas

Construction of new recreation facilities could release hazardous materials. Mitigation measure REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. Construction equipment used for the new construction would require the use of hazardous materials (e.g., diesel and gasoline fuels, hydraulic oil). Fuels, oils, and other hazardous materials used during construction could be accidentally released within construction, staging, and access areas through spills, fueling, and equipment repair. An HMMP and HASP would be prepared, as described above. **With implementation of the HMMP and the HASP, impacts from the accidental release of hazardous materials during construction of new recreation facilities would be less than significant**.

3.21.5 References

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3.22 Traffic and Transportation

This section describes how the Proposed Action and alternatives could affect the area's transportation and circulation. This section includes a description of the area of analysis, the local and direct access routes identified to be used during construction, the existing non-motorized transportation network, and transit resources. This section also contains an analysis of future traffic volumes resulting from each alternative and describes mitigation measures to reduce impacts during construction. Appendix S includes tables that support this transportation and circulation analysis, and Appendix T describes 2020 Traffic Volume Projections.

3.22.1 Area of Analysis

The area of analysis for the Klamath Hydroelectric Settlement Agreement (KHSA) includes roadways in Siskiyou and Shasta Counties in California and Klamath and Jackson Counties in Oregon. The area of analysis for the KHSA is rural with very low-density development. Most of the private property is undeveloped and/or used as grazing land for cattle with the exception of several small communities in the vicinity of Copco 1 and Iron Gate Reservoirs. Figure 3.22-1 depicts the transportation network in the area of analysis for the KHSA. The area of analysis for the Klamath Basin Restoration Agreement (KBRA) constitutes the entirety of the Klamath Basin and can be characterized as both urban and agricultural.

Table 3.22-1 lists the dam sites within the KHSA along with the corresponding regional and local roads that access each site.

3.22.2 Regulatory Framework

This analysis uses Oregon Department of Transportation (ODOT) and California Department of Transportation (Caltrans) accepted methods for measuring impacts on roadways. The Lead Agencies used these guidelines in the absence of county level guidelines. Caltrans measures traffic capacities in terms of a Level of Service (LOS). In California, the Siskiyou County General Plan is used as a guide in determining significance (1988). The ODOT system of congestion measurement is different from the LOS system that Siskiyou County and Caltrans use. The ODOT, Klamath County, and Jackson County, use a volume-to-capacity (v/c) ratio.

Where roadway planning level capacities were desired, and were not available from ODOT, Caltrans or County sources, the Lead Agencies used Caltrans accepted guidelines developed by the Florida Department of Transportation (FDOT) to outline roadway planning capacities in the project area.

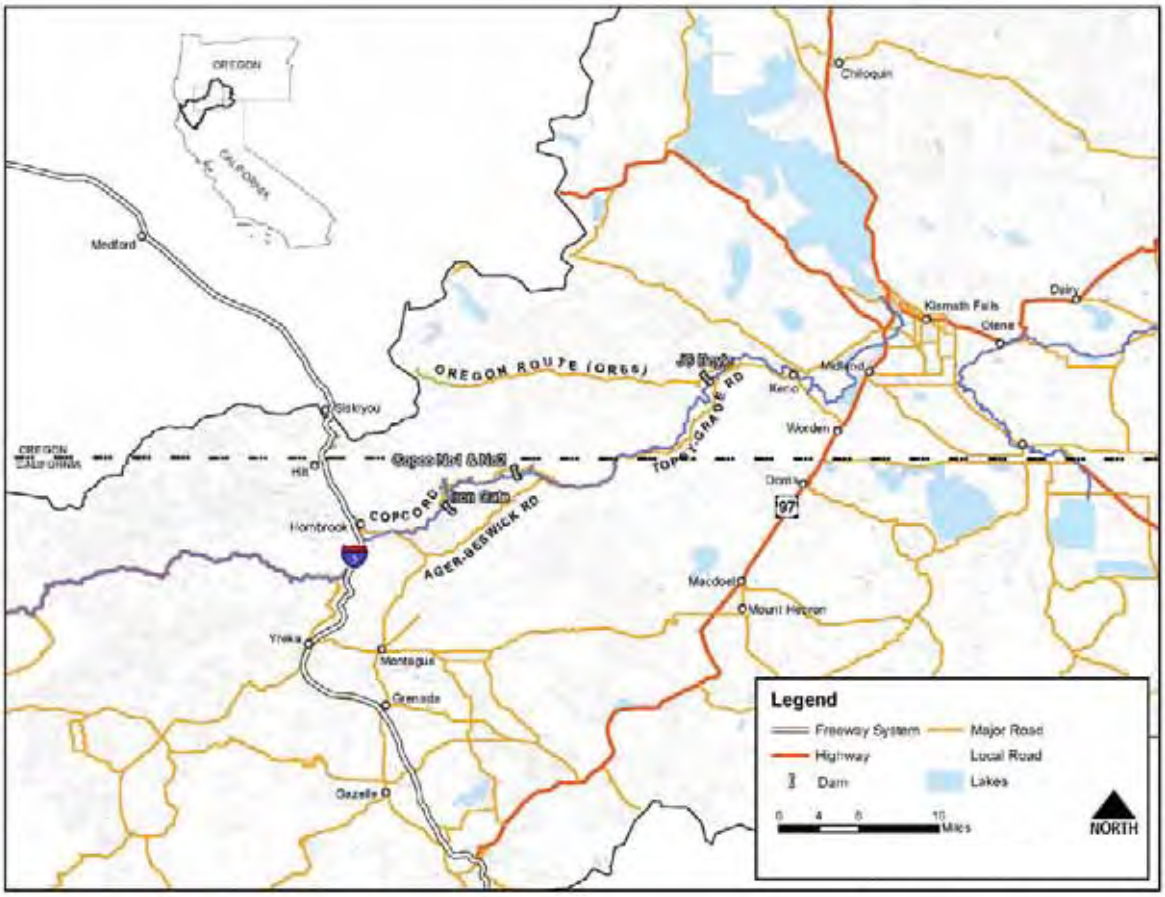

Figure 3.22-1. Regional Access Routes Relative to the KHSA.

Table 3.22-1. Local and Regional Access Roads Relative to KHSA

Dam Site	Interstate Access Road	Regional Access Road	Local Access Road
J.C. Boyle	Interstate 5 (1-5) (in Oregon) and US97	Oregon Route (OR) 66	Topsy Grade Road
Copco 1	I-5 (in California)	Copco Road	Ager-Beswick Road
Copco 2	I-5 (in California)	Copco Road	Ager-Beswick Road
Iron Gate	I-5 (in California)	Copco Road	Lakeview Road

Source: CDM field observation, Oct 2010.

3.22.2.1 Significance Criteria

For the purposes of the Klamath Facilities Removal Environmental Impact Statement/ Environmental Impact Report (EIS/EIR), effects would be significant if they resulted in one or more of the following conditions or situations:

- An alternative conflicted with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system.[1] (Traffic Flow Effects)
- Non-compliance with county planning regulations. (Traffic Flow Effects)
- Traffic related to implementation of the alternative resulted in a LOS worse than level C in Siskiyou County.[2] (Traffic Flow Effects)
- Traffic related to implementation of the alternative resulted in a v/c ratio of more than 0.75 for OR66 or 0.70 for U.S. Route 97 (US97).[3] (Traffic Flow Effects)
- Traffic related to implementation of the alternative traversed blind corners or sharp turns; if large trucks would be turning onto and off of roadways with high speed limits; and/or if conflicts would occur at existing recreation sites where passenger cars may consistently turn in and out. (Traffic Safety Effects)
- An alternative conflicted with adopted policies, plans, or programs regarding public transit. (Public Transit Effects)
- Project-related vehicle volumes were great enough to exceed the capacity of a road in the area of analysis. This would slow or impede general vehicle traffic along a roadway and delay public transit service. Effects would also be significant if construction activities were adjacent to public transit passenger pick up/drop off facilities and inhibited vehicle travel or transit vehicle turning movements. (Traffic Flow Effects)
- An alternative resulted in the following Non-Motorized Transportation Effects:
    - Substantial degradation of road conditions that interfered with non-motorized vehicle use.
    - Conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities.
    - Deconstruction or construction traffic crossing or running along existing non-motorized transportation facilities.
    - A need for the narrowing or rerouting of non-motorized transportation infrastructure such as a bicycle lane or sidewalk.

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[1] Taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.

[2] In California, progressively worsening traffic conditions are given the letter grades “A” through “F.” While most motorists consider an “A,” “B,” or “C” LOS as satisfactory, LOS “D” is considered marginally acceptable. Congestion and delay are considered unacceptable to most motorists; these conditions would result in LOS “E” or “F” ratings. LOS analyses can be very detailed but for the purposes of this analysis LOS will only be discussed when referring to industry-accepted general planning standards for roadway capacity. LOS C is the threshold for capacity for California roads in this analysis. According to the Siskiyou County General Plan, LOS worse than level C is not acceptable (Siskiyou County 1988).

[3] In Oregon, several different thresholds apply to various roads. A v/c ratio of 1.0 is equivalent to a poor LOS (E or F) with long delays. Klamath and Jackson Counties and ODOT are willing to accept a certain amount of congestion during peak periods to encourage drivers to find other modes of transportation or other times to travel. Jackson County requires that I-5 have a v/c ratio no higher than 0.85 (Jackson County 2005). Klamath County requires that OR66 have a v/c ratio no greater than 0.75 and US97 have a v/c ratio of no greater than 0.70 (Klamath County 2004).

3.22.3 Existing Conditions/Affected Environment

3.22.3.1 KHSA – River Reach Road Network

The following describes the characteristics of the roadways within the KHSA transportation analysis area. The Lead Agencies recorded these characteristics during site visits and relied on existing traffic volume data for the subject roadways from ODOT and Caltrans.

- **I-5** – a major north/south interstate highway that runs the length of California and continues through Oregon. This is a main regional access road for the Four Facilities on the Klamath River. Through Siskiyou and Jackson Counties, I-5 has four lanes. The posted speed limit is 70 miles per hour (mph) in California and 65 mph in Oregon. The portion of I-5 in California closest to the Iron Gate Dam has more than 17,000 vehicles per day in Annual Average Daily Traffic (AADT) in its peak month, and averages 15,200 AADT. In Oregon, near the intersection with OR66, traffic volumes are closer to 14,300 AADT.
- **OR66** – Known locally as Green Springs Highway, this road also carries the ODOT designation of Highway Number 21. OR66 is a two lane, east/west, asphalt State highway. It is approximately 32 feet wide and the posted speed limit is 55 mph in some locations. Some sharp curves on OR66 require posted speed reductions. OR66 connects I-5 to the J.C. Boyle Dam and to US97 and intersects I-5 approximately 14 miles north of the California border. Traffic counts from 2009 along OR66 show 9,500 AADT just east of I-5 and 500 AADT closest to the J.C. Boyle Dam.
- **US97 –** Known locally as the California-Dalles Highway, this road carries the ODOT designation of Highway Number 4 and is a four-lane, north/south, asphalt US highway. A barrier divides the northbound and southbound lanes and it has a wide shoulder. The posted speed limit is 65 mph and AADT in 2009 was 9,700 vehicles.
- **Copco Road** – a minor collector that leads from I-5 to the Iron Gate, Copco 1 and Copco 2 Dams. Copco Road is a paved, two-lane road in good pavement condition with few pavement cracks or ruts and is approximately 27 feet wide. Copco Road maintains this character from its intersection with I-5 east to a point about 10 miles from the Copco Developments near the Juniper Point Picnic Area. The section between the intersection of Copco Road with Ager Road and the Juniper Point Picnic Area, contains intermittent pavement surfacing that has not been as well maintained as the portions to the west of Ager Road. The final 3 miles, from Camp Creek Road near the Juniper Point Picnic Area to the Copco Dams, are gravel and narrow, and less than 18 feet wide in some locations. The posted speed limit on Copco Road from I-5 to the Juniper Point Picnic Area is generally 55 mph with a few sharp curves, especially in the portions that run along the Iron Gate Reservoir. AADT for this analysis is based on field observation. See Figure 3.22-2 for a photo of a portion of Copco Road.

Source: Camp Dresser & McKee (CDM) 2010

Figure 3.22-2. Copco Road (north of river, facing west).

- **Topsy Grade Road and Ager-Beswick Road –** The roads known as Topsy Grade Road in Oregon and Ager-Beswick Road in California run along the southern side of the Klamath River and connecting the Copco 1 Reservoir to the J.C. Boyle Dam. The road sections between those two locations the road are mostly unimproved with natural surfacing. While these road sections have several different surfacing and sizing characteristics along it, the relevant portion, Topsy Grade Road near the J.C. Boyle Dam, is partially gravel and partially paved. It provides access to the Topsy Grade Recreation Area from OR66. Topsy Grade Road would give access to OR66 from the J.C. Boyle construction site, and Ager-Beswick Road would provide haul access, via Patricia Avenue (with construction of a temporary access connection along the dam abutment), from Copco 1 to the City of Yreka, California.
- **Unpaved access roads –** each dam has a small network of one lane, gravel access roads leading from either Copco Road or OR66 to the dams themselves. These roads are no wider than 15 feet and are no longer than ½ mile. Most of the traffic along these roads consists of PacifiCorp's technicians accessing the facilities and recreational users.
- **J.C. Boyle unpaved access roads** – While this road network shares the same characteristics of the other unpaved access roads, it has a small bridge linking the north and south sides of the dam. This is a key link and might play a role in construction activities. Figure 3.22-3 is a photo of this bridge.

Source: CDM 2010

Figure 3.22-3. Access Bridge at J.C. Boyle Dam.

- **Lakeview Road** – a local road that accesses the Iron Gate Dam itself. Lakeview Road intersects with Copco Road at the entrance to the Iron Gate Recreation Area. A one-lane bridge crosses the river (see Figure 3.22-4) at this intersection linking to Lakeview Road. Lakeview Road is a gravel road that leads up to the top of Iron Gate Dam. It is approximately 24 feet wide and has a steep embankment on the east side, without a guardrail. Lakeview Road connects to an unnamed bridge access road. The narrow, gravel access road leads onto the top of Iron Gate Dam. For the purposes of further analysis, Lakeview Road would be considered an unpaved access road except when discussing the bridge.

