RECLAMATION

Managing Water in the West

Final Planning Report

Cle Elum Dam Fish Passage Facilities

Storage Dam Fish Passage Study

Yakima Project, Washington

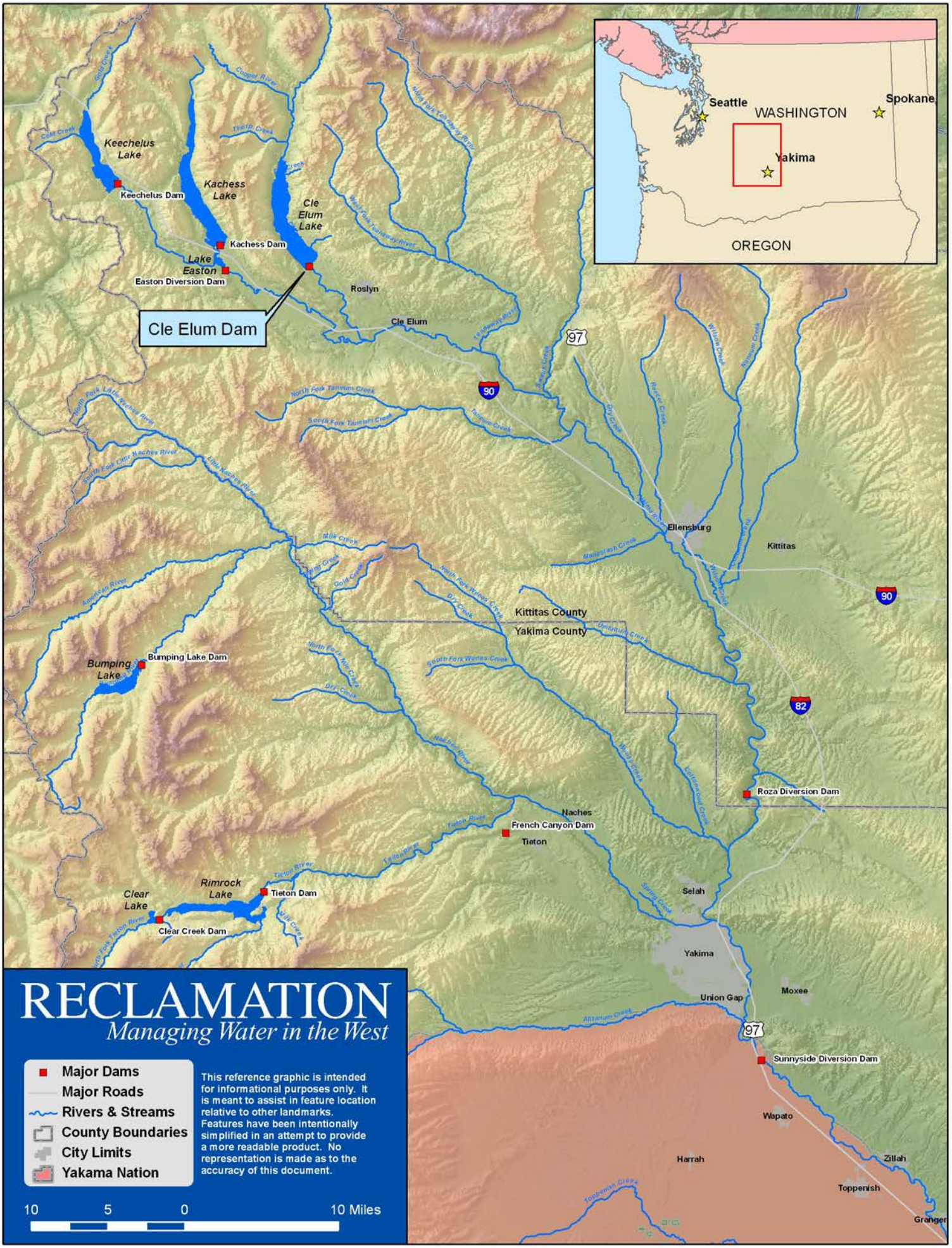
U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Cascades Area Office
Yakima, Washington

April 2011

Mission Statements

The Mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.


Seattle
WASHINGTON
Spokane
Yakima
OREGON
Keechelus Lake
Keechelus Dam
Kachess Lake
Kachess Dam
Cle Elum Lake
Lake Easton
Easton Diversion Dam
Cle Elum Dam
Roslyn
Cle Elum
Ellensburg
Kittitas
Kittitas County
Yakima County
Bumping Lake
Bumping Lake Dam
Naches
French Canyon Dam
Tieton
Roza Diversion Dam
Rimrock Lake
Tieton Dam
Clear Lake
Clear Creek Dam
Selah
Yakima
Union Gap
Moxee
Sunnyside Diversion Dam
Wapato
Harrah
Zillah
Toppenish
Granger
90
97
82
RECLAMATION
Managing Water in the West
Major Dams
Major Roads
Rivers & Streams
County Boundaries
City Limits
Yakama Nation
This reference graphic is intended for informational purposes only. It is meant to assist in feature location relative to other landmarks. Features have been intentionally simplified in an attempt to provide a more readable product. No representation is made as to the accuracy of this document.
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ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations

BPA	Bonneville Power Administration
Core Team	Technical Yakima Basin Storage Fish Passage Work Group
CPOM	coarse particulate organic matter
DEC	Design, Estimating, and Construction
DEIS	Draft Environmental Impact Statement, Cle Elum Dam Fish Passage Facilities and Fish Reintroduction Project
Ecology	Washington Department of Ecology
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement, Cle Elum Dam Fish Passage Facilities and Fish Reintroduction Project
FERC	Federal Energy Regulatory Commission
fisheries co-managers	Yakama Nation and Washington State Department of Fish and Wildlife
FP/FR	fish passage facilities/fish reintroduction
ft/s	feet per second
ft^3/s	cubic feet per second
FY	fiscal year
HPA	Hydraulic Project Approval
IMPLAN	Implan Analysis for Planning
m^2	square meters
Mitigation Agreement	*Mitigation Agreement between the USDI Bureau of Reclamation and Washington Department of Fish and Wildlife Regarding Keechelus Dam Construction Issues Including Fish Passage*
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
N	nitrogen
NMFS	National Marine Fisheries Service
NPCC	Northwest Power and Conservation Council (formerly Northwest Power Planning Council)
NRHP	National Register of Historic Places

O&M	operation and maintenance
OMR&P	operation, maintenance, replacement, and power
PIT	Passive Integrated Transponder
PUD	Public Utilities District
Reclamation	Bureau of Reclamation
RED	Regional Economic Development
RM	river mile
ROD	Record of Decision
SOD	Safety of Dams
SR	State Route
Storage Study	Yakima River Basin Water Storage Feasibility Study
Study	Yakima Project Storage Dam Fish Passage Study
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
WDFW	Washington Department of Fish and Wildlife
YKFP	Yakima/Klickitat Fisheries Project
YRBWEP	Yakima River Basin Water Enhancement Project

EXECUTIVE SUMMARY

Executive Summary

Introduction

This Final Planning Report, Cle Elum Dam Fish Passage Facilities, is the product of a Bureau of Reclamation-led cooperative investigation with the Yakama Nation, State and Federal agencies, and others, to study the feasibility of providing fish passage at the five large storage dams. A fish recovery effort has been underway in the Yakima River basin since the 1980s. Need for passage at Yakima Project dams was identified by the Northwest Power Planning Council[1] in 1983. In 2004, the NPCC identified passage at Cle Elum Dam to be a Tier 1 priority, i.e., a priority that addresses correcting limiting factors having the greatest impact on local fish species.

Reclamation began studying fish passage at the Yakima Project Dams in 2002, as a result of commitments made to Washington State and the Yakama Nation related to safety of dams (SOD) work that occurred at Keechelus Dam. In 2003, Reclamation completed an appraisal-level assessment of alternatives for providing fish passage at the five dams and identified Cle Elum and Bumping Lake Dams as the highest priority sites for continued investigation of fish passage feasibility. Feasibility-level studies and a Draft Planning Report were completed in 2008 (Reclamation, 2008 [Draft Planning Report]).

Throughout this process, Reclamation has collaborated with a Technical Yakima Basin Storage Fish Passage Work Group (Core Team) of biologists, engineers, and other specialists from Federal, State, Tribal, and local entities to develop and evaluate fish passage alternatives. This Core Team and subgroups have met regularly to work through the biological, engineering, and operational issues associated with fish passage.

Final planning and National Environmental Policy Act (NEPA), State Environmental Policy Act (SEPA) and Endangered Species Act (ESA) compliance have been completed (see Chapter 7). This document, the Final Planning Report, concludes that construction of fish passage facilities at Cle Elum Dam has the greatest benefits and highest priority. Total cost of the facilities is estimated to be approximately $84 million at 2008 pricing levels for Alternative 3, Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam (Preferred Alternative).

Background

Reclamation's commitment to study the feasibility of fish passage at the Yakima Project dams is documented in agreements, permits, and litigation settlements associated with the

[1] The Northwest Power Planning Council is now known as the Northwest Power and Conservation Council (NPCC).

Yakima Project's Keechelus Dam Safety of Dams modification. Early in 2001, many Yakima River basin interest groups, including the Yakama Nation, urged Reclamation to incorporate fish passage facilities as part of the proposed reconstruction at Keechelus Dam under the SOD program. Reclamation determined that fish passage facilities could not be added under existing SOD authority. However, in the January 2002 *Record of Decision (ROD) for Keechelus Dam Modification* (Reclamation 2002), Reclamation committed to seek funding under existing authorities to conduct a feasibility study for providing fish passage at all Yakima Project storage dams. Further, Reclamation agreed to mitigation agreement terms and Hydraulic Project Approval (HPA) conditions with the Washington Department of Fish and Wildlife (WDFW) to investigate fish passage feasibility.

In April 2002, the Yakama Nation filed a Notice of Intent to File a Claim under the ESA regarding the Keechelus Dam SOD Modification and later initiated a lawsuit. In 2003, the Court rendered a judgment in favor of Reclamation concerning the NEPA and ESA compliance for the SOD project. The Yakama Nation then appealed that decision to the 9th Circuit Court of Appeals. In 2006, Reclamation and the Yakama Nation entered into a Settlement Agreement to resolve litigation, in which the parties agreed to collaborate to prepare technical plans and a planning report for fish passage at Cle Elum and Bumping Lake Dams. It was also agreed that Reclamation would provide interim downstream passage at Cle Elum Dam until permanent fish passage was implemented or Reclamation concludes that permanent fish passage was infeasible.

Construction of interim (downstream) passage facilities at Cle Elum Dam was completed by Reclamation in 2005. The interim facilities include a plywood flume built on the existing spillway and two PIT-tag detectors along the flume to record passage of tagged fish. Data gathered from use of the temporary passage facilities confirm that fish can and will navigate a downstream passage at the dam on their own volition.

Study Area

The Study area lies within the Yakima River basin located in south-central Washington State. It includes Yakima, Kittitas, and Benton counties; about half of the basin lies in Yakima County. The Yakima River basin encompasses about 6,155 square miles. The Yakima Project provides irrigation water for a strip of fertile land that extends for 175 miles on both sides of the Yakima River in south-central Washington. The irrigable lands presently being served total approximately 464,000 acres. The Yakima Project storage dams are shown on the frontispiece map.

Authorities

The Tieton and Sunnyside divisions of the Yakima Project were authorized by the Secretary of the Interior on December 12, 1905, under the Reclamation Act of 1902 for

the authorized purpose of irrigation. Bumping Lake Dam was constructed in 1910 and Cle Elum Dam in 1933; both under this authority.

The Yakima Project Storage Dam Fish Passage Study is conducted under the authority of the Act of December 28, 1979 (93 Stat. 1241, P. L. 96-162, Feasibility Study - Yakima River Basin Water Enhancement Project). Section 1205 of Title XII of the Yakima River Basin Water Enhancement Project Act of October 31, 1994 (P.L. 103-434, as amended, 108 Stat. 4550) authorized fish, wildlife, and recreation as additional purposes of the Yakima Project. Section 1206 of Title XII of this Act authorizes Reclamation to construct juvenile (i.e., downstream) fish passage facilities at Cle Elum Dam under a cost ceiling. Some aspects of fish passage facility construction, operation, and maintenance for the Yakima Project are also covered by the Hoover Power Plant Act of 1984.

Study Purpose and Objectives

Cle Elum Dam was not equipped with fish passage facilities when constructed. Lack of fish passage at the dam blocked access to the lake and upstream habitat for anadromous salmonids and resulted in the extirpation of one of the largest sockeye salmon runs in the Columbia River Basin from the Yakima River basin. Restoration of fish passage is expected to enhance ecosystem integrity by:

- Restoring sockeye salmon (*Onchorynchus nerka*) populations to self-sustaining levels capable of supporting harvest;
- Increasing the life history diversity, geographic distribution, and abundance of coho salmon (*O. kisutch*), spring Chinook salmon (*O. tshawytscha*), and Pacific lamprey (*Entosphenus tridentatus*) to self-sustaining levels capable of supporting increased harvest;
- Contributing to the recovery of Endangered Species Act (ESA)-listed upper Middle Columbia River steelhead (*O. mykiss*); and
- Reconnecting isolated populations of ESA-listed bull trout (*Salvelinus confluentus*).

Plan Formulation

The Core Team determined that providing downstream juvenile and upstream adult fish passage at Cle Elum Dam, in combination with reintroduction of anadromous salmonid species, and other actions, would achieve the ecological benefits and functions necessary to restore fish populations.

The Yakima basin fisheries comanagers, the Yakama Nation and WDFW, developed a reintroduction plan for anadromous fish species above Reclamation's Yakima Project storage dams. The fish reintroduction plan helped guide the development of alternatives for fish reintroduction at Cle Elum Dam, which led to the development of the Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam Alternative. That alternative was evaluated in the Draft Planning Report and is referred to as "Alternative 2" in this Final Planning Report.

In June 2009, Reclamation assembled a Value Planning Team comprised of people with diversity, expertise, and independence to creatively scrutinize the alternatives presented in the Draft Planning Report. As a result, the team developed a *Value Planning Final Report - Cle Elum Dam Fish Passage Facilities* (Reclamation, 2009 [Value Planning]) that examined the component features of the project and defined critical functions, governing criteria, and associated costs. In addition to the Alternative 2 proposal, the Value Planning Report identified six other proposals. Two of these were combined and are described in this report as Alternative 3-Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam.

Fish Passage Facilities Alternatives

Reclamation considered a number of different fish passage alternatives at Cle Elum Dam. Plan formulation has been an iterative process relying heavily upon the professional expertise and judgment of biologists, engineers, hydrologists, and other team members. Through a collaborative process with the Core Team, the decisions were made regarding which alternatives should be pursued in detail.

Alternative 1 -- No Action Alternative

Under the No Action Alternative, Reclamation would not modify Cle Elum Dam or its features to include fish passage facilities and the interim fish passage facility would be removed. In accordance with the Mitigation Agreement between Reclamation and WDFW, Reclamation and WDFW would work to identify an as-yet-undetermined alternative to fish passage, consistent with State law.

Alternative 2 -- Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

This alternative includes the construction of facilities for downstream juvenile fish passage and upstream adult fish passage. The main features of the downstream fish facility include a multilevel gated intake structure located in the forebay 500 feet upstream of the spillway inlet channel and a juvenile fish bypass conduit. The upstream fish passage facility features would include a barrier dam and fish ladder and adult collection facility (see Figure ES- 1).

All land required for construction and operation of the proposed downstream fish passage features is federally owned either by Reclamation or is within the Wenatchee National Forest.

Field costs of construction of fish passage facilities at Cle Elum Dam for Alternative 2 were estimated at $81.0 million (2008 dollars) and noncontract costs were estimated at $15 million, for a total construction cost of $96 million. Average annual OMR&P costs for the Cle Elum Dam fish passage facilities were estimated at $300,000.

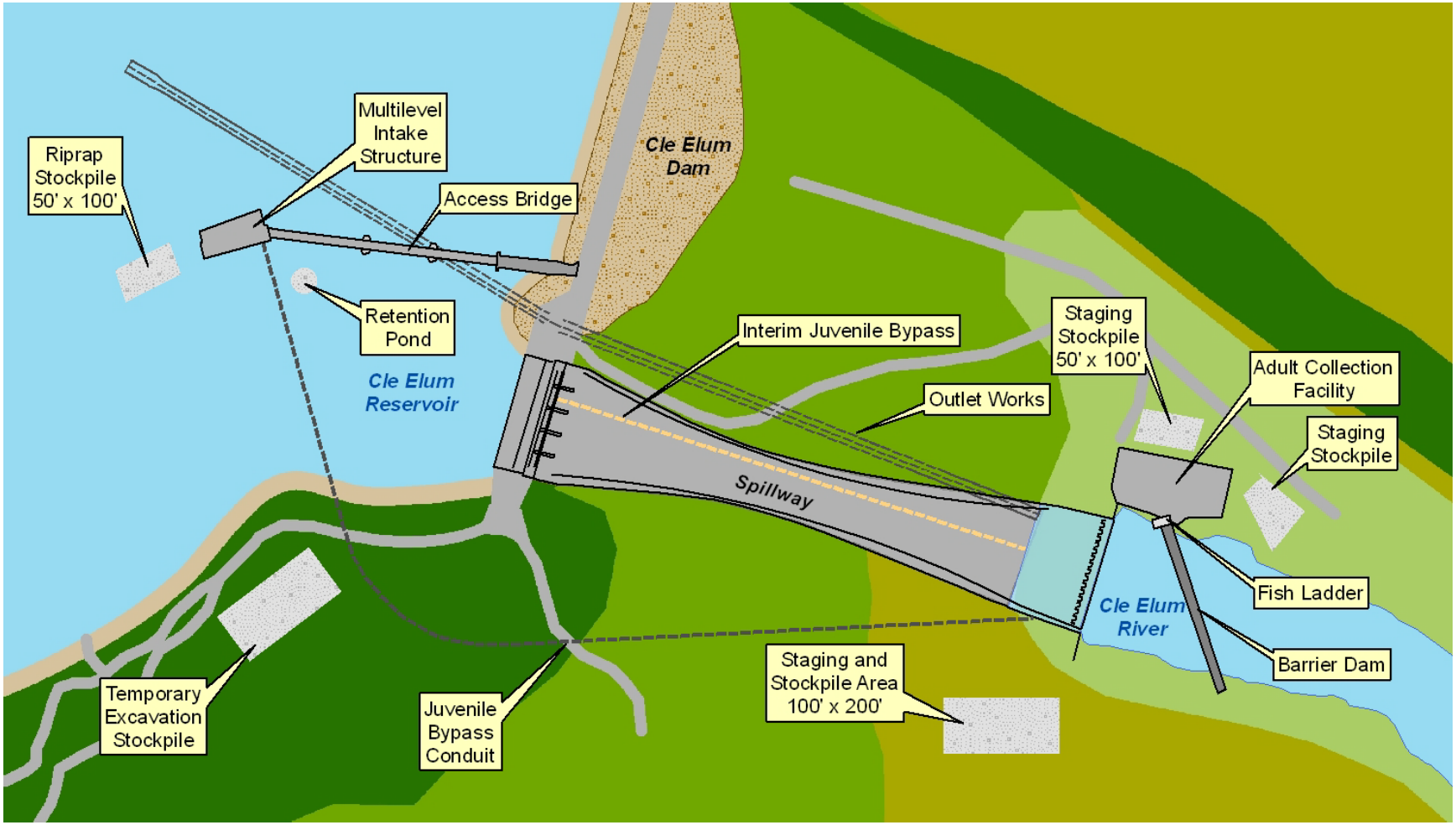


Figure ES- 1. Alternative 2 - upstream and downstream fish passage facilities

Alternative 3 -- Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam (Preferred Alternative)

Alternative 3, which originated from proposals #1 and #3 of the Value Planning Report, is similar to Alternative 2, including construction of both downstream juvenile and upstream adult fish passage. The major difference is that all adult passage facilities downstream of the dam would be located on the right bank. The main features of the downstream fish facility include a multilevel gated intake structure located against the right bank abutment and juvenile bypass conduit. This alternative eliminates the need for an access bridge for the intake structure and a barrier dam. The fish ladder and adult collection facility would both be located on the right bank (see Figure ES- 2).

Field costs of construction of fish passage facilities at Cle Elum Dam for Alternative 3 were estimated at $69 million (2008 dollars) and noncontract costs were estimated at $15 million, for a total construction cost of $84 million. The annual OMR&P impacts for Alternative 3 were estimated to be $300,000.

Summary of Costs

The following table provides a summary of the estimated costs for the alternatives. "Construction Costs" includes field costs—the costs to construct the facilities and noncontract costs. "Noncontract costs" include land acquisition, engineering and design, permitting, and other costs. "IDC" means Interest During Construction, and "OMR&P" refers to Operations, Maintenance, Replacement, and Power.

Table ES- 1. Summary of Alternative Cost Estimates ($ millions)

Alternative	Field Cost	Noncontract Cost	Total Construction Costs	IDC Costs	Total Project Cost	Maximum Annual OMR&P Cost
1: No Action	--	--	--	--	--	--
2: Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	$81.0	$15.0	$96.0	$7.84	$103.84	$0.3
3: Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam	$69.0	$15.0	$84.0	$7.76	$91.76	$0.3

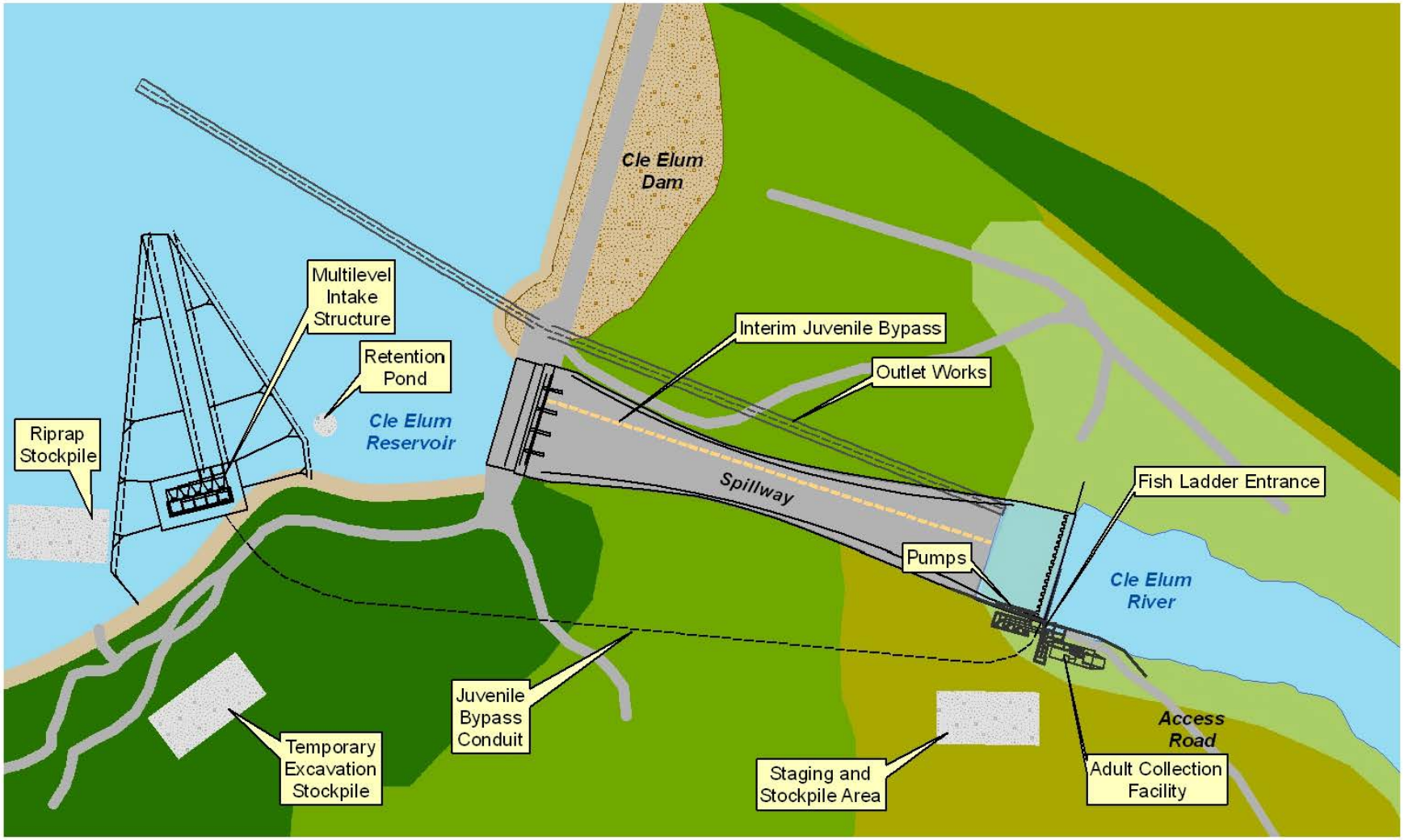


Figure ES- 2. Alternative 3 - upstream and downstream fish passage facilitie

Impacts

Construction of fish passage facilities at Cle Elum Dam and successful reintroduction of anadromous salmonids would restore much of the biological diversity and productivity that was lost when sockeye were extirpated from the upper basin and tributaries with dam construction. Restoring anadromous and resident fish to their historical habitat above the reservoirs and reintroducing sockeye would contribute to Yakama Nation ceremonial and spiritual values and would result in regional economic and environmental impacts.

Since the Cle Elum River basin historically supported sockeye, Chinook and coho salmon, and steelhead, anadromous salmonid populations are anticipated to reestablish with installation of fish passage facilities at the dams and as active reintroduction efforts are pursued. Fish passage and anadromous fish reintroduction are expected to generate ecosystem benefits upstream of Cle Elum Dam by providing additional food sources and nutrients for aquatic species, including resident and anadromous fish, as well as terrestrial animals (e.g., bears, eagles) and plants.

The infusion of marine-derived nutrients contributed by the carcasses of returning adults is fundamental to ecological functioning of the watershed and would enhance aquatic and terrestrial production, improve the overall trophic status of the ecosystem, and enhance future productivity of anadromous salmonids. The return of spawning adult salmon will serve as a "nutrient pump" by transporting marine-derived nutrients to headwaters and streams where they provide an energy input into the system. Juvenile rearing salmon can feed directly on decomposing salmon carcasses or on the benthic macroinvertebrate production enhanced by the release of nutrients from the carcasses. Recent research has shown that nutrients contributed by returning adult salmon also influences productivity in the riparian zone through several physical and biological mechanisms (Naiman, et al., 2005). Restoring these nutrient cycles is a fundamental element of efforts to improve the ecological functioning of these watersheds.

Economic Impacts

The feasibility-level construction cost estimate (field costs and noncontract costs) for Alternative 2 was $96 million; adding interest during construction brings the total project cost to $103.8 million. Field costs were estimated at $81 million, of which $65.4 million were expected to be incurred within the region (Yakima and Kittitas Counties) and the remainder outside the region. Neither noncontract costs nor interest costs generate economic impacts. These in-region contract construction costs (field costs) were estimated to generate an additional $92.9 million of output/sales, 961 jobs, and $36.8 million of labor income over the 3-year construction period. Average annual OMR&P costs were estimated to generate an additional $436,700 of output/sales, five jobs, and $216,200 of labor income.

The feasibility-level construction cost estimate (field costs and noncontract costs) for Alternative 3 was $84 million; adding interest during construction brings the total project cost to $91.8 million. Field costs were estimated at $69 million, of which $55.9 million were expected to be incurred within the region (Yakima and Kittitas Counties) and the remainder outside the region. Neither noncontract costs nor interest costs generate economic impacts. These in-region contract construction costs (field costs) were estimated to generate an additional $79.6 million of output/sales, 830 jobs, and $31.8 million of labor income over the 3-year construction period. Average annual OMR&P costs and impacts would be similar to Alternative 2.

The increase in overall watershed productivity would be expected to provide positive economic impacts associated with improved recreational fisheries in the Yakima River basin, downriver, and the ocean recreational and commercial fisheries. Nonharvest recreational activities, including viewing of fish and wildlife, would also contribute to increased regional economic impacts.

Environmental Impacts

Reclamation has evaluated the effects of constructing the two fish passage alternatives at Cle Elum Dam compared to taking no action. This analysis is summarized in Table ES-2 below. The table compares the impacts associated with the three fish passage facility alternatives. The phrase "short-term" refers to impacts associated with construction activities. The phrase "long-term" refers to impacts following the construction period. Additional information about impacts to key resources is found in Chapter 7 of this document, and detailed information about impacts to all resources can be found in Chapter 5 of the *Final Environmental Impact Statement-Cle Elum Dam Fish Passage Facilities and Fish Reintroduction Project* (FEIS).

Table ES- 2. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Water Resources	No impacts.	Short-term: Minor increases in turbidity and sedimentation during construction. Long-term: None.	Same as Alternative 2.
Fish	Historic habitat would continue to be blocked. Removal of interim facilities would stop fish reintroduction efforts.	Short-term: Potential disturbance during construction. Long-term: Benefit to species diversity and productivity/genetic diversity.	Same as Alternative 2. Fewer construction impacts.

Table ES- 2. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Vegetation	No impacts.	Short-term: Removal of vegetation from construction areas. Long-term: Some loss of permanent vegetation and loss of mature vegetation for approximately 50 years.	Same as Alternative 2. Fewer construction impacts.
Wildlife	No impacts.	Short-term: Minor disturbance near facilities during construction and operation activities. Long-term: Loss of mature habitat for approximately 50 years.	Same as Alternative 2. Fewer construction impacts.
Threatened and Endangered Species			
Bull trout Middle Columbia River (MCR) steelhead	Historic habitat would continue to be unavailable to steelhead and populations of bull trout would remain isolated from one another.	Short-term: Potential disturbance during construction. Long-term: Beneficial effect with implementation of fish passage.	Same as Alternative 2. Fewer construction impacts.
MCR steelhead critical habitat	No impacts.	Permanent impacts to designated critical habitat as a result of barrier dam construction.	Permanent impacts to designated critical habitat as a result of pump construction (less impact than Alternative 2).
Grizzly bear Gray wolf Canada lynx	No impacts.	Short-term: If present, species likely to avoid area during construction. Long-term: Potential beneficial impact from increased prey.	Same as Alternative 2. Fewer construction impacts.
Ute ladies'-tresses	No impacts.	Short-term: Potential habitat may be disturbed. Long-term: None.	Same as Alternative 2. Fewer construction impacts.
Northern spotted owl	No impacts.	Short-term: Potential loss of nesting and foraging habitat. Long-term: Potential loss of nesting habitat until forest matures.	Same as Alternative 2. Fewer construction impacts.
Visual Resources	Beneficial impact since interim passage facilities would be removed from dam.	Short-term: Construction equipment and activities would be visible. Long-term: Visible items in project area such as intake structure, access bridge, barrier dam.	Less impact than Alternative 2, as barrier dam and access bridge are eliminated from Alternative 3.
Air Quality	No impacts.	Short-term: Minor dust associated with construction and traffic. Long-term: None.	Same as Alternative 2.

Table ES- 2. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Climate Change	No impacts.	Short-term: Minor increases in greenhouse gas emissions. Long-term: Access to historic habitat may help fish withstand climate change impacts.	Same as Alternative 2.
Noise	No impacts.	Short-term: Construction noise limited to daytime hours. Long-term: None.	Same as Alternative 2.
Recreation	No impacts.	Short-term: Noise, traffic delays. Long-term: None.	Same as Alternative 2.
Land and Shoreline Use	No impacts.	Short-term: Small amounts of land converted from forest to fish passage facilities. Long-term: Same as short-term.	Same as Alternative 2.
Utilities	No impacts.	Short-term: None. Long-term: Minor increase in power demand for pumping.	Same as Alternative 2 except more power would be required for pump.
Transportation	No impacts.	Short-term: Noise, traffic delays. Long-term: None.	Same as Alternative 2.
Environmental Justice	No impacts.	No impacts.	No impacts.
Cultural Resources	No impacts. Removal of interim facilities would restore dam closer to historic appearance.	Potential adverse effects to dam, potential effects to prehistoric/historic resources.	Potential effects to prehistoric/historic resources.
Indian Sacred Sites	No impacts.	No impacts.	No impacts.
Indian Trust Assets	No impacts.	No impacts.	No impacts.
Socioeconomics	No impacts.	Short-term: Construction would generate sales, jobs and labor income in the region. Long-term: Small increase in sales, jobs, and labor income.	Short-term: Same as Alternative 2 except smaller increases. Long-term: Same as Alternative 2.

Findings and Recommendation

Reclamation and the Core Team found that Alternative 2 and Alternative 3 both provided the same level of fish passage effectiveness. Both alternatives would provide access to approximately 29 miles of potential spawning and/or juvenile rearing habitat above the reservoir plus access to the reservoir itself, which is currently inaccessible.

Fish passage at Cle Elum Dam would also reestablish connectivity between bull trout populations above and below Cle Elum Dam and enhance the overall ecological health in the reservoir and the upper Cle Elum basin through the infusion of marine-derived nutrients from returning adults.

Preferred Alternative

Reclamation has selected Alternative 3, Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam, as the Preferred Alternative for the Fish Passage Facilities portion of the FP/FR Project. Alternative 3 would result in fewer adverse environmental impacts and would cost approximately $12 million less than Alternative 2, while still meeting the purpose and need of the fish passage project.

Alternative 3 would eliminate the fish barrier dam downstream from the spillway stilling basin. Fish would be attracted to the fish ladder by a combination of flow from the downstream juvenile passage conduit and pumped attraction flows rather than be guided to the ladder by a barrier dam. This would reduce the construction footprint downstream of the dam and preserve access to the existing fish habitat in the stilling basin.

All of the passage facilities would be located on the right bank, further reducing adverse environmental impacts. With the multilevel intake structure located against the right bank abutment, access would be from the shore which eliminates the need for an access bridge. The location of the intake structure reduces the length of the juvenile bypass conduit from 1,520 feet to 950 feet. Eliminating the access bridge also minimizes potential impacts to the historic dam structure. In addition, access roads would not be required on the left bank of the river since the adult passage facility would be located on the right bank. The road system constructed for installation and construction of the passage facilities would also serve as permanent access.

Recommendation

In accordance with Reclamation's commitment to the Yakama Nation, this Planning Report and the Cle Elum Dam FP/FR Project FEIS will be submitted to the Office of the Secretary of the Department of the Interior with a determination that fish passage at Cle Elum is technically feasible. In addition, the report will be submitted with the recommendation that, should significant cost-share funding become available, Reclamation would support proceeding with the final design phase of the project.

Recognizing that it is likely that funding opportunities at the Federal level will continue to be limited in future budget climates, Reclamation anticipates being able to proceed from the final design phase to construction only if or when sufficient non-Federal cost-share funding becomes available. Note that Section 109 of the Act of August 17, 1984 (98 Stat. 1333, P.L. 98-381 [Hoover Power Plant Act]) authorizes the Secretary of the Interior ***" . . . to design, construct, operate, and maintain fish passage facilities within the Yakima River Basin, and to accept funds from any entity, public or private, to design, construct, operate, and maintain such facilities."***

CONTENTS

CONTENTS

Tables

Figures

Chapter 1

LOCATION, PURPOSE, AND AUTHORITY

Chapter 1. Location, Purpose, and Authority

The Bureau of Reclamation is leading a cooperative investigation with the Yakama Nation (Yakama Nation), State and Federal agencies, and others, to study the feasibility of providing fish passage at five large storage dams of the Yakima Project—Keechelus, Kachess, Cle Elum, Bumping Lake, and Tieton. The investigation initially lead to a focus on providing fish passage at Cle Elum and Bumping Lake Dams. A *Cle Elum and Bumping Lake Dams Fish Passage Facilities Designs and Estimates Appendix* for the Storage Dam Fish Passage Study, Yakima Project, Washington, was completed in August 2008 (Reclamation, 2008 [D&E Appendix]). In addition, a *Cle Elum and Bumping Lake Dams Fish Passage Facilities Planning Report – Draft* was completed in September 2008 (Reclamation, 2008 [Draft Planning Report]).

