

Section 1

Introduction

The Klamath Basin covers over 12,000 square miles in southern Oregon and northern California (see Figure 1-1) and contains natural resources and economic opportunities related to fisheries, farming, ranching, timber harvest, mining, and recreation. These resources and opportunities have economically sustained many communities throughout the basin for decades. The Klamath Basin is also home to six federally recognized Indian tribes who depend on many of these same natural resources to support their way of life and spiritual wellbeing, as they have for thousands of years. The basin's natural resources including clean water, abundant and reliable supplies of fish, and terrestrial plants and animals, are central to Indian cultural identity.

Although rich in natural resources, communities throughout the Klamath Basin have faced repeated hardships because of water shortages, degraded water-quality, troubled fisheries, and the need to conserve three fish species protected by the Federal Endangered Species Act (ESA). These hardships have been most strongly felt by Indian tribes, commercial and recreational fishing communities, farmers, and ranchers, but they also affect the economy of the entire basin, often creating deep conflicts among communities. Although hardships and conflicts have been prevalent for decades, they became particularly acute from 2001 to 2010 (see sidebar), prompting development of the Klamath Hydroelectric Settlement Agreement (KHSA) and the Klamath Basin Restoration Agreement (KBRA). The KHSA provides for the study and evaluation of the potential removal of the four lower dams on the Klamath River (herein called the Four Facilities; see Figure 1-2) which are owned by PacifiCorp, and the KBRA contains programs for resource restoration and sustainable communities. The KHSA and KBRA were developed by a broad range of local, tribal, state, and Federal stakeholders to resolve water and fisheries issues and to reduce the likelihood of future hardships; both agreements were signed in February 2010 in Salem, Oregon, by representatives of over 40 basin stakeholder groups. PacifiCorp signed the KHSA because their license to operate the Four Facilities expired in 2006 and the company determined the customer costs and risks from relicensing the Four Facilities would be greater than the customer costs and risks associated with dam removal under KHSA.

Events, actions, and hardships in the Klamath Basin from 2001 to 2010:

- In spring of 2001, the Bureau of Reclamation (Reclamation) was required to greatly curtail water deliveries to irrigators due to water shortages and the need to protect Endangered Species Act (ESA) listed fish.
- In September 2002, there was a major die off in the Klamath River of adult fall run Chinook salmon (at least 30,000 fish).
- In 2005, warnings against physical contact with the water in Iron Gate and Copco 1 reservoirs due to toxic algae bloom began being posted annually.
- In 2006, low abundance of Klamath River stocks of Chinook salmon lead to severe restrictions on commercial and recreational harvest along 700 miles of the Oregon and California coast, as well as major reductions in Klamath River recreational and tribal fisheries.
- In 2009, Klamath area commercial salmon harvest was closed.
- In 2010, there was a significant reduction in water deliveries to Reclamation's Klamath Project due to dry hydrologic conditions.
- In 2010, the Klamath Tribes continued to limit their harvest of suckers to only ceremonial use for the 25th consecutive year and experienced their 92nd year without access to salmon.

Figure 1-1: Major Features of the Klamath Basin

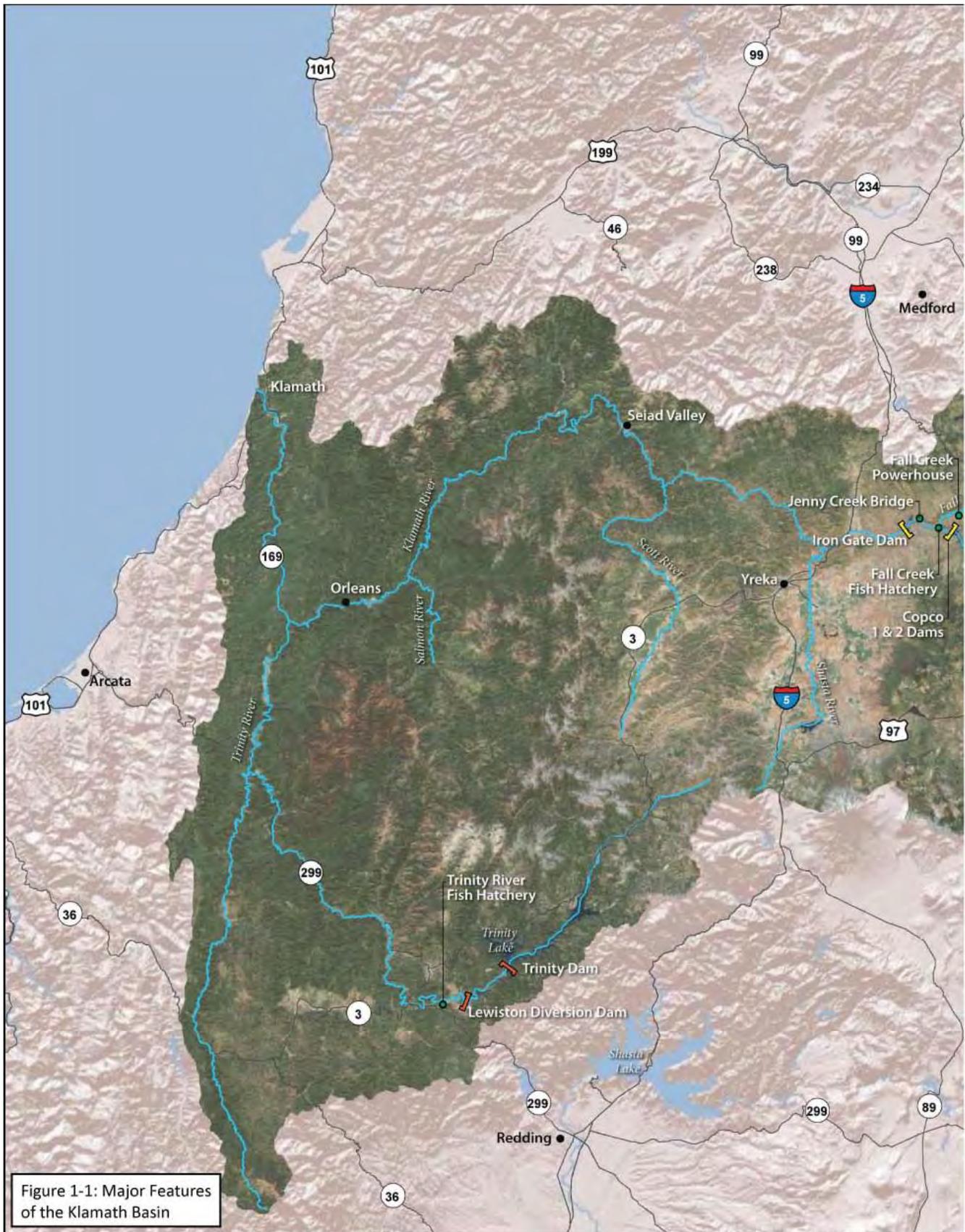
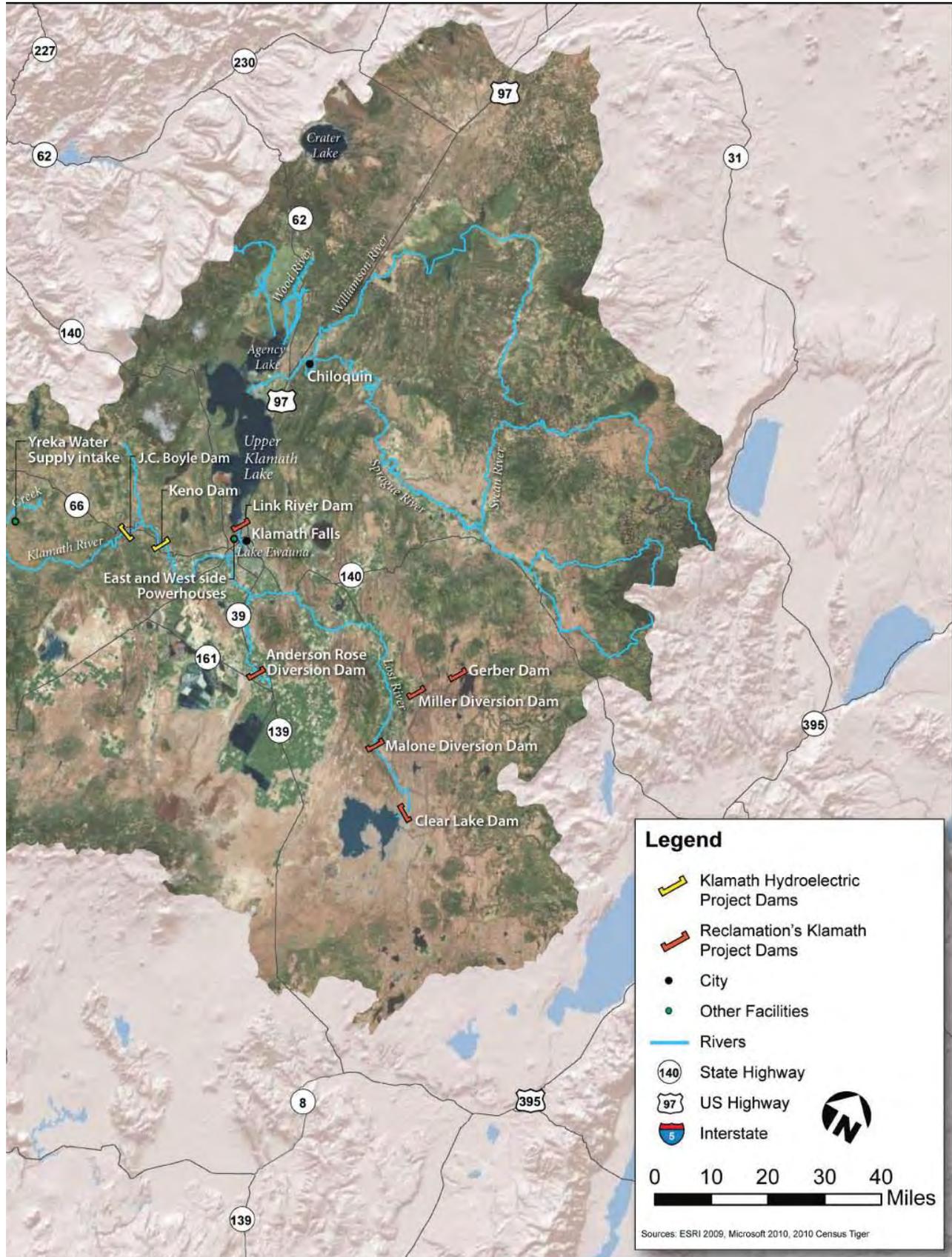