Source: CDM 2010

Figure 3.22-4. Bridge Accessing Lakeview Road (looking south).

- **Baseline Transit Service -** The Siskiyou Transit and General Express is the only transit service in the KHSA area of analysis. It is a regional service that connects the downtowns of Dunsmuir, Weed, Mt. Shasta, Grenada, McCloud, the City of Yreka, Montague, Fort Jones, Greenview, Etna, Klamath River, Horse Creek, Hamburg, Seiad Valley and Happy Camp. Service is very limited, sometimes running only one or two times a week. One route branches into the area of analysis and currently runs twice a week: the Hornbrook route. The Hornbrook route follows I-5 north into Hornbrook, turns east on Copco Road and then turns south (well before reaching the Iron Gate Dam) at Ager Road heading towards Montague, California.

  In addition, Greyhound bus service runs on US97 connecting Klamath Falls to other cities in the region and to nearby Amtrak stations (Siskiyou County 2008). As with the Siskiyou Transit and General Express, this service is limited and is along a major U.S. highway.

- **Non-motorized Transportation Network –** The area of analysis has very few or no sidewalks and no designated bicycle routes of any kind. Because various camp and recreational sites exist throughout the KHSA area of analysis, it should be expected that bicycle riders and pedestrian travel along the river reach road network will be limited in capacity.

  Specific information about the haul routes needed for construction and deconstruction activities as well as potential right-of-way requirements is provided in the Detailed Plan for Facilities Removal which will be produced if there is a Secretarial Determination. There would be subsequent environmental analysis on this plan to analyze traffic and transportation impacts from the Proposed Action.

3.22.3.2 KBRA – Road Network

The Upper Klamath Basin road network exhibits many of the same characteristics of the local access roads and other routes described for the KHSA area of analysis. Activities to be implemented that would likely affect transportation include the Phase I and Phase II Fisheries Restoration Plans. KBRA activities might include decommissioning local access roads, upgrading and/or replacing culverts to improve fish passage, and using backhoes and dump trucks to reshape channels and deliver gravel to augment fish spawning. Exact locations of these activities are currently undefined.

3.22.4 Environmental Consequences

3.22.4.1 Environmental Effects Determination Methods

3.22.4.1.1 Traffic Flow Effects

The scope of this analysis includes all roads that would experience construction related traffic. Routes were identified between each construction site and anticipated disposal sites. The greatest traffic flow effects would be nearest to the construction sites and those portions of the road were used during this analysis to assess potential impacts.

The Lead Agencies considered two components of traffic growth in evaluating future year conditions. First, the team determined an annual background growth rate based on historical data from 2000 through 2009. The Lead Agencies used that data to create a trend line and project baseline traffic volume to 2020. See Appendix T for the graphs showing these projections. Second, the Lead Agencies collected construction data including the number of construction trucks, construction truck routes and timing, number of workers, and worker traffic routes and timing. Lead Agencies provided this data for the project alternatives and added to the network any increases in traffic expected from each of the alternatives.

In addition to construction trucks hauling materials, construction workers accessing the sites may affect traffic flows in the area. Using construction worker forecasts and the current traffic volumes along available access roads, Lead Agencies projected traffic increases from workers. To access Iron Gate, Copco 1 and Copco 2 Dams, workers must travel along I-5 to Copco Road or Ager-Beswick Road. The worker access trip counts were assigned to these two roads. The J.C. Boyle Dam has two different directions from which workers might originate. In consideration of the current traffic volume to the east and west of J.C. Boyle Dam along OR66, this analysis uses the percentages of AADT to indicate how many workers might originate their trips from the east or from the west. Based on this analysis, the Lead Agencies assume that 12 percent of workers traveling to J.C. Boyle Dam would come from the west, taking I-5 to OR66 and 88 percent would come from the east, taking US97 to OR66.

The Lead Agencies used Caltrans accepted guidelines developed by the FDOT, along with road characteristics, to outline roadway planning capacities in the project area. The FDOT publishes a concise LOS Planning Handbook (2009) with service volume tables correlated to different roadway types and geometries, based on the Highway Capacity Manual (HCM). The HCM contains vast technical data that is very specific to traffic engineering technical analysis. The FDOT LOS Planning Handbook takes the detailed technical data from the HCM and summarizes it into a user friendly format that is appropriate for planning level analyses, such as is the case with this assessment.

Because the project area is remote and not generally considered to have peak commute times, the Lead Agencies assumed that existing traffic would largely be uniform throughout various times of day.

3.22.4.1.2 Traffic Safety Effects

Based upon site visits and map analysis, combined with review of planned truck hauling routes, the Lead Agencies identified roads with potentially hazardous points along them. Safety hazards include blind corners or turnouts and sharp turns or areas where slow construction traffic might conflict with high roadway speed limits. The Lead Agencies also assessed potential visibility hazards due to dust.

3.22.4.1.3 Public Transit Effects

The Lead Agencies examined the local and regional deconstruction traffic routes for each alternative and compared them to existing local and regional transit service routes to determine potential conflicts. The analysis relates traffic volumes to transit service because any road segments with projected traffic volumes over their functional LOSs could have disruptions in transit service.

3.22.4.1.4 Non-Motorized Transportation Effects

The Lead Agencies identified existing bikeways within the area of analysis and categorized them by class (bike path, bike lane, or bike route). The team also compared bikeways to construction traffic routes and timing to determine potential effects on the mobility and safety of cyclists and pedestrians. The team also reviewed available local or county planning documents addressing bicycle planning in the area of analysis to evaluate potential effects on planned bikeways. Although the project area would be a low pedestrian traffic area, the analysis addressed potential areas of conflict between trucks and pedestrians as well.

3.22.4.1.5 Road Condition Effects

In order to adequately assess the structural integrity and load carrying capacity of each road's surfacing section, a detailed geotechnical analysis would need to be conducted; this is out of the scope of this analysis.

3.22.4.2 Effects Determinations

3.22.4.2.1 Alternative 1: No Action/No Project Alternative

Traffic Flow Effects

Changes in traffic volumes could affect traffic flow. Any increase in traffic flow associated with the No Action/No Project Alternative would not exceed the planned LOS or v/c ratios for any roads in the area of analysis. **There would be no change from existing conditions from traffic flow effects.**

Traffic Safety Effects

Implementation of the Interim Measures (IMs) could cause traffic safety effects associated with sharp turns along Copco Road and OR66. Implementation of several IMs, including IM 7 – J.C. Boyle Gravel Placement and Habitat Enhancement (for one year) and IM 8 – J.C. Boyle Bypass Barrier Removal could result in increased traffic from haul trucks and construction workers; however, any increases in traffic flow would be minor and would not contribute substantially to the number of vehicles on the road. **This fact combined with the installation of signage at sharp turns along OR66 and Copco Road would reduce traffic safety effects associated with implementation of the interim measures to less than significant.**

Road Condition Effects

Changes in the road conditions could occur. Roads in the area of analysis would not experience wear greater than that for which they were designed under the No Action/No

Project Alternative. Any minor traffic safety conflicts would be mitigated through best management practices. **There would be no change from existing conditions from road condition effects.**

Public Transit Effects

Changes in public transit could occur. Public transit service would experience no negative effects from the No Action/No Project Alternative. Any minor public transit effects would be mitigated through best management practices. **There would be no change from existing conditions from public transit effects.**

Non-motorized Transportation Effects

Changes in non-motorized transportation could occur. There are no anticipated negative effects on non-motorized transportation due to the No Action/No Project Alternative. Any non-motorized transportation effects would be mitigated through best management practices. **There would be no change from existing conditions from non-motorized transportation effects.**

Ongoing Restoration Actions

While the KBRA would not be fully implemented under the No Action/No Project Alternative, ongoing restoration actions from Fish Habitat Restoration could have traffic and transportation impacts during construction activities.

Construction activities associated with the continued implementation of ongoing restoration actions could cause temporary effects to traffic and transportation. Construction activities including channel construction, floodplain rehabilitation, fish passage and facilities construction, and breaching levees would likely involve the use of heavy equipment and construction vehicles. **Construction activities that would occur for the ongoing restoration programs are anticipated to result in potentially significant impacts to traffic and transportation. Best management practices incorporated into the project would minimize any traffic impacts to less than significant.**

3.22.4.2.2 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

Traffic Flow Effects

Transportation of equipment and supplies associated with dam facility deconstruction activities could result in temporary traffic flow effects on I-5, OR66, US97, and access roads. No long-term or permanent traffic volume increases or long-term changes in traffic patterns are expected as a result of the Proposed Action, including any changes resulting from shifts in recreation use described in Section 3.20, Recreation. Therefore, any transportation impacts associated with the Proposed Action would be limited in duration to the proposed deconstruction or construction period. The deconstruction and reservoir restoration schedule for the Proposed Action extends 18-months starting in May 2019. Work completed in 2019 would include small scale construction staging activities and analysis of road and bridge condition and any repair work that might be

identified during this analysis. The peak deconstruction activity and associated traffic would be generated in 2020; therefore this analysis is focused on the year 2020 when the largest effects would be anticipated.

The traffic projections for 2020, based on data from 2000 through 2009, indicate a decrease in baseline traffic on I-5 in California and OR66. In light of the recent increases in the cost of fuel and other economic factors, the years 2007 to 2009 may be an anomaly. When that data was excluded, I-5 showed an increase, but OR66 still showed a small decrease in the 2020 projection compared to baseline. In each case, the combined total of the projected baseline traffic volumes and the traffic that would result from implementation of each of the alternatives would not exceed the significance criterion for I-5, OR66, or US97 for any of the alternatives.

Table 3.22-2 consolidates the roadway planning capacities and the anticipated traffic for each alternative, and contains projected LOSs and v/c ratios. Appendix S presents a detailed analysis of the hauling and worker trips for each alternative. Hauling trips include trips to a local recycling facility in Klamath Falls, Oregon and the City of Yreka, California as well as truck trips for additional deconstructed materials to disposal sites outside of the project boundaries. As Table 3.22-2 shows, none of the main roads in the area of analysis would experience volumes in excess of their planned LOS or v/c ratio due to traffic resulting from implementation of the Proposed Action or the other alternatives. **Traffic flow effects on I-5, OR66, US97, and access roads would be less than significant.**

Transportation of equipment and supplies associated with dam facility deconstruction activities could result in temporary traffic flow effects on on-site roads. The only routes of concern with respect to traffic effects are the on-site gravel roads at each dam. The short but frequent heavy vehicle trips anticipated as part of dam deconstruction and reservoir restoration (the Proposed Action could generate over 1,500 AADT at some locations) could cause traffic flow concerns. Signage and construction traffic management to reduce construction traffic generated impacts would be implemented. **Traffic flow effects on on-site roads would be less than significant.**

Construction activities associated with the demolition of recreation facilities could result in temporary traffic flow effects on I-5, OR66, US97, and access roads. The demolition of recreation facilities would take place following dam deconstruction activities. Truck trips associated with construction activities at recreation sites would occur after the peak traffic period calculated for dam deconstruction activities. **Therefore, traffic flow effects on I-5, OR66, US97, and access roads would be less than significant.**

Table 3.22-2. Traffic Flow Projections

Roads	Road Type	Planning Capacity			No Action/No Project			Full Facilities Removal of Four Dams (Proposed Action)		
		LOS	v/c Ratio	AADT	LOS	v/c Ratio	AADT	LOS	v/c Ratio	AADT
I-5 (California)	Limited Access Interstate Highway	C	--	49,900	A	--	18,350	A	--	18,597
I-5 (Oregon)	Limited Access Interstate Highway	--	0.85	63,700	--	0.24	15,100	--	0.24	15,112
OR66	State Highway	--	0.75	40,800	--	0.01	490	--	0.01	582
US97	US Highway	--	0.70	48,000	--	0.19	9,300	--	0.20	9,380
Copco Rd	Major Roadway	C	--	5,500	A	--	250	A	--	515
Topsy Grade Rd	Major Roadway	--	0.85	5,500	--	0.04	200	--	0.04	202
Unpaved Access Roads	Site Internal Gravel Roads	--	0.95	N/A	--	N/A	30	--	N/A	1,240
Roads	**Road Type**	**Partial Facilities Removal of Four Dams**			**Fish Passage at Four Dams**			**Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate**		
		LOS	v/c Ratio	AADT	LOS	v/c Ratio	AADT	LOS	v/c Ratio	AADT
I-5 (California)	Limited Access Interstate Highway	A	--	18,593	A	--	18,454	A	--	18,530
I-5 (Oregon)	Limited Access Interstate Highway	--	0.24	15,111	--	0.24	15,104	--	0.24	15,104
OR66	State Highway	--	0.01	574	--	0.01	514	--	0.01	514
US97	US Highway	--	0.20	9,373	--	0.20	9,320	--	0.19	9,320
Copco Rd	Major Roadway	A	--	511	A	--	354	A	--	430
Topsy Grade Rd	Major Roadway	--	0.04	202	--	0.04	200	--	0.04	200
Unpaved Access Roads	Site Internal Gravel Roads	--	N/A	1,240	--	N/A	102	--	N/A	966

Source: 1. Caltrans Traffic Data Branch, 2. FDOT 2009, 3. Klamath County 2004, 4. ODT 2010, 5. Amador County Transportation Commission, 2004.
Key:
v/c: volume-to-capacity ratio
AADT: Annual Average Daily Traffic
LOS: Level of Service

Traffic Safety Effects

Activities associated with the Proposed Action, would cause traffic safety effects at each deconstruction site, on Copco Road, Topsy Grade/Ager-Beswick Road, and on OR66. The Lead Agencies have identified three potential areas of concern within the area of analysis.

