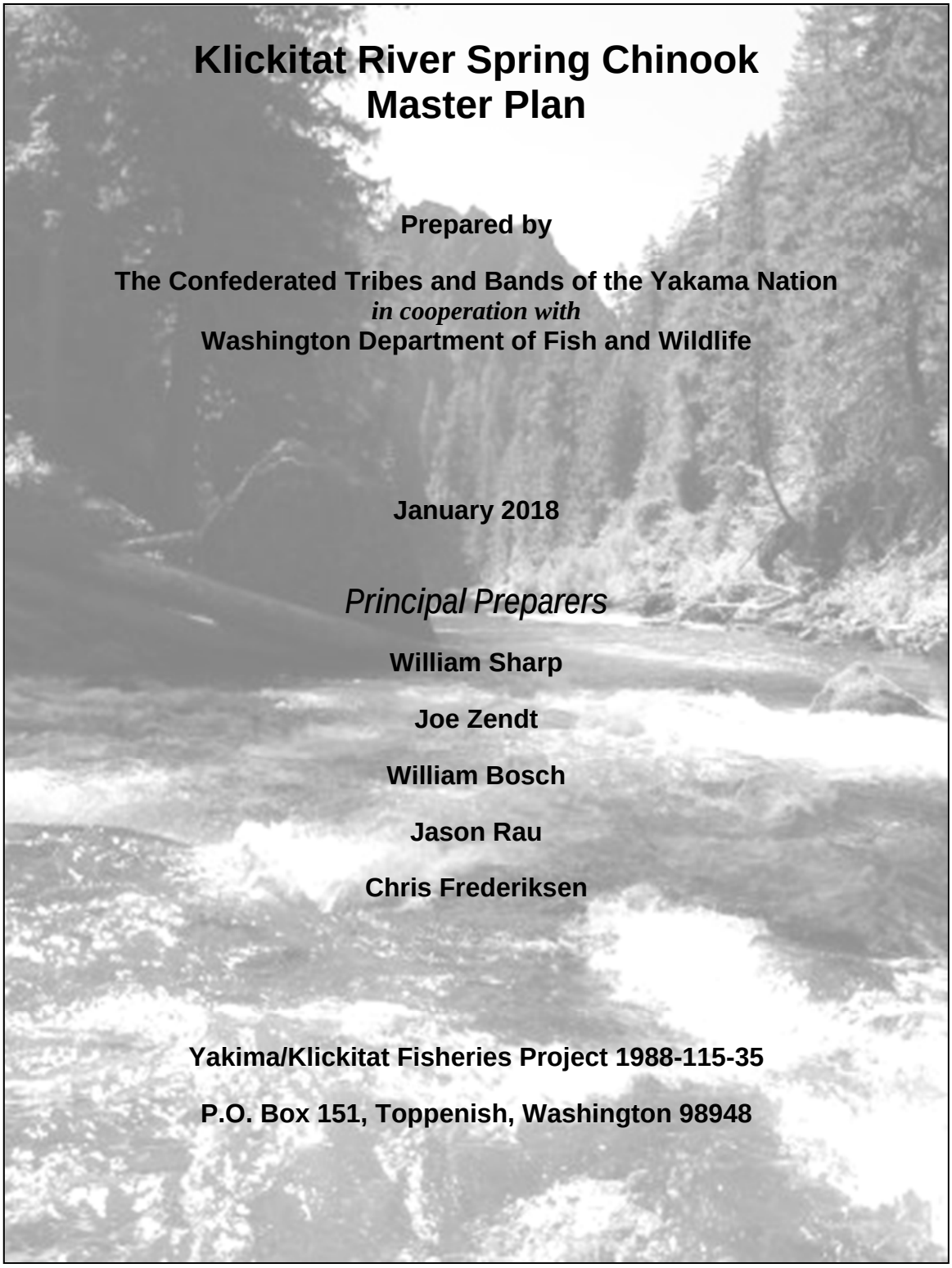

Klickitat River Spring Chinook Master Plan

Prepared by

The Confederated Tribes and Bands of the Yakama Nation
in cooperation with
Washington Department of Fish and Wildlife

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EXECUTIVE SUMMARY

Introduction

The Klickitat River Spring Chinook Master Plan is submitted to the Northwest Power and Conservation Council (NPCC) by the Yakama Nation in fulfillment of Step review requirements for major projects. This document was preceded by drafts submitted in April 2004, March 2008, and July 2012. This revision has been updated to reflect accomplishments and changes since the July 2012 plan was submitted, to incorporate responses to the ISRP's review of the July 2012 plan, and to reflect the new 2014 NPCC Fish and Wildlife Program. While earlier drafts of the Master Plan took an "all species" approach, this Master Plan is now focused on providing information related to the spring Chinook integrated program and the capital construction elements to support that effort.

The major changes in this revision are as follows:

- Capital construction pursuant to NPCC step review is limited to proposed spring Chinook upgrades at the Klickitat Hatchery,

- Although an acclimation site in the lower Klickitat River at or downstream of Wahkiacus was in prior versions and is still proposed, funding for development, operations, and maintenance of this site will likely be external to NPCC processes, so this site is no longer discussed here,

- Harvest and hatchery programs for spring Chinook are discussed in this document as only program changes for spring Chinook require the capital construction funds proposed herein; potential changes to other species' programs were provided in prior versions and will be updated and described in future Master Plans should NPCC process capital construction funds be required to meet proposed facility needs for those species.

- Habitat activities in the Klickitat Subbasin are conducted under the Klickitat Watershed Enhancement Project (KWEP; BPA Project 1997-056-00). Actions and expected benefits were described in prior revisions of the Master Plan and are summarized here for information purposes.

The Yakama Nation proposes to construct improvements to the existing Klickitat Hatchery near Glenwood, Washington. Improvements to the Lyle Falls Fishway and broodstock collection facility, and the Castile Falls Fishway and escapement monitoring facility were completed in earlier phases of the project. These improvements and facility upgrades are needed to support programs for spring Chinook.

The Klickitat Hatchery began operations in 1952 (construction was not complete until 1954). At that time, the science and art of artificial production was relatively

rudimentary. Within the past 50 years, scientific inquiry has led to new thinking about how and why to engage in artificial production. Hatchery programs can no longer act as surrogates for lost habitat (Lichatowich 1999), but rather must be viewed as tools that can be managed as part of a unified strategy to meet watershed or regional resource goals, in concert with actions affecting habitat, harvest rates, water allocation and other factors (HSRG 2004, 2005). This Master Plan incorporates new approaches to artificial production for the Klickitat Hatchery's spring Chinook program.

Spring Chinook, which are native to the Klickitat Subbasin, supported a significant Tribal fishery prior to 1920. The run size has declined greatly since that time. Since 1977, the run size has ranged from 500 to 5,300 fish with most of the fish being of hatchery origin. Natural escapement has averaged about 300 fish since 1977.

Project History

The Yakama Nation has actively managed fish and wildlife on their Tribal lands for more than 50 years. Fishing opportunities for Tribal members are guaranteed by the Treaty of 1855 (12 Stat. 951) between the Yakama Nation and the United States of America. These Treaty-reserved fishing rights were reaffirmed by a federal court in *U.S. v Oregon* in 1969.

The Klickitat Hatchery, Lyle Falls Fishway, and Castile Falls Fishway were built as part of an effort to mitigate for lost fishing opportunities. The operation of the three facilities transferred from the Washington Department of Fish and Wildlife (WDFW) to the Yakama Nation in December 2005. They are operated under the Yakima/Klickitat Fisheries Project (YKFP) in coordination with WDFW. The YKFP uses artificial production to re-establish, supplement, and/or increase natural production of anadromous salmonids and harvest opportunities while maintaining long-term fitness of the target populations and minimizing or avoiding impacts on non-target species.

Goals and Objectives of the Proposed Klickitat Spring Chinook Program

The proposed Klickitat program has as its primary goal an increase in the number and distribution of spring Chinook within the Klickitat Subbasin while maintaining or increasing present harvest. The Master Plan establishes biological goals, objectives, and strategies designed to achieve the primary goal. The following biological goals, which are consistent with the NPCC Fish and Wildlife Program (NPCC 2014), are designed to achieve both the biological performance of the target species and improve environmental conditions to allow sustainable populations.

Conservation: 1) increase population viability by ensuring that the adaptation of the population is driven by the natural environment, and 2) ensure that population size remains large enough to allow the population to maintain itself (Sections 6.1.1 and 6.1.3)

Harvest: 1) meet or exceed Treaty harvest obligations consistently and on a long-term sustainable basis, 2) maintain or increase recreational fisheries on a long-term sustainable basis (Section 6.1.3)

Habitat: increase the quantity and quality of Klickitat River mainstem, delta, and tributary habitat that currently or historically supported spring Chinook (Section 6.1.5). Improve habitat and aquatic conditions across all life stages, from adult holding through overwintering and outmigration. These activities are conducted and funded under the Klickitat Watershed Enhancement Project (KWEP; BPA Project 1997-056-00). We reference these habitat actions here for information purposes because we expect them to benefit spring Chinook productivity.

NPCC Three-Step Review, Context and Rationale of the Proposed Project

The Major Project Review was established by the NPCC as a means to systematically review large capital projects recommended to the Bonneville Power Administration for funding through the Columbia River Basin Fish and Wildlife Program. The review is also known as the "Three Step Review." Its goal is to consider funding only for projects that have successfully completed the planning process. The review links environmental reviews and funding to specific phases of project development and planning, i.e. concept, progress review, and detailed or final. Each phase must fulfill certain requirements before the project is allowed to progress to the next phase.

The Step requirements are based on the Guiding Scientific Principles contained in the Fish and Wildlife Program (FWP). An applicant must document all aspects of the project including location, magnitude, goals and objectives, environmental effects, operations and maintenance and costs over a period of 10 years. Chapter 3.0 of the Master Plan explains in detail how the proposed programs have been designed to be consistent with the scientific principles and the Step review requirements.

Chapter 4.0 presents the local and regional context of the proposed project. The proposed project is located in the Klickitat Subbasin in southcentral Washington State within the NPCC's Columbia River Gorge Province. The area is lightly populated and is typical of the arid and semi-arid country on the east slope of the Cascade Mountains. The proposed project is cognizant of and consistent with a number of other recent and on-going planning efforts in the area including the Klickitat Subbasin Plan, NOAA-Fisheries Recovery Plan, Washington State Watershed Planning Process, and the Washington State Salmon Recovery Planning Process.

The Proposed Program

The YN reviewed multiple strategies and approaches for achieving spring Chinook fisheries objectives in the Klickitat River. Chapter 5.0 provides the historical, human, legal, and political context within which the Klickitat Spring Chinook Master Plan was developed and will be implemented. Rationale and justification for the objectives and strategies described in the Master Plan relate directly to this context. Increasing a sustainable anadromous fish population within the Klickitat Subbasin can be supported from multiple standpoints. As discussed in Chapter 6.0, many alternatives were considered. Some strategies would not achieve the goals defined for the program and were rejected. The preferred alternative describes those strategies which proponents

believe will most effectively contribute to meeting federal treaty trust, mitigation, and restoration obligations arising from the context described in Chapter 5.0.

A detailed discussion of the actions and objectives aimed at accomplishing the goals of the Master Plan is presented in Chapter 6.0. The following are the major actions proposed for Spring Chinook.

Habitat: increase the quantity and quality of Klickitat River mainstem, delta, and tributary habitat that currently or historically supported spring Chinook (Section 6.1.5). Improve habitat and aquatic conditions across all life stages, from adult holding through overwintering and outmigration. These activities are conducted and funded under the Klickitat Watershed Enhancement Project (KWEP; BPA Project 1997-056-00). We reference these habitat actions here for information purposes because we expect them to benefit spring Chinook productivity.

Hatcheries: The YN recognizes that current hatchery practices need to be changed to reflect recent scientific advances and to avoid negative effects hatchery fish may have on naturally spawning salmon populations including listed species. Because hatchery fish may interbreed with, compete with, and prey on native fish populations, the following actions are proposed to reduce these impacts while still maintaining the Klickitat's contribution of releases deemed necessary to satisfy the Columbia River Tribes' treaty-reserved fishing rights:

1. Volitional release strategies will be implemented to the extent logistically practical.

2. Hatchery adult spring Chinook will be collected at Lyle Falls or the Klickitat River Hatchery, then transported and released into suitable habitat above Castile Falls in an effort to re-supply marine derived nutrients and to re-establish spring Chinook production in the upper Klickitat River.

3. The hatchery program for spring Chinook will be monitored against specific objectives for natural escapement and production. Adaptive management measures are specified and will be implemented as necessary to assure that the hatchery program minimizes impacts to natural populations. See Chapter 6 for details.

4. The long-term goal for the preferred alternative is to be consistent with hatchery reform guidelines for the composition of hatchery and natural origin (NOR) spring Chinook spawners used for hatchery broodstock and escaping to the natural spawning grounds.

5. Hatchery programs will be operated in compliance with Tribal and federal environmental regulations, including requirements to maintain water quality, water quantity, and fish passage. These actions will assure that hatchery operations will not reduce the productivity and capacity of this watershed to support natural stocks.

Harvest: A major goal of the Master Plan is to provide harvest to Tribal members as required by treaty obligations and for sport fishing, while at the same time protecting

naturally spawning populations. Because hatchery fish provide most of the harvestable fish in the Subbasin, the Master Plan is structured to balance potential hatchery impacts to listed species with the harvest benefits they provide. The goal is to provide greater harvest benefits while reducing potential impacts to natural populations. If successful, an average of 4,000 spring Chinook are expected to be harvested in all Columbia River mainstem and Klickitat River terminal fisheries annually.

Additional harvest actions that will be implemented to better meet harvest goals or protect listed fish species include:

1. Differentially marking hatchery fish in the Subbasin so they can be distinguished from natural origin fish in the hatchery broodstock, on the spawning grounds, and in fisheries.

2. State recreational fisheries are expected to continue targeting marked (hatchery-origin) spring Chinook while requiring release of unmarked (presumed natural-origin) fish.

The programmatic goals for spring Chinook consist of distinct and separate goals for conservation and harvest. The conservation goals for spring Chinook are distilled into separate, measurable goals for the VSP parameters that define a viable salmonid population. Harvest goals are expressed as a mean number of fish caught annually in the terminal fisheries for commercial, Tribal, and sport fishers.

Program Summary

The Klickitat spring Chinook population is currently not listed under the ESA. On average, the Klickitat spring Chinook run to the Subbasin is approximately 75% hatchery and 25% natural fish. Both conservation and harvest goals are proposed for Klickitat spring Chinook.

The main conservation objectives are to: 1) increase population viability by ensuring that the adaptation of the population is driven by the natural environment, and 2) ensure that the population size remains large enough to allow the population to maintain itself. For natural/hatchery composite programs, the influence of the hatchery and natural environments on the adaptation of the composite population is dependent on the proportion of natural-origin broodstock in the hatchery (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The conservation objectives for spring Chinook are found in Table 1.

Table 1: Conservation Goals for Klickitat River Spring Chinook

Parameter	Objective
Productivity	Recruits/Spawner > 7.0[a]
Abundance	Average Adult Escapement > 700 per year Minimum Escapement > 400
Spatial Structure	Spawning Throughout Historical Range

PNI	0.67

[a] see Appendix B.

Note: the R/S value is based on a theoretical intrinsic productivity estimate for future habitat conditions. Measured R/S values for spring Chinook are currently estimated at 3.69 (Table 6-9).

The primary harvest objective for spring Chinook is to meet or exceed Treaty harvest obligations consistently and on a long-term basis. The secondary objective is to maintain or increase recreational fisheries on a long-term sustainable basis. It is mandatory that all harvest objectives must be attainable while still meeting the conservation objectives. The harvest objectives for spring Chinook are shown in Table 2.

Table 2: Harvest objectives for Klickitat River Spring Chinook

Fishery	Objective
Mainstem Columbia River- Tribal	600
Mainstem Columbia River- Non-Tribal	400
Klickitat River Terminal- Tribal	1,800
Klickitat River Terminal- Sport	1,200
Total Harvest	4,000

The alternative strategies considered for spring Chinook were: 1) maintain the existing hatchery program and 2) eliminate the hatchery program and improve habitat. These strategies did not meet the harvest goals and presented many hatchery-related problems. They were rejected in favor of the preferred strategy: develop an integrated hatchery program and continue to improve habitat.

Spring Chinook Hatchery Plan

The hatchery plan involves conversion of the existing segregated harvest program to an integrated harvest program. The program is designed to increase the viability of the natural population while simultaneously producing the adults needed to meet the 4,000 fish harvest objective for all fisheries combined. To achieve these objectives, it is estimated that the hatchery program should release 800,000 yearling spring Chinook annually.

The hatchery program will be converted from segregated to an integrated conservation/harvest program by incorporating an increasing proportion of NOR Klickitat River spring Chinook into the broodstock over time (Appendix B). The pace of broodstock conversion will depend on the size of the natural-origin spring Chinook run which is expected to vary annually. To reduce impacts to the natural-origin spring Chinook population, no more than 25% of returning NOR fish passing upstream through the Lyle Falls facility will be taken for brood stock in any year. The program will be implemented in phases eventually reaching a targeted release goal of 800,000 fish which will be incubated, reared, and released volitionally at the Klickitat River Hatchery. Released fish will be differentially marked using elastomer eye tag to denote parental origin (hatchery, natural, or mixed). Broodstock may be collected at Lyle Falls, the Klickitat River Hatchery, and Castile Falls.

Spring Chinook Harvest Plan

Harvest management provisions will be designed to maximize harvest of adipose-clipped hatchery-origin fish while reducing harvest on the natural component of the population. To achieve the objectives, bag limit and season adjustments will be enacted and the collection location for the majority of broodstock will be shifted to the Lyle Falls Fishway. Surplus fish escaping the fisheries to the Klickitat River Hatchery will continue to be distributed to Tribal members for subsistence and ceremonial purposes; they will not be returned to the river.

Monitoring and Evaluation

The proposed monitoring and evaluation program is funded separately under Project 1995-063-35 and was described in detail in prior revisions of the Master Plan. We repeat relevant elements of the M&E program here for information purposes and completeness.

The following is a list and brief description of categories of monitoring and evaluation presently occurring in the Klickitat Basin:

- Hatchery performance including: adult collection, holding, spawning, rearing, mark rates, release, juvenile migration, and smolt-to-adult survival. The origin and stock of salmon used for broodstock will be documented as well as changes in the phenotypic and genotypic characteristics of fish used at Klickitat Hatchery. Information will be used to refine the hatchery rearing practices and release schedule.

- Harvest monitoring (funded under a BIA contract) will be focused on sampling subsistence fisheries at Cascade Locks and The Dalles Dam on the mainstem Columbia River and on sampling all Tribal fisheries on the Klickitat River. The Regional Mark Information System (RMIS) will be monitored to evaluate the extent to which Klickitat hatchery releases are harvested in ocean or Columbia River mainstem commercial and sport fisheries. *U.S. v Oregon* Technical Advisory Committee (TAC) reports will also be monitored to evaluate the extent to which Klickitat hatchery releases are harvested in commercial and sport fisheries in the Columbia River mainstem and sport fisheries in the Klickitat River.

- Escapement: The composition and abundance of natural and hatchery-origin fish returning to the Klickitat River and to the natural spawning grounds will be monitored.

- Juvenile and adult-to-adult productivity will be monitored. Migration timing and travel time will also be monitored.

- Ecological Interactions: YN staff will use information from the literature as well as in-basin demographic and migratory data collected from other M&E tasks to evaluate potential bottlenecks to survival or productivity. Methods will be

investigated to evaluate predation and competition, including hatchery juvenile distribution, duration of presence, survival (from tagging data), and possible stomach analysis for development of a predation index. The extent of activities will be determined by available funding.

- Disease: Using NOAA Mitchell Act funding, YN staff will work with USFWS fish health specialists to implement disease management protocols and monitor hatchery operations for specific fish pathogens in accordance with the Washington Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines. Protocols are designed to minimize potential disease transmission within and outside of the hatchery, assuring that fish reared at the Klickitat Hatchery have high survival rates with little chance of pathogen transmission to naturally-rearing fishes and aquatic organisms.

- Genetics: Gain a thorough understanding of the genetic make-up of the target supplemented stock in order to maintain long term genetic variability and minimize the impacts of domestication. YN staff will collect genetic samples from adult and juvenile spring Chinook. Analysis of genetic markers will be used to evaluate the relationship of Chinook populations in the Klickitat River relative to others in the Columbia River Basin. The influence of hatchery programs will be evaluated.

Conceptual Designs of Proposed Facilities

The integrated program requires the proposed changes to the existing Klickitat Hatchery facilities. The existing Klickitat Hatchery was completed in 1954 and is no longer adequate to accommodate programs based on the latest scientific thinking. Many of the facilities need repair and do not meet current building codes. It is proposed to rebuild the adult holding chambers and spawning building, refurbish the adult ladder, build circular rearing tanks supplied with river water, remodel a portion of the main hatchery building and facilities, build two new houses for hatchery personnel, upgrade spring water delivery system, install avian netting to an existing raceway bank and reconstruct the pollution abatement system.

Project Costs

Project costs are based on the proposed programs (Chapters 6.0 and 7.0) and the conceptual designs (Chapter 8.0). Costs are developed to the conceptual design level required by NPCC and include cost estimates for finalization of facility planning and design, capital construction, operations and maintenance, and monitoring and evaluation. Estimates for operations and maintenance as well as monitoring and evaluation are extended to ten years. BPA will be procuring the capital construction design and build work utilizing a fixed firm price contract that will contribute to cost control as designs are refined. BPA has not committed to operations and maintenance funding for the hatchery capital upgrades due to concerns related to the Mitchell Act origins of the funding used

for the construction of the existing facilities. Cost estimates will be refined further through NPCC Step progression up to final design.

Capital Construction Cost Estimates

Estimating construction costs requires careful consideration of current cost for labor, material, and equipment. The capital construction costs (Table 4) were supplied by Harbor Consulting Engineers of Seattle (HCE), use standard sources, and were evaluated with direct costs quoted by materials suppliers. They are also based on local project costs and vendor locations.

Klickitat Hatchery assumed the following:

- Fall 2015 dollars
- 10% estimating contingency
- Two phases of construction with winter shutdowns
- 2.5% annual escalation

The current estimate for capital construction includes new facilities as well as modification of existing facilities. Due to the level of certainty a 10% contingency is applied to the overall cost.