Figure 1-1: Major Features of the Klamath Basin (continued)



If fully implemented, the KHSA would result in the removal of the Four Facilities, which are part of Federal Energy Regulatory Commission (FERC) Project No. 2082 (see Figure 1-2). This report, the *Klamath Dam Removal Overview Report for the Secretary of the Interior: An Assessment of Science and Technical Information* (Overview Report), presents a synthesis of new scientific studies¹ and data collection activities called for in the KHSA (see Section 3.2.4 of the KHSA), and other existing reports. The new studies, which will inform the Secretarial Determination² (see sidebar: Four Questions before the Secretary of the Interior on Dam Removal) regarding the removal of the Four Facilities, were conducted with input from signatories of the KHSA, other stakeholders, and the public, as outlined in Appendix A of the KHSA.

Figure 1-2: Klamath River Basin and PacifiCorp’s Four Facilities. The Klamath Basin covers over 12,000 square miles and includes PacifiCorp’s J.C. Boyle, Copco 1, Copco 2, and Iron Gate dams on the main stem of the Klamath River. These Four Facilities would be removed under the KHSA.



¹ Suggested guidance for prioritized new studies and data collection needs, and the science process for conducting these studies, is summarized in Section 3.2.4 and Appendices A, I, and J of the KHSA. Section 3 of this report provides additional information on the science process used for the Secretarial Determination process and how new studies were identified and designed, and how new reports were prepared and reviewed.

² The Secretarial Determination is the determination made by the Secretary of the Interior on whether to remove the Four Facilities.

Signatories of the KHSA, with the exception of the Federal government and PacifiCorp, also signed the accompanying KBRA. The Federal government is not able to sign the KBRA until Congress passes Federal legislation authorizing the agreement. The KBRA contains interrelated plans and programs intended to benefit fisheries throughout the basin, water and power users in the Upper Klamath Basin, counties, Indian tribes, and basin communities. Implementation of the KBRA is also being evaluated in this Overview Report because the KBRA would be implemented if there is an Affirmative Secretarial Determination³ on the KHSA. While some elements of the KBRA may be implemented without an Affirmative Secretarial Determination, a number of the actions and programs described in the KBRA would likely not be implemented, or would be implemented differently, if the Secretarial Determination was Negative, and the Four Facilities remained in place.

1.1 PURPOSE AND SCOPE OF THIS REPORT

The KHSA identified information needs, and specific questions that should be addressed with new studies and analyses, prior to the Secretary of the Department of the Interior (DOI) making a determination on removal of the Four Facilities (Secretarial Determination). The sidebar summarizes the major information needs and questions to be addressed for a Secretarial Determination. These questions are an expansion of what was originally described in Section 3.2.4 and Appendix I of the KHSA. Questions 1 and 4 (see sidebar) were expanded to also include implementation of KBRA in the analysis to inform a Secretarial Determination. And question 1 was expanded to analyze effects on several other native fish species in addition to salmonids (salmon and trout).

This report provides a single, convenient, peer-reviewed summary of key findings from the Federal technical studies that were undertaken to address each of the four questions of the Secretarial Determination, and to summarize findings from other reports and data sources relevant to these questions. This report was developed by CDM Smith (a private consulting, engineering, and science company), in coordination with the Technical Management Team (TMT) (see Section 3.1, *Technical Oversight*) under contract with the Bureau of Reclamation (Reclamation), on behalf of the DOI. This report also provides findings and conclusions at a level that is understandable to readers not familiar with each of the technical disciplines (e.g., biology, engineering, and economics). Consequently, this report is not written in a standard science reporting format with a full technical description of study assumptions, methods used, data sources, and uncertainties. Its focus is on summarizing findings and conclusions from many reports and information sources, and in some cases, drawing some new, overarching conclusions. Readers wanting detailed technical discussions on the various study topics summarized in this report are directed to the cited Federal studies available on KlamathRestoration.gov. The intended audience for this report is broad, including the Secretary of the Interior and Secretary of Commerce, other government agency officials, stakeholders in the basin, and the general public.

³ A determination made by the Secretary of the Interior that removal of the Four Facilities should proceed (see KHSA Section 1.4)

Four Questions before the Secretary of the Interior on Dam Removal

The Secretary of the Interior will make a determination on whether or not to remove the Four Facilities by addressing the four questions below, using existing and newly developed information (Secretarial Determination). The Determination will be made in coordination with the Secretary of Commerce.

1. Will facilities removal and KBRA implementation advance restoration of salmonid fisheries and other fish species in the Klamath Basin over a 50 year time frame?
2. What would dam removal entail; what mitigation measures may be needed; and what would these actions cost?
3. What are the potential risks and liabilities associated with dam removal to be considered by the entity removing the dams?
4. Is facilities removal and implementation of KBRA in the public interest, which includes but is not limited to consideration of potential effects on local communities and tribes?