Throughout this Study, Reclamation has collaborated with a Technical Yakima Basin Storage Fish Passage Work Group (Core Team) of biologists, engineers, and other specialists from Federal, State, Tribal, and local entities to develop and evaluate fish passage alternatives. This Core Team and subgroups have met regularly to work through the biological, engineering, and operational issues associated with fish passage.

Based on priorities and funding, and with the support of the Core Team, Reclamation decided to proceed with the next phase for Cle Elum Dam only at this time. A value planning study, economic analyses, and feasibility-level engineering designs in addition to National Environmental Policy Act (NEPA), State Environmental Policy Act (SEPA) and Endangered Species Act (ESA) compliance have been completed. Passage at the other dams will require further study.

1.1. Location

The Study area lies within the Yakima River basin located in south-central Washington State bounded on the west by the Cascade Range, on the north by the Wenatchee Mountains, on the east by the Rattlesnake Hills, and on the south by the Horse Heaven Hills. It includes Yakima, Kittitas, and Benton Counties; about half of the basin lies in and occupies most of Yakima County. The Yakima River flows southeasterly for about 215 miles from its headwaters in the Cascades east of Seattle, Washington, to its confluence with the Columbia River near Richland, Washington. The Yakima River basin encompasses about 6,155 square miles. The frontispiece map depicts the general Study area and location of the Yakima Project storage dams, including Cle Elum Dam.

1.1.1 Yakima Project

The Yakima Project provides irrigation water for a narrow strip of fertile land that extends for 175 miles on both sides of the Yakima River in south-central Washington. The irrigable lands presently being served total approximately 464,000 acres.

There are seven divisions in the Project: Storage, Kittitas, Tieton, Sunnyside, Roza, Kennewick, and Wapato. The Wapato Division is operated by the Bureau of Indian Affairs, but receives most of its water supply from the Yakima Project for irrigation of 136,000 acres of land. Over 45,000 acres not included in the seven divisions are irrigated by private interests under water supply contracts with Reclamation. Storage dams and reservoirs on the project are Bumping Lake, Clear Creek (Clear Lake), Tieton (Rimrock Lake), Cle Elum, Kachess, and Keechelus. Other project features are five diversion dams, canals, laterals, pumping plants, drains, two powerplants, and transmission lines.

1.1.1.1. Project Purposes

Reclamation operates the Yakima Project to achieve specific purposes: irrigation water supply, flood control, power generation, and instream flows for fish, wildlife, and recreation. Irrigation operations and flood control management have been historical priorities for reservoir operations. The Yakima Project's authorization and water rights, issued under Washington State water law and the *1945 Consent Decree,* are statutory constraints for water resources. Reclamation must operate the Yakima River divisions and storage facilities in a manner that avoids injury to water users within this framework.

Legislation in 1994 provided that an additional purpose of the Yakima Project shall be for fish, wildlife, and recreation, but that this additional purpose "shall not impair the operation of the Yakima Project to provide water for irrigation purposes nor impact existing contracts." Since April 1995, the Yakima Project has been operated as required by the 1994 legislation to maintain target streamflows downstream from Sunnyside Diversion Dam as measured at the Yakima River near the Parker stream gage.

Hydroelectric power is produced coincidentally to other Project purposes. Reservoir storage releases are not made to meet hydroelectric power demand; sometimes incidental power generation at Project facilities is subordinated to meet instream flow requirements. Recreational needs are considered but are incidental to other Project purposes. Maximizing flood control, irrigation water delivery, and meeting streamflow needs requires continuous water management adjustments and includes many system operation considerations.

1.2. Study Purpose, Scope, and Objectives

Cle Elum Dam is one of five major storage dams in the Yakima Project that was not equipped with fish passage facilities when constructed. Cle Elum Lake was a natural lake turned into a reservoir by the construction of the dam. Successful implementation of fish passage at Cle Elum and Bumping Lake Dams could eventually lead to future detailed studies of passage at the other three dams−Kachess, Keechelus, and Tieton.

Historically, the natural lake supported three species of salmon, steelhead (an ocean-run trout), bull trout, and other resident fish important to Native Americans. Lack of passage at the dam blocked access to the lakes and upstream habitat for anadromous salmonids and resulted in the extirpation of one of the largest sockeye salmon runs in the Columbia River Basin (see section 2.2.1). Sockeye salmon are dependent on lakes for juvenile rearing. The absence of passage has also isolated local populations of bull trout and prevented the recolonization of populations diminished by natural catastrophic events.

Restoration of fish passage at Cle Elum Dam is being evaluated with the objective of maximizing ecosystem integrity by restoring connectivity, biodiversity, and natural production. The extirpation of the abundant sockeye salmon and other species from the basin substantially reduced species diversity and substantially decreased the infusion of marine-derived nutrients that contributed to the overall biological productivity of the upper basin lakes and tributaries (NPCC, 2004). There have been no natural returns of marine-derived nutrients to the lakes since construction of the dams. The carcasses of returning salmon can reintroduce marine nutrients to the ecosystem that are fundamental for ecological restoration (Naiman, et al., 2005). Birds of prey and terrestrial and aquatic animals feed on salmon and steelhead carcasses. The reduction of marine-derived nutrients also affects predators, aquatic and terrestrial vegetation, and resident fisheries by reducing overall system productivity.

Construction of passage features has the potential to reconnect isolated populations of bull trout; increase the life history diversity, geographic distribution, and abundance of salmon; and increase populations of upper basin steelhead and coho and Chinook salmon. Two of the species that would benefit, bull trout and Middle Columbia River steelhead, were listed as threatened under the Endangered Species Act (ESA) in 1998 and 1999, respectively.

1.3. Study and Other Authorities

The Tieton and Sunnyside divisions of the Yakima Project were authorized by the Secretary of the Interior on December 12, 1905, under the Reclamation Act of 1902 for the authorized purpose of irrigation. Cle Elum Dam was constructed in 1933 under this authority.

This Study is a feasibility investigation of fish passage at Cle Elum Dam, one of the five large storage dams of the Yakima Project. Congress authorized Reclamation to conduct a feasibility study to address the water resource needs of the Yakima River basin in the Act of December 28, 1979 (93 Stat. 1241, P. L. 96-162, Feasibility Study - Yakima River Basin Water Enhancement Project [YRBWEP]). A feasibility investigation of fish passage at the Yakima Project storage dams is one aspect of the study authorized; this Study was conducted under the authority of this Act.

Other authorities relevant to the construction, operation, and maintenance of the Yakima Project are listed below.

1.3.1 Hoover Power Plant Act of 1984

Congress passed the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (commonly called the Northwest Power Act) (94 Stat. 2697; 16 U.S.C. 839 note; 16 U.S.C. 839b note), creating the Northwest Power Planning Council, now known as the Northwest Power and Conservation Council (NPCC). Under this authority, the NPCC adopted a Columbia River Fish and Wildlife Program identifying actions for the protection and restoration of fish and wildlife. The YRBWEP is a Federal action to improve streamflow and fish passage conditions and is part of a comprehensive program to restore the Yakima River basin anadromous fishery resource. Phase I of YRBWEP was initiated to construct fish passage and protective facilities within the Yakima River basin in conjunction with the Bonneville Power Administration (BPA), the State of Washington, and others under the auspices of the NPCC pursuant to the Northwest Power Act.

Section 109 of the Hoover Power Plant Act of August 17, 1984 (P.L. 98-381, 98 Stat. 1340), authorizes Reclamation to design, construct, and operate fish passage facilities within the Yakima River basin that is in accordance with the NPCC's Columbia River Fish and Wildlife Program. A companion law was enacted August 22, 1984, to provide, among other things, for operation and maintenance costs related to fish facilities (P.L. 98-396, 98 Stat. 1379).

1.3.2 Yakima River Basin Water Enhancement Project Act of 1994

Phase II of YRBWEP focused on the conservation program of the enhancement project and was authorized by Congress in Title XII of the Yakima River Basin Water Enhancement Project Act of October 31, 1994 (P. L. 103-434, as amended, 108 Stat. 4550). Section 1205 of Title XII authorized fish, wildlife, and recreation as additional purposes of the Yakima Project. Section 1206 of Title XII authorizes Reclamation to construct juvenile (downstream) fish passage facilities at Cle Elum Dam under a cost ceiling.

1.4. Study Background

Anadromous salmonids, including sockeye salmon (*Oncorhynchus nerka*), coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), and steelhead (*O. mykiss*), historically occupied the four natural lakes in the Yakima River basin (Keechelus, Kachess, Cle Elum, and Bumping Lakes) and their upstream tributaries, as did resident fish including bull trout (*Salvelinus confluentus*). Timber crib dams constructed by others between 1904 and 1910 at the outlets of these four natural glacial lakes blocked fish passage to tributaries upstream from the dams. Reclamation later constructed larger storage dams over the timber crib dams, beginning in 1910, as well as a fifth new dam on the Tieton River. Construction of the timber dams, followed by the larger Reclamation storage dams, eliminated access to previously productive spawning and rearing habitat for anadromous salmonids and resident fish, and inundated a considerable amount of pristine, high-quality habitat.

Several watershed assessment and planning efforts have recognized the lack of fish passage at Yakima River basin storage facilities, including Cle Elum, as a significant limiting factor in the recovery of salmon, steelhead, and bull trout populations in the basin. Beginning in 1983, the NPCC's Fish and Wildlife Program identified measures for restoring fish populations in the Yakima River basin. A number of studies have occurred under this program, including the Cle Elum Lake Anadromous Salmon Restoration Feasibility Study. This study, conducted from 1987 to 1993, assessed the feasibility of reestablishing sockeye salmon above Cle Elum Lake and concluded that adequate spawning habitat existed (Flagg et al., 2000). A report prepared for the Washington State Conservation Commission in 2001, pursuant to the State's Salmon Recovery Act of 1998, cited the lack of anadromous fish passage at Cle Elum, Bumping, and other major Yakima River basin storage dams as one of the most critical habitat concerns in the Yakima River basin (Haring, 2001). The NPCC's *2004 Yakima Subbasin Plan* identified fish passage at Cle Elum Dam as a Tier 1 (or top level) high-priority need in the basin (NPCC, 2004). Section 2.3 of this report provides additional information about some of these studies and other related programs focused on the recovery of anadromous salmonids in the Yakima River basin.

Early in 2001, many Yakima River basin interest groups urged Reclamation to incorporate fish passage facilities as part of the proposed reconstruction at Keechelus Dam under the Safety of Dams (SOD) program. Reclamation carefully considered this issue but determined that fish passage facilities could not be added under existing SOD authority. However, in the January 2002, *Record of Decision (ROD) for Keechelus Dam Modification* (Reclamation 2002), Reclamation committed to seek funding under its existing authority (Act of December 28, 1979; 93 Stat. 1241, P.L. 96-162, Feasibility Study – Yakima River Basin Water Enhancement Project) to conduct a feasibility study for fish passage at all Yakima Project storage dams.

Subsequent to issuance of the ROD, Reclamation signed negotiated agreements and agreed to construction permit conditions, all associated with the Keechelus Dam SOD reconstruction that has guided this feasibility investigation. These documents are summarized here and provided in Appendix A.

1.4.1 Mitigation Agreement - Washington Department of Fish and Wildlife and Reclamation

The *Mitigation Agreement between the USDI Bureau of Reclamation and Washington Department of Fish and Wildlife Regarding Keechelus Dam Construction Issues Including Fish Passage* (Mitigation Agreement) was signed in April 2002 (Appendix A). Major provisions included:

- Conduct an assessment of fish passage, potential fish production, and sustainability at each Yakima Project storage dam and reservoir.
- Examine engineering feasibility at dams where the assessment determined fish passage was desirable and practicable.
- Negotiate with WDFW to determine alternatives to fish passage where the assessment determined it was impracticable or infeasible.
- Seek funds to ensure timely implementation of identified fish passage and alternative fish restoration measures.
- Provide interim passage (trap-and-haul) until fish passage facilities are constructed.

1.4.2 Hydraulic Project Approval (HPA)

WDFW issued the *Hydraulic Project Approval for Safety of Dams Reconstruction of Keechelus Dam* on April 17, 2002 (Appendix A). The HPA contains 65 provisions requiring compliance during and after the SOD reconstruction of Keechelus Dam. Provisions 56, 57, and 58 of the HPA contain essentially the same provisions as the Mitigation Agreement but also include specific milestone dates for completion of certain activities.

1.4.3 Litigation

In April 2002, the Yakama Nation filed a 60-Day Notice of Intent to File a Claim under the ESA regarding the Keechelus Dam SOD modification and later initiated a lawsuit. The Court rendered a judgment in favor of the United States in January 2003. Shortly thereafter, the Yakama Nation appealed the Court's decision. The Yakama Nation and

Reclamation entered into mediation procedures which resulted in a Settlement Agreement signed in 2006 (Appendix A).

The following agreements were made:

- Reclamation agreed to use existing congressional authority and funding to implement interim downstream fish passage measures at Cle Elum Dam until permanent fish passage is implemented or Reclamation concludes permanent passage is infeasible.

- Reclamation and the Yakama Nation agreed to study and develop feasible measures, if any, for permanent downstream and upstream fish passage implementation at Cle Elum and Bumping Lake Dams.

- Reclamation agreed to provide annual funding to the Yakama Nation for cooperative planning activities by the Yakama Nation Fisheries Resource Management Program.

- Reclamation agreed to prepare a technical plan and planning report with regard to feasibility of implementing permanent fish passage at Cle Elum and Bumping Lake Dams.

- Reclamation and the Yakama Nation agreed to meet to discuss whether the Technical Yakima Basin Storage Fish Passage Work Group (Core Team) should study and develop additional plans with regard to the feasibility of implementing permanent upstream and downstream fish passage at Kachess, Keechelus, and Tieton Dams in the Yakima River basin.

1.5. Study Investigations

Reclamation initiated this Study in 2002. The following summarizes previous investigations leading up to and contributing to the feasibility-level study.

1.5.1 Phase I Assessment Report

Reclamation completed a *Yakima Dams Fish Passage, Phase I Assessment Report* (Reclamation 2005 [Phase I]) that evaluated fish passage at the five Yakima Project storage dams. Based on the information developed for this Assessment, Cle Elum Dam was identified as one of the two highest priority sites for continued investigation of fish passage feasibility (Bumping Lake Dam was the other). Section 3.1 provides additional information about the Phase I Assessment.

1.5.2 Cle Elum Dam Interim Fish Passage

In the early spring of 2005, Reclamation completed construction of an interim (temporary, experimental) downstream juvenile fish passage facility at Cle Elum Dam. Annual reports documented interim passage program results for 2006, 2007, 2008, and 2009 (Reclamation, 2006; Reclamation, 2008 [Interim Fish Passage]; Reclamation, 2009 [Interim Fish Passage]; Reclamation, 2010 [Interim Fish Passage]). Section 2.5. of this report provides additional information about the program.

1.5.3 Anadromous Fish Reintroduction Plan

The fisheries co-managers (Yakama Nation and WDFW) have developed a plan to reintroduce anadromous salmonids upstream from the Yakima Project dams (Reclamation, 2005 [Reintroduction]; Fast and Easterbrooks, 2008). The plan identifies species, goals, sequencing, and timing and is detailed in Section 2.3.3.

1.6. Coordination with Others

Reclamation is supported in this effort by a Core Team of biologists, engineers, and other specialists from Federal, State, and local entities. Partners include:

- Yakama Nation
- Yakima/Klickitat Fisheries Project
- National Marine Fisheries Service (NMFS)
- U.S. Fish and Wildlife Service (Service)
- Washington Department of Fish and Wildlife (WDFW)
- Bonneville Power Administration (BPA)
- City of Yakima
- North Yakima Conservation District
- Tri-County Water Resources Agency
- U.S. Forest Service (USFS)
- Washington Department of Agriculture
- Washington Department of Ecology (Ecology)
- Wenatchee National Forest
- Yakima Basin Joint Board
- Yakima River Basin Commodity Coalition

- Yakima-Tieton Irrigation District

The Core Team and subgroups met on a regular basis to work through biological, engineering, and operational issues associated with fish passage at the dam and planning reintroduction of fish species to coincide with construction of a fish passage facility at Cle Elum Dam. The primary input to the process from non-Reclamation team members comes in the form of discussion of options, review comments on Reclamation-drafted documents, and Core Team meeting attendance. The Core Team continues to meet on an as-needed basis.

Environmental compliance, coordination, and consultation with others are described in Chapter 7.

1.7. Other Related Yakima River Basin Studies and Activities

Other Yakima River basin activities or issues that are linked in various ways to the objectives of this fish passage study have been considered throughout the planning process. Following is a brief summary of the most pertinent activities.

1.7.1 Cle Elum Dam Preliminary Analysis of Fish Passage Concepts

As part of YWBWEP Title XII, Reclamation conducted an analysis of potential fish passage at Cle Elum Dam following a proposal in 1998 to raise the water surface elevation in Cle Elum Lake by 3 feet. This study entailed a preliminary analysis of potential downstream and upstream fish passage options at Cle Elum Dam (Reclamation, 2000).

1.7.2 Yakima River Basin Water Enhancement Project

The Yakima River Basin Water Enhancement Project (YRBWEP) was authorized under P.L. 103-434, of October 31, 1994, as amended by P.L. 105-62, October 13, 1997, and P.L. 106-372, October 27, 2000.

This project evaluates and implements structural and nonstructural measures to increase the reliability of the irrigation water supply and enhance streamflows and fish passage for anadromous fish in the Yakima River basin. Facility modifications; implementation of water conservation measures; the purchase or lease of land, water, or water rights from willing sellers for habitat improvements and habitat restoration; and changes in operations, management, and administration may be implemented to reduce the demand on the available water supply. Two-thirds of water conserved under YRBWEP's Basin Conservation Program would remain instream to benefit anadromous fish. Tribal water

supply systems would be improved, the Toppenish Creek Corridor enhanced, and an irrigation demonstration program would be developed for the Yakama Nation to enhance Tribal economic, fish, wildlife, and cultural resources.

Specific projects completed or proposed under YRBWEP include:

- Conservation projects such as construction of re-regulation reservoirs, piping canals, and automation of canal gates by Sunnyside, Roza, Benton, Kennewick, and Union Gap irrigation districts.

- Similar conservation projects for the Yakama Nation.

- Purchase of land and water to improve anadromous fish habitat and increase instream flows.

- Electrification of hydraulic pumps and/or exchange in diversion points for delivery of Kennewick Irrigation District water.

- Work in tributaries to remove fish barriers and increase instream flows.

YRBWEP is managed by Reclamation's Columbia-Cascades Area Office in partnership with Ecology and various local entities such as the irrigation districts, the Yakama Nation, and various basin biologists from Federal and State entities, among others.

1.7.3 Yakima River Basin Water Storage Feasibility Study

In the Act of February 20, 2003 (P.L. 108-7), Congress directed Reclamation "to conduct a feasibility study of options for additional water storage in the Yakima River basin, Washington, with emphasis on the feasibility of storage of Columbia River water in the potential Black Rock Reservoir . . ." Reclamation initiated the Yakima River Basin Water Storage Feasibility Study (Storage Study) in May 2003. This study addresses two potential actions:

1. Diverting Columbia River water to a potential Black Rock reservoir for further transfer to irrigation entities in the Yakima River basin as an exchange supply, thereby reducing irrigation demand on Yakima River water and improving Yakima Project stored water supplies.

2. Creating additional water storage for the Yakima River basin to provide increased management flexibility of the existing water supply.

A *Final Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study* was completed (Reclamation, 2008 [Storage Study]) to address the technical viability of Yakima River basin storage alternatives and the extent that the

additional stored water supply would improve anadromous fish habitat, improve the water supply for existing proratable (junior) water users, and provide water supply for future municipal demands. Reclamation completed this study in April 2009 with a concluding letter to Ecology identifying the No Action Alternative as the preferred alternative.

1.7.4 Yakima Basin Integrated Water Resource Management Alternative Study

Based on comments received on the *Draft Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study* (Reclamation, 2008 [Draft Storage Study]), Ecology began a separate study in mid-2008 of solutions to the Yakima basin's water supply problems including consideration of habitat and fish passage needs. As a result, the *Yakima Basin Integrated Water Resource Management Alternative Final Environmental Impact Statement* was issued in June 2009 (Ecology, 2009). The integrated alternative includes seven key elements: fish passage, modifying existing structures and operations, new surface storage, groundwater storage, fish habitat enhancement, water conservation, and market-based reallocation.

1.7.5 Yakima River Basin Water Enhancement Project Workgroup

With the implementation of YRBWEP Phase 2 and completion of the Storage Study and Ecology's Yakima Basin Integrated Water Resource Management Alternative FEIS, there has now been over three decades of work and information produced by basin stakeholders. Reclamation and Ecology initiated the YRBWEP 2009 Workgroup, consisting of the Yakama Nation, other Federal and State agencies, county and city governments, environmental organizations, and irrigation districts, in April 2009. In December 2009, the Workgroup released a proposal for a *Preliminary Integrated Water Resource Management Plan for the Yakima River Basin* (Preliminary Integrated Plan) (Reclamation and Ecology, 2009). In December 2010, the 2010 Workgroup achieved consensus on a final proposal for an Integrated Plan by agreeing to the *Yakima River Basin Water Enhancement Project Workgroup, Integrated Water Resource Management Plan, Summary Support Document* (Reclamation and Ecology, 2010) that outlined the proposal. Further feasibility-level analyses of the proposed Integrated Plan and other alternatives that may address the Yakima Basins water resource problems are expected to result in a final planning report and related environmental compliance products.

The proposed fish passage facilities at Cle Elum Dam are included in the fish passage element of the proposed Integrated Plan and will be evaluated along with other elements of the proposed Integrated Plan in the context of the interrelated benefits to all Plan elements. Fish passage at Cle Elum Dam is not dependent on actions proposed in the

Integrated Plan, but the value of such passage would be enhanced by implementation of other elements of the proposed Integrated Plan. For example, under the proposed Integrated Plan, instream flows would improve below Cle Elum Dam and at other locations which would enhance passage benefits. Reclamation believes that fish passage at Cle Elum Dam would provide significant benefits even if other elements of the Integrated Plan are not implemented.

1.7.6 Grant County Public Utility District Application to Federal Energy Regulatory Commission

On January 17, 2007, a preliminary permit to study the development of a hydroelectric plant at Cle Elum Dam was issued by the Federal Energy Regulatory Commission (FERC) to the Public Utility District (PUD) No. 2 of Grant County, Washington (FERC Project No. P-12746). While conveying no rights of development, the preliminary permit is an exclusive right to study the site for up to 3 years while the permittee develops plans and performs studies leading to the filing of licensing documents. Additionally, the preliminary permit protects the site from competition from other potential developers.

The project, as proposed in the permit application, is a 30.2-megawatt (MW) powerplant that would be constructed alongside the existing stilling basin at the same location as Reclamation's proposed upstream adult fish collection facility for Alternative 2. Construction and operation of Reclamation's proposed fish passage facilities could impact the feasibility of developing the site for power production. Reclamation has met with Grant County PUD representatives to discuss the proposed hydropower project. It is Grant County PUD's responsibility to propose a facility that does not impact the location or effectiveness of the fish passage facilities.

On December 18, 2009, Grant County PUD formally notified FERC that they would no longer pursue the hydroelectric project at Cle Elum Dam as currently proposed.

1.7.7 Additional Analyses

Numerous technical appendices and memoranda document the analyses contributing to this feasibility-level investigation of fish passage. These are referenced in this document and key information summarized where appropriate. Many of these can be found at: http://www.usbr.gov/pn/programs/usao_misc/fishpassage/index.html or in Reclamation files and include:

Phase I Assessment Report, Technical Series No. PN-YDFP-001. April 2005.

Stream Macroinvertebrate Surveys in the Cle Elum and Bumping River Watersheds, Technical Series No. PN-YDFP-002. January 2005.

Fisheries Reintroduction Plan, Technical Series No. PN-YDFP-003. February 2005.

Cle Elum Juvenile PIT Tag Fish Bypass System, Technical Series No. PN-YDFP-004. October 2005.

Physical, Chemical, and Biological Characteristics of Cle Elum and Bumping Lakes, Technical Series No. PN-YDFP-005. March 2007.

Coho Salmon Production Potential in the Cle Elum River Basin, Technical Series No. PN-YDFP-007. March 2007.

Assessment of Sockeye Salmon Production Potential in the Cle Elum River Basin, Technical Series No. PN-YDFP-008. March 2007.

Coho Salmon Production Potential in the Bumping River Basin, Technical Series No. PN-YDFP-009. March 2007.

Assessment of Sockeye Salmon Production Potential in the Bumping River Basin, Technical Series No. PN-YDFP-010. March 2007.

Cle Elum Dam Interim Fish Passage Operations 2006 Annual Report, Technical Series No. PN-YDFP-011. December 2006.

Cle Elum and Bumping Lake Dams Fish Passage Facilities Biology Appendix, Technical Series No. PN-YDFP-012. January 2008.

Cle Elum Dam Interim Fish Passage Operations 2007 Annual Report, Technical Series No. PN-YDFP-013. May 2008.

Cle Elum and Bumping Lake Dams Fish Passage Facilities Designs and Estimates Appendix, Technical Series No. PN-YDFP-006. August 2008.

Yakima Dams Fish Passage Study Economics Technical Memorandum. September 2008.

Cle Elum Dam Interim Fish Passage Operations 2008 Annual Report, Technical Series No. PN-YDFP-014. April 2009.

Cle Elum Dam Interim Fish Passage Operations 2009 Annual Report, Technical Series No. PN-YDFP-015. December 2010.

Chapter 2

BIOLOGICAL CONSIDERATIONS, ASSESSMENTS, AND BENEFITS OF FISH PASSAGE

Chapter 2. Biological Considerations, Assessments, and Benefits of Fish Passage

This chapter provides an overview of biological information considered during the design of downstream and upstream fish passage facilities at Cle Elum Dam. Reclamation and Core Team members funded or conducted a number of additional biological assessments to determine existing stream and reservoir habitat conditions and the potential to restore and sustain anadromous salmonids above the lakes. Detailed discussion of the data collection methods and analyses described in this section can be found in technical reports and the *Biology Appendix* (Reclamation, 2008 [Biology Appendix]), and are referenced as appropriate.

2.1. Yakima River Basin Fisheries

Estimates of the historic abundance of the several species of salmon and steelhead in the Yakima River basin vary widely. Estimated historic abundance of spring Chinook salmon range from about 55,000 to 200,000; for summer Chinook salmon, from 86,000 to 100,000; for fall Chinook salmon, from 50,000 to 100,000; for coho salmon, from 44,000 to 150,000; for sockeye salmon, from 150,000 to 200,000; and for steelhead, from 24,000 to 80,000 (Yakama Nation, 2001). This results in an estimated historic abundance ranging from 470,000 to 841,000 for all adult salmon and steelhead.

It is estimated that by 1900, prior to construction of the Project storage dams, the number of returning anadromous salmonid adults to the Yakima River basin had been reduced by about 90 percent compared to historic runs (Tuck, 1995). Salmon and steelhead runs continued to decline as a result of loss of habitat above the lakes and other anthropogenic activities and, by 1920, only an estimated 11,000 adults returned to the Yakima River basin (Tuck, 1995), a reduction of more than 98 percent of the historic run (NPCC, 1990).

Timber crib dams, initially constructed to enlarge four existing natural glacial lakes (Keechelus, Kachess, Cle Elum, and Bumping), blocked fish passage to tributaries upstream from the dams and contributed to the eventual extirpation of the sockeye salmon runs in the Yakima River basin by the early 20th Century (Bryant and Parkhurst, 1950; Davidson, 1953; Fulton, 1970; Mullan, 1986). Reclamation later constructed larger storage dams over the timber crib dams beginning in 1910, as well as a fifth new dam on the Tieton River. None of the existing dams have fish passage facilities.

2.2. Species of Interest

2.2.1 Sockeye Salmon

Sockeye salmon (*Oncorhynchus nerka*) were extirpated from the Yakima River basin in the early 1900s. Historically, juvenile sockeye salmon reared in all of the headwaters lakes—Keechelus, Kachess, Cle Elum, and Bumping—and adults likely spawned both in the lakes and lake tributaries. Juvenile rearing is dependent upon lakes. Before construction of unladdered timber crib dams (1904-1910) at the outlets of these four lakes, the sockeye salmon run was probably larger than any other in the Columbia River Basin in terms of numerical abundance (Yakama Nation, 1990), with estimated historic annual returns ranging from 150,000 to 200,000.

Except for a handful of adult fish returning in 1991, 1993, and 1995, from experimental Cle Elum Lake research releases of hatchery-reared stock developed from Lake Wenatchee stock and a number of experimental releases of smolts in the 1940s, sockeye salmon have not returned to the Yakima River basin since the1920s. Present day run-timing for adult sockeye salmon at Rock Island Dam and Rocky Reach Dam on the Columbia River peaks in early- to mid-July, and reintroduced sockeye salmon from either Lake Wenatchee or Lake Osoyoos would likely have a similar run-timing.

Juvenile sockeye salmon rear almost exclusively in lakes, rather than their natal streams, as do other Pacific salmon species. Sockeye salmon also exhibit unique spawning behavior. Some populations of adult sockeye salmon spawn in tributaries entering lakes or in lakes, while some populations spawn in rivers flowing out of the lakes downstream from the lake outlet. Upon emergence, sockeye salmon fry in lake outlet spawning populations must migrate upstream in order to utilize the rearing habitat in the lake, whereas fry emerging from lake inlet streams must migrate downstream to the rearing habitat in the lake. The direction sockeye salmon fry migrate is genetically based and is an important consideration for fish passage and hatchery supplementation (Burgner, 1991).

Most sockeye salmon rearing lakes are oligotrophic (low in nutrients), but which are sufficiently productive to support sockeye salmon. Among the lakes in the upper Columbia River Basin that support sockeye salmon populations, Lake Wenatchee is oligotrophic while Lake Osoyoos on the Okanogan River is somewhat more productive.

2.2.2 Coho Salmon

Coho salmon (*O. kisutch*) were extirpated gradually from the Yakima River basin, with the last spawning fish observed in 1977, and zero fish counted at Prosser Dam by 1984 (Haring, 2001). All upper Columbia River coho salmon stocks, including those in the Yakima River, are believed to be extinct; endemic coho salmon were extirpated in the

early 1980s (Berg and Fast, 2001). A coho salmon restoration program began in 1983 and has experienced some success (Yakama Nation, 2004). Coho salmon are already present in the Yakima River system, principally as part of the Yakima/Klickitat Fisheries Project (YKFP) coho salmon reintroduction program.

Beginning in the 1950s and continuing through the 1970s, an extensive network of coho salmon hatcheries was constructed in the lower Columbia River. Efforts to restore coho salmon within the Yakima River basin rely largely upon releases of hatchery-produced fish. Natural reproduction of hatchery-reared coho salmon, outplanted as smolts, is now occurring in the Yakima River and the Naches River. Natural reproduction is evident from the increasing occurrence of age-zero coho salmon parr (juvenile fish) in samples collected at numerous points in the basin (Yakama Nation, unpublished data, 2000). Coho salmon currently returning to the basin are a mix of hatchery stocks from outside the basin. Efforts are underway to develop a "naturalized" stock.

Currently, coho salmon enter the Yakima River in the fall with about 10 to 20 percent of the adults reaching the upper watershed between Cle Elum and Easton in November and December. Spawning occurs soon afterward; the eggs incubate over the winter and hatch in the spring. After the fry emerge from the gravel, the juveniles rear in the stream until the following spring when they outmigrate as 1-year-old smolts.

2.2.3 Spring Chinook Salmon

Spring Chinook salmon (*O. tshawytscha*) in the Yakima basin are comprised of three populations that spawn in the Naches, American, and upper Yakima subbasins. The upper Yakima wild population is supplemented with hatchery spring Chinook reared at the Cle Elum Supplementation and Research Facility and released from three acclimation sites, which are part of the YKFP supplementation project. An estimated 12 percent of the adult wild spring Chinook salmon that spawn in the upper Yakima River basin spawn in the 8-mile reach of the Cle Elum River downstream from the dam.

All Yakima River stocks of spring Chinook salmon exhibit an extensive downstream migration of pre-smolts in the late fall and early winter (Pearsons et al., 1996; Berg and Fast, 2001). Most juvenile spring Chinook salmon in the Upper Yakima River basin migrate down river during the fall-winter period and overwinter in the Yakima River somewhere between Roza and Prosser Dams (Berg and Fast, 2001).

Adult spring Chinook salmon return to the upper mainstem Yakima River beginning in May. Adults migrate close to the area where they will spawn and find a place to hold in cover (deep water with woody debris or undercut banks or both) until they spawn in September and October. Depending on water temperature, the peak of spawning activity for spring Chinook salmon in the upper mainstem Yakima River is from September 15 to October 1 (Fast et al., 1991). Adults that spawn in the upper reaches of tributaries

typically move into the tributaries by the end of June or early July when flows are still high enough for them to traverse the lower reaches of the tributaries. Variability in run timing is influenced by high and low flows. Run timing for spawning runs of all salmon and steelhead is delayed during years of high flow and accelerated in years of low flow.

2.2.4 Steelhead

Adult Middle Columbia River steelhead (*O. mykiss*) return to the upper Yakima River between September and May. Generally, adult Middle Columbia River steelhead migration into the Yakima River basin begins in late summer and peaks in late October and again from late February or early March following a relatively inactive period during the coldest wintertime water temperatures.

Typically, steelhead spawn earlier in lower-elevation warmer waters than in higher-elevation colder waters. Overall, most spawning occurs between March through May (Hockersmith et al., 1995), although WDFW personnel have observed steelhead spawning as late as July in the Teanaway River (river mile [RM] 176.1), a tributary to the upper arm of the Yakima River. Yakima River basin steelhead are tributary spawners, with most currently spawning in the complex, multichannel reaches of tributaries with a "moderate" gradient (about 1 to 4 percent) (Berg and Fast, 2001), such as Naches River and tributaries, Satus Creek, or Toppenish Creek.

Juvenile steelhead emerge from the gravel between June and August and rear in the areas near where they were spawned for 2 to 4 years before migrating to the sea. Juvenile steelhead utilize tributary and mainstem reaches throughout the Yakima River basin as rearing habitat and use faster and deeper water as they grow. Some downstream movement begins in November, but the peak of the smolt outmigration occurs between mid-April and May.

Yakima River basin steelhead are a component of the ESA-listed Middle Columbia River steelhead distinct population segment.

2.2.5 Bull Trout

Bull trout (*Salvelinus confluentus*) occurred historically throughout most of the Yakima River basin. Today, however, they are fragmented into relatively isolated populations. Although bull trout were probably never as abundant as other salmonids in the basin, due in part to their requirements for cold, clear water, they were certainly more abundant and more widely distributed than they are today (WDFW, 1998).