Table 4: Capital construction estimated costs by fiscal year

Capital Construction Cost Estimate	Current Design Status	FY 2018	FY 2019	FY 2020	FY 2021	TOTAL
Klickitat Hatchery Design, Permitting & Const Mgmt (12.75% of Construction). Expense funds.	Conceptual	$700,054	$500,055	$200,000		$1,400,109
Klickitat Hatchery Construction & Upgrades Capital Funds			$5,481,280	$5,481,280		$10,962,559
Annual Estimate		*$700,054*	*$5,981,335*	*$5,681,280*		*$12,362,668*

Operations, maintenance, and monitoring and evaluation estimates are based on FY18 salary, operating, and equipment costs.

Table 5: Operation and Maintenance (O&M) Cost Estimates

Operation & Maintenance Costs	FY 2018	FY 2019	FY 2020	FY 2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028
Castile Falls Fishway	231,000	236,775	242,694	248,762	254,981	261,355	267,889	274,586	281,451	288,487	295,700
Lyle Falls Fishway	396,000	405,900	416,048	426,449	437,110	448,038	459,239	470,720	482,488	494,550	506,913
Klickitat Hatchery (Spring Chinook)			294,175	301,529	309,068	316,794	324,714	332,832	341,153	349,682	358,424
Klickitat Field Office facility O&M	33,000	33,825	34,671	35,537	36,426	37,336	38,270	39,227	40,207	41,212	42,243
Annual Total	$660,000	$676,500	$987,588	$1,012,277	$1,037,584	$1,063,524	$1,090,112	$1,117,365	$1,145,299	$1,173,931	$1,203,279

Escalated by 2.5%/yr.

Table 6: Ten-Year summary of future costs

CHAPTER 1.0 INTRODUCTION

The Klickitat Subbasin Spring Chinook Master Plan is submitted by the Yakama Nation (YN) to the Northwest Power and Conservation Council (NPCC) in fulfillment of Council requirements. NPCC requires all organizations and entities seeking funding for major projects related to fish and wildlife to fulfill the stipulations outlined in the "Step" process (Sections 1.5 and 3.1).

1.1 Description of the Current Project Proposal

Improvements to the Lyle Falls Fishway and broodstock collection facility, and to the Castile Falls Fishway and escapement monitoring facility (Figures 1-1 and 1-2) have now been completed. The Yakama Nation proposes to construct improvements to the existing Klickitat Hatchery near Glenwood, Washington (Figure 1-2). These upgrades are needed to support the described program for spring Chinook.

1.2 Document Organization

Chapter 1.0 introduces the project and Chapter 2.0 presents the goals and objectives of the proposed fishery programs. Consistency with NPCC Step 1 requirements is discussed in Chapter 3.0; Chapter 4.0 presents the project context. The project rationale is presented in Chapter 5.0. The proposed programs and monitoring and evaluation activities are discussed in chapters 6.0 and 7.0. Concept designs are presented in Chapter 8.0 and cost estimates are presented in Chapter 9.0. This document has also been updated to reflect accomplishments and changes since the July 2012 plan was submitted, to incorporate responses to the ISRP's review of the July 2012 plan, and to reflect the new 2014 NPCC Fish and Wildlife Program.

In addition to material contained in the body of the document, detailed information supporting the text is found in the appendices. The appendices contain the Hatchery Genetic Management Plan for spring Chinook and modeling results. Hyperlinks found throughout the text guide the reader to additional supporting information.

It should be noted that, in this Master Plan the term "Subbasin" refers to the Klickitat Subbasin; "subbasin" refers to the watersheds of individual Klickitat tributaries. "Basin" denotes the Columbia River Basin.

Figure 1-1: Location of Project

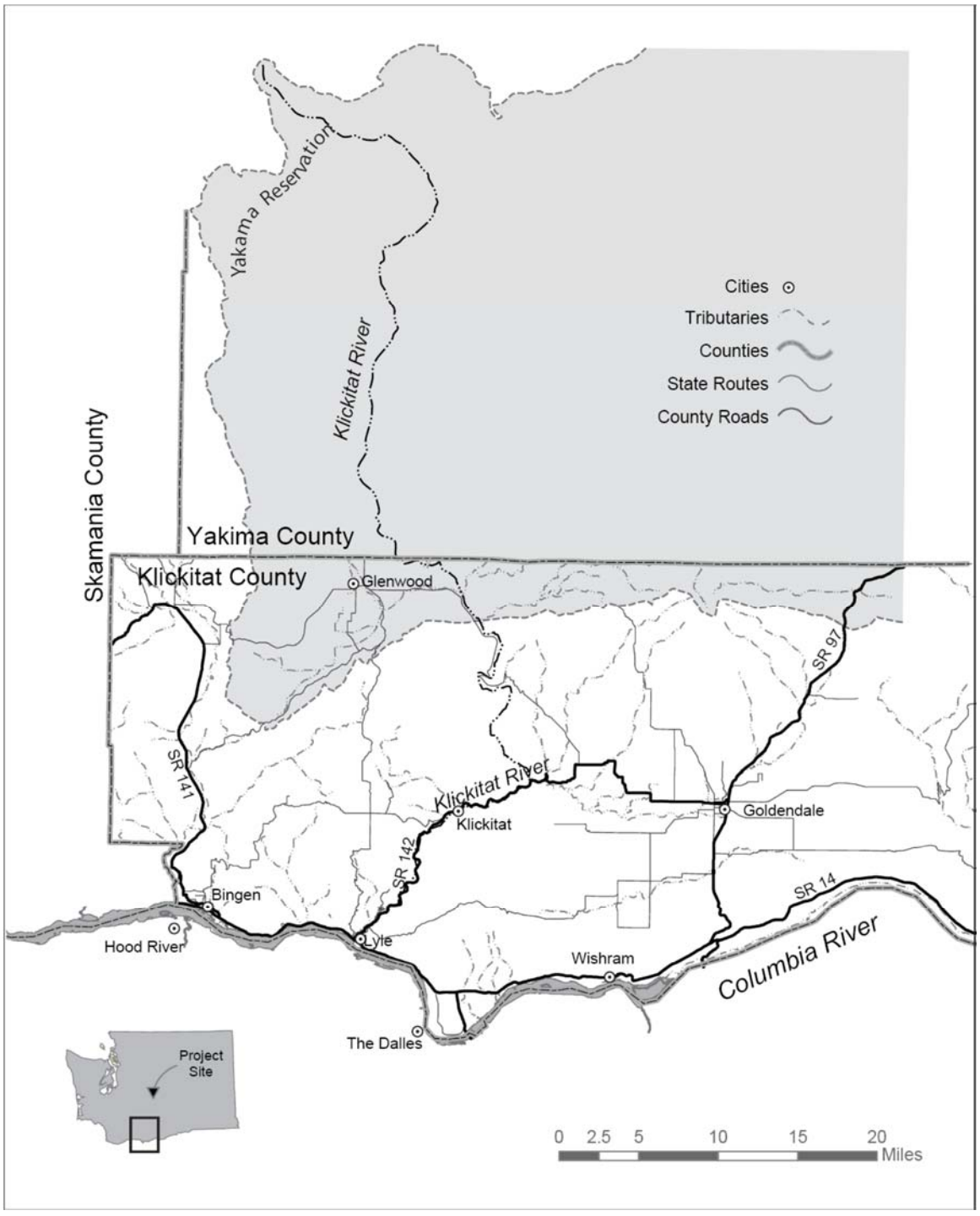


Figure 1-2: Location of Project Facility

1.3 Need for the Project

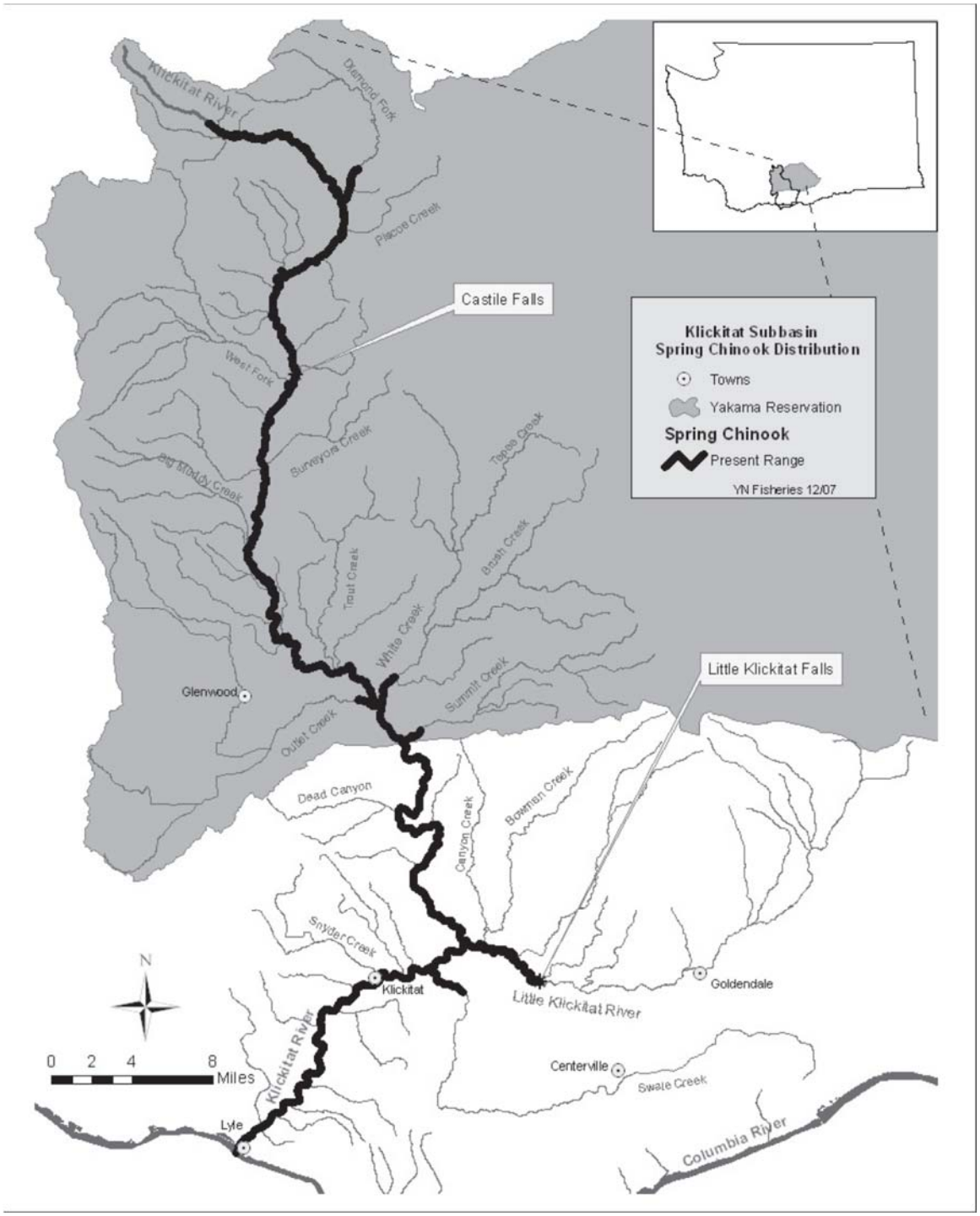
Anadromous fish populations have declined in the Klickitat Subbasin, as well as the entire Columbia River Basin, through a combination of habitat degradation, overfishing, and blockages to fish passage. At the same time, the human population has continued to grow, placing more pressure on already depressed fish stocks. The Yakama Nation wants to ensure an adequate and sustainable supply of spring Chinook to satisfy ceremonial, subsistence, commercial, and sport needs.

The proposed project relies upon the most current scientific research to design a project that will assure abundant fish while fulfilling federal treaty trust responsibilities as well as other Tribal needs. The proposed project draws on information gained through the Yakima/Klickitat Fisheries Project's (YKFP) Cle Elum Supplementation and Research Facility and the Hatchery Scientific Review Group (HSRG). Hatchery reform and habitat restoration actions proposed in the Master Plan have a high degree of likelihood of meeting current and future demands on the fisheries resources.

The Klickitat Hatchery began operations in 1952 (construction was not complete until 1954). At that time, the science and art of artificial production was relatively rudimentary. Within the past 50 years, scientific inquiry has led to new thinking about how and why to engage in artificial production. New approaches view artificial production as supplementation of natural populations rather than as substitutes for them.

Spring Chinook are native to the Klickitat River Subbasin (Figure 1-3). Large natural runs supported a significant Tribal fishery at Lyle Falls prior to 1920. By 1951, the annual spring Chinook run ranged between 1,000 and 5,000 fish annually. The run size averaged about 2,500 fish by 1959. Since 1977, the run size has ranged between 500 and 5,300 fish with an average of 1,900 fish. Most of the returning fish are of hatchery origin; natural escapement has ranged from 100 to about 1,100 fish and has averaged about 300 fish annually since 1977.

Figure 1-3: Distribution of Spring Chinook in the Klickitat Subbasin



Several factors are believed to have adversely affected natural production of spring Chinook in the Klickitat River.

- It is believed that hatchery operations have contributed to a shortened run, smaller body size and fish that cannot negotiate Castile Falls as a wild stock. The native wild stocks were presumed to be larger fish able to produce more offspring and thus, would be able to better exploit available habitat.

- "Improvements" in the 1960s to the Castile Falls Fishway were not successful and resulted in reduced fish passage.

- Degradation due to livestock grazing, logging, and road construction has negatively affected salmonid habitat in the Klickitat Subbasin.

The ecological, historical, and legal rationale for the proposed project is discussed further in Chapter 5.0.

1.4 Project History

The Yakama Nation has actively managed fish and wildlife on their Tribal lands for more than 50 years. During this time, wild and artificially produced spring Chinook (*Oncorynchus tshawytscha*) in the Klickitat Basin have been managed to ensure their long-term existence and provide fishing opportunities in an effort to mitigate for the loss of fisheries due to construction of the Columbia River hydroelectric dams.

Fishing opportunities for Tribal members are guaranteed by the Treaty of 1855 (12 Stat. 951) between the Yakama Nation and the United States of America which states "that the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians; and at all other usual and accustomed stations, in common with the citizens of the United States . . . .". The rights secured by this Treaty were impaired by the loss of fisheries resources following construction of the Columbia River mainstem hydroelectric dams as well as by other causes. Non-treaty fishing opportunities have also eroded with the dwindling populations of salmon and steelhead.

Indian fishing rights were confirmed by a federal court in *U.S. v Oregon*[1] in 1969 (http://www.ccrh.org/comm/river/legal/sojudge.htm). This case was a landmark decision in establishing Columbia River treaty tribes' rights to traditional fishing areas and fish.

The Klickitat Hatchery and Lyle Falls Fishway were constructed between 1950 and 1954 as part of an effort to mitigate for lost fishing opportunities. Fishways were developed at Castile Falls during the 1950s to facilitate spring Chinook access to upriver habitats. The hatchery was previously operated by the Washington Department of Fish and Wildlife (WDFW). The operation of the hatchery, as well as Lyle Falls and Castile Falls

[1] 302 F. Supp. (Dist. Oregon 1969)

fishways, was transferred to the Yakama Nation in December 2005 and has since been operated under the YKFP in coordination with WDFW.

The YKFP uses artificial production to re-establish, supplement, and/or increase natural production of anadromous salmonids and harvest opportunities while maintaining the long-term fitness of the target populations and minimizing or avoiding impacts on non-target species (Bonneville Power Administration 1996). Planning, implementation, and evaluation of YKFP programs are guided by the Regional Assessment of Supplementation Project (RASP 1992). YKFP is also aimed at the experimental aspects of determining the effect of supplementation on natural production of anadromous salmonids.

The Klickitat River Anadromous Fisheries project grew out of the Klickitat Salmon and Steelhead Hatchery preliminary design effort (R.W. Beck and Associates, et al. 1990). A technical work group comprising representatives of BPA, Yakama Nation, WDF, WDW, as well as R.W. Beck and Associates and Fish Management Consultants was formed to design a hatchery for steelhead and spring Chinook in order to "test the hypothesis that new artificial propagation in the basin can be used to increase harvest and enhance natural production while maintaining genetic resources of wild stock fishes." The proposed hatchery was to be located downstream from the existing Klickitat hatchery.

The emphasis then shifted to the Yakima Subbasin and the Cle Elum Supplementation and Research Facility which was used to test the concept of supplementation on spring Chinook. Cle Elum released its first fish in 1999 and supplementation in that system has increased adult returns and redd abundance while generally keeping risks from ecological interactions within proscribed limits (Fast et al. 2015). Focus then returned to the Klickitat Subbasin.

It was decided at that point to concentrate on upgrading the facilities at the existing Klickitat hatchery rather than construct an entirely new hatchery as outlined in the 1990 technical working group document (R.W. Beck and Associates et al. 1990). The scope was widened to include facility improvements at Lyle Falls (improved passage plus broodstock and fish sampling capability) and Castile Falls (improved passage plus video monitoring) and originally included fall Chinook, coho, and steelhead along with spring Chinook to ultimately have all stocks benefit from the current scientific approaches to hatchery management.

Once the scope of the proposed Klickitat River Anadromous Fisheries Project was defined, preliminary planning and design work began. A draft Master Plan was submitted to the NPCC in 2004. The NPCC review raised a number of issues which were addressed in a revised Master Plan issued March 2008. The revised plan incorporated guidelines for hatchery reform issued by the HSRG (2005) and used the AHA modeling tool to conduct more comprehensive analyses of proposed production programs.

A new revision of the Master Plan was issued in July 2012 to incorporate information gained through all of these prior reviews. Improvements to Lyle Falls and Castile Falls facilities have been completed and the scope of this Master Plan has been revised to

discuss just the additional improvements to facilities and programs needed to benefit spring Chinook.

At this time, a final EIS with a record of decision is expected in spring 2019.

1.5 NPCC Three-Step Review

The Major Project Review was established by the NPCC as a means to systematically review large capital projects recommended to the Bonneville Power Administration (BPA) for funding through the Columbia River Basin Fish and Wildlife Program. The premise is that only proposed projects that are targeted to meet a need within the Columbia River Basin and which are clearly defined in terms of biological benefits will be eligible for funding. Project proponents must think carefully about what they want to achieve and how they want to achieve it. Projects must also be designed to be as economical as possible. The long-term implications of proposed projects as well as the short-term gains must also be considered. The goal of the Major Project Review, known as the Three-Step Review, is to consider funding only for projects that have successfully completed the planning process from project concept to final design (NPCC 2006).

The Three-Step Review links environmental reviews and funding to specific phases of project development and planning. The first step is development of a plan at the conceptual level. This is considered the preliminary or feasibility stage and "is important in identifying all major components and elements" as well as showing the initial layout of components at the proposed site and/or within the proposed plan. Concept designs are expected to have a variance (contingency) of plus or minus 35% to 50%. The concept of the proposed project is contained in a master plan which is submitted to the NPCC for review. Approval of the master plan by the NPCC is accompanied by a notice to proceed to Step 2.

In Step 2, the proposed project is further refined and is submitted for environmental review—usually an environmental impact statement (EIS) or environmental assessment (EA). Step 2 is also known as the "progress review phase." Any major difficulties in the design and proposal are identified in this phase. More details are presented to assure that the project is economically viable and financially responsible and meets "the intent and scope of the previous decision." Expected variance is plus or minus 25% to 35%. At this stage, any changes to the proposed project between steps 2 and 3 are expected to be minor. Approval of this phase allows the project proponent to proceed with Step 3.

Step 3 is "detailed/final" design phase. Final designs are formulated for all facilities and programs and cost estimates are refined accordingly. Expected variances will be plus or minus 10% to 15%. A detailed "and exhaustive review has been carried out" and cost estimates represent "the best available estimate of construction costs for the project." Program operations, research, and monitoring and evaluation (M&E) costs are also presented as final estimates.

NPCC reviews proposed projects according to elements based on the Guiding Scientific Principles presented in the Columbia River Basin Fish and Wildlife Program (NPCC

2014). These principles and the Step 1 review elements are discussed in more detail in Chapter 3.0.

For BPA funded work, firm fixed price contracting will be used for most design and construction work. Project specific contracting strategies, such as design/build contracting, will be employed early in the design process to manage scope, schedule, and budget.

CHAPTER 2.0 GOALS AND OBJECTIVES OF THE PROPOSED KLICKITAT PROGRAM

The basis of any planning effort is the establishment of goals and objectives. All decisions made about facilities and programs must be aimed at accomplishment of the goals and objectives. The proposed Klickitat program has as its primary goal an increase in the number and distribution of spring Chinook within the Klickitat Subbasin. An increase in number and distribution of fish is desirable for both social and biological reasons. From the social standpoint, more fish means that YN members can continue to participate in traditional activities. Larger numbers of fish can also benefit the YN from the economic standpoint by increasing the opportunity for commercial and sport harvests.

This Master Plan has established a number of biological goals and objectives that will contribute to accomplishment of the overall goal of increasing spring Chinook numbers and distribution within the Subbasin. Biological objectives are defined by the NPCC Fish and Wildlife Program (NPCC 2014) which contains the following language.

> *Biological objectives should clearly describe physical and biological changes needed to achieve the vision in a quantifiable fashion. They will serve as a benchmark to evaluate progress toward the subbasin vision and should have measurable outcomes. Biological objectives should 1) describe and quantify the degree to which the limiting factors will be improved, and 2) describe and quantify changes in biological performance of populations that will result from actions taken to address the limiting factors.*

The biological objectives established for this Master Plan are designed to achieve both biological performance of the target species and improve environmental conditions to allow sustainable populations. Quantifiable goals have been established for spring Chinook. The biological goals established for this proposed project are shown below and are also discussed further in Chapter 6.0.

Conservation: 1) increase population viability by ensuring that the adaptation of the population is driven by the natural environment, and 2) ensure that population size remains large enough to allow the population to maintain itself (Sections 6.1.1 and 6.1.3)

Harvest: 1) meet or exceed Treaty harvest obligations consistently and on a long-term sustainable basis, 2) maintain or increase recreational fisheries on a long-term sustainable basis (Section 6.1.3)

Habitat: increase the quantity and quality of Klickitat River mainstem, delta, and tributary habitat that currently or historically supported spring Chinook (Section 6.1.5). Improve habitat and aquatic conditions across all life stages, from adult holding through overwintering and outmigration. These activities are conducted and funded under the Klickitat Watershed Enhancement Project (KWEP; BPA Project 1997-056-00). We reference these habitat actions here for information purposes because we expect them to benefit spring Chinook productivity.