Adapted from Appendix I of the KHSA.

The scope of this report is the information needed to inform the Secretary in making his decision as it relates to the four KHSA-derived questions. Consequently, this report should not be viewed as a comprehensive synthesis of all the literature available on the Klamath Basin. This report does, however, (1) draw conclusions regarding the likely effects of removal of the Four Facilities and KBRA implementation on salmonid fisheries and other fish species; (2) describe a detailed plan for removing the Four Facilities, mitigation actions that may be needed, and a range of costs for these actions; and (3) describe the risks and liabilities associated with dam removal. This report does not draw conclusions regarding whether dam removal is in the public interest; that determination will be made by the Secretary of the Interior in a Record of Decision, and in coordination with the Secretary of Commerce.

To structure the analysis of the four questions of the Secretarial Determination, two scenarios were developed to represent a comparison of existing conditions to dam removal with implementation of KBRA. These scenarios are used throughout this report and consist of the following:

- **Dams Remain Without Implementation of the KBRA:** For the purposes of this analysis, this scenario assumes the Four Facilities remain and without Implementation of the KBRA (also referred to as “dams remain” or “dams in”). This scenario also assumes that PacifiCorp continues current operations under annual FERC licenses, without installation of fish passage facilities. The expired license had no requirements for fish passage around the Four Facilities and it is not known when fish passage facilities would be completed if the Four Facilities were given a long-term licensed by FERC. Operations of the Four Facilities includes passing water through the dams in accordance with two ESA Biological Opinions that (1) maintain Upper Klamath Lake levels to protect two endangered sucker species (USFWS 2008), and (2) maintain flow conditions downstream of Iron Gate Dam to protect threatened coho salmon (NOAA Fisheries Service 2010). The dams remain scenario also assumes, for purposes of this analysis, that these two biological opinions would remain in effect during the study period (2012 – 2061), agency funding for fish habitat restoration actions would continue at current levels, and the Iron Gate Fish Hatchery would continue to operate.

A dams remain scenario also includes other regulatory conditions that would affect the environment and circumstances in the Klamath Basin. To improve water quality, the Oregon Department of Environmental Quality (ODEQ) and California’s North Coast Regional Water Quality Control Board (NCRWQCB) collaborated to develop Total Maximum Daily Loads (TMDLs) for impaired water bodies within the basin. TMDLs are water pollution control plans that identify the pollutant load reductions that are necessary to meet water quality standards. The California and Oregon Klamath River TMDLs focus on reducing elevated water temperatures, increasing dissolved oxygen levels, and reducing nutrient concentrations in the mainstem Klamath River over a 50-year time period (NCRWQCB 2010b, ODEQ 2010).

- **Dam Removal and Implementation of the KBRA:** The dam removal and implementation of the KBRA scenario (also referred to as “dams out with

KBRA” or “dams out”) includes the removal of the Four Facilities as described in the KHSA and full implementation of the KBRA. Dam removal would create a free flowing river from Keno Dam to the Pacific Ocean, would restore bedload and sediment transport processes, and would allow volitional fish passage to potential habitat in the upper basin. This scenario includes the complete or partial removal of the Four Facilities but leaves in place Link River and Keno dams, which are critical for delivery of water to farms and the National Wildlife Refuges. Link River Dam stores water in Upper Klamath Lake for Reclamation’s Klamath Project. Keno Dam maintains water elevations necessary for gravity-feed delivery of irrigation water from the Klamath River between Link River and Keno dams. Both Link River and Keno dams are relatively small and have fish passage facilities. Under the KHSA, Keno Dam ownership would be transferred from PacifiCorp to the Department of the Interior. Under this scenario it is also assumed the Iron Gate Fish Hatchery would continue to operate through 2028, but would be discontinued thereafter. The actual decision to close or to continue the hatchery would be made based on the progress of fisheries restoration.

KBRA implementation in this scenario includes the many programs and actions described and listed in Section 1.2.8 *Klamath Basin Restoration Agreement* as well as a commitment to “adaptive management” when administering the KBRA. Adaptive management is an approach to resource management that readily adjusts plans and restoration actions as environmental conditions change or as new information is obtained. Monitoring the outcomes and effectiveness of current restoration actions is essential for a successful adaptive management program. The KBRA includes large fisheries and water-quality monitoring programs and research plans to inform this management process. The KBRA also includes basin-wide fish habitat and water quality restoration programs, except for the Trinity River Basin, which has a separate restoration program (Trinity River Restoration Program) that would be implemented in either a dams in or a dams out scenario. It is expected that TMDL goals would be met more quickly in this scenario owing to planned KBRA restoration actions aimed at improving water quality, particularly in the upper basin. KBRA also includes programs for reintroducing salmonids to the upper basin; increasing the certainty of water deliveries to farms; increasing the certainty and volume of water deliveries to National Wildlife Refuges; reducing agricultural water use, particularly in dry years; increasing opportunities for creating beneficial peak-flow events below Link River Dam and increasing flow variability that more closely mimics a natural hydrograph; and assisting local communities. For this scenario, it is assumed that flows under the KBRA would occur as modeled and described in Reclamation 2012g, which includes planned changes in the operation of Reclamation’s Klamath Project, voluntary reductions (30,000 acre feet) in off-project irrigation water use, and increased water deliveries to National Wildlife Refuges.

1.2 BACKGROUND

The multifaceted issues in the Klamath Basin include water shortages, environmental degradation, and depressed fish populations, each of which adversely affect endangered species, agricultural and fishery communities, and their respective economies, as well as the way of life and health of tribal communities. This section provides expanded context for these issues, including background on the hydrologic, biological, and physical setting; important historical changes that have taken place in the basin; important regulatory conditions and actions; and additional information on the KHSA and KBRA.

1.2.1 Hydrologic Setting

The headwaters of the Klamath River, unlike most other watersheds in the Pacific Northwest, originate in relatively flat open valleys before descending into a steep river canyon that intercepts inputs from multiple groundwater inflows in the upper basin⁴ and the Shasta, Scott, Salmon, and Trinity Rivers, among others, in the lower basin, prior to emptying into the Pacific Ocean.

Figure 1-3: Most precipitation falls in the Lower Basin’s coniferous forest contrasted against the Upper Basin which is dominated by semi-arid chaparral and pinion pine.



The upper basin contains large, porous aquifers that store precipitation falling throughout the year and steadily release cool water into stream channels. Consequently, seasonal stream flow fluctuations in upper basin streams are relatively small. In contrast, the lower basin does not contain large, porous aquifers that temporarily store precipitation. As a result, precipitation tends to runoff more quickly in the lower basin, creating relatively “flashy” streams.

Precipitation in the watershed varies widely, ranging from an annual average of 15 to 25 inches in the open valleys in the headwaters, which are in the rain shadow of mountains to the west, to approximately 80 inches of rainfall near the river’s mouth (see Figure 1-3). Consequently, the amount of water running off from the upper basin, even though it is nearly equal in size to the lower basin, is relatively small, averaging less than 20 percent of the total on an annual basis, as

⁴ This report subdivides the Klamath Basin into the Upper and Lower Klamath Basins at Iron Gate Dam. The portion of the river and its tributaries upstream of Iron Gate Dam fall within the upper basin and the portion downstream of the dam fall within the lower basin.

illustrated in Figure 1-4. The steadier groundwater discharge from the upper basin, however, does provide an important source of water for the lower basin and for fish during the dry summer and early fall months when flows in the lower basin tributaries are low.