Three bull trout life history forms are present in the Yakima River basin: adfluvial (migrate to lakes), fluvial (migrate to rivers), and resident. Adfluvial and fluvial fish reside in lakes and mainstem rivers, respectively, during part of the year. Fry and juveniles rear in their natal streams for 1 to 4 years before migrating downstream into

lakes or mainstem river systems. Adults migrate back into tributary streams to spawn, after which they return to the lake or river. The resident life history form resides in a particular stream for its entire life cycle. Adfluvial populations occur in Cle Elum, Bumping, Kachess, Keechelus, and Rimrock Lakes. A fluvial population is present in the mainstem Yakima River and Naches River. The population in the North Fork Teanaway River drainage is likely fluvial, but information on this population is limited. A resident population occurs in Ahtanum Creek (WDFW, 1998).

Bull trout are late summer/early fall spawners and most spawning activity in the Yakima River basin, irrespective of life history form, occurs from early September through early October; however, spawning may occur as early as August (Deep Creek in the Bumping system) or as late as mid-October to early November (Kachess River-Mineral Creek in the Kachess system). For the migratory life history forms, the spawning migration can begin as early as mid-July (Gold Creek in the Keechelus system) when adults move upstream to hold in deep pools or it may occur just prior to spawning (Indian Creek in the Rimrock Lake system).

The primary downstream migration periods for juvenile bull trout from their natal tributaries into lakes or rivers occur from June through November. The early summer migration appears to be in response to increased flows and may correspond with a switch in prey from invertebrates to fish, whereas the fall migration appears to be primarily in response to decreasing water temperatures and the need to find suitable overwintering habitat (Fraley and Shepard, 1989; Murdoch, 2002).

Fish passage facilities at Cle Elum Dam would allow volitional movement of bull trout throughout the basin and reestablish connectivity with populations elsewhere in the basin. Currently, there are no plans to supplement any Yakima River basin bull trout populations because of their ESA-listed status.

2.3. Restoration Efforts

Restoration of anadromous and resident fish in the Yakima River basin are the focus of several programs managed and funded by Federal and State agencies and Tribes. These programs are currently addressing habitat improvements, changes in stream flows, reconnecting tributaries, and other actions to promote restoration. Many of these plans identify the storage dams as a limiting factor for restoration of anadromous fish. Fish passage at the Yakima River basin storage dams is essential to restore sockeye salmon to the Yakima basin. The following sections summarize some restoration and recovery programs that are related to Reclamation’s efforts to provide fish passage in the Yakima River basin.

2.3.1 Columbia River Basin Fish and Wildlife Program

Through the Northwest Power Plan Act of 1980 (see Section 1.3), the NPCC was directed to prepare a regional conservation and electric power plan and to develop a fish and wildlife protection and restoration program to protect and rebuild populations affected by hydropower development in the Columbia River Basin. The NPCC adopted its Columbia River Basin Fish and Wildlife Program in 1982, which included measures to restore greatly depleted fish runs in the Yakima River basin. The primary measures for rapid implementation in the basin were installation of fish passage and protective facilities. Reclamation has been actively involved with Federal, State, Tribal, and other partners to implement these measures.

Passage at the Yakima Project storage dams was identified in the NPCC's Columbia River Fish and Wildlife Program in 1983. Measure 904(d)(6) implemented a study to determine the feasibility of reestablishing anadromous fish runs above Cle Elum Dam. NMFS conducted a multiyear study funded by the BPA between 1987 and 1993 to assess the feasibility of restoring sockeye salmon to Cle Elum Lake (Flagg et al., 2000). The NMFS study indicated that juvenile sockeye salmon released into Cle Elum Lake in the late summer-early fall successfully overwintered and were able to locate the lake outlet and outmigrate the following spring. Higher irrigation releases from Cle Elum Dam may have attracted juvenile sockeye salmon to the dam outlet. In addition, the fish survived downstream migration through the Yakima and Columbia Rivers, with a few adults returning to the Yakima River in subsequent years. The study noted that adequate spawning habitat existed upstream of the lake, although the reservoir was oligotrophic and would benefit from an in-lake fertilization program to increase the carrying capacity for juvenile sockeye salmon. These results encouraged the basin fisheries co-managers and others to continue to advocate upstream and downstream fish passage facilities at Yakima River basin water storage projects.

The Phase I Yakima River basin fish screening program occurred from 1983 to 1990 and corrected some juvenile fish entrainment problems at about 16 of the largest diversion dams and canals in the basin below the five major storage dams; most of these were Reclamation owned and operated facilities. In 1988, the Yakama Nation submitted an application to amend the NPCC's Columbia River Basin Fish and Wildlife Program to begin preliminary design on a Phase II fish screen program for the Yakima River basin. The NPCC approved the amendment in 1989 and authorized the BPA to provide funding; BPA asked Reclamation to provide engineering and design expertise. The Phase II program aimed at correcting fish entrainment conditions at about 60 smaller diversions in the basin. Reclamation modified or rebuilt diversion structures to reduce or eliminate entrainment of juvenile outmigrants at just over half of these, beginning from fiscal year (FY) 1992 through 2006.

Recognizing that some suitable spawning and rearing habitat existed above the several Reclamation water storage dams and that access to this habitat was totally blocked, page 12 of the Executive Summary of the *2004 Yakima Subbasin Plan* (NPCC, 2004) states,

> *Kachess, Keechelus, Cle Elum, and Bumping Dams block passage for sockeye and bull trout and Tieton Dam blocks passage for bull trout. A high priority objective is to restore passage to at least one dam by 2007, possibly through various fish passage options such as ladders, trap and haul, and modification of outlets for downstream passage.*

The Supplement to the 2004 *Yakima Subbasin Plan* (NPPC, 2004 [Supplement]) identifies fish passage at Cle Elum Dam as a Tier 1 (or top level) high-priority need in the basin. The Supplement noted that the Tier 1 limiting factors have the greatest impact on the focal species in the basin and these limiting factors should be addressed first.

2.3.2 Yakima/Klickitat Fisheries Project

The Yakima-Klickitat Fisheries Project (YKFP) is a joint project of the Yakama Nation (lead entity) and the WDFW, and is sponsored in large part by the BPA, with oversight and guidance from the NPCC. The YKFP is among the largest and most complex fisheries management projects in the Columbia River Basin in terms of data collection and management, physical facilities, habitat enhancement and management, and experimental design and research on fisheries resources.

The YKFP is designed to use artificial propagation in an attempt to reestablish, supplement, or increase natural production and harvest opportunities of anadromous salmonids while maintaining the long-term fitness of the target population and keeping ecological and genetic impacts on nontarget species within specified limits. The YKFP is also an experiment to resolve uncertainties associated with supplementation. As a "laboratory," the YKFP would help determine the role of supplementation in increasing natural production of anadromous salmonids. Both controlled experiments and basic monitoring contribute information.

Consistent with the Council's Fish and Wildlife Program (NPCC, 1994; NPCC, 2000; NPCC, 2004), the objectives of the YKFP are to:

- Enhance existing stocks of anadromous fish in the Yakima and Klickitat River basins, while maintaining genetics and ecological resources.
- Reintroduce stocks formerly present in the basins.
- Apply the knowledge gained from supplementation throughout the Columbia River Basin.

2.3.3 Anadromous Fish Reintroduction Plan

Fisheries resources in the Yakima River basin are managed jointly by the WDFW and the Yakama Nation. Concurrent with Reclamation's efforts to design interim and permanent fish passage facilities at Cle Elum Dam, the Yakima River basin fisheries co-managers developed an anadromous fish reintroduction plan (Reclamation, 2005 [Reintroduction]; Fast and Easterbrooks, 2008) that describes the target species and outlines the sequence and timing for reintroduction of selected species above Cle Elum Dam. The reintroduction plan is consistent with the goals and objectives of the YKFP and the 2004 *Yakima Subbasin Plan*.

The plan proposes a phased approach starting with coho salmon, followed by sockeye salmon, and eventually spring Chinook salmon, summer steelhead, and Pacific lamprey (*Entosphenus tridentatus*). An additional objective is to provide two-way passage for resident bull trout to restore genetic connectivity between adfluvial populations in the storage reservoirs and fluvial (riverine) bull trout that reside downstream of the dams. Sockeye salmon are the preferred species for reintroduction, but some logistical and fish culture and health and disease issues need to be resolved before sockeye salmon can be reintroduced, so coho salmon would be reintroduced initially.

The Yakama Nation and WDFW have developed their reintroduction plan using species available in the near-term, mid-term, or long-term. Reintroduction was determined to be a viable and realistic approach to salmonid restoration rather than waiting for existing fish populations downstream of the dam to colonize or "pioneer" newly accessible upstream habitat using adult passage facilities. The plan suggests that it could take three or four salmon generations (15 to 20 years) or more to realize significant use of habitat above the reservoir if fish reintroduction, especially for sockeye salmon, is not aided by human intervention. The reintroduction plan proposes to use both adult and juvenile salmon to accelerate repopulation of the habitat.

2.3.3.1. Near-Term – Coho Salmon

Near-term efforts would use hatchery coho salmon smolts and adults that are currently readily and reliably available (2008 and out-years) to reestablish a localized broodstock for hatchery and natural production. Coho salmon would be used to initiate a properly functioning ecosystem by introducing marine-derived nutrients back into the Cle Elum River watershed. This would enhance the primary goal of reestablishing sockeye salmon, which utilize the lake environment for juvenile rearing. Salmon carcass "analogs" produced from surplus lower Columbia River hatchery salmon (coho or Chinook salmon) may also be purchased and used to increase ecosystem productivity and the survival and growth of juvenile salmon produced naturally from adults that are trapped, transported, and spawn upstream of the reservoirs.

2.3.3.2. Near-Term and Mid-Term – Sockeye Salmon

Sockeye salmon are the preferred species for reintroduction above Cle Elum Lake since they have been extirpated from the Yakima River basin. There are, however, logistical and fish-cultural issues that need to be addressed and overcome that would, in effect, prolong sockeye salmon reintroduction efforts, so their reintroduction would span both the near-term and mid-term timeframe. There are two potential donor stocks in the upper Columbia River Basin, Wenatchee and Osoyoos Lakes on the Wenatchee and Okanogan Rivers, respectively. Both of these stocks are wild or naturally produced populations that exhibit highly variable abundance from year to year. This variability makes it difficult to design a plan with firm dates for consistent and adequate numbers of fish for the reintroduction program. Currently, the near-term (next 4 years) outlook for the Okanogan population is an upward trend, with returning adult populations estimated between 45,000 to 55,000. In light of the current resurgence of Upper Columbia Sockeye, the Yakama Nation has initiated an adult reintroduction program in the Cle Elum. In 2009, approximately 1,000 adult sockeye were collected at Priest Rapids Dam and transported by truck and released into Cle Elum Lake. The Yakama Nation and WDFW have developed a sliding scale of adults available for this reintroduction effort based on the adult run size to the Columbia. In 2010, the Columbia run of sockeye was larger; 2,000 adult sockeye were transported and released into Cle Elum Lake and 500 fish were released into Copper Lake. This adult effort is planned to continue, with the number of transported sockeye (up to 10,000 fish) determined by Columbia run size, in future years. The recovery efforts are expected to be cyclic while using outside sources for broodstock. The mid-term reintroduction efforts would continue to use outside sources for broodstock when available, along with adults that have returned to the Yakima River basin.

2.3.3.3. Near-Term and Mid-Term – Spring Chinook Salmon

Spring Chinook salmon are also considered a small-scale “near-term” and “mid-term” objective for reintroduction above Yakima Project storage dams. Currently, all smolts produced at the Cle Elum Supplementation and Research Facility are fully allocated to a sophisticated experimental design and cannot be used for reintroduction experiments. However, the near-term objective would use surplus eggs (90,000 to 120,000 reared to summer parr life stage with a June/July release) from supplemented hatchery egg viability and morphometric studies being conducted at the facility. Any spring Chinook salmon that voluntarily enters the adult fish trap located at the base of Cle Elum Dam would be transported and released into Cle Elum Lake (trap and haul).

2.3.3.4. Near-Term and Long-Term – Steelhead

Steelhead reintroduction above the dam would be “small-scale” in the near-term because steelhead are an existing native, wild stock that is listed as “threatened” under the ESA. The near-term strategy consists of the Yakama Nation collecting steelhead kelts at the

Chandler Juvenile Fish Monitoring Facility as part of their kelt reconditioning program. All adult steelhead that pass through the Roza Adult Fish Monitoring Facility are Passive Integrated Transponder (PIT)-tagged in the ventral girdle, which allows them to retain the tag for life. The "near-term" emphasis would apply to any upper Yakima River kelts that are reconditioned under this program. Reconditioned upper Yakima kelts would be spawned together as part of the kelt viability study. The progeny from these fish and the viability study would be raised to the summer parr stage and released above Cle Elum Lake. Since steelhead are listed as threatened, the near-term strategy described above of reintroducing the progeny of kelts from the viability study is expected to continue for some time.

Currently, no hatchery steelhead smolt production occurs in the Yakima River basin, so there is no available source of locally adapted hatchery smolts that could be used to accelerate steelhead reintroduction above the storage reservoirs. However, the habitat above the reservoirs is intact and underutilized; therefore, steelhead would be allowed and encouraged to expand as soon as possible into this habitat. The reintroduction of summer parr from the viabilitiy study is part of this program. Any adult steelhead that voluntarily enters the adult fish trap located at the base of Cle Elum Dam would be transported and released into Cle Elum Lake as long as the trap-and-haul upstream passage facility operates.

2.3.3.5. Long-Term – Pacific Lamprey

Pacific lamprey are very rare in the Yakima River subbasin and little is known about their life history, historic distribution, or current limiting factors; hence, reintroduction of this species is considered a long-term objective. The Yakama Nation is currently developing a reintroduction plan for this species and is considering areas above the Yakima Project reservoirs.

2.4. Habitat Conditions

A number of activities occurred to assess the production potential of coho and sockeye salmon in new habitat that would be accessible with construction of fish passage facilities. Reclamation collected information on limnological conditions in Cle Elum Lake and on benthic macroinvertebrates in tributaries to the lake. The USFS conducted stream inventories and compiled habitat data on the tributaries above Cle Elum Lake. These efforts provided initial information on the quality and quantity of habitat accessible and usable to each of the salmonid species as well as the potential for survival and growth. Additional information can be found in the reports referenced in this section.

2.4.1 Available Upstream Habitat

In the Phase I Assessment, the Core Team assessed tributary habitat conditions upstream of the five Yakima Project storage reservoirs. Tributary stream lengths in miles up to natural or manmade barriers were obtained from various published reports and USFS stream surveys. The Core Team estimated the extent of the spawning and rearing habitat in the tributary streams using numerous environmental variables such as stream gradient, reported assessments of the quality of spawning conditions, water temperature, habitat conditions including large woody debris, and pool frequency and quality. The data were obtained from various agency reports and peer-reviewed papers. On-the-ground observations and experiences of Core Team members were also considered. Appendix B of the Phase I Assessment report provided a detailed discussion of the analysis and the supporting data.

2.4.1.1. Watershed Above Cle Elum Lake

The Phase I Assessment determined that about 29.4 miles of tributary habitat upstream of Cle Elum Lake are potentially accessible if passage at the dam were provided. Cle Elum Lake is the largest of the four reservoirs in the Yakima River basin formed from existing glacial lakes that once supported runs of anadromous salmonids. Historically, sockeye salmon used the lake for rearing and, along with coho and spring Chinook salmon, the streams above the lake for spawning (Flagg et al., 2000). Resident fishes including bull trout would have had year-round access into the lake.

The lake has a large and diverse watershed with numerous tributaries, three of which (Cle Elum, Cooper, and Waptus Rivers) contain a large amount of potential spawning habitat for anadromous salmonids and bull trout (Slatick and Park, 2000). Table 2-1 lists the potentially accessible stream habitat by tributary above Cle Elum Lake. Figure 2-1 shows major tributaries above Cle Elum Lake.

Table 2-1. Potentially Accessible Stream Habitat by Tributary above Cle Elum Lake.

Tributary Stream	Potentially Accessible Habitat (miles)	Comments
Cle Elum River	21.6	Steep cascades at RM 9 may impede upstream fish migration
Thorp Creek	0	Barrier cascades and high gradient in lower reach
Cooper River	0.6	Barrier falls
Waptus River	7.2	Impassable falls
Total	**29.4**	

Note: Other tributaries to Cle Elum Lake were considered too small or steep to support migratory fish.

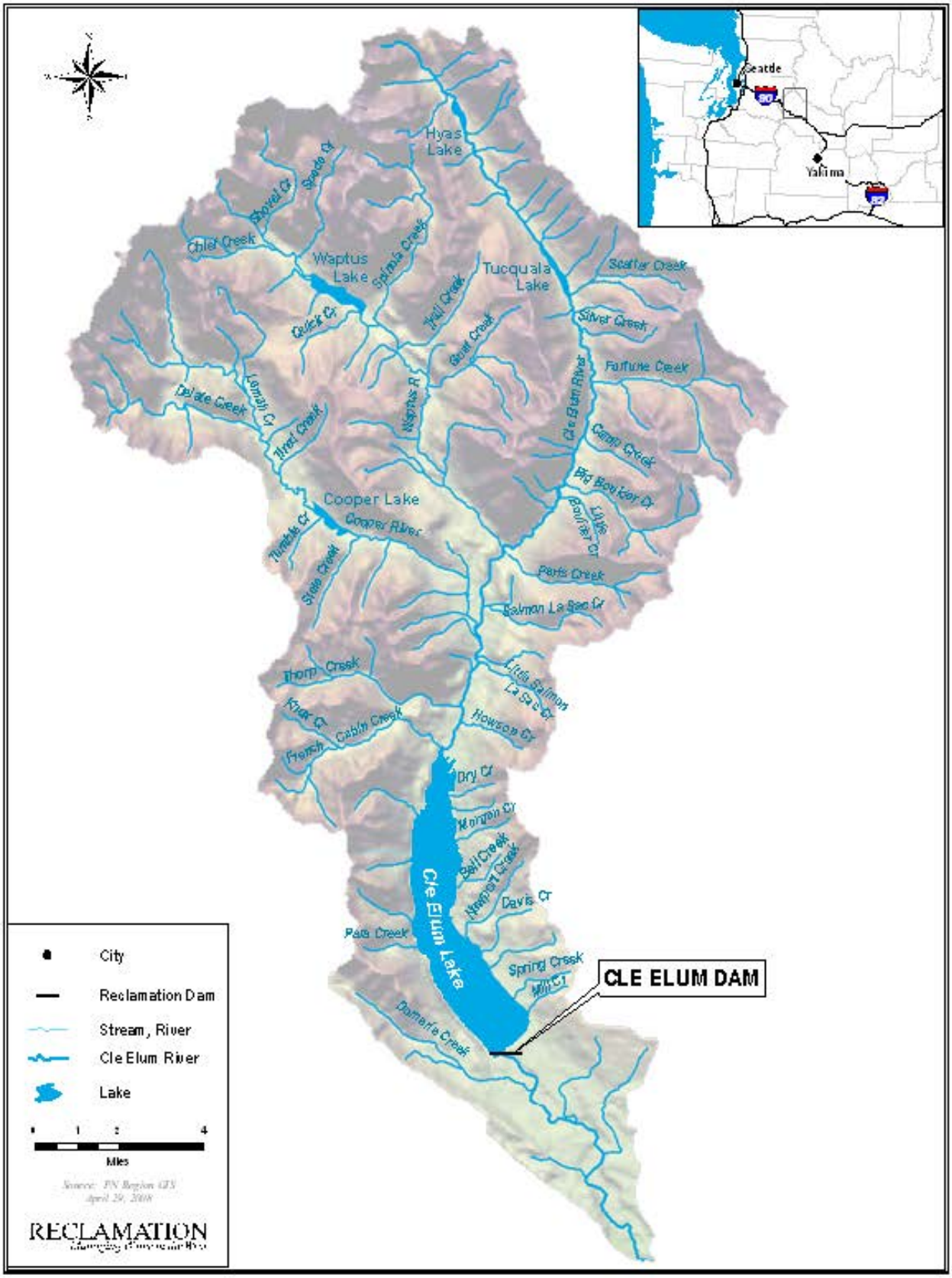


Figure 2-1. Cle Elum River Watershed Above Cle Elum Lake

2.4.2 Limnological Study

A limnological study of Cle Elum Lake was conducted to describe in more detail the physical, chemical, and biological conditions in the lake, to assess primary and secondary production, to determine if the present conditions would support introduced anadromous salmonids, and ultimately to determine to what extent anadromous salmonid fisheries can be restored to the basin. Information obtained in this study was used extensively in assessing sockeye salmon production potential. Reclamation collected information monthly from September 2003 to October 2005 at Cle Elum Lake, except during the winter months. A complete description of the results can be found in Lieberman and Grabowski (2006).

The limnological study indicated that Cle Elum Lake is a relatively unproductive oligotrophic lake with low nutrient levels, chlorophyll *a* concentrations, phytoplankton biovolume, zooplankton densities, and total organic carbon concentrations similar to other lakes that support viable sockeye salmon populations. After salmon are reintroduced and established above Cle Elum Dam, marine-derived nutrients from the returning adults are expected to increase river and lake productivity and benefit the ecosystem. Nutrient enrichment of the lake is a potential short-term method to increase both algal and zooplankton production to improve juvenile fish survival until productivity increases from the infusion of marine-derived nutrients from returning adult salmon. The results of the study also indicate that the range of water temperatures in the lake would be suitable for the diel vertical migrations of juvenile sockeye salmon.

2.4.3 Macroinvertebrate Survey

Reclamation biologists conducted a benthic macroinvertebrate survey at 21 sites in September 2003 and 2004 and in March/April 2004 to assess species composition and standing crop in the watershed above Cle Elum Lake. The abundance and types of aquatic macroinvertebrates associated with the watershed helped in determining the capability of anadromous salmonids to develop self-sustaining populations above the dam. Macroinvertebrate data provided information on habitat quality and information on the potential for survival and growth of juvenile anadromous salmonids. Growth rates of salmonids are often linked to food availability and increased food may result in increased growth rates and ultimately higher survival. Differences in the ability of streams to produce salmonids are often related to food availability rather than physical habitat. Complete details of the survey are reported by Nelson (2005).

The study concluded that macroinvertebrate standing crops in the watershed above Cle Elum Reservoir were low and likely related to regional geology and water quality (e.g., low alkalinity). The data suggested low retention of CPOM in the Cle Elum watershed. To take full advantage of fish passage at Cle Elum Dam, it may be necessary to increase retentiveness of organic matter in the watershed above the reservoir. Increased

retentiveness would also allow for full utilization of salmon carcasses in the system and their contribution of marine-derived nutrients to the ecosystem. Goals to achieve increased CPOM and macroinvertebrate standing crop are achievable (see example of Laitung et al., 2002) and would likely contribute to the success of an anadromous fish passage program.

2.4.4 Other Stream Surveys

Stream surveys conducted by USFS staff biologists from as early as 1991 to current, for the purpose of ongoing habitat assessments, were available. The USFS also collected additional water temperature information in the Cle Elum River at eight locations in July through October 2004, to supplement earlier information. In 2003, the Washington Conservation Corps sampled reaches of the Cle Elum River for bed composition for the USFS. The results of these data collection activities are described in the Biology Appendix (Reclamation, 2008 [Biology Appendix]).

These data supplemented by the limnological and invertebrate information described earlier, formed the basis for estimating the amount of spawning habitat for coho and sockeye salmon and juvenile rearing habitat for coho salmon, to assess production potential in the Cle Elum watershed.

2.5. Interim Juvenile Fish Passage at Cle Elum Dam

Juvenile coho salmon were used to test whether smolts could locate and use an interim juvenile bypass facility constructed on the spillway of Cle Elum Dam. Juvenile coho salmon successfully used the interim bypass facility during releases in 2006, 2007, 2008, and 2009. The preliminary tests of the interim facility indicate the basic concept proposed for downstream passage would work effectively to move fish downstream.

In the early spring of 2005, Reclamation completed construction of the interim (temporary, experimental) downstream juvenile fish passage facility at Cle Elum Dam. The passage features include a stop-logged overflow section and plunge pool installed in the second radial gate bay from the left side of the spillway and a temporary plywood and lumber framed flume built on the existing spillway. Two PIT-tag detectors were installed in the flume. Annual reports document interim passage program results (Reclamation, 2006; Reclamation 2008 [Interim Fish Passage]; Reclamation, 2009 [Interim Fish Passage]; Reclamation, 2010 [Interim Fish Passage]).

Low reservoir levels in 2005 caused by drought conditions precluded the planned release of 10,000 PIT-tagged coho salmon smolts into the reservoir. Instead, many of the fish were released in April at several points downstream from Cle Elum Dam; some fish were held back and used to test the efficiency of the PIT-tag detectors in the interim juvenile fish passage facility. The Yakama Nation released 3,000 PIT-tagged coho salmon parr

into the Cle Elum River near Tucquala Lake 12.9 miles upstream of Cle Elum Reservoir in August 2005. The purpose of this release was to test rearing and overwintering survival, and outmigration in the spring of 2006.

In 2006, Yakama Nation biologists released about 10,000 PIT-tagged coho salmon smolts into the reservoir from a net pen located about ½-mile upstream from the spillway. They also released about 1,000 PIT-tagged coho salmon smolts downstream from the dam as controls and another 1,000 fish directly into the passage facility to check efficiency of the PIT-tag detectors. About 3,000 PIT-tagged coho salmon parr were again released into the Cle Elum River near Tucquala Lake.

Even though the period of operation in 2006 was late in the season and of relatively short duration, 617 PIT-tagged coho salmon smolts were recorded passing through the interim juvenile passage facility. Thirty of these fish were from the group of 3,000 coho salmon parr released in the summer of 2005 at Tucquala Lake. The remaining fish were from the group of 10,000 coho salmon smolts released into the reservoir in late May 2006.

In 2007, Yakama Nation biologists again released about 10,000 PIT-tagged coho salmon smolts into the reservoir. The PIT-tag detectors counted 3,450 of the smolts as they passed through the juvenile passage facility. In addition, another 954 fish from the 2006 releases were counted as they passed through the facility in 2007. This indicated that almost 10 percent of the tagged smolts that were released in 2006 survived and overwintered in the lake. This was an unexpected and encouraging development. Many of the smolts were also detected at downstream locations as they migrated out to sea. About 800 tagged smolts were used to test the efficiency of the PIT-tag detectors, and about 200 fish were used to assess condition and survival of fish after passing through the facility. Several PIT-tagged coho salmon adults from previous year releases were detected as they returned to the Yakima River system in 2007. Nine adults were detected at Prosser Dam.

For the 2008 releases, Yakama Nation biologists tagged approximately 12,000 coho salmon smolts with PIT tags to evaluate downstream passage and survival. The release strategy in 2008 was modified from previous years to include a new strategy of direct releases of smolts into the upper end of the lake along with releases from the net pen. Direct releases were made so that biologists could observe the ability of fish to migrate the entire span of the lake and find the outlet works, mimicking a more natural migration condition.

In April, 5,973 tagged smolts were placed in a net pen (CLN) to be acclimated in the reservoir about ½-mile upstream from the juvenile passage facility. The CLN group was released from the net pen on June 10, 2008. The other 5,944 smolts were released directly into the reservoir (UCL) in April to assure that sufficient numbers of "physiologically-ready" migrant smolts were present to adequately test the facility.

In 2008, 3,072 tags were detected by the PIT-tag readers. Of the tags detected in the flume, 2,021 were from the UCL group, while 1,030 were from the CLN treatment. Four of the tags detected were from coho parr released in Lake Tucquala in 2007; six tag detections were from the 2007 net pen group. An additional 11 tag detections were fish that were double-tagged in 2008. The double-tagged fish were released with the CLN group but were assigned to a separate tag file for subsequent analysis.

For the 2009 releases, Yakama Nation biologists tagged approximately 11,934 coho salmon smolts with PIT tags to evaluate downstream passage and survival. Fish were released from a truck directly in to the Cle Elum River upstream of the reservoir. A total of 316 tags were detected by the PIT tag readers. Of the tags detected, 193 were from fish released in the spring of 2009, while 123 came from fish that were released in the spring of 2008.

In summary, the original intent of the study was to demonstrate that fish released in the reservoir can navigate the lake and find a surface spill route that is releasing water at a flow rate consistent with project operations. The flume has been operated over the past 6 years and has passed fish successfully under a variety of operating conditions. The project also evaluated the health of fish passing through the structure, and found they do not suffer injury during passage. The data collected from the study has confirmed that fish can and will navigate a downstream fish passage facility on their own volition.

2.6. Potential Benefits of Fish Passage

Constructing fish passage facilities at Yakima Project storage dams in combination with successful reintroduction of anadromous salmonids would restore in large part the biological diversity and productivity lost when fish were extirpated from the upper basin lakes and tributaries, resulting in significant ecosystem and cultural benefits. As the reintroduced fish populations build over time, economic benefits would be realized from potential recreational fisheries in the Yakima River basin and contributions to downriver or ocean recreational and commercial fisheries.

2.6.1 Ecosystem Benefits

The reintroduction of anadromous salmonids, particularly coho salmon and sockeye salmon, into historically occupied habitat upstream from Cle Elum Dam is expected to have substantial beneficial effects on stream, lake, and terrestrial ecosystems. Since the Cle Elum River basin supported coho and sockeye salmon historically, it is likely that over time, anadromous salmonid populations would be reestablished as fish passage facilities are installed. The characteristics of the lake are similar to other lakes in the Pacific Northwest, Canada, and Alaska that support viable sockeye salmon populations. Returning adult salmon from restored populations are expected to contribute marine-

derived nutrients to the system and increase river and lake productivity over time. This would benefit resident fish as well.

The infusion of marine-derived nutrients contributed by the carcasses of returning adults is fundamental to ecological restoration of the watershed and is expected to enhance aquatic and terrestrial production, improve the overall trophic status of the ecosystem, and enhance productivity for future production of anadromous salmonids.

The increase of marine-derived nutrients into the system would also benefit ESA-listed bull trout through increased productivity. Further, passage facilities would provide an opportunity for greater connectivity among bull trout populations in the upper basin.

High-elevation lakes that support sockeye salmon production are often oligotrophic, as is the case with Cle Elum Lake. Recent studies using stable isotopes of nitrogen (N) have shown that the annual pulse of marine-derived nutrients from salmon carcasses historically provided substantial energy input into the aquatic ecosystem (e.g., Mathisen et al., 1988; Kline et al., 1990; Bilby et al., 1996) and terrestrial ecosystems. Studies of sediments in various lakes have shown that concentrations of marine isotopes of N have declined when anadromous salmonids were reduced in numbers by fishing activities or blocked from formerly accessible spawning and rearing habitats by dams or water diversions. Some studies estimate that the concentration of marine-derived nutrients currently being returned to inland watersheds in Washington, Oregon, and California has declined to 6 to 7 percent of historical levels (Gresh et al., 2000). In another study (Flagg et al., 2000), phosphorus concentrations in the sediments of Cle Elum Lake decreased to about 19 percent of that prior to the construction on the outlet of the original lake of a timber crib dam that blocked anadromous fish passage after about 1910. Studies have shown that up to 40 percent of the carbon in a coho salmon smolt can come from nutrients derived from decaying carcasses of the previous generation of salmon.

Returning and spawning adult salmon serve as a “nutrient pump” by transporting marine-derived nutrients to tributaries where they provide an energy input into the system. Salmon accumulate greater than 95 percent of their biomass in the ocean, so they can return substantial amounts of nutrients with their corresponding energy content to their natal stream ecosystem. Salmon carcasses provide an organic source of nutrients more directly biologically available to rearing juvenile salmon and benthic macroinvertebrates. This enhances and benefits benthic macroinvertebrate production by providing a direct food source or by increasing the algal food base for invertebrates. Decomposition of the spawned out carcasses releases nutrients to the algae. Juvenile rearing salmon can feed directly on decomposing salmon carcasses or on the benthic macroinvertebrate production enhanced by the nutrients.

These nutrients furthermore enhance productivity at various trophic levels within aquatic food webs, but they may also fertilize riparian vegetation. Recent research has shown

that nutrients contributed by returning adult salmon also influences productivity in the riparian zone through several physical and biological mechanisms (Naiman, et al., 2005). For example, the consumption of salmon by terrestrial piscivores such as birds, mammals, and insects, transfers some of the marine-derived nutrients to riparian and terrestrial areas where it influences growth of vegetation (Helfield and Naiman manuscript submitted). Increased growth of riparian zone vegetation may provide increased shading of the streams that would have an effect on stream water temperature. Over time, the nutrient contribution could result in a greater amount of large woody debris to the stream that would increase stream channel complexity and fish rearing habitat.

2.6.2 Salmon Production Potential

Reclamation estimated the production potential for coho and sockeye salmon that could be supported by the suitable habitat upstream from Cle Elum Lake. These estimates are based on available physical and biological data for lake and tributary habitat conditions. The production estimates assisted in determining the improved harvest opportunities as well as the overall ecosystem benefits associated with construction of the fish passage facilities and implementation of a reintroduction plan.

2.6.2.1. Coho Salmon Production Potential

The estimate of production potential for coho salmon was based on substantial stream survey information from the Wenatchee National Forest, Cle Elum Ranger District staff biologists, literature values for redd size and fecundity, information from an existing coho salmon supplementation program in the Yakima River basin, and additional information on habitat characteristics and limiting factors from various sources. The methods used and the results obtained are described in Reclamation (2007 [Cle Elum Coho]).

The analysis estimated that the Cle Elum River upstream from the lake had 159,160 square meters (m^2) of suitable spawning substrate for coho salmon that could support about 15,000 spawning pairs and produce about 596,817 smolts. This is a maximum estimate and is unlikely to be achieved. An assessment of stream habitat used for overwintering by juvenile coho salmon estimated that about 30,818 smolts could be produced, with the number of returning adults ranging up to about 1,851. A return of 1,600 adult coho salmon to the upper Cle Elum River was determined to be a reasonable estimate, since recent returns to the Yakima River counted at Prosser Dam were as high as 10,248 adults in 2009 (Yakama Nation, unpublished data, 2010).

2.6.2.2. Sockeye Salmon Production Potential

Estimates of sockeye salmon spawning habitat in the upper Cle Elum River were made similarly to that described for coho salmon. Spawning sockeye salmon generally use less

area for a redd than do coho salmon, so the available habitat would support more spawning sockeye salmon. Sockeye salmon juveniles rear in lakes rather than in streams. Details of the methods used and the results obtained are described in Reclamation, 2007 [Cle Elum Sockeye].

The estimated adult sockeye return to Lake Cle Elum ranged from about 30,000 to about 160,000 fish, depending on the assumed production parameters. The spawner-per-hectare method was used to estimate adult sockeye production for Lake Cle Elum. This method assumed 30 spawners per hectare; a median and full pool surface area of 1,515 and 1,948 hectares respectively; a one-to-one sex ratio; a fecundity of 2,700 eggs per female; a 5-percent egg-to-smolt survival rate; and a 1-to-4 percent smolt-to-adult survival rate.