CHAPTER 3.0 CONSISTENCY WITH NPCC STEP 1 REQUIREMENTS

The NPCC Major Projects (Three Step) Review Process is based on the policies detailed in the 2000 Columbia Basin Fish and Wildlife Program (FWP) and subsequent updates. The 2014 FWP updated the set of guiding principles that serve as the scientific foundation for the program. These guiding principles, in turn, provide the basis for the requirements contained in the NPCC Major Projects Review (NPCC 2006). Every project that comes before the NPCC for funding is expected to be consistent with the guiding scientific principles and the Major Projects requirements, both in spirit and in fact.

3.1 The Guiding Scientific Principles

The YN has made every effort to design the proposed project to conform to the guiding scientific principles and the Major Project Review requirements that flow from them. This section presents the principles and discusses how the Master Plan accommodates them.

- Healthy ecosystems sustain abundant, productive, and diverse plants and animals distributed over a wide area.

Language from the NPCC Fish and Wildlife Program further amplifies this principle:

> *An ecosystem includes all living things in a given area, interacting with each other and with the physical environment. This interaction affects the abundance, productivity, and diversity of plants and animals. Taking into account these interactions and the natural limits of ecosystems is critical for successfully maintaining, restoring, and enhancing ecosystems.*

The biological objectives for the Master Plan are based on an analysis of the entire life cycle of and ecosystem inhabited by each species of interest. The ecosystem of concern for Klickitat River anadromous fish includes the mainstem Columbia River and its estuary and the Pacific Ocean. Though the analysis allowed biologists to explicitly account for the effects that habitat conditions in the mainstem Columbia River, estuary, and ocean have on anadromous fish production in the Klickitat River, it is recognized that improvements in areas outside the Klickitat River Subbasin are not likely to occur in the foreseeable future. Many such actions are outside the influence of the Yakima/Klickitat Fisheries Program.

The Master Plan recognizes that the aquatic and terrestrial habitats present within and outside of the Klickitat Subbasin determine the abundance, productivity, and diversity of the Subbasin's fish populations. The quality and quantity of habitat within the Subbasin has been evaluated through field surveys and modeling. This has resulted in the identification of habitat factors that are likely limiting fish production in the Subbasin. Strategies and actions to improve habitat and associated ecological functions have been

developed, have been incorporated into prior revisions of the Master Plan, and are being implemented within the historical range of the spring Chinook population (Chapter 6.0).

Harvest is also a "condition" that determines the diversity and abundance of fish. The Master Plan proposes fishing seasons and limitations on the number of fish caught in all fisheries. In addition, fisheries that select for marked hatchery fish will continue in the Subbasin (Chapter 6.0).

- Biological diversity allows ecosystems to adapt to environmental changes.

NPCC Fish and Wildlife Program:

> *The natural diversity of species, populations, genes, and life history traits contributes to ecosystem stability and adaptability to environmental change. The loss of locally adapted populations can reduce species diversity in an ecosystem. Introducing non-native species can increase diversity but can also disturb the connections between native species and reduce their ability to adapt and survive. Management actions are most meaningful over the long term when they contribute to the diversity of locally adapted populations of native species and also to the habitats needed to support them.*

In addition to ongoing habitat actions to address ecosystem and biological diversity, the proposed integrated spring Chinook program intends to move the hatchery population towards more diverse, natural characteristics over time as brood stock composition transitions to more natural-origin and fewer hatchery-origin fish (Chapter 6). Increasing the abundance of fish spawning naturally should also increase diversity over time as fish seek and colonize new or underutilized habitats.

- Ecosystem conditions affect the well-being of all species including humans.

NPCC Fish and Wildlife Program:

> *Humans are integral parts of ecosystems. Our actions have a pervasive impact on the structure, function, and resilience of ecosystems, while at the same time, our health and well-being are tied to ecosystem conditions. Having ecosystems that can respond to change contributes to healthy ecosystems that support healthy species and human populations. A landscape perspective and management approach is necessary to maintain redundancies and diversity that allow ecosystems to be resilient to unexpected changes.*

The Master Plan accounts for the fact that Klickitat River fish populations are important locally and regionally. The environmental conditions within the Subbasin vary by stream. As a result, the life history, abundance, and productivity of fish inhabiting the streams may also be different from one another. It is important to maintain life history

diversity in fish populations because it allows the population to take advantage of changing environmental conditions. This may be especially important as climate change effects accelerate.

It is important to note that there is no intrinsically correct ecosystem. Past fisheries management decisions under the federal Mitchell Act carved out a principle role for the Klickitat Subbasin in mitigating the impacts of dam construction. This resulted in a modification of the pre-development ecosystem. The Master Plan accounts for the needs and Treaty-reserved rights of the Yakama Nation while recognizing that man is part of the environment occupied by fish and that man has been a significant force in the development of the Klickitat Subbasin as it exists today including its fish stock abundance, productivity, and diversity. Tribal members have been fishing in the Klickitat Subbasin for generations and the Klickitat River has high cultural significance to members of the YN. This significance has increased greatly as harvest opportunity has decreased at other traditional fishing sites due to ESA salmon listings. To maintain the Yakama Nation's treaty fishing rights and traditional way of life, the Master Plan continues to support the production of hatchery fish principally for Tribal harvest. The monitoring and evaluation program will be used to assist managers in determining the impacts the Plan's programs may be having on wild fish populations.

Habitat actions and strategies being implemented include:

- Protecting stream corridor structure and function
- Restoring passage and connectivity between habitat areas
- Restoring floodplain function and channel migration processes
- Restoring riparian condition
- Restoring normative flow regimes
- Restoring degraded water quality, including water temperature

One of the key roles anadromous fish play in the Klickitat River is the delivery of marine-derived nutrients back to the Subbasin as their carcasses decompose after spawning. These nutrients increase stream productivity and provide a food source for both terrestrial and aquatic species (Cedarholm et al. 2000). Increased adult production goals for spring Chinook should further help alleviate the loss of marine-derived nutrients as additional fish spawn naturally in the Subbasin.

The use of locally adapted broodstock and the reduction in out-of-Subbasin hatchery transfers signal a change in Subbasin fisheries management. The Master Plan emphasizes the production of native spring Chinook through implementation of an integrated harvest program. The proposed production and harvest actions are expected to increase the abundance and productivity of spring Chinook, thereby ensuring that the ecological functions provided by this species are maintained into the future.

- Cultural and biological diversity is the key to surviving changes

NPCC Fish and Wildlife Program:

> *Ecosystems change over time, increasing or decreasing benefits to species, including humans. Biological diversity in species and their populations makes this adaptability possible. Similarly, the cultural diversity of people and communities represented by learned behaviors, ideas, values, and institutions allows for society to adapt to these changes.*

The fishery actions within the watershed are designed to support diversity of fish populations primarily through habitat improvement, increased access to suitable habitat, and habitat protection actions across the Subbasin. Prior versions of the Master Plan documented many habitat actions that are being implemented to protect and restore the native ecology of the Subbasin. Thus, if environmental conditions result in, for example, the failure of a spawning aggregate in one portion of the Subbasin, the existence of populations in other parts of the Subbasin will allow production to continue.

It is known that changing ocean and estuary conditions can result in wide swings in fish population abundance. The Master Plan sets a minimum escapement target for spring Chinook to account for low survival years as well as higher average escapement targets to take advantage of better survival years. This strategy will help fish populations to rebuild quickly to levels needed to sustain the species over time. To achieve the higher average escapement target, harvest will likely need to be adjusted in some years. Harvest actions will be consistent with the goal of allowing more wild fish to spawn naturally, thereby producing more juveniles in subsequent years.

It is recognized that, while hatchery programs may provide substantial harvest and conservation benefits, they also pose risks to native fish communities. Hatcheries can prevent fish from taking advantage of favorable habitat conditions by decreasing population productivity. To reduce hatchery effects on wild anadromous fish populations, the Master Plan sets performance targets for the proportion of hatchery fish present on the spawning grounds (pHOS), incorporates HSRG recommendations to ensure that the natural environment, rather than the hatchery environment, drives the local adaptation of the composite stock, limits the proportion of the wild population used as hatchery broodstock, and sets minimum and average adult escapement targets. The influence of hatchery populations on natural-origin fish will also be reduced by maximizing harvest opportunities to target hatchery fish and by implementing measures to increase homing fidelity. The objective is to ensure that the natural, rather than the hatchery, environment drives local adaptation of the integrated population.

Monitoring and evaluation programs will aid managers in determining impacts to wild fish populations.

- Ecosystem management should be adaptive and experimental.

NPCC Fish and Wildlife Program:

> *Ecosystems are complex, they change constantly, and our understanding of them is limited. In response, natural resource managers must strive to improve their knowledge and be adaptable to include information as it is learned. Using a structured process of learning can contribute to new scientific knowledge that informs decisions.*

Biological goals for spring Chinook are based on both conservation and harvest objectives. M&E activities will be used to track the viability of the natural populations. Scientifically based information derived from such activities will be used to guide long-term adaptive management strategies pertaining to these populations.

The spring Chinook abundance objective is to achieve a minimum and average escapement of 400 and 700 adults, respectively. In regard to spatial structure, the objective is to have spring Chinook spawn throughout their historical range in the Subbasin.

- Ecosystem management can only succeed by considering people

NPCC Fish and Wildlife Program:

> *People live in ecosystems. Understanding what's important to people about the places they live, sharing scientific information, developing communication networks, and creating partnerships that enhance collaboration can make management actions more sustainable. Aligning policies with the appropriate level of governance can also improve effectiveness. Recognizing that local actions can affect socioeconomic outcomes at regional, national, or international scales will increase the effectiveness and efficiency of management actions.*

Common threads running through the discussions of all of the scientific principles are human effects on anadromous fish and their habitats and the human need for anadromous fish. Ongoing habitat actions are focused on addressing human degradation of stream habitat throughout the Subbasin. The Master Plan does not account for, or assume, any improvements in habitat conditions in the mainstem Columbia or estuary. Strategies and actions are designed to target the key habitat factors limiting fish abundance, productivity, spatial structure, and life history diversity.

The hatchery program attempts to balance the treaty harvest rights of the Yakama Nation with the impacts hatchery facilities and fisheries have on native fish communities. This balance is evidenced by the substantial changes to hatchery production programs proposed for the Subbasin.

Harvest levels and rates will be monitored and enforced under the proposed project. Selective sport fisheries that require fishers to release wild fish will be maintained

throughout the Subbasin. Tribal members may choose to release unmarked fish to the stream as well.

3.2 Step 1 Requirements for All Projects

The Guiding Scientific Principles are the basis for the review elements contained in the NPCC's Major Project Review. A discussion of how the Master Plan addresses each general project review element is presented in this section. The review elements are quoted from NPCC 2006.

> *Address the relationship and consistencies of the proposed project to the scientific principles.*

Section 3.1 contained a thorough presentation of the Guiding Scientific Principles and the ways in which the proposed Master Plan satisfies them. In addition, the Master Plan has been designed to satisfy the Step 1 requirements, all of which derive from the Scientific Principles. The proposed project recognizes the inter-relationships between species, their habitats, natural forces, and human activities. Biological objectives with measurable attributes have been defined for each of the target species (Chapter 6.0) and the links between the proposal and other projects and activities in the Subbasin are described (Chapter 4.0). Implementation strategies as well as monitoring and evaluation are included in the Master Plan (chapters 6.0 and 7.0). Conceptual designs and costs are found in chapters 8.0 and 9.0.

> *Describe the link of the proposal to other projects and activities in the adopted subbasin and the desired end-state condition for the target subbasin.*

The Klickitat Subbasin is the target of the proposed project. The Master Plan is linked to and consistent with the Klickitat Subbasin Plan (Yakama Nation, Klickitat County, and WDFW 2004) and the Klickitat Subbasin Recovery Plan (NOAA-Fisheries 2009). The goals and objectives defined for the proposed project echoes those found in the other plans. It is envisioned that the implementation of the proposed project will augment the actions performed under the Subbasin and recovery plan and will lead to healthy, harvestable, and sustainable populations of spring Chinook within the Subbasin. The Klickitat Subbasin Plan and recovery plan are discussed further in sections 4.2.1 and 4.2.2.

> *Define the biological objectives with measurable attributes that define progress, provide accountability and track changes through time associated with this project.*

Biological objectives have been established for spring Chinook within the Klickitat Subbasin. The objectives are defined in terms of "primary" conservation and harvest objectives and numerical objectives. Conservation goals are measured in terms of productivity, abundance, life history diversity, and geographic distribution (spatial structure). Harvest goals are divided into Tribal and sport harvests in the mainstem and inside the Klickitat Subbasin. The primary objectives and references to the sections and

tables containing the measurable objectives are presented in Chapter 2.0 and discussed in detail in Chapter 6.0.

Define expected project benefits.

The major expected benefits of this project are fishery enhancement and preservation of biological diversity as described further in Chapter 6.

Describe the implementation strategies as they relate to the current conditions and restoration potential of the habitat for the target species and the life stage of interest.

Implementation strategies are contained in Chapter 6.0 for each of the target species. Strategies have been established to implement conservation, harvest, and habitat actions. All actions are aimed at accomplishing the goals and objectives established for each species. Spring Chinook strategies are detailed in section 6.1.5.

Address the relationship to the habitat strategies (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.3).

The habitat objectives and strategies contained in prior revisions of the Master Plan are based on the habitat strategies found in the 2000 Columbia River Basin Fish and Wildlife Program (NPCC 2000). The FWP calls for protection and restoration "of freshwater habitat for all life history stages of the key species." It also requires that "ecological connectivity between aquatic areas, riparian zones, floodplains and uplands" be protected and increased. The habitat strategies we are implementing reflect these requirements.

The strategies include protecting stream corridor structure and function, restoring passage and connectivity between habitat areas, restoring floodplain function and channel migration processes, restoring riparian condition, restoring normative flow regimes, and restoring degraded water quality.

Ensure that cost-effective alternate measures are not overlooked and include descriptions of alternatives for resolving the resource problem, including a description of other management activities in the subbasin, province, and basin.

Formulation of the proposed project included examination of other strategies (Section 6.1.4). The discussions of strategies include descriptions of the options and the reasons for their rejection. Generally, the options were 1) continue existing hatchery operations, 2) cease hatchery operations and concentrate on habitat improvement and restoration, and 3) modify hatchery programs as well as habitat improvement and restoration. The YN considered current management activities in the Subbasin, province, and Basin before proposing the preferred option.

Provide the historical and current status of anadromous and resident fish and wildlife in the subbasin most relevant to the proposed project.

The historical and current status of Klickitat spring Chinook is described in Chapter 6.0. Spring Chinook populations are considered depressed by WDFW.

Describe current and planned management of anadromous and resident fish and wildlife in the subbasin.

Chapter 6.0 also contains descriptions of both current and planned management of spring Chinook in the Klickitat Subbasin. It is recognized that past and current management of hatcheries, harvest, and habitat within the Subbasin have not led to increasing fish numbers and distribution. Therefore, new management strategies are being proposed under this Master Plan.

Demonstrate consistency of the proposed project with National Marine Fisheries Service recovery plans and other fishery management and watershed plans.

The proposed project has been designed to be compatible and consistent with the draft Klickitat Recovery Plan and the Klickitat Subbasin Plan. All of the plans have the goal of increasing naturally spawning anadromous fish numbers and distribution in the Klickitat Subbasin while minimizing negative effects to resident fish and wildlife. All the plans were stimulated by and based upon the NPCC's FWP (NPPC 2000, 2014).

Describe the status of the comprehensive environmental assessment.

A revised EIS specific to spring Chinook actions is in progress.

Describe the monitoring and evaluation plan.

The monitoring and evaluation plan proposed for this project was detailed in Chapter 7.0 of prior revisions of the Master Plan and is not repeated here. The proposed monitoring and evaluation program deals with hatchery, harvest, and habitat components of the Master Plan.

The M&E plan has been designed to be consistent with the Columbia River Basin regional strategies including Monitoring, Evaluation, Research, and Reporting (MERR); Anadromous Salmonid Monitoring Strategy (ASMS); Collaborative Systemwide Monitoring and Evaluation Project (CSMEP), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP). YN continues to participate in regional efforts to develop standardized research, monitoring, and evaluation methods and recommendations and is committed to using adaptive management to incorporate regional recommendations into Yakama Nation projects, including those being implemented in the Klickitat Subbasin.

M&E for hatchery activities focus on determining the success of the hatchery programs, identifying the effects each program has on native stocks, and identifying and rectifying critical uncertainties. In relation to harvest, managers will use time, area, and gear restrictions in combination with measures such as selective fisheries to target fish not intended for restoration purposes. Fisheries will be monitored using creel and on-the-water methods; regulations will be enforced by Tribal and WDFW fish and wildlife

officers. Estimated harvest by population and run sizes will be updated and analyzed on a regular basis so that in-season adjustments to fisheries can be made if necessary.

The results of ongoing M&E activities are presented in annual reports. A yearly workshop is held to present study findings to other agencies and interested public. Study results and workshop materials are stored on the web at www.ykfp.org.

> *Describe and provide specific items and cost estimate for 10 Fiscal Years for planning and design (i.e. conceptual, preliminary and final), construction, operation and maintenance and monitoring and evaluation.*

The costs associated with the proposed project are presented in Chapter 9.0.

3.3 Step 1 Requirements for Artificial Production Projects

In addition to the NPCC requirements for all projects, the Major Project Review process has specific requirements for artificial production projects.

> *Address the relation and link to the artificial production policies and strategies (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.4 and Technical Appendix)*

The proposed project is based on the artificial production principles and strategies found in the FWP (NPCC 2014). The 2014 FWP states *"The Council defers to the agencies and tribes to define the scope and purpose(s) of the hatchery and fish propagation methods, as well as the appropriate management techniques, consistent with current and evolving scientific principles."* One of the main purposes of the proposed project is to increase numbers and distribution of native species (spring Chinook) by transitioning from traditional hatchery programs to HSRG-based integrated programs using genetically similar stocks (Chapter 6.0). The M&E plan is designed and being implemented to ensure that production strategies are not harmful to naturally spawning native stocks. If problems are identified, management programs and strategies will be adjusted (adaptive management).

> *Provide a completed Hatchery and Genetic Management (HGMP) for the target population(s).*

An updated HGMP for the proposed Klickitat River Spring Chinook Master Plan is included in Appendix A.

> *Describe the harvest plan (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.5).*

Harvest plans for spring Chinook are outlined in Chapter 6.0. The goals of the harvest plan are summarized in Chapter 2.0.

> *Provide a conceptual design of the proposed facilities, including an assessment of the availability and utility of existing facilities.*

The conceptual designs for the proposed hatchery modifications and new facilities are contained in Chapter 8.0.

Provide a conceptual design of the proposed strategies and/or facilities.

The conceptual designs for the facilities are presented in Chapter 8. Strategies for harvest, hatcheries, and habitat are described in Chapter 6. Monitoring and evaluation strategies are summarized in Chapter 7.

CHAPTER 4.0 LOCAL AND REGIONAL CONTEXT FOR THE PROPOSED PROJECT

4.1 Local and Regional Context

4.1.1 Geography, Topography, Hydrology, Habitat, and Land Use

The Klickitat Subbasin is located in southcentral Washington State within the NPCC's Columbia Gorge Province (Figure 4-1). The Subbasin covers an area of about 1,350 square miles and is nearly equally divided between Yakima and Klickitat counties. The northern portion of the Subbasin lies within the boundaries of the reservation of the Confederated Tribes and Bands of the Yakama Nation.

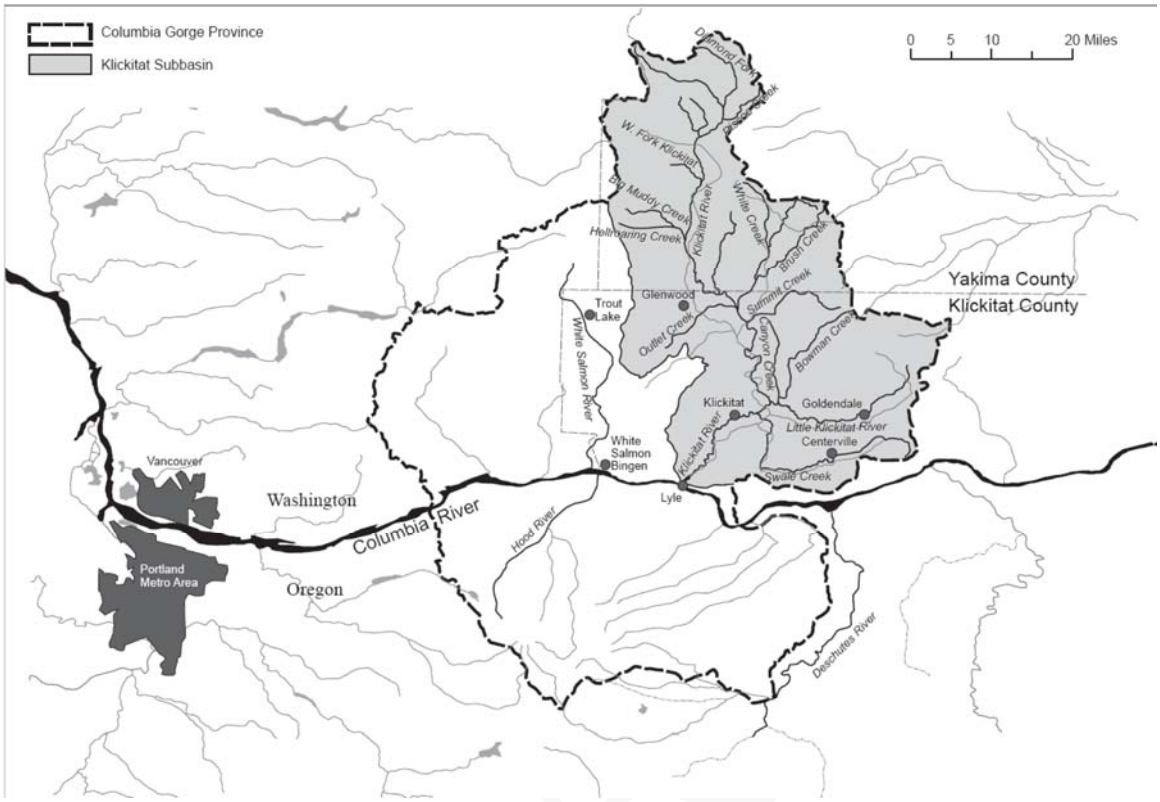
The area's climate is characterized by the Pacific Ocean's maritime influence and the more arid climates found on the east side of the Cascade Range. Temperatures in the northwest portion of the Subbasin are cooler and wetter than those in the southeast. Summers are dry with average temperatures of 55°F to 70°F and winters are cold and wet with average temperatures of 25°F to 37°F. Precipitation decreases from the west to the east side of the area. Mount Adams typically receives 140 inches of precipitation per year while east side areas receive about 9 inches. The months receiving the greatest precipitation are December and January; the driest months are July and August (Yakama Nation et al. 2004).

