HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program	Upper Columbia River Spring-run Chinook Salmon – Nason Creek Supplementation Program
Species or Hatchery Stock:	Spring Chinook Salmon *Oncorhynchus tshawyscha*
Agency/Operator:	Public Utility District No 2 of Grant County, Washington Department of Fish and Wildlife, Yakama Nation
Watershed and Region:	Wenatchee Watershed Upper Columbia Region
Date Submitted:	9/15/09
Date Last Updated	9/15/09

SUMMARY

The goals of this program are to prevent the extinction of, to conserve, and to aid in the recovery of the naturally spawning Nason Creek spring Chinook salmon aggregation and to meet the mitigation responsibilities of Grant County Public Utility District No. 2 (Grant PUD) for unavoidable losses associated with the operation of the Priest Rapids Hydroelectric Project (consists of Wanapum and Priest Rapids Dams) while factors that limit the recovery of the Wenatchee spring Chinook salmon population are remediated. The integrated recovery program is funded by Grant PUD. Overall program direction is provided in the Biological Opinion approved for the Priest Rapids Hydroelectric Project, the Section 10 permit #1196 issued for scientific research/ production, and the Priest Rapids Project Salmon and Steelhead Settlement Agreement. As directed by program documents, the Priest Rapids Coordinating Committee Hatchery Subcommittee has been formed to oversee the planning and implementation of this and Grant PUD's other mitigation supplementation programs.

The Nason Creek spring Chinook salmon population is part of the Upper Columbia River (UCR) Spring Chinook Salmon Evolutionary Significant Unit (ESU) which was listed as endangered under the Endangered Species Act (ESA). Supplementation is being used as a risk aversion measure to meet mitigation obligations, to increase the number of returning adults, and to decrease the risk of extinction. It is one of several components of the recovery strategy for Upper Columbia River spring-run Chinook salmon. Concurrent habitat, harvest, and hydro-system protection and improvement strategies are being employed throughout the region.

The supplementation program is designed to trap and spawn Nason Creek origin adults to produce the 250,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 1,163 (0.00465 smolt-to-adult return ratio (SAR)) adult spring Chinook salmon to Nason Creek each year. The facilities required for the program have the following functions: capturing adults, holding adults, rearing pre-smolts, acclimating through the winter, and acclimating at final release locations. Adults will likely be trapped at Tumwater Dam, a Nason Creek weir, and/or by other means in Nason Creek. Adult holding, incubation, and rearing facilities are being designed at a piece of property on Nason Creek. However, these facility components have not yet been built yet.

Brood collection is an important part of the supplementation process. Capture of Nason Creek origin adults that are representative of the natural population is a program objective. Local acclimation is another important program component. The program goal is to hold pre-smolts in the Nason Creek basin for several months prior to release. Acclimation, and other facilities, will be designed and operated to improve adult survival rates, minimize straying, minimize impacts to naturally produced fish, and to fit into the existing watershed landscape.

Program managers have developed quantitative program objectives for the hatchery and associated monitoring and evaluation (M&E) objectives. These objectives will serve as the guidelines for the development and evaluation of hatchery mitigation programs, risk assessment, development of monitoring and evaluation plans, and the basis for adaptive management. Program effectiveness in several general categories will be measured: legal mandates, conservation of the naturally spawning population, genetic characteristics, and facility operation. An M&E plan is proposed that will collect the data necessary to measure program performance. The M&E plan conforms to the objectives and data collection protocols that were generated from Chelan and Douglas PUDs' Habitat Conservation Plans.