Haul truck movement on unpaved roads could cause traffic safety effects associated with dust along gravel roads. High trip volumes would create a substantial amount of dust in dry conditions on Copco Road, Lakeview Road, Topsy Grade/Ager-Beswick Road, and the roads leading to and surrounding each dam. Parts of these roads have gravel surfaces. The dust would create a substantial visibility hazard for vehicles on the deconstruction sites throughout the area. Installation of signage, dust abatement and proper construction traffic management that would be implemented as a part of the Proposed Action would reduce the severity of this effect. **Visibility hazards caused by traffic-related dust generation would be a less than significant impact.**

Transportation of materials to and from the dam sites could cause traffic safety effects associated with vehicle turnouts along Copco Road, Topsy Grade/Ager-Beswick Road and OR66. If Copco Road, Topsy Grade/Ager-Beswick Road, Iron Gate and Copco 1 Reservoir Recreation Sites are open,[4] there would be substantial safety concerns regarding traffic at the entrance to each small recreation parking area; this includes the boat launch downstream from Iron Gate Dam. The access road for the J.C. Boyle Dam is immediately off of OR66, where the posted speed limit is 55 mph. This location, while providing a clear view of oncoming traffic, would have a safety conflict related to speed differentials between construction vehicle traffic and normal vehicular traffic. Construction vehicles could pose safety risks to passenger and other vehicles traveling on roads in the project area. Construction vehicles travel at slower speeds, require more acceleration and deceleration time, and slow or stop traffic to make turns. Left turns across oncoming traffic could pose safety risks if truck acceleration is slow and oncoming speed limits were high. The following locations could experience traffic safety hazards related to conflicts between construction vehicles and regular traffic:

- Three boat launches and three camp sites along Copco Road.
- The recreation area accessed from Topsy Grade Road.
- One boat launch (access to the Klamath River) downstream from Iron Gate Dam, immediately adjacent to the bridge.

The installation of construction signage on OR66 and Copco Road in accordance with the Manual of Uniform Traffic Control Devices would reduce all traffic conflicts and alert oncoming traffic to slow merging construction traffic. **Traffic conflicts at vehicle turnouts along Copco Road, Topsy Grade/Ager-Beswick Road, and OR66 would be a less than significant impact.**

[4] With the removal of the facilities, reservoir recreation opportunities would no longer exist. It is possible that Copco and Topsy Grade Roads may be completely closed to non-project related traffic during deconstruction with the exception of provisions for local residential access.

Vehicles associated with dam removal could cause traffic safety effects associated with sharp curves along Copco Road and OR66. Both OR66 and Copco Road have several sharp turns that could require large construction vehicles to travel at very slow speeds. Copco Road narrows along certain portions of the roadway, and has many winding turns, mirroring the shore of the lake. **The installation of signage at sharp turns along OR66 and Copco Road would reduce this impact to less than significant.**

The removal of existing recreation facilities could result in traffic impacts along adjacent roadways. As described in Section 3.20, Recreation, some recreation facilities, such as campgrounds and boat ramps, currently located on the reservoir banks would need to be removed once the reservoir is drained. These construction activities would occur at different times than dam removal deconstruction activities; thus, there would be no overlap in traffic volumes associated with deconstruction of the dams. **This fact combined with the installation of signage at sharp turns along OR66 and Copco Road would reduce traffic safety effects to less than significant.**

Road Condition Effects

Existing roads and bridge structures near the dam sites may not have adequate strength capacity for construction vehicles. Under the Proposed Action, further analysis of road conditions and bridge weight capacities would be necessary. Roads in the area of analysis do not have heavy traffic volumes and some do not have traffic from heavy vehicles, such as construction trucks. Some of the roads in the area of analysis may not have been designed to sustain heavy loads.

Three existing bridges in the area of analysis might be important for deconstruction efforts, but could be incapable of supporting and withstanding the weight of heavy deconstruction and hauling vehicles. Initial analysis of these bridges by the Lead Agencies indicated the potential need for repair or replacement prior to dam removal. Siskiyou County's schedule for maintenance of these facilities is unknown. Bridges include:

- A bridge at Iron Gate Dam connecting Copco Road to Lakeview Road. This is the only route that provides access to the south side and top of Iron Gate Dam.
- A bridge at J.C. Boyle Dam that provides access to the south side and top of that dam from OR66. At this location, an alternate route via Topsy Grade Road would allow construction vehicles to access the dam and avoid the bridge.
- Daggett Road Bridge used to access the Copco 2 Powerhouse.
- Jenny Creek Bridge was constructed on accumulated sediment. Preliminary engineering assessments identified the potential for movement of sediment during reservoir draw down that could deem the bridge structurally unsound. Replacement of the bridge at an alternate location would be necessary.

While many of these roads and bridges were put in place to facilitate the construction of the Four Facilities, it is unknown whether they are in good enough condition to withstand the weight and frequency of trips during deconstruction. As part of the development of

the construction plan, an in depth analysis of bridge and road capacity and state of repair would be conducted by the dam removal entity (DRE), with remedial actions taken prior to the commencement of facility deconstruction.

In addition to the local county roads in the project area, the access ramps to Interstate 5 may also see an increase in heavy construction traffic during deconstruction activities. The increased traffic load could accelerate the rate of wear at these on- and off-ramps, requiring additional maintenance and/or repairs in order to maintain the ramps to existing standards.

Following completion of dam deconstruction additional analysis of road condition would be completed and where needed, as a result of wear generated by deconstruction repairs and or replacement actions would be completed. **Construction traffic could have significant impacts on roads and bridges in the project area. Analysis of road and bridge condition and repair prior to and following dam deconstruction along with implementation of Mitigation Measure TR-1 would reduce any impacts to less than significant.**

Public Transit Effects

Trip volumes and routes of material hauling and worker trips could affect regional transit service. While there are small overlaps between minor haul routes and public transit routes, deconstruction traffic is not expected to interfere with public transit service. **Effects on regional transit service would be less than significant.**

Non-motorized Transportation Effects

Heavy vehicle traffic could cause non-motorized transportation (pedestrian and cyclist) effects. Although the area of analysis has no non-motorized transportation facilities, cyclists and pedestrians might travel along Copco and Topsy Grade/Ager-Beswick Roads in a limited capacity due to the recreational nature of the area. These pedestrians and cyclists would have to travel along the road itself, and could encounter safety hazards when sharing the road with large hauling vehicles, which could occupy much of the available road width, generate dust, or vary speeds around corners. Development of appropriate signage to notify of potential conflicts within the area would reduce this impact by warning drivers and non-motorized users. **The safety hazard for non-motorized transportation would be a less than significant impact.**

Interim Measures

Implementation of the IMs could result in temporary traffic flow effects on I-5, OR66, US97, and access roads. Implementation of several IMs, including IM 7 – J.C. Boyle Gravel Placement and Habitat Enhancement (for seven years) and IM 16 – Water Diversions could result in increased traffic from haul trucks and construction workers; however, any increases in traffic flow would be minor and would not contribute substantially to the number of vehicles on the road. **Traffic flow effects on I-5, OR66, US97, and access roads from implementing the interim measures would be less than significant impact.**

Implementation of the IMs could cause traffic safety effects associated with sharp turns along Copco Road and OR66. Implementation of several IMs, including IM 7 – J.C. Boyle Gravel Placement and/or Habitat Enhancement, IM 8 – J.C. Boyle Bypass Barrier Removal, and IM 16 – Water Diversions could result in increased traffic from haul trucks and construction workers; however, any increases in traffic flow would be minor and would not contribute substantially to the number of vehicles on the road. **This fact combined with the installation of signage at sharp turns along OR66 and Copco Road would reduce traffic safety effects associated with implementation of the IMs to less than significant.**

Keno Transfer

The transfer of the Keno Facility to United States Department of the Interior (DOI) could result in effects to traffic and transportation. The Keno Transfer, which is part of the Proposed Action, is a transfer of title for the Keno Facility from PacifiCorp to the DOI. This transfer would not result in the generation of new impacts on transportation compared with existing facility operations. Following transfer of title, DOI would operate the Keno Facility in compliance with applicable law and would provide water levels upstream of Keno Facility for diversion and canal maintenance consistent with agreements and historic practice (KHSA Section 7.5.4). **The transfer of the facility and recreation lands would result in no change from existing conditions from traffic or transportation.**

East and Westside Facilities Decommissioning – Programmatic Measures

The decommissioning of the East and Westside Facilities could generate adverse traffic and transportation effects. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA would eliminate the need for diversions at Link River Dam into the two canals. Decommissioning of the facilities would generate some construction traffic. Routes used by this construction traffic would be signed and appropriate safety measures would be incorporated. **Decommissioning the facilities would have less than significant effects on traffic or transportation.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

Activities associated with relocation of the City of Yreka Water Supply Pipeline and relocation or demolition of recreation facilities could cause traffic safety effects associated with sharp curves along Copco Road and OR66. These construction activities would occur at different times than dam removal deconstruction activities; thus, there would be no overlap in traffic volumes associated with deconstruction of the dams. **This fact combined with the installation of signage at sharp turns along OR66 and Copco Road would reduce traffic safety effects to less than significant.**

Construction activities related to the relocation of the City of Yreka Water Supply Pipeline could result in temporary traffic flow effects on I-5, Copco Road, and access roads. Relocation of the City of Yreka Water Supply Pipeline would occur prior to the start of dam deconstruction.

Therefore, related construction activities for pipeline relocation would take place well before the peak deconstruction activity involved in dam removal. **Traffic flow effects on I-5, Copco Road, and access roads would be less than significant impact.**

KBRA – Programmatic Measures

Construction activities associated implementation of several KBRA programs could cause traffic effects including increases in traffic, the presence of increased numbers of heavy construction equipment, and temporary road closures or detours. The following programs could cause these impacts:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration Project
- On- Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Klamath River Tribes Interim Fishing Site
- Power for Water Management Program
- Additional Water Conservation and Storage

Construction activities associated with the above-listed KBRA programs could cause temporary traffic effects. KBRA program implementation could result in temporary closures and/or traffic detours associated with culvert upgrades or replacement. In some cases, local access roads could be decommissioned. Minor amounts of vehicular traffic might need to identify alternate routes. Gravel augmentation activities for streambeds could result in gravel deliveries to various locations using dump trucks and placement using backhoes, which could cause traffic flow and safety effects and road condition effects. Construction activities including channel construction, mechanical thinning of trees, road decommissioning, fish passage and facilities construction, breaching levees, and fish hauling could cause temporary increases in traffic and traffic safety effects. It is assumed that construction related to some of these programs could occur on the same roads as the hydroelectric facility removal actions and could contribute to the effects of facility removal on traffic and transportation. **Due to the potentially large amount of construction activities that would occur for the various KBRA programs could generate adverse traffic effects; however, the implementation of best management practices would minimize any traffic impacts to less than significant. Additional traffic analysis and environmental compliance would be completed as appropriate.**

Operational activities associated with the Fisheries Reintroduction and Management Plan could result in temporary traffic effects associated with trap-and-haul activities. Haul trucks would be required to seasonally relocate anadromous fish species around the Keno Impoundment/Lake Ewauna during periods of poor water quality. Haul trucks would carry upstream-migrating fish from the downstream from Keno Dam to areas in Upper Klamath Lake and its tributaries. They would also carry out-migrating fish from Link River Dam to areas downstream from Keno Dam. Haul trucks would increase

traffic on the roads between these sites. Haul trucks may travel on OR66 and US97, access roads, and on-site roads. As shown in Table 3.2-2, area roads carry substantially fewer vehicles in the Proposed Action than the Planning Capacity; additional truck trips for trap and haul operations would not substantially change traffic conditions. Hauling activities would occur after the peak traffic-generating period of facility removal because fish cannot access Keno Dam until after removal of the Four Facilities; however, some construction traffic associated with completing removal activities and reservoir restoration may occur at the same time as hauling operations. Construction traffic related to dam removal and hauling operations, taken together, could increase the severity of the traffic effects, but the combined traffic would likely still be less than the peak traffic during dam deconstruction. The timing of these trap and haul operations from the hydroelectric facility removal actions analyzed above reduce the potential for any negative traffic effects generated by these trap and haul actions from contributing to the effects of facility removal actions. **The traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant. Implementation of specific plans and projects described in the KBRA would require future environmental compliance as appropriate**.

3.22.4.2.3 Alternative 3: Partial Facilities Removal of Four Dams Alternative

Traffic Flow Effects

Traffic flow effects for the Partial Facilities Removal of Four Dams Alternative would be the same as those for the Proposed Action. **Traffic flow effects on I-5, OR66, US97, and access roads would be a less than significant impact. Traffic flow effects on on-site roads would be a less than significant impact.**

Traffic Safety Effects

Traffic safety effects for the Partial Facilities Removal of Four Dams Alternative would be the same as those for the Proposed Action. **Implementation of Alternative 3 would be less than significant.**

Road Condition Effects

Road condition effects for the Partial Facilities Removal of Four Dams Alternative would be the same as those for the Proposed Action. **Construction traffic could have significant impacts on roads and bridges in the project area. Analysis of road and bridge condition and repair prior to and following dam deconstruction along with implementation of Mitigation Measure TR-1 would reduce any impacts to less than significant.**

Public Transit Effects

Public transit effects for the Partial Facilities Removal of Four Dams Alternative would be the same as those for the Proposed Action. **Implementation of Alternative 3 would be less than significant.**

Non-motorized Transportation Effects

Non-motorized transportation effects for the Partial Facilities Removal of Four Dams Alternative would be the same as those for the Proposed Action. **Implementation of Alternative 3 would be less than significant.**

Keno Transfer

The effects of the Keno Transfer would be the same as those described for the Proposed Action.

East and Westside Facilities Decommissioning – Programmatic Measures

The effects of decommissioning the East and Westside Facilities would be the same as those described for the Proposed Action.

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of relocating the City of Yreka Water Supply Pipeline would be the same as those described for the Proposed Action.

KBRA – Programmatic Measures

The Partial Facilities Removal Alternative would include full implementation of the KBRA. Therefore, impacts related to KBRA actions would be the same as under the Proposed Action, discussed above.