The Subbasin's geology is typical of the basalt-covered areas of eastern Washington and Oregon. Thick layers of basalt cover the land; rivers carve steep-walled canyons through the layers. Mountainous portions of the Subbasin are characterized by coniferous forests while more the arid regions are covered by vegetation typical of sagebrush steppes and grasslands. The Klickitat River occupies a relatively wide valley separated from the surrounding plateau by steep slopes.

Forests cover nearly 75% of the Klickitat Subbasin. Upland areas provide habitat for a variety of large and small mammals, birds, reptiles, and amphibians. According to the Klickitat Subbasin Plan (Yakama Nation et al. 2004), many wildlife species in this area are "listed as federal and/or state Threatened, Endangered, Sensitive or At-Risk." The area is important for overwintering mule deer and is part of the Pacific flyway for migratory waterfowl. Elk and mule deer use the higher elevations during the summer months and many neotropical migratory birds as well as the flammulated owl, breed in the Klickitat Subbasin. The Subbasin provides habitat for western gray squirrels, a species which is at low levels in other parts of Washington.

Terrestrial habitat has been adversely affected in many areas of the Subbasin. Logging, agriculture, residential development, road construction, and the introduction of invasive species of plants and animals have all played a part in reducing riparian, wetland, and upland habitats. Habitats such as white oak forests have been fragmented which adversely affects wildlife movements through the area.

Figure 4-1: Klickitat Subbasin and Columbia Gorge Province



The major rivers in the area are the Columbia River, Klickitat, and Little Klickitat. Each contains populations of anadromous and resident fish. The anadromous populations have decreased over the past century due to reduction in suitable aquatic habitat, fish passage blockage, and commercial overharvest. Life history, distribution, and population information about the fish species that are the focus of this Master Plan are found in chapters 1.0 and 6.0, Appendix A, and the Klickitat Subbasin Plan (Yakama Nation, Klickitat County, and WDFW 2004)

The Klickitat River headwaters lie in the Goat Rocks Wilderness at about 5,000 ft in elevation. From here, the river flows 95 miles before entering the Columbia River at Lyle, Washington, upstream of Bonneville Dam. The Klickitat is "one of the longest undammed rivers in the northwest" (Yakama Nation et al. 2004). Swale Creek, Little Klickitat River, Outlet Creek, the West Fork of the Klickitat, Diamond Fork, and Big Muddy Creek are major tributaries to the Klickitat.

The hydrology of the Klickitat Subbasin is described in detail in the Klickitat Subbasin Plan (Yakama Nation et al. 2004). Channel gradients range from 8% or greater near the headwaters to less than 1% along much of the mainstem. In the vicinity of the Klickitat Hatchery at RM 42.4, the channel gradient is 1% to 2%. The river has two major falls: Lyle Falls at RM 2.2 and Castile Falls at RM 64 to 64.5. Lyle Falls is a series of five falls ranging from 4 to 12 feet; Castile Falls is a series of 11 falls with a total elevation change of approximately 80 feet. The major tributaries are generally characterized by low gradient reaches on the valley floor, a falls or high gradient reach between the valley and the plateau.

River flows within the Subbasin are unregulated. Water is diverted from portions of some tributaries, including Swale Creek, Little Klickitat River, and Outlet Creek, for water supplies and irrigation. The remainder of the Subbasin exhibits a natural flow regime. Klickitat River flows, as well as those of tributaries in the middle and upper portions of the Subbasin, are dominated by snowmelt. The highest river flows occur in late spring. The snow pack on Mt. Adams contributes to river flows well into the summer months. In the mid-elevations, hydrographs are dominated by rain on snow; highest flows occur in the winter during warm winter storms.

In the lower elevations where channel gradients are nearly flat, stream velocities, stream energy, and erosion potential are low. In the steeper canyon areas, there is greater energy and greater erosion potential. Sedimentation occurs as a result of forest and agricultural practices and construction activities. The areas along the mainstem above Castile Falls and the riparian areas along parts of the Little Klickitat River are the most affected in the Subbasin.

The Subbasin experiences other water quality problems related to low instream flows and high water temperatures. Swale Creek and Little Klickitat River (and many of its tributaries) have flows too low to support fish during part of the year. Other streams, including the mainstem Little Klickitat, experience water temperatures too high for resident and anadromous fish. High water temperatures may be the result of low water and lack of riparian vegetation.

The natural hydrology of the lower reaches of the Subbasin has been altered by inundation due to the creation of the Bonneville Pool following construction of Bonneville Dam. The Klickitat Subbasin Plan (Yakama Nation et al. 2004) states that "[t]ravel corridors between the Klickitat River and the Columbia River, and connectivity to essential habitats (e.g., breeding, feeding, seasonal ranges) between and along the Columbia River to other subbasins [and] drainages was lost for a number of species (i.e., blacktail deer, western gray squirrels, neotropical birds)." In addition, hydroelectric development has resulted in the loss of wetland habitat especially in the valleys and on the plateaus. Though the lower Klickitat River has "remained relatively isolated from direct shoreline development over most of its length", channelization and constriction from road development has damaged habitat in some reaches.

Two major hydroelectric dams are located on the Columbia River near the mouth of the Klickitat River: Bonneville and The Dalles. Juvenile and adult anadromous fish must pass Bonneville Dam to complete their life history. Irrigation diversions or water supply facilities are located in Glenwood Valley (Hellroaring Irrigation Co.), Swale Creek, and the Little Klickitat River (Figure 4-1).

Existing artificial production facilities in the Klickitat Subbasin are Klickitat Fish Hatchery and fish ladders at Lyle Falls and Castile Falls (Figure 1-2). Descriptions of these facilities are found in Chapter 8.0 or earlier versions of this Master Plan.

4.1.2 Archeology, History, and Socio-economic Aspects

The Klickitat Subbasin is thought to have been occupied by humans for more than 30,000 years. Archeological evidence shows that salmon fishing has occurred on the Columbia River for more than 10,000 years. People traveled from outside the area to trade for salmon. European Americans began to arrive in large numbers in the Columbia River country in 1843.

Currently, the Klickitat Subbasin has about 11,000 residents. The population centers are Goldendale (3,760 residents) and the unincorporated towns of Klickitat, Lyle, and Glenwood (Figure 1-2). It estimated that residential development occurs on less than 0.5% of the Subbasin. The area is important for recreation, timber, and agriculture. There are two major hydroelectric dams (Bonneville and The Dalles) on the Columbia River in the vicinity of the Klickitat Subbasin.

Land use is consistent with the Subbasin's climate, vegetation, and topography. Most of the Subbasin is forested (Section 4.1.1) and is managed for commercial timber production. The primary landowner is the Yakama Nation; the rest of the forest lands are owned by the State of Washington and various private entities.

The remainder of the Subbasin is used mostly for agriculture: pasturage, dry-land farming, and livestock grazing. These activities occur outside of the areas unsuited to forest. About 8,600 acres are irrigated, primarily along Outlet Creek, the upper Swale Creek drainage, and along the Little Klickitat River near Goldendale.

The Klickitat Subbasin is about equally divided between Klickitat and Yakima counties (Yakama Nation et al. 2004; Figures 1-1 and 1-2). The northern half of the Subbasin is within the Yakama Nation Reservation. In the southern half, about 90% of the land is privately owned, about 10% is owned by various agencies of the State of Washington, and the rest (less than 1%) is owned by the federal Bureau of Land Management and the U.S. Fish and Wildlife Service (USFWS). Special use areas within the Subbasin include the Columbia River Gorge National Scenic Area, the Klickitat Wildlife Area, and Conboy Lake National Wildlife Refuge. The lower 10 miles of the Klickitat River are designated "recreational" under the federal Wild and Scenic Rivers Act in 1986.

4.2 Current and Planned Management Activities

The Klickitat Subbasin is currently covered by and consistent with several management plans including the Klickitat Subbasin Plan (Yakama Nation, Klickitat County, and WDFW 2004), NOAA-Fisheries Middle Columbia River Steelhead Recovery Plan (NOAA-Fisheries 2009), NOAA-Mitchell Act FEIS (NOAA-Fisheries 2017), Washington State Watershed Planning Process, and the Washington State Salmon Recovery Planning Process.

4.2.1 Klickitat Subbasin Plan

The Klickitat Subbasin Plan was prepared for the NPCC in 2004. The subbasin planning process exists within the context of the Fish and Wildlife Program (NPCC 2000) which envisioned that the plans would provide locally developed fish and wildlife restoration and protection priorities. The Klickitat Subbasin Plan had as a major goal the identification of management actions that would promote compliance with the federal Endangered Species Act and the federal Clean Water Act. The plan's vision statement is as follows:

> *We envision healthy self-sustaining populations of indigenous fish and wildlife that support harvest and other purposes. Decisions and recommendations will be made in a community based, open and cooperative process that respects different points of view, and will adhere to all rights and statutory responsibilities. These efforts will contribute to a robust and sustainable economy.* (Yakama Nation et al. 2004)

The Subbasin goals identified by the plan are:

- *Protect or enhance the structural attributes, ecological function, and resiliency of habitats needed to support healthy populations of fish and wildlife.*

- *To restore and maintain sustainable, naturally producing populations of spring Chinook, steelhead that support tribal and non-tribal harvest and cultural and economic practices while protecting the biological integrity and the genetic diversity of the subbasin.* (Yakama Nation et al. 2004)

The proposed project is aimed at accomplishing both Subbasin goals, but is particularly concerned with the second goal.

4.2.2 NOAA Recovery Plan

NOAA Fisheries Service adopted a final ESA recovery plan to satisfy the requirements of the Endangered Species Act to support recovery of the middle Columbia River steelhead Distinct Population Segment (DPS) of steelhead found in the Klickitat Subbasin (NOAA 2009). The recovery plan was developed as a collaborative process initiated by NOAA with input and assistance from the Middle Columbia Forum (Mid-C Forum), a bi-state, tri-tribe group in which the YN participated. The plan includes a locally developed management unit plan for the Klickitat Basin (Recovery Plan for the Klickitat River Population of the Middle Columbia River Steelhead DPS). The purpose of the plan is to "restor[e] the Klickitat steelhead population and its habitats to a level that supports recovery of the Middle Columbia River steelhead DPS and allows the population to become a viable component of its ecosystem." NMFS policy with recovery of salmonid populations must also achieve the goal of restoration of the meaningful exercise of tribal fishing rights. The proposed spring Chinook integrated hatchery project is consistent with the goals of the NOAA Recovery Plan.

4.2.3 Washington State Watershed Planning Process

The watershed planning process for the State of Washington began with passage of ESHB 2514 in 1998 (Ch. 90.82 RCW). The planning process is aimed at finding local solutions to watershed issues. The primary goal of the program is to successfully manage water to ensure that the supply is sufficient for all users including people, farms, and salmon.

4.2.4 Washington State Salmon Recovery Planning Process

In 2000, the State of Washington instituted the salmon recovery planning process under the concept that "extinction is not an option." The goal of the process is to "[r]estore salmon, steelhead, and trout populations to healthy harvestable levels and improve those habitats on which the fish rely" (Joint Natural Resources Cabinet 2002). Lead entity strategic plans must include objective, measurable criteria for recovery; site-specific management; and time and cost estimates aimed at recovery of salmonid populations. The plans integrate local habitat efforts with actions involving hatcheries and harvest. These planning elements are entirely consistent with the proposed project.

The lead entity for the salmon recovery area encompassing the Klickitat River is Klickitat County. The YN is represented on both the Citizen's Advisory Committee and the Technical Advisory Committee along with a variety of local, state, and federal agencies and organizations. The Klickitat Lead Entity Region Salmon Recovery Strategy document is available online at
http://www.klickitatcounty.org/DocumentCenter/View/235

.

The vision statement of the Klickitat Lead Entity Region Salmon Recovery Strategy is as follows:

> *Restore salmon, steelhead, and trout populations to healthy, self-sustaining, and harvestable levels and improve and maintain habitat on which fish rely, with strong community support and participation in the Klickitat Lead Entity geographic area.*

Their mission is to: "support salmon recovery by identifying credible and fundable habitat protection and enhancement projects and support related programs and activities that produce sustainable and measurable benefits for fish and fish habitat." (Klickitat County 2010).

4.2.5 Mitchell Act EIS.

Congress enacted the Mitchell Act (16 United States Code of Federal Regulations [USC] 755 757) in 1938 for the conservation of anadromous (salmon and steelhead) fishery resources in the Columbia River Basin (defined as all tributaries of the Columbia River in the United States [U.S.] and the Snake River Basin). It authorized the establishment, operation, and maintenance of one or more hatchery facilities in the states of Oregon, Washington, and Idaho, scientific investigations to facilitate the conservation of the fishery resource, and "all other activities necessary for the conservation of fish in the Columbia River Basin in accordance with law."

NOAA Fisheries has released a final environmental impact statement (FEIS) to inform its decisions regarding what kind of hatchery programs to fund with federal appropriations provided under the Mitchell Act. The scope of this EIS includes all of the Columbia River Basin open to salmon and steelhead. Under the Mitchell Act, funding through the Congressional Appropriations process is provided to produce salmon and steelhead for fishing and conservation. The Biological Opinion on this EIS, published in January 2017, indicates that the increased production of spring Chinook at Klickitat Hatchery is in compliance with ESA.

http://www.westcoast.fisheries.noaa.gov/hatcheries/mitchell_act/ma_feis.html

CHAPTER 5.0 PROJECT RATIONALE

Chapter 5.0 discusses the rationale behind the proposed project from the historical, legal, socio-economic, and ecological standpoints. This discussion is intended to further address ISRP comments on prior revisions of the draft Master Plans regarding the need for additional project justification and rationale.

5.1 Historical and Legal Rationale

Timeline of Major Events Affecting Columbia River Salmon Management and Treaty Fisheries

1855 The United States enters into several treaties with Indian tribes living along the Columbia River and its tributaries in what are now the states of Oregon, Washington and Idaho. A key provision of all four treaties is: **"That the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians; and at all other usual and accustomed stations, in common with the citizens of the United States . . . "** (12 Stat. 951). Prior to the treaties, combined salmon and steelhead returns to tribal usual and accustomed fishing areas in the Columbia Basin were estimated to range upwards of 10 million (CRITFC 1995, 2000; NPCC 2009). Human population in the region encompassing the present states of Oregon, Washington and Idaho was likely less than 1 million (estimated from available census data).

1855-

1968 Non-Indian settlement and development in the Columbia River Basin proceeds.

In 1938, Bonneville Dam is completed. The "Mitchell Act" is enacted to "provide for the conservation of fishery resources in the Columbia River...." Department of Interior allows federal and state agencies to implement Mitchell Act by constructing numerous fish hatcheries in the lower Columbia River below most of the tribal usual and accustomed fishing places.

In 1957, The Dalles Dam is completed inundating Celilo Falls and eliminating the major tribal fishing area. With the construction of The Dalles and John Day (1971) dams, federal, state, and tribal fishery agencies estimated that spawning grounds for as many as 65,000 adult fall Chinook were eliminated (*U.S. v Oregon* Production and Technical Advisory Committees).

1968 In July 1968, fourteen members of the Confederated Tribes and Bands of the Yakama Indian Nation file suit in federal district court in Oregon against the Oregon Fish Commission and Oregon Game Commission (*Sohappy v.*

Smith). The tribal fishermen seek a decree that would define their treaty fishing rights and a clarification on the manner and extent to which the State of Oregon may regulate Indian fishing.

In September, the United States files suit in federal district court in Oregon against the State of Oregon seeking a judgment and injunction to enforce Indian off-reservation fishing rights in the Columbia River Basin (*United States v. Oregon*).

The Confederated Tribes and Bands of the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the Confederated Tribes of the Warm Springs Reservation of Oregon intervene in *U.S. v. Oregon* as plaintiffs.

Judge Robert Belloni is the judge assigned to the cases. In November, Judge Belloni consolidates the *Sohappy v. Smith* and *U.S. v. Oregon* proceedings.

1969 Judge Belloni renders his decision in the *Sohappy v. Smith* and *U.S, v. Oregon* proceedings. He rules that the tribes have a right to a fair share of the available harvest and that the state is limited in its power to regulate the exercise of the Indians' federal treaty rights. Judge Belloni also finds that it is patently unfair to manage the Columbia Basin salmon such that few fish survive to reach the tribes' usual and accustomed fishing places and that the tribes have an absolute right to that fishery and thus are entitled to a fair share of the fish **produced** by the Columbia River system.

1970-1977 In 1973, Congress passes the Endangered Species Act (ESA) which authorizes "… the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to [the ESA] are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, **propagation**, live trapping, and transplantation…" 16 U.S.C. Sect. 1532(3).

In 1974, the State of Washington is granted intervention in the *U.S. v. Oregon* proceedings. Judge Belloni modifies his original decision to read: "The Indian treaty fishermen are entitled to have the opportunity to take up to 50% of the [spring] chinook run destined to reach the tribes' usual and accustomed grounds and stations. By `destined to reach . . . ' I am referring to that portion of the [spring] run which would, in the normal course of events, instinctively migrate to these places except for prior interception by non-treaty harvesters **or other artificial factors**."

In the first *U.S. v Oregon* management plan adopted in 1977, the parties agreed to "diligently pursue and promote through cooperative efforts upriver maintenance and enhancement of fish habitat and hatchery rearing programs…" Since 1977, the parties to *U.S. v Oregon* have negotiated a series of plans for fisheries management in the Columbia River Basin. These plans have been adopted as orders of the U.S. District Court for the District of Oregon. The *U.S. v Oregon* management planning process is the principal forum through which problems of anadromous fish harvest, stock restoration, and production are addressed.

1980 Congress passes the Pacific Northwest Electric Power, Planning and Conservation Act, establishing the Northwest Power Planning Council, now known as the Northwest Power and Conservation Council. The act requires the Council to develop a fish and wildlife protection and restoration program. The 2014 program with amendments acknowledges the legal and social context described here and includes the following language regarding vision and objectives:

"The vision for this program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, supported by mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem. This envisioned ecosystem provides abundant opportunities for tribal trust and treaty-right harvest, non-tribal harvest, and the conditions that allow for restoration of the fish and wildlife affected by the construction and operation of the hydrosystem.

The vision will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. Where this is not feasible, other methods that are compatible with self-sustaining fish and wildlife populations will be used, including certain forms of production of hatchery fish. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance habitat and species assemblages compatible with the altered ecosystem.

…The program continues to include a set of quantitative goals and related timelines for anadromous fish. These include, among others, increasing total adult salmon and steelhead runs to an average of 5 million annually by 2025 in a manner that emphasizes the populations that originate above Bonneville Dam and supports tribal and non-tribal harvest…" (Council Document 2014-12)

1991-Present Beginning in 1991, 13 species of Columbia and Snake River salmon and steelhead are listed for protection under the ESA further restricting the tribes' treaty fisheries. The National Marine Fisheries Service (NOAA

Fisheries) issues a series of biological opinions concerning operation of the Federal Columbia River Power System (FCRPS) which are sequentially challenged in federal court by a number of different states, environmental groups and tribes.

In 1994, combined counts of salmon and steelhead at Bonneville Dam number fewer than 0.5 million.

In 2017, human population in the states of Oregon, Washington and Idaho combined was approximately 13.5 million.

The Parties to *U.S. v Oregon* sign the 2008-2017 Management Agreement which is adopted by a federal court order stating, "The Court has examined the 2008-2017 *United States v. Oregon* Management Agreement in light of the Court's Judgment of October 10, 1969, as amended May 10, 1974, and other materials in the case files. The Court concludes that the 2008-2017 *United States v. Oregon* Management Agreement is fundamentally fair, adequate, and reasonable, both procedurally and substantively, in the public interest, and consistent with applicable law, and that it has been negotiated by the parties in good faith." Parties are currently working towards another 10 year agreement for submittal to the Court in January of 2018. The spring Chinook program and production numbers identified in this Master Plan are wholly consistent with the updated *United States v. Oregon* Management Agreement.

In 2008, the Yakama Nation, Confederated Tribes of Umatilla, and Confederated Tribes of Warms Springs entered into the Columbia Basin Fish Accords. The Accords are an agreement between the federal government and signatory tribes and were designed to supplement NOAA Fisheries' biological opinions for listed salmon and steelhead and the Northwest Power and Conservation Council's fish and wildlife program. Under the Accords, the federal agencies and tribes agree to work together as partners "on the ground" to provide tangible survival benefits for salmon recovery - by upgrading passage over federal dams, by restoring river and estuary habitat, and by creative use of hatcheries. In exchange, the Accord tribes agreed to forego litigation regarding existence and operation of the FCRPS for the duration of the agreements.

This timeline provides the historical, human, legal, and political context within which the Klickitat River Spring Chinook Master Plan was developed and will be implemented. Rationale and justification for the objectives and strategies described in the Master Plan relate directly to this context. While many alternatives were considered, the preferred alternative describes those strategies which proponents believe will most effectively contribute to meeting federal treaty trust, mitigation, and restoration obligations arising from this context.

5.2 Socio-economic Rationale

The proposed project is expected to result in harvest of 4,000 spring Chinook annually (Chapter 6.0). The economic benefits of harvesting salmon have been discussed in numerous reports in recent years, with at least one report (IEAB 2005) projecting an annual contribution to West Coast communities in excess of $140 million. Subsistence harvest is beneficial economically to Tribal members because they are able to catch salmon rather than buy them. As the IEAB noted, "Although the impact from Columbia Basin salmonid production may be relatively small in comparison [to the regional economy], this economic impact can be significant in some local communities with close ties to the fishing industry". The economic benefits from Klickitat River fisheries generally accrue to smaller communities many located in currently economically depressed areas along the Columbia River and in Klickitat County.

5.3 Ecological Rationale

The ecological rationale for the proposed project is rooted in the recognition that hydroelectric installations and habitat degradation have led to critically low populations of salmonids throughout the Columbia River Basin including the Klickitat Subbasin. Several populations are considered depressed, threatened or endangered. Secondly, habitat, hatchery, and harvest actions to date have not yet resulted in naturally producing, self-sustaining populations of salmon and steelhead.