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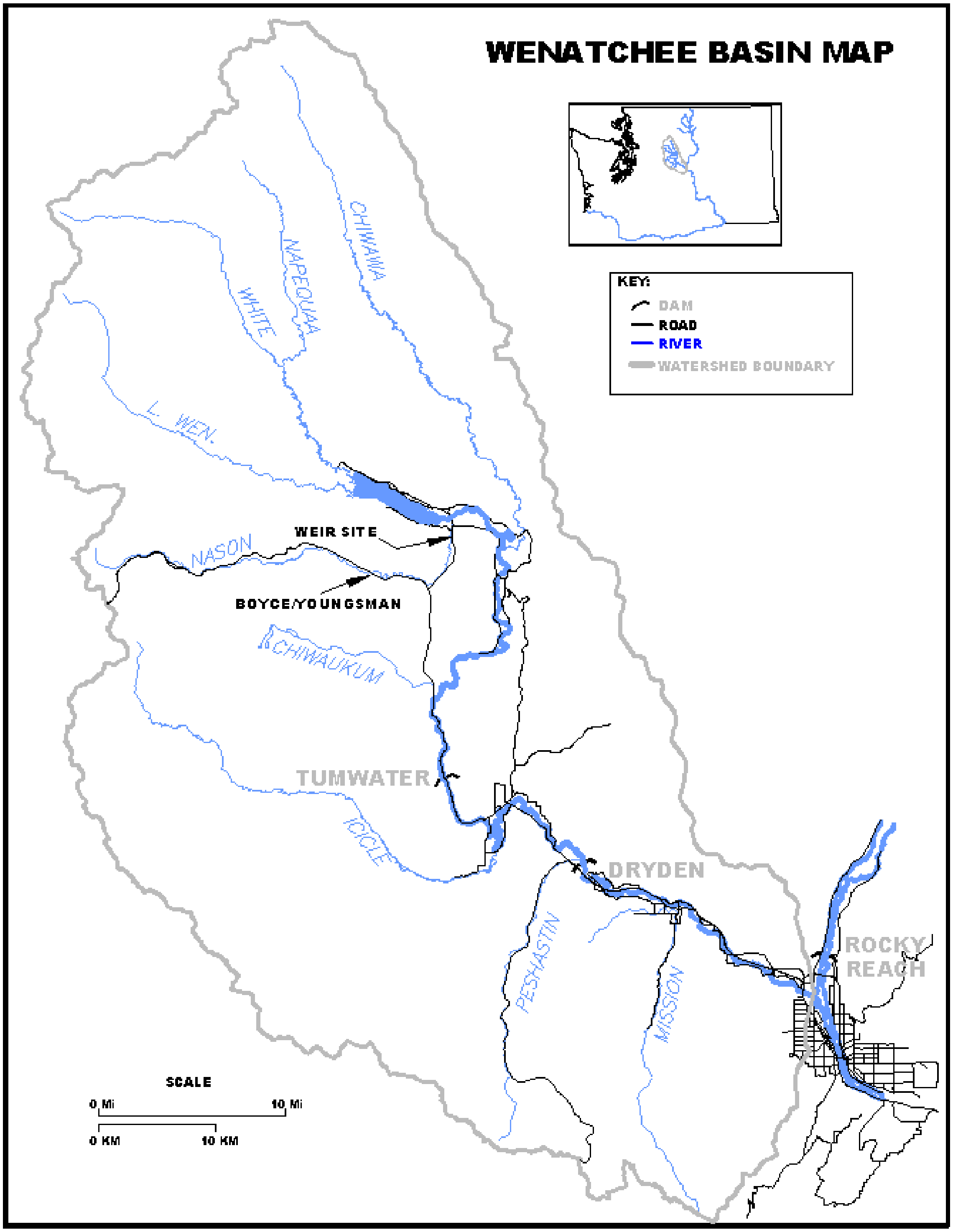

Figure 1. Map of the Wenatchee watershed.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of program.
Upper Columbia River Spring-run Chinook Salmon – Nason Creek Supplementation Program.

1.2) Species and ESA status.
Spring Chinook salmon, *Oncorhynchus tshawytscha*, endangered.

1.3) Responsible organization and individuals.
Indicate lead contact and on-site operations staff lead:
Agency: Grant PUD
Name (and title): Todd Pearsons – Fisheries Scientist
Address: P.O. Box 878, Ephrata, WA. 98823
Telephone: 509 764-0500x3304
Fax: 509 989-7305
Email: tpearso@gcpud.org