Chapter 3

PLAN FORMULATION

Chapter 3. Plan Formulation

Reclamation considered a number of different fish passage options at Cle Elum Dam. Plan formulation has been an iterative process relying heavily upon the professional expertise and judgment of biologists, engineers, hydrologists, and other team members. Through a collaborative process with the Core Team, the concepts, costs, and perceived benefits of each plan were discussed and decisions made as to which plans should be pursued in detail. The engineers developed conceptual layouts and cost estimates for alternative plans that could provide passage through differing ranges of reservoir pool elevations and differing lengths of fish passage time. The biologists estimated general increases in fish populations associated with passage into currently unoccupied habitat in the Yakima River basin. The following alternatives for Cle Elum Dam were considered:

1. Alternative 1 – No Action

2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam; and

3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam (Preferred Alternative).

For the two action alternatives, the alternative descriptions include construction activities, the typical operations scenario, and operation and maintenance of the facilities.

3.1. Prioritization of Sites

Reclamation completed a Phase I Assessment in 2003 (Reclamation, 2005 [Phase I]) at the five Yakima Project storage dam sites. The purpose of this Assessment was to consolidate and document existing habitat information, evaluate preliminary passage concepts, and prepare appraisal-level cost estimates for passage options. Initial efforts were directed towards the evaluation of the technical feasibility of providing fish passage at Keechelus Dam in light of the SOD reconstruction activities. It was concluded that the Keechelus SOD work would not preclude fish passage options nor increase the cost of constructing fish passage in the future.

During the Phase I Assessment, Reclamation determined that there are a range of options and opportunities for providing fish passage and potentially reestablishing populations of anadromous salmonids in tributaries above all five storage reservoirs. The assessment concluded that some form of upstream and downstream passage for anadromous salmonids and bull trout connectivity is technically possible at all five Yakima Project storage dams. However, construction of fish passage facilities would be much more

expensive at some dams, in relation to available habitat, than at others. Further, the amount and quality of tributary habitat upstream from the reservoirs varied.

Based on information developed for the Phase I Assessment, Cle Elum Dam was identified as one of the two highest priority sites for continued investigation of fish passage feasibility (Bumping Lake Dam was the other). The rationale for selecting this site is explained below.

Cle Elum is the largest reservoir in the Yakima River basin, and has a substantial amount of tributary and mainstem habitat upstream from the reservoir (see Figure 3-1). The habitat is generally in good condition and some is pristine, since much of the watershed lies within the Alpine Lakes Wilderness Area. Considerable research has been completed on the Cle Elum watershed, especially in relation to the restoration of sockeye salmon. The investment required to provide permanent passage in relation to the miles of habitat available is among the lowest of any of the reservoirs in the basin. The YRBWEP Act of 1994 (Title XII, Public Law 103-434) authorized construction of permanent downstream passage facilities at Cle Elum Dam. For this reason, if proven feasible, the downstream passage features could be implemented more quickly than passage at the other dams.

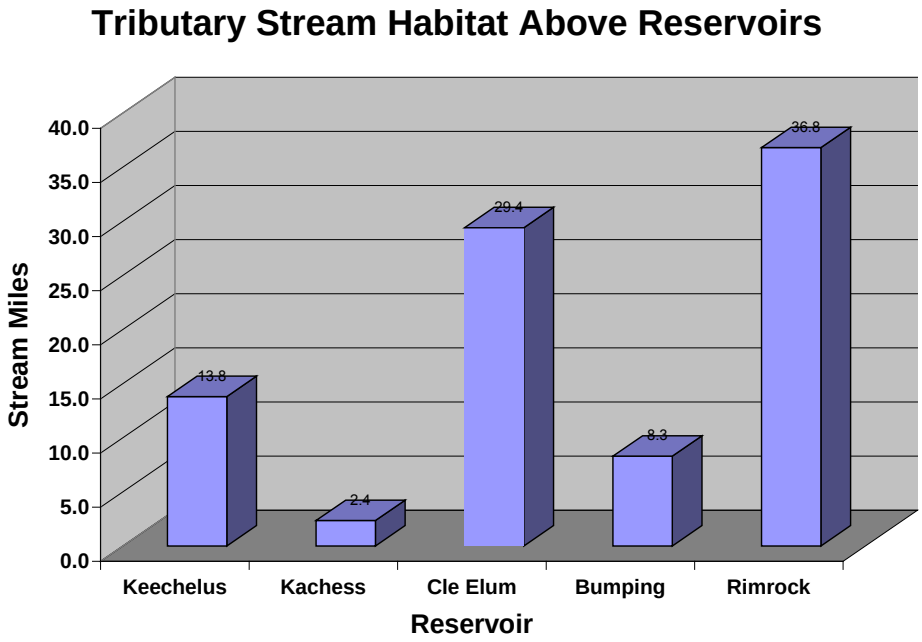


Figure 3-1. Miles of Tributary Stream Habitat Above Reservoirs.

Bumping Lake is a smaller dam and reservoir and smaller watershed. Tributary habitat quantity is about one-fifth of that above Cle Elum Lake (Figure 3-1). However, the small reservoir size in relation to the watershed runoff allows considerable flexibility in operations. The low dam height should also result in less expensive fish passage features,

although the cost per mile of habitat made accessible may be higher than at Cle Elum Dam.

Substantial tributary habitat exists upstream from Rimrock Lake. However, downstream passage at Tieton Dam was determined to be difficult due to its large height and location within a narrow rock canyon.

3.2. Interim Downstream Fish Passage

An interim downstream fish passage facility was constructed at Cle Elum Dam in early spring of 2005 and was an integral part of the feasibility study (see Section 2.5). The most promising (and most cost effective) concepts involve volitional movement of fish with minimal operational requirements. The operation of the interim fish passage facility, coupled with the release of PIT-tagged juvenile coho salmon in the lake and upper river, assisted in evaluating fish movement and behavior in the reservoirs and tributaries, and thus, the feasibility of passage. Installation of temporary experimental passage facilities confirmed that fish can find the entrances to the passage facilities and will volitionally move through them.

3.3. Biological Assessments

Reclamation and the Core Team conducted a number of biological assessments in 2003 through 2007, described in the previous chapter and documented in a *Biology Appendix* (Reclamation, 2008 [Biology Appendix]) and other technical reports. This information assisted the fisheries co-managers in developing goals and objectives for reintroduction and in developing estimates of the capability of establishing self-sustaining populations of anadromous salmonids above Cle Elum Dam. It also helped to quantify potential benefits.

Reintroduction of anadromous fish is essential to achieve the ecosystem objectives and other benefits described in Section 2.6. Concurrent with the engineering design of fish passage facilities, the fisheries co-managers developed an anadromous salmonid reintroduction plan to guide reintroduction efforts above Cle Elum Dam (Reclamation, 2005 [Reintroduction]; Fast and Easterbrooks, 2008). This plan was first issued in February 2005 to assist in the design of interim fish passage facilities at Cle Elum Dam. The plan was updated in 2008 to incorporate additional data generated by modeled analyses and by data collected during interim downstream passage in previous years. Section 2.3.3 described the reintroduction plan's goals and objectives.

In September 2010, Reclamation completed a biological assessment for Middle Columbia River (MCR) steelhead (Reclamation, 2010 [Steelhead]) for NMFS. NMFS issued a "may affect, not likely to adversely affect" determination for the fish passage construction activities; but determined these activities would have "adverse effects" on

Essential Fish Habitat and provided a list of conservation recommendations. Reclamation subsequently agreed to implementation of these conservation recommendations in the construction of the Cle Elum fish passage facilities.

Also in September 2010, Reclamation completed in a biological assessment for bull trout and northern spotted owl (Reclamation, 2010 [Bull trout]) and their designated critical habitats, and the Service issued a determination of "may affect, not likely to affect" for both species and their designated critical habitats.

3.4. Value Planning

In June 2009, Reclamation assembled a Value Planning Team comprised of people with diversity, expertise, and independence to creatively scrutinize the alternatives presented in the Draft Planning Report. As a result, the team developed a *Value Planning Final Report - Cle Elum Dam Fish Passage Facilities* (Reclamation, 2009 [Value Planning]) that examined the component features of the project and defined critical functions, governing criteria, and associated costs. In addition to the Alternative 2 proposal, the Value Planning Report identified six other proposals:

Proposal #1 – Use of spillway as barrier dam and right bank fish facility: Eliminates the barrier dam used to direct upstream migrating fish to the adult trap and collection facility on the left bank and instead rely on the Cle Elum Dam Spillway and the flow from the downstream passage conduit to attract upstream migrating fish to a collection facility on the right bank. When the water surface elevation in the reservoir is below the level for the downstream passage system to be operational, attraction flow is provided by a pump. An additional feature of this proposal is to provide a juvenile sampling facility at the discharge of the downstream passage conduit. Proposal #1 was partially accepted.

Proposal #2 – Install HDPE trash racks instead of steel: Replaces the upstream and downstream passage steel trash racks used in the baseline design with trash racks made of High Density Polyethylene (HDPE). Proposal #2 was fully accepted.

Proposal #3 – Move downstream intake structure to shoreline: Moves the downstream passage intake structure from a location in the reservoir to a new location on the reservoir shoreline. This will eliminate the cellular sheet pile cofferdam and replace it with a smaller earth material cofferdam, eliminate the access bridge, shorten the length of the downstream passage conduit, and change the excavated cut slopes from 3:1 to 1.5:1. It will require the addition of an excavated approach channel to the structure. The design of the intake structure will remain essentially the same. Proposal #3 was partially accepted.

Proposal #4 – Concrete fixed angle wall exclusion weir barrier dam: Replaces the gated barrier dam used on the baseline design with a fixed crest barrier dam. The proposal assumes the fixed crest barrier dam to be designed as a velocity barrier with a sloping concrete apron and a vertical weir wall. Proposal #4 was rejected because a fixed

crest barrier wall will cause flooding of the trap and collection facility during periods of very high flow releases from the spillway.

Proposal #5 – Obermeyer gates across top portion of barrier dam: Replaces the baseline concept of the barrier dam designed with twenty-five over-shot gates and replace it with Obermeyer gates. The Obermeyer gates will be a continuous series of overlapping, pneumatically-operated steel plate gates. Proposal # 5 is withdrawn because acceptance of Proposal # 1 will preclude the acceptance of Proposal # 5.

Proposal #6 – Tunnel through right abutment: Replaces the cut and cover method of constructing the downstream passage conduit with tunneling through the right abutment. The tunnel will follow the same alignment as the conduit in the baseline design. After the tunnel is excavated, a cast-in-place concrete liner would be constructed and any voids around the concrete would be grouted on five foot intervals. Proposal #6 is partially accepted. It is recommended that the tunnel construction of Proposal #6 be further evaluated during the final design phase of this project.

Proposal # 1 and # 3 were combined and are described in this report as Alternative 3- Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam.

3.5. Alternative Plans

The Core Team believes that juvenile and adult fish passage at Cle Elum Dam can help achieve the ecological benefits and function needed to restore anadromous fish populations in the Yakima River basin, or lead to successful reintroduction of species, such as sockeye salmon, that have been extirpated from the basin. Numerous existing Yakima River basin programs currently address habitat improvements, changes in streamflows, reconnecting tributaries, and other actions to promote restoration (these were described in Chapter 2). Alternatives to fish passage at the dam could aid in these ongoing efforts but would fall short of providing the unique benefits gained by allowing passage of anadromous fish into the habitat above the dam. Successful passage and reintroduction of anadromous fish species would bring very important marine-derived nutrients into the headwaters area of tributaries above the dam, thereby benefiting both aquatic and terrestrial wildlife throughout the basin. Fish passage at the dam would also connect isolated populations of bull trout.

Dam removal and major operational changes were not considered to be viable alternatives and were not evaluated. A basic study assumption and constraint is that fish passage operations at the dams must be consistent with other Project operations and not impact existing water delivery contracts, flood control, or instream flow requirements.

3.5.1 Recommended Plan

A number of physical, hydrological, and biological considerations were involved in the development of downstream and upstream fish passage designs. The biological considerations included the species targeted for passage, the periods when fish passage is required, and other issues presented earlier in this report. In 2006, Reclamation's engineers began detailed engineering studies to evaluate the feasibility of providing fish passage at Cle Elum and Bumping Lake dams. The engineering concepts explored in the Phase I Assessment were developed in further detail and reviewed with the Core Team. The Core Team discussed the advantages and disadvantages of the various concepts and selected the downstream and upstream fish passage concepts for Reclamation's engineers to develop feasibility-level designs, cost estimates, and schedules. Throughout the feasibility-level design process, Reclamation engineers reviewed iterations of the design and design criteria (i.e., timing of upstream and downstream fish passage, passage design flows, sizing criteria for holding ponds, pipe velocities) with the Core Team. Adjustments were made to the designs based on these discussions. Engineering design, cost estimates, and schedules for the recommended plan are provided in Chapters 4 and 5.

3.5.1.1. Downstream Passage

The challenge of providing downstream passage at the dam is to be able to provide passage at critical times when fish are migrating downstream. The basic downstream passage concept evaluated would provide surface releases of sufficient volume to attract migrating juvenile fish to an overflow gate leading to a conduit and safely discharging the fish downstream. The fish would enter the fish passage system under their own volition rather than being collected and handled and then transferred downstream.

3.5.1.2. Upstream Passage

An upstream trap-and-haul facility is proposed in lieu of a fish ladder that would need to accommodate reservoir fluctuations in excess of 100 vertical feet at Cle Elum Lake. Trap-and-haul methods for upstream fish passage have been used successfully at other large dams in the Pacific Northwest. Each site would include an angled barrier structure across the river to lead fish into the collection facility. The adult migrants would move volitionally along the barrier structure, into a fish ladder entrance, and up the ladder into a holding area. Fish would be transported by tank truck to the reservoir or upstream tributaries to spawn. The collection facility would also provide an opportunity for biologists to collect information from the returning adults.

Sections 4.2 and 4.3 provide additional information about the proposed alternatives for fish passage facilities at Cle Elum Dam.

3.5.2 Alternative 1 - No Action

The No Action Alternative represents the most likely future expected if permanent fish passage facilities are not constructed at Cle Elum Dam. The impacts and benefits of the action alternatives are measured against the No Action Alternative. Under the No Action Alternative, Reclamation would not modify Cle Elum Dam or its features to include fish passage facilities and the interim fish passage facilities would be removed. The interim facilities only provide juvenile passage. In accordance with the Mitigation Agreement, Reclamation would work with WDFW to identify an as-yet-undetermined alternative to permanent fish facilities that might allow fish reintroduction.

3.6. Risk Assessment

Reclamation's SOD program uses a risk assessment technique as a primary tool to ensure that Reclamation dams are operated in a manner that minimizes risks to downstream human populations. Reclamation policy requires a risk analysis before any modification to a dam or any of its features occurs or before a potentially significant change in operation of a reservoir is proposed. Reclamation conducted risk assessments to analyze potential changes in risk of failure associated with modification to Cle Elum Dam and its features from the addition of the fish passage facilities (see Reclamation, 2007 [Geotechnical]).

The analysis concluded that the proposed modifications for fish passage pose very small to minimal additional risks, assuming all construction and design assumptions are implemented.

The magnitude of the risks is below guidelines levels. The recommended plan described in this Study reflects the assumptions used in the risk assessment. The assessment did not consider risks associated with construction of the facilities, but evaluated potential risks assuming the facilities were in place.

3.7. Design, Estimating, and Construction Review

A Design, Estimating, and Construction (DEC) review of draft feasibility-level design and costs estimates for the recommended fish passage plan occurred in December 2007 (Reclamation, 2008 [DEC Review]). A DEC review consists of an oversight review by an independent expert team convened by Reclamation to ensure that cost estimates are appropriate, that there are no major technical flaws, and that project risks and uncertainties are identified and addressed. Reclamation made some modifications to the feasibility-grade designs and cost estimates to address recommendations from the DEC review. These revisions are reflected in the designs and cost estimates presented in Chapters 4 and 5 in this report.

Chapter 4

PROPOSED FISH PASSAGE FACILITIES

Chapter 4. Proposed Fish Passage Facilities

The following sections describe the recommended plan to construct upstream and downstream fish passage facilities at Cle Elum Dam. An overview of the existing facilities is also provided. The *Designs and Estimates Appendix* (Reclamation, 2008 [D&E Appendix]) provides detailed descriptions and drawings of the facilities proposed. A Supplement to the Designs & Estimates Appendix (Reclamation, 2011) has been prepared, which includes feasibility-level designs and cost estimates for Alternative 3.

4.1. Existing Facilities

The Yakima Project has five major storage reservoirs (Clear Lake is a minor facility) with a total storage capacity of a little over 1 million acre feet (MAF); total yearly runoff passing through the storage reservoir system averages 1.71 MAF. Table 4-1 summarizes the system storage capacity and average annual runoff for these Project storage facilities.

Table 4-1. System Storage Capacity and Average Annual Runoff on September 30 (period of record 1920-1999)

Reservoir	Drainage area ($mi.^2$)	Capacity (acre-feet)	Avg. Annual Runoff (acre-feet)	Ratio of Avg. Runoff to Capacity	September 30 Historical Storage (acre-feet)		
					Minimum	Average	Maximum
Keechelus	54.7	157,800	244,764	1.5:1	4,800	40,500	126,900
Kachess	63.6	239,000	213,398	0.9:1	20,100	107,200	227,200
Cle Elum	203.0	436,900	672,200	1.5:1	12,900	118,000	359,500
Bumping	70.7	33,970	209,492	6.2:1	2,400	7,900	24,600
Rimrock	187.0	198,000	367,966	1.8:1	200	74,500	145,100
System	579.0	1,065,400	1,707,820	1.6:1	51,700	357,500	660,200

4.1.1 Cle Elum Dam and Reservoir

Cle Elum Dam was completed in 1933 and is located at the lower end of a natural lake at RM 8.2 on the Cle Elum River, 8 miles northwest of the city of Cle Elum, Washington. The earthfill dam includes the main Cle Elum Dam, a dike adjacent to the left abutment of the dam, and three small saddle dikes. The dam has a maximum structural height of 165 feet and a crest length of 1,800 feet including the main dike. The earthfill dam forms a reservoir with a capacity of 436,900 acre-feet, with 427,930 acre-feet available for use. Cle Elum Reservoir has the largest storage capacity and average annual runoff in the Yakima River basin.

Cle Elum Dam is equipped with a gated spillway (sill elevation 2223.00) with capacity of 40,000 cubic feet per second (ft^3/s) at reservoir elevation 2240. The spillway consists of radial gates and a concrete-lined open channel in the right abutment. The outlet works consist of a gated control tower and a reinforced concrete conduit through the right abutment of the dam.

4.1.2 Project Operations

The five Project reservoirs are operated in a coordinated manner to provide for the needs of the system as a whole. The releases from each reservoir are balanced to meet system-wide irrigation and water demands in conjunction with natural runoff and return flow available in the basin. No single reservoir is designated to supply the needs of one particular area, irrigation district, or Project division. The major storage facilities store runoff during the winter and spring/summer seasons. This water is released later during low-flow periods in the summer and fall seasons for irrigation.

Operational releases at Cle Elum, Bumping Lake, and Keechelus dams are affected by the presence of Chinook salmon redds in the Cle Elum, Bumping, and upper Yakima rivers, respectively, downstream of the dams. About 12 percent of the spring Chinook salmon redds in the Upper Yakima River basin were found in the Cle Elum River in recent years, while about 50 percent of the redds were found in the Yakima River reach upstream from the mouth of the Cle Elum River to Easton Diversion Dam. The presence of redds downstream results in conflicting needs for the operational releases from the reservoirs.

Reclamation makes efforts to reduce impacts of Project operations on the fishery resources and to provide for appropriate water flows, while at the same time providing water for irrigation purposes. Reclamation implements three atypical operational strategies beginning in late August each year. These are “Flip-Flop,” “Mini Flip-Flop,” and “KRD Canal Bypass” and are described below. Each of these operational schemes is designed to balance the need for irrigation water delivery with the protection of spring Chinook salmon redds in the upper arm of the Yakima River above Roza Dam.

Flip-Flop – Flip-Flop operation meets Lower Yakima basin irrigation demands (below the confluence of the Naches River) primarily from upper mainstem Yakima River (above Roza Dam) storage during the summer months and then reduces flows in the upper mainstem Yakima River during the latter part of the irrigation season. Late-season Lower Yakima basin demands are then met primarily from Rimrock Lake on the Naches River arm. The purpose of the Flip-Flop operation is to encourage spring Chinook salmon in the upper mainstem Yakima River above Roza Dam to spawn at lower river stage levels. This minimizes the river flows (and storage releases) required to keep the redds watered and protected during the subsequent incubation period (November through March).

Mini Flip-Flop – In years of sufficient water supply, heavier releases are made from Keechelus during June, July, and August to meet upper mainstem Yakima River above Roza Dam demands; Keechelus releases are reduced in September and October to provide suitable spawning flow in the Yakima River reach from Keechelus to the upper end of Lake Easton. This minimizes the river flows (and Keechelus storage releases) required to keep the redds watered and protected during the subsequent incubation period (November through March).

Kittitas Reclamation District (KRD) Canal Bypass – The operation uses storage upstream from Easton Diversion Dam to supply some of the irrigation diversion demand in the lower Kittitas/Ellensburg valley, Roza Irrigation District, and flow demands below Roza Diversion Dam while maintaining target spawning flows in the Easton reach of the Yakima River. Flows are bypassed through the KRD canal beginning about September 1 and continuing to about mid-October when KRD's irrigation season ends. This allows the target flow below Easton Diversion Dam (about 200 ft^3/s) to be maintained while releases from Keechelus Lake and Kachess Lake totaling about 1,450 ft^3/s are continued for downstream demand.

4.1.3 Cle Elum Dam and Reservoir Operations

Cle Elum Lake is operated to meet irrigation demands, flood control, and instream flows for fish. The prime flood control season extends from mid-November through mid-June. Cle Elum Lake regulates about 20 percent of the entire runoff above Parker gage (RM 103.7). With the largest storage capacity in the Yakima River basin, it is the main resource for meeting the large irrigation demands in the lower Yakima River basin.

Cle Elum releases are greatest in July and August in order to meet most of the Lower Yakima River basin diversion demands during these months. Late season irrigation demands (mid-September) are met primarily from Rimrock Lake. The 2,863-ft^3/s summer release from Cle Elum is reduced during the Flip-Flop operation to a minimum flow range of 200 to 300 ft^3/s to support both spawning and irrigation demands on the upper Yakima River basin system. This allows Reclamation to meet a target flow range (200 to 300 ft^3/s) in the Cle Elum River during winter for spring Chinook salmon incubation and early rearing. Average monthly releases at Cle Elum Dam for the mean, maximum, minimum, and 93 percent and 7 percent exceedances are shown in Figure 4-1 for the 1981 to 2007 period of record.

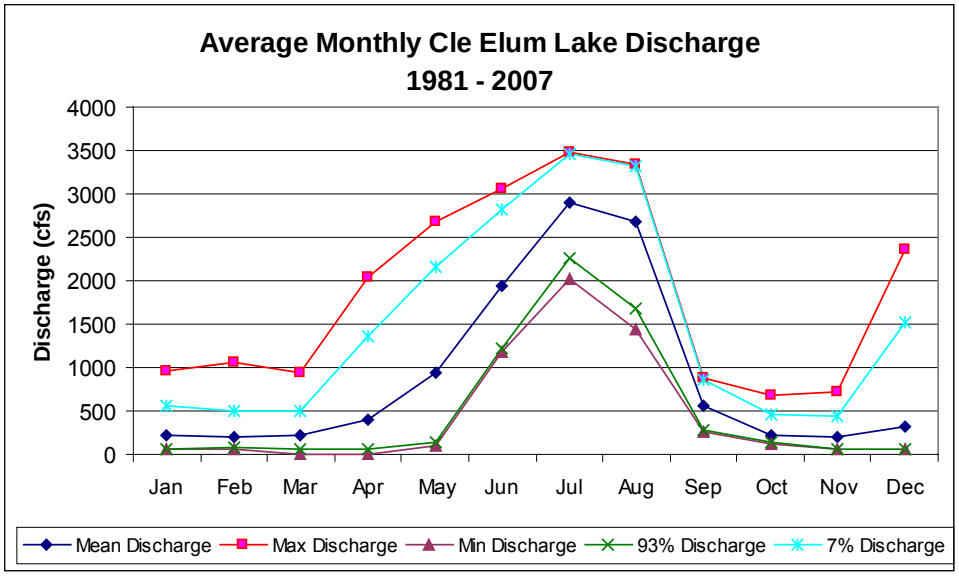


Figure 4-1. Average Monthly Cle Elum Lake Discharge

The reservoir typically reaches its lowest elevation in September or October when the irrigation season ends. In the winter months, water is released to meet downstream demands and to maintain flood control space. In the spring, water is stored in the reservoir to regulate downstream flows for flood control and to store water for irrigation demands later in the year. The highest reservoir elevations generally occur in the May to July period depending on the annual water supply. Full pool is at elevation 2240 feet. Figure 4-2 shows the average monthly reservoir elevations for mean, maximum, minimum, and 93 and 7 percent exceedances for the 1981 to 2007 period of record.

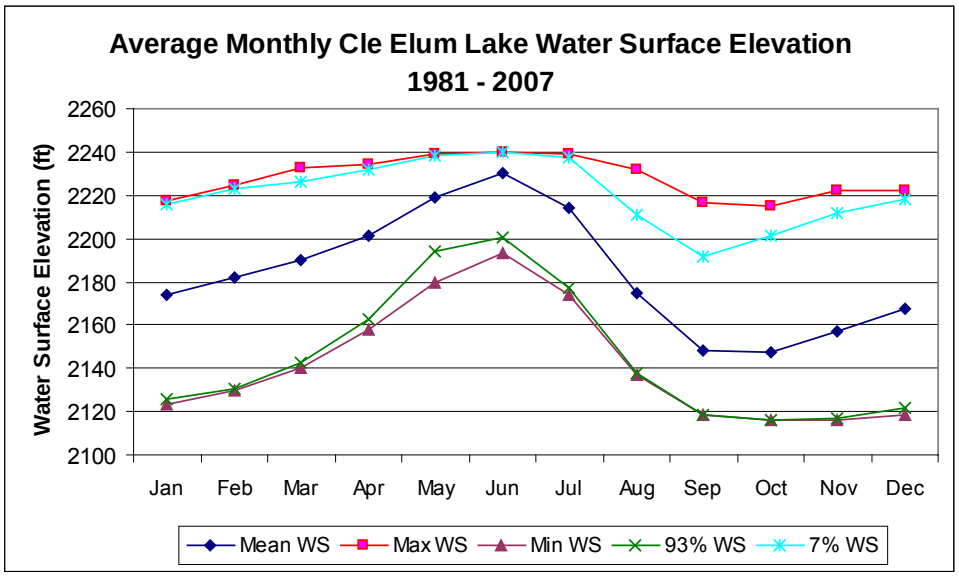


Figure 4-2. Average Monthly Cle Elum Lake Water Surface Elevation.

In order to perform maintenance on the outlet works gates, the upstream guard gates must be closed. To perform work in the outlet conduit, the main gates must be closed. Either action allows no flow into the river downstream. Therefore, the required maintenance on the main gates is attempted only when the lake is above spillway crest (elevation 2223); otherwise, pumping is necessary to maintain downstream flows. Maintenance of the guard gates must be done when the reservoir is below elevation 2120.5 or lower than the top of the outlet intake structure and would require pumping. The ramping rate for operations is 2 inches per hour as measured at the first gage downstream from the dam. (The proposed fish passage facility could provide an auxiliary outlet.)

4.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

Alternative 2 includes the construction of facilities for downstream juvenile fish passage and upstream adult fish passage. The downstream fish passage facilities are intended to allow fish produced or released into the Cle Elum basin to pass the dam and migrate to the ocean. Because Cle Elum Reservoir is an active irrigation facility, design of the downstream passage facilities must account for fluctuating reservoir levels during juvenile migration periods. The upstream fish passage facilities are intended to allow adult salmonids returning from the ocean to pass Cle Elum Dam to spawn in the tributaries to the reservoir.

The main features of the downstream fish facility include:

- Multilevel intake structure, and
- Juvenile fish bypass conduit.

The upstream fish passage facility would include the following features:

- Barrier dam; and
- Fish ladder and adult collection facility.

In addition to describing these facilities, the following sections discuss:

- Construction activities,
- Typical annual operation scenario, and
- Operation and maintenance activities.

Figure 4-3 shows the site plan for the upstream and downstream fish passage facilities under Alternative 2. Section 4.4. summarizes and compares the major features for Alternatives 2 and 3.

4.2.1 Downstream Fish Passage

The downstream fish passage facility would release 100 to 400 cubic feet per second (ft^3/s) of surface water to attract migrating juvenile and adult fish (i.e., adult bull trout and steelhead kelts) to an intake structure. It is anticipated that all juvenile fish and adult bull trout and steelhead kelts would use the intake. From the intake structure, fish would move into a 7-foot-diameter conduit (pipe) through the right abutment of the dam that would discharge fish safely into the spillway stilling basin below the dam. The fish would enter the fish passage system voluntarily rather than being collected and transferred downstream.

All land required for construction and operation of the proposed downstream fish passage features is federally owned either by Reclamation or located within the Wenatchee National Forest.

4.2.1.1. Multilevel Intake Structure

The intake structure, located 500 feet upstream of the spillway inlet channel, would consist of a rectangular concrete tower with five multilevel intake overflow gates. Figure 4-4 provides a front view and interior view of the intake structure. The overflow gates within the intake structure would release flows for fish passage at any time the reservoir water surface elevation is between 2,190 feet and 2,240 feet (full pool).

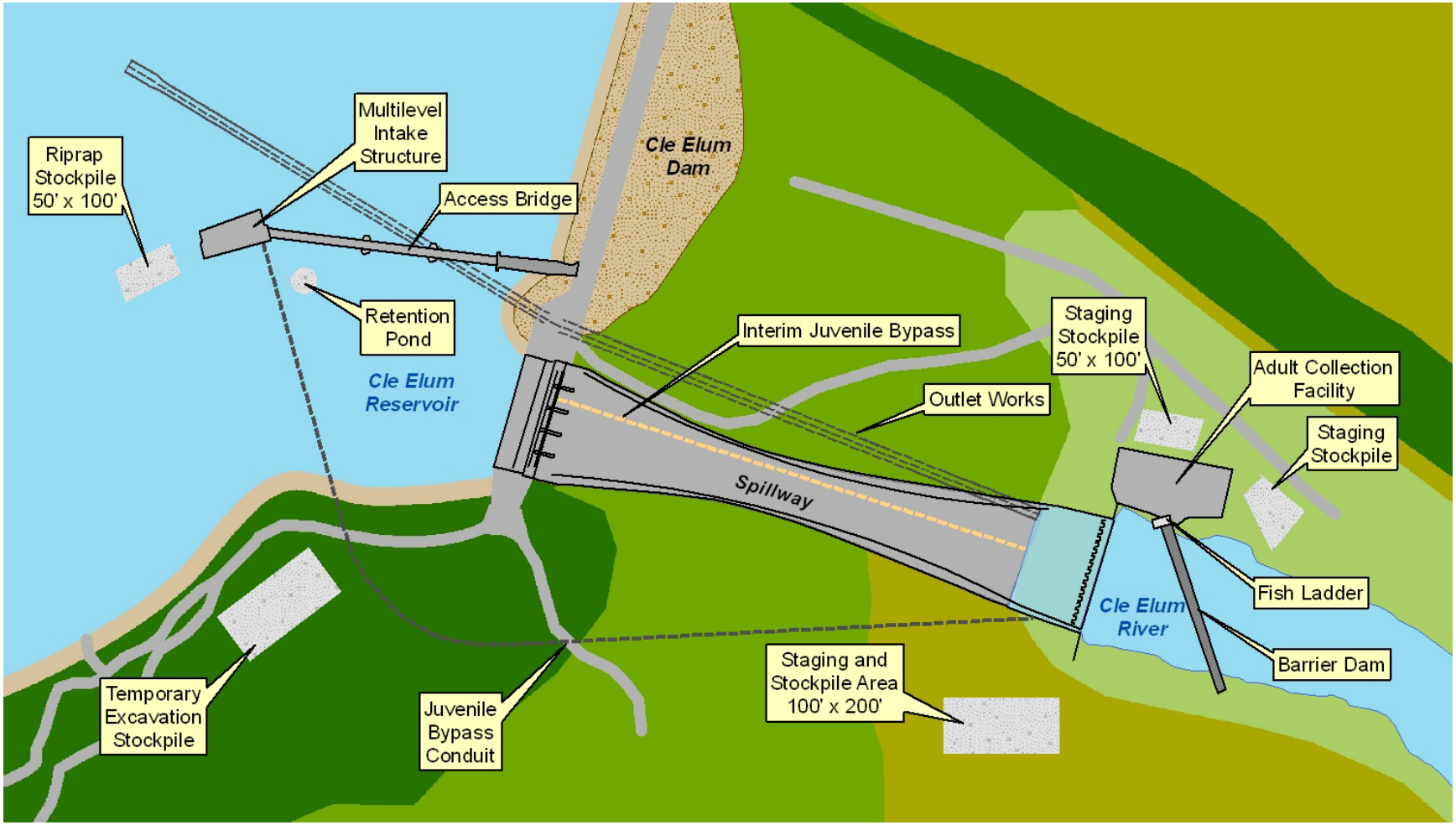


Figure 4-3. Alternative 2 - upstream and downstream fish passage facilities

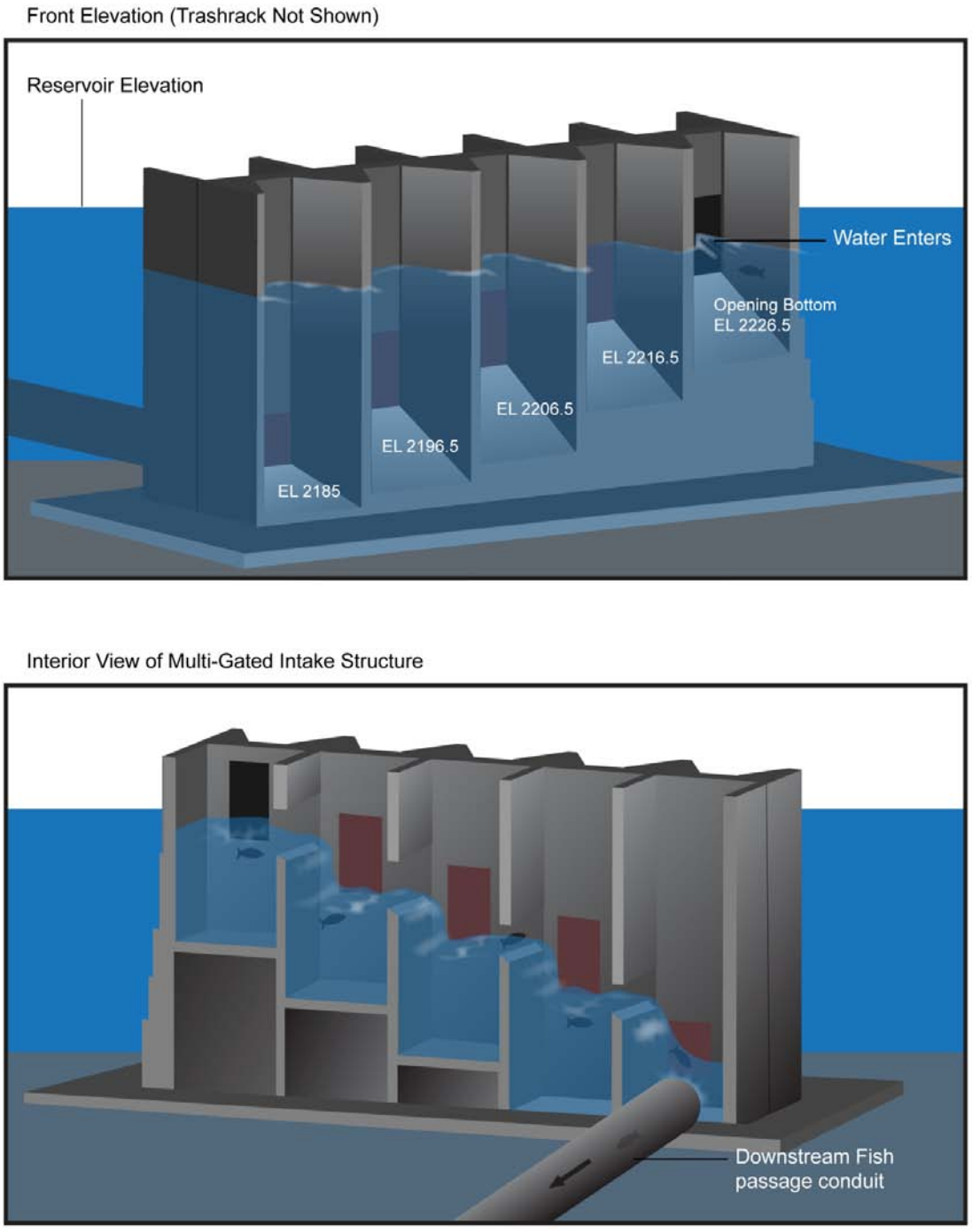


Figure 4-4. Cle Elum intake structure

Overflow gates would provide surface release flows to attract fish from the reservoir into the intake structure. To protect the fish from injury, flows would be dissipated over as many as five weirs, depending on surface water elevation. The weirs and pools would control the potential drop at all times and would permit open channel flow in the juvenile bypass conduit.