The proposed project, in conjunction with ongoing habitat restoration actions, is part of a holistic approach to returning salmon populations and habitat to a state as close as possible to those existing prior to development. The purpose of the proposed project is to produce, in a hatchery setting, salmon that will be used to supplement spring Chinook in the Klickitat Subbasin with the goal of eventually discontinuing the hatchery production if the naturally spawning populations become self-sustainable and meet harvest obligations. The hatchery program is designed to avoid adverse impacts to resident and native anadromous populations. For the spring Chinook program, brood stocks as close to the native stocks as possible will be used.

In addition, ongoing habitat restoration and enhancement activities are designed so that increased fish production from the spring Chinook hatchery program will have some place to spawn and rear. Returning as much damaged habitat as possible to an approximation of its original form will benefit not only the target species, but others as well including terrestrial species.

Chapter 6.0 describes in detail the proposed hatchery and harvest programs for spring Chinook.

CHAPTER 6.0 PROPOSED PROGRAM

The YN reviewed multiple strategies and approaches for achieving fisheries objectives in the Klickitat River. While many alternatives were considered, the preferred alternatives describe those strategies which YN believes will most effectively contribute to meeting federal treaty trust, mitigation, and restoration obligations as described in Chapter 5.

The Master Plan recognizes that to be successful, actions must be integrated across what the region refers to as the "4 Hs" (Hatcheries, Habitat, Harvest, and Hydro). The Master Plan focuses primarily on Habitat, Hatcheries, and Harvest because there are no hydroelectric facilities on the Klickitat River. However, the effect that mainstem Columbia River dams (Hydro) in addition to other development activities throughout the Columbia River Basin have had on the survival of fish populations originating upstream of Bonneville Dam was taken into consideration when setting hatchery release numbers, adult escapement, and harvest goals.

A brief summary of the major actions or objectives proposed for each "H" examined in the plan is presented below.

Habitat: increase the quantity and quality of Klickitat River mainstem, delta, and tributary habitat that currently or historically supported spring Chinook (Section 6.1.5). Improve habitat and aquatic conditions across all life stages, from adult holding through overwintering and outmigration. These activities are conducted and funded under the Klickitat Watershed Enhancement Project (KWEP; BPA Project 1997-056-00). We reference these habitat actions here for information purposes because we expect them to benefit spring Chinook productivity.

Hatcheries: The YN recognizes that current hatchery practices need to be changed to reflect recent scientific advances and to avoid negative effects hatchery fish may have on naturally spawning salmon populations including listed species. Because hatchery fish may interbreed with, compete with, and prey on native fish populations, the following actions are proposed to reduce these impacts while still maintaining the Klickitat's contribution of releases deemed necessary to satisfy the Columbia River Tribes' treaty-reserved fishing rights:

1. Volitional release strategies will be implemented to the extent logistically practical.

2. Hatchery adult spring Chinook will be collected at Lyle Falls, Castile Falls or the Klickitat River Hatchery, then returning adults (F1's) transported and released into suitable habitat above Castile Falls in an effort to re-supply marine derived nutrients and to re-establish spring Chinook production in the upper Klickitat River.

3. The hatchery program for spring Chinook will be monitored against specific objectives for natural escapement and production. Adaptive management measures

are specified and will be implemented as necessary to assure that the hatchery program minimizes impacts to natural populations.

4. The long-term goal for the preferred alternative is to be consistent with hatchery reform guidelines for the composition of hatchery and natural origin (NOR) spring Chinook spawners used for hatchery broodstock and escaping to the natural spawning grounds.

5. Hatchery programs will be operated in compliance with Tribal and federal environmental regulations, including requirements to maintain water quality, water quantity, and fish passage. These actions will assure that hatchery operations will not reduce the productivity and capacity of a watershed to support natural stocks.

Harvest: A major goal of the Master Plan is to provide harvest to Tribal members as required by treaty obligations and for sport fishing, while at the same time protecting naturally spawning populations and contributing to the recovery of ESA-listed steelhead and bull trout. Because hatchery fish provide most of the harvestable fish in the Subbasin, the Master Plan is structured to balance potential hatchery impacts to listed species with the harvest benefits they provide. The goal is to provide greater harvest benefits while reducing potential impacts to natural populations. If successful, an average of 4,000 spring Chinook are expected to be harvested in all Columbia River mainstem and Klickitat River terminal fisheries annually.

Additional harvest actions that will be implemented to better meet harvest goals or protect listed fish species include:

1. Marking hatchery fish released in the Subbasin so they can be distinguished from natural-origin fish in the hatchery broodstock, on the spawning grounds, and in fisheries.

2. State recreational fisheries are expected to continue targeting marked (hatchery-origin) spring Chinook while requiring release of unmarked (presumed natural-origin) fish.

The spring Chinook strategies proposed in this Master Plan are described below. We include descriptions of the alternative approaches considered, as well as the rationale for rejection.

6.1 Spring Chinook

6.1.1 Spring Chinook Stock Assessment

Spring Chinook Conservation Status

The Klickitat spring Chinook population is part of the mid-Columbia Spring Chinook ESU, which is currently not listed under ESA. However, WDFW considers the population depressed due to chronically low adult returns (WDFW 2005). On average, the Klickitat spring Chinook run comprises approximately 75% hatchery and 25% natural fish (Appendix B). Low numbers of returning natural-origin adults along with potential genetic issues (described below in Section 6.2.2 under Hatchery Management) have led to concerns regarding the status and trends of this native population.

Data on the total natural origin adult returns, spawning escapement, age composition and recruitment rates of the natural Klickitat spring Chinook population for brood years 1984 through 2011 are presented in Table 6-1. The data show that over this period, spring Chinook adult production averaged 762 fish, ranging from 54 to 2,365.

Table 6-1: Returns, spawning escapement and recruitment rate estimates for natural Klickitat spring Chinook, brood years 1984 – 2016

Brood Year	Natural Spawners	Age Distribution of Natural Returns				Estimated Brood Year Recruitment	Natural Recruits per Spawner
		Age-3	Age-4	Age-5	Age-6		
1984	102	29	782	65	6	882	8.65
1985	79	117	381	504	1	1004	12.71
1986	142	43	215	155	4	418	2.94
1987	312	112	303	176	12	603	1.93
1988	1108	76	334	387	3	800	0.72
1989	295	44	318	105	5	471	1.60
1990	224	9	19	25	2	54	0.24
1991	241	10	60	38	4	113	0.47
1992	318	35	334	294	23	686	2.16
1993	430	37	479	145	0	660	1.54
1994	96	22	137	42	0	201	2.09
1995	72	64	108	105	4	282	3.91
1996	274	115	1002	285	0	1402	5.12
1997	595	156	259	120	0	535	0.90
1998	240	208	1179	616	2	2005	8.35
1999	119	416	1424	519	5	2365	19.87
2000	516	313	808	21	2	1145	2.22
2001	312	377	262	107	0	746	2.39
2002	898	28	311	223	0	562	0.63
2003	1142	37	207	87	0	330	0.29
2004	817	64	322	36	0	422	0.52
2005	125	177	204	48	0	430	3.44
2006	242	168	365	77	0	610	2.52
2007	296	89	552	183	0	823	2.79
2008	191	309	644	104	0	1057	5.52
2009	164	253	381	30	0	664	4.06
2010	265	260	437	101	1	799	3.02
2011	422	121	950	208		1279	3.03
Mean						762	3.70

Yakama Nation Fisheries

Spring Chinook spawning escapement has ranged from 72 to 1,142 with a mean of 358. A proportion of these spawners were probably hatchery fish, but since most returning hatchery adults were not marked prior to 2007, and sample sizes of recovered carcasses on spawning grounds since then are small, it is not possible to develop a precise estimate (Yakama Nation, Klickitat County, and WDFW 2004, Zendt et al. 2010, and Zendt et al. 2016).

Mark-recapture estimates of spring Chinook run size to Lyle Falls on the lower Klickitat River in recent years, conducted by tagging fish at Lyle Falls then recapture upstream at Klickitat Hatchery, have averaged about 3,900 hatchery and 500 wild fish (total adults and jacks; Zendt et al. 2016 and more recent YKFP unpublished data). Mark-recapture methods have yielded higher run size estimates than the run reconstruction methods in Table 6-1, but are likely influenced by higher-than-average returns of hatchery fish in some recent years and possibly by undercounting of redds.

Spring Chinook Harvest Status

Spring Chinook are caught primarily in Columbia River mainstem and terminal fisheries in the Klickitat River. From 1996 to 2005, spring Chinook catch in mainstem non-Tribal and Tribal fisheries averaged 26 and 159 fish respectively[2]. The combined sport and Tribal harvest of spring Chinook within the Klickitat River Subbasin has averaged 894 fish over this same period. The fisheries result in a combined total exploitation rate of 43% (Appendix B).

Historically, hatchery spring Chinook released into the Klickitat River were not marked. Therefore, it was not possible to determine if harvest rates varied for wild and hatchery fish. Beginning in 2002, all spring Chinook juveniles released from the Klickitat River were adipose fin-clipped allowing future managers to calculate harvest and exploitation rates for both run components.

6.1.2 Recent Management Strategies

Spring Chinook Habitat Management

Over the last 20 years, habitat management in the Klickitat River Subbasin has focused on the development and implementation of actions that restore ecological function and allow spring Chinook and other anadromous fish access to areas blocked by obstructions.

Spring Chinook Hatchery Management

Propagation of the indigenous Klickitat Spring Chinook stock began in 1951 when the Klickitat River Hatchery began operations. Between 1951 and 1959, natural-origin (NOR) adults were collected for broodstock at the Lyle Falls Fishway near the mouth of the Klickitat River (RKm 3.2). Since then, collection of broodstock has relied upon

[2] Harvest numbers for mainstem fisheries are based on assumed harvest rates for Upper Columbia River spring Chinook as Klickitat River fish cannot be distinguished from the run at large.

volunteer fish at the on-site hatchery trap (RKm 69). This method of broodstock collection has resulted in the incorporation of very few natural-origin spring Chinook on an annual basis.

Marshall (unpublished) found substantial genetic divergence between the hatchery and natural components of the population. More recent analysis (Hess et al. 2011), however, finds that the hatchery and natural-origin fish are quite similar and that some introgression has occurred between the stream-type Klickitat spring Chinook population and ocean-type Chinook stocks (likely Wells Hatchery summer Chinook that were released in the Klickitat in the late 1970s). This analysis points to past hatchery practices (possible incorporation of returning summer Chinook into spring Chinook brood mating, which has been discontinued) that likely initiated this interbreeding, and to the fact that the introgressed genotype persists in much of the hatchery and wild spring Chinook population with an unknown effect on fitness. Additional research is occurring to determine the effects.

Annual hatchery releases have consisted of both yearling and subyearling spring Chinook ranging from 419,500 to 960,000 for release years 1996 through 2016 (Table 6-2). Currently, hatchery spring Chinook yearlings are volitionally released from their rearing ponds at the Klickitat Hatchery (RKm 68) in March at about 13 to15 fpp in size. Subyearling spring Chinook have been transported and released directly into the Klickitat River from May through August at a size of 50 to 80 fpp. No releases of subyearlings have occurred since 2008.

Table 6-2: Spring Chinook subyearling and yearling hatchery releases for years 1996-2017

Release Year	Subyearling Release			Yearling Release		
	Number	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1996	223,000	5/28-5/29	54	610,000	2/8-2/9; 3/1-3/16	6
1997	382,500	5/27-5/29	49.5	580,600	3/1-3/15	7
1998	343,380	5/6, 5/7, 6/30	77	584,500	3/2-3/12	7
1999	40,600	5/11	81	538,000	3/1, 3/2	7.5
2000	190,842	5/2, 5/3, 8/9, 8/17	63.6	562,000	3/1-3/10, 3/20-3/31	6.4
2001	252,098	5/13, 7/22	51.4	615,000	3/7-3/9	7.7
2002	223,298	5/13	51.4	605,000	3/8-3/10	7.7
2003	286,400	5/6,8/6	71/36	607,500	3/5-3/8	8.0
2004	348,910	4/4, 5/10	70/60	609,800	3/1 – 3/5	13.7
2005	269,800	5/5 – 5/17	68	628,196	3/1 – 3/7	14.5
2006	155,230	5/21, 6/12, 7/12	58/68/56	607,900	3/6 – 3/10	14.1
2007	21,830	7/12	56	606,000	3/5 – 3/6	16
2008	39,422	5/14, 6/20, 6/21	90/77	449,232	3/3 – 3/8	14.4
2009	N/A	N/A	N/A	624,700	2/25 – 2/27	14.2
2010	N/A	N/A	N/A	419,475	3/9 – 3/11	16
2011	N/A	N/A	N/A	621,375	3/15 – 3/22	13.2

2012	N/A	N/A	N/A	621,925	3/13 – 3/16	14
2013	N/A	N/A	N/A	628,300	3/5 – 3/7	15.3
2014	N/A	N/A	N/A	548,210	3/3 – 3/6	19
2015	N/A	N/A	N/A	552,490	3/16 – 3/20	17.1
2016	N/A	N/A	N/A	519,350	3/22 – 3/24	16

Until the 2002 brood year, the majority of juvenile spring Chinook released each year were not adipose fin-clipped. Since this time, all spring Chinook hatchery juveniles have been marked with an adipose fin-clip. In addition, some have been given a coded-wire-tag (CWT).

Current Hatchery Performance

Hatchery spring Chinook smolt-to-adult survival rates averaged approximately 0.35% and ranged from 0.01% to 1.31% for brood years 1990 through 2000 (Appendix A). Zendt et al. 2016 used available PIT tag return data to estimate an average release-to-adult survival rate (return to Bonneville Dam) of about 0.51%. Additional analysis conducted in November, 2016 using PTAGIS data for Klickitat Hatchery spring Chinook released from 2007-2013 indicated a pooled average Bonneville-to-Bonneville PIT-detected smolt-to-adult return rate for age-3 to age-5 adults of 1.6% (range 0.6% to 2.2%). These data indicate that a major limiting factor for spring Chinook is smolt survival from release to Bonneville Dam. The measured recruit per spawner ratio (R/S) for hatchery-origin fish is 2.44. In contrast, the natural spring Chinook population had an average R/S value of 3.72 (Table 6-1).

Total hatchery spring Chinook adult production for return years 1990 through 2016 ranged from 397 to 2,985 and averaged 1,255. This estimate does not include those fish harvested in marine and mainstem Columbia River fisheries. The inclusion of these fish would increase total production by between 3% and 13% dependent on the return year[3].

Culture practices at the Klickitat Hatchery have resulted in an egg-to-smolt survival rate of 73%. Bacterial Kidney Disease (BKD) has been a problem in the past, but has been reduced through the implementation of improved culture methods at the Klickitat Hatchery.

Prior to 2003, spring Chinook yearlings were released from the hatchery at approximately 8 fpp or larger (Table 6-2)[4]. Releasing fish at 8 fpp is likely responsible for the high rate of mini-jack returns to the hatchery, which averaged 75% for the 1996 through 2003 brood years[5]. To correct this problem, spring Chinook yearling release size was decreased to 13 to 15 fpp in 2004 to better mimic the wild juveniles being produced from the Subbasin (Table 6-2).

[3] Harvest rates on Klickitat River spring Chinook caught in Columbia River fisheries are not available. It is assumed that Klickitat River-origin fish are caught at similar rates as Upper Columbia River spring Chinook.
[4] Fish at 8 fpp are larger than fish at 16 fpp as it requires more fish to equal one pound.
[5] The mini-jack rate was calculated by dividing the number of mini-jacks returning to the hatchery by the total number of fish (adults, mini-jacks and jacks) collected at the hatchery.

Spring Chinook Harvest Management

Klickitat River spring Chinook are caught primarily in Columbia River mainstem and in the Klickitat River. In 2008, *U.S. v Oregon*[6] parties signed the 2008-2017 Management Agreement that scheduled harvest rates according to the strength of the ESA-listed upriver spring Chinook run size (*U.S. v Oregon* Parties 2008). Harvest rates on the natural component of the spring Chinook run in Zones 1-5 and the Zone 6 treaty fishery range from 1% to 2% and 3% to13%, respectively (Appendix B). Also in 2001, a selective fishery for hatchery spring Chinook was established in the Columbia River which requires sport fishers to release unmarked spring Chinook back to the river.

Because returning age-4 adult Klickitat River hatchery spring Chinook were not adipose fin-clipped prior to 2006, it was assumed that mainstem Columbia River harvest rates on both the hatchery and natural components are similar to those occurring on ESA-listed Upper Columbia River spring Chinook, i.e. between 3% and13%.

Until 2006, spring Chinook fisheries in the Klickitat River were non-selective for hatchery fish. Sport fishers in the Klickitat River since 2006 are allowed to keep only marked hatchery spring Chinook, while Tribal fishers may retain any spring Chinook caught. The combined sport and Tribal harvest rate on spring Chinook returning to the Subbasin was about 35% for the 1996-2005 period.

The Tribal fishery is generally open Tuesdays through Saturdays from early April until the end of May and closes for most of June to allow adequate adult escapement to the Klickitat Hatchery. In years of lower abundance, the Tribal fishing season has been shortened by a day or two each week. The sport fishery is generally open 1 to 3 days per week downstream of the Fisher Hill Bridge (RKm 2.9). In years of higher spring Chinook abundance, the fishery is generally open above Lyle Falls to the Klickitat River Hatchery (RKm 68).

6.1.3 Biological Goals for Spring Chinook

Both conservation and harvest goals are proposed for Klickitat spring Chinook. Conservation goals are measured in terms of productivity, abundance, life history diversity, and geographic distribution (spatial structure). Harvest goals are divided into Tribal and sport harvests in the mainstem and inside the Klickitat Subbasin.

Spring Chinook Conservation

The main conservation objectives for Klickitat spring Chinook are: 1) to increase population viability by ensuring that the adaptation of the population is driven by the natural environment and 2) to ensure that the population size remains large enough to allow the population to maintain itself.

[6] *United States v. Oregon*, originally a combination of two cases, *Sohappy v. Smith* and *U.S. v. Oregon* (302 F. Supp. 899), legally upheld the Columbia River treaty tribes reserved fishing rights. Although the Sohappy case was closed in 1978, *U.S. v. Oregon* remains under the federal court's continuing jurisdiction serving to protect the tribes' treaty reserved fishing rights.

For natural/hatchery composite programs such as Klickitat spring Chinook, the influence of the hatchery and natural environments on the adaptation of the composite population is dependent on the proportion of natural-origin broodstock in the hatchery (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The larger the ratio pNOB/(pHOS+pNOB), the greater the strength of selection from the natural environment relative to that of the hatchery environment. The value produced from this calculation is the proportion of natural influence or PNI (HSRG, WDFW, and Northwest Indian Fisheries Commission 2004a). The HSRG recommends a PNI value of 0.67 for programs that have a goal of increasing stock viability. The objective for spring Chinook in the Klickitat is to achieve a PNI of 0.67.

The spring Chinook abundance objective is to achieve a minimum and average escapement of 400 and 700 adults, respectively. These abundance objectives were based primarily on the expected improvement in fish performance from the implementation of habitat actions described in the Klickitat Subbasin Recovery Plan (NOAA-Fisheries 2009). The habitat actions are also hypothesized to increase population productivity from about 6 to over 7 recruits per spawner (Appendix B). This is the productivity objective for this species.

In regard to spatial structure, the objective is to have spring Chinook spawn throughout their historical range in the Subbasin. Re-establishing their historical spawning distribution should expose the fish to the widest possible range of environmental conditions within the Subbasin. This, in turn, should increase population life history diversity.

A summary of the conservation objectives for spring Chinook is presented in Table 6-3.

Table 6-3: Conservation goals for Klickitat River spring Chinook

Parameter	Objective
Productivity	Recruits/Spawner > 7.0[a]
Abundance	Average Adult Escapement > 700 per year / Minimum Escapement > 400
Spatial Structure	Spawning Throughout Historical Range
PNI	0.67

[a] see Appendix B

Spring Chinook Harvest

The primary harvest objective for spring Chinook is to meet or exceed Treaty harvest obligations consistently and on a long-term sustainable basis. This includes a contribution to the Zone 6 component and the terminal fishery at which are some of the last historical fishing sites remaining for Treaty-Indian fishers.

A secondary objective is to maintain or increase recreational fisheries on a long-term sustainable basis. Recently, all spring Chinook released from the Klickitat River Hatchery have been marked. This is expected to result in an increased harvest of spring Chinook in the mainstem Columbia and the Klickitat River because marking will allow

sport fishers to distinguish between wild and hatchery fish in the mixed wild/hatchery run.

A mandatory condition of all harvest objectives is that they be attainable while still meeting the conservation objectives described above. This means that harvest will not occur at the expense of conservation-- conservation objectives will be given a higher priority than harvest.

The harvest objectives and performance criteria for Klickitat River spring Chinook are summarized in Table 6-4.

Table 6-4: Harvest objectives for Klickitat River spring Chinook

Fishery	Objective
Mainstem Columbia River- Tribal	600
Mainstem Columbia River- Non-Tribal	400
Klickitat River Terminal- Tribal	1,800
Klickitat River Terminal- Sport	1,200
Total Harvest	4,000

6.1.4 Alternative Strategies Considered for Spring Chinook

The YN considered three options for the future management of Klickitat River spring Chinook:

1. Maintain existing hatchery program
2. Eliminate hatchery program and improve habitat
3. Develop integrated hatchery program and improve habitat

Of the three options considered, option 3 best achieved the conservation and harvest objectives identified for spring Chinook. This option is described in more detail in Section 6.1.5. The two options that were rejected are described in the following paragraphs.

Maintain Existing Hatchery Program

This alternative would maintain the status quo for hatchery production and operation. Currently, 600,000 spring Chinook juveniles are released at the Klickitat Hatchery (RKm 68) to provide fish for Tribal and non-Tribal fisheries.

Subbasin habitat would be improved over time as habitat actions designed to recover ESA-listed steelhead are implemented in the Subbasin. Spring Chinook geographic distribution would also increase due to the recent implementation of the fishway at Castile Falls that improves fish access to the Upper Klickitat River watershed.

Current harvest strategies would persist for both Treaty and non-treaty fisheries occurring in the Columbia River mainstem and Klickitat River. This includes a non-selective fishery for Tribal fishers and a selective fishery targeting hatchery fish for recreational fishers. Though the habitat improvement component of this alternative produces substantial benefits to spring Chinook and other fish species, the alternative was rejected due to problems associated with the hatchery program. These problems include:

- The observed recruits per spawner ratio (R/S) for the current hatchery program (2.2) is less than that of the natural environment (3.2) under existing habitat conditions. Therefore, bringing fish into the hatchery environment actually reduces the productivity and, therefore, viability of the combined (hatchery + natural) spring Chinook population.