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

- Washington Department of Fish and Wildlife (WDFW): Jeff Korth - Co-manager and Priest Rapids Coordinating Committee, Hatchery Subcommittee (PRCC HSC) member.
- Confederated Bands and Tribes of the Yakama Nation (YN): Tom Scribner - Co-manager and PRCC HSC member.
- Confederated Tribes of the Colville Indian Reservation (CCT): Kirk Truscott - Co-manager and PRCC HSC member.
- Confederated Tribes and Bands of the Umatilla Indian Reservation (CTUIR): Carl Merkle - Co-manager and PRCC HSC member.
- National Marine Fisheries Service (NMFS): Kristine Petersen - Administration of the Endangered Species Act and member of the PRCC HSC.
- U.S. Fish and Wildlife Service (USFWS): William Gale – Administration of the Endangered Species Act and member of the PRCC HSC.
- USFWS, Little White Salmon/Willard National Fish Hatchery (NFH): Speros Doulos - Complex Manager. Contractor to Grant PUD.
- Ross & Associates, Inc.: Elizabeth McManus – PRCC HSC facilitator; contractor to Grant PUD.
- Sea Springs Co: Greg Ferguson – HGMP production and facilities planning consultant to Grant PUD.
- Jacobs Engineering: David Allison – Facilities engineering consultant to Grant PUD.

1.4) Funding source, staffing level, and annual operating costs.
Funding: Public Utility District No.2 of Grant County (Grant PUD- see Attachment 4 for

a list of acronyms) has spent a total of of over $1 million on the Nason Program to date.

Table 1. Costs of the Nason Hatchery Program through July, 2009.

Facility Design	$ 452,121
Captive Broodstock	$ 162,295
Ground Wells	$ 120,841
Water Quality Testing	$ 2,860
Technical Expert Services	$ 2,723
Sea Springs	$ 44,960
Migrant Trapping	$ 62,209
Labor	$ 157,436
Total	$ 1,005,446

1.5) Location(s) of hatchery and associated facilities.

Facilities for the supplementation program will be designed and constructed consistent with the Biological Opinion issued for the Priest Rapids Project by NMFS on February 1, 2008 (Biological Opinion). Three pieces of property along Nason Creek have been purchased by Grant PUD and several alternatives are being evaluated:

Broodstock capture options

- Floating weir at river mile (RM) 2, upstream of the Nason Creek campground.
- Existing ladder trap at the Tumwater Dam.

Adult holding and incubation (green egg) options

- Boyce/Youngsman property – RM 9 on Nason Creek.
- Cascade Gardens property - RM 9 on Nason Creek.
- Other sites in the upper Wenatchee watershed.

Rearing options

- Boyce/Youngsman property – RM 9 on Nason Creek.
- Cascade Gardens property - RM 9 on Nason Creek.
- Other sites in the Columbia River watershed.

Overwinter acclimation options

- Boyce/Youngsman property – RM 9 on Nason Creek.
- Cascade Gardens property - RM 9 on Nason Creek.
- Other sites in the Nason Creek watershed.

Final acclimation/release options

- Boyce/Youngsman property – RM 9 on Nason Creek.
- Cascade Gardens property - RM 9 on Nason Creek.
- Other sites in the Nason Creek watershed.

1.6) Type of program.

Integrated Recovery Program (see Attachment 1 for definitions).

A draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009 – see section 3.2) describes a proposal to operate the Wenatchee hatchery programs with two components. A conservation component (125,000 WxW smolt production) is intended to rebuild the natural population using a fully integrated broodstock collection program, and a "safety net" stepping stone component (125,000 HxH smolt production) that completes the full production level of the program, is genetically linked to the natural population, and guards against catastrophic run failure.

Adult returns would be managed at Tumwater Dam such that the conservation fish are allowed to spawn naturally at appropriate levels, collected for broodstock for the safety net program, or used in another beneficial manner. Adults produced in the safety net program will be allowed to contribute to the spawn escapement above Tumwater Dam if required to meet spawning objectives, used for restoration/reintroduction in minor spawning areas, or broodstock. If safety net adults are in excess to meet spawning objectives, used for restoration/reintroduction in minor spawning areas, or broodstock, the they may be available for harvest in the Wenatchee River, or other beneficial uses.

1.7) Purpose (goal) of program.