3.22.4.2.4 Alternative 4: Fish Passage at Four Dams

Traffic Flow Effects

Construction activities associated with the Fish Passage at Four Dams Alternative could result in temporary traffic flow effects on I-5, OR66, US97, access roads, and on-site roads. Under this alternative there would be intermittent construction hauling trips on I-5, OR66, and US97. The only roads experiencing daily heavy vehicle trips would be the local unpaved roads adjacent to each dam. These roads would have 18 daily vehicle trips for fish passage construction, comprised of mainly concrete delivery from nearby batch plants. Material hauling trips would be limited, and worker trips would make up the majority of construction-related traffic. If concrete delivery were not provided at batch plants near the construction sites, then concrete delivery could come from either Klamath Falls, Oregon or the City of Yreka, California. In this case, the estimated 18 daily vehicle trips accounting for concrete delivery would not only access the local roadways, but would be added to traffic on the other major roadways, as shown in Appendix T, 2020 Traffic Volume Projections. The addition of an additional 18 daily vehicle trips to the AADT volumes would not cause deterioration in levels of service.

No long-term or permanent traffic volume increases or long-term changes in traffic patterns would occur as a result of this alternative. Any incremental transportation impacts associated with this alternative would be temporary and would occur during the one-year construction period. The number of construction days at J.C. Boyle and Copco 2 Dams would both be less than 130 days; Copco 1 and Iron Gate Dams would have fewer than 290 construction days.

Traffic associated with this alternative would cause none of the roads in the area of analysis to have a LOS worse than A or a v/c ratio greater than 0.25. The combined total of the projected baseline traffic volumes and the traffic that would result from implementation of this alternative would not exceed the significance criteria for traffic flow impacts. **Traffic flow effects on I-5, OR66, US97, access roads, and on-site roads would be a less than significant impact.**

Implementation of the prescriptions provided by the U.S. Fish and Wildlife Service (USFWS), U.S. Department of the Interior (DOI), and Department of Commerce (DOC) in the Federal Energy Regulatory Commission (FERC) 2007 EIS and seasonal trap and haul operations implemented at Keno Dam could result in temporary traffic flow effects on OR66 and US97, access roads, and on-site roads. Following construction of fishways to provide for volitional fish passage, interim seasonal trap and haul operations would be implemented below Keno Dam to avoid poor water quality conditions in Keno Impoundment/Lake Euwana. As vehicle trips associated with trap and haul operations would take place following fishway construction, there would be no overlap between these trips and peak construction traffic. These activities would be similar to those described above under the Proposed Action in the KBRA Fisheries Reintroduction and Management Plan. **Thus, traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant.**

Traffic Safety Effects

Activities associated with the Fish Passage at Four Dams Alternative would cause traffic safety effects at each construction site, on Copco Road, Topsy Grade/Ager-Beswick Road, and on OR66. Traffic safety effects for the Fish Passage at Four Dams alternative would be almost exactly the same as those for the Proposed Action, with two differences: 1) the recreation sites along Copco Road from Iron Gate Dam to Copco Dams would remain open; and 2) construction related traffic would be much lighter than that of the Proposed Alternative. While the traffic volume under this alternative would be lower than under the Proposed Action, the safety impacts would be the same. Installation of signage, dust abatement and proper construction traffic management would minimize impacts. **This impact would be less than significant.**

Activities associated with the implementation of the prescriptions and seasonal trap and haul operations could cause traffic safety effects on OR66 and US97, access roads, and on-site roads. As described under the analysis of traffic flow effects, vehicle trips associated with trap and haul operations would take place following fish passage construction. There would be no overlap between these trips and peak construction traffic. These activities would be similar to those described under the Proposed Action in the KBRA Fisheries Reintroduction and Management Plan. **Thus, traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant.**

Road Condition Effects

Road condition effects for the Fish Passage at Four Dams Alternative would be the same as those for the Proposed Action. As part of the development of the construction plan, an in-depth analysis of bridge and road capacity and state of repair would be conducted by

the Hydropower Licensee, with remedial actions taken prior to the commencement of construction. Following completion of construction, additional analysis of road condition would be completed and where needed, as a result of wear generated by construction repairs and or replacement actions would be completed. **Construction traffic could have significant impacts on roads and bridges in the project area. Analysis of road and bridge condition and repair prior to and following construction would reduce any impacts to a less than significant level.**

Public Transit Effects

Public transit effects for the Fish Passage at Four Dams Alternative would be the same as those for the Proposed Action. **Implementation of Alternative 4 would be less than significant.**

Non-motorized Transportation Effects

Non-motorized transportation effects for the Fish Passage at Four Dams Alternative would be the same as those for the Proposed Action. Development of appropriate signage to notify of potential conflicts within the area would reduce this impact by warning drivers and non-motorized users. **The safety hazard for non-motorized transportation would be a less than significant impact.**

Trap and Haul – Programmatic Measures

Operation of trap and haul measures could result in temporary traffic effects. Haul trucks would be required to seasonally relocate anadromous fish species around the Keno Impoundment/Lake Ewauna during periods of poor water quality. Haul trucks would carry upstream-migrating fish from the downstream from Keno Dam to areas in Upper Klamath Lake and its tributaries. They would also carry -migrating fish from Link River Dam to areas downstream from Keno Dam. Haul trucks would increase traffic on the roads between these sites. Haul trucks may travel on OR66 and US97, access roads, and on-site roads. As shown in Table 3.22-2, area roads carry substantially fewer vehicles in the Fish Passage at Four Dams Alternative than the Planning Capacity; adding additional truck trips for trap and haul operations would not substantially change traffic conditions. **The traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant.**

3.22.4.2.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

Because Copco 1 and 2 Dams are adjacent to one another, they share local access roads, and the greatest traffic effects at either of the dams would apply to both. Under this alternative, the traffic and transportation effects at Iron Gate, Copco 1 and Copco 2 Dams would be the same as Proposed Action and would be less than significant after mitigation, and the traffic and transportation effects at J.C. Boyle Dam would be similar to that of the Fish Passage at Four Dams Alternative and would be less than significant.

Activities associated with the implementation of the prescriptions and seasonal trap and haul operations could cause traffic safety effects on OR66 and US97, access roads, and on-site roads. As described under the analysis of traffic flow effects, vehicle trips

associated with trap and haul operations would take place following dam deconstruction and fishway construction. There would be no overlap between these trips and peak construction-related traffic. These activities would be similar to those described under the Proposed Action in the KBRA Fisheries Reintroduction and Management Plan. **Thus, traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant.**

Trap and Haul – Programmatic Measures

Operation of trap and haul measures could result in temporary traffic effects. The trap and haul measures around Keno Impoundment/Lake Euwana would have the same impacts under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as the Fish Passage at Four Dams Alternative. **The traffic flow effects on OR66 and US97, access roads, and on-site roads would be less than significant.**

City of Yreka Water Supply Pipeline Relocation – Programmatic Measures

The effects of relocating the City of Yreka Water Supply Pipeline would be the same as those described for the Proposed Action.

3.22.4.3 Mitigation Measures

3.22.4.3.1 Mitigation Measures by Consequence Summary

Mitigation Measure TR-1 – Relocate Jenny Creek Bridge and relocate or modify in place as appropriate culverts located along Copco Road away from sediment deposits potentially susceptible to down cutting as a result of reservoir drawdown to prevent bridge foundation failure.

3.22.4.3.2 Effectiveness of Mitigation in Reducing Consequences

All of the mitigation strategies indentified herein would reduce potential impacts to less than significant. Other actions that mitigate potential impacts would be standard, best management practices incorporated into project design activities. Such practices include construction zone signing and dust abatement, coupled with the periodic grading of roadways during construction. Implementation of these during project design and construction would reduce potential impacts to less than significant.

3.22.4.3.3 Agency Responsible for Mitigation Implementation

The DRE would be responsible for implementing mitigation measure TR-1.

3.22.4.3.4 Remaining Significant Impacts

Mitigation measures TR-1 would reduce traffic and transportation impacts to less than significant levels.

3.22.4.3.5 Mitigation Measures Associated with Other Resource Areas

Implementation of Mitigation Measure AR-1 could result in temporary traffic flow, traffic safety, and road condition effects on access roads and on-site roads. Mitigation measure AR-1 would relocate mussels in the Hydroelectric Reach and in the Lower Klamath River, downstream from Iron Gate Dam, to tributary streams or upstream of the Hydroelectric Reach. Relocation would take place prior to dam deconstruction activities and reservoir drawdown. Following dam deconstruction, mussels would be moved back

to their approximate location or to other suitable habitat in the river. Given the timing of vehicle trips associated with relocation activities, there would be no overlap with peak construction traffic during dam removal. **Thus, the impact to traffic flow, traffic safety, and road conditions on access roads and on-site roads would be less than significant.**

Implementation of Mitigation REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. Recreation facility construction would take place following dam deconstruction activities and reservoir drawdown. Given the timing of vehicle trips associated with replacement activities, there would be no overlap with peak construction traffic during dam removal. **Thus, the impact to traffic flow, traffic safety, and road conditions on access roads and on-site roads would be less than significant.**

Several other mitigation measures may require construction, including mitigation measures H-2 (move or elevate structures with flood risk), GW-1 (deepen or replace wells), and WRWS-1 (modify water intakes). These measures could produce vehicle trips associated with construction activities. These activities would take place before or after the primary construction and deconstruction activities associated with the Proposed Action and other alternatives; therefore, they would not add to these construction traffic impacts. These construction activities are generally smaller efforts that would not cause a substantial increase in vehicle trips. **Thus, the impact to traffic flow, traffic safety, and road conditions on access roads, on-site roads, and on roads would be less than significant.**

3.22.5 References

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3.23 Noise and Vibration

This section addresses the noise and vibration impacts of the Proposed Action and alternatives. It includes a description of the area of analysis, the affected environment, and existing conditions. This section also describes the criteria used to define and determine noise and vibration impact significance and the assessment methods. The potential impact from noise and vibration are evaluated for each alternative, and possible mitigation measures are listed. Appendix U describes basic noise and vibration concepts, detailed methods and calculations, and modeling results.

3.23.1 Area of Analysis

The area of analysis for noise and vibration effects associated with the Klamath Hydroelectric Settlement Agreement (KHSA) includes areas near the Four Facilities and the haul routes in Klamath and Jackson Counties, Oregon, and Siskiyou and Shasta Counties, California. Figure 3.23-1 shows the locations of the Four Facilities and haul routes. The area of analysis for the Klamath Basin Restoration Agreement (KBRA) constitutes the entirety of the Klamath Basin.

3.23.2 Regulatory Framework

Noise and Vibration levels in the area of analysis are regulated by local laws and policies. There are no Federal or State regulations applicable to noise and vibration levels from construction activity in the area of analysis.

3.23.2.1 Local Authorities and Regulations

3.23.2.1.1 Siskiyou County General Plan Noise Element (1978)

The Siskiyou County General Plan Noise Element contains criteria for maximum allowable noise levels from construction equipment. Table 3.23-1 lists the maximum allowable noise levels in A-weighted decibels (dBA) for construction equipment applicable to the Proposed Action. There are no other applicable State or local regulatory levels for noise or vibration in the area of analysis.

Although the Proposed Action does not involve highway construction, Federal and State highway traffic noise criteria provide a basis for analyzing project traffic noise impacts. The Federal Highway Administration (FHWA) requires highway agencies to define a "substantial" noise increase as an increase of 5 to 15 dBA over existing noise levels (23 CFR Part 772). The California Department of Transportation (Caltrans) defines "substantial" as a predicted increase greater than or equal to 12 dBA over existing 1-hour equivalent noise levels (L_{eq}) (Caltrans 2006). The Oregon Department of Transportation (ODOT) defines substantial noise increase as greater than or equal to 10 dBA above the existing 1-hour Leq (ODOT 2009).

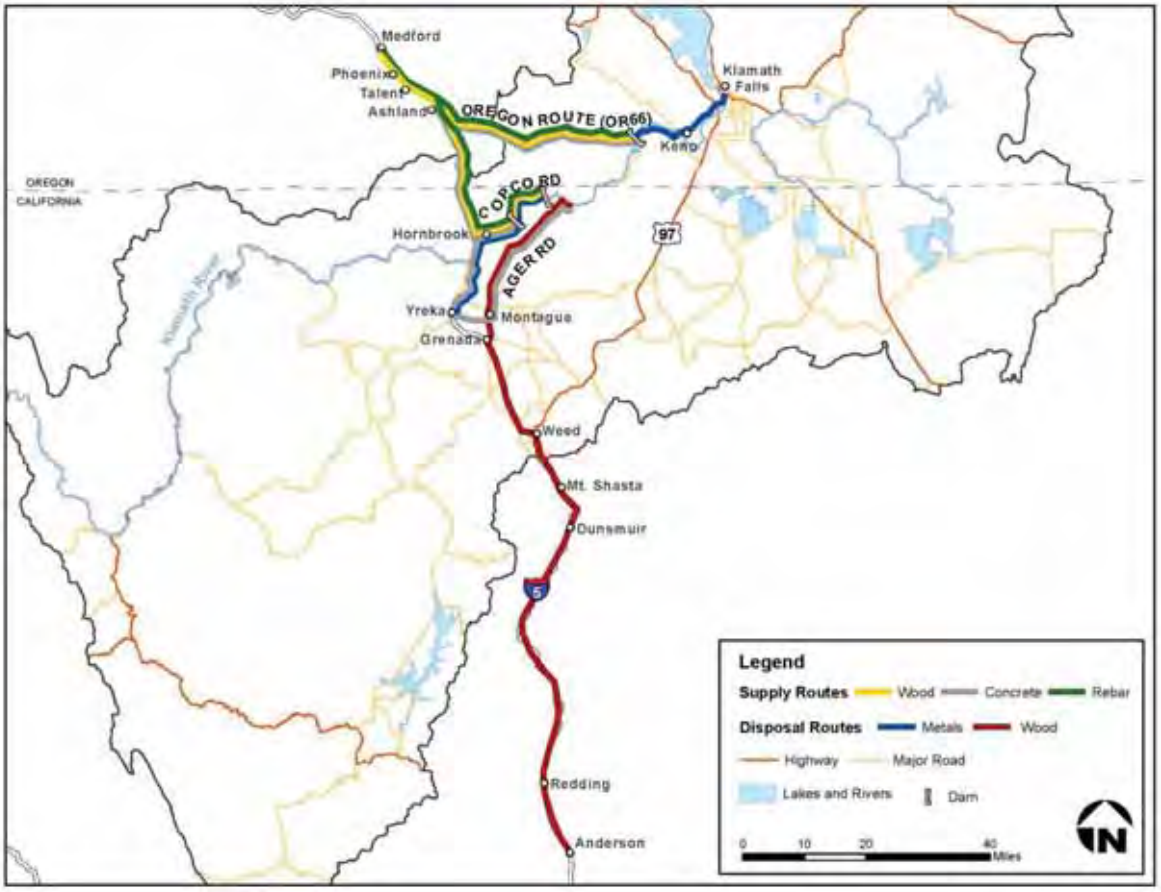

Figure 3.23-1. Primary Haul Routes from Dam Sites.