- Historically, the hatchery program produced large numbers of mini-jacks each year. As mini-jacks are not generally found in the wild, their production may be impacting the life history diversity of the spring Chinook population.

- Mini-jacks spend the majority of their lives in freshwater rather than migrating to the ocean. These fish may prey on and compete with other juvenile anadromous fish rearing or migrating through the Klickitat and Columbia rivers. This increased predation and competition could potentially reduce the survival rates for ESA-listed fish species inhabiting these same areas.

- Because of low hatchery productivity, the overall harvest goal of 4000 adults in terminal sport and Tribal fisheries has not been achieved. Since 1994, the number of adult harvested in these terminal fisheries has averaged just over 600 fish (Zendt et al. 2016).

- Genetic introgression issues stemming from past practices (discussed above in section 6.2.2) persist in the current program; further reform of the program including use of natural-origin broodstock will likely move the population towards a more natural genotype, which should provide increases in fitness and productivity.

Eliminate Spring Chinook Hatchery Program and Improve Habitat

Under this option, the existing hatchery program for spring Chinook would be eliminated. The primary strategy for meeting both conservation and harvest goals for this species would be to improve stream habitat throughout the Klickitat River Subbasin. Harvest rates would be controlled so that spawning escapement averaged 700 adults.

The benefits of implementing this option include:

1. Analysis based on expected habitat improvements suggest that the abundance of the natural component of the spring Chinook population might increase by 132%, resulting in an average total run size of approximately 1,200 adults.

2. Improving habitat would likely increase the abundance, productivity, spatial structure, and diversity of other fish species inhabiting both tributary and mainstem areas. Some wildlife species would also benefit from improved riparian habitat condition and the resulting increase in fish abundance.

3. Terminating the hatchery program would eliminate predation and competition risks to native fish species associated with the release of 600,000 juvenile spring Chinook each year.

4. Program termination would result in some cost savings.

The risks to harvest and conservation goals from the implementation of this option include:

1. Harvest goals are unlikely to be achieved with natural production alone. It is projected that fewer than 500 fish on average would be harvested each year.

2. In-river harvest would have to be severely reduced or eliminated in many years to meet the minimum spawning escapement needed to protect wild fish. The elimination of fisheries does not achieve the harvest objective of *"meeting or exceeding Treaty harvest obligations consistently and on a long-term sustainable basis"*.

3. This program was included in the legally binding 2008-2017 *U.S. v Oregon* Management Agreement, and in the draft ten year agreement that will be presented to the Court in January 2018.

4. The projected increases stemming solely from habitat improvements are far from certain, and will not likely take effect immediately. With current natural-origin spring Chinook escapement averaging less than 500 fish, the risk of extirpation of this native population is high. Elimination of the hatchery program without further conservation measures is likely to result in very low near-term abundance levels that increase this risk.

Because this option did not meet the harvest and conservation goals and *U.S. v OR* production obligations identified for the Subbasin, it was not selected for implementation. However, because it was obvious that habitat actions can produce important benefits for fish, a habitat component was included in the preferred option (Section 6.1.5).

6.1.5 Preferred Option for Spring Chinook: Develop Integrated Hatchery Program and Improve Habitat

The preferred option incorporates an integrated hatchery program and substantial improvements in stream habitat to meet conservation and harvest objectives. A detailed description of the habitat, hatchery, and harvest actions included in the preferred alternative is presented below.

Spring Chinook Habitat

The habitat objective of this alternative is to increase the quantity and quality of Klickitat River mainstem, delta, and tributary habitat that currently supports or historically supported spring Chinook. This objective will be achieved by continuing to implement strategies and actions that target factors limiting spring Chinook production in the Subbasin.

Integrated Hatchery Programs for Spring Chinook

The hatchery component of the preferred option involves conversion of the existing segregated harvest program to an integrated harvest program (HSRG, WDFW, and Northwest Indian Fisheries Commission 2004a). The program is designed to increase the viability of the natural population while simultaneously producing the adults needed to meet the 4,000 fish harvest objective for all fisheries combined. To achieve the objectives, it is estimated that the hatchery program should eventually release 800,000 yearling spring Chinook annually.

Hatchery Operations

The existing segregated harvest program will be converted to an integrated conservation/harvest program by incorporating an increasing proportion of NOR Klickitat River spring Chinook into the broodstock over time (HSRG, WDFW, and Northwest Indian Fisheries Commission 2004a). The pace of broodstock conversion will depend on the size of the natural-origin spring Chinook run which is expected to vary annually. To reduce impacts to the natural-origin spring Chinook population, no more than 1 of every 2 NOR fish passing upstream through the Lyle Falls facility will be taken for brood stock. Present data indicate that 20-50% (averaging about 25%) of the return passes upstream using the ladder at Lyle (Table 6-5). Therefore, taking at most 1 of every 2 of these fish will limit NOR brood collection to at most 10-25% of the total run's natural-origin component taken for the integrated hatchery program in any year. The program will be managed to increase the viability of the natural population while simultaneously producing the adults needed to meet harvest objective for all fisheries combined. To achieve both conservation and harvest objectives, it is estimated that the hatchery program will eventually maintain a release number of approximately 800,000 yearling spring Chinook.

Table 6-5: Lyle Falls Fishway Spring Chinook Passage Estimates

Return Year	Total Run Size Estimate[1]	Wild Run Size Estimate[1]	Hatchery Run Size Estimate[1]	Total Handled	Wild Fish Handled	Hatchery Fish Handled	Overall Handling Rate	Overall Ladder Usage Rate[2,3]
2007	1882	393	1489	254	53	201	0.135	0.333
2008	1712	449	1263	103	22	81	0.060	0.253
2009	6204	620	5584	671	64	607	0.108	0.216
2010	4535	508	4027	204	22	182	0.045	0.122
2011	4536	685	3851	549	83	466	0.121	0.521
2012	4452	579	3873	371	47	324	0.083	0.253
2013	6421	462	5959	485	35	450	0.076	0.210
2014	5060	309	4751	415	25	390	0.082	0.208
2015	5865	663	5202	525	59	466	0.090	0.192
2016	4052	442	3610	281	30	251	0.069	0.178
						Avg.	*0.086*	*0.249*

[1]Run size estimates to Lyle Falls using mark-recapture methods

[2]Based on handling rate expanded for days trap fished and run duration

[3]Mark-recapture run size are generated assuming a similar ladder-use rate for hatchery and wild fish (by using tag recapture data from hatchery fish for wild fish estimates), so only an overall ladder usage estimate is given (inferring different hatchery and wild efficiency rates would not be valid).

The 800,000 fish will be incubated, reared, and released volitionally at the Klickitat River Hatchery. Offspring of NOR adults used as broodstock will be differentially marked (e.g., CWT and/or eye elastomer tag, but no adipose fin-clip) so that, upon their return as adults, they can be distinguished from the progeny of hatchery-origin broodstock. The fish will be released volitionally from the hatchery starting in April at a size of 15 to 20 fpp. All juveniles produced from hatchery-origin broodstock will be adipose-clipped so that they may be targeted in selective fisheries. Approximately 17% of both groups will continue to be tagged with a CWT (WDFW activity) to determine overall survival and harvest rates in ocean, mainstem Columbia River, and Subbasin fisheries.

Both hatchery-origin (HOR) and natural-origin (NOR) adults returning to the Subbasin may be used as broodstock. Priority for broodstock use will be as follows:

1. Natural-origin adults.

2. Hatchery-origin adults with a CWT/elastomer tag (progeny of NOR broodstock).

3. Hatchery-origin adults with an adipose clip (progeny of HOR broodstock). It is anticipated that this portion of the program will be phased out over time as returns of NOR and integrated hatchery program fish increase.

Broodstock will be managed to achieve a PNI of 0.67 over time. This objective will be achieved by controlling the number of hatchery fish spawning naturally and NOR adults used as broodstock.

Broodstock may be collected at Lyle Falls, Klickitat River Hatchery, and Castile Falls. As returns from the integrated program increase, a portion of these adults (collected at Lyle Falls or the hatchery) will be transported and released above Castile Falls to reduce the abundance of hatchery-origin fish on the primary natural spawning grounds, and to

re-stock marine-derived nutrients and augment natural populations above Castile Falls. As natural escapement levels above Castile Falls increase over time, releases of integrated hatchery-origin fish above Castile Falls will be reduced to meet the PNI standard of 0.67. A PNI value of 0.67 ensures that the natural, not the hatchery, environment drives local adaptation (HSRG, WDFW, and Northwest Indian Fisheries Commission 2004a). Achieving this objective will require monitoring natural and hatchery spring Chinook adults migrating past Castile Falls to determine the proportion of the composite population each represents.

With implementation of the hatchery program described here, we anticipate a substantial increase in recruit performance from the 2.18 and 3.5 R/S values observed for the current hatchery program and natural production, respectively (Appendix B). The increase in hatchery fish survival will most likely derive from the implementation of better hatchery culture practices, use of NOR broodstock, and implementation of volitional release strategies. The Yakima River Cle Elum Supplementation and Research Facility spring Chinook program uses the strategies identified for the conservation component and has been able to achieve a geometric mean R/S value of 7.8 (Bosch 2016); therefore, the substantial increase modeled for the Klickitat spring Chinook program (Appendix B) is considered achievable over the long-term.

Harvest Management for Spring Chinook

Harvest management provisions will be designed to maximize harvest of adipose- clipped hatchery-origin fish while reducing harvest levels on the natural component of the population. Major actions that will be undertaken as part of the harvest strategy include the following.

- Sport and Tribal terminal fisheries will be modified if estimated NOR escapement to the Subbasin falls below 400 adults.

- The daily bag limit of two hatchery-origin adults may be increased to four adults for the sport fishery occurring above the Tribal dipnet fishery at Lyle Falls. The increased catch limit for hatchery fish (adipose fin-clipped) would help reduce the proportion of hatchery-origin fish spawning in the wild and would help to meet or exceed the PNI standard (0.67).

- Recent studies suggest that implementing and maintaining a selective sport fishery in the Klickitat River will reduce harvest effects on the natural population (Pyper et al. 2012; Fritts et al. 2016). The reduced harvest rate is the result of fishers releasing adipose fin-present adults.

- Surplus hatchery fish escaping the fisheries to the Klickitat River Hatchery will be distributed to Tribal members for subsistence and ceremonial purposes. Surplus hatchery fish will not be returned to the river to spawn.

- The Tribal fishery will likely be open from Tuesday through Saturday from early April until the end of May to allow for adequate escapement of natural and

hatchery broodstock. In years of lower spring Chinook abundance, the Tribal fishing season may be shortened by a day or two each week. The sport fishery will open 1 to 3 days per week downstream of the Fisher Hill Bridge (Rkm 2.9). In years of adequate abundance, a selective sport fishery is usually opened in the river reach extending from Lyle Falls to the Klickitat River Hatchery (Rkm 68).

- The majority of broodstock collection may be shifted to the Lyle Falls Fishway near the mouth of the Klickitat River. This action is designed to ensure that both natural escapement and hatchery broodstock needs are met without having to substantially reduce Tribal and sport terminal fisheries.

6.1.6 Facilities

The facilities listed below are required to implement the preferred strategy for spring Chinook. See Chapter 8 for more details.

Klickitat Hatchery

The Klickitat Hatchery has undergone a number of modifications and renovations between 1950 and 2017. Since 1993, only minor improvements have taken place. The hatchery requires significant upgrading to be consistent with scientific and technological advances.

Smolt Trapping Facilities

Smolt trapping will be continued downstream of the hatchery release site. Trapped smolts will allow estimation of juvenile migration timing, presence, and abundance within the Subbasin.

Lyle Falls Fishway

Lyle Falls Fishway has been modified with improved fish passage, fish trapping, and PIT detection capabilities.

Castile Falls Fishway

Additional monitoring facilities are now in operation that will allow us to determine the number of hatchery and natural-origin spring Chinook adults passing the Castile Falls Fishway. This information will be used to ensure that the PNI 0.67 standard is achieved.

CHAPTER 7.0 MONITORING AND EVALUATION

The proposed monitoring and evaluation program is funded separately under Project 1995-063-35 and was described in detail in prior revisions of the Master Plan. We repeat relevant elements of the M&E program here for information purposes and completeness.

The Columbia River Basin Research Plan (NPCC 2017), which was developed with input from the Independent Scientific Advisory Board (ISAB), ISRP, and PNAMP, identified a number of critical uncertainties regarding hatchery management that are relevant to this proposed program:

> Question 1. Are current propagation efforts successfully meeting harvest and conservation objectives while managing risks to natural populations?
>
> 1.2. Can hatchery production programs meet adult production and harvest goals (integrated and segregated) while protecting naturally spawning populations?
>
> 1.3. What are the interactions, by life stage, between hatchery-origin and natural-origin populations with respect to competition, predation (direct and indirect), and disease including harvest in fisheries targeting hatchery-origin adults; and from hatchery effluent?
>
> 1.4. What is the magnitude of any demographic benefit or detriment to the production of natural-origin juveniles and adults from natural spawning of hatchery-origin supplementation adults?
>
> 1.5. What are the range, magnitude and rates of change of natural spawning fitness of integrated (supplemented) populations, and how are these related to management rules including the proportion of hatchery fish permitted on the spawning grounds, and the proportion of natural origin adults in the hatchery broodstock?

The overall M&E plan (including harvest monitoring conducted with other funding sources) for the proposed project is intended to address all of the above questions, at least to some extent. The M&E activities described below focus on monitoring status and trends of native anadromous populations and critical uncertainties regarding interactions between the spring Chinook hatchery program and natural production. The M&E programs associated with hatchery facility operation and compliance with state and federal regulations are presented in more detail in the HGMP (Appendix A) and in prior revisions of the Master Plan.

7.1 Hatchery Monitoring and Evaluation

Objective 7.1.1. Operate adult trap(s) at the Lyle and Castile Falls ladders to sample returning fish for stock composition and facilitate broodstock collection.

Approach: YN biologists and technical staff will operate adult fish traps at the Lyle and Castile Falls ladders and Klickitat Facilities for spring Chinook broodstock development and/or fish sampling. Factors such as run timing, spawn timing, population demographics, phenotypic and genetic characteristics, and return rates are part of the necessary evaluation that should be conducted to facilitate future development of programs specified in this Master Plan. Evaluation staff is responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected. These adult traps are also used for estimating adult returns (see 7.3).

Task 7.1.1.1. Operate adult trap(s) and facilitate collection and transport of broodstock for the Klickitat hatchery programs.

Task 7.1.1.2. Compile all data from trapping and spawning, and calculate return rates (using CWT, PIT tag, and mark-recapture analysis) for program evaluation.

Objective 7.1.2. Determine the origin and stock of salmon as broodstock. Monitor and evaluate changes in the phenotypic and genotypic characteristics of fish used at Klickitat Hatchery.

Approach: YN expects to observe an assortment of endemic and non-endemic stocks of salmon in the Klickitat Subbasin, especially at Lyle Falls where "dip-ins" are common and most fish used for production at the Klickitat Hatchery will be collected. YN, WDFW co-managers and NMFS desire to maintain the integrity of the salmon stocks for use in the program and to minimize the potential negative effects of hatchery operations on ESA listed populations. In addition, the project has goals of protecting the health of natural populations while using these stocks for harvest mitigation production.

Broodstock Management

To monitor the phenotypic and genotypic integrity of populations cultured for the program, YN staff strives to collect and mate adults for broodstock to monitor stock demographics (e.g. run/spawn timing, age structure, sex ratios and size of fish) for gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season.

YN will use PIT tags, CWTs, fin clips, scale readings, and DNA sampling to identify and remove stray fish from broodstock. We will estimate the numbers of untagged stray fish associated with decoded CWTs to derive the stray component of fish that were processed.

Since all endemic stock fish are from unmarked/untagged natural origin fish, any external or internal marks that identify them as hatchery origin fish can quickly be identified and enable them to be removed from NOR (integrated) broodstock programs.

Task 7.1.2.1. Collect scale samples on all untagged fish processed at Klickitat Hatchery. Scales from each fish will be used to document age-structure and to assist in differentiation of hatchery and naturally produced fish.

Task 7.1.2.2. Examine all salmon for marks and tags, and determine sex. Recover and decode all tags from spawned carcasses.

Task 7.1.2.3. Calculate the rate at which natural origin salmon are included in broodstock.

Task 7.1.2.4. Estimate the rate at which unmarked/untagged hatchery strays were included in broodstock using parent-based tagging or other methods.

Task 7.1.2.5. Estimate stock composition (e.g., hatchery- or natural-origin) of fish retained for broodstock.

Task 7.1.2.6. Examine salmon for marks, wire (CWT), sex, and collect scales to determine age composition after spawning.

Task 7.1.2.7. Collect length and weight samples from hatchery and natural origin spawned females. Estimate fecundity for each and create relationships with body size information to track for long-term changes.

Task 7.1.2.8. Enumerate jacks retained in broodstock each week to assist with reporting and to assure jacks are incorporated in broodstock within the spawning protocol guideline.

Task 7.1.2.9. Document brood year specific phenotypic characteristics for salmon at Klickitat Hatchery (endemic, conventional production/supplementation), and compare and report changes that have occurred over time. Methods will be similar to those described in Knudsen et al 2006 and Knudsen et al 2008.

Objective 7.1.3. Monitor and evaluate the survival of hatchery salmon produced and reared at Klickitat Hatchery.

Approach: YN staff will collect data on growth and survival of salmon produced and reared at the Klickitat Hatchery by life stage, from egg to release as pre-smolts.

Task 7.1.3.1. Using gravimetric methods, estimate the number of eggs spawned.

Task 7.1.3.2. Enumerate live eggs at “shock” time using an egg counter.

Task 7.1.3.3. Document fry mortalities during incubation.

Task 7.1.3.4. Estimate the number of fish ponded as the live egg count less documented fry mortalities.

Task 7.1.3.5. Document mortalities during rearing by pond and month.

Task 7.1.3.6. Document size of fish (length and weight) using sub-sample by rearing pond and month.

Task 7.1.3.7. Document feed type and food conversion (weight gained divided by pounds of food fed) by rearing pond and month.

Task 7.1.3.8. Estimate the number of fish released (e.g., if 100% of the fish are marked, this is the number of fish marked (see 7.1.4) less documented mortalities from ponding to release).

Objective 7.1.4. Comply with HSRG guidelines and program goals for natural stock restoration and local, natural-origin brood stock development.

Approach: Establish and maintain program marking protocols that allow returning fish to be distinguished by origin and stock. Marking strategies (Table 7-1) are still under development and review. Fish in programs targeted for harvest will be adipose-clipped at high rates to facilitate harvest in all fisheries. For the spring Chinook program, all hatchery-origin fish that could potentially escape to the natural spawning grounds will be 100% marked for identification and evaluation purposes. Passage and handling rates through the Lyle Falls facility have resulted in an average sample rate of 8-10% for spring Chinook (which could be increased with newly completed improvements in attraction flow at the fishway and increased sampling effort). Sufficient staff is available to mark-sample all fish that are handled at the Lyle Falls trap facility. Fishery harvest monitoring will strive to achieve a 20% mark-sample rate for at least adipose presence or absence. These mark and adult return sample rates are equivalent to or exceed those used in most other Columbia Basin programs with similar purposes. Therefore, we believe they will be sufficient to provide reasonable confidence in the parameters (e.g., fishery contribution, survival to Klickitat river mouth, pHOS, pNOB, etc.) we are attempting to evaluate. We expect to detect and correct any insufficiencies through our annual review process.

Task 7.1.4.1. Mark hatchery-origin spring Chinook produced at Klickitat Hatchery as documented in Table 7-1.

Task 7.1.4.2. Estimate the total number of fish on hand at marking.

Task 7.1.4.3. Observe marks on returning fish and use these data to manage proportion of natural fish in brood stock (PNoB – Objective 7.1.2) and proportion of hatchery fish on the spawning grounds (PHoS – Objective 7.3.1) per guidelines established by the YKFP Policy Group (as recommended by technical implementation teams).

Table 7-1: Hatchery release numbers, number marked, and mark type by species and hatchery component

Species	Component	# Released	# Marked	Tag or Mark
Spring Chinook[1] Progeny of:	Hatchery-Origin	See Chapter 6	100%	100% AD-Clip of which ~17% also have CWT ~5% PIT
	Natural-Origin	See Chapter 6	100%	100% Eye-Elastomer and/or CWT; ad-clip mark rate to be determined ~5% PIT

[1] Total release will be ~800,000. The number of spring Chinook releases from hatchery- and natural-origin parents will vary depending on the number of NOR incorporated into the broodstock, based on run size – see Chapter 6.

Objective 7.1.5. Monitor and evaluate the quality and release of salmon produced at Klickitat Hatchery.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon to determine survival rates between life stages and examine potential variables that may influence observed survivals. To document the percent precocious male fish in all of our release groups, visual sampling of salmon juveniles will occur. To document PIT tag loss that occurs between tagging and release of salmon, we will install PIT tag arrays in the outlet channels at all release sites.

Task 7.1.5.1. Evaluate mark quality and tag retention before release.

Task 7.1.5.2. Evaluate fish health of a sub-sample of fish at release. Document and report release size and general condition of juvenile salmonids prior to release.

Task 7.1.5.3. Summarize hatchery records for each brood year to document and report green egg-to-fry, fry-to-smolt, and green egg-to-smolt survival rates for each species, and for each release strategy where appropriate.

Task 7.1.5.4. Based on above monitoring, recommend changes in rearing, marking, and/or tagging protocols to hatchery and YKFP management.

Task 7.1.5.5. Install and maintain PIT tag antenna array in the outlets of all final rearing and release ponds and raceways.

Task 7.1.5.6. Document the number of PIT tagged fish in the release and calculate the number of PIT tags shed between tagging and release.

Task 7.1.5.7. Document the number of CWT tagged fish in the release and calculate the number of CWT tags shed between tagging and release.

Task 7.1.5.8. Report tagged release data to regional PTAGIS and RMIS data bases.

Objective 7.1.6: Evaluate salmon release strategies, release sites, and smolt out-migration timing and survival from Klickitat Hatchery releases to downstream detection sites.