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Conservation/Preservation: The purpose of the program is to increase the number of natural spawners in Nason Creek and reduce short-term extinction risk for the Wenatchee River population of spring Chinook salmon. The goal of this program is to prevent the extinction of and conserve the naturally spawning Nason Creek spring Chinook salmon spawning aggregation while factors that limit the recovery of the Wenatchee population are remediated.

The conservation/preservation program has been incorporated as part of a suite of mitigation actions listed in the Biological Opinion issued for the Priest Rapids Project by NMFS on February 1, 2008 (Biological Opinion; NOAA 2008). As recovery of natural production occurs, the responsible parties (see below) will modify the program to meet the continuing mitigation responsibilities related to unavoidable losses associated with the operation of the Priest Rapids hydro complex.

1.8) Justification for the program.

This program was originated, and is proposed to be continued, to reduce the risk of extinction for naturally spawning, Wenatchee River spring Chinook. The population has been in decline since data started being recorded and numbers have dropped below those thought to be required for a viable spawning aggregate. Supplementation is one of the techniques being implemented to halt this decline and offers the potential to produce relatively rapid increases in adult return numbers. The supplementation program is designed to trap and spawn Nason Creek origin adults to produce the 250,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 1,163 (0.00465 smolt-to-adult return ratio (SAR) from data collected for the Chiwawa supplementation program) adult spring Chinook salmon to Nason Creek each year.

The figure below, from the NOAA Interior Columbia Technical Recovery Team (http://www.nwfsc.noaa.gov/trt/trt_documents/wenatchee_river_chinook07.pdf) shows the abundance trend for both natural origin and total spawners for the entire Wenatchee River spring Chinook salmon population. Data includes both hatchery, except Icicle, and natural origin fish. The Wenatchee population reached critical levels in the late 1990's and natural-origin spawning numbers remain severely depressed.

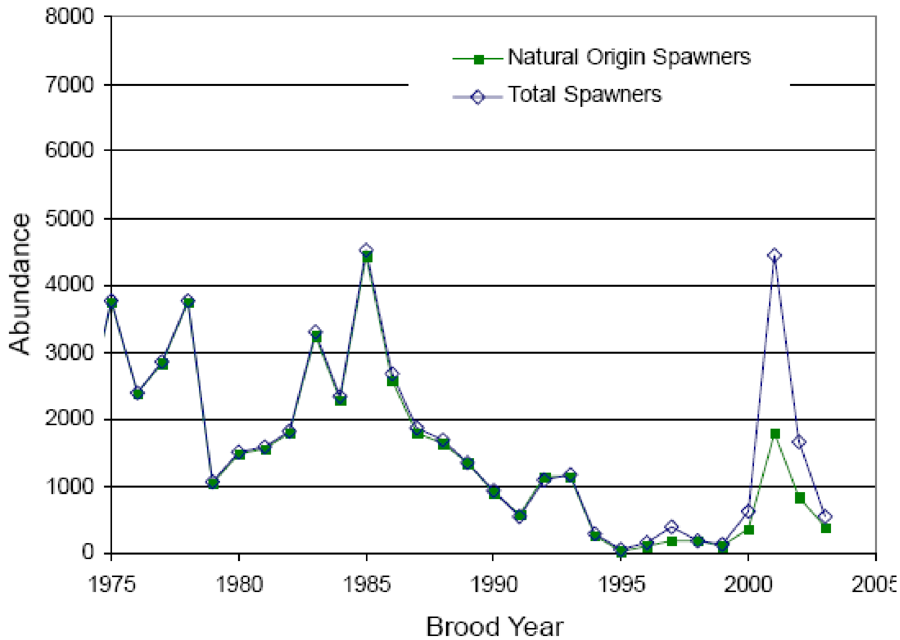


Figure 2. Abundance trend for both natural origin and total spawners for the entire Wenatchee River spring Chinook salmon population

The Nason Creek Major spawning Area follows the trends of the Wenatchee spring Chinook population.

The Nason Creek major spawning area is within the Upper Columbia River (UCR) spring-run Chinook salmon Evolutionarily Significant Unit (ESU) which is listed as Endangered (Federal Register Vol. 64, No. 56, March 24, 1999; endangered status reaffirmed on June 28, 2005). This ESU includes all naturally spawning populations of spring Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. McClure et al. (2003) further delineated the

ESU, describing three populations: Wenatchee River (except Icicle Creek), Entiat River, and the Methow River. Supplementation using artificial propagation of the White River, Nason Creek, Chiwawa River, Twisp River, Methow River, and Chewuch River stocks was determined to be essential to recovery and these hatchery programs are included in the ESU.

The Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (Recovery Plan; UCSRB 2006)) (see Section 3.1) proposes recovery criteria for UCR spring Chinook based on information contained in Interior Columbia Basin Technical Recovery Team (ICBTRT 2004b) and Ford et al. (2001). The Recovery Plan suggests that recovery requires reducing or eliminating threats to the long-term persistence of populations, maintaining widely distributed populations across diverse habitats of their native ranges, and preserving genetic diversity and life history characteristics. Successful recovery of the species means that populations have met certain measurable criteria associated with viable salmonid populations. The recovery plan focuses on four viable salmonid population (VSP) parameters: abundance, productivity, spatial structure, and diversity of naturally produced fish.

The Nason Creek recovery effort is expected to complement supplementation programs in other key tributaries of the Wenatchee River population by enhancing population metrics for the Wenatchee River basin spring Chinook population. The Nason Creek supplementation program is designed to support recovery consistent with the following UCR spring Chinook VSP recovery criteria (UCRSRB 2006):

Abundance/Productivity:
Several criteria are required to achieve recovery of the Upper Columbia Spring Chinook ESU.

Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations must fall above the 5% extinction-risk (viability) curves.

Criterion 2: At a minimum, the Upper Columbia Spring Chinook ESU will maintain at least 4,500 naturally produced spawners and a spawner:spawner ratio greater than 1.0.

The Wenatchee population will maintain a 12 year geometric mean minimum number of spawners of 2,000 and a 12 year geometric mean minimum spawner:spawner ratio of 1.2.

“Because populations with fewer than 500 individuals are at higher risk for inbreeding depression and a variety of other genetic concerns (McClure et al. 2003 discusses this topic further), the ICTRT does not consider any population with fewer than 500 individuals to be viable, regardless of its intrinsic productivity. Therefore we set the threshold level (minimum acceptable long term average spawning abundance) for the smallest category of drainages at 500 spawners (ICBTRT 2007a).”

It is anticipated that the supplementation program in Nason Creek will increase the abundance of spawners up to the habitat carrying capacity in Nason Creek. However, it is likely that the productivity of the population will decrease as the population approaches or exceeds carrying capacity and as the proportion of hatchery origin spawners and proportion of hatchery origin brood increases. The supplementation program is designed to trap and spawn Nason Creek origin adults to produce the 250,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 1,163 (0.00465 smolt-to-adult return ratio (SAR) taken from the Chiwawa Hatchery program) adult spring Chinook salmon to Nason Creek each year. If hatchery adults that spawn in the natural environment produce 0.5 natural origin progeny/hatchery parent, then about 582 natural origin spawners would be produced to spawn in the natural environment. This short-term demographic benefit is not without risk to the long-term productivity of the population (treated later in this document), but the short-term reduction in extinction risk is thought to out-weigh the risks to long-term fitness. However, there are considerable scientific uncertainties associated with impact to long-term fitness.

Spatial Structure/Diversity:
Criterion 3: Over a 12-year period, naturally produced spring Chinook will use currently occupied major spawning areas (minor spawning areas are addressed primarily under Criteria 4 and 5) throughout the ESU according to the following population-specific criteria: Naturally produced spring Chinook spawning will occur within four of the five major spawning areas in the Wenatchee subbasin (Chiwawa River, White River, Nason Creek, Little Wenatchee River, or Wenatchee River) and within one minor spawning area downstream from Tumwater Canyon (Chumstick, Peshastin, Icicle, or Mission). The minimum number of naturally produced spring Chinook redds within each major spawning area will be either 5% of the total number of redds within the Wenatchee subbasin or at least 20 redds within each major area, whichever is greater.

Criterion 4: The mean score for the three metrics of natural rates and levels of spatially mediated processes will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations and all threats for “high” risk have been addressed.