Table 3.23-1. Maximum Allowable Noise Levels from Construction Equipment in Siskiyou County, CA

Equipment Type	Peak Noise Level (dBA at 50 feet)[1]
Compressors	81
Concrete Mixers	81
Concrete Pumps	81
Cranes	81
Dozers	81
Front Loaders	81
Generators	81
Pneumatic Tools	86
Pumps	81
Tractors	81
Trucks	81

Source: Siskiyou County 1978.

Notes:

[1] *Maximum allowable noise levels from construction equipment at 100 ft from Siskiyou County's General Plan converted to noise levels at 50 ft.*

3.23.3 Existing Conditions/Affected Environment

The Lead Agencies identified noise-sensitive human receptor locations (i.e. residences) based on a review of current topographic, aerial, and land use maps. Existing outdoor ambient noise levels at affected sensitive receptor locations were estimated using published average ambient noise levels for various land uses. Siskiyou County presents average noise levels for various land use categories in the Noise Element of their General Plan (Siskiyou County 1978). However these median ambient noise levels for different land use categories were developed based on a one-time field survey in the 1970s and none of the measurements were taken in the project area. Therefore, the Lead Agencies used average daytime L_{eq} and nighttime outdoor L_{eq} noise levels from U.S. Environmental Protection Agency's (USEPA's) *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (1974) to estimate ambient noise levels at selected receptor locations. Noise levels for rural residential areas in the USEPA document are lower than the levels presented in the Siskiyou County General Plan; it is more conservative to analyze the impacts using the USEPA levels. Because noise and vibration impacts would not occur without a receptor, the Affected Environment includes the rural residential areas closest to the proposed construction sites. The following paragraphs describe the sensitive receptors in the Affected Environment. Another sensitive receptor is terrestrial wildlife, such as nesting birds. Potential affects to terrestrial wildlife are analyzed in Section 3.5, Terrestrial Resources.

3.23.3.1 Existing Noise Levels near Construction Sites

The land surrounding the J.C. Boyle Dam is primarily undeveloped, and land use is primarily recreational. Recreational sites would be closed to visitors during construction and demolition activities; therefore, no impact analysis was conducted for campgrounds. No residential areas are within a mile of the dam. Because of this, noise and vibration impacts to humans would not occur from construction and deconstruction activities at the J.C. Boyle Dam. Trucks from J.C. Boyle Dam would most likely travel on Oregon Route 66 (OR66), approximately 2,500 feet west of the dam, reached via Topsy Grade Road to access Interstate 5 (I-5) or U.S. Route 97 (US97). Figure 3.23-2 shows the locations of J.C. Boyle Dam, Topsy Campground, Topsy Recreation Site, and Topsy Grade Road.

Copco 1 Dam and Powerhouse are approximately 2,200 feet west of a rural residential area (see Figure 3.23-3). Residences on Janice Avenue are the closest sensitive receptors, and the estimated existing daytime and nighttime outdoor L_{eq}, based on the USEPA information as noted above are 40 and 30 dBA, respectively. The 2,200-foot distance between the dam and the receptor would provide 34 decibels (dB) of noise reduction, based on basic noise propagation calculation as described in Appendix U. The line of sight from the dam to the Janice Avenue receptor is blocked by a hill, the top of which is about 60 feet higher in elevation than the top of Copco 1 Dam at the hill's highest point along the line of sight between the dam and the receptor. The terrain may provide up to 5 dB of additional noise attenuation from the construction site to the Janice Avenue receptors. Copco Road and Topsey Grade Road are the main off-site haul routes from

this construction site. The Lead Agencies estimated traffic noise for trucks transporting materials in and out of the Copco 1 Dam and Powerhouse site via Copco Road and Topsey Grade Road.

Figure 3.23-2. J.C. Boyle Noise Receptors (Closest Receptors to J.C. Boyle Dam).

The closest sensitive receptor to Copco 2 Dam is the residential area on Janice Avenue described above for Copco 1 Dam. From Copco 2 Dam, the receptor is approximately 3,700 feet to the east. The line of sight from the dam to the receptor is blocked by two hills that have elevations approximately 180 feet higher than the top of the dam. Because of this natural topography surrounding the dam and distance between the dam and the receptor, noise from onsite construction activities at Copco 2 Dam would be reduced by 44 dB. No further analysis was conducted on noise from construction equipment and on-site hauling at Copco 2 Dam. The Lead Agencies estimated traffic noise for trucks

transporting materials in and out of Copco 2 Dam via Copco Road and Ager-Beswick Road. Figure 3.23-3 shows the Copco 1 Dam, Copco 1 Powerhouse, and Copco 2 Dam locations as well as the closest sensitive receptor on Janice Avenue.

Figure 3.23-3. Copco 1 and 2 Noise Receptor (Closest Receptor to Copco 1 and Copco 2 Dams).

The Iron Gate Dam area is approximately 1,100 feet east of Copco Road, its main haul route. The closest sensitive receptor to Iron Gate Dam is on Tarpon Drive, approximately 4,500 feet southwest of the dam, as shown on Figure 3.23-4. Based upon the rural residential land use category, the existing daytime outdoor L_{eq} on Tarpon Drive is likely 40 dBA. The existing nighttime outdoor L_{eq} at this receptor is approximately 30 dBA. At its highest point along the line of sight between the receptor and the dam, the hill on river left just upstream of Iron Gate Fish Hatchery is approximately 20 feet lower in elevation than the top of Iron Gate Dam. At the receptor, the hill would provide up to

3 dBA of noise reduction, in addition to the 43 dBA reduction due to distance from the construction site, for a total reduction of 46 dBA. Although this reduction is greater than that for Copco 2 Dam, there would be nighttime construction activities at Iron Gate Dam which may result in significant impact; the Lead Agencies estimated onsite construction and hauling noise levels.

Figure 3.23-4. Iron Gate Noise Receptors (Closest Receptor to Iron Gate Dam).

Section 3.5, Terrestrial Resources, shows the presence of special-status bird and other animal species near each of the dam sites and describes potential impacts and possible mitigation measures related to noise.

Table 3.23-2 summarizes the existing noise levels for the residential receptors selected to assess the noise and vibration impacts from each construction site. Daytime is defined as hours between 7:00 a.m. and 10:00 p.m., and nighttime is defined as 10:00 p.m. to 7:00 a.m. PacifiCorp's residential properties were assumed to be unoccupied during the transfer of ownership to Reclamation and were not considered in this analysis.

Table 3.23-2. Existing Noise Levels at Residential Receptors near Construction Sites

Construction Site [1]	Receptor Description	Distance from Construction Site (feet)	Estimated Existing Daytime L_{eq} (dBA)	Estimated Existing Nighttime L_{eq} (dBA)
Copco 1 Dam	Residential Area on Janice Ave, East of Copco 1 Dam.	2,200	40	30
Copco 2 Dam [2]	Residential Area on Janice Ave, East of Copco 1 Dam.	3,700	N/A	N/A
Iron Gate Dam	Residential Area on Tarpon Dr, SW of Iron Gate Dam.	4,500	40	30

Sources: Google Earth; USEPA 1974.

Notes:

[1] There are no applicable receptors at the J.C. Boyle Dam.

[2] Copco 2 Dam was not analyzed for noise impacts because the reduction in noise level due to distance and terrain between the receptor and the construction site would result in less than significant noise increase at the receptor.

Key:

dBA = A-weighted decibels

L_{eq} = 1-hour equivalent noise level

N/A = not applicable

3.23.3.2 Existing Noise Levels along the Haul Routes

The Lead Agencies used the FHWA Traffic Noise Model, Version 2.5 (TNM2.5) to estimate the existing daytime peak hour L_{eqs} along proposed haul routes. Peak-hour traffic was estimated by multiplying the average daily traffic by 10 percent based on a review of Caltrans and ODOT 2009 average daily and peak hourly traffic data (Caltrans 2010; ODOT 2010). Average daily traffic values published by ODOT (2010) and Caltrans (2010) were used to estimate the existing noise levels on OR66, US97, and I-5. Traffic volumes for I-5 between the City of Yreka and Anderson, California are higher than those for north of the City of Yreka; therefore, for conservative analysis, the lower volumes in the northern portion were used for the baseline. Field observations conducted for the preparation of the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report (EIS/EIR) provided the basis for estimating existing 1-hr L_{eq} along Topsy Grade Road, Copco Road, and Ager-Beswick Road.

This analysis uses peak-hour noise level results from TNM2.5 for generic receptors 50 and 500 feet from the edge of the road. Fifty feet represents the minimum distance for a receptor along any roadway and 500 feet is the maximum recommended receptor distance for traffic noise models (Caltrans 2006). Table 3.23-3 summarizes the existing peak hour L_{eq} for project haul routes at 50 feet and 500 feet from the edge of the roadway.

Table 3.23-3. Existing Peak Hour L_{eq} Along Proposed Haul and Commute Routes

Haul Route/Commute Segment	Existing Daytime Peak hour L_{eq} (dBA)[1]	
	50 feet	500 feet
Topsy Grade County Road / Ager-Beswick Road	53	42
US97	75	64
OR66	60	49
Copco Road	58	46
I-5: Between Medford, OR and OR66	77	66
I-5: Between OR66 and the City of Yreka, CA	76	66

Source: Caltrans 2010. ODOT 2010. USEPA 1974.

Notes:
Daytime 1-hour L_{eq} estimated by modeling traffic counts using TNM2.5.
Key:
dBA = A-weighted decibels
L_{eq} = 1-hour equivalent noise level

3.23.3.3 Environmental Consequences

Potential sources of noise from implementation of the KHSA include construction equipment and construction-related traffic noise. Impact determination methods, criteria, and effects determination are presented below.

3.23.3.4 Environmental Effects Determination Methods

This analysis compared the impacts of the Proposed Action and alternatives to the baseline existing conditions. This analysis assumes that no considerable changes in land use would occur in the next 10 years and therefore, existing conditions and the No Action/No Project ambient noise levels would be the same. The Lead Agencies determined noise and vibration levels from construction equipment in the project area and construction-related traffic for each action alternative using the methods described below. A more detailed method description, analysis results, and data supporting the analysis are included in Appendix U.

3.23.3.4.1 On-site Construction Noise

The construction impact analysis focused on outdoor receptors in residential areas near the construction sites. Anticipated sources of construction noise include cranes, excavators, loaders, dozers, concrete trucks, water tankers, pick-up trucks, generators, air compressors, and pavement breakers.

Principles and methods described in FHWA's Roadway Construction Noise Model User's Guide (2006) were the basis for predicting noise impacts associated with construction equipment for the action alternatives. Table 3.23-4 presents noise levels of common construction equipment operating at full power (L_{max}) measured 50 feet from the source, the percentage of time the equipment would be operated at full power (usage factor), and the L_{eq} over a single shift (FHWA 2006). For equipment whose L_{max} in the Roadway Construction Noise Model exceeds the maximum allowable noise levels from construction equipment in the Siskiyou County General Plan Noise Element (1978), the upper limits from Siskiyou County were used.

Table 3.23-4. Construction Operations, Equipment Types, and Their Noise Levels

Equipment Types	Usage Factor	L_{max} at 50 feet (dBA)	L_{eq} at 50 feet (dBA)
Air Compressor	40%	78	74
Backhoe	40%	78	74
Blasting	1%	94	74
Compactor	20%	83	76
Concrete Mixer Truck	40%	79	75
Concrete Pump Truck[1]	20%	81	74
Crane	16%	81	73
Dozers[1]	40%	81	77
Dump Truck	40%	77	73
Excavator	40%	81	77
Front End Loader	40%	79	75
Generator	50%	81	78
Grader	40%	85	81
Jackhammer[1]	20%	81	74
Mounted Impact Hammer (hoe ram)	20%	90	83
Pickup Truck	40%	75	71
Pumps	50%	81	78
Scraper	40%	84	80
Tractor[1]	40%	81	77

Source: FHWA 2006. Siskiyou County 1978.

Notes:

[1] Maximum allowable noise levels from construction equipment at 100 ft from Siskiyou County's General Plan converted to noise levels at 50 ft.

Key:

dBA = A-weighted decibels

L_{eq} = 1-hour equivalent noise level

L_{max} = noise levels of equipment operating at full power

Detailed equipment lists for each phase of construction were not available at the time of this analysis. Therefore, the analysis conservatively assumed that the dam removal phase would involve the greatest amount of construction equipment. Attenuation due to sound travel from the source to the receptor was applied to the combined L_{eq} at 50 feet from all equipment, and the approximate noise level from construction at the receptor was added to existing outdoor ambient levels. Noise levels for each dam were analyzed separately because the facilities are spread out. Other phases, such as road and/or bridge improvement, the City of Yreka pipeline construction, implementation of the interim measures, cofferdam construction, drawdown, and removal of recreational facilities, would cause less noise and vibration impacts than on the peak day.

Vibration from Construction Sites

In addition to producing noise, construction activities have the potential to produce vibration that is annoying to humans and may cause damage to structures. Blasting, drilling, and demolition cause the highest levels of vibration from construction projects. Table 3.23-5 presents the peak particle velocity (PPV) in inches per second (in/sec) and

vibration velocity level (L_v) in vibration decibels (VdB) for typical construction equipment (Federal Transit Administration [FTA] 2006). The Lead Agencies applied these levels to each construction site as appropriate and calculated the equivalent PPV and L_v at the receptor. As was done for noise, the PPV and L_v are based on all construction equipment operating simultaneously on peak construction days.