A trashrack with 1-foot bar spacing would be installed on the upstream side of the overflow gates to allow juvenile fish to easily pass through the openings. However, larger debris would be blocked from entering the structure. An automated trashrake system would be installed to remove the accumulated debris.

In order for maintenance personnel to access the intake structure within the reservoir, a bridge would be constructed from the crest of the dam and extend 500 feet out to the intake structure. The bridge would have two concrete piers and a 150-foot-long earthen approach ramp armored with rock that would extend from the crest of the dam to the bridge abutment.

4.2.1.2. Juvenile Fish Bypass Conduit

A reinforced concrete juvenile bypass conduit would be installed to carry passage flows from the upstream intake structure to discharge fish into the downstream spillway stilling basin (Figure 4-3).

The underground juvenile bypass conduit would be 1,520 feet in length with a 7-foot inside diameter. It would be gravity flow with a maximum design open channel flow of about 400 ft^3/s. At the end of the conduit section, the bypass transitions over a 20-foot length from a round section to a 7-foot-wide by 7-foot-high rectangular open flume at the downstream end. The conduit would narrow to a 4-foot-wide section extending down a steep slope and flatten out before discharging at the base of the existing stilling basin wall below the dam. The transition from the conduit to the rectangular flume extends another 300 feet to the exit in the river. The total bypass system is approximately 1,800 feet long.

In order to install the conduit, a trench would be excavated and concrete poured to form the walls of the conduit. When the concrete is cured, the trench would be backfilled with the excavated material. The depth of cut would vary from 20 to 75 feet with a 15-foot-wide working space at the invert 3:1 side slopes. The juvenile bypass conduit would pass through the right embankment of the dam.

4.2.2 Upstream Fish Passage

The upstream adult fish passage facility would include a barrier dam, a fish ladder, and a collection facility. The barrier dam and collection facility would be located about 150 feet downstream from the spillway stilling basin. The collection facility would be located on the left bank of the river as shown in Figure 4-3.

4.2.2.1. Barrier Dam

A vertical-drop hydraulic barrier structure, about 300 feet long and controlled by overshot weir gates, would span the width of the Cle Elum River approximately 100 feet

downstream from the spillway stilling basin and the juvenile bypass conduit outlet. The barrier would be oriented to the river flow at a 55-degree angle. This angle is intended to create attraction flow to guide fish to the fish ladder entrance. When the collection facility is not in use, the adjustable overshot weir gates would be in their fully-down position.

4.2.2.2. Ladder and Adult Collection Facility

At the fish ladder and adult collection facility, migrating adults would be attracted to the ladder entrance by the auxiliary water flow and then swim up the ladder into the adult fish collection facility (Figure 4-3). Ladder flows of up to 6 ft^3/s would be supplied by the collection facility supply pump and/or gravity flow. The ladder itself would have a series of 12 pools, each 8 feet long by 4 feet wide by 4 feet deep.

The adult fish collection facility would consist of a building to enclose an adult holding tank, fish lock, and fish handling and sorting equipment. The facility would be similar to the existing collection facility at Roza Diversion Dam on the Yakima River (Figure 4-5).

Figure 4-5. View of exterior of Roza adult fish collection facility (top left); pool and weir-type fish ladder (top right); fish chute to work area or back to river (middle left); fish lock (middle right); and adult holding tank (bottom, right)

Fish hauling would be required in order for adult fish to access upstream locations. Fish would be collected daily from the facility and transported by a hatchery truck to locations in and around the upper reservoir or upstream tributaries. Fish transport would be conducted by WDFW and the Yakama Nation as part of its fish reintroduction project.

4.2.3 Construction Activities

Construction of the fish passage facilities is expected to be completed over three construction seasons. Table 4-2 shows the proposed schedule for constructing the different elements of the fish passage facilities. Construction would occur from April 15 to November 30 for 3 years. Most of the work is scheduled for fall when reservoir levels would be low from normal seasonal drawdown. The following roads would be used to access the project site. Proposed improvements are identified where appropriate. The proposed roads and improvements are shown in Figure 4-6.

- Existing two-lane paved road connecting to SR-903 which provides access to the left abutment of the dam.

- Improvements to a gravel access road, 1,800 feet east of the dam, to the fish collection site and left side of the barrier dam. Improvements would include widening and grading of a new road alignment. The road would be used later for operation and maintenance of the adult collection facility.

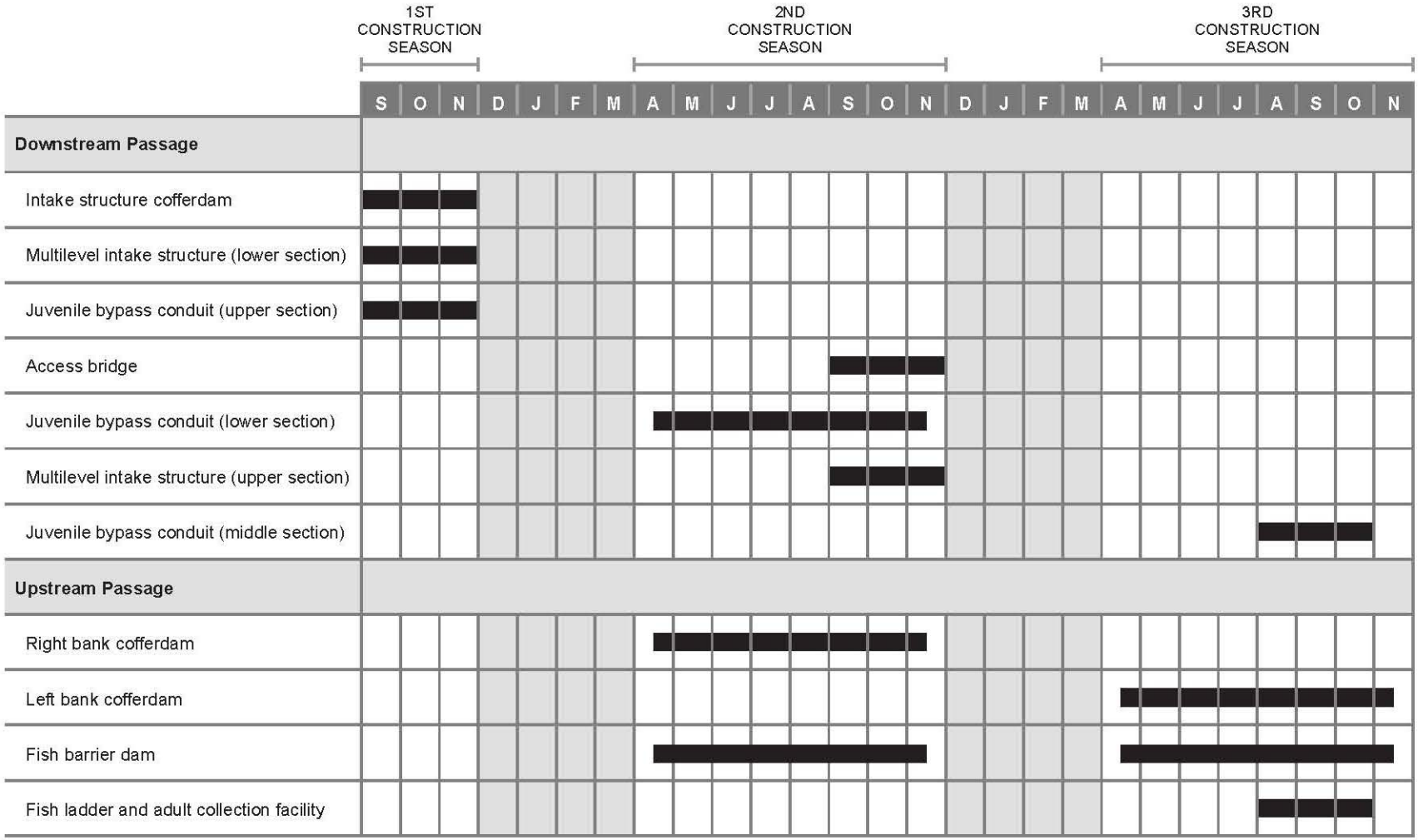
- Construction of a temporary access road from the new county road, 1 mile downstream from the dam to the right abutment and then onto the lakebed to the cofferdam site for the intake structure. This road would be removed when construction is completed.

In addition, Kittitas County plans to construct a new county road and bridge across the Cle Elum River approximately 1 mile downstream from the spillway. The bridge is being built to improve access to new housing in the area. The county is awaiting funding for the bridge project and does not yet have a schedule for construction. If the bridge is complete prior to construction of the fish passage facilities, Reclamation may make use of the bridge for some construction activities, but it is not currently part of the construction access.

Two staging areas and stockpiles would be required for downstream passage. These are shown on Figure 4-3. One would be located near the intake on the lakebed (riprap stockpile). The second would be at the top right abutment of the dam (temporary excavation stockpile).

Three staging areas and stockpiles would be required for the upstream passage (see Figure 4-3). One would be located on the left bank downstream from the spillway stilling basin adjacent to the adult collection facility; the second would be on the left bank immediately across from the bottom of the spillway between the spillway and the new access road; and the third would be on the right bank across from the bottom of the spillway and stilling basin.

Table 4-2. Construction schedule for Alternative 2



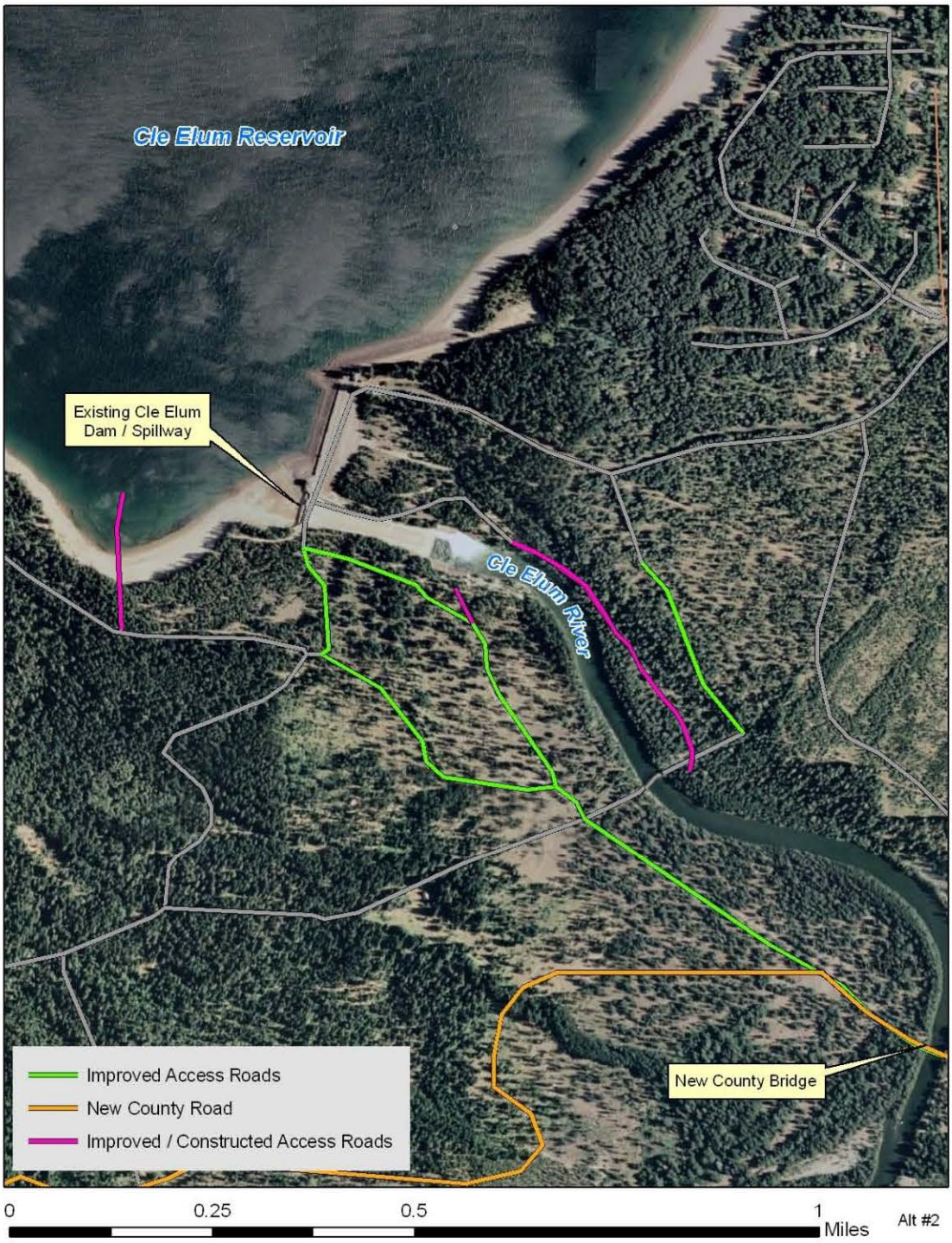


Figure 4-6. Proposed roads and road improvements for Alternative 2

Two cofferdams would be needed, one each for downstream and upstream construction activities. For construction activities associated with the downstream fish passage facilities, a cellular sheet pile cofferdam would be constructed approximately 500 feet upstream of the dam within the reservoir bed to allow for dewatering of the construction area around the intake structure. For construction activities associated with upstream fish passage facilities, a 12-foot-high cofferdam would be required immediately downstream from the stilling basin to allow for dewatering of the construction area for the barrier dam and fish ladder. The cofferdam would be formed by a combination of large sandbags and gravel.

Power to operate equipment such as roller gates and gantries (cranes that raise and lower the gates) would be provided by connecting to the power supply at the existing gatehouse control building. A new 600-foot-long cable would be installed along the dam from the gatehouse to the access bridge. At the bridge, a cable would be attached to the girders out to the intake structure. Power to operate the trashrake would still be within the capacity of the existing power supply. Power to the adult collection facility and fish ladder would be routed from the gate house and down the face of the dam to these facilities.

The three-phase power supply to serve the barrier dam and the adult collection facility would extend approximately 1,000 feet from the existing gatehouse control building and be routed down the face of the dam.

The field cost of fish passage facilities at Cle Elum Dam for Alternative 2 is estimated at $81.0 million (2008 dollars). Adding noncontract costs of $15.0 million brings the total construction cost of Alternative 2 to $96 million. Average annual OMR&P costs for the Cle Elum Dam fish passage facilities were estimated at $300,000.

4.2.4 Typical Annual Operation Scenario

The following sections describe how the fish passage facilities would be operated on an annual basis. Existing reservoir operations are described in Section 4.2.2 of the FEIS. The fish passage facilities will require that the outlet works of the dam would be operated differently. However, the new facilities would not affect overall water operations. All fish passage facilities have been designed to ensure no changes to current reservoir operations, TWSA, or existing Reclamation contracts.

4.2.4.1. Typical Annual Operations Scenario - Downstream Fish Passage Facilities

Downstream fish passage would be provided from mid-March to mid-August (average year). The multilevel intake structure would allow fish passage between elevations 2,190 feet to 2,240 feet (full pool). In mid-March (average year) as the reservoir fills and

reaches an elevation 2,190 feet, smolts will be able to access the intake tower when they are ready to migrate, but the reservoir is still well below spillway elevation. Then, as the reservoir is drawn down below 2,190 feet in the summer to meet irrigation demand, the intake structure will become nonfunctional. It would also allow passage during years when the reservoir does not completely fill. Table 4-3 shows the percent of time when the spillway and intake structure would be accessible for outmigration period (March 15 to June 15) for the 1981 to 2009 period of record. Figure 4-8 shows the daily pool elevation in relation to the minimum pool elevation required to allow the intake structure and spillway to function as well as their functional time periods in relation to the same time period. The intake structure on average would provide passage over the entire smolt outmigration period 76 to 81 percent of the time compared to 35 to 42 percent for the spillway depending on the water year type (Table 4-3 and Figure 4-7). Even in the worst year of 2001, smolt passage would be available for 22 percent of the March 15 to June 15 smolt outmigration period.

Table 4-3. Comparison of smolt passage provided by the proposed juvenile bypass facility and the spillway from March 15 to June 15 for dry, average, and wet water years at Cle Elum Reservoir

Water Year Type	Intake Structure (2,190 ft min)	Spillway (2,223 ft min)
Dry (n=5)	76%	35%
Average (n=17)	81%	42%
Wet (n=7)	78%	37%

The juvenile passage facility would provide surface releases of fish passage flows in the range of 100 to 400 ft^3/s. A minimum discharge of 100 ft^3/s through the existing outlet gate is necessary to prevent potential cavitation[2] at lower releases, while the remaining minimum flow of 100 ft^3/s through the intake structure would be required to meet the approximate 200 ft^3/s minimum flow requirement downstream from Cle Elum Dam to protect Chinook salmon redds. As reservoir releases are increased to meet downstream irrigation demands, the juvenile fish passage releases would be increased from 100 to 400 ft^3/s. For example, if the downstream irrigation demand required a reservoir release of 1500 ft^3/s, 1,100 ft^3/s would be released through the outlet works and 400 ft^3/s through the intake structure.

Fish passage operations would be integrated into existing project demands and would not impact existing water delivery contracts, TWSA, or flood control operations. Daily reservoir releases to meet irrigation and/or instream flow demand would be the combined flows through the outlet works plus the juvenile bypass conduit. Water for the upstream passage facility would be provided from the stilling basin by a combination of a pump and gravity flow provided by the barrier dam. The pumped and/or gravity flow would be recirculated to the stilling basin at the adult fish ladder entrance.

[2] Cavitation occurs when bubbles form around pump systems. Pressure from the bubbles can cause damage to equipment.

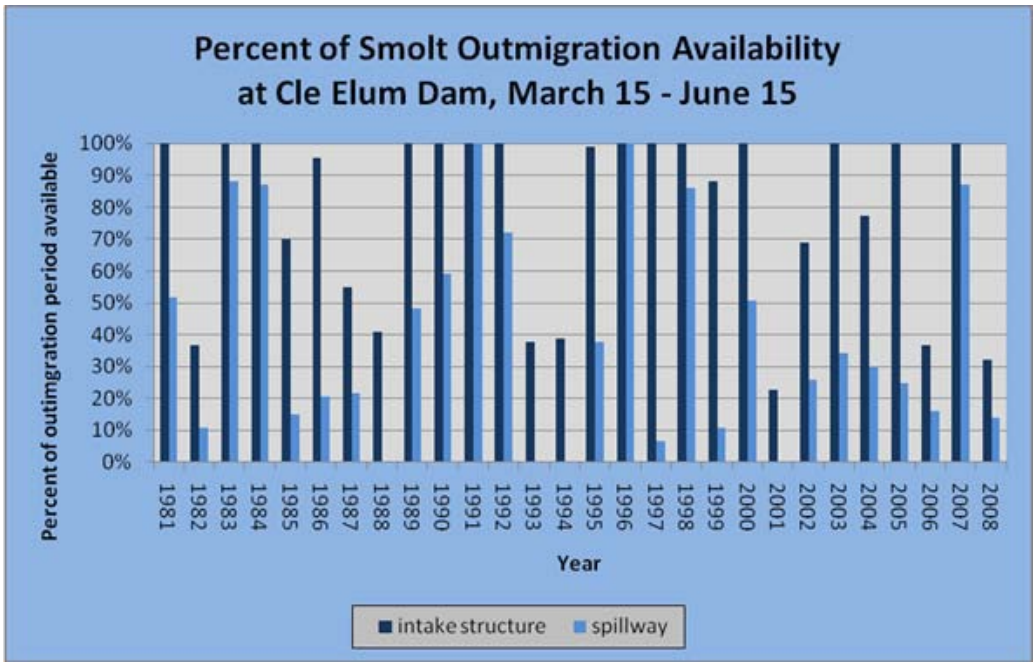


Figure 4-7. Percent accessibility during the March 15 – June 15 smolt outmigration period for the spillway (light blue bar) and the intake structure (dark blue bar) for the period of record 1981-2009

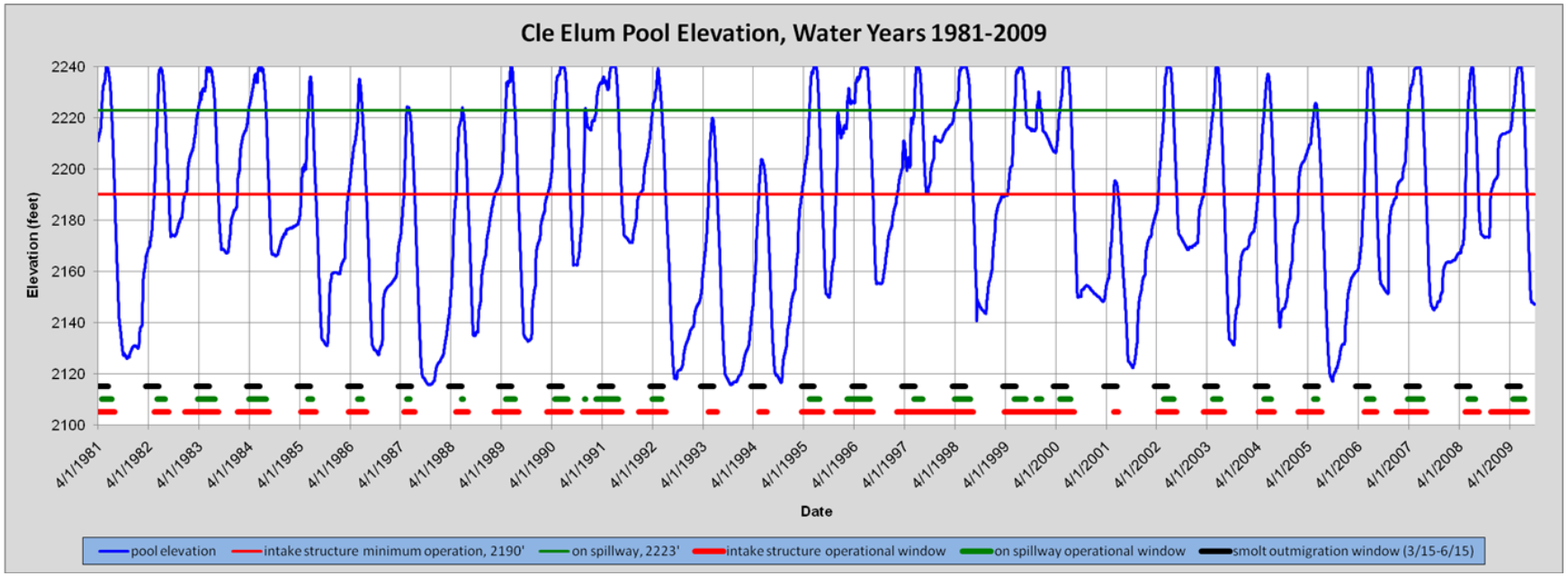


Figure 4-8. Daily reservoir elevation and the minimum reservoir elevation required to operate the spillway (green line) and the intake structure (red line) in relation to the smolt outmigration period of March 15 – June 15 for the period of record 1981-2009

4.2.4.2. Typical Annual Operation Scenario – Upstream Fish Passage Facilities

The barrier dam and adult collection facility would be operated from mid-March to late December. Peak upstream movement of adult salmon would be expected from June through November.

The adjustable gates on the barrier dam would be operated in a fully-upright position during normal operations, and would provide a 10- to 12-foot vertical hydraulic drop to prevent upstream passage beyond the collection facility. This would raise the tailwater elevation upstream of the barrier dam by 10 to 12 feet under normal operations, which would increase by 10 to 12 feet the amount of head exerted on the outlet works. This additional head would, in turn, reduce the discharge capacity of the outlet works; however, the loss in outlet works discharge capacity would be offset by the additional discharge capacity of up to 400 ft^3/s from the juvenile bypass conduit. If additional outlet works discharge capacity were required, the adjustable barrier gates could be lowered to reduce the tailwater surface elevation upstream of the barrier dam and on the outlet works.

This increase in the tailwater elevation at the base of the spillway would not impact spillway operations. When river flows exceed about 6,500 ft^3/s, the adjustable barrier gates would be lowered. This action would prevent the tailwater elevation upstream of the barrier dam from spilling out and flooding the area where the adult collection facility would be located.

Adult fish would be guided by the angled barrier dam to the fish ladder entrance, and from there continue up the ladder and enter the adult collection tank. Biologists would measure, weigh, examine, take scale and other samples, and mark the fish as needed for monitoring and evaluation purposes. Fish would be transported on a daily basis (or more frequently during peak migration) in trucks and released in the reservoir or upstream tributaries (see Chapter 3 of the FEIS for a full description of the fish reintroduction portion of the FP/FR Project).

If the intake structure and juvenile bypass conduit are in operation at the same time that the adjustable barrier gates are in the raised position, the juvenile fish migrating downstream that are discharged from the juvenile bypass conduit would enter the tailwater upstream of the barrier dam. The fish would then spill over the barrier dam to continue their downstream migration.

The adjustable barrier gates would each have sensors and actuators that would lower each gate in sequence starting at the left side of the river. This sequence would provide the most attraction flow to the collection facility. To allow monitoring of the difference

between the water elevation formed at the barrier dam and the river tailwater elevation, sensors would be connected to the Hydromet system.

Although the fish passage facilities will require different operations at the dam, their operation will not affect overall water operations. Like the downstream fish passage facilities, operation of the upstream passage facilities would be integrated into existing project demands and would not impact existing water delivery contracts, TWSA, or flood control operations. Water for the upstream passage facility would be provided from the stilling basin by a combination of a pumping plant and gravity flow provided by the barrier dam. The pumped and/or gravity flow would be immediately returned to the stilling basin at the adult fish ladder entrance.

4.2.5 Operation and Maintenance

Responsibilities for fish passage facilities operation and maintenance will be determined by Reclamation with input from the Yakama Nation and WDFW. Typical annual maintenance duties would include inspection and maintenance of the roller gates, overshot barrier gates, trashracks, conduits, power, control and monitoring systems, pumps, fencing, access roads, gantry crane, trashrake, and other equipment and structures. Major maintenance and disassembly of pumps would take place on a 5-year cycle. Replacement of pumps and associated equipment would be on a 20-year cycle.

4.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam (Preferred Alternative)

Alternative 3, which originated from proposals #1 and #3 of the Value Planning Report (Reclamation [Value Planning]), is very similar to Alternative 2, including construction of both downstream juvenile and upstream adult fish passage (see Figure 4-9). The major difference is that all passage facilities would be located on the right bank. Locating all the facilities on the right bank reduces construction and operation costs and lessens environmental impacts. The main features of the downstream fish facility include:

- Multilevel intake structure, and
- Juvenile fish bypass conduit.

The main feature of the upstream passage facility would be a fish ladder and adult collection facility. A pump with a fish screen would provide attraction flows to the fish ladder. No barrier dam would be constructed.

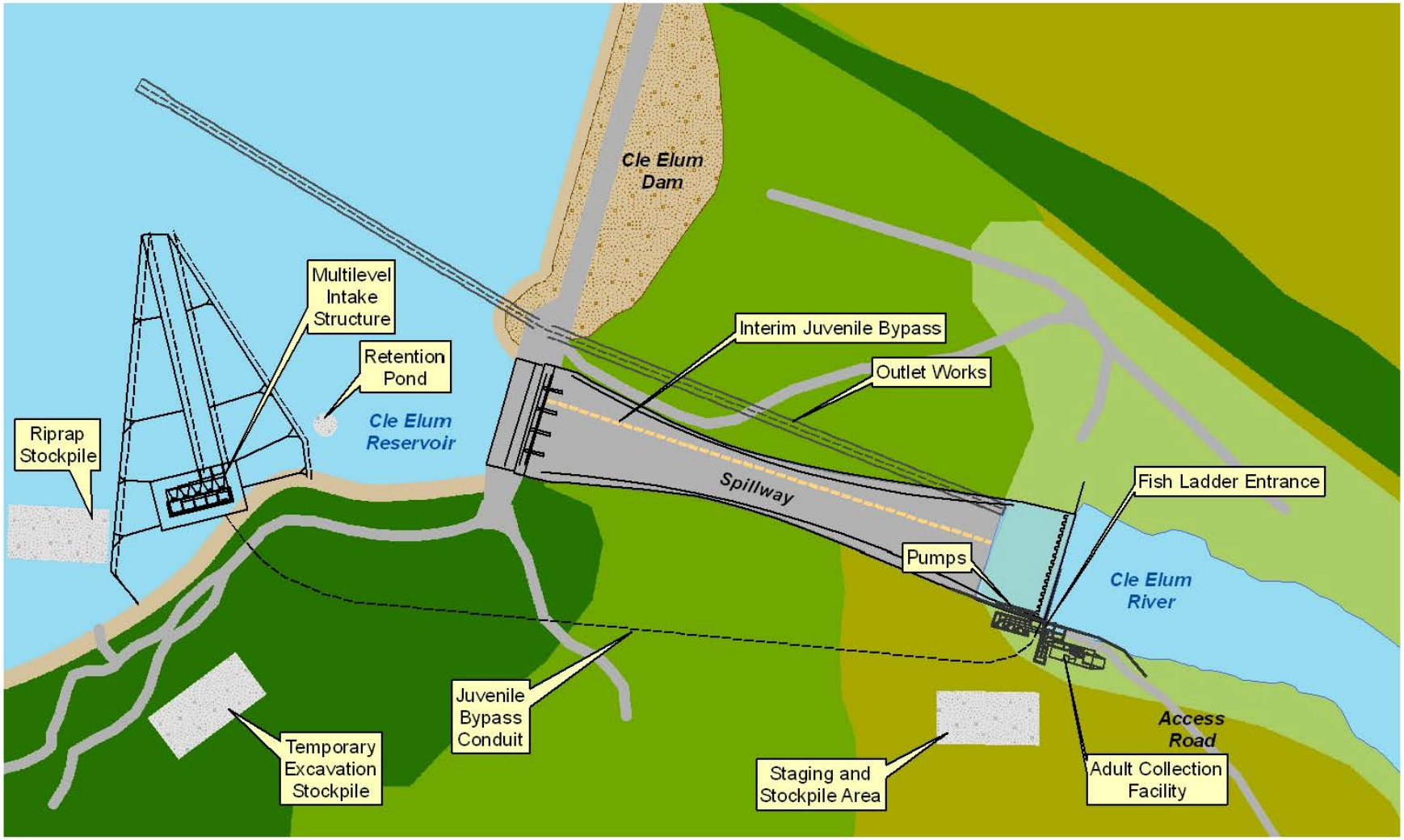


Figure 4-9. Alternative 3 - upstream and downstream fish passage facilitie

In addition to describing these facilities, the following sections discuss:

- Construction activities,
- Typical annual operation scenario, and
- O&M activities.

Figure 4-9 shows the site plan for the upstream and downstream fish passage facilities under Alternative 3. Section 4.4. summarizes and compare the major features for Alternatives 2 and 3.

4.3.1 Downstream Passage

Downstream passage for Alternative 3 would be very similar to Alternative 2 except that under this alternative, the intake structure would be located against the right (southwest) abutment, eliminating the need for the access bridge. The juvenile bypass conduit would be located adjacent to the spillway on the right bank.

4.3.1.1. Multilevel Intake Structure

The intake structure for Alternative 3 is the same as the intake structure for Alternative 2 (see Section 4.2.1.1.), except that it is located against the right bank abutment. This would require excavation into the abutment and into the lakebed to maintain a deep channel leading to the intake structure. The access bridge to the intake structure would be eliminated because the structure could be accessed from shore (see Figure 4-9).

4.3.1.2. Juvenile Fish Bypass Conduit

The juvenile bypass conduit is the same as the juvenile bypass conduit described for Alternative 2 (see section 4.2.1.2.), except that the total length of the conduit would be decreased to 950 feet.

4.3.2 Upstream Passage

The upstream fish passage for Alternative 3 would be similar to Alternative 2, except that the facility would be located on the right bank of the river instead of the left. Also, the barrier dam has been eliminated from Alternative 3 and a larger pump would be installed in the stilling basin upstream of the fish ladder entrance.

4.3.2.1. Barrier Dam

Under Alternative 3, no barrier dam would be constructed. Elimination of the barrier dam from the design was recommended as a cost savings in the Value Planning Report (Reclamation, 2009 [Value Planning]). Locating the adult collection facility and fish ladder on the right bank places the ladder entrance in an area of calm water at the base of the spillway. The combination of the flow from the downstream juvenile passage conduit and the pumped auxiliary attraction flow would provide adequate flows for adult fish to find the ladder entrance.

4.3.2.2. Fish Ladder and Adult Collection

The structures associated with the fish ladder and adult collection facility would be the same as for Alternative 2 (Section 4.2.2.2.), except for the following:

- The fish ladder and adult collection facility would be located on the right bank instead of the left bank,
- A larger pump would be installed, and
- No barrier dam and associated structures would be installed.

Compared to Alternative 2, a larger pump would be needed to provide auxiliary attraction flows for the adult fish facility, in addition to the flows to the adult collection facility and fish ladder. (The pumping plant for Alternative 2 would provide flows only to the adult holding facility and fish ladder.) The pump would be located in the stilling area near the right bank and operate from July through December, plus whenever the juvenile intake structure is inoperable due to low reservoir levels or high water temperatures (greater than 16° C or 61° F).

4.3.3 Construction Activities

Construction activities would be similar to those for Alternative 2 except that no access roads would be required on the left bank of the river since the adult collection facility would be located on the right bank (Figure 4-10). The proposed construction schedule for Alternative 3 is presented in Table 4-4. The road system constructed for installation of the juvenile bypass conduit would also serve for construction and permanent access to the fish ladder and adult collection facility.