At its higher elevations (above 5,000 feet), the Upper Klamath Basin receives rain and snow during the late fall, winter, and spring. Peak stream flows in the upper basin generally occur during snowmelt runoff in late spring and early summer. Peak runoff events in the lower basin tend to occur from November through March, when rainfall is highest, or when rain-on-snow events occur.

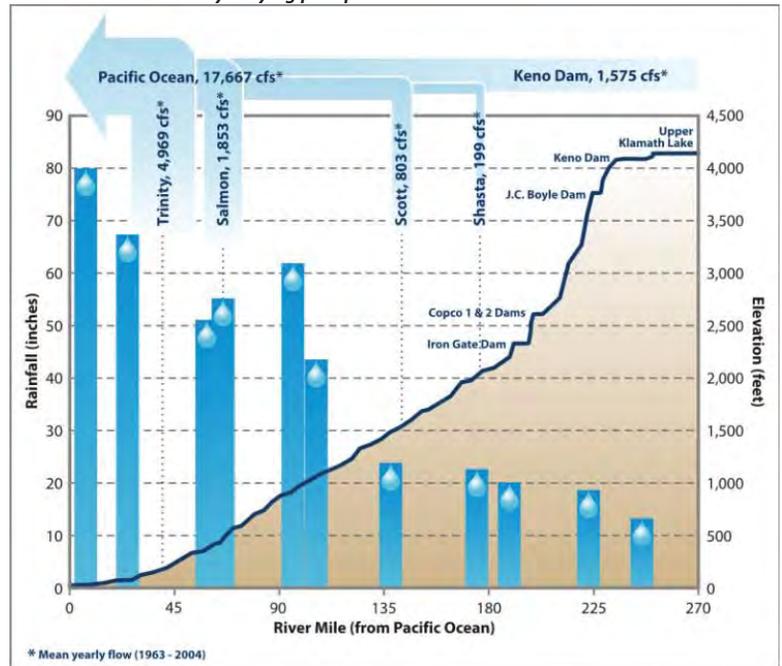
1.2.2 Historical Changes

Prior to the 1800s, the Upper Klamath Basin featured a vast complex of 350,000 acres of lakes and wetlands, interconnected by sloughs and river channels. The rivers and wetlands of the Klamath Basin supported large and diverse fish populations and were an important stopover point for migratory birds and waterfowl. For thousands of years, these fish, birds, wildlife, vegetation, and other natural resources sustained Indian tribes in the Klamath Basin.

Settlers that moved to the western United States in the 1800s and 1900s found many of these wetlands and upland areas to be attractive for farming if drained and/or if they could be supplied with irrigation water. The construction of Reclamation's Klamath Project began in the early 1900s to facilitate farming. Reclamation's Klamath Project, the largest water delivery system in the basin, supplies irrigation water for up to 235,000 acres of agricultural lands. Farms and ranches upstream from Upper Klamath Lake, on tributaries downstream of Upper Klamath Lake, and in the lower Klamath River (e.g., Scott, Shasta, and Trinity Rivers) use surface water supplies that are not part of Reclamation's Klamath Project. Some of these agricultural areas also rely on groundwater supplies.

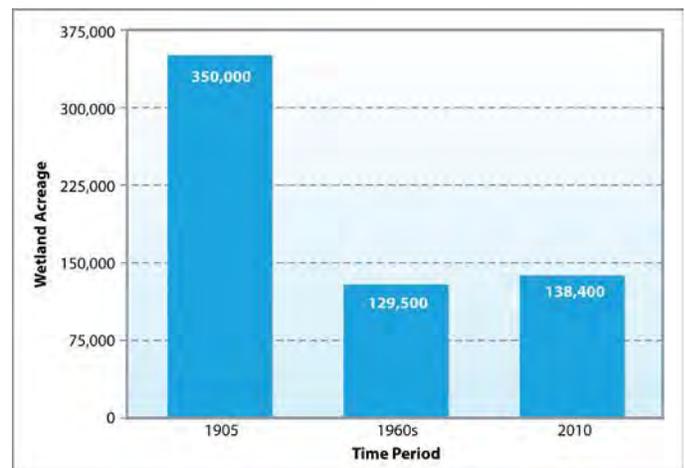
Hundreds of thousands of acres of the wetlands in the Upper Klamath Basin, including wetlands in Reclamation's Klamath Project area, were converted to farming and ranching activities (see Figure 1-5). Some of the wetlands were retained through establishment of the Lower Klamath National Wildlife Refuge (NWR) by President Roosevelt in 1908, creating the first waterfowl refuge in

Figure 1-4: The Klamath River is a unique river system with a flat topography as its headwater with a steeper downstream portion beginning near Keno Dam. In addition, the basin receives widely varying precipitation.



Source: Western Regional Climate Center 2011, Reclamation 2012g, FERC 2007

Figure 1-5: Klamath Basin wetland acreage over time (1905-2010).



Source: Akins 1970, Natural Resources Conservation Service 2007 as referenced in Larson and Brush 2010

the United States and conserving critical habitat for birds along the Pacific Flyway. Other NWRs in the upper basin include Tule Lake NWR and Upper Klamath Lake NWR, both established in 1928.

The Klamath Hydroelectric Project was constructed by the private utility company PacifiCorp⁵, between 1918 and 1962, and includes the East and West Side Powerhouses on Link River Dam, and Keno, J.C. Boyle, Copco 1, Copco 2, Iron Gate, and Fall Creek dams (see Figure 1-2). The East and West Side Powerhouses and Fall Creek Dam locations are shown on Figure 1-1. PacifiCorp developed all of these dams for the purpose of power generation. Keno Dam, however, was never converted to a hydroelectric facility. Link River dam impounds irrigation water in Upper Klamath Lake for use on Reclamation’s Klamath Project. The installed maximum capacity of the entire project is 163 megawatts (MW) and, on average, the project produces 82 MW (or 716,800 megawatt-hours [MWh] of electricity annually) (FERC 2007).