Approach: Floating rotary screw traps and a PIT array are operated in the lower Klickitat Basin on a year-round or seasonal basis as access and flows allow. At each daily trap check, environmental and trap data is recorded along with biological data on 10 to 30 of each salmonid species represented. The excess and non-salmonid fish are tallied by species. Biodata consists of fork lengths, weights and smoltification stage. Environmental and trap data recorded includes weather conditions, water temperature and clarity, trap cone revolution speed, and debris load in the trap cone and live box.

Task 7.1.6.1. Maintain services of a qualified biometrician with experience in estimating smolt trap efficiency rates for Klickitat Basin fish.

Task 7.1.6.2. Collect fork lengths, weights, smoltification state, genetic samples, and scale samples from hatchery- and natural-origin juvenile fish obtained in screw trap operations.

Task 7.1.6.3. Document migration timing and magnitude for juvenile salmon on a daily, seasonal and annual basis.

Task 7.1.6.4. Maintain a database of all biological data for releases from Klickitat hatchery and for natural-origin fish.

Task 7.1.6.5. PIT tag juvenile fish in screw trap operations for use in entrainment, survival and smolt-to-adult survival rate estimation.

Objective 7.1.7. Assist in the planning, spawning, record keeping, and summarizing data for spawned salmon at Klickitat Hatchery.

Approach: YN biologists annually assist in the spawning operations of salmon at Klickitat Hatchery. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction of CWTs, DNA and scale sampling, etc.) from all fish retained/spawned for broodstock. This collaborative role will be critical for optimizing production strategies. In addition, evaluation staff will work closely with the hatchery staff to provide weekly /monthly /yearly summaries of the data for hatchery reports and ESA compliance.

Task 7.1.7.1. Develop or update spawning data collection protocols as needed for review and approval by YKFP technical teams and Fish Management staffs prior to the onset of spawning for all species.

Task 7.1.7.2. Assist in the spawning of salmon at Klickitat Hatchery.

Task 7.1.7.3. Collect biological data from all (or representative sample) spawned fish (sex, length, scales, DNA, marks/tags, CWT extraction and verification, PIT tag detection).

Task 7.1.7.4. Where applicable, assist or provide hatchery staff with the necessary data summaries for completion of hatchery records from spawning activities.

7.2 Harvest Monitoring and Evaluation

Harvest monitoring of Klickitat River-origin salmonids will be performed by WDFW and the Yakama Nation. The WDFW is responsible for monitoring non-tribal sport and commercial fisheries in the Columbia River, Klickitat River, and ocean. The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document.

The Tribal harvest monitoring program is designed to achieve project goals through:

- sampling subsistence fisheries below Bonneville Dam and at Cascade Locks, The Dalles Dam and on the mainstem Columbia River
- sampling all Tribal fisheries in the Klickitat River

Objective 7.2.1. Monitor Tribal Subsistence Fisheries in the Columbia River

Approach: YN biologists and technicians annually monitor tribal ceremonial and subsistence fisheries in the Columbia River from the newly established tribal fishing area below Bonneville Dam upstream to McNary Dam. Fishing areas are observed to record total effort in a monitored time frame, with a subsample of effort monitored for observed catch. Biologists expand recorded data for each fishing area and time frame to estimate total catch.

Task 7.2.1.1. Monitor Tribal fisheries below Bonneville Dam and at Cascade Locks and The Dalles Dam daily whenever fisheries are conducted.

Task 7.2.1.2. Each fishing day will be divided into three 8-hour periods. A different observer will be used to monitor each 8-hour period.

Task 7.2.1.3. Every 2 hours, the observer will record the number of active gear, the number of fish captured per gear type, and the length of the observation period.

Task 7.2.1.4. Catch estimates will be calculated by expanding the counts for both time and gear.

Task 7.2.1.5. Caught fish will be randomly sub-sampled for marks. Fish species and (if possible) sex will be identified for each fish and each fish will be examined for marks. Length measurements will be taken for each fish caught. Scale samples will be collected on each fish for aging. DNA samples will also be collected on a sub-

sample of fish if required as part of genetic studies being undertaken by YN or other research groups.

Task 7.2.1.6. Recovered CWTs will be sent to WDFW for processing. WDFW will report tag recoveries and information to the appropriate regional databases.

Task 7.2.1.7. YN will be responsible for reporting PIT-tag recoveries to PITAGIS (the PIT-Tag Information System) and other regional databases.

Task 7.2.1.8. YN reports estimated harvest in these fisheries through the *U.S. v Oregon* Technical Advisory Committee (TAC). Annual harvest in these fisheries is maintained as part of the TAC record.

Task 7.2.1.9. YN biologists will analyze available data and estimate the number of Klickitat released salmon by origin caught in these fisheries.

Objective 7.2.2. Monitor Fisheries in the Klickitat River Basin

Approach: The majority of Tribal fishing activities in the Klickitat River occur mainly at Lyle Falls. This fishery will be monitored in a manner similar to that described in Objective 7.2.1. Non-tribal recreational fisheries also occur in the Klickitat and are monitored by WDFW using standard creel methods.

Task 7.2.2.1. YN staff will monitor tribal subsistence fisheries in the Klickitat Basin using methods described in Objective 7.2.1.

Task 7.2.2.2. YN staff will conduct interviews with Tribal fishers. Their catch may be subsampled as described in Objective 7.2.1 above.

Task 7.2.2.3. WDFW will monitor recreational fisheries in the Klickitat River using standard creel methods.

Objective 7.2.3. Estimate harvest of Klickitat Basin salmon in Marine Fisheries.

Approach: The Regional Mark Information System (RMIS) will be queried regularly for any CWT recoveries of Klickitat hatchery releases in ocean or Columbia River mainstem fisheries. The results of these queries will be analyzed to estimate the number of fish harvested in marine and lower Columbia River non-tribal fisheries.

Task 7.2.3.1. YN staff will maintain a database of CWT codes released in Klickitat hatchery programs.

Task 7.2.3.2. YN staff will run annual queries of the regional RMIS database, searching for recoveries of Klickitat hatchery CWT codes.

Task 7.2.3.3. YN staff will estimate harvest of Klickitat hatchery salmon in marine and lower Columbia River fisheries and report these estimates in annual reports.

7.3 Escapement Monitoring and Evaluation

Objective 7.3.1. Estimate escapement of salmon to the mouth of the Klickitat River by stock and origin.

Approach: YN staff will utilize counts at the Lyle and Castile Falls and hatchery swim-in ladders and maintain a database of counts of fish by date, ladder, and species. In addition, YN biologists and technical staff will operate adult fish traps at these ladders for endemic broodstock development and biological sampling. Adult trap data and PIT and CWT detection data will also be used for estimating adult return composition (stock and origin).

Task 7.3.1.1. Enumerate returning fish using ladder count data, other databases, and present methods.

Task 7.3.1.2. Conduct trapping operations and fish sampling per established protocols.

Task 7.3.1.3. Evaluate trapping operation and tag detection databases to estimate composition of returning fish by stock and origin.

Task 7.3.1.4. Evaluate harvest estimates for Klickitat Basin fisheries and spawning survey data to estimate escapement.

Task 7.3.1.5. Summarize and report above data.

Objective 7.3.2: Estimate adult returns, collect life history characteristics, and document distribution of adults to spawning areas.

Approach: Measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. YN monitors the returns of salmon throughout the Klickitat Basin via ladder counts and adult trap operations at Lyle and Castile Falls and hatchery swim-in ladders, spawning ground surveys, mark-recapture estimation, and harvest monitoring. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Spawning surveys provide numbers of redds, spawn timing, and distribution of fish in each of the surveyed reaches and tributaries. These are primary actions to track program performance and progress toward meeting goals.

Task 7.3.2.1. Conduct spawning ground surveys to count redds, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of salmon in the Klickitat Basin.

Task 7.3.2.2. Conduct mark-recapture estimation of adult run size to Lyle Falls using floy tags or other marks administered at Lyle Falls adult trap, and recapture/recovery at hatchery ladder and adult holding ponds, via carcass recovery on spawning surveys, or in sport fishery catch.

Task 7.3.2.3. Process scales and CWTs for age composition.

Task 7.3.2.4. Estimate stray rates from the PTAGIS and RMIS regional databases and DNA sampling.

7.4 Productivity Monitoring and Evaluation

Objective 7.4.1. Estimate juvenile smolt production of salmon by stock and origin.

Approach: YN staff will maintain and operate rotary screw trap and instream PIT array in the lower Klickitat Subbasin. A number of salmon juvenile migrants will be sub-sampled annually. Staff will maintain a database containing length, weight, marks, DNA, etc. information collected from these samples. These and available PIT data will be analyzed to estimate smolt outmigration from the system and smolt-to-adult productivity (return) rates.

Task 7.4.1.1. Operate juvenile monitoring rotary screw traps and collect phenotypic and genotypic data from a subsample of migrating juveniles.

Task 7.4.1.2. Maintain a database of these sample data.

Task 7.4.1.3. Use PIT or acoustic tags and technologies to evaluate flow/ entrainment relationships and trap capture rates to estimate annual smolt outmigration by stock and origin.

Task 7.4.1.4. Evaluate available PIT data to estimate smolt-to-smolt and smolt-to-adult survival indices (see objective 7.1.6), using analysis techniques such as those in Buchanan and Skalski (2007) or similar.

Objective 7.4.2. Estimate adult-to-adult productivity of salmon in the Klickitat Basin.

Approach: YN staff will compile and maintain annual run reconstruction tables using the data collected from the objectives and tasks described above. Available age-at-return data will be used to develop brood/cohort return tables and adult return per spawner productivity.

Task 7.4.2.1. Compile available escapement, harvest, and age-at-return data. Update and maintain these data annually in appropriate databases and spreadsheets.

Task 7.4.2.2. Report these data in annual reports and other appropriate technical fora.

7.5 Disease Monitoring and Evaluation

Objective 7.5.1. Maintain Klickitat hatchery operation protocols that minimize potential disease transmission within and outside of the hatchery, assuring that fish reared at the Klickitat Hatchery have high survival rates with little chance of pathogen transmission to naturally-rearing fishes and aquatic organisms.

Approach: Using NOAA Mitchell Act funding, YN staff will work with USFWS fish health specialists to implement disease management protocols and monitor hatchery operations for specific fish pathogens in accordance with the Washington Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines.

Task 7.5.1.1. On at least a monthly basis, both healthy and clinically diseased fish from each fish lot will be given a health exam. The samples will include a minimum of 10 fish per lot.

Task 7.5.1.2. At spawning, a minimum of 150 ovarian fluids and 60 kidney/spleens will be examined for viral pathogens from on-station broodstock. The enzyme linked immunosorbent assay (ELISA) sampling will be performed on all spawned spring Chinook females to reduce potential vertical transmission of *Renibacterium salmoninarum* (causative agent of bacterial kidney disease) to the progeny. Additional fish health samples will be collected to assess the incidence of other bacterial and parasitic pathogens.

Task 7.5.1.3. Prior to transfer or release, fish will be given a health exam. This exam may be in conjunction with the routine monthly visit. This sample will consist of a minimum of 60 fish per lot.

Task 7.5.1.4. Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures, such as optimal fish-rearing densities.

Task 7.5.1.5. Movements of fish and eggs will be conducted in accordance with the Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines. As needed, fish transferred from other facilities to the Klickitat Basin will be given a health inspection.

Task 7.5.1.6. At spawning, eggs will be water-hardened in iodophor as a disinfectant. All eggs transferred to the facility will be surface-disinfected with iodophor as per the USFWS Fish Health Policy.

Task 7.5.1.7. Juvenile fish will be administered antibiotics orally when needed for the control of bacterial infections.

Task 7.5.1.8. Formalin (37% formaldehyde) will be dispensed into water for the control of fungus on eggs and the control of parasites on juveniles and adult salmon. Treatment dosage and time of exposure may vary with species, life-stage and condition being treated.

Task 7.5.1.9. All equipment (nets, tanks, rain gear) will be disinfected with iodophor between different fish/egg lots.

Task 7.5.1.10. Different fish/egg lots will be kept in separate ponds or incubation units.

Task 7.5.1.11. Tank trucks or tagging trailers will be disinfected when brought onto the station. Foot baths containing iodophor will be strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Task 7.5.1.12. Therapeutants approved by the U.S. Food and Drug Administration or those under Investigative New Animal Drug permits will be used for treatments. Under special circumstances, extra-label usage of other animal drugs may be prescribed by a veterinarian to control resistant disease organisms.

7.6 Genetic Monitoring and Evaluation

Objective 7.6.1. Gain a thorough understanding of the genetic make-up of target stocks in order to maintain long term genetic variability and minimize the impacts of domestication on supplemented stocks.

Approach: YN staff will collect genetic samples from adult and juvenile salmon. Analysis of genetic markers will be used to evaluate the relationship of Chinook populations in the Klickitat River relative to others in the Columbia River Basin and estimate subbasin origin of stray fish found in the Klickitat River. The influence of hatchery programs will be evaluated for each species. Subpopulation structure within the Klickitat subbasin will also be evaluated.

Task 7.6.1.1. Collect genetic samples from adult spring Chinook salmon at the Lyle adult trap on the lower Klickitat River (RM 2.4) and from adult salmon taken for broodstock at the Klickitat Hatchery.

Task 7.6.1.2. Collect genetic samples from juvenile Chinook salmon at rotary screw traps and via stream electrofishing.

Task 7.6.1.3. Send samples for analysis by CRITFC geneticists or other similarly qualified lab with information added to existing databases.

Task 7.6.1.4. Evaluate results with particular interest to the following questions:

1. How have hatchery practices influenced the genetic composition and reproductive success of Klickitat spring Chinook salmon (e.g., see Williamson et al. 2010 and Hess et al. 2011)?
2. What are the effects of hatchery program reforms on this genetic composition?

Task 7.6.1.5. Incorporate information into future reports and management actions through review with YKFP policy and technical teams.

CHAPTER 8.0 CONCEPTUAL DESIGNS

Improvements and changes are proposed for the existing Klickitat Hatchery (Figure 1-2).

The biological objectives established for this Master Plan are designed to achieve both biological performance of the target species and improve environmental conditions to allow sustainable populations. The goals of the actions proposed under this Master Plan include conservation, habitat, and harvest components (Chapter 2.0).

Reforming existing hatchery practices is essential to achieving these goals and successful implementation of these hatchery reform measures requires rehabilitating and expanding the current aging hatchery infrastructure. In an earlier phase, YN contracted with Harbor Consulting Engineers (HCE) to inspect hatchery facilities, evaluate existing conditions, develop early conceptual designs, and develop/refine cost estimates. The early Master Plan was a multiples species (spring Chinook, steelhead, fall Chinook and Coho) initiative that looked at infrastructure upgrades and expansions to meet the hatchery reform needs for each stock. To meet needs for the priority spring Chinook and available capital resources a spring Chinook focused Master Plan is now offered.

The discussion in the remainder of this chapter summarizes this early conceptual design studies for the Klickitat hatchery with updated infrastructure elements and Step 1 cost estimates. Early documents that included changes to the spring Chinook program have remained relatively consistent with this 2017 version. The comprehensive and updated elements are outlined below.

8.1 Klickitat Hatchery

8.1.1 Existing Facilities and Needs Assessment

Construction of the Klickitat Hatchery at RM 42 on the Klickitat River was completed in 1954 (Figure 8-1). This location was chosen due to its proximity to a large groundwater spring. Original construction was financed by the U.S. Department of the Interior through the USFWS. The hatchery has been operated by WDFW. Operation and administration of the hatchery was transferred to the Yakama Nation in December 2005. Prior to the transfer, the Yakama Nation conducted a facility inventory and assessment survey at the hatchery. The significant results from that assessment are discussed in the following paragraphs.

The main hatchery building was built in 1949 and is approximately 6,853 sq ft. The building includes the main hatchery room (3,339 sq ft), feed room (1,536 sq ft), office and personnel space (1,632 sq ft), and a storage loft (347 sq ft). There are 22 existing hatchery raceways, each approximately 130 ft long. Much of the existing plumbing is original equipment and is approaching the end of its expected life. In order to avoid failure and consequent catastrophic mortality during egg incubation or other hatchery life stages scheduled inventory and replacement is warranted.

The office and personnel space, located at the west end of the building, is still in its original configuration. The space is cramped and substandard. The existing facilities are insufficiently insulated and poorly lighted. Finally, more space is needed to accommodate additional staff required for the expanded spring Chinook hatchery program.

The east side of the hatchery building houses the feed room, cold storage, feed mixing room, and dry feed storage. A cold storage room is no longer needed because, since 1993, the programs have utilized dry fish food. Cold storage of moist feed is no longer necessary. The rest rooms are not up to code, including a lack of handicap accessibility. A washer and dryer and shower were originally planned for the loft area (plumbing stubs are installed). None of these facilities have been installed despite the use of chemicals and other hazardous substances at the hatchery.

The original buildings used a combination of electric and oil heat; however, only electric heat is used at this time. Upgrades to the hatchery building electrical system were last made in 1983 when two 150 amp panels were installed and the oil-fired boiler was replaced with an electric boiler. At that time, the hatchery lighting system was converted from incandescent to fluorescent. In 2017 the YN contracted with Klickitat Public Utility District to upgrade main power supply line, replacing the existing 2-phase or "V-phase" with modern 3-phase delivery. This power upgrade is essential for incubation water chilling and river pumping for the spring Chinook program.

Upgrades to the Klickitat Hatchery are needed in order to implement HSRG and YKFP hatchery reform measures. New and re-constructed facilities will allow proper loading rates during adult fish holding as well as optimal juvenile densities prior to release. Proper loading and optimal densities have been shown to increase pre-spawning and post-release survival. The goals of the proposed upgrades are to provide optimal incubation, rearing, and adult holding facilities in keeping with HSRG guidelines and the standards set by YKFP's Cle Elum Supplementation and Research Facility. The Yakama Nation desires to provide a clean and safe working environment that promotes commitment and ownership.

Avian netting and associated support structure would be installed over Raceway Bank C which holds the spring Chinook production, in order to reduce predation and disease transmission risk.

A river acclimation facility sized for an 800,000 yearling spring Chinook program would be built on-station. Pumped river water would be used to acclimate production in eight 30ft circular rearing tanks. The acclimation tanks would be covered by a manufactured steel building. The primary source of pumped river water would occasionally be blended with spring water through a distribution box to modulate turbidity inputs into the tanks during high flow events and periods of high glacial inputs.

A single lane vehicle bridge was completed in late summer 2010 and is sufficient to allow access by heavy equipment to the west bank of the hatchery property. This bridge was constructed with water transmission lines within the box girders. These lines will be

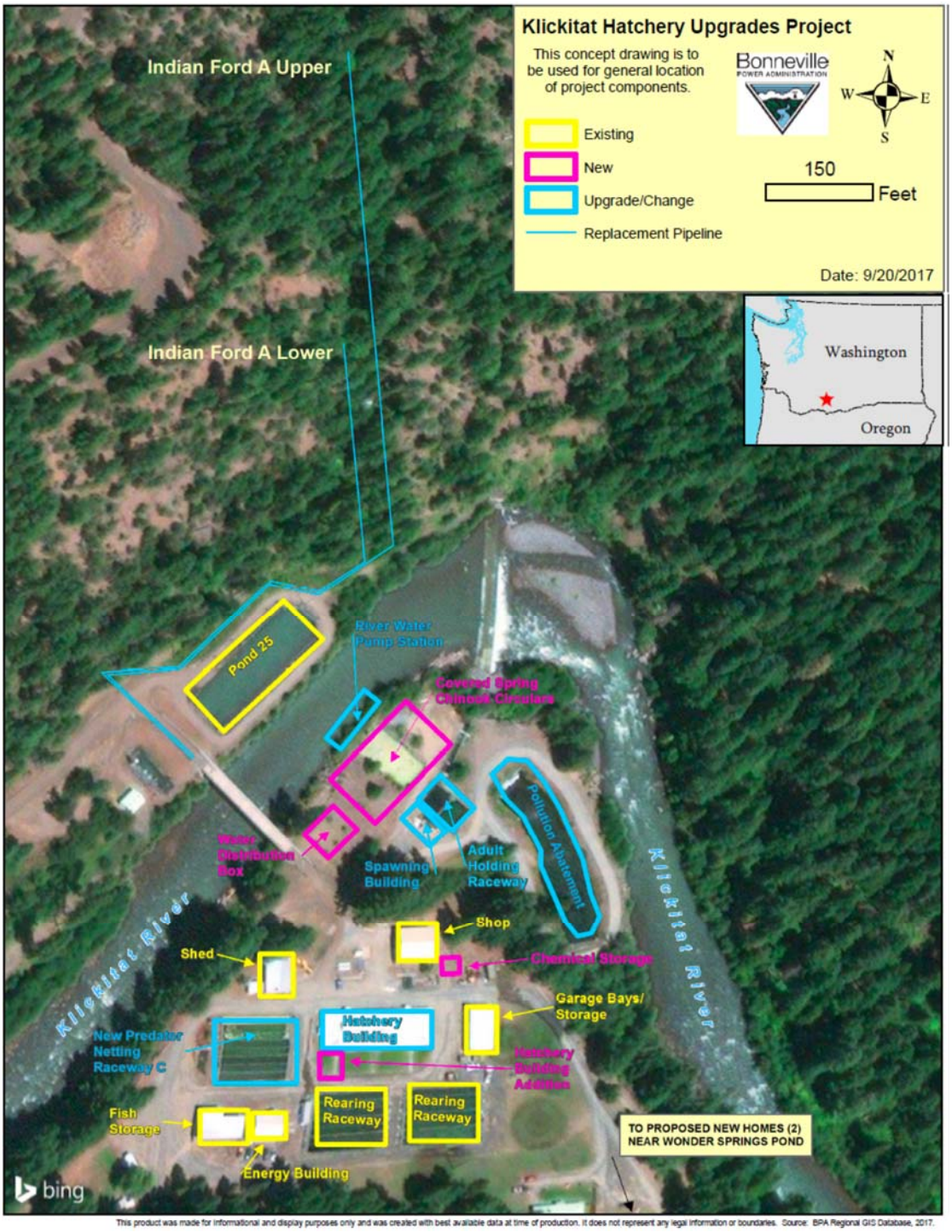
used to re-route both the Indian Ford A upper (1,320 liner ft.) and Indian Ford A lower (460 liner ft.) spring water supplies across the river to the west bank. Currently water is delivered under the river in aging pipes (over 60 years old) that have experienced ruptures. As this is the primary water supply for egg incubation and overall hatchery operations, replacement is of paramount importance.