The cofferdam for construction of the intake structure would be reconfigured to account for the new location against the right bank. The cofferdam for the upstream passage facilities would also be reconfigured using a smaller cofferdam on the right bank to construct the lower portion of the fish ladder, juvenile bypass flume, and to install the pump and fish screen.

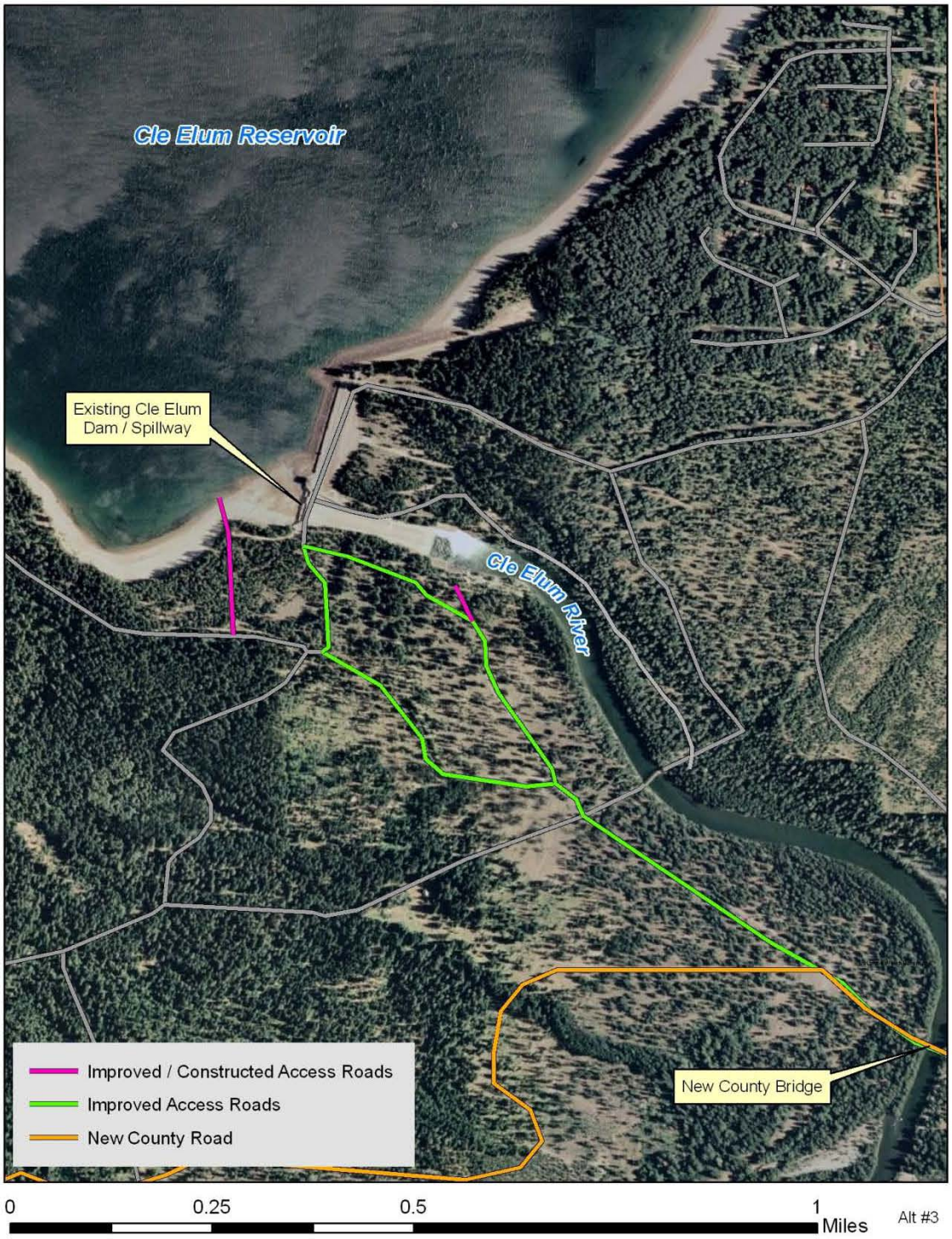
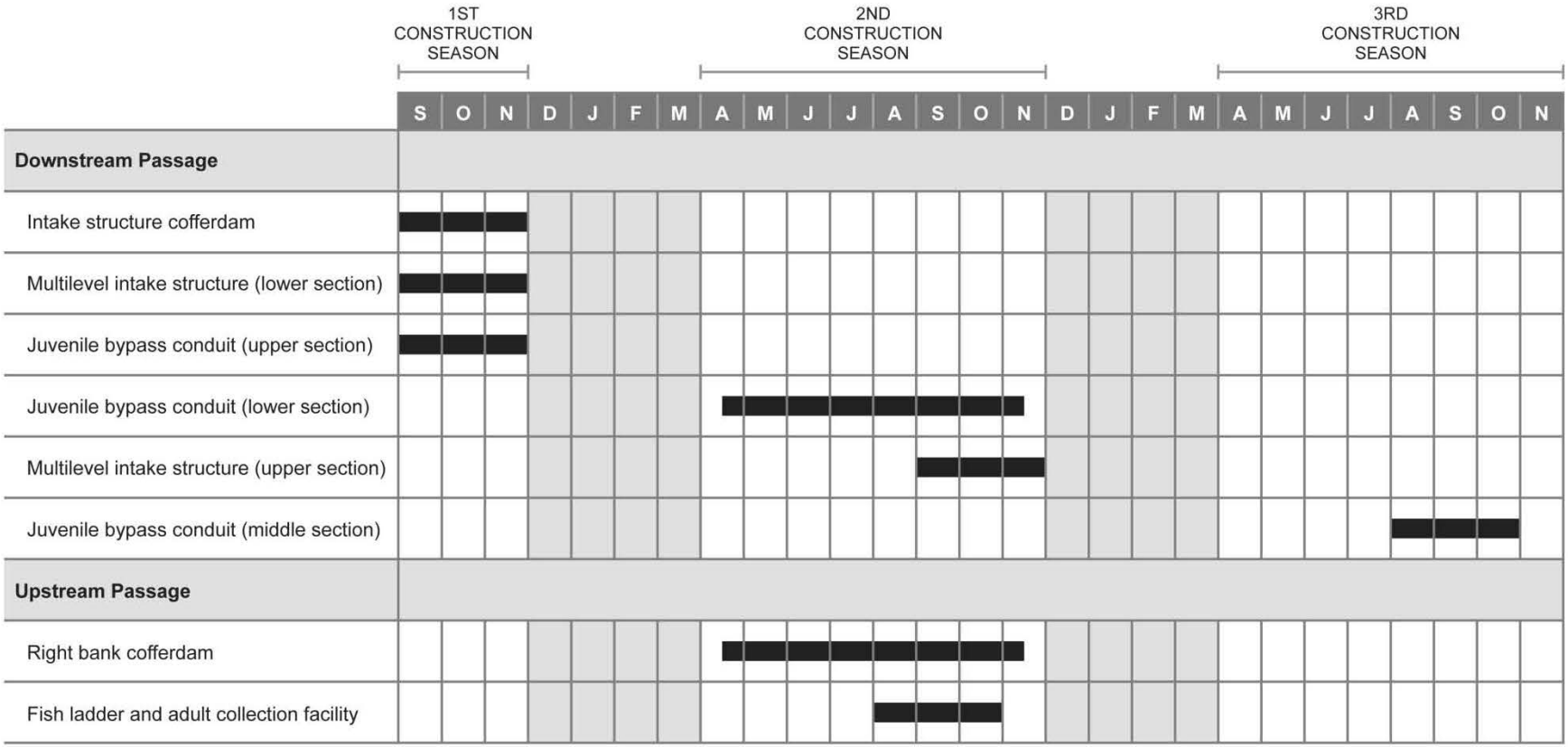


Figure 4-10. Alternative 3 proposed roads and road improvements

Table 4-4. Construction schedule Alternative 3



The power supply to service the fish passage facilities would still originate from the existing gatehouse control building. The power supply to serve the intake structure would be routed from the gatehouse and under the spillway deck. In similar fashion, service to the adult collection facility would be provided by a power supply originating at the gatehouse, and either routed by way of an overhead power line across the spillway or by following the same route to the multilevel intake tower and then in a buried conduit following the alignment of the juvenile bypass pipe to the adult collection facility and fish ladder.

As with Alternative 2, all land required for construction and operation of the downstream fish passage features is federally owned either by Reclamation or located within the Wenatchee National Forest.

The field cost of fish passage facilities at Cle Elum Dam for Alternative 3 was estimated at $69 million (2008 dollars). Adding noncontract costs of $15.0 million brings the total construction cost of Alternative 3 to $84 million. The annual OMR&P impacts for Alternative 3 were estimated to be $300,000.

4.3.4 Typical Annual Operation Scenario

The Alternative 3 fish passage facilities would be operated similarly to Alternative 2. There would be no impacts to existing project operations, TWSA, or Reclamation contracts.

4.3.4.1. Typical Annual Operation Scenario – Downstream Fish Passage Facilities

Downstream fish passage operations would be the same as for Alternative 2 (Section 4.2.4.1.).

4.3.4.2. Typical Annual Operation Scenario – Upstream Fish Passage Facilities

The upstream fish passage facility operations would be the same as for Alternative 2 (Section 4.2.4.2.). However, since the barrier dam is not proposed with Alternative 3, operations associated with it would not be included.

4.3.5 Operation and Maintenance

Operation and maintenance would be the same as for Alternative 2 (Section 4.2.5), except there would be a larger pumping unit. The access bridge and barrier dam are not included with Alternative 3.

4.4. Comparison of Facilities for Alternative 2 and Alternative 3

Table 4-5 compares the major facilities associated with each of the two action alternatives. Figure 4-11 shows where the intake structures would be located for each alternative.

Table 4-5. Summary of major facilities – Cle Elum Fish Passage Facility

Facility/Structure	Alternative 2	Alternative 3
Juvenile Downstream Fish Passage		
Multilevel intake structure	Located upstream of dam 5 drop bays 5 8-foot-wide roller gates	Same as Alternative 2, except located against right abutment of dam
Access bridge	16-foot-wide x 370-foot-long on 2 concrete piers	None
Fish passage conduit	1,520-foot-long, 7-foot-diameter concrete conduit, non-pressurized, 400 cfs flow capacity	Same as Alternative 2, except length is approximately 950 feet long and alignment altered to accommodate new intake location
Trashrack	1-ft. bar spacing, automated trashrake system	Same as Alternative 2
PIT-tag detector system	Located near the flume exit	Same as Alternative 2
Adult Upstream Fish Passage		
Collection facility	150 ft. downstream from the spillway stilling basin, left bank of river, prefabricated metal building, drainfield	Same as Alternative 2, except located on the right bank adjacent to the spillway
Fish ladder flows and attraction flows	4 cfs to 6 cfs	Up to 180 cfs
Fish ladder pools	12 feet long x 4 feet wide x 4 feet deep	Same as Alternative 2, but somewhat longer
Weirs	2 feet wide x 1 foot deep center notch	Same as Alternative 2
Trashrack	26 feet wide x 7 feet tall; 1-inch clear openings; maximum approach velocity of 1 ft/s	None
Pump	Provides flow only to the fish collection tank and fish ladder, which requires 4-6 cfs. Gravity flow from the barrier dam used to provide auxiliary attraction flow for the fish ladder	Provides collection tank and fish ladder flow; provides auxiliary attraction flow for fish ladder when intake structure is not in operation (July-December). Variable speed with a maximum of up to 180 cfs.
Barrier dam	300 feet long x 44 feet wide x 12 feet high at an angle of 55 degrees. Vertical hydraulic drop of 10-12 feet, with adjustable barrier gates	None

Figure 4-11. Aerial view of Cle Elum Dam showing approximate locations of intake structures for both action alternatives. Pool elevation is 2,119 feet in this photo

Chapter 5

CONSTRUCTION COST ESTIMATES AND SCHEDULE

Chapter 5. Construction Cost Estimates and Schedule

The plans and cost estimates displayed in this report are intended to be used to evaluate the feasibility of constructing and operating fish passage facilities at Cle Elum Dam. The estimates are suitable for requesting construction fund appropriations from Congress. Cost estimates provided for Project construction are comprised of field costs and noncontract costs, and annual operating costs are comprised of operation, maintenance, replacement, and power (OMR&P) costs.

5.1. Construction Costs

The project construction cost is made up of two components:

- **Field costs** (construction contract costs) which include the direct contract cost of materials and services to construct project facilities and construction contract costs and contingencies.
- **Noncontract costs** which include facilitating services, investigations, developing designs and specifications, construction engineering and supervision, and environmental compliance.

5.1.1 Field Costs (Construction Contract Costs)

For Alternative 2, Reclamation's Pacific Northwest Region Design Group prepared preliminary layouts and conceptual drawings for all major project features. Detailed structural designs were not prepared, but the layouts and drawings were sufficiently defined to allow development of approximate quantities for each kind or class of material and labor needed for construction to meet feasibility-level criteria. Quantities for all major construction items (i.e., earthwork, concrete, piping, gates) were calculated from the drawings. Reclamation's Technical Service Center developed unit prices and prepared the construction cost estimates based on the drawings, plans, and quantity estimates prepared by the Pacific Northwest Region.

For Alternative 3, Reclamation's Technical Service Center prepared comparable feasibility-level designs and cost estimates.

5.1.1.1. Allowances for Minor Undefined Items and Estimating Uncertainties

At the feasibility stage of project investigation, it is not practical to identify all items associated with construction of a project. The cost estimates include a separate line item

to account for the cost of these minor undefined items of work. Unlisted items provide a contingency for minor design changes and for minor pay items that have not been itemized but that would have some influence on the total cost. A 15-percent allowance for these unlisted items is included in the estimates based on the estimator's professional judgment.

The cost estimates also include a 25-percent contingency to cover minor differences in actual and estimated quantities, unforeseeable difficulties at the site, changed site conditions, possible minor changes in plans, and other uncertainties.

5.1.2 Noncontract Costs

Noncontract costs are those associated with work or services that support a project. Noncontract costs include post-authorization investigations, project management costs, collection of design data, preparation of final designs and specifications including Value Engineering studies, permits and environmental compliance costs, construction engineering, contract administration, and other related costs. Estimates for the labor, equipment, materials, and supplies needed for these different activities were developed jointly between the Pacific Northwest Region and the Technical Service Center based on experience at projects of similar scope and complexity. The Technical Service Center developed the costs for post-authorization investigations, data collection, and final design. All other noncontract costs were developed by the Pacific Northwest Region.

5.1.3 QA/QC (Quality Assurance/Quality Control)

Preliminary conceptual drawings of project features were reviewed by representatives of several Groups within the Civil Engineering Services, Geotechnical Services, Infrastructure Services, and Water Resources Services divisions of the Technical Service Center. The Technical Service Center also conducted a Safety of Dams (SOD) Risk Analysis of the proposed features. A DEC Oversight Review of the plans and cost estimates was completed under the direction of the Senior Advisor, DEC, and was approved by the Director, Technical Resources Center.

5.2. Cost Estimates

The *Designs & Estimates Appendix* (Reclamation 2008 [D&E Appendix]) contains detailed construction cost estimates for Cle Elum Dam Alternative 2 and Bumping Lake Dam fish passage facilities. However, at the time the D&I Appendix was prepared, Alternative 3 had not been developed. Therefore, a Supplement to the D&E Appendix (Reclamation, 2011) has been prepared, which includes the detailed cost estimates for Alternative 3.

The following disclaimer should be included with any document that contains or references the cost estimates found in this report:

> *Reclamation has provided the enclosed cost estimate as a resource for use in discussions among interested parties evaluating this specific project, activity, concept, issue, etc. Presentation of this estimate does not in and of itself imply Reclamation's support for moving forward with the effort. When appropriate, Reclamation specifically will articulate support for further action through other means, such as a report containing recommendations.*

5.2.1 Alternative 2: Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

5.2.1.1. Project Cost Estimates

The total construction cost for Alternative 2 is estimated to be $96 million at January 2008 price levels. This includes field costs of $81 million and noncontract costs of $15 million. Table 5-1 provides a summary of the project cost estimates.

Table 5-1. Project Cost Estimates for Alternative 2, Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam (January 2008 prices)

Description		Subtotal	Total
Downstream Passage Facility			
Roads and Road Structures	$2,260,000		
Dams	$31,700,000		
Waterway Structures	$26,000,000		
		$60,000,000*	
Upstream Fish Passage Facility			
Structures and Improvements	$5,730,000		
Road and Road Structures	$1,200,000		
Waterway Structures	$13,700,000		
Pumps and Prime Movers	$170,000		
Accessory Electrical Equipment	$82,000		
		$21,000,000*	
Total Field Costs			$81,000,000*
Noncontract Costs			
Data Collection and Final Designs	$7,900,000		
Construction Engineering and Inspection	$5,700,000		
NEPA,ESA, Permits & Contract Administration	$910,000		
Total Noncontract Costs			$15,000,000*
TOTAL CONSTRUCTION COST			**$96,000,000***

Indexes are from Reclamation, *Construction Cost Trends 1977 = 100*
*Totals rounded to the nearest $100,000 or $1 million using guidelines in Reclamation's *Cost Estimating Handbook* (March 1998).

5.2.1.2. Annual OMR&P Estimate

The total annual OMR&P costs for Cle Elum Dam fish passage features are estimated to be about $300,000 per year. O&M staff account for about 84 percent of the total. Equipment, supplies, electrical power, and special maintenance items account for the other 16 percent. A breakdown of the OMR&P costs can be found in the *Designs & Estimates Appendix*.

5.2.2 Alternative 3: Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

5.2.2.1. Project Cost Estimates

The total construction cost for Alternative 3 is estimated to be about $84 million at January 2008 price levels. This includes field costs of $69 million and noncontract costs of $15 million. Table 5-2 provides a summary of the project cost estimates.

Table 5-2. Project Cost Estimates for Alternative 3, Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam (January 2008 prices)

Description	Field Costs	Subtotal	Total
Downstream Passage Facility			
Roads and Road Structures	820,000		
Dams	26,535,000		
Waterway Structures	25,645,000		
		$53,000,000*	
Upstream Fish Passage Facility			
Structures and Improvements	$4,127,000		
Roads and Road Structures	116,000		
Waterway Structures	$6,624,000		
Pumps and Prime Movers	$4,785,000		
Accessory Electrical Equipment	$348,000		
		$16,000,000*	
Total Field Costs			$69,000,000*
Noncontract Costs			
Data Collection and Final Design	$7,900,000		
Construction Engineering and Inspection	$5,700,000		
NEPA,ESA, Permits & Contract Administration	$910,000		
Total Noncontract Costs			$15,000,000*
TOTAL CONSTRUCTION COST			**$84,000,000***

Indexes are from Reclamation, *Construction Cost Trends 1977 = 100*
* Totals rounded to the nearest $100,000 or $1 million using guidelines in Reclamation's *Cost Estimating Handbook* (March 1998).

5.2.2.2. Annual OMR&P Estimate

The total annual OMR&P costs for Alternative 3 are estimated to be the same as for Alternative 2, or approximately $300,000 per year. O&M staff account for about 84 percent of the total. Equipment, supplies, electrical power, and special maintenance items account for the other 16 percent. A breakdown of the OMR&P costs can be found in the *Designs & Estimates Appendix*.

5.3. Project Control Schedule

Contingent upon congressional appropriations and and/or the availability of non-Federal funding, Reclamation would support proceeding with the final design phase for Alternative 3.

The final design phase would include collecting survey data and conducting geologic and subsurface investigations to verify the materials and properties expected to be encountered during construction. Reclamation would conduct hydraulic modeling of proposed fish facilities and prepare final engineering designs, construction drawings, and specifications in collaboration with the Core Team as funding is available.

Table 5-3 and Table 5-4 provide the Project Control Schedules showing the anticipated implementation schedule and funds required by fiscal year for Alternatives 2 and 3, respectively. Assumptions for both alternatives are as follows:

1. One contract and specifications will be issued for the construction;

2. Construction will span 3 calendar years (over 4 fiscal years);

3. Design will occur over 2 fiscal years;

4. All costs indexed to mid-point of fiscal year, assuming a 4-percent rate of inflation; and costs for liaison and coordination activities are assumed to occur 75 percent during preconstruction and 25 percent during construction.

Table 5-3. Alternative 2-Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam Project Control Schedule

Item	Jan 2008 Cost	FY 1	FY 2	FY 3	FY 4	FY 5	Construc-tion FY6	Construc-tion FY7	Construc-tion FY8	Construc-tion FY9	Total
Liaison and Coordination	$260,000	$41,000	$43,000	$45,000	$47,000	$48,000	$21,000	$22,000	$23,000	$24,000	$314,000
Environmental Compliance and Permitting	$470,000	$200,000	$207,000	$36,000	$37,000	$39,000					$519,000
Realty Specialist	$26,000				$31,000						$31,000
Contract Administration-Pre-Award	$60,000						$77,000				$77,000
Contract Administration-Post-Award	$96,000						$31,000	$32,000	$34,000	$35,000	$132,000
Design Data Collection and Hydraulic Model Study	$2,000,000			$2,290,000							$2,290,000
Final Design	$5,800,000				$3,460,000	$3,600,000					$7,060,000
VE Studies	$100,000			$110,000							$110,000
Construction Management	$5,700,000						$1,840,000	$1,910,000	$1,990,000	$2,070,000	$7,810,000
Subtotal—Total Noncontract Costs (Rounded)	$15,000,000										
Construction (Field Cost)	$81,000,000						$5,500,000	$41,500,000	$35,400,000	$29,800,000	$112,200,000
Total Project Cost	**$96,000,000**										
Total Funding Needs by Fiscal Year		**$241,000**	**$250,000**	**$2,500,000**	**$3,600,000**	**$3,700,000**	**$7,500,000**	**$43,500,000**	**$37,400,000**	**$31,900,000**	**$130,500,000**

**All costs are rounded and indexed to mid-point of FY assuming a 4% rate of inflation

Table 5-4. Alternative 3-Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam Project Control Schedule

Item	Jan 2008 Cost	FY 1	FY 2	FY 3	FY 4	FY 5	Construc-tion FY6	Construc-tion FY7	Construc-tion FY8	Construc-tion FY9	Total
Liaison and Coordination	$260,000	$41,000	$43,000	$45,000	$47,000	$48,000	$21,000	$22,000	$23,000	$24,000	$314,000
Environmental Compliance and Permitting	$470,000	$200,000	$207,000	$36,000	$37,000	$39,000					$519,000
Realty Specialist	$26,000				$31,000						$31,000
Contract Administration-Pre-Award	$60,000						$77,000				$77,000
Contract Administration-Post-Award	$96,000						$31,000	$32,000	$34,000	$35,000	$132,000
Design Data Collection and Hydraulic Model Study	$2,000,000			$2,290,000							$2,290,000
Final Design	$5,800,000				$3,460,000	$3,600,000					$7,060,000
VE Studies	$100,000			$110,000							$110,000
Construction Management	$5,700,000						$1,840,000	$1,910,000	$1,990,000	$2,070,000	$7,810,000
Subtotal—Total Noncontract Costs (Rounded)	$15,000,000										
Construction (Field Cost)	$69,000,000						$13,412,000	$31,451,000	$32,709,000	$15,087,000	$92,659,000
Total Project Cost	**$84,000,000**										
Total Funding Needs by Fiscal Year		**$241,000**	**$250,000**	**$2,500,000**	**$3,600,000**	**$3,700,000**	**$15,380,000**	**$33,410,000**	**$34,760,000**	**$17,220,000**	**$111,000,000**

*All costs are rounded and indexed to mid-point of FY assuming a 4% rate of inflation

Chapter 6

ECONOMIC EVALUATION

Chapter 6. Economic Evaluation

6.1. Cost-Effectiveness Analysis

Cost-effectiveness analysis (CEA) is an approach which can be used to rank alternatives in an attempt to identify the alternative which generates the most beneficial output per dollar of investment. Beneficial output is represented by physical measures of project effectiveness. Estimates of effectiveness by alternative are divided by the cost of each alternative to obtain cost-effectiveness estimates for each alternative. These cost-effectiveness estimates by alternative are used to rank the alternatives.

CEA is sometimes applied in lieu of benefit-cost analyses, especially when critical project benefits cannot be adequately measured in economic terms (i.e., monetized). CEA is also useful when an action is legally mandated and the primary decision involves selecting the least cost method of achieving the desired goal.

6.1.1 Methodology

The objective of the Cle Elum Dam Fish Passage Facilities and Fish Reintroduction (FP/FR) Project is to evaluate methods for providing fish passage at Cle Elum Dam. Fish species which would benefit from passage include federally threatened and endangered (T&E) species (i.e., steelhead and bull trout). The Cle Elum Dam FP/FR Project stems from a Mitigation Agreement between Reclamation and WDFW in 2002 in response to the Keechelus Dam Safety of Dams Modification. Later, as a result of litigation from the Yakama Nation, a Settlement Agreement was reached between the Tribe and Reclamation that stipulated Reclamation would conduct an assessment of fish passage at each Yakima Project storage dam and seek funds for timely implementation of feasible fish passage measures. Since the Cle Elum Dam FP/FR Project involves both ESA threatened and endangered (T&E) species (which are especially difficult to value in economic terms), and to comply with agreements, the decision was made to pursue a CEA.[3]

Instead of attempting to measure the economic value of the T&E species as would be required in a benefit-cost analysis, CEA uses physical measures of alternative effectiveness. For this study, the most appropriate physical measure of fish passage effectiveness would likely be the increase in fish populations by alternative expected over

[3] The *Economic Principles and Guidelines for Water and Related Land Resource Implementation Studies* (Principles and Guidelines) were considered for this study. However, since this study centers on reintroduction of threatened and endangered species and compliance with a Mitigation Agreement with WDFW and a Settlement Agreement with the Yakama Nation, the four-account analysis following the Principles and Guidelines was not performed for this Study.

the duration of the study period. Dividing the fish populations by alternative by the cost of each alternative or vice versa allows for the ranking of the alternatives in terms of the number of fish saved per dollar or the cost per fish saved.

Core team fisheries biologists determined that the two proposed alternatives would be equally effective in passing fish by Cle Elum Dam since both alternatives employ the same engineering mechanisms for upstream (trap-and-haul) and downstream (juvenile bypass conduit) fish passage. The main difference between alternatives is the location of the upstream and downstream facilities. Given the proposed alternatives were deemed equally effective, it was not necessary to actually estimate the number of fish saved for each alternative to develop the CEA. In this situation, the CEA boils down to a simple least cost analysis.

6.1.2 Results

Costs were estimated by Reclamation engineers for both proposed alternatives (see Table 6-1). Construction costs include noncontract costs (i.e., liaison & coordination, environmental compliance and permitting, reality specialist, contract administration, design data collection and hydraulic model study, final design, value engineering study, and construction management) and field costs of construction contracts to build the facilities. Total project cost includes construction costs and interest during construction (IDC).

It should be noted that interest is charged on both noncontract and field costs, but only during the construction period. Therefore, any noncontract costs which were expected to occur prior to the start of the construction period were summed and added to the field costs in the first year of the construction period before calculating IDC.

Since both proposed alternatives were deemed equally effective, Alternative 3 would be preferred from a cost effectiveness standpoint since it would generate similar levels of fish passage as Alternative 2, but at a lower overall cost.

Table 6-1. Summary of Alternative Cost Estimates ($ millions)

Alternative	Field Cost	Noncontract Cost	Total Construction Costs	IDC Costs	Total Project Cost	Maximum Annual OMR&P Cost
1: No Action	--	--	--	--	--	--
2: Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam Partial—Banks	$81.0	$15.0	$96.0	$7.84	$103.84	$0.3

Table 6-1. Summary of Alternative Cost Estimates ($ millions)

Alternative	Field Cost	Noncontract Cost	Total Construction Costs	IDC Costs	Total Project Cost	Maximum Annual OMR&P Cost
3: Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam	$69.0	$15.0	$84.0	$7.76	$91.76	$0.3

6.2. Socioeconomics

The socioeconomic analysis developed for this Study consists of a cost-based Regional Economic Development (RED) analysis.

6.2.1 Methodology

The RED analysis focuses on estimating alternative-specific economic impacts to the study region's local economy. For this analysis, regional impacts stem from two primary effects: upfront construction costs and annual OMR&P costs.

Additional costs occurring within the region were measured compared to the No Action Alternative. The RED analysis includes not only the initial or direct impact on the primary affected industries, but also the secondary impacts (multiplier effects) resulting from those industries providing inputs to the directly affected industries (indirect effects) as well as household spending of income earned by those employed in the directly or indirectly impacted sectors of the economy (induced effects).

The study area or "region" was selected based on the location of the proposed fish passage facilities and the economic interaction between neighboring counties within the area. The project is located within Kittitas County. However, given the proximity of the City of Yakima in Yakima County, the assumption was made that Yakima and Kittitas Counties are economically linked; therefore, the region was defined as both Yakima and Kittitas Counties of Washington State.

Regional economic activity can be measured in a variety of ways. This analysis focuses on three commonly applied measures of regional economic impact: output, employment, and labor income. Output reflects the dollar value of production (sales revenues and gross receipts) from all industries in the region. Employment measures the number of jobs in a particular sector, both full-time and part-time. Labor income is a measure of employee compensation (wages and benefits) plus income for self-employed individuals.

The regional economic impact analysis involves running estimates of in-region costs through an economic impact model generated specifically for the study area. The IMPLAN (IMpact analysis for PLANning) model was selected for this analysis. IMPLAN is a commonly applied input-output (IO) modeling system that estimates the effects of changes in expenditures within a region. Input-output models measure commodity flows from producers to intermediate and final consumers. Purchases for final use (final demand) drive the model. 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 region (imports and value added) stop the cycle.

These indirect and induced effects can be derived mathematically using a set of multipliers. The multipliers describe the change of output for each regional industry caused by a $1 change in final demand for any given industry.

IMPLAN data files are compiled from a variety of sources for the study area, including the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, and the U.S. Census Bureau. Input-output models are static—they measure impacts based on economic conditions at a given point in time. Since the IMPLAN data used in the initial analysis was from 2004, impacts were measured based on a 2004 representation of the regional economy. Subsequent re-runs of impacts used the same underlying 2004 IMPLAN data under the assumption that the makeup of the two-county economy would not have changed significantly. This explains why the cost estimates are referred to as 2008 dollars, but the regional economic impacts are measured in 2004 dollars.

6.2.2 Affected Environment

Table 6-2 displays the latest output, employment, and labor income information as generated by the IMPLAN model based on 2004 data for the combined economy of Kittitas and Yakima Counties, aggregated into 14 major sectors. In 2004, these two counties generated $12.6 billion in output, 134.5 thousand jobs, and $4.4 billion in labor income.

The IMPLAN model includes 509 sectors which were aggregated into 14 primary sectors for display purposes. While the ranking of the five most important sectors within the economics of Kittitas and Yakima Counties vary based on the regional economic measure considered, the following major economic sectors consistently fell within the top five: 1) agriculture, forestry, and fisheries; 2) manufacturing; 3) retail trade; 4) services; and 5) Federal, State, and local government. Looking at the employment measure, these five sectors represent about 83 percent of the total employment within the region in 2004.

In addition to providing some detail on the current (2004) makeup of the regional economy, this current condition information was used to evaluate the magnitude of estimated regional economic impacts. These estimates of current conditions were assumed to adequately reflect the No Action Alternative and to provide a useful basis for comparison.

Table 6-2. Baseline data for Kittitas and Yakima Counties - output, employment, and labor income

IMPLAN Model: Yakima Fish Passage Kittitas and Yakima Counties
Base Year: 2004

IMPLAN Industry Numbers	Industry	Industry Output (million $)	% of Total	Employment (Jobs)	% of Total	Labor Income (million $)	% of Total
1-18	Agriculture, Forestry, and Fisheries	1,689.235	13.45	26,193	19.47	626.014	14.29
19-29	Mining	1.891	0.02	17	0.01	0.643	0.01
30-32	Utilities	111.834	0.89	226	0.17	20.175	0.46
33-45	Construction	650.321	5.18	6,147	4.57	257.398	5.88
46-389	Manufacturing	2,806.953	22.35	9,537	7.09	434.830	9.93
390	Wholesale Trade	601.510	4.79	5,373	3.99	226.148	5.16
391-400	Transportation and Warehousing	382.527	3.05	4,261	3.17	170.289	3.89
401-412	Retail Trade	787.549	6.27	12,681	9.43	318.007	7.26
413-424	Information	358.231	2.85	1,975	1.47	83.952	1.92
425-430	Finance and Insurance	385.816	3.07	2,538	1.89	113.214	2.59
431-436	Real Estate, Rental, and Leasing	346.029	2.76	2,706	2.01	70.190	1.60
437-494	Services	2,507.039	19.96	41,655	30.97	1,104.959	25.23
495-506	Federal, State, and Local Government	1,313.388	10.46	21,214	15.77	953.728	21.78
507-509	Other	617.146	4.91	0	0.00	0.000	0.00
	Totals:	12,559.468		134,520		4,379.548	

6.2.3 Environmental Consequences

Construction and operation of fish passage facilities at Cle Elum Dam associated with the proposed alternatives are expected to generate socioeconomic impacts within Kittitas and Yakima Counties due to in-region construction and OMR&P costs.

6.2.3.1. Alternative 1 – No Action Alternative

No socioeconomic impacts are anticipated from the No Action Alternative because no fish passage related construction costs or OMR&P costs would be incurred. Minor costs would be associated with the removal of the interim passage facilities.

6.2.3.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

Upfront Impacts from Construction Contract Costs

Total in-region construction contract costs (field costs) for the fish passage facilities at Cle Elum Dam associated with Alternative 2 designs were developed by Reclamation cost engineers. These in-region costs were separated into various construction sectors and run through the IMPLAN model. Results are presented in Table 6-3.

Table 6-3. Cle Elum Dam fish passage facilities for Alternative 2—construction cost-related output, employment, and labor income impact (2004)

IMPLAN Industry Numbers	Industry	Industry Output ($)[1]	Employment (Jobs)[1]	Total Labor Income($) [1]	Percent Change[2,3] from Current Conditions[4]
1-18	Agriculture, Forestry, and Fisheries	423,296	6	119,821	0.02
19-29	Mining	100	0	33	0.00
30-32	Utilities	345,982	1	60,942	0.31
33-45	Construction	61,592,318	615	26,165,785	10.01
46-389	Manufacturing	1,828,748	7	343,255	0.08
390	Wholesale Trade	2,562,389	23	963,375	0.43
391-400	Transportation and Warehousing	1,424,398	15	615,538	0.34
401-412	Retail Trade	3,810,892	63	1,516,919	0.50
413-424	Information	1,058,983	5	224,366	0.26
425-430	Finance and Insurance	1,772,340	11	493,640	0.43
431-436	Real Estate, Rental, and Leasing	1,788,707	12	366,239	0.44
437-494	Services	12,241,776	198	5,646,705	0.47
495-506	Federal, State, and Local Government	1,080,754	6	315,030	0.03
507-509	Other	2,992,727	0	0	n/a
Totals:		92,923,411	961	36,831,646	0.71

[1] Figures in each row are rounded; therefore, the totals presented in each column may not agree exactly with the rounded sums.

[2] See Table 6-2 for current conditions estimates (current conditions are based on the two-county economy in 2004). As noted above, the initial impacts were run using IMPLAN data from 2004. Subsequent re-runs of the impacts, based on

refined cost estimates, also used the 2004 data under the assumption that the two-county regional economy would not have changed significantly.