1.2.3 Reclamation’s Klamath Project

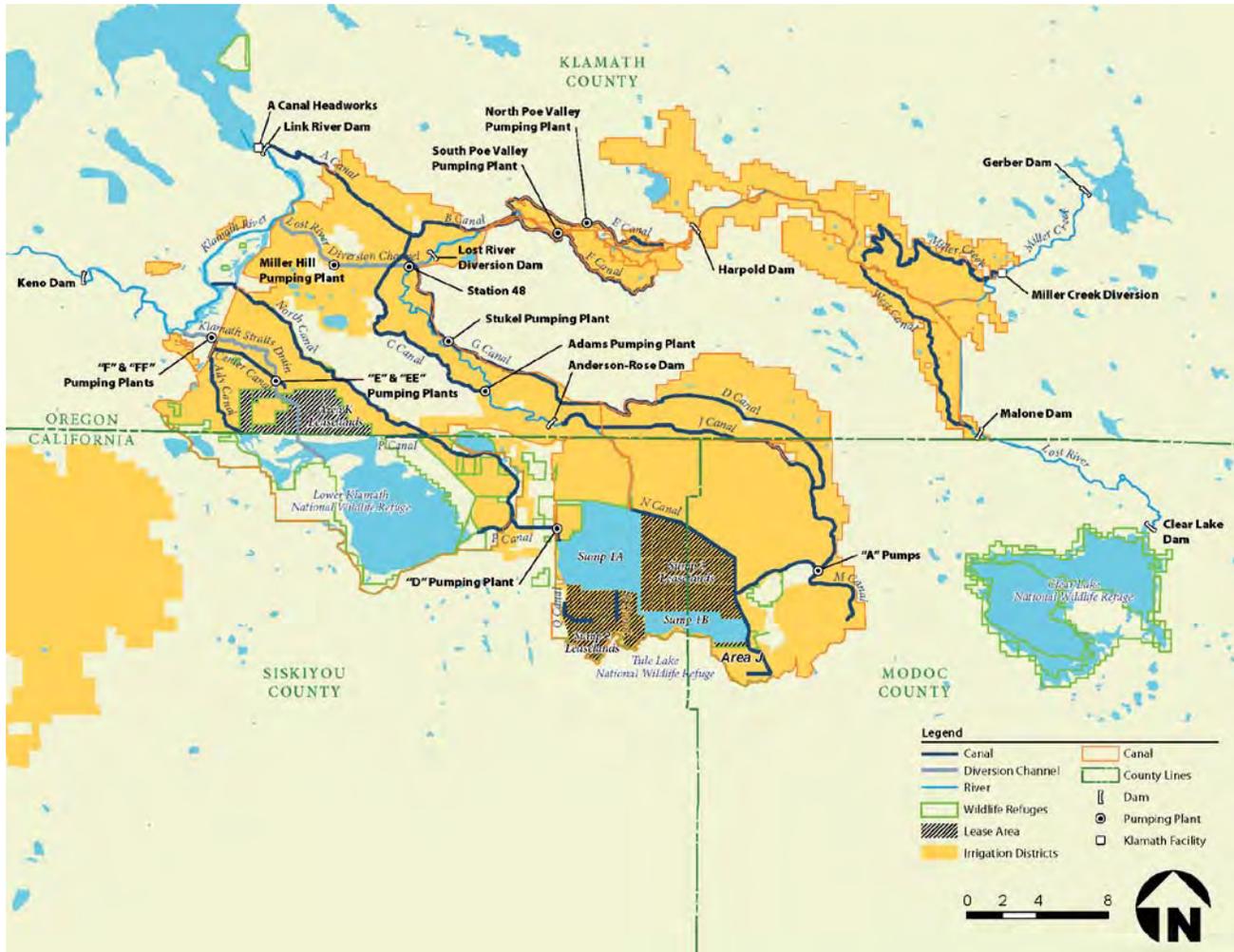
Table 1-1: Reclamation’s Klamath Project Dams

Dam	Purpose	Location	Year Construction Was Completed
Link River	Storage	Upper Klamath Lake	1921
Clear Lake	Storage	Clear Lake on Lost River	1910
Gerber	Storage	Gerber Reservoir on Miller Creek	1925
Lost River	Diversion	Lost River	1912
Anderson-Rose	Diversion	Lost River	1921
Malone	Diversion	Lost River	1923
Miller	Diversion	Miller Creek	1924

The Secretary of the Interior authorized development of Reclamation’s Klamath Project on May 15, 1905 under provision of the Reclamation Act of 1902 (32 Stat. 388) and construction began in 1906. Reclamation’s Klamath Project consists of three primary storage facilities and four diversion dams (see Table 1-1), as well as the associated canals, drains, pumping plants, two tunnels, and the Lost River Diversion Channel (see Figure 1-6). Reclamation’s Klamath Project provides irrigation water for up to 235,000 acres of irrigable acres that produced crops with an average annual gross farm revenue of \$148.6 million between the years 2005 and 2009 (Klamath Basin Hydro-Economic Model (KB_HEM) as referenced in Reclamation 2012g). In general, Reclamation’s Klamath Project operations consist of storing water (runoff and groundwater discharge) during the winter and spring and releasing it for use by water users during the growing season. The availability of water is dependent on the annual inflows because Reclamation’s Klamath Project has limited capacity to store water to carry over for the following year. Water is also supplied to the Lower Klamath and Tule Lake NWRs. Irrigation return flows from Reclamation’s Klamath Project and the refuges are discharged to the Klamath River primarily through the Klamath Straights Drain above Keno Dam (see Figure 1-6).

⁵ PacifiCorp refers to the current utility and all previous owners/names.

Figure 1-6: Reclamation's Klamath Project is the largest irrigation program in the Klamath Basin providing irrigation water for up to 235,000 acres of agriculture generating approximately \$148 million in annual farm revenues.



1.2.3.1 Link River and Keno Dams

Two dams important to the operations of Reclamation's Klamath Project are the Link River and Keno dams, both of which would remain in place as specified in the KHSA even if the Four Facilities were removed. These two facilities are equipped with fish passage that would allow anadromous and other fish to access the upper basin. With removal of the Four Facilities, anadromous fish would be able to access the Lost River Basin (see Figure 1-1). To prevent anadromous fish from becoming entrained in the unsuitable habitat of the Lost River Basin, KBRA provides for screening of potential access points. Link River Dam was constructed on the natural reef outlet of Upper Klamath Lake and allows Reclamation to store and divert water for the Klamath Project. Keno Dam is owned and operated by PacifiCorp, whose predecessor, the California Oregon Power

Figure 1-7: Keno Dam would remain according to the KHSA.



Figure 1-8: Link River Dam would remain according to the KHSA.



Company (Copco), constructed Keno Dam to better regulate the releases of water from Link River Dam to the Four Facilities downstream. Keno Dam does not divert water or generate hydroelectric power. Under a January 4, 1968 contract with Reclamation, PacifiCorp operates Keno Reservoir elevations between 4085 and 4086.5 feet above sea level to aid in the diversion of irrigation water into Reclamation’s Klamath Project through the Lost River Diversion Channel and the North Canal (see Figure 1-6).

1.2.4 Existing Biological and Physical Conditions

The rich biological diversity of the Klamath Basin includes drier pine and fir forests in the upper basin and dense redwood forests in the lower basin; these forests together support more than 3,000 known plant species and more than 200 vertebrate species, including amphibians, reptiles, birds, and mammals.

The wetlands and forests of the basin are a critical layover for migrating birds in the spring and fall. Nearly 80 percent of the Pacific Flyway’s migratory waterfowl, shorebirds, and other waterbirds use the wetlands in the basin.

The Klamath Basin is home to 30 native fish species and is the third-largest producer of salmon in the lower United States (Institute for Fisheries Resources 2006). The basin historically produced large runs of steelhead, Chinook salmon, coho salmon, green sturgeon, eulachon, coastal cutthroat trout, and Pacific lamprey. Runs of these fish contributed substantially to tribal, commercial, and recreational fisheries (U.S. Fish and Wildlife Service [USFWS] 1986; DOI, Klamath Basin Fisheries Task Force 1991; Gresh et al. 2000).

Fish populations in the basin have decreased from the numbers observed in the early 1900s. Steelhead populations that were thought to exceed one million fish prior to the 1900s fell to 400,000 by 1960. Similarly, coho salmon returns declined by 70 percent in the period since the 1960s (National Resource Council [NRC] 2008). Large declines have also been seen in spring and fall-run Chinook, with populations at a fraction of their former size (Moyle et al. 2008). Section 4.1, *Expected Effects of Dam Removal and KBRA on Physical, Chemical, and Biological Processes that Support Salmonid and other Fish Populations*, provides additional details on the status of fish populations.

Multiple physical changes in the basin over the past 150 years, including operation of hydroelectric dams, overharvest of fish, wetland draining, water diversion for agricultural uses, ranching operations, mining operations, and timber harvest, have contributed to the decline of fisheries. These activities have created barriers for fish passage to hundreds of miles of streams in the Upper Klamath Basin, degraded spawning and rearing habitat, and degraded water quality. The Klamath River is listed as a Clean Water Act (CWA) impaired waterway (on the “303(d)” list) in both California and Oregon due to water

temperature, sedimentation, pH, organic enrichment/low dissolved oxygen, nutrients, ammonia, chlorophyll-a, and microcystin (an algal toxin). The river does not currently support its fisheries-related or human health-related beneficial uses. The resulting declines in fisheries have created hardships for Indian tribes and other fishing communities. The Klamath Tribes in the upper basin have been most adversely affected by these changes due to the complete loss of their salmon fishery for over 90 years (because upstream migration has been blocked by the Klamath Hydroelectric Project Dams) and the loss of their sucker fishery in the upper basin for the past 25 years, except for ceremonial purposes.