Criterion 5: The score for the eight metrics of natural levels of variation will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations and all threats for “high” risk have been addressed.

In addition to survival enhancement of the listed spring Chinook population, program justification includes other cultural, socio-economic, and ecological benefits. For example, the commercial value of Columbia basin tribal, commercial, and recreational fisheries is estimated by the Independent Economic Analysis Board (IEAB 2005) as contributing “about $142 million total personal income annually to communities on the West Coast.” A recovered UCR spring Chinook population can help increase that harvest, directly and indirectly. Also, general ecosystem recovery is a goal of many Columbia River Tribes, communities, and citizen groups. The benefits to other listed and non-listed species in the region are discussed in section 3.5 and in Addendum A. As stated in the Endangered Species Act (1973): "various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation;…these species of fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."

It is anticipated that the supplementation program in Nason Creek will increase the spatial structure of spawners by planting hatchery fish into minor spawning areas that currently have few to no adult spawners (e.g., Peshastin Creek). Diversity may increase or decrease depending upon the amount of straying, compositing of broodstock, and local adaptation that occurs through properly run supplementation programs.

The Nason Creek spring Chinook hatchery program will be designed to release approximately 250,000 yearling smolts annually from a newly constructed hatchery located on Nason Creek. A smaller number of these fish may be released into semi-natural locations identified by the Yakama Nation. This release level is anticipated to result in the average return of approximately 1,163 (0.00465 smolt-to-adult return ratio (SAR; Hillman et al. 2009)) adult spring Chinook salmon to Nason Creek each year. The maximum returns are expected to be 3,905 (SAR = 0.01562, Hillman et al. 2009) and the lowest returns are expected to be 90 adults (SAR = 0.00036, Hillman et al. 2009). Hatchery returns will be allowed to spawn naturally when insufficient number of natural origin spawners are available. Hatchery returns may also be used in hatchery broodstock when insufficient numbers of natural origin fish are available. Hatchery returns that exceed those needed for broodstock or spawning in Nason Creek, will be used to outplant into minor spawning areas below Tumwater Dam, conservation fisheries, nutrient enhancement, or food – when fish return in number that are surplus to recovery needs.

The supplementation program is designed to trap and spawn Nason Creek origin adults. Adults will be trapped at Tumwater Dam or at Nason Creek. Adults will be held and spawned at a facility on Nason Creek or other suitable facility. Eggs will be incubated, juveniles reared, and pre-smolts acclimated throughout the winter and spring at a hatchery facility to be built on Nason Creek.

The hatchery program will be adaptively managed as information is generated through the implementation of the M&E plan. The M&E plan was structured around the objectives of the hatchery program and is consistent with an ongoing M&E plan funded by Chelan Public Utility District.

The Nason Creek hatchery programs will have two components:

1) a Conservation component intended to rebuild the natural population using a fully integrated broodstock collection program, and

2) a “safety net” stepping stone component that completes the full production level of the program, is genetically linked to the natural population, and guards against catastrophic run failure..

In each tributary area the two parts of the program would be reared separately until at least marking. Post marking they could be combined for final rearing and release, or remain separate if multiple small acclimation sites are developed in the tributary areas.

Adult returns would be managed at Tumwater Dam such that the conservation fish are allowed to spawn naturally at appropriate levels, collected for broodstock for the safety net program, or used in another beneficial manner. Adults produced in the safety net program will usually be available for harvest in the Wenatchee River or other beneficial uses, but normally would not contribute to spawning upstream of Tumwater Dam.

1.9, 1.10) Performance Standards and Indicators.

Quantitative objectives for Grant PUD hatchery programs were developed and approved by the PRCC. The metrics for the program are presented in Table 2 and the quantitative objectives are presented in Tables 3 and 4. M&E objectives and metrics are presented in section 11.

Table 2. Metrics for quantitative objectives.