Table 3.23-5 Vibration Levels for Construction Equipment

Equipment Types	PPV at 25 feet (in/sec)	L_v at 25 feet (VdB)
Clam Shovel Drop	0.202	94
Vibratory Roller	0.210	94
Large Bulldozer / Hoe Ram	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79

Source: FTA 2006.
Key:
in/sec = inches per second
L_v = vibration velocity level
PPV = peak particle velocity
VdB = vibration decibels

Construction-Related Traffic Noise

Transportation noise impacts include noise generated from an increase in local vehicle traffic due to construction workers commuting and trucks hauling waste and construction materials. Details regarding the roadways affected by this Proposed Action are presented in Section 3.22, Traffic and Transportation. Trucks for onsite waste disposal were included in the construction equipment analysis.

Under the Proposed Action, trucks would haul recyclable metal waste to the City of Yreka, California for waste originating in California and to Klamath Falls, Oregon for waste originating in Oregon. Wood waste from Copco 2 Dam would likely be hauled to a hazardous waste landfill in Anderson, California. For construction of fish passages, rebar and wood would be supplied from Medford, Oregon, and concrete would be transported from the City of Yreka, California. The haul routes would likely be I-5, US97, OR66, Copco Road, Ager-Beswick/Ager Road, and Topsy Grade Road. Communities potentially affected by project-related traffic include unincorporated areas of Siskiyou (California) and Klamath (Oregon) Counties and the following cities: the City of Yreka, Montague, Grenada, Weed, Dunsmuir, Mt. Shasta, Redding, and Anderson in California and Klamath Falls, Ashland, Talent, Phoenix, and Medford in Oregon. Figure 3.23-1 shows, for each supplied or removed material type, the haul route and the communities along the haul routes.

Like the trucks, construction workers would commute to the sites using the major highways and roads (I-5, OR66, US97, Copco Road, Ager-Beswick, and Topsy Grade Road). Based on the impact analysis in Section 3.17, Population and Housing, the analysis assumed that workers at facilities in California (Copco 1, Copco 2, and Iron Gate) would commute from Medford, Oregon or the City of Yreka, California and workers at J.C. Boyle Dam would commute from Keno, Oregon and Klamath Falls, Oregon.

This analysis bases the off-site traffic noise impact assessment on the sum of likely existing noise levels near the haul routes, as described in the Affected Environment/ Environmental Setting section, and additional traffic noise from the project. Results from TNM2.5 were used for predicting noise levels 50 feet and 500 feet from roadways. This analysis assumes that off-site hauling to suppliers and landfills would only occur during the daytime. Although the worker commute may not overlap with off-site hauling, the number of cars and trucks from worker commute and hauling were added to the baseline traffic counts for a conservative analysis. Nighttime construction at Copco 1 and Iron Gate would have less impact (i.e., only worker commute) than daytime commute and offsite hauling.

3.23.3.5 Significance Criteria

For the purpose of this analysis, a project action would be significant if it resulted in any the following:

- A greater than 10 dBA increase in the daytime or nighttime outdoor 1-hour L_{eq} at the receptor from on-site construction operations
- A PPV greater than 0.3 in/sec at the receptor
- An L_v greater than 72 VdB at the receptor
- A greater than 12 dBA (in California) or 10 dBA (in Oregon) increase above existing 1-hour L_{eq} for traffic-related noise

The criteria above were based on the characteristics of noise, published studies on vibration effects, and established regulations. Although Siskiyou County does not have local significance criteria for noise and vibration levels, the significance criteria itemized above is expected to provide a conservative analysis of noise and vibration levels. Daytime is defined as the hours between 7:00 am and 10:00 p.m., and nighttime is defined as the hours between 10:00 p.m. to 7:00 a.m. A 10 dBA increase in noise level is perceived as a doubling of noise (FHWA 2011). A PPV of 0.3 in/sec or greater can damage old residential structures from continuous or frequent vibration sources (Jones and Stokes 2004). The annoyance level for vibration is 72 VdB in residential areas (FTA 2006). Caltrans (2006) and ODOT (2009) define a substantial increase in noise levels from traffic as an increase of 12 dBA or 10 dBA, in California and Oregon, respectively, above existing 1-hour L_{eq}.

3.23.3.6 Effects Determinations

The following sections describe the noise and vibration impacts for each alternative.

3.23.3.6.1 Alternative 1: No Action/No Project

The Four Facilities would not be removed and fish passages would not be constructed. This analysis assumes that ambient noise levels under the No Action/No Project Alternative would be the same as existing conditions. **Therefore, implementation of the No Action/No Project Alternative would cause no change from existing conditions from construction noise impacts.**

Several ongoing resource management actions could cause noise and vibration impacts. There may be some noise and vibration effects due to the use of construction equipment throughout the basin associated with ongoing resource management actions, including the Fish Habitat Restoration Program. These activities may include mechanical thinning of vegetation, gravel augmentation, and breaching levees. Although sufficient information is currently not available to estimate noise and vibration impacts, the quantity of equipment required to complete these restoration activities are expected to be less than the required equipment for dam removal and fish ladder construction activities. **Noise and vibration impacts from ongoing resource management actions are therefore assumed to be less than significant.**

3.23.3.6.2 Alternative 2: Full Facilities Removal of Four Dams (Proposed Action)

This section summarizes the noise and vibration effects that would be caused by removing the dams, powerhouses, and other associated structures. J.C. Boyle Dam was not analyzed relative to impacts to human receptors because there are no applicable human sensitive receptors within a 1-mile radius. Copco 2 Dam was also not analyzed for human receptor noise impacts because the line of sight between the dam and the receptor is completely blocked by the terrain, and the nearest sensitive receptor is 3,700 feet from the dam. Impacts to special-status bird species identified near J.C. Boyle Dam and Copco 2 Dam are discussed in further detail below, as well as in Section 3.5, Terrestrial Resources. The Proposed Action impacts are expected to occur between January and September 2020 for approximately four to six months during the scheduled peak dam removal at each site. There are no long-term noise and vibration impacts due to the Proposed Action.

Construction Equipment Noise and Vibration

Two shifts of construction workers are expected to carry out deconstruction of Copco 1 and Iron Gate Dams. Both work shifts overlap with daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) existing levels defined in the previous section. The shifts are described further below. Table 3.23-6 lists the predicted average 1-hour L_{eq} at each construction site and receptor, the increase in noise level at the receptor that would occur as a result of the Proposed Action, and the times of day when the significant impact is expected to occur.

Table 3.23-6. Summary of Noise Levels from Deconstruction Activities for the Proposed Action

Location[1]	L_{eq} (dBA)		
	At Construction Site (50 feet)	At Receptor with Proposed Action	Increase in L_{eq} Caused by Proposed Action
Copco 1 Dam			
Daytime[2]	88-91	50-52	10-**12**
Nighttime[3]	88-91	49-52	10-**22**
Iron Gate Dam			
Daytime[2]	91	46	6
Nighttime[3]	91	44-46	6-**14**

Source: FHWA 2006.

Notes:

1 J.C. Boyle Dam removal was not analyzed because there are no receptors within 1 mile. Copco 2 Dam removal was not analyzed because the line of sight to the closest receptor is completely blocked.

2 Daytime is defined as between the hours of 7:00 a.m. to 10:00 p.m.

3 Nighttime is defined as between the hours of 10:00 p.m. to 7:00 a.m.

Key:

dBA = A-weighted decibels

L_{eq} = 1-hour equivalent noise level

Deconstruction activities at the Four Facilities could cause a temporary increase in noise levels at Copco 1 Dam that could affect residents in the area. The predicted shift-period L_{eq} from all construction equipment on a peak construction day at Copco 1 is 91 dBA at 50 feet during the first shift (6:00 a.m. to 3:00 p.m.) and 88 dBA during the second shift (3:00 p.m. to midnight). Attenuation due to distance, topography, and the atmosphere would reduce these construction site L_{eq} by approximately 39 dBA at the nearest receptor. Compared to the daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) existing outdoor noise levels of 40 and 30 dBA, the resulting increases range from less than 10 to 22 dBA, depending on the time of day. The first shift exceeds the significance criteria at all times because of the high source noise level. The second shift only exceeds the significance criteria after 10:00 p.m. when the background noise levels are expected to be very low. **This increase in outdoor noise levels would have a temporary significant noise impact on the residential area near Copco 1 Dam. Mitigation Measure NV-1 would be implemented but would not reduce outdoor noise impacts to less than significant levels at sensitive receptors; therefore noise impacts would remain significant and unavoidable for outdoor receptors during Copco 1 Dam deconstruction.**

Deconstruction activities at the Four Facilities could cause a temporary increase in nighttime noise levels at Iron Gate Dam. The predicted shift-period L_{eq} from the Iron Gate facilities removal is 91 dBA at 50 feet during both shifts (7:00 a.m. to 4:00 p.m. and 4:00 p.m. to 11:00 p.m.). The combination of existing noise, distance divergence, topographic attenuation, and atmospheric attenuation would result in a shift-period L_{eq} of 46 dBA during the daytime (7:00 a.m. to 10:00 p.m.) and 44 dBA during the nighttime (10:00 p.m. to 11:00 p.m.) at the nearest receptor. The estimated noise level at the receptor exceeds the significance criterion for nighttime noise. **Deconstruction noise**

would cause a temporary significant noise impact on the residential area near Iron Gate Dam at night. Mitigation Measure NV-1 would be implemented but would not reduce nighttime outdoor noise impacts to less than significant levels at sensitive receptors. Nighttime noise impacts would remain significant and unavoidable for outdoor receptors during Iron Gate nighttime deconstruction.

Reservoir restoration activities could result in short-term increases in noise levels in the project vicinity. Additional equipment, including hydro seeding barges, trucks, and helicopters, would be used for reservoir restoration at the same time as dam deconstruction. This reservoir restoration activity would add to the noise levels generated by dam deconstruction activities in and around the dam sites described above. Additionally residential areas along Copco and Iron Gate Reservoirs away from the dam deconstruction sites may experience temporary increased noise levels due to passing hydro seeding vessel or vehicle along the embankment. Aerial hydro seeding is scheduled to begin on March 15 and last for 10 days at Iron Gate and 20 days at Copco. The helicopter would make 30 trips per day between the hours of 7:30 a.m. and 7:00 p.m. All other hydro seeding would be accomplished by barges and trucks. **Helicopters and other equipment noise from embankment restoration would cause a temporary significant noise impact on the residential areas near Copco and Iron Gate Reservoirs and increase the significant noise levels generated by dam deconstruction in and around the dam sites. Mitigation Measure NV-1 would be implemented but would not reduce outdoor noise impacts to less than significant levels at these sensitive receptors.**

Blasting activities at Copco 1 Dam could increase vibration levels. Table 3.23-7 summarizes the Proposed Action's vibration levels at sensitive receptors. Because of blasting, during the first shift at Copco 1 Dam, the PPV and L_v at the nearest receptor are 0.065 in/sec and 84 VdB, respectively. For reference, vibration levels without blasting are shown in Table 3.23-7. The first shift at Copco 1 Dam would therefore exceed the significance criteria for L_v and this is because of the substantial amount of blasting required. During the second shift, the maximum PPV for this alternative would be 0.001 in/sec at the receptors and the L_v at the receptors would be approximately 48 VdB. The vibration levels from Iron Gate Dam and Copco 2 Dam or during the second shift from Copco 1 Dam would not exceed the significance criteria of 0.3 in/sec and 72 VdB. **Deconstruction activities would result in significant human annoyance levels for vibration impacts at receptors near Copco 1 Dam during blasting operations in the first shift. Mitigation Measure NV-1 would be implemented but would not reduce vibration impacts to less than significant levels; therefore, vibration impacts to humans would remain significant and unavoidable during blasting at Copco 1.**

Deconstruction-Related Traffic Noise

Transporting waste to off-site landfills and construction worker commutes could cause increases in noise along haul routes. Noise effects from transporting waste and construction worker commute were evaluated for receptors at 50 feet and 500 feet from the road. Table 3.23-8 shows the results of the TNM2.5 modeling for this potential impact. The TNM2.5 results showed only minor increases in existing L_{eq} for receptors

50 feet or more from all haul routes analyzed. Increases in traffic from construction worker commutes for the second shift at Copco 1 and Iron Gate would result in less noise impact than that presented in Table 3.23-8. **Transporting waste off-site and construction worker commutes would result in less than significant noise impacts for receptors 50 feet or more from all local roadways.**

Table 3.23-7. Summary of Vibration from Construction Activities for the Proposed Action

Source[1]	PPV at Receptor (in/sec)	L_v at Receptor (VdB)
Copco 1 Dam		
Shift 1	0.065 (0.002 without blasting)	**84** (53 without blasting)
Shift 2	0.001	47
Copco 2 Dam	0.001	48
Iron Gate Dam		
Shift 1	0.001	48
Shift 2	0.001	48

Source: FTA 2006.
Notes:
[1] J.C. Boyle was not analyzed because there are no receptors within 1 mile.
Key:
L_v = vibration velocity level
PPV = peak particle velocity
VdB = vibration decibels
in/sec = inches per second

Table 3.23-8. Summary of Construction-Related Traffic Noise from Off-site Hauling and Construction Worker Commute for the Proposed Action

Haul Route/Commute Segment	Peak 1-hour L_{eq} (dBA)		Increase in L_{eq} Caused by Proposed Action (dBA)[1]	
	50 ft	500 ft	50 ft	500 ft
Topsy Grade Road	56	45	3	3
OR66	62	51	2	2
US97	76	64	0	0
I-5: Between OR66 and Medford, OR	77	66	0	0
Ager-Beswick Road	54	43	1	1
Copco Road	63	51	5	5
I-5: Between OR66 and the City of Yreka, CA	77	66	0	0

Notes:
[1] The increase in L_{eq} may appear different when subtracting the existing 1-hour L_{eq} from peak 1-hour L_{eq} values due to rounding.
Key:
dBA = A-weighted decibels
L_{eq} = 1-hour equivalent noise level
ft = feet