1.2.4.1 Klamath Basin Hatcheries

Two fish hatcheries exist in the Klamath Basin, the Iron Gate Hatchery (IGH) and the Trinity River Hatchery (see Figure 1-1), producing spring and fall-run Chinook salmon, coho salmon, and steelhead. IGH is located just below Iron Gate Dam. Existing capacity at IGH, which was completed in 1966, was based on the need to mitigate for the loss of 16 miles of spawning and rearing habitat caused by the construction of Iron Gate Dam. Fish production goals for the IGH are shown in Table 1-2. The IGH is operated by California Department of Fish and Game (CDFG) and funded by PacifiCorp.

Table 1-2: Rearing and Stocking Goals for Iron Gate Hatchery

Species	Egg Allotment	Type	Number
Fall Chinook	10,000,000	Smolt	5,100,000
		Yearling	900,000
Coho	500,000	Yearling	75,000
Steelhead	500,000	Yearling	200,000

Source: CDFG 2009

The Trinity River Hatchery was constructed by Reclamation following construction of the Trinity River and Lewiston dams on the Upper Trinity River. The Trinity River Hatchery is located just below Lewistown Dam (see Figure 1-1). The Trinity River Hatchery fish production goals are presented in Table 1-3; these fish production goals would continue unaffected by implementation of either KHSA or KBRA.

Table 1-3: Rearing and Stocking Goals for Trinity River Hatchery

Species	Egg Allotment	Type	Number
Spring Chinook	10,000,000	Smolt	1,000,000
		Yearling	400,000
Fall Chinook	6,000,000	Smolt	2,000,000
		Yearling	900,000
Coho	1,200,000	Yearling	500,000
Steelhead	2,000,000	Yearling	800,000

Source: CDFG 2009

The KHSA specifies that PacifiCorp would transfer ownership of the IGH to CDFG at the time of dam removal (2020) and that PacifiCorp would continue to fund IGH operations for 8 years following dam removal (until 2028). CDFG may choose to continue operations of IGH as a conservation hatchery after 2028 or they may choose to discontinue its use altogether. That decision would likely be

based on monitoring data, reintroduction success for Chinook salmon, steelhead, and coho salmon in the upper basin following dam removal, and consultations with other government agencies and tribes.

1.2.5 Regulatory Conditions

The basin faces many regulatory challenges, including managing species listed under the Federal ESA, the California Endangered Species Act (CESA), and/or Oregon wildlife protection laws; compliance with the CWA TMDLs; compliance with the Wild and Scenic River Act (WSRA); and an ongoing Oregon adjudication process to settle water right claims.

1.2.5.1 Endangered Fish Species

Klamath Basin fish species listed under the Federal ESA are coho salmon, bull trout, Lost River sucker, shortnose sucker, green sturgeon, and eulachon. Species listed under the CESA are coho salmon, bull trout, Lost River sucker, shortnose sucker, and longfin smelt. In addition, both the Lost River and shortnose suckers are fully protected under the California Fish and Game Code Section 5515(a)(3)(b)(4) and (6), respectively. The State of Oregon also lists the two sucker species under its endangered species regulations ([ORS 496.171-496.192](#)).

1.2.5.2 TMDLs

There are currently nine TMDLs (see sidebar) established in the Klamath Basin. These TMDLs identify the pollutant load reductions that are necessary to meet water quality standards. The California and Oregon Klamath River TMDLs focus on reducing high water temperatures, increasing dissolved oxygen levels, and reducing nutrient concentrations and microcystin⁶ impairments in the mainstem Klamath River (NCRWQCB 2010a, ODEQ 2010). Water-quality issues in the Scott, Shasta, and Trinity Rivers are addressed in separate technical analyses and TMDLs; water-quality impacts from these tributaries on the mainstem Klamath River were included in the modeling effort conducted for the *Action plan for the Klamath River Total Maximum Daily Loads addressing temperature, dissolved oxygen, nutrient, and Microcystin impairments in the Klamath River in California*, and the *Klamath River and Lost River implementation plan* (NCRWQCB 2010a). TMDL implementation is intended to result in improvements to water quality conditions, however, it could take decades to fully attain these TMDLs (ODEQ 2010, NCRWQCB 2010a).

1.2.5.3 Wild and Scenic River Act

The National Wild and Scenic River (WSR) System was created by Congress through the WSRA in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Klamath River contains two WSR designated reaches based on the natural, cultural, and recreational values of rivers in a free-flowing condition. One WSR designated reach is between J.C. Boyle Dam and the beginning of

⁶ Microcystin is a toxin produced by the blue-green algal species *Microcystis aeruginosa*.

What is a TMDL?

A Total Maximum Daily Load (TMDL) is regulated under the Clean Water Act (CWA) for water bodies with water quality that does not support designated beneficial uses or meet water quality standards. A TMDL is a calculation of the maximum amount (load) of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

Copco 1 Reservoir, and the second reach is from Iron Gate Dam to the Pacific Ocean (see Section 4.4.5, *Wild and Scenic River*).

1.2.5.4 Oregon Water Rights Adjudication

The Klamath Basin Adjudication is the adjudication process for pre-1909 and Federal reserved water right claims for the use of surface water within the Klamath Basin. The Klamath Basin proceeding began in 1975. Claims of water use have been gathered and contests have been filed on most of those claims. Administrative law judges have been holding hearings and issuing proposed orders determining the claims and contests. The Oregon Water Resources Department (OWRD) will review those proposed orders, and any proposed settlements of contest, and submit its Findings and Order of Determination to the Klamath Circuit Court in December 2012. Water right claims have been filed by private water users, The Klamath Tribes (see Section 4.4.2, *Tribal*), Klamath allottees, and the United States (for Reclamation’s Klamath Project and for Indian tribes and other Federal reservations of land). Once OWRD’s findings are submitted to the court, parties will have an opportunity to file exceptions to those findings. The Klamath Circuit Court will resolve the exceptions and issue a decree. As of July 2010, 97 percent of contests and 92 percent of the claims have reached a proposed resolution, either by issuance of an administrative law judge’s proposed order or by a proposed settlement of contests (OWRD 2010).

1.2.6 Conditions Leading to the Development of the KHSA

While construction and operation of reservoirs and dams on the Klamath River facilitated development, growth, and expansion of an agricultural economy in the region, and created a locally important source of hydroelectric power, it also contributed to declines in fisheries and water quality, affecting tribal resources and culture, and fishing communities. (See sidebar for a description of the purpose of the Four Facilities.) During the last decade, competing demands for water resources led to unpredictable water deliveries to farms and NWRs, ongoing litigation over water rights, a major salmon die off, and closures of commercial fishing. PacifiCorp’s FERC license also expired, requiring PacifiCorp to undertake an expensive and uncertain FERC relicensing process for the Klamath Hydroelectric Project (described in more detail below). These concerns led a group of diverse stakeholders to come together to develop a pair of collaborative and mutually beneficial agreements—the KHSA and the KBRA (see Section 1.2.8, *Klamath Basin Restoration Agreement [KBRA]*).