[3] Note that current conditions estimates in Table 6-2 are in millions of dollars, whereas impact estimates listed above are in dollars.

[4] The percent change across impact measures varies slightly. The percentages presented reflect employment changes.

As shown in Table 6-1, the field cost to construct fish passage facilities at Cle Elum Dam for Alternative 2 was estimated at $81.0 million, of which $65.4 million was expected to be incurred within the two-county region. Neither the noncontract costs nor the interest costs would generate economic impacts. As shown in Table 6-3, these in-region contract construction costs were estimated to generate an additional $92.9 million of output/sales, 961 jobs, and $36.8 million of labor income over the 3-year construction period. While the overall impact of this in-region construction activity was estimated to be relatively small—less than 1 percent change in total economic activity as compared to current conditions (see Table 6-2)—certain sectors of the economy are expected to temporarily experience somewhat larger positive impacts (e.g., the construction sector was estimated to incur gains of 9 to 10 percent).

Annual Impacts from OMR&P Costs

Average annual OMR&P costs for the Cle Elum Dam fish passage facilities were developed by Reclamation cost engineers and were estimated at $300,000. All of these costs are assumed to occur within the region. These in-region OMR&P costs were estimated to generate an additional $436,700 of output/sales, five jobs, and $216,200 of labor income annually, on average. The impact of these in-region OMR&P costs on the overall economy and, specifically, on the construction industry and other maintenance and repair sector, was estimated to be relatively small (a change of less than 2 percent compared to current conditions).

6.2.3.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

Upfront Impacts from Construction Costs

Results of running in-region contract construction costs through the IMPLAN model for Alternative 3 are presented in Table 6-4. The field cost to construct fish passage facilities at Cle Elum Dam for Alternative 3 was estimated at $69.0 million, of which $55.9 million was expected to be incurred within the two-county region. Neither noncontract costs nor interest costs would generate economic impacts. These in-region construction costs were estimated to generate an additional $79.6 million of output/sales, 830 jobs, and $31.8 million of labor income over the 3-year construction period. While the overall impact of this in-region construction activity was estimated to be relatively small—less than 1 percent change in total economic activity as compared to current conditions (see

Table 6-2)—certain sectors of the economy are expected to temporarily experience somewhat larger positive impacts (e.g., the construction sector was estimated to incur gains in the range of 8 to 9 percent).

Table 6-4. Cle Elum Dam fish passage facilities for Alternative 3—construction cost-related output, employment, and labor income impact (2004)

IMPLAN Industry Numbers	Industry	Industry Output ($)[1]	Employment (Jobs)[1]	Total Labor Income($)[1]	Percent Change[2,3] from Current Conditions[4]
1-18	Agriculture, Forestry, and Fisheries	368,807	5	104,399	0.02
19-29	Mining	73	0	24	0.00
30-32	Utilities	297,546	1	52,457	0.28
33-45	Construction	52,619,403	531	22,577,286	8.64
46-389	Manufacturing	1,594,828	6	301,858	0.07
390	Wholesale Trade	2,182,819	19	820,669	0.36
391-400	Transportation and Warehousing	1,168,455	12	509,473	0.28
401-412	Retail Trade	3,306,174	55	1,315,790	0.43
413-424	Information	916,964	5	194,165	0.23
425-430	Finance and Insurance	1,518,253	9	422,877	0.37
431-436	Real Estate, Rental, and Leasing	1,522,753	10	311,249	0.37
437-494	Services	10,591,673	171	4,894,456	0.41
495-506	Federal, State, and Local Government	932,954	5	271,825	0.02
507-509	Other	2,581,953	0	0	n/a
Totals:		79,602,657	830	31,776,527	0.62

[1] Figures in each row are rounded; therefore, the totals presented in each column may not agree exactly with the rounded sums.

[2] See Table 6-2 for current conditions estimates (current conditions are based on the two-county economy in 2004). As noted above, the initial impacts were run using IMPLAN data from 2004. Subsequent re-runs of the impacts, based on refined cost estimates, also used the 2004 data under the assumption that the two-county regional economy would not have changed significantly.

[3] Note that current conditions estimates in Table 6-2 are in millions of dollars, whereas impact estimates listed above are in dollars.

[4] The percent change across impact measures varies slightly. The percentages presented reflect employment changes.

Annual Impacts from OMR&P Costs

The annual OMR&P impacts for Alternative 3 were assumed to be essentially the same as for Alternative 2.

6.2.4 Mitigation

Since all of the short-term and long-term cost-based socioeconomic impacts are positive (i.e., they result in a gain in regional economic activity), no mitigation would be necessary.

Chapter 7

ENVIRONMENTAL COMPLIANCE

Chapter 7. Environmental Compliance

7.1. National Environmental Policy Act/State Environmental Policy Act Compliance

The Bureau of Reclamation (Reclamation) and the Washington State Department of Ecology (Ecology) have prepared a Final Environmental Impact Statement (FEIS) on the Cle Elum Dam Fish Passage Facilities and Fish Reintroduction Project (FP/FR Project). The FEIS is a combined National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) EIS. It meets the requirements of both NEPA and SEPA with Reclamation and Ecology as joint leads in its preparation. Both the Fish Passage Facilities and Fish Reintroduction projects were developed in collaboration with the Yakama Nation and the Washington Department of Fish and Wildlife. (NOTE: A compact disc of the FEIS is attached to the back cover of this document.)

Reclamation evaluated the impacts of the fish passage facilities. Ecology and the Washington Department of Fish and Wildlife (WDFW), in collaboration with the Yakama Nation, evaluated the fish reintroduction portion of this project. Although the fish passage alternatives and the fish reintroduction program are presented separately in the FEIS, the two actions are closely related. At the request of WDFW, Ecology was asked to act as joint lead agency for the State. Implementation of fish reintroduction is dependent on installation of the fish passage facilities. If no passage facilities are installed, fish reintroduction would not be feasible.

7.1.1 Scoping

The scoping period began April 8, 2009, and concluded May 8, 2009. Six comment letters were received.

On April 30, 2009, Reclamation, Ecology, WDFW, and the Yakama Nation held a public scoping meeting at the Hal Holmes Center in Ellensburg, Washington. The Scoping Meeting was preceded by a 1-hour open house. The meeting was held from 5:30 to 7:30 p.m. and 20 individuals attended. The alternatives being considered were presented, and attendees were given the opportunity to comment on the alternatives, NEPA/SEPA process, and resources being evaluated in the Draft Environmental Impact Statement (DEIS).

7.1.2 DEIS Comment Period

Reclamation and Ecology released the DEIS in January 2010. The public comment period began February 3, 2010, when notice was published in the *Federal Register* and

extended to March 22, 2010. Reclamation and Ecology held an open house on February 18, 2010, in Cle Elum, Washington, to receive comments on the DEIS.

During the comment period, Reclamation and Ecology received 18 comments on the DEIS in the form of letters and emails. One letter was from Congressman Doc Hastings, three were from Federal agencies, six were from State and local agencies, and eight were from members of the public. Those comments and responses to them are included in the Comment and Responses section of the FEIS.

7.2. Agency Coordination and Consultation

7.2.1 Cooperating Agencies

Reclamation and Ecology were responsible as joint lead agencies for developing the joint NEPA/SEPA EIS, in coordination with WDFW and the Yakama Nation. Though there are many agencies involved and interested in the FP/FR Project, only BPA assumed the role of cooperating agency in regard to this EIS.

7.2.2 Endangered Species Act, Section 7

Section 7(a)(2) of the ESA of 1973 (Public Law 93-205;16 USC 1531 et seq., as amended) requires Federal agencies to consult with the U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service (NMFS) when a Federal action may affect a listed endangered or threatened species or critical habitat. This is to ensure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat.

Reclamation has initiated consultation with the Service and NMFS. On October 27, 2010, Reclamation received concurrence from the Service on a “may affect, not likely to adversely affect” for bull trout. On November 22, 2010, NMFS issued a letter concurring with the “may affect, not likely to adversely affect” determination for MCR steelhead and critical habitat, but issued a “may affect” determination for Essential Fish Habitat. Reclamation will comply with the Essential Fish Habitat Conservation Recommendations included in the letter.

7.2.3 U.S. Forest Service

Reclamation will continue coordinating project activities with the USFS throughout the project.

7.2.4 U.S. Army Corps of Engineers

Coordination activities are ongoing with the U.S. Army Corps of Engineers (Corps) in conjunction with their interests and responsibilities for wetlands.

Reclamation will make application to the Corps for a permit under Section 404 of the Clean Water Act.

7.2.5 Environmental Protection Agency

Coordination activities are ongoing with the Environmental Protection Agency because of its role in the NEPA review process.

7.2.6 Washington Department of Archaeology and Historic Preservation

Reclamation received comments on the DEIS from the Washington DAHP. In conjunction with issuing the FEIS, Reclamation will submit a case study documenting the potential effects of the action alternatives, formally initiating consultation with the Washington SHPO and the Yakama Nation. Upon issuance of the Record of Decision and prior to construction, Reclamation will conduct identification efforts within the area of potential effects of the selected alternative. Reclamation will consult with the Washington SHPO, the Yakama Nation, and other interested parties to resolve any adverse effects. No irreversible actions in connection with the selected alternative will occur until the adverse effects are resolved through consultation.

7.3. Tribal Consultation and Coordination

Executive Order 13175 establishes “regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications, to strengthen the United States Government-to-Government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes.”

Reclamation initiated Government-to-Government consultation with the Yakama Nation in October 2009. The Bureau of Indian Affairs (BIA) Yakima Office and the Yakama Nation Deputy Director of Natural Resources were contacted via letter and telephone to determine the potential presence of Indian Trust Assets (ITAs) within the project area. The letter requested that BIA and the Nation identify ITAs or any other resources of concern within the area potentially impacted by the FP/FR Project. In addition to the formal consultation, Reclamation is developing the fish passage facilities project in collaboration with the Yakama Nation and WDFW is also developing the fish reintroduction project in collaboration with the Yakama Nation.

7.3.1 Indian Trust Assets

The Yakama Nation and the BIA were contacted regarding the presence of ITAs in or near the project area and none were identified. It is the general policy of Reclamation to perform its activities and programs in such a way as to protect ITAs and avoid adverse effects whenever possible (Reclamation, 2000).

Reclamation will comply with procedures contained in Departmental Manual Part 512.2 which protect ITAs.

7.3.2 National Historic Preservation Act

As described in Section 7.2.6, the NHPA requires Federal agencies to consult with the SHPO and Native American Tribes with a traditional or religious interest in the study area, and with the interested public. Reclamation has identified the Yakama Nation as a Tribe with a potential traditional or religious interest in the study area. Reclamation will consult with the Yakama Nation as provided under the NHPA, NAGPRA (Section 7.3.3), and EO 13007 (Section 7.3.4).

7.3.3 Native American Graves Protection and Repatriation Act

Reclamation will include in construction contracts a stipulation and protocol in the event of inadvertent discovery of human remains that are determined to be American Indian.

7.3.4 Executive Order 13007: Indian Sacred Sites

Executive Order 13007 (1996) instructs Federal agencies to promote accommodation of access and protect the physical integrity of American Indian sacred sites. A sacred site is defined as 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. A sacred site can only be identified if the Tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of a site.

7.4. Compliance with Other Federal Laws

In addition to the laws, EO, and regulations described above, Reclamation has complied and will continue to comply with the following EOs.

7.4.1 Executive Order 11988: Floodplain Management

Reclamation will comply with EO 11988 to reduce the risk of flood loss to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

7.4.2 Executive Order 11990: Protection of Wetlands

Reclamation will comply with EO to minimize disturbance, loss, or degradation of wetlands.

7.4.3 Executive Order 12898: Environmental Justice

Executive Order 12898 established environmental justice as a Federal agency priority to ensure that minority and low-income groups are not disproportionately affected by Federal actions. As discussed in Chapters 5 and 6 of the FEIS, none of the action alternatives would have disproportionate adverse impacts to minority or low income populations.

Public information activities will continue through the future developments of this project.

7.5. Additional Reviews, Approvals, and Permits

To implement a selected fish passage plan, Reclamation would apply for various permits; take certain actions; and comply with various laws, regulations, and Executive Orders in addition to the ones listed above. The following is a partial list of other major permits, actions, and laws that Reclamation must consider before implementing a selected alternative:

- Section 401 Permit, Clean Water Act
- Section 402 Permit, National Pollutant Discharge Elimination System, Clean Water Act
- Washington Department of Natural Resources Permit
- National Pollutant Discharge Elimination System Permit(s)
- Hydraulic Project Approval
- Kittitas County Shoreline Management Program
- Kittitas County Critical Areas Permit or Approval

7.6. Resource Analysis

Following is a narrative summary of the effects of the alternatives on key resources that likely would be affected by the alternatives. Detailed information about impacts to all resources can be found in Chapter 5 of the *Final Environmental Impact Statement-Cle Elum Dam Fish Passage Facilities and Fish Reintroduction Project* (FEIS). Overall, the fish passage facilities are expected to have positive benefits on natural resources in the Cle Elum basin.

7.6.1 Water Resources

7.6.1.1. Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no construction and dam and reservoir operations would not change. Therefore, no changes to water quality or water supply would occur.

7.6.1.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

No long-term impacts to water quality would be expected from operation of the fish passage facilities. A short-term pulse of turbidity may occur following re-watering of the areas where ground disturbance occurred during construction; however, these instances would be short in duration and a one-time event. Following construction, all disturbed areas would be stabilized and would not provide a source of chronic erosion over the long-term.

Construction and operation of the fish passage facilities would have no impacts on water supply. Construction operations would be coordinated to allow flow releases from Cle Elum Dam to remain unchanged. Fish passage operations would be integrated into existing project demands and would not impact existing water delivery contracts, total water supply available, or flood control operations.

7.6.1.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

Construction and long-term impacts to water quality and water supply would be similar to those described for Alternative 2.

7.6.2 Fish

7.6.2.1. Alternative 1 – No Action Alternative

Under the No Action Alternative, Reclamation would not construct permanent fish passage facilities at Cle Elum Dam. Approximately 29.4 miles of historic spawning and rearing habitat would continue to be blocked from anadromous fish use. In addition, the existing interim fish passage facilities would be removed which would stop the fish reintroduction efforts that have begun in the basin and restrict downstream passage for the anadromous fish that have been released in Cle Elum Lake.

7.6.2.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

In the long-term, fishery resources would benefit from permanent fish passage facilities. Valuable habitat upstream of Cle Elum Reservoir would be accessible and available to all species for spawning, rearing, foraging, and migration. While there is the potential for short-term increases in turbidity and sedimentation, it is expected that the use of best management practices related to temporary erosion and sediment control will minimize these impacts. In addition, much of the work will be completed during the dry season which will minimize the potential for mobilizing disturbed soils and sediment.

7.6.2.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

Construction and long-term impacts would be similar to those described for fish passage facilities under Alternative 2.

7.6.3 Threatened and Endangered Species

7.6.3.1. Alternative 1 – No Action Alternative

Under the No Action Alternative, Reclamation would not modify Cle Elum Dam to include fish passage facilities and the interim fish passage facility would be removed. There would be no increase in ecosystem productivity that would be beneficial to threatened and endangered species that utilize habitat (riverine and terrestrial) above the reservoir. Removal of the interim fish passage facilities would cause the Yakama Nation to stop their ongoing fish reintroduction program, which is intended to benefit bull trout and Middle Columbia River (MCR) steelhead.

7.6.3.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

Overall, the proposed project would benefit bull trout and MCR steelhead by allowing access to available upstream spawning and rearing habitat and reconnecting populations that were previously isolated by the dam. Habitat for MCR steelhead would be temporarily affected by construction of the fish ladder and adult collection facility. Reclamation will comply with the Essential Fish Habitat Conservation Recommendations provided by NMFS in its concurrence letter for Endangered Species Act (ESA) consultation.

Other listed species, which may occur in the area, such as gray wolves, grizzly bears, Canada lynx, and Ute ladies'-tresses are unlikely to be negatively affected by the project and would likely benefit from increased ecosystem productivity.

7.6.3.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

Impacts would be similar to those described under Alternative 2 except construction downstream of the dam would affect a smaller area of MCR steelhead habitat.

7.6.4 Cultural Resources

7.6.4.1. Alternative 1 – No Action Alternative

Under the No Action Alternative, Reclamation would not modify Cle Elum Dam to include fish passage facilities. Therefore, there would be no potential for disturbance of cultural resources. Removal of the interim fish passage facilities from the dam would restore it closer to its historic appearance.

7.6.4.2. Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam

Alternative 2 includes extensive construction that would cause ground disturbance in the area around and downstream of the dam. The area was previously disturbed during construction of the dam. The proposed downstream fish passage conduit passes through the original construction camp used during the building of Cle Elum Dam. While no standing structures still exist, there may be historical archaeological values that could be affected by ground disturbance. A Kittitas-Yakama seasonal camp, *Aiyalim*, is also located in the dam area. Its exact location is unknown, but the camp could be disturbed by construction. Furthermore, the multilevel intake structure and access bridge would be attached to Cle Elum Dam, which is eligible for the National Register of Historic Places

(NRHP). These facilities could detract from the historic qualities of the dam; however, the dam has undergone other modifications since it was constructed.

7.6.4.3. Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam

Impacts to cultural resources would be similar to those described for Alternative 2. However, the intake structure would not be attached to the dam, eliminating that potential impact to the historic structure.

7.7. Summary of Impacts

Reclamation has evaluated the effects of constructing the two fish passage alternatives at Cle Elum Dam compared to taking no action. This analysis is summarized in Table 7-1 below. The table compares the impacts associated with the three fish passage facility alternatives. The phrase "short-term" refers to impacts associated with construction activities. The phrase "long-term" refers to impacts following the construction period.

Table 7-1. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Water Resources	No impacts.	Short-term: Minor increases in turbidity and sedimentation during construction. Long-term: None.	Same as Alternative 2.
Fish	Historic habitat would continue to be blocked. Removal of interim facilities would stop fish reintroduction efforts.	Short-term: Potential disturbance during construction. Long-term: Benefit to species diversity and productivity/genetic diversity.	Same as Alternative 2. Fewer construction impacts.
Vegetation	No impacts.	Short-term: Removal of vegetation from construction areas. Long-term: Some loss of permanent vegetation and loss of mature vegetation for approximately 50 years.	Same as Alternative 2. Fewer construction impacts.
Wildlife	No impacts.	Short-term: Minor disturbance near facilities during construction and operation activities. Long-term: Loss of mature habitat for approximately 50 years.	Same as Alternative 2. Fewer construction impacts.
Threatened and Endangered Species			

Table 7-1. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Bull trout Middle Columbia River (MCR) steelhead	Historic habitat would continue to be unavailable to steelhead and populations of bull trout would remain isolated from one another.	Short-term: Potential disturbance during construction. Long-term: Beneficial effect with implementation of fish passage.	Same as Alternative 2. Fewer construction impacts.
MCR steelhead critical habitat	No impacts.	Permanent impacts to designated critical habitat as a result of barrier dam construction.	Permanent impacts to designated critical habitat as a result of pump construction (less impact than Alternative 2).
Grizzly bear Gray wolf Canada lynx	No impacts.	Short-term: If present, species likely to avoid area during construction. Long-term: Potential beneficial impact from increased prey.	Same as Alternative 2. Fewer construction impacts.
Ute ladies'-tresses	No impacts.	Short-term: Potential habitat may be disturbed. Long-term: None.	Same as Alternative 2. Fewer construction impacts.
Northern spotted owl	No impacts.	Short-term: Potential loss of nesting and foraging habitat. Long-term: Potential loss of nesting habitat until forest matures.	Same as Alternative 2. Fewer construction impacts.
Visual Resources	Beneficial impact since interim passage facilities would be removed from dam.	Short-term: Construction equipment and activities would be visible. Long-term: Visible items in project area such as intake structure, access bridge, barrier dam.	Less impact than Alternative 2, as barrier dam and access bridge are eliminated from Alternative 3.
Air Quality	No impacts.	Short-term: Minor dust associated with construction and traffic. Long-term: None.	Same as Alternative 2.
Climate Change	No impacts.	Short-term: Minor increases in greenhouse gas emissions. Long-term: Access to historic habitat may help fish withstand climate change impacts.	Same as Alternative 2.
Noise	No impacts.	Short-term: Construction noise limited to daytime hours. Long-term: None.	Same as Alternative 2.
Recreation	No impacts.	Short-term: Noise, traffic delays. Long-term: None.	Same as Alternative 2.
Land and Shoreline Use	No impacts.	Short-term: Small amounts of land converted from forest to fish passage facilities. Long-term: Same as short-term.	Same as Alternative 2.
Utilities	No impacts.	Short-term: None. Long-term: Minor increase in power demand for pumping.	Same as Alternative 2 except more power would be required for pump.

Table 7-1. Comparison of impacts for fish passage facilities

Resource	Alternative 1 – No Action	Alternative 2 – Right Bank Juvenile Passage with Left Bank Adult Passage with Barrier Dam	Alternative 3 – Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam
Transportation	No impacts.	Short-term: Noise, traffic delays. Long-term: None.	Same as Alternative 2.
Environmental Justice	No impacts.	No impacts.	No impacts.
Cultural Resources	No impacts. Removal of interim facilities would restore dam closer to historic appearance.	Potential adverse effects to dam, potential effects to prehistoric/historic resources.	Potential effects to prehistoric/historic resources.
Indian Sacred Sites	No impacts.	No impacts.	No impacts.
Indian Trust Assets	No impacts.	No impacts.	No impacts.
Socioeconomics	No impacts.	Short-term: Construction would generate sales, jobs and labor income in the region. Long-term: Small increase in sales, jobs, and labor income.	Short-term: Same as Alternative 2 except smaller increases. Long-term: Same as Alternative 2.

Chapter 8

FINDINGS AND RECOMMENDATION

Chapter 8. Findings and Recommendation

Reclamation has completed a feasibility-level investigation of proposed upstream and downstream fish passage facilities at Cle Elum Dam. This Planning Report documents the data collected, analyses conducted, economic evaluation and the feasibility-level engineering designs and cost estimates completed.

8.1. Project Viability

Based on feasibility-level engineering and design, both fish passage alternatives are technically viable. The Yakama Nation and WDFW have developed a fisheries reintroduction plan for anadromous fish species designed to complement and enhance the benefits of fish passage at Cle Elum Dam.

8.2. Costs

The feasibility-level construction cost estimate (field costs and noncontract costs) for Alternative 2 was $96 million; adding interest during construction brings the total project cost to $103.8 million. Field costs were estimated at $81 million, of which $65.4 million were expected to be incurred within the region (Yakima and Kittitas Counties) and the remainder outside the region. These in-region costs were estimated to generate an additional $92.9 million of output/sales, 961 jobs, and $36.8 million of labor income over the 3-year construction period. Average annual OMR&P costs were estimated to generate an additional $436,700 of output/sales, five jobs, and $216,200 of labor income.

The feasibility-level construction cost estimate (field costs and noncontract costs) for Alternative 3 was $84 million; adding interest during construction brings the total project cost to $91.8 million. Field costs were estimated at $69 million, of which $55.9 million were expected to be incurred within the region (Yakima and Kittitas Counties) and the remainder outside the region. These in-region costs were estimated to generate an additional $79.6 million of output/sales, 830 jobs, and $31.8 million of labor income over the 3-year construction period. Average annual OMR&P costs and benefits would be similar to Alternative 2.

8.3. Conclusions

Reclamation and the Core Team found that Alternative 2 and Alternative 3 both provided the same level of fish passage effectiveness. Both alternatives would provide access to

approximately 29 miles of potential spawning and/or juvenile rearing habitat above the reservoir plus access to the reservoir itself, which is currently inaccessible.

Yakima basin fishery co-managers, Yakama Nation and WDFW, and NMFS and U.S. Fish and Wildlife Service biologists conclude that a plan to reintroduce anadromous salmonids into the upper Cle Elum watershed is an important and necessary component of the FP/FR project to maximize the benefit of fish passage at Cle Elum Dam by reintroduction of adult and juvenile fish to accelerate the rate of colonization.

Fish passage at Cle Elum Dam would benefit bull trout and mid-Columbia River steelhead by allowing access to available upstream spawning and rearing habitat and reconnecting populations that were previously isolated by the dam. It would also enhance the overall ecological health in the reservoir and the upper Cle Elum basin through the infusion of marine-derived nutrients from returning adults.

8.4. Preferred Alternative

Reclamation has selected Alternative 3, Right Bank Juvenile Passage with Right Bank Adult Passage without Barrier Dam, as the Preferred Alternative for the Fish Passage Facilities portion of the FP/FR Project. Alternative 3 would result in fewer adverse environmental impacts and would cost approximately $12 million less than Alternative 2, while still meeting the purpose and need of the fish passage project.

Alternative 3 would eliminate the fish barrier dam downstream from the spillway stilling basin. Fish would be attracted to the fish ladder by a combination of flow from the downstream juvenile passage conduit and pumped attraction flows rather than be guided to the ladder by a barrier dam. This would reduce the construction footprint downstream of the dam and preserve access to the existing fish habitat in the stilling basin.

All of the passage facilities would be located on the right bank, further reducing adverse environmental impacts. With the multilevel intake structure located against the right bank abutment, access would be from the shore which eliminates the need for an access bridge. The location of the intake structure reduces the length of the juvenile bypass conduit from 1,520 feet to 950 feet. Eliminating the access bridge also minimizes potential impacts to the historic dam structure. In addition, access roads would not be required on the left bank of the river since the adult passage facility would be located on the right bank. The road system constructed for installation and construction of passage facilities would also serve as permanent access.

8.5. Recommendation and Next Steps

In accordance with Reclamation’s commitment to the Yakama Nation, this Planning Report and the Cle Elum Dam FP/FR Project FEIS will be submitted to the Office of the

Secretary of the Department of the Interior with a determination that fish passage at Cle Elum is technically feasible. In addition, the report will be submitted with the recommendation that, should significant cost-share funding become available, Reclamation would support proceeding with the final design phase of the project.

Recognizing that it is likely that funding opportunities at the Federal level will continue to be limited in future budget climates, Reclamation anticipates being able to proceed from the final design phase to construction only if or when sufficient non-Federal cost-share funding becomes available. Note that Section 109 of the Act of August 17, 1984 (98 Stat. 1333, P.L. 98-381 [Hoover Power Plant Act]) authorizes the Secretary of the Interior ***" . . . to design, construct, operate, and maintain fish passage facilities within the Yakima River Basin, and to accept funds from any entity, public or private, to design, construct, operate, and maintain such facilities."***

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Appendix A

AGREEMENTS

MITIGATION AGREEMENT BETWEEN THE USDI BUREAU OF RECLAMATION AND WASHINGTON DEPARTMENT OF FISH AND WILDLIFE REGARDING KEECHELUS DAM CONSTRUCTION ISSUES INCLUDING FISH PASSAGE.

This Mitigation Agreement ("Agreement") is made between the Washington State Department of Fish and Wildlife, hereinafter referred to as WDFW, and the USDOI Bureau of Reclamation, hereinafter referred to as Reclamation. For purposes of this Agreement, the above entities are referred to collectively as "the Parties." The terms of this Agreement shall be binding upon the respective successors or assigns of each Party.

WHEREAS the U.S. Department of Interior Bureau of Reclamation ("Reclamation") and the Washington Department of Fish and Wildlife ("WDFW") share a common objective to protect, maintain and enhance water, fish and wildlife resources, and they recognize their mutual desire to continue a long-standing working relationship;

WHEREAS Congress established that the purposes of the Federal Yakima Project include fish, wildlife and recreation and that the existing storage rights of the project include storage for the purposes of fish, wildlife and recreation (Public Law 103-434, Title XII Yakima River Basin Water Enhancement Project - Sec 1205(e) Operation of Yakima Project);

WHEREAS Congress established that said storage for the purposes of fish, wildlife and recreation shall not impair the operation of the Yakima Project to provide water for irrigation purposes nor impact existing contracts (Public Law 103-434, Title XII Yakima River Basin Water Enhancement Project - Sec 1205(e) Operation of Yakima Project);

WHEREAS The Washington State law requires that a dam or other obstruction shall be provided with a durable and efficient fishway approved by the director of WDFW and that the fishway shall be maintained in an effective condition and continuously supplied with sufficient water to freely pass fish (RCW 77.55.060);

WHEREAS Reclamation and WDFW agree that Reclamation's authorities in the Yakima Basin provide for a broad range of fish enhancement activities including such things as barrier removal, screening of diversions and restoration of instream flows on both the mainstem river and tributaries, within proscribed limits;

WHEREAS Reclamation and WDFW agree that restoring fish passage at man-made barriers is, in nearly all cases, biologically preferable for conserving, restoring and enhancing indigenous fish species; and

WHEREAS the parties agree that moving forward expeditiously with repairs to Keechelus Dam is in the public interest to protect public safety and provide necessary

water for project purposes.

THEREFORE the parties agree to work collaboratively to carry out their respective responsibilities and agree as follows:

I. Commitments of WDFW:

WDFW Agrees:

1) To issue a Hydraulic Project Approval (HPA) for the proposed Safety of Dams reconstruction of Keechelus Dam as soon as possible. The HPA shall incorporate the provisions of this agreement.

2) To provide technical support to Reclamation so that the fisheries objectives of this agreement may be met.

II. Commitments by the United States of America

Reclamation Agrees:

1) To abide by the provisions of the HPA.

2) To immediately conduct an assessment of fish passage at all Yakima Project storage reservoirs in the Yakima River Basin as outlined in the HPA for the Keechelus Safety of Dams Modification Project. The assessment shall include consideration of the potential fish production and likelihood of sustainability above each dam using a mutually acceptable assessment tool. Where fish passage is determined to be desirable and practicable, based upon the results of this assessment, Reclamation shall examine engineering feasibility. Where fish passage is determined to be impracticable or infeasible, Reclamation shall negotiate with WDFW to provide an alternative to fish passage, consistent with state law.

3) To seek appropriate funding to ensure timely implementation of: a) fish passage facilities, where passage is determined to be desirable and practicable by the project-wide passage assessment (item 2 above), and b) alternative fish restoration measures for locations where fish passage is determined by the project-wide assessment to be biologically beneficial but impractical or infeasible.

4) Until construction of fish passage facilities at each of the Yakima Project storage reservoirs where fish passage has been determined as necessary as per item 2 above, and such fish passage facilities are in operation, to provide interim fish passage (e.g. trap and haul program) in collaboration with WDFW at each of those reservoirs.

5) To restore fish passage for salmonids from Lake Keechelus into Cold Creek, in collaboration with WDFW, as an interim measure to address fish passage concerns at Keechelus Dam and construction-related impacts of the Safety of Dams project. Reclamation shall do this in concert with the reconstruction of Keechelus Dam and ensure that conditions suitable for adult passage into Cold Creek from the reservoir are restored.

6) To develop a formal process involving regularly scheduled meetings to occur no less than biannually to ensure that there is ample opportunity for input by the fish management agencies (WDFW, National Marine Fisheries Service, US Fish and Wildlife Service and the Yakama Nation) into decisions concerning fish enhancement measures implemented by Reclamation under its various authorities in the Yakima River basin.

7) To ensure that construction materials for major Reclamation projects (including Safety of Dams projects) are sourced from sites not in the geomorphic flood plain of the Yakima River, or tributaries, whenever practicable.

8) To ensure that the proposed Safety of Dams reconstruction-related actions at Keechelus Dam will not result in significant additional costs for retrofitting fish passage facilities at Keechelus Dam nor require future significant modification of the portions of the dam being reconstructed as part of the SOD work.

9) To ensure that the functions of the large (approximately 300 acres) wetland complex below the toe of Keechelus Dam are not impaired. This wetland is the source of water for three different water courses, at least two of which are fish-bearing streams, which flow into a river side channel complex below Keechelus Dam. Reclamation shall mitigate for unavoidable impacts to this wetland as outlined in the Final Environmental Impact Statement (FEIS) for the Keechelus Dam Safety of Dams Modification (September 2001). If for some reason the land acquisition outlined in the FEIS cannot be accomplished, alternative mitigation strategies shall be developed in cooperation with the WDFW and others.

III. DISPUTE RESOLUTION

1) In the event that a dispute between the parties should arise, the parties shall make every effort to informally resolve the matter. Should a dispute arise, the aggrieved party shall send the other parties written notice of the issue in dispute, which shall state the aggrieved party's preferred resolution to the matter. Nothing shall prevent the parties from using any other remedy otherwise available to them if informal dispute resolution does not work; provided, however, that no party shall engage in self-help without first notifying the other parties of its intended act(s) and providing reasonable time for the other parties to respond.

2) Each Party shall have all remedies otherwise available in equity or at law to enforce the terms of this agreement, including specific performance and injunctive relief. No party shall be liable in damages to any other Party or other person for any breach of this agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this agreement, or any other cause of action arising from this agreement.

IV. MODIFICATION OF AGREEMENT

This agreement may only be modified upon written agreement of the parties.

V. SAVINGS CLAUSE

Nothing herein shall prevent, waive or diminish the right or authority of WDFW to use any statutory or other remedy available to enforce the provisions of this agreement. Nothing herein shall prevent, waive or diminish the right or authority of WDFW to protect populations of fish, or any other aquatic life in Lake Keechelus, theYakima River or tributaries to the fullest extent allowed by law, nor shall this preclude the WDFW from using any statutory or other remedy available concerning or relating to these fish. Nothing contained in this agreement is intended to unlawfully limit the authority or responsibility of the Department of Fish and Wildlife to invoke penalties or otherwise fulfill its responsibilities as a public agency.

VI. GENERAL PROVISIONS

1) Nothing herein shall or shall be construed to obligate Reclamation to expend or involve the United States of America in any contract or other obligation for the future payment of money in excess of appropriations authorized by law and administratively allocated for the purposes and projects contemplated hereunder.

2) No member of, or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this Agreement or to any benefit that may arise out of it.

3) The parties agree to comply with all federal statues relating to nondiscrimination, including but not limited to: Title VII of the Civil Rights Act of 1964, as amended which prohibits discrimination on the basis of race, color, religion, sex or national origin; Title IX of the Education amendments of 1972, as amended, which prohibits discrimination on the basis of sex; the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990, as amended, which prohibit discrimination on the basis of disability: the Age Discrimination in Employment Act of 1976, as amended, which prohibits discrimination based on age against those who are at least 40 years of age; and the Equal Pay Act of 1963.

4) The Agreement shall become effective on the date of last signature hereto and

extended until terminated. Either party may formally request modification of the agreement.

5) Nothing in this Agreement shall, or shall be construed to alter or affect the authorities, rights or obligations of the parties under existing law or regulations.

THE UNITED STATES OF AMERICA

By: Eric Glover
Dated: 4/8, 2002

Eric Glover
Area Manager
Bureau of Reclamation

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

By: Jeff Tayer
Dated: 11/4-08-, 2002

Jeff Tayer, Regional Director
Department of Fish and Wildlife

HYDRAULIC PROJECT APPROVAL

RCW 77.55.100 - appeal pursuant to Chapter 34.05 RCW

State of Washington
Department of Fish and Wildlife
Region 3 Office
1701 South 24th Avenue
Yakima, Washington 98902-5720

DATE OF ISSUE: April 17, 2002

LOG NUMBER: 00-E1998-01

PERMITTEE

USDI Bureau of Reclamation
Upper Columbia Area Office
ATTENTION: David Kaumheimer
1917 Marsh Road
Yakima, Washington 98901
(509) 575-5848 ext. 232
Fax: (509) 454-5650

AUTHORIZED AGENT OR CONTRACTOR

USDI Bureau of Reclamation
Pacific Northwest Construction Office
ATTENTION: Bernie Meskimen
P.O. Box 2967
Yakima, Washington 98902
(509) 575-5946
Fax: (509) 454-5622

PROJECT DESCRIPTION: **Dam Reconstruction** -Safety of Dams reconstruction of Keechelus Dam. Work includes reconstructing the earthen dam, construction of access roads, handling and stockpiling of materials, excavating and placing fill and drain in wetlands, constructing new bridges, and installing bank protection materials.