Keno Transfer

The transfer of Keno Facility to the United States Department of the Interior (DOI) could have adverse effects on noise and vibration. The Keno Transfer is a transfer of title for the Keno Facility from PacifiCorp to the DOI. This transfer would not result in the generation of new impacts on noise and vibration compared with existing facility operations. Following transfer of title, DOI would operate Keno in compliance with applicable law and would provide water levels upstream of Keno Dam for diversion and canal maintenance in accordance with agreements and historic practice (KHSA Section 7.5.4). **Therefore, the Keno Transfer would have no change from existing conditions for noise and vibration.**

East and Westside Facility Decommissioning – Programmatic Measures

The decommissioning of the East and Westside Facilities could have adverse effects on noise and vibration. Decommissioning of the East and Westside canals and hydropower facilities of the Link River Dam by PacifiCorp as a part of the KHSA will eliminate the need to divert water at Link River Dam in to the two canals. The decommissioning and deconstruction activities could create noise and vibration in excess of applicable standards depending on the location of nearby sensitive receptors. Surveys of receptors and specific decommissioning activities will need to be completed prior to the decommissioning in order to prevent adverse impacts to sensitive receptors. **Therefore, the decommissioning of the East and Westside Facilities would have a less than significant effect on noise and vibration.**

KBRA – Programmatic Measures

The KBRA has several programs that could cause temporary increases in noise and vibration level. The following KBRA programs may cause some noise and vibration impacts from the use of heavy equipment:

- Phases I and II Fisheries Restoration Plans
- Fisheries Reintroduction and Management Plan
- Wood River Wetland Restoration
- On-Project Plan
- Water Use Retirement Program
- Fish Entrainment Reduction
- Power for Water Management Program
- Additional Water Conservation and Storage

Construction activities associated with the KBRA could cause temporary increases in noise and vibration levels. Construction activities associated with the above KBRA programs include channel construction, mechanical thinning of trees, road decommissioning, fish passage and facilities construction, breaching levees, and fish hauling. While the exact geographic location and timing of these programs is not known, it is assumed that some could occur at the same time and in the same area as the hydroelectric facility removal actions analyzed above and could contribute to the effects of facility removal on noise and vibration. **Due to the potentially large amount of**

construction activities that would occur for the various KBRA programs, it is anticipated that the effects from noise and vibration could be potentially significant on sensitive receptors. Mitigation Measure NV-1 would be expected to reduce noise and vibration impacts to less than significant levels; therefore, noise vibration impacts to humans would be expected to be reduced to a less than significant impact. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.

Operational activities associated with the Fisheries Reintroduction and Management Plan could result in temporary increases in noise and vibration levels from vehicles associated with trap-and-haul activities. Haul trucks relocating anadromous fish species around Keno Impoundment /Lake Eauwna could produce noise and vibration. Seasonal trap and haul operations would occur below Keno Dam and near Link River Dam during periods of poor water quality. Hauling activities would occur after the peak noise-generating period of facility removal because fish cannot access Keno Dam until after removal of the Four Facilities; however, some noise and vibration associated with completing removal activities and reservoir restoration may occur at the same time as hauling operations. Construction noise and vibration related to dam removal and hauling operations, taken together, could increase the severity of the effects, but the combined noise and vibration would likely still be less than the peak levels during dam deconstruction. The timing of these trap and haul operations from the hydroelectric facility removal actions analyzed above reduce the potential for any negative noise and vibration effects generated by these trap and haul actions from contributing to the effects of facility removal actions. **Although the exact extent and timing of these hauling activities is not known, it is anticipated that the effects from noise and vibration could be potentially significant on sensitive receptors (including the Topsy Campground near Keno Dam). Mitigation Measure NV-1 would be expected to reduce noise and vibration impacts to less than significant levels; therefore, noise vibration impacts to humans would be expected to be reduced to a less than significant impact. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.**

3.23.3.6.3 Alternative 3: Partial Facilities Removal of Four Dams

Under this alternative, short-term demolition activities and drawdown of reservoirs would still occur; however, only in-stream facilities and select ancillary facilities would be demolished. Although there would be less total construction work and material hauling, peak day operations would be similar to those of the Proposed Action.

Deconstruction activities at the Four Facilities could increase noise and vibration levels. Noise and vibration impacts would be the same as for the Proposed Action and would be significant for construction noise and vibration impacts. **Mitigation Measure NV-1 would be implemented but would not reduce outdoor noise impacts to less than significant levels at sensitive receptors. Noise impacts would remain significant and unavoidable for outdoor receptors near Copco 1 and Iron Gate. Equipment noise from embankment restoration would cause a temporary significant noise impact on the residential areas near Copco Lake and Iron Gate Reservoir. Vibration impacts**

to humans would remain significant and unavoidable during blasting at Copco 1. Transporting waste to off-site landfills and construction worker commutes would result in a less than significant noise impact for receptors 50 feet or more from all local roadways.

Keno Transfer

The effects of the Keno Transfer would be the same as those for the Proposed Action.

East and Westside Facility Decommissioning – Programmatic Measures

The effects of the East and Westside Facilities removal would be the same as those described for the Proposed Action.

KBRA – Programmatic Measures

The Partial Facilities Removal Alternative would include full implementation of the KBRA. Therefore, impacts related to KBRA actions would be the same as under the Proposed Action, discussed above.

3.23.3.6.4 Alternative 4: Fish Passage at Four Dams

This section summarizes the potential noise and vibration impacts from constructing a fish passage at the Four Facilities. J.C. Boyle Dam was not analyzed for this alternative because there are no applicable sensitive receptors within a 1-mile radius. Copco 2 Dam was also not analyzed because the line of sight between the dam and the receptor is completely blocked by hills.

Construction Equipment Noise and Vibration

Construction activities at the Four Facilities could cause a temporary increase in noise levels at Copco 1 and Iron Gate receptor sites. Table 3.23-9 summarizes the predicted average 1-hour L_{eq} at each construction site and receptor, and the temporary increase in noise level at the receptor that would occur as a result of the Fish Passage at Four Dams Alternative. There are no long-term noise and vibration impacts due to this alternative.

Table 3.23-9. Summary of Noise Levels from Construction Activities for the Fish Passage at Four Dams Alternative

Location[1]	1-Hour L_{eq} (dBA)		
	At Construction Site (50 feet)	At Receptor with Fish Passage Construction	Increase in Existing L_{eq} Caused by Fish Passage Construction
Copco 1 Dam	90	52	**12**
Iron Gate Dam	90	45	5

Source: FHWA 2006.

Notes:

[1] J.C. Boyle was not analyzed because there are no receptors within 1 mile. Copco 2 Dam was not analyzed because the line of sight to the closest receptor is completely blocked.

Key:

dBA = A-weighted decibels

L_{eq} = 1-hour equivalent noise level

Fish passage construction activities could cause a temporary increase in noise levels at Copco 1 Dam. The predicted shift-period L_{eq} from construction activities at Copco 1 Dam is 90 dBA at 50 feet. Attenuation offered by distance, topography, and the atmosphere would reduce this L_{eq} to approximately 52 dBA at the nearest receptor. The resulting increase in ambient noise levels at the receptor would be 12 dBA. **This increase in ambient noise levels would represent a significant noise impact on the residential area near Copco 1 Dam. Mitigation Measure NV-1 would be implemented but would not reduce outdoor noise impacts to less than significant levels at sensitive receptors. Noise impacts would remain significant and unavoidable for outdoor receptors during construction.**

Fish passage construction activities could cause a temporary increase in noise levels at Iron Gate Dam. The predicted shift period L_{eq} from construction activities at Iron Gate Dam is 90 dBA at 50 feet. Attenuation offered by distance, topography, and the atmosphere would reduce this 1-hour L_{eq} to approximately 45 dBA at the nearest receptor. The resulting increase in ambient noise levels at the receptor would be 5 dBA. **This increase in ambient noise levels would result in a less than significant noise impact on the residents near Iron Gate Dam.**

Construction activities could increase vibration levels. Table 3.23-10 summarizes vibration levels at the receptors for the Fish Passage at Four Dams Alternative. The maximum PPV for this alternative would be 0.003 in/sec at the receptor near Copco 1 Dam. The L_v at the receptors would range from 46 to 57 VdB for different vibration source locations; these vibration levels would not exceed the 0.3 in/sec and 72 VdB significance criteria. **Construction activities would result in less than significant vibration impacts.**

Table 3.23-10. Summary of Vibration Levels at Receptors from Construction Activities for the Fish Passage at Four Dams Alternative

Location[1]	Peak Particle Velocity (in/sec)	Vibration Velocity Level (VdB)
Copco 1 Dam	0.003	57
Copco 2 Dam	0.001	48
Iron Gate Dam	0.001	46

Source: FTA 2006.
Notes:
[1] J.C. Boyle was not analyzed because there are no receptors within 1 mile.
Key:
VdB = vibration decibels
in/sec = inches per second

Construction-Related Traffic

Transporting construction materials from off-site suppliers and construction worker commute could cause increases in noise along haul routes. The Lead Agencies evaluated

the noise effects of transporting materials to the construction sites for receptors at 50 feet and 500 feet from the road. Table 3.23-11 shows the results of the TNM2.5 modeling for this potential impact. The TNM2.5 results showed only minor increases in existing L_{eq} for receptors 50 feet or more from all haul routes analyzed. **Transporting construction materials from off-site suppliers and construction worker commute would have a less than significant impact on receptors 50 feet or more from all local roadways.**

Table 3.23-11. Summary of Construction-Related Traffic Noise from Off-site Hauling for the Fish Passage at Four Dams Alternative

Haul Route/Commute Segment	Peak 1-hour L_{eq} (dBA)		Increase in Existing L_{eq} Caused by Fish Passage Construction (dBA)[1]	
	50 ft	500 ft	50 ft	500 ft
Topsy Grade Road	56	44	3	3
OR66	62	50	1	1
US97	76	64	0	0
I-5: Between Medford, OR and OR66	77	66	0	0
Ager-Beswick Road	54	43	3	3
Copco Road	60	49	2	2
I-5: Between OR66 and the City of Yreka, CA	77	66	0	0

Notes:
[1] The increase in L_{eq} may appear different when subtracting the existing 1-hour L_{eq} from peak 1-hour L_{eq} values due to rounding.
Key:
dBA = A-weighted decibels
L_{eq} = existing 1-hour equivalent noise level
ft = feet

Trap and Haul – Programmatic Measures

Trap and Haul operations could result in temporary increases in noise and vibration levels from vehicles used to relocate fish. Haul trucks relocating anadromous fish species around Keno Impoundment/Lake Euwana could produce noise and vibration. Seasonal trap and haul operations would occur below Keno Dam and near Link River Dam during periods of poor water quality. Although the exact extent and timing of these hauling activities is not known, it is anticipated that the effects from noise and vibration could be potentially significant on sensitive receptors (including the Topsy Campground near Keno Dam). Mitigation Measure NV-1 would be expected to reduce noise and vibration impacts to less than significant levels; therefore, noise vibration impacts to humans would be expected to be reduced to a less than significant impact. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.

3.23.3.6.5 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Dams

This section summarizes the noise and vibration impacts that would be caused by constructing a fish passage at J.C. Boyle and Copco 2 Dams and removing the facilities at

the Copco 1 and Iron Gate Dams. The analysis for this alternative does not predict construction impacts at J.C. Boyle Dam because there are no applicable receptors. Copco 2 Dam was also not analyzed for noise impacts because the line of sight between the dam and the receptor is completely blocked by hills.

Construction Equipment Noise and Vibration

Construction and deconstruction activities could cause a temporary increase in noise and vibration levels at receptor sites. Noise and vibration impacts at Copco 1 and Iron Gate Dams would be the same as for the Proposed Action. Vibration impacts near Copco 2 would be the same as for the Fish Passage at Four Dams Alternative. Increased noise and vibration levels would occur only during the construction/deconstruction period; no long-term noise and vibration impacts would occur. **Deconstruction at Copco 1 and Iron Gate Dams would have a temporary significant noise impact on outdoor receptors near the dam. Vibration impact to humans would be significant near Copco 1 Dam during blasting. Vibration impacts would be less than significant at receptors near Iron Gate and Copco 2 Dams. Equipment noise from embankment restoration would have a temporary significant noise impact on the residential areas near Copco and Iron Gate Reservoirs. Mitigation Measure NV-1 would be implemented but would not reduce outdoor noise and/or vibration impacts to less than significant levels at sensitive receptors near Copco 1 and Iron Gate Dams. Noise impacts would remain significant and unavoidable for outdoor receptors. Vibration impacts would also remain significant and unavoidable to humans near Copco 1.**

Construction-Related Traffic

Transporting waste to off-site landfills, hauling construction materials from off-site suppliers, and construction worker commute could cause increases in noise along haul routes. Noise impacts from haul trucks and worker commute were evaluated for receptors at 50 feet and 500 feet from the road. Table 3.23-12 shows the results of the TNM2.5 modeling for this alternative. The TNM2.5 results showed only minor increases in existing L_{eq} for receptors 50 feet or more from all haul routes analyzed. The second shift at Copco 1 and Iron Gate would not impact the roads in Oregon and would cause less impact on the California roads than what is presented in Table 3.23-12. **Transporting waste and construction materials and construction worker commute would have a less than significant impact on receptors 50 feet or more from all local roadways.**

Trap and Haul – Programmatic Measures

Trap and Haul operations could result in temporary increases in noise and vibration levels from vehicles used to relocate fish. The trap and haul measures around Keno Impoundment/Lake Euwana would have the same impacts under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as the Fish Passage at Four Dams Alternative. Although the exact extent and timing of these hauling activities is not known, it is anticipated that the effects from noise and vibration could be potentially significant on sensitive receptors (including the Topsy Campground near Keno Dam). Mitigation Measure NV-1 would be expected to reduce noise and vibration

impacts to less than significant levels; therefore, noise vibration impacts to humans would be expected to be reduced to a less than significant impact. Implementation of specific plans and projects described in the KBRA will require future environmental compliance as appropriate.