The Four Facilities have been operating under annual FERC licenses to produce hydropower since the original license expired in 2006. PacifiCorp filed an application with FERC for a new operating license for the Klamath Hydroelectric Project in 2004. During relicensing, several agencies, led by the NOAA Fisheries and other agencies,

Purpose of the Hydroelectric Project Four Facilities

The Four facilities are used exclusively by PacifiCorp for power generation. PacifiCorp allows flat water recreation on three of the reservoirs and whitewater boaters take advantage of consistent flows from the J.C. Boyle powerhouse as secondary benefits. The reservoirs provide no active flood storage however; their removal would slightly alter the peak flood flows for a distance of 18 miles below Iron Gate Dam due to flow attenuation provided by this reservoir (see Section 4.2.1.4, *Iron Gate Dam*). The Four Facilities only provide one minimal water supply for agricultural out of J.C. Boyle and provide no water for domestic purposes.

Figure 1-9: Copco 1 Dam, powerhouse, and downstream area of the Klamath River. This facility would be removed under the KHSA.



under Section 10(a) authority of the Federal Power Act (FPA),⁷ recommended to FERC the removal of the Four Facilities as the preferred measure to protect declining Klamath River fisheries. Concurrently, under Section 18 authority of the FPA, the United States Department of Commerce (DOC) and DOI prescribed mandatory fishways and passage at each mainstem dam. The DOI conditioned increased flows in the largely dewatered bypass reach of the Klamath River downstream of J.C. Boyle Dam to improve riparian habitat, whitewater recreation, and fisheries under Section 4(e) authority.

The DOC and DOI fishway prescriptions to address declining fish harvests in the lower Klamath River, and to reopen blocked fish habitat in the upper basin, were supported by various interest groups. The fishway prescriptions and DOI's mandatory flow conditions were challenged by PacifiCorp and others under the Energy Policy Act of 2005, in a trial-type hearing that considered disputed issues of material fact relating to the prescriptions and conditions. The resulting Administrative Law Judge decision (*In the Matter of: Klamath Hydroelectric Project, Docket Number 2006-NOAA Fisheries Service-0001, September 27, 2006*) found that the agencies met their burden of proof regarding most of the factual issues in dispute. FERC conducted environmental analysis of the proposed project, including the mandatory terms and conditions and prescriptions, in 2007.

FERC continues to wait for action from the State of California regarding PacifiCorp's applications for Water Quality Certification for the hydroelectric project pursuant to Section 401 of the CWA. FERC cannot issue a license decision until California issues, denies, or waives a 401 Certification. Requirements for 401 Certification remain unresolved for relicensing the Klamath Hydroelectric Project and would likely represent a large cost and fiscal risk to PacifiCorp and its customers.

The agencies' mandatory prescriptions and conditions, requirements for a 401 certification, and FERC's required conditions, would result in significant operational changes to the Klamath Hydroelectric Project. The prescriptions and conditions would reduce the potential power generation capacity by about 20 percent of annual generation (Scott 2010), decrease peaking operations to only one day a week, and would cause the Klamath Hydroelectric Project to operate at a net annual loss (FERC 2007). PacifiCorp estimates that it would incur relicensing capital costs (in 2010 dollars⁸) in excess of \$400 million (with the majority of costs resulting from implementation of aquatic resource protection, mitigation, and enhancement measures) and \$60 million in additional

⁷ The FPA established the predecessor to FERC to (in addition to regulating interstate activities of power and natural gas industries) coordinate national hydroelectric facilities for all non-Federal hydropower facilities. The FPA provides for cooperation between FERC and other Federal agencies, including resource agencies, in licensing and relicensing power projects. A 1986 amendment to the FPA mandated that each license include conditions to protect, mitigate, and enhance fish and wildlife affected by the project. These conditions are to be based on recommendations received pursuant to the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) from the USFWS, NOAA Fisheries Service, state fish and wildlife agencies, and Indian tribes (FPA Sec. 10(a)) potentially affected by the project.

⁸ This phrase indicates that the stated cost is presented as the value of the dollar in that year (in this case year 2010).

operations and maintenance costs over a 40-year license term (Oregon Public Utilities Commission [OPUC] 2011). PacifiCorp would be allowed to recover these costs through customer surcharges, if approved through future Public Utilities Commission (PUC) actions. Alternatively, the KHSA sets a cost cap for PacifiCorp customers in Oregon and California of \$200 million dollars (2020 dollars) for removal of the Four Facilities. Customers in Oregon would be responsible for \$184 million and customers in California would be responsible for \$16 million. The KHSA also specifies that if additional funding for dam removal were needed beyond \$200 million, up to \$250 million (in 2020 dollars) would come from California, either through the issuance of a bond or other appropriate financing mechanism. The United States government would not be responsible for any of the costs of Four Facilities removal, as described in KHSA.

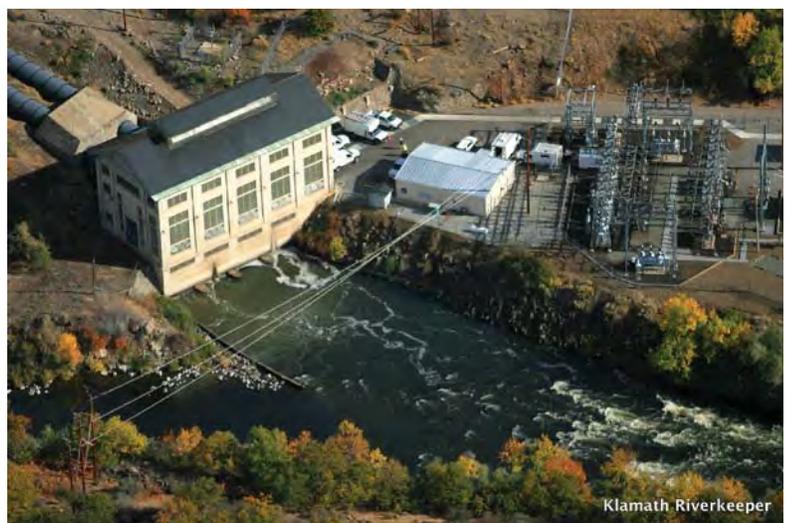
The potential costs and liabilities associated with implementing fishways and meeting CWA 401 certification at the Four Facilities, combined with the prospect of an annual loss of power revenue and the protection of prudent and reasonable utility rates for its customers, resulted in PacifiCorp’s decision to enter into the KHSA. PacifiCorp recognized that the terms of the KHSA “provide significant benefits to PacifiCorp’s customers” (California Public Utilities Commission [CPUC] 2011). The cost cap protects customers from the uncertain costs of relicensing, litigation, and possibly dam removal that customers may be responsible for absent the KHSA. Among the benefits of the KHSA, PacifiCorp recognized “cost protection regarding dam removal cost, liability associated with dam removal, FERC relicensing costs, and possible litigation due to controversies in the Klamath Basin region regarding the operation of the dams as benefits of the KHSA” (CPUC 2011).

1.2.7 Public Utilities Commission Rulings on the KHSA

For PacifiCorp to receive approval to collect revenue necessary for implementation of the KHSA through customer surcharges, the CPUC and OPUC needed to concur with PacifiCorp’s finding that KHSA was in the best interest of customers. That is, PacifiCorp was required to demonstrate to both utility commissions that the incremental ratepayer increases were fair and reasonable.

PacifiCorp’s records and testimony before both PUCs compared customer’s risk of cost increases under the KHSA to the potential rate increases that could result from relicensing the Four Facilities. Both PUCs ruled that implementing the KHSA with customer surcharges resulted in the best financial outcome to PacifiCorp’s customers when compared to the known costs and future risks of relicensing the Four Facilities.

Figure 1-10: Copco 2 powerhouse would be removed under KHSA’s description of full facilities removal.



KBRA Fisheries Programs

Elements:

1. Restoration
2. Reintroduction
3. Monitoring

Goals:

1. Restore and maintain ecological functionality and connectivity of historical fish habitats
2. Re-establish and maintain naturally sustainable and viable populations of fish to the full capacity of restored habitats
3. Provide for full participation in harvest opportunities of fish species

All three of the Fisheries Program elements include developing coordinated implementation plans. The implementation plans will identify the specific restoration, reintroduction, and monitoring projects to be implemented within an adaptive management framework.