PROJECT LOCATION: **Lake Keechelus Dam - Yakima River -** Keechelus Dam adjacent to I-90, east of Snoqualmie Pass.

#	WRIA	WATER BODY	TRIBUTARY TO	1/4 SEC.	SEC.	TOWNSHIP	RANGE	COUNTY
1	39.0002	Yakima River	Columbia River	SE	27	20 North	15 East	Kittitas

PROVISIONS

1. **TIMING LIMITATIONS:** The project may begin **May 1, 2002** and shall be completed by **November 30, 2004.**

GENERAL PROJECT PROVISIONS APPLICABLE TO ALL ELEMENTS

GENERAL

2. Work shall be accomplished per plans and specifications entitled, Keechelus Dam Modification, Solicitation Number 02SP101485, dated September 21, 2001 and information submitted by USDI Bureau of Reclamation (Reclamation) to Washington Department of Fish and Wildlife (WDFW) with the Hydraulic Project application, except as modified by this Approval. A copy of these plans shall be available on-site during construction. Plan changes must be specifically approved by the WDFW field representative.

3. Temporary run-off and erosion control measures shall be employed as necessary throughout the project area to prevent discharge of sediment-laden water, earth or sediment to watercourses or wetlands. Unless specifically approved in the plan of work, there shall be no discharge of sediment, turbid water or water containing materials harmful to fish or aquatic life to water bodies or wetlands.

4. Concrete structures shall be sufficiently cured to prevent leaching of chemicals harmful to fish or aquatic life prior to removal of containment measures and allowing contact with surface water.

5. Aggregate, sand, gravel, clay or earth needed to construct the project shall be obtained from the Bureau of Reclamation designated borrow areas referred to as DSL Borrow Area, DSLE Borrow Area, Iron Horse Trail Quarry and the Crystal Springs SnoPark site, or obtained from public or commercial sources which are not in the geomorphic flood plain of the Yakima River, except that gravel may be obtained from floodplain sources where it can be clearly shown that removal of these materials is not likely to adversely affect Middle Columbia River steelhead or bull trout.

REQUIRED SALVAGE OF TREES AND SHRUBS

6. Select trees and riparian shrubs which must be removed to construct this project shall be salvaged for use on site (see restoration plans) or stockpiled at an approved stockpile site for use elsewhere in creating fish habitat and restoring shoreline vegetation. Trees and shrubs for salvage shall be identified and clearly marked on site in collaboration with WDFW. The total number of trees with intact rootwads to be salvaged shall be determined by WDFW and Reclamation at the time of marking based on the needs for restoration work, the ability to stockpile trees and the size of the trees actually salvaged for these purposes. .

7. Removal of each tree designated for salvage shall be done by excavating around the rootwad to loosen soil and then pushing the tree over so as to keep a large rootwad attached to the tree for use as in-channel Large Woody Debris (LWD). Where practical, select trees shall be removed and placed or stockpiled as whole trees (no cutting, limbing or removal of rootwads).

8. Trees and shrubs of a size suitable for machine transplanting as part of construction site or wetland restoration shall be marked in advance, removed with a trackhoe with rootballs intact, protected from dessication and replanted as soon as possible.

STAKING AND MARKING

9. The project boundary and clearing limits shall be clearly marked/staked prior to any clearing or ground disturbing activity. Sensitive areas and trees to be protected from disturbance or salvaged shall be delineated/marked so as to be clearly visible to equipment operators.

ENVIRONMENTAL COMPLIANCE INSPECTION AND REPORTING

10. The Bureau of Reclamation shall monitor and ensure contractor compliance with HPA provisions. If work occurs in violation of permit provisions, Reclamation shall immediately stop work on the particular task or project section until the problem is corrected. Reclamation shall promptly notify WDFW of any non-compliance with provisions and the actions taken to address the problem.

11. The permittee shall provide a qualified "Environmental Compliance Inspector", knowledgeable about fishes, wetlands and the environment of the upper Yakima River Basin. This inspector shall have the authority to assure compliance with plans, permit provisions and mitigation measures. This inspector shall be on site on a sufficiently regular basis to monitor work and ensure compliance with HPA provisions. The inspector shall be present during all activities of special concern identified in the approved Plan of Work and pre-construction meeting.

EQUIPMENT LIMITATIONS

12. Except for work to install containment/coffer dams, all work shall be done in isolation from surface water (i.e. wetlands, streams, Lake Keechelus, and the Yakima River). Equipment shall work from the access

roads, constructed work platforms, the bank, from the dry shoreline or dry lake bed, or from inside of containment or coffer dams.

13. Equipment operating in the shoreline zone, wetlands or associated buffers, or operating within the ordinary high water line shall be maintained in good working conditions such that petroleum products or other harmful chemicals are not leaked or spilled to these areas.

14. Equipment entering the wetted perimeter of the river, lake or tributary streams in accordance with the approved plan of work (i.e. to install containment structures, etc.) shall be cleaned prior to entering the water so as to be free of accumulations of earth, petroleum products and other materials harmful to fish life.

REQUIRED NOTIFICATIONS, MEETINGS AND SUBMITTALS

NOTIFICATION REQUIREMENT

15. The permittee or contractor shall notify the Department field office by phone (509) 925-1013 or FAX (509) 925-4702 at least 72 hours prior to starting work on those portions of this project within the ordinary high water line. Leave message for Habitat Biologist Brent Renfrow. The notification shall include the permittee's name, project location, starting date for work, and the log number for this Hydraulic Project Approval.

PRE-CONSTRUCTION MEETINGS AND SUBMITTALS

16. **Water Control Plan**. Prior to commencement of work within the ordinary high water marks, the permittee shall submit for approval a detailed water control plan showing the proposed methods for isolation of work areas from water, methods for care of the release of water from Keechelus Lake during construction, and measures to be taken to meet river flow and water quality requirements. This plan shall include back-up pump(s) installed and ready for immediate service or other satisfactory contingency measures to maintain instream flow without interruption. No work shall begin within the ordinary high water marks until a satisfactory plan is approved.

17. **Spill Prevention and Containment Plan**. Prior to commencement of work within the ordinary high water marks, the permittee shall submit for approval a detailed Spill Prevention and Containment Plan. No work shall begin within the ordinary high water marks until a satisfactory plan is approved.

18. **Plan of Work**. Prior to commencement of work, the permittee shall arrange a preconstruction meeting with WDFW, the project superintendent and key personnel to discuss and develop a detailed Plan of Work, and highlight areas of special concern. The Plan of Work shall address all elements of work related to or affecting the lake, watercourses, and wetlands. The plan shall include the timing and sequence of work, installation and removal of the temporary containment structures needed to isolate the work areas, water management in the work area, dewatering of work areas, location of settling ponds, access roads, borrow and stockpile areas, etc.. The plan of work shall describe in detail how the permittee shall ensure protection of water quality, fish and fish habitat during clearing, grubbing, and construction of the downstream drain,

outlet tunnel section, bridges, cutoff wall and embankment. No work shall begin within the ordinary high water marks until a satisfactory plan is approved and staked in the field as appropriate.

19. **Wetland Restoration and Monitoring Plan**. By August 15, 2002, the permitee shall submit to WDFW for approval a detailed wetland restoration and monitoring plan for restoring the large wetland complex immediately downstream of Keechelus Dam and monitoring the success of the restoration measures. The plan shall include the time table for restoration and the schedule for monitoring and reporting. This plan shall include landscaping and cultural measures for restoring vegetation, and structural measures to restore pre-project (i.e. 1998) hydrology to the wetland complex and stream channels. The plan shall also include a ten-year monitoring program and contingency measures to ensure that vegetation is successfully restored and that the hydrology is not adversely affected by the toe drain or other project features.

CARE AND MANAGEMENT OF WATER DURING CONSTRUCTION

TEMPORARY CONTAINMENT STRUCTURES

20. Temporary containment structures shall be in place prior to initiation of in-water work or ground-disturbing work within or adjacent to the ordinary high water line of Lake Keechelus, water courses or wetlands. Containment structures must effectively isolate the work area and prevent discharge of sediment or harmful materials to water or wetlands.

21. Containment structures placed or worked in water shall be installed using only clean materials (e.g. sand bags, "ecology blocks", plastic sheeting, washed gravels, etc.) until the structure is closed and the work area fully contained. Only clean materials shall be allowed on the outboard side of structures. After the work area is contained, materials containing fines may be used within the contained area if necessary.

22. Removal of containment structures and cofferdams shall be done in the reverse of the sequence in which they are installed. Removal shall be done in a manner which minimizes the release of fine sediment to water or wetlands. Materials used in the temporary containment structures shall be removed from the site and disposed of in approved locations.

DEWATERING OF WORK AREAS

23. During initial dewatering of work areas, turbid water shall be pumped to an upland area to allow fines to settle out before the water re-enters the river. Subsequent pumping to remove clean water infiltrating through sands and gravels may be discharged directly to water courses and wetlands provided that: a) a perforated sump chamber is installed away from the main work area to intercept the inflow, b) waste water containing raw concrete or other harmful materials is NOT reaching the sump chamber, c) water being pumped from the sump is clear (no suspended solids or turbidity), and d) state water quality standards are satisfied. Lines discharging water shall be equipped with a diffusing device which shall prevent the scouring and dislodging of fine sediments from the bank or bed of the watercourse or wetlands.

24. Wastewater containing earth, silt or contaminants (e.g. bentonite, raw concrete, etc.) shall be pumped to an upland area where these contaminants shall be treated and removed from the water. Care shall be taken to ensure no harmful material (e.g. fresh cement, petroleum products, wood preservatives, toxic chemicals, etc.)

are allowed to enter the water of the river, lake, streams or wetlands. (Note that raw concrete is toxic to fish and other aquatic life.)

SETTLING PONDS

25. Settling ponds shall be located in upland sites away from watercourses and wetlands, or at specifically approved locations. Water and erosion control measures shall be taken at all sites so as to prevent transport of sediment or harmful materials (e.g. fresh cement, petroleum products, bentonite, chemicals, etc.) to waters or wetlands.

MAINTENANCE OF INSTREAM FLOW BELOW DAM

26. Flows released from the dam to the river shall be set at approximately 100 cfs by September 10th. Once spawning of chinook and bull trout occurs downstream from the dam, there shall be no reduction in flow released from the dam except as follows: a) flow below the dam may be reduced to 70 cfs for a period of time not to exceed 24 hours to allow installation and removal of low flow bypass facilities as per the approved water control plan; and b) flow below the dam may be reduced to less than 100 cfs IF, based upon the location and distribution of redds, Reclamation's ability to operate, and recommendations of SOAC, WDFW and Reclamation concur that a lower instream flow is acceptable.

27. After September 10th, WDFW shall be notified prior to altering flows. Leave message for John Easterbrooks (509) 457-9330 and Brent Renfrow (509) 925-1013. Except for emergency actions, notification shall be at least 72 hours in advance of the anticipated change.

28. During the period when the dam's outlet works are blocked to replace the outlet conduit section, river flow shall be monitored continuously to ensure that the bypass system is functioning adequately and that there is no disruption of water flow to the river.

29. Sufficient measures shall be taken to prevent sediment from entering the river from the bypass operations or from construction-related discharges from the work area. If pumps are used to bypass flow to the river, the pump intake shall be located where only clean water will be drawn into the pump. If necessary to obtain proper submergence of the intake, a pool sufficient to accommodate the pump intake and pump screen may be excavated in the lake bed at the location of the intake. The pump outlet shall be equipped with a diffusing device or located where the discharge will not mobilize fine materials nor scour the river bank or bed. There shall be no increase of turbidity (over background) permitted in the river below the project.

30. If pumps are used to bypass flow to the river, the pump system shall be equipped with a fish guard (screen) to prevent passage of fish into the pumps. The screen shall be consistent with the current WDFW screening criteria (copy attached). Screen maintenance shall be adequate to maintain screen criteria and to prevent injury or entrapment to juvenile fish. The screen shall remain in place whenever water is withdrawn through the pump intake.

State of Washington
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1701 South 24th Avenue
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DATE OF ISSUE: April 17, 2002 **LOG NUMBER:** 00-E1998-01

CLEARING AND GRUBBING OF CONSTRUCTION AREA

TREE AND STUMP REMOVAL

31. All work within wetlands or watercourses shall be done in isolation from the wetted perimeter, or performed during a period when the site is dry.

32. The work area shall be protected from erosion. Water and sediment control measures shall be installed and maintained to prevent discharge of earth or silty water to wetlands or watercourses.

EMBANKMENT REMOVAL AND RECONSTRUCTION

REMOVAL AND RECONSTRUCTION OF EXISTING EMBANKMENT

33. Work shall be performed per the plans and specifications and as detailed in the approved Plan of Work (refer to provision #18 above).

34. Any surplus or waste embankment material shall be disposed of at approved location(s) outside of the Yakima River floodplain.

OUTLET WORKS AND OUTLET CHANNEL

REPLACEMENT OF PORTION OF OUTLET CONDUIT

35. Work shall be done in the dry.

36. Any concrete or grout shall be sufficiently cured prior to contact with water to avoid leaching of materials harmful to fish. (Note that raw concrete is toxic to fish and other aquatic life.)

RIPRAP

37. Grouted riprap installation in the outlet channel shall be placed in the dry.

CLEARING AND MODIFICATION OF OUTLET CHANNEL BANKS

38. To prevent sloughing of earth into the outlet channel and the Yakima River, the outlet channel shall be isolated from the excavation area during bank sloping by a temporary containment barrier of ecology blocks or equivalent, durable and sturdy containment barrier.

SPILLWAY AND OUTLET CHANNEL BRIDGES

GENERAL

39. The work areas at each bridge site shall be separated from the channel by a secure barrier that shall prevent sloughing or erosion of earth and fine material from the work area into the water course.

REMOVAL OF EXISTING BRIDGES

40. Prior to bridge removal, any accumulation of earth or traction material on the bridges shall be carefully removed in a manner which does not discharge this material to the watercourse. Waste material shall be disposed of in approved locations.

41. The existing steel bridges shall be removed in a manner which does not damage the beds or banks of the watercourses. Bridge members shall be fully suspended while being removed from across the channel. There shall be no dragging of the bridge members through the riverbed or across the face of the bank.

BRIDGE CONSTRUCTION

42. During preparation of abutments, adequate containment shall be provided to prevent discharge of earth, raw concrete, grout, chemicals or other harmful material to the channel.

43. The new bridges shall be installed in a manner as to not damage the beds or banks of the watercourses. Bridge members shall be suspended while being placed across each channel. There shall be no dragging of bridge members through the channel or across the face of the bank.

44. During grouting or pouring of concrete, the bridges shall be draped or sealed to prevent leakage of raw cement or other harmful materials, or leakage of water contaminated with such materials to the watercourses.

45. Bridge approach material shall be structurally stable and protected from erosion. Adequate drainage facilities shall be incorporated in the roadway and bridge approach material to direct road runoff away from the bridge and into biofiltration swale or other suitable stormwater treatment area.

46. Curbs or wheel guards shall be installed on each bridge.

GATEHOUSE BRIDGE

BRIDGE REPLACEMENT

47. Removal of the existing bridge and installation of the new gate house bridge shall be done in a manner which does not allow earth, debris or waste materials to be entrained in to the outlet of the reservoir and discharged to the Yakima River.

DOWNSTREAM DRAIN CONSTRUCTION

WORKSITE LIMITATIONS

48. All work shall be done in isolation from surface water. All sediment shall be contained within the work area boundary.

49. The equipment travel routes, clearing limits, and excavation limits shall be clearly staked in the field prior to beginning work within the wetland complex. The wetland outside of the construction area shall be clearly marked in the field and separated from the construction area with silt fence or equivalent barrier.

50. During construction, water in the drain trench shall be pumped to suitable location for treatment. Following treatment, this water shall be directed back to the wetland complex to help maintain the natural soil water table. Clean water infiltrating into the drain trench may be discharged directly to the wetland area in a manner consistent with provision #23 above.

TRENCH EXCAVATION AND INSTALLATION OF DRAIN IN WETLAND

51. Equipment operating within the delineated areas of the wetlands shall be maintained in good working condition such that petroleum products and other harmful materials are not leaked to wetlands.

52. All wetland soils removed during trench excavation shall be transported to the borrow pit or other approved site for temporary stockpiling for use in final restoration of the borrow pit.

DOWNSTREAM DRAIN OUTFALLS

53. Outfall to the Yakima River shall be constructed in isolation from the flowing water of the river.

54. The outfall shall be protected from erosion.

FISH PASSAGE IN LAKE KEECHELUS TRIBUTARY STREAMS DURING DAM CONSTRUCTION

TEMPORARY FISH PASSAGE DURING RESERVOIR DRAWDOWN

55. During the time period that Keechelus Reservoir is drawn down below the average low pool elevation (approximately elevation 2456), Reclamation shall monitor fish passage from Lake Keechelus into the major tributary streams to Lake Keechelus (i.e. Gold Creek, Meadow Creek and Coal Creek) at least two times per week. If passage is impaired, permittee shall immediately report this information to WDFW and consult with WDFW to determine what corrective measures shall be taken to provide passage (e.g. temporary flume, minor channel modification, permanent channel modification, etc.). Reclamation shall construct corrective measures as soon as possible but not later than seven days after determining that passage is impaired.

FISH PASSAGE AT KEECHELUS DAM OR ALTERNATIVE

56. Permittee shall immediately conduct a project-wide assessment of fish passage at all Yakima Project reservoirs. This assessment shall be done in collaboration with WDFW and the first phase of the assessment shall be completed and distributed by January 31, 2003. The first facility to be considered in this project-wide assessment shall be Keechelus Dam. The assessment shall include investigations as to the engineering, constructability and biological considerations of fish passage at each facility. The assessment shall include consideration of the potential fish production and likelihood of sustainability above each dam using a mutually acceptable assessment tool. Phase II of the assessment shall prioritize where fish passage is

determined to be desirable and practicable, based upon the results of the phase I assessment. Phase II shall focus on engineering feasibility, cost, water management implications, and biological parameters for restoring specific stocks. Phase II of the assessment shall be completed by January, 2004. Where fish passage is determined to be both desirable and feasible, the permittee shall seek funding and complete design and construction of fish passage facilities in a timely manner. A separate HPA or HPA amendment is required for construction of these facilities. Where fish passage is determined to be undesirable or impractical, based upon the results of this assessment, Reclamation shall negotiate with WDFW an alternative to providing fish passage consistent with state law. The net benefit of this alternative shall provide equal or greater productivity and ecological function than that predicted for fish passage facilities if constructed at the dam(s).

57. **The Permittee shall immediately begin the assessment of Keechelus Dam as per provision #56 above, and determine whether the proposed design and construction of the Safety of Dams Project will adversely affect the feasibility, cost or efficacy of fish passage facilities at this dam. Reclamation shall modify the Safety of Dams work as necessary to ensure that the proposed Safety of Dams reconstruction-related actions at Keechelus Dam will not result in significant additional costs for retrofitting fish passage facilities at Keechelus Dam nor require future modification of the portions of the dam being reconstructed as part of the SOD work.**

58. **The Permittee shall provide interim fish passage (e.g. trap and haul program) in collaboration with WDFW at facilities where fish passage is desirable based upon the results of the project-wide passage assessment.** Interim passage shall be provided at locations agreed upon by the fish management entities as soon as possible but not later than one year from completion of Phase II of the passage study.

SITE RESTORATION

GENERAL SITE RESTORATION

59. Settling ponds and other earthworks within the ordinary high water mark of Lake Keechelus shall be recontoured to original grade, unless an alternate restoration/grading plan is specifically approved by WDFW.

60. All earth areas adjacent to the watercourse which have been exposed or disturbed by this project are to be graded to a stable grade, seeded with a suitable erosion control seed mix which includes native grasses and forbs, and protected from erosion with a straw mulch or equivalent.

61. Riparian and wetland plantings shall be cared for and maintained as per the monitoring plan, so as to ensure survival and rapid establishment of a robust plant community.

LONG-TERM WETLAND RESTORATION

62. Permittee shall complete the implementation of the approved wetland restoration plan by **November 30, 2004.**

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DATE OF ISSUE: April 17, 2002 **LOG NUMBER:** 00-E1998-01

63. The wetland channels shall be restored to include complex large woody debris such as rootwads or small debris jams, etc.. The banks of the channel, where not fully vegetated, shall be planted with appropriate native plants adapted to streamsides and wetlands.

POST-CONSTRUCTION MONITORING

WETLAND COMPLEX RESTORATION MONITORING

64. The permittee shall monitor the performance and function of the wetland complex, the impacts of the new toe drain on the wetland and flow within the wetland channels, the success in restoration of pre-1998 wetlands hydrology and the success of revegetation of the areas disturbed during construction. Monitoring shall also assess whether mitigation objectives described in the EIS are achieved. Project monitoring shall be as per the approved submitted monitoring plan, and shall include a detailed inspection with sampling and photo documentation and written report submitted to WDFW for approval for one, three, five and ten years post construction. Copies of the monitoring results shall be sent to WDFW following each periodic site review. Any failures of features or revegetation and any deficiencies in performance shall be corrected in a timely fashion. Any corrective action which requires work within the lake, river, wetland or stream channels shall require specific approval from WDFW.

65. If monitoring results indicate that the restoration plan is not successful (i.e. wetland hydrology is not fully restored or that areas remain where native vegetation has not been successfully established) by year five the permittee shall develop a contingency plan to address the restoration deficiencies. The permittee shall submit this plan to WDFW for review and approval, and implement the approved corrective measures in a timely fashion.

SEPA: DS, Adoption of Existing Environmental Document and addendum - Washington Department of Ecology, April 8, 2002

APPLICATION ACCEPTED: April 17, 2002 **ENFORCEMENT OFFICER:** Rogers 125 [P1]

Brent Renfrow
Area Habitat Biologist **(509) 925-1013**

For Director
WDFW

Enclosures: Location map, site plan, construction boundary map, and project narrative

State of Washington
Department of Fish and Wildlife
Region 3 Office
1701 South 24th Avenue
Yakima, Washington 98902-5720

DATE OF ISSUE: April 17, 2002 **LOG NUMBER:** 00-E1998-01

GENERAL PROVISIONS

This Hydraulic Project Approval (HPA) pertains only to the provisions of the Fisheries Code (RCW 77.55 - formerly RCW 75.20). Additional authorization from other public agencies may be necessary for this project.

This HPA shall be available on the job site at all times and all its provisions followed by the permittee and operator(s) performing the work.

This HPA does not authorize trespass.

The person(s) to whom this HPA is issued may be held liable for any loss or damage to fish life or fish habitat which results from failure to comply with the provisions of this HPA.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All HPAs issued pursuant to RCW 77.55.100 or 77.55.200 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The permittee has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All HPAs issued pursuant to RCW 77.55.110 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the permittee: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.170.

APPEALS - GENERAL INFORMATION

IF YOU WISH TO APPEAL A DENIAL OF OR CONDITIONS PROVIDED IN A HYDRAULIC PROJECT APPROVAL, THERE ARE INFORMAL AND FORMAL APPEAL PROCESSES AVAILABLE.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100, 77.55.110, 77.55.140, 77.55.190, 77.55.200, and 77.55.290:
A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:
   (A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA; or
   (B) An order imposing civil penalties.
It is recommended that an aggrieved party contact the Area Habitat Biologist and discuss the concerns. Most problems are resolved at this level, but if not, you may elevate your concerns to his/her supervisor. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30-days of the denial or issuance of a HPA or receipt of an order imposing civil penalties. The 30-day time requirement may be stayed by the Department if negotiations are occurring between the aggrieved party and the Area Habitat Biologist and/or his/her supervisor. The Habitat Protection Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or its designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.100 OR 77.55.140:

State of Washington
Department of Fish and Wildlife
Region 3 Office
1701 South 24th Avenue
Yakima, Washington 98902-5720

DATE OF ISSUE: April 17, 2002 **LOG NUMBER:** 00-E1998-01

A person who is aggrieved or adversely affected by the following Department actions may request an formal review of:

(A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA;
(B) An order imposing civil penalties; or
(C) Any other "agency action" for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, shall be plainly labeled as "REQUEST FOR FORMAL APPEAL" and shall be RECEIVED DURING OFFICE HOURS by the Department within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.110, 77.55.200, 77.55.230, or 77.55.290:
A person who is aggrieved or adversely affected by the denial or issuance of a HPA, or the conditions or provisions made part of a HPA may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS RESULTS IN FORFEITURE OF ALL APPEAL RIGHTS. IF THERE IS NO TIMELY REQUEST FOR AN APPEAL, THE DEPARTMENT ACTION SHALL BE FINAL AND UNAPPEALABLE.

SETTLEMENT AGREEMENT

Confederated Tribes and Bands of the Yakama Nation v. J. William McDonald, et al.,
9th Cir. Docket No. 03-35229,
District Court No. CY-02-3079-AAM (E.D. Wash.)

WHEREAS, the parties consent to execution of this Settlement Agreement (Agreement) in full settlement of all issues arising in *Confederated Tribes and Bands of the Yakama Nation v. J. William McDonald, et. al.*, 9th Cir. Docket No. 03-35229, District Court No. CY-02-3079-AAM (E.D. Wash.),

WHEREAS, the parties have conferred and engaged in negotiations pursuant to the Mediation Program of the U.S. Court of Appeals for the Ninth Circuit,

WHEREAS, this Settlement Agreement is the result of each party's good faith effort to resolve this case,

WHEREAS, each government party to this Settlement Agreement desires to work within the framework of a government-to-government relationship,

WHEREAS, the parties agree that this Settlement Agreement constitutes a fair resolution and compromise of this matter and its underlying competing contentions,

WHEREAS, the parties intend that this Settlement Agreement completely resolve, as among them, all issues raised in this case, or that could properly have been raised in this case, and that this Settlement Agreement is binding upon the parties, and

WHEREAS, though intended to resolve all issues in this case, this Settlement Agreement primarily addresses the establishment of a cooperative framework among the parties for achieving the ultimate goal of passage of anadromous fish at all U.S. Bureau of Reclamation (BOR) irrigation water storage facilities within the Yakima Basin where feasible, as well as anadromous fish reintroduction and habitat restoration efforts,

THE PARTIES AGREE AS FOLLOWS:

1. The Yakama Nation agrees to voluntarily dismiss its appeal in this action before the U.S. Court of Appeals for the Ninth Circuit, with prejudice.

2. BOR agrees to use its existing congressional authority and funding under § 1206 of the Yakima River Basin Water Enhancement Project (YRBWEP), Pub. L. No. 103-434, 108 Stat. 4550, 4560 (1994), to implement interim juvenile (downstream) fish passage measures at Cle Elum Dam, as developed by the Technical Yakima Basin Storage Fish Passage Work Group described in ¶ 6(a). BOR has implemented interim juvenile (downstream) fish passage at Cle Elum Dam and shall continue to do so per this paragraph.

3. "Interim" is defined throughout this Settlement Agreement as the period of time from the execution date of this document to the time at which permanent adult (upstream) and/or

juvenile (downstream) fish passage is implemented, or to the time at which the Regional Director, Pacific Northwest Region, BOR, concludes that permanent adult (upstream) and/or juvenile (downstream) fish passage is infeasible, for Cle Elum and Bumping Lake Dams as described in ¶ 7.

4. The parties agree to study and develop feasible measures, if any, for inclusion in a Cooperative Technical Plan for permanent juvenile (downstream) and adult (upstream) fish passage implementation at Cle Elum and Bumping Lake Dams.

5. BOR agrees to provide up to $65,000.00 in annual funding to the Yakama Nation for cooperative planning activities by the Yakama Nation Fisheries Resource Management Program, beginning in FY 2005 and continuing until submission of the planning report to the Office of the Secretary as described in ¶ 7. To receive this funding, the Yakama Nation must enter into an appropriate financial agreement with BOR, and thereafter comply with the terms of that financial agreement, or any future agreement executed to provide additional funding to the Yakama Nation. After the planning report is submitted to the Office of the Secretary as described in ¶ 7, BOR's funding obligations to the Yakama Nation shall cease.

6. BOR will develop the Cooperative Technical Plan in accordance with the following principles:

a. The Technical Yakima Basin Storage Fish Passage Work Group shall provide technical assistance in the development of biological and engineering measures for anadromous fish passage and reintroduction of anadromous fish above the Yakima Project storage dams. The Work Group shall provide technical assistance in the evaluation and monitoring of such measures upon implementation. This Work Group may consist of biologists and engineers from BOR, the Yakama Nation, irrigation interests, NOAA Fisheries, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the Washington Department of Fish and Wildlife.

b. To the extent that interim fish passage measures are implemented, the Cooperative Technical Plan shall include a proposed program to monitor and evaluate the performance of the fish passage measures at Cle Elum and Bumping Lake Dams and a proposal for authorization of participation by, and funding for, the Yakama Nation in the monitoring and evaluation activities.

c. The Cooperative Technical Plan will include a section discussing whether existing data from Cle Elum and Bumping Lake Dams and from the monitoring programs discussed in ¶ 6(b) can be used in the development of additional plans for fish passage measures at other BOR dams in the Yakima Basin, including Keechelus, Kachess, and Tieton Dams. The section shall also identify uncertainties and additional data necessary to determine the feasibility of fish passage at these three dams.

7. Consistent with federal law and applicable planning principles and standards, the Regional Director, Pacific Northwest Region, BOR, shall prepare a planning report with regard to the feasibility of implementing permanent fish passage at Cle Elum and Bumping Lake Dams. BOR shall include the Cooperative Technical Plan in BOR's administrative record for this

planning report and in the report itself as an appendix. The planning report shall include the Regional Director's recommendations and conclusions with respect to the feasiblity of implementing permanent juvenile (downstream) and adult (upstream) fish passage implementation at Cle Elum and Bumping Lake Dams. BOR shall submit, through appropriate Departmental channels, the Regional Director's planning report and any other required documentation to the Office of the Secretary, U.S. Department of the Interior, for consideration.

8. Within six months of the completion of the planning report for Cle Elum and Bumping Lake Dams outlined in ¶ 7, the parties shall meet to discuss whether the Technical Yakima Basin Storage Fish Passage Work Group should study and develop additional plans (consistent with federal law and applicable planning principles and standards) with regard to the feasibility of implementing permanent adult (upstream) and juvenile (downstream) fish passage at Kachess, Keechelus and Tieton Dams within the Yakima River Basin. If the parties agree that additional plans are warranted, they shall attempt to negotiate a memorandum of agreement outlining the process and establishing deadlines for the completion of additional plans addressing passage at Kachess, Keechelus, and Tieton Dams.

9. Designated representatives of the parties shall meet on a semiannual basis to discuss the progress of the implementation of the Settlement Agreement.

10. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define or interpret the rights of the Yakama Nation under the Treaty of June 9, 1855. The parties do not construe this Settlement Agreement to waive, abrogate, diminish, define or interpret the Treaty rights of the Yakama Nation.

11. Nothing in this Agreement shall be construed to limit or modify the discretion accorded to the Federal Defendants, by the Endangered Species Act, 16 U.S.C § 1531 et seq., the Administrative Procedures Act, 5 U.S.C. §§ 551-559, 701-706, or other federal laws.

12. This Agreement shall not be construed as an admission or agreement by any party, whether plaintiff, defendant or intervenor, as to the validity or legitimacy of any or all of any party's factual or legal contentions made in this case, including but not limited to any party's contentions regarding Yakama Nation Treaty rights.

13. Except as set forth in this Agreement, all parties reserve and do not waive any and all other legal rights and remedies.

14. Nothing in this Agreement shall be construed to obligate the United States to pay any attorney's fees or costs associated with this case.

15. The parties agree that the United States shall not be liable for costs or attorney's fees under the Equal Access to Justice Act, 28 U.S.C. § 2412 or the Endangered Species Act, 16 U.S.C. 1540(g).

16. No provision of this Agreement shall be interpreted to constitute a commitment or requirement obligating the United States to pay funds in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341, and nothing herein shall be construed to obligate the United States to expend or

involve the United States in any contract or other obligation for future payment of money in excess of appropriations authorized by law and administratively allocated for the purposes and projects contemplated hereunder.

17. No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this Agreement or to receive any benefit that may arise out of it other than as a water user or landowner in the same manner as other water users or landowners.

18. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, interpret or impair the rights of the landowners/water users, irrigation districts, water companies or municipalities which receive their water from or through BOR operated reservoirs, dams or other facilities.

19. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, interpret or impair the obligation or ability of BOR to deliver water in accordance with its contracts and obligations provided by the 1945 Judgment in *KRD, et al. v. SVID et al.*, Civil 21, US. District Court (ED Wash.), and the water rights adjudicated in *Washington State Dept. of Ecology v. Acquavella*, Yakima County No. 77-2-01484-5.

20. The parties disagree as to whether reintroduced fish stocks or species, if any, and restoration of habitat for such reintroduced stocks or species constitute "enhancement" of fish life as defined in *Washington State Dept. of Ecology v. Acquavella*, Yakima County No. 77-2-01484-5. Nothing in this Agreement shall be deemed to waive, abrogate, diminish, define, or interpret the rights of any parties with regard to this issue. The parties expressly reserve their rights, as well as any arguments, on this issue.

21. This Agreement constitutes the final, complete and exclusive agreement and understanding among the parties hereto with respect to the matters addressed herein. There are no representations, agreements or understandings relating to this Agreement other than those expressly contained herein. All prior communications, discussions, drafts, meetings or writings of any kind are superseded by this Agreement and shall not be used by any party to vary, contest or otherwise interpret the terms of this Agreement.

22. In the event of a disagreement among the parties concerning the interpretation or performance of any aspect of this Agreement, the dissatisfied party shall provide the other parties with written notice of the dispute and a request for negotiations. Within 30 days of the date of the written notice, or such time thereafter as the parties may mutually agree upon, the parties shall meet and confer in an effort to resolve their differences. If the parties are unable to reach agreement within 30 days of such meeting, the dissatisfied party may seek appropriate resolution by filing the appropriate complaint based on applicable law.

23. Any notice required or made with respect to this Agreement shall be in writing and shall be effective upon receipt. For any matter relating to this Agreement, the contact persons are:

For Plaintiff

Tom Zeilman
15 North 15th Avenue
Yakima, Washington 98902

For Defendant

Area Manager
Upper Columbia Area Office
U.S. Bureau of Reclamation
1917 Marsh Road
Yakima, WA 98901

24. The parties may agree in writing to modify any provision of this Agreement.

25. The undersigned representatives of each party certify that they are fully authorized by the party or parties they represent to agree to the terms and conditions of this Agreement and do hereby agree to the terms herein.

For the Bureau of Reclamation:

J. William McDonald

J. WILLIAM MCDONALD
Regional Director
Pacific Northwest Region
Bureau of Reclamation
U.S. Department of the Interior

Sept. 1, 2006
Date

For the Yakama Nation:

Lavina Washines

Chairman
Yakama Tribal Council

Dec 6-06
Date