Hatchery reform and expansion would require additional capacity and improved adult holding conditions prior to spawning. Construction of a modern spawning building and crowding system to decrease pre-spawning mortality and modernize working conditions is needed. The incubation room is of sufficient size however, additional incubation trays and plumbing are required to satisfy planned expansion to an 800,000 smolt program.

The current abatement system is out of date and functioning marginally. The needs assessment supports conversion of the existing Pond #24 acclimation site to serve as the hatchery pollution abatement pond to meet EPA standards and to better utilize available space.

Additional residential housing is needed due to the expanded scope of the hatchery facility. The YN wants to construct two new houses that will help encourage families to locate to the facility and will help to retain staff at the site.

Figure 8-1: Existing and Proposed Facilities



8.1.2 Proposed Modifications for the Klickitat Hatchery

The Klickitat Hatchery has undergone a number of modifications and renovations between 1950 and 2017. Since 1993, only minor improvements have taken place. The hatchery requires significant upgrading to be consistent with scientific and technological advances. Review and recommendations from the HSRG and YKFP scientists as well as, USFWS fish health monitoring has led to programmatic changes which require new facilities. In addition, existing residences, office spaces, and other work areas need to be reconfigured for greater efficiency and brought into compliance with current building codes. Most of the existing structures need maintenance and repairs to allow continued use.

Hatchery Buildings

The proposed modifications to the hatchery buildings are as follows.

- Rebuild aging water transmission lines.
- The building needs to be remodeled to allow better organization and use of the space.
- Glass block "windows" in the Raceway Room need to be either removed or covered with blinds to exclude sunlight in incubation areas.[7]
- The hatchery building will require electrical upgrades to assure worker safety as well as fish health. Upgraded alarm systems are needed to avoid the risk of catastrophic fish loss. The upgraded alarm systems require upgraded electrical systems.
- The inhabited spaces are currently, and will continue to be, heated with electricity. Upgrading to increase energy efficiency is necessary. It is proposed that all new additions and remodels will be constructed to increase thermal efficiency. The ceilings will be insulated to R-38 and the walls will be insulated to R-15.
- Water supply fixtures need to be replaced. Many of the valves and couplings are original equipment and have greatly outlived their life expectancies.
- The rest rooms must be upgraded and remodeled to current code.
- A secure room to house non-moist feed will be attached to the building. No refrigeration is needed for non-moist feed.

[7] Currently, the glass block windows allow sunlight to enter the incubation room. Exposure to direct sunlight can kill salmon eggs. Sunlight needs to be excluded or re-directed to avoid damage to incubating salmon eggs.

- A washer, dryer, and shower, as well as an eye wash station, will be installed in the loft.

- Upgraded lighting will be required for new hatchery incubation and raceway spaces and occupied personnel spaces. Occupied personnel spaces will also require new energy efficient lighting and additional electrical outlets.

- A central monitoring station, similar to that in use at the Cle Elum Hatchery, is needed to link all alarms and sensing devices. The system will track hatchery conditions such as water level, water temperature, and dissolved oxygen; record alarms; and notify staff when alarms occur. Collected information will be stored and made available to managers.

- It is proposed to build an addition to the office/personnel space to house an isolated incubation room and a wet room/laboratory (Figure 8-1). The lab and isolated incubation facility will be similar to that at Cle Elum Supplementation and Research Facility and will be used to conduct pathogen analysis per USFWS disease protocols. The addition will also contain a locker room and break room for hatchery personnel.

Residences

The proposed expansion will require construction of two more houses. The houses could be either new, "stick built" or modular/pre-fabricated construction. The new houses will be adjacent to existing houses. New septic systems and site improvements will be required for the houses.

Raceways and Other Facilities

- Existing spring Chinook raceways (Bank C) will be evaluated for ability to accommodate recent innovations in juvenile rearing. The sides and bottoms of the raceways may need to be colored which will most likely require sandblasting and re-coating with epoxy. Avian netting will need to be installed to reduce predation and the potential for disease transmission.

- The in-river pumping station and its three pumps will be refurbished to supply river water for final spring Chinook rearing.

- A Distribution box (D-box) will need to be constructed to blend pumped river water with gravity spring water during periods of high river turbidity.

- Fill and cover existing pollution abatement pond, and reroute discharge pipelines to Pond #24, which is proposed to be reconfigured to serve as the new pollution abatement pond.

CHAPTER 9.0 PROJECT COSTS

9.1 Overview of Project Cost Estimates

The costs contained in this chapter are based on a refined spring Chinook focus and key infrastructure to support that effort. Earlier cost evaluations were modified for spring Chinook actions and need with updated cost estimates from previous Step 1 cost estimates presented in Chapter 8.0 and the programs presented in chapters 6.0 and 7.0. Costs detailed Table 9-1 are presented here at the preliminary design level. Included in the chapter are cost estimates for finalization of facility planning and design, permitting, construction oversight, and as-built drawings) (Section 9.2), capital construction cost estimates (Section 9.3), ten-year cost estimates for operations and maintenance (Section 9.4), and ten-year cost estimates for monitoring and evaluation (Section 9.5).

The proposed work was broken into defined components and relative costs were taken into consideration. The accuracy of cost estimates is a function of completeness of project planning. These estimates have been prepared for a project at the conceptual level; cost estimates will be refined further in the NPCC Step review process.

9.2 Cost Estimates for Facilities Planning and Design

As major projects in the Klickitat Subbasin evolve from conceptual to finished products, increasingly detailed plans to meet operation, facility, or programmatic requirements are developed. In order to reduce potential late-stage design or programmatic changes, the Yakama Nation assembled a Steering and Design Committee to provide review and input during this Step 1 conceptual planning phase now focusing on spring Chinook elements. The objective was to validate the program, design criteria, and cost estimates to the maximum extent possible through comprehensive early review.

Comprehensive input in the early planning stages is important to meeting the project proponent's requirements, thus ensuring that the facility can be constructed to meet program expectations and goals and remain consistent with cost projections. Such detailed cooperative planning also yields an improved understanding of future operations and associated maintenance as well as monitoring and evaluation. The Yakama Nation and BPA plan to conduct value engineering at approximately 60% design stage to receive review from a broad team of knowledgeable individuals at this stage of the 3-Step processes.

Step 1 Conceptual Planning and Design

Conceptual planning and design work for the Klickitat Anadromous Fisheries Program was initiated in winter 1996, and then refined to the winter of 2015 to focus on spring Chinook design and construction elements.

Step 2 Preliminary Planning and Design

The preliminary planning and design stage is intended to complete the Council's Step 2 requirements. This phase is designed to identify any major difficulties or concerns with

the program or facility design. Step 2 design work should provide sufficient detail and specifics to assure the intent and scope of Step 2 conceptual design work can be met and to further refine the anticipated cost estimates. Step 2 will include completed NEPA and ESA reviews. Project detail will be presented at the preliminary (Step 2) design level. At the completion of this stage, major difficulties with the design and proposed project will be identified.

Initiation of design and value engineering work is proposed for FY 2018 and FY2019. Details of the Step 2 design budget have been developed to meet the remaining balance of capital Accord funds available for spring Chinook reform actions at the Klickitat Hatchery. At the time of this writing, Lyle Falls and Castile Falls construction is completed and both facilities are in operation to meet the needs outlined in this Master Plan

The Yakama Nation will continue to use the YKFP management framework (Policy Group, Science/Technical Advisory Committee, and Monitoring and Implementation Planning Team) and consultants as needed throughout the Step process. This structure utilizes available knowledge and expertise in an effort to reduce levels of uncertainty, identify opportunities for cost reductions, identify new research or state-of-the-art equipment that should be considered, and to carefully review all aspects of the final design and related cost estimates. This approach will support a well-developed project plan and will reduce risks related to future project cost control. A refined level of detail and associated relative certainty will be particularly valuable during the bid solicitation and bid break down processes.

In addition, the Yakama Nation and BPA will implement value analysis (also known as value engineering) at the 60% design stage during the Step 2 planning and design work for the Klickitat as required by the NPCC Step process (NPCC 2006). Value analysis methods are currently applied across many disciplines and project types during design and development stages of large projects. A thorough value analysis study may result in identification of cost effective alternatives that still meet the goals and objectives of the project.

Step 3 Final Planning and Design

Upon completion of Step 2, Step 3 final planning and construction oversight costs will be developed. Initiation of this work is proposed for FY 2019. Details of the Step 3 budget planning and design budget will be presented to NPCC as soon as they become available. Yakama Nation will continue to rely on an interdisciplinary team approach described above to finalize design and cost estimates.

9.3 Capital Construction Cost Estimates

Estimating construction costs by tracking inflation alone is no longer an accurate method of predicting costs. Construction estimates in today's global economy are often affected by cost spikes caused by the amount of construction and energy costs taking place in other countries. It is hard to accurately predict for long range purposes, what will trigger

the next increases or how those increases will impact a specific project. A useful approach under the current construction climate is to estimate costs based upon a marketplace rationale, add contingency funds based upon a best estimate of the current costs, and have a qualified contractor check all prices.

Predicting construction costs requires careful consideration of current cost for labor, material, and equipment. Each of these cost elements are influenced by local, national, and world markets. Historical construction cost escalations are not always good indicators of future costs. Fuel prices and the consumption of raw material such as copper, aluminum, steel, cement, and wood fiber have significant short-term influences. The construction costs supplied by HCE were updated and narrowed to focus actions that support advancing the integrated spring Chinook program. For this updated analysis standard sources were evaluated with direct costs quoted by materials suppliers. They are also based on local project costs and vendor locations.

Klickitat Hatchery assumed the following:

- October 2015 dollars
- 10% estimating contingency
- Three phases of construction with winter shutdowns
- 2.5% annual escalation

The current estimate for capital construction includes new facilities as well as modification of existing facilities. The costs presented in this chapter are preliminary estimates based on conceptual designs. Due to the level of certainty, a contingency allowance will be accounted for in future Step phases. However, contingency is largely dependent on the quantity of uncertainties associated with the project and the amount of pre-investigation work completed. It is expected that the estimated construction costs represent a range and that cost refinements would be identified in future planning stages through analysis of alternative and elimination of many uncertainties.

Preliminary estimates (table 9-1) extrapolated from HCE initial work included labor rate forecasts are also obtained from bidding contractors, familiar with the types or work in question. Native American-owned contractors are included in the labor search. Lodging and per-diem adjustments were made to the base labor rates depending upon travel time from the population center to the work site. Past labor-intensive fisheries projects completed in 2011 at Castile Falls in the upper Klickitat have proved to be a reliable cost basis for remote Klickitat River projects. The cost basis is especially appropriate for concrete vendors, steel and wood suppliers, concrete testing companies, and crane delivery, according to Harbor Consulting Engineers.

Sources of information for the costs included Native American and non-Native American construction contractors, RS Means (www.rsmeans.com), Washington State Department of Transportation, the Small Business Administration database for minority and women-owned construction enterprises (www.sba.gov), and costs associated with the YN Castile Falls fisheries projects completed in 2011.

Transportation costs for manufactured items such as valves, gates, pipe, and pre-cast concrete were adjusted for the difficulty of delivering such items to remote construction sites.

Modification of the Klickitat Hatchery is needed to meet the biological objectives of the Master Plan (Chapter 8). It is estimated that maintenance and operations costs can be reduced if these facility enhancements and upgrades are implemented.

The Yakama Nation has established a list of key actions for implementing the proposed capital projects. Tables 9-1 and 9-2 provide estimated construction costs for the proposed facility improvements. As discussed in Chapter 8.0, the Klickitat Hatchery upgrades are needed for improved maintenance, building code corrections, energy efficiency, improved spring Chinook salmon culture, and hatchery program regulatory requirements.

Table 9-1: Klickitat Hatchery modification construction cost estimate

Klickitat Hatchery Upgrades & New Construction		
October 2015 dollars		
Water Supply and Delivery Line Upgrades		
Indian Ford A Upper		**$1,015,000**
· Rehab intake structure.	170,000	
· Upgrade entire length of pipeline.	800,000	
· High pressure line at SCS Circulars, spawning building, Adult holding.	30,000	
· Flow meter w/ LCD Display @ Hatchery Building	12,000	
· Auto-dialer system	3,000	
Indian Ford A Lower		**$230,000**
· Rehab intake structure.	40,000	
· Degassing chamber at D-box/SCS Raceway	25,000	
· Upgrade/reroute pipeline, ends at SCS Raceway/D-Box (20% of cost, cell C11)	150,000	
· Flow meter w/ LCD Display @ Hatchery Building	12,000	
· Auto dialer system	3,000	
Multi-Chamber Distribution Box (Raceway Headbox/Diversion)		**$475,000**
· Construct Multi-Chambered D-box (cast in place).	200,000	
· Run piping from A Low, B & C banks reuse, and river pumps to D-box.	100,000	
· Run piping from D-box to, SCS circulars, adult holding, PA, ladder	175,000	
Demolition		
· Existing pollution abatement pond (waste onsite)	40,000	**$91,000**
· Existing adult holding and spawning building (waste onsite)	45,000	
· Abandoned pipelines/underground infrastructure, as needed	6,000	
Adult Fish Ladder Rehab/ Adult Trapping and Holding		**$760,000**
Ladder - inspect concrete patch as needed, rehab weirs	15,000	
Trap - Install V-trap w/ counter	70,000	
Holding - Construct two holding chambers (~110' x ~15' x ~10' high)	530,000	
· Crowders, entry ports, truck entry ports, pickets and juvenile screening	145,000	
Spawning Building (a.k.a Adult Capture Building)		**$1,738,000**
· Fish lift with bulkhead	1,410,000	
· Electro sort table, electro lift basket, ramps, pneumatic gates, (e.g. LWSNFH)	200,000	
· Return ports to adult chambers	20,000	
· Egg take and biosampling stations (mobile tables/furniture, etc.)	50,000	
· Return pipe to river for unintended swim-ins.	20,000	
· Computer networked to all networked devices at the KH	8,000	
· Building to be enclosed/insulated for May – Jan operation	30,000	
Spg Chk Circular Tank Rearing System		**$3,410,000**
· River pumps (replace motors only) 3-phase/480 motors	50,000	
· Rehab vertical turbine pumps after professional evaluation	10,000	
· Mod 6" fish transfer pipe from raceway banks A,B,C	40,000	
· Eight 30' circular tanks; flow through, side boxes, windowed	2,300,000	
· Center discharge to pollution abatement	20,000	
· Fish exit/side-discharge to ladder	20,000	
· Pre-engineered steel building over circulars w/ gates	970,000	
Spring Chinook Raceway		**$170,000**
Avian netting over Raceway Bank C	170,000	
Pollution Abatement		**$1,040,000**
· Reconfigure/excavate Pond #24 to become offline pollution abatement	30,000	
· Re-route all new and existing waste drain lines	25,000	
· Fence	35,000	
· Aeration (*if needed*)	150,000	
· Concrete line pollution abatement pond	800,000	
Human Living/Working Conditions		**$1,125,000**
Two new @ ~$285,000 ea. plus , site prep (2), water (2), power (2), septic (2)	855,000	
Office/locker room/usable space area expansion (~2,000 sq. ft.)	270,000	
	ESTIMATED TOTAL	**$10,054,000**

Table 9-2: Capital construction estimated costs by fiscal year

Capital Construction Cost Estimate	Current Design Status	FY 2018	FY 2019	FY 2021	FY 2021	FY 2022	TOTAL
Klickitat Hatchery Design, Permitting & Const Mgmt (12.75% of Construction)	Conceptual	$700,054	$700,055				$1,400,109
Klickitat Hatchery Construction & Upgrades			$5,481,280	$5,481,280			$10,962,559
Annual Estimate		*$700,054*	*$6,181,335*	*$5,481,280*			*$12,362,668*

9.4 Ten-Year Cost Estimate for Operations and Maintenance

Operations, maintenance, and monitoring and evaluation estimates are based on FY 2018 salary, operating, and equipment costs.

9.4.1 Operations and Maintenance

Operation and Maintenance (O&M) cost estimates are presented in Table 9-3. It is assumed that the existing BPA Klickitat O&M project (Number 199910336) will be revised and expanded according to accommodate changes in O &M needs.

Table 9-3: Operation and Maintenance (O&M) Cost Estimates

Operation & Maintenance Costs	FY 2018	FY 2019	FY 2020	FY 2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028
Castile Falls Fishway	231,000	236,775	242,694	248,762	254,981	261,355	267,889	274,586	281,451	288,487	295,700
Lyle Falls Fishway	396,000	405,900	416,048	426,449	437,110	448,038	459,239	470,720	482,488	494,550	506,913
Klickitat Hatchery (Spring Chinook)			294,175	301,529	309,068	316,794	324,714	332,832	341,153	349,682	358,424
Klickitat Field Office & M&E support	33,000	33,825	34,671	35,537	36,426	37,336	38,270	39,227	40,207	41,212	42,243
Annual Total	$660,000	$676,500	$987,588	$1,012,277	$1,037,584	$1,063,524	$1,090,112	$1,117,365	$1,145,299	$1,173,931	$1,203,279

Escalated by 2.5%/yr.

9.5 Monitoring and Evaluation Costs

The existing Klickitat Monitoring and Evaluation Program generates data that will be used in hatchery management, is funded separately under Project 1995-063-35, and was described in detail in prior revisions of the Master Plan. We repeated relevant elements of the M&E program here for information purposes and completeness.

9.5.1 Summary of Estimated Costs for All Project Areas

Table 9-4 provides a 10-year summary of estimated costs for all project areas. Note that operational costs are from the fiscal year 2018 Accord budget. Operational costs post-2018 assume an inflation rate of 2.5% per year.

Table 9-4: Ten-Year summary of future capital and operations and maintenance costs

Cost Area	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
A. Capital Construction, Design and Permitting.											
Expense	700,054										
Capital		5,981,335	5,681,280								
B. Operations and Maintenance Costs - Expense	660,000	676,500	987,588	1,012,277	1,037,584	1,063,524	1,090,112	1,117,365	1,145,299	1,173,931	1,203,279
C. Monitoring and Evaluation Costs - Expense	Covered under Project 1995-063-35. FY2018 amount is $1,627,952.										
Total Estimated Costs (excl. M&E)	$1,360,054	$676,500	$987,588	$1,012,277	$1,037,584	$1,063,524	$1,090,112	$1,117,365	$1,145,299	$1,173,931	$1,203,279
Capital Total		$5,981,335	$5,681,280								

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GLOSSARY

Anadromous	Fish which hatch and rear in fresh water, migrate to the ocean to grow and mature, and return to fresh water to spawn
Acclimation	The process by which hatchery fish are accustomed to the natural waters into which they will be released
Attraction Water	Water that is released at the downstream opening of a fish ladder to allow fish to use the ladder for their upstream migration. The volume of water must be sufficient to selection by upstream migrants.
ATPase	ATPases are a class of enzymes that catalyze the decomposition of adenosine triphosphate (ATP) into adenosine diphosphate (ADP) and a free phosphate ion. This dephosphorylation reaction releases large amounts of energy which are used for many biochemical processes including muscle contraction and the metabolism of sugar.
Broodstock	Adult fish used by hatcheries to propagate the next generation of fish
Eye elastomer tag	A tagging method that consists of injecting a plastic (elastomer) tag into the eye of a fish in order to identify it when it is caught, returns to the river from the sea, and/or is observed on the spawning grounds
Habitat Unit	A discrete area of a stream such as a pool, riffle, or glide
Head cutting	An in-stream fracture where an unstable stream substrate exists due to flows being in disequilibrium with the existing channel gradient
Introgression	Infiltration of the genes of one species into the gene pool of another through repeated backcrossing of an interspecific hybrid with one of its parents
Mini-jack	A juvenile anadromous fish that returns the same year it was released from the hatchery; this generally occurs when fish are released from the hatchery at a size that is too large
Outplants	Hatchery fish that are released into a stream or lake

Reach	An extended portion of a river along its length
Smoltification	The physiological, morphological, and behavioral changes, including loss of parr marks and development of the silvery color of adults and a tolerance for saltwater, that take place in juvenile salmon (parr) as they prepare to migrate downstream and enter the sea
Supplementation	Using hatchery-bred fish to augment fish populations in rivers and streams

ACRONYMS AND ABBREVIATIONS

Af	Anadromous female
AHA	All "H" Analyzer
Am	Anadromous male
AER	Adult Equivalent Run
A2R	Age 2 Recruits
ASR	All Species Review
ATPase	Adenosine triphosphate
BKD	Bacterial Kidney Disease
BPA	Bonneville Power Administration
C+E	Catch plus Escapement
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Culvert-multiplate
CMU	Concrete Masonry Unit
CRITFC	Columbia River Inter-Tribal Fish Commission
CSMEP	Collaborative Systemwide Monitoring and Evaluation Project
CWT	Coded wire tag
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Ecologically Significant Unit
fpp	Fish per pound
FWP	Columbia Basin Fish and Wildlife Program
HGMP	Hatchery Genetics Management Program
HOR	Hatchery Origin
HOS	Hatchery Origin Spawners
HSRG	Hatchery Scientific Review Group
HVAC	Heating, ventilation, and air conditioning
ICTRT	Interior Columbia Technical Recovery Team
IEAB	Independent Economic Analysis Board
IHN	Infectious haematopoetic necrosis
ISAB	Independent Scientific Advisory Board
ISRP	Independent Scientific Review Panel
K	Potassium
LCR	Lower Columbia River
LWD	large woody debris

MaSA	Major Spawning Area
MCFEG	Mid-Columbia Fisheries Enhancement Group
M&E	Monitoring and evaluation
MiSA	Minor Spawning Area
Na	Sodium
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration – Fisheries
NOR	Natural origin
NPCC	Northwest Power and Conservation Council
ODFW	Oregon Department of Fish and Wildlife
pHOS	Proportion of hatchery fish present on the spawning grounds
PIT	Passive Integrated Transponder
PNAMP	Pacific Northwest Aquatic Monitoring Program
PNI	Proportionate Natural Influence
pNOB	Proportion of Natural Origin Broodstock
RASP	Regional Assessment of Supplementation of Projects
RCW	Regulatory Code of Washington
Rkm	River kilometer
Rm	River mile
R/S	Recruit per spawner
SAR	Smolt-to-adult (SAR survival rate is measured from the point where a juvenile fish is released or captured to their return to the same point as an adult)
TAC	Technical Advisory Committee
TRT	Technical Review Team
URB	Upriver Bright
USFWS	U.S Fish and Wildlife Service
VSP	Viable Salmon Population
WDFW	Washington Department of Fish and Wildlife
YKFP	Yakima/Klickitat Fisheries Project
YN	Yakama Nation