The Fisheries Restoration Plan will use best available science and adaptive management to establish restoration priorities in the first 10 years of implementation. Current focus areas include coarse sediment management between Keno Dam and the Shasta River, reduction of organic nutrients above and below Keno Reservoir, and projects that benefit existing fishery resources or prepare habitats for use by anadromous fish.

The Fisheries Reintroduction and Management Plans include investigations, monitoring, and actions in two phases to reintroduce anadromous fish above the Four Facilities prior to their removal.

The Fisheries Monitoring Plan will be coordinated with the Restoration and Reintroduction plans. It will inform the adaptive management processes and include methods for stock identification, status and trends, and monitoring of the effectiveness of restoration actions.

1.2.8 Klamath Basin Restoration Agreement (KBRA)

The signatory parties to the KHSR recognized that dam removal would not address many of the issues within the basin. As a result, all of the parties, except for Federal government and PacifiCorp, signed an accompanying agreement—the KBRA. (The Federal government is not able to sign KBRA until Congress passes Federal legislation authorizing the agreement.) The KBRA contains interrelated plans and programs intended to benefit fisheries throughout the basin, water and power users in the upper Klamath Basin, counties, Indian tribes, and basin communities. The KBRA negotiations brought many diverse stakeholders together to develop compromises needed to reach agreement that would allow them to support one another's efforts to restore fisheries in the Klamath Basin while providing for sustainable agriculture. The KBRA is intended to result in effective and durable solutions that address the limited availability of water to support agricultural, National Wildlife Refuges, and fishery needs, and to resolve the water conflicts among the many users.

Implementation of the KBRA is intended to accomplish the following:

1. Restore and sustain natural fish production and provide for full participation in ocean and river harvest opportunities of these fish.
2. Establish reliable water and power supplies for agricultural uses, communities, and NWRs in the upper Klamath Basin.
3. Contribute to public welfare and sustainability of all communities through reliable water supply; affordable electricity; programs to offset potential property tax losses and address economic development issues in counties; and, efforts to support tribal fishing and long-term economic self-sufficiency.

The key negotiated outcomes of the KBRA include mutually-beneficial agreements that the Klamath, Karuk, and Yurok Indian tribes would not exercise water right claims that would conflict with water deliveries to Reclamation's Klamath Project water users, and for project water users to not challenge reduced water deliveries (see Table 1-4). The KBRA provides a framework for mutual support for fisheries restoration and reintroduction programs; greater certainty about water deliveries at the beginning of each growing season; and, agreement and assurances that the parties would work collaboratively to resolve outstanding water-right contests pending the outcome of the Oregon Klamath Basin Adjudication process. In addition, the KBRA includes a voluntary Water Use Retirement Program (WURP) in the upper basin; three restoration projects intended to increase the amount of water storage in the Upper Klamath Basin; regulatory assurances; Power for Water Management Program; county and tribal economic development programs; and tribal resource management programs.

Many programs described in the KBRA will require future collaborative planning and scoping efforts to undertake specific projects in these programs. For example, the Fisheries Programs requires the development of a coordinated Fisheries Restoration Plan, a Reintroduction Plan, and a Monitoring Plan (see Table 1-4). Specific basin-wide goals and objectives for these plans and programs are explicitly described in the KBRA. Individual restoration and monitoring projects, and other activities prescribed by the KBRA, are only generally defined in scope and location. Many programs function as an extension to existing restoration and monitoring actions being implemented by Federal and state agencies and other parties. Although there is uncertainty in the specifics of the KBRA, known outcomes of ongoing and completed basin restoration projects, combined with the objectives of the KBRA, serve as an indication of where and when future projects will be implemented and their expected results. The KBRA includes an adaptive management process (to be developed in the Fisheries Restoration Plan and Fisheries Monitoring Plan) whereby uncertainties associated with implementing restoration projects would be scientifically monitored, and the new information applied, ensuring that programs are maximally focused on achieving the short and long-term goals and objectives of the KBRA.

The United States will be a party to the KBRA if there is Congressional authorization according to the KBRA terms. Legislation bills have been introduced in both the House (House Bill 3398, sponsored by Congressman Mike Thompson (CA)) and the Senate (Senate Bill 1851, sponsored by Senator Jeff Merkley (OR)) to authorize restoration in the Klamath Basin in accordance with the KHSA and the KBRA. The KBRA can be viewed in its entirety at KlamathRestoration.gov.

1.2.9 Summary and Path Forward

The California CWA 401 Certification required for FERC to relicense PacifiCorp's Klamath Hydroelectric Project has been postponed awaiting progress on a Secretarial Determination. In the interim, the DOI and DOC mandatory prescriptions are not included as terms of the annually renewed Klamath Hydroelectric Project FERC license, although they would be a part of a long-term license. If there is an Affirmative Secretarial Determination, the KHSA provides for removal of the Four Facilities. The agreement includes provision for either the full or partial removal of the dams, power generation facilities, and ancillary facilities to create a free-flowing river by December 31, 2020.

Table 1-4: List of Major KBRA Programs, Plans, and Commitments

Program, Plans, and Commitments
Fisheries Programs
Fish Habitat Restoration Activities
Fisheries Restoration Phase I Plan
Fisheries Restoration Phase II Plan
Fisheries Reintroduction Plan – Phase I, Oregon
Fisheries Reintroduction Plan – Phase II, Oregon
Fisheries Reintroduction Plan – California
Fisheries Monitoring Plan
Additional Water Storage Projects:
Williamson River Delta Project
Agency Lake and Barnes Ranches Project
Wood River Wetland Restoration Project
Future storage opportunities
Water Resources Program
Water Diversion Limitations for Reclamation's Klamath Project Including National Wildlife Refuges
Water Deliveries for National Wildlife Refuges in Klamath Reclamation Project Area
Groundwater Technical Investigations
On-Project (Klamath Project) Plan
Commitments among Klamath Project irrigators, Party Tribes, and the U.S. related to Water Use/Rights
Commitments Related to Finance Issues (§§ 15.4.2., 15.4.4.)
Operation of Klamath Reclamation Project Facilities (Link River and Keno dams)
Water Use Retirement Program
Off-Project Water Settlement
Off-Project Reliance Program
Power for Water Management Program and Plans
Drought Plan
Emergency Response Plan
Climate Change Assessment
Environmental Water Management
Interim Flow and Lake Level Program
Regulatory Assurances Programs
Fish Entrainment Reduction
General Conservation Plan or Habitat Conservation Plan
County and Tribal Programs
Klamath County Economic Development Plan
California Water Bond Legislation (Siskiyou County Economic Development Funding)
Tribal Programs Fisheries and Conservation Management
Tribal Programs Economic Revitalization
Mazama Forest Project (for Klamath Tribes)
Klamath Tribes Interim Fishing Site

The parties to the KHSA recognized that removing the dams alone would not provide for a full restoration of Klamath Basin fisheries. The adjoined KBRA was developed to build on dam removal and advance fisheries by restoring habitat, increasing water storage, improving flow and water-quality conditions for fish, and implementing a salmonid reintroduction program in the upper basin. Moreover, implementation of the KBRA would create new water and power programs, regulatory assurance programs, and programs for tribes and counties, to establish a new balance of water uses in the basin that would sustain communities. The signatories crafted the KBRA to create durable solutions to avoid the rotating hardships basin communities experienced over the last decade.

Figure 1-11: Agriculture is one of the many resources in the Klamath Basin that would benefit from increased certainty of water deliveries with the implementation of the KHSA and KBRA.