Table 3.23-12. Summary of Construction-Related Traffic Noise from Off-site Hauling for the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative

Haul Route/Commute Segment	Peak 1-hour L_{eq} (dBA)		Increase in Existing L_{eq} Caused by Fish Passage Construction or Facilities Removal (dBA)[1]	
	50 ft	500 ft	50 ft	500 ft
Topsy Grade Road	56	44	3	3
OR66	62	50	1	1
US97	76	64	0	0
I-5: Between Medford, OR and OR66	77	66	0	0
Ager-Beswick Road	53	42	0	0
Copco Road	62	51	4	4
I-5: Between OR66 and the City of Yreka, CA	77	66	0	0

Notes:
[1] The increase in L_{eq} may appear different when subtracting the existing 1-hour L_{eq} from peak 1-hour L_{eq} values due to rounding.
Key:
ft = feet
dBA = A-weighted decibels

3.23.3.7 Mitigation Measures

The following sections describe the recommended noise and vibration mitigation measures for each alternative.

3.23.3.7.1 Mitigation Measure by Consequences Summary

Mitigation Measure NV-1 – The Dam Removal Entity (DRE) will develop a Noise and Vibration Control Plan (NVCP) to address increased day and night time noise levels as a result of the Proposed Action. The NVCP will identify the procedures for predicting construction noise levels at sensitive receptors prior to performing construction activities and will describe the reduction measures required to meet the target noise level. The NVCP will be based on planned construction activities. Noise and vibration mitigation measures will include, but will not be limited to the following:

- The DRE will ensure that the Construction Contractor is maintaining equipment to comply with noise standards (e.g., exhaust mufflers, acoustically attenuating shields, shrouds, or enclosures).
- For nighttime or after-hour construction, the DRE will coordinate with the local jurisdictions to minimize noise. Nearby residents will be notified of hours and duration of construction activities.

- Schedule truck loading, unloading, and hauling operations so as to reduce daytime and nighttime noise impacts to less than noticeable levels.
- The blasting schedule will be coordinated with local jurisdictions to minimize noise. Nearby residents will be notified of blasting schedules.
- Appropriate blasting techniques will be employed to minimize noise and vibration.
- Noise and vibration complaints will be addressed promptly by the DRE and high impact activities rescheduled or alternate means of demolition and construction implemented, when feasible.

3.23.3.7.2 Effectiveness of Mitigation in Reducing Consequences

Implementation of mitigation measure NV-1 would manage noise and vibration impacts but would not reduce to less than significant levels. Because of the large construction areas and the long distances between the construction site and the receptors, conventional methods to reduce noise source, such as constructing barriers, would not provide a substantial reduction in noise levels and would not reduce noise and vibration to less than significant levels.

3.23.3.7.3 Agency Responsible for Mitigation Implementation

The DRE will be responsible for implementing mitigation measure NV-1.

3.23.3.7.4 Remaining Significant Impacts

Mitigation measures presented in Section 3.23.5 would not reduce noise impacts to less than-significant levels for outdoor receptors. This is because of the very low existing noise levels at the receptor compared to the high noise levels at the construction site. However, actual existing daytime and nighttime ambient noise levels may be higher than those used in this analysis and construction noise levels may be lower and therefore the impact may be less. This analysis calculated outdoor noise levels at residential properties. A review of the parcel lots near each dam site indicated that the following parcels are located within a one-mile radius of each dam site, as shown in Figures 3.23-5 and 3.23-6, and may be affected by noise:

- Iron Gate: 40 parcels, excluding Federal, county, and PacifiCorp Properties
- Copco 1 and 2: 135 parcels, excluding Federal, county, and Pacific Power and Light Properties

It is not known at this time how many parcels would be occupied during construction and demolition activities; therefore it is assumed all parcels would contain residents and would be affected. The majority of parcels, however, are located farther from the construction sites than the peak sensitive receptor, so any potential impacts would be less than what was estimated for the peak receptor.

As described earlier, all calculated noise levels are for outdoor human receptors. Buildings with an open window would reduce the noise levels indoors by 10 dB. A light frame building with a closed ordinary sash would reduce the outdoor noise level by

20 dB. Depending on the building and window types, up to 35 dB reduction in indoor levels may be achieved (FHWA 2011), substantially reducing impacts for indoor receptors.

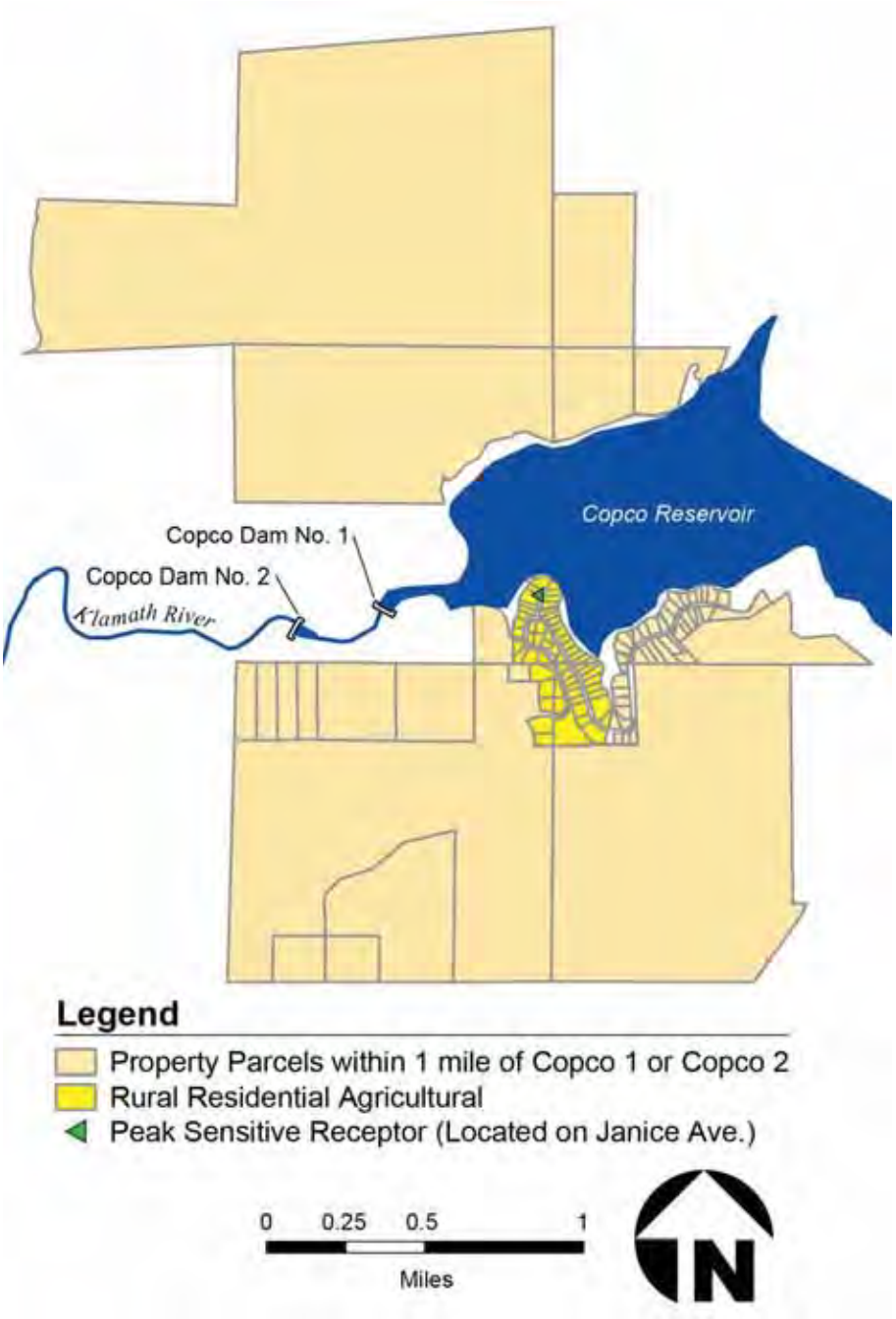

Figure 3.23-5. Parcel Lots within One-Mile of Copco 1 and 2 Dams.

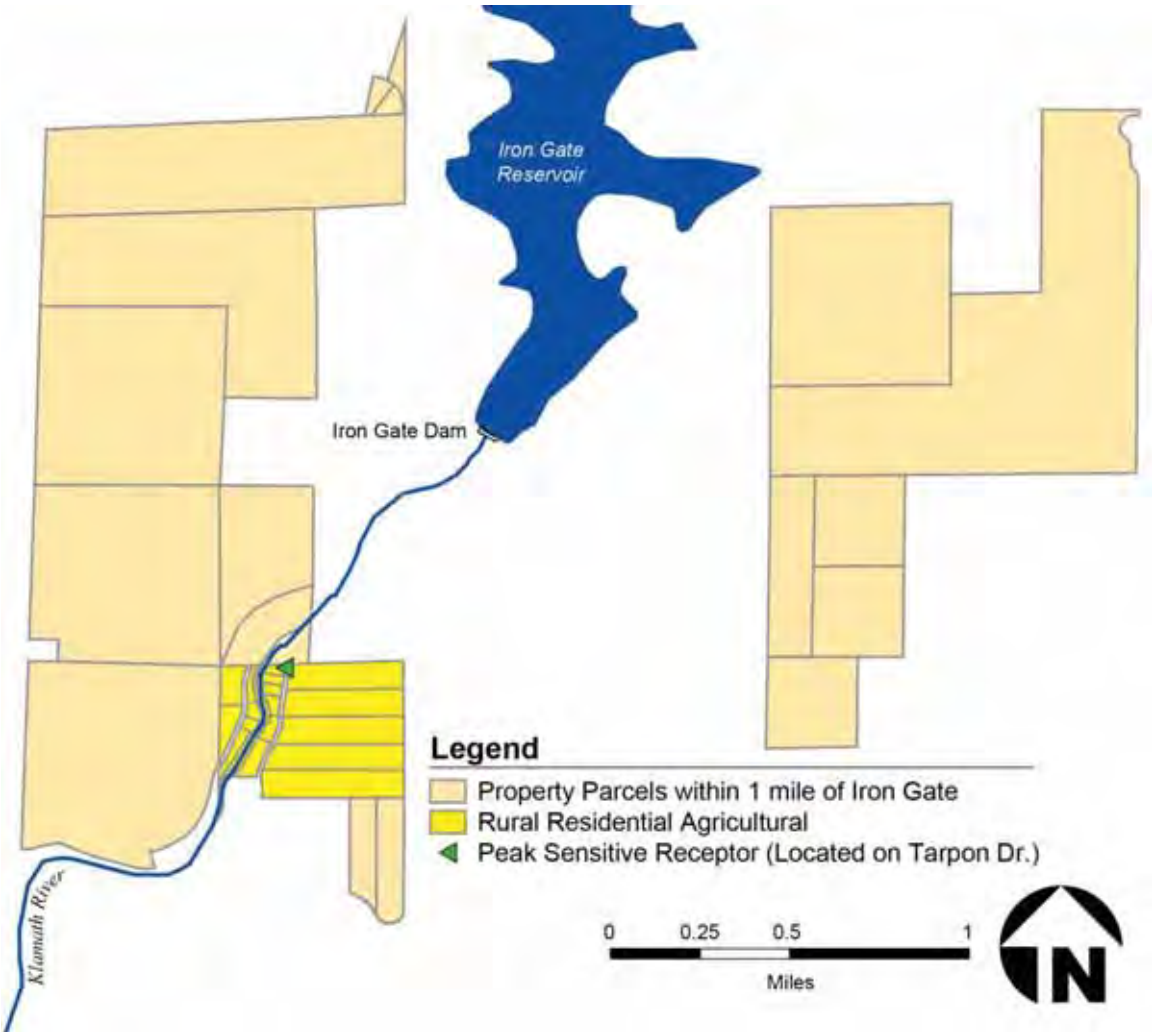

Figure 3.23-6. Parcel Lots within One-Mile of Iron Gate Dam.

Mitigation Measures Associated with Other Resource Areas

Transporting fish and mollusks under Mitigation Measures AR-1, 2, 5-7 could cause temporary increases in traffic noise. These mitigation measures involve trap and haul of fish and mollusks to protect them from the reservoir drawdown and dam deconstruction activities. It is anticipated that as many as 150 truck trips may be required to transport juvenile fish from areas downstream from Iron Gate Dam to the confluence of Klamath and Trinity Rivers between February and April of 2020. On average, the traffic volume during peak construction times would increase by two trucks due this mitigation measure. As a rule of thumb, for traffic noise levels to increase significantly, hourly traffic volume must multiply by approximately a factor of 10. **The noise and vibration impacts of these measures would be less than significant.**

Construction activities under Mitigation Measure TR-1 could cause a temporary increase in noise and vibration levels. Relocation of Jenny Creek Bridge and culverts near Iron Gate Reservoir would occur before the other construction phases of dam removal. In comparison to the dam removal, equipment and time required for this construction would be minimal. No sensitive receptors were identified near the bridge and therefore, noise and vibration from construction would not impact human receptors. **Construction noise and vibration due to TR-1 would be less than significant.**

Construction activities under Mitigation Measure REC-1 could cause a temporary increase in noise and vibration levels. Mitigation REC-1 would create a plan to develop recreational facilities and access points along the newly formed river channel between J.C. Boyle Reservoir and Iron Gate Dam. Recreation facilities, such as campgrounds and boat ramps, currently located on the edge of the reservoir would need to be replaced in appropriate areas near the new river channel once the reservoir is removed. In comparison to the dam removal, equipment and time required for this construction would be minimal. Recreation facility replacement would occur following dam removal and would not generate noise levels that exceed levels anticipated for the peak day. **Construction noise and vibration due to REC-1 would be less than significant.**

Several other mitigation measures may require construction, including mitigation measures H-2 (move or elevate structures with flood risk), GW-1 (deepen or replace wells), and WRWS-1 (modify water intakes). These measures could produce noise and vibration associated with construction activities. These activities would take place before or after the primary construction and deconstruction activities associated with the Proposed Action and action alternatives; therefore, they would not add to these noise and vibration impacts. The construction activities are generally smaller efforts that would not cause a substantial increase in noise to sensitive receptors. **Construction-related mitigation measures would cause a less than significant noise and vibration impact to sensitive receptors.**

3.23.4 References

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