Metric	Definition or calculation	Why important
Release number and size (M&E indicator 6)	Total number and weight of juveniles released	Necessary to assess whether or not the program is meeting mitigation production levels consistent with the Settlement Agreement.
Proportion of natural influence (PNI) (M&E indicator 7)	Proportion of total selection (hatchery and natural) that is due to natural selection. Calculated as pNOB/(pNOB + pHOS) pNOB=proportion of natural origin brood in the hatchery pHOS=proportion of hatchery origin spawners in the natural environment	Helps determine size of programs, type of programs, management of hatchery broodstock, management of fish of different origins on the spawning grounds
Hatchery SAR (M&E indicator 4)	Smolt-adult return rate by brood year	Necessary monitoring to assess overall hatchery smolt survival. Essential for run-forecasting and out-year mitigation requirements.
Within hatchery survival (M&E indicator 6)	Survival by life stage	Necessary monitoring to assess/maximize the efficacy of hatchery rearing and will guide future hatchery rearing strategies.
Escapement (M&E indicator 1)	Number of adults that spawn in the natural environment	Under escapement can harm the viability of the population and over escapement can result in lost harvest opportunity and potentially reduced productivity
Stray rate (M&E indicator 5)	Three metrics for evaluating straying: Stray 1=percentage of hatchery release that strays to non-target spawning areas, Stray 2=percentage of a non-target spawning population that contains hatchery strays, Stray 3=percentage of non-target populations that stray into targeted population	Straying into non-target populations has the potential to reduce productivity of non-target populations and reduce between population diversity. Strays from other programs could impact the target population.
Relative productivity (M&E indicators	Productivity of hatchery and natural origin fish in the hatchery and the natural	Critical factor in evaluating whether a hatchery is contributing to or reducing natural production. Evaluating productivity

1 and 4)	environment across generations. This includes: freshwater productivity (e.g., The number of juveniles / redd or juveniles / spawner. Juveniles may be measured at different life-stages such as parr, emigrants, or smolts), Hatchery and natural origin adult recruits/spawner and hatchery smolt-to-adult recruitment (SAR).	at different life-stages also helps assess the time and place of achievement of objectives (i.e. assess potential mining of adults).
Genetic Diversity (M&E indicator 3)	Allele frequency. Effective population size. Divergence among MSAs.	Genetic diversity within and between populations is associated with increased productivity and long-term fitness.
Biological characteristics of adult hatchery and natural origin offspring (M&E indicators 2 and 3)	Size at age, age at maturation, return and spawn timing, sex ratio, fecundity, egg size, spawn location	Manifestations of genetic and environmental differences which could impact long-term fitness, viability and productivity. Utilized as a monitoring indicator to support management decisions based on assessment of biological significance.
Harvest (M&E indicator 8)	Number of fish to be harvested in all fisheries	Contributes value to commercial, subsistence, and recreational fisheries, and is important for spiritual reasons
Non-target taxa of concern (NTTOC) (M&E indicator 9)	% impact to a taxon baseline abundance, size, or distribution A risk assessment will be conducted that will identify which NTTOC, if any, will be monitored and will help inform the frequency and intensity of monitoring. The containment objectives need to be consistent with HCP objectives.	Allows for a proper balancing of target and non-target taxa benefits and costs
BKD concentration (M&E objective 7)	ELISA optical densities.	Reduces disease risk to the population.

Table 3. Draft biological goals for integrated hatchery programs that will be used for evaluation of different hatchery strategies and presentation in HGMPs. PNI=proportion of natural influence, EN= spawning escapement of natural origin fish, K=the minimum number of spawners to produce the asymptotic number of recruits, R=recruitment productivity in recruits per spawner, A=number of adults, H= hatchery, E=spawning escapement (hatchery and natural origin fish combined), N=natural origin recruits, D= donor population, Ne=effective population size, RH=recruitment of hatchery fish, RHN=recruitment of hatchery fish in the natural environment, RN =recruitment of natural origin fish in the natural environment, B = hatchery broodstock, P = prespawn mortalities.

HGMP	Release # and size (see table 3)	PNI[1], (E relative to K)		Genetic Diversity	Stray Rate	Relative Productivity	Biological characteristics
Nason Creek	Nason Creek (250,000 @ 10-15 fish /pound)	0.50 per MSA, 0.67 for population.		Allele freq. H = N = D Sub-population genetic distance $_{\text{year x}}$ = distance $_{\text{year y}}$ $(Ne/E)_{\text{year x}} = (Ne/E)_{\text{year y}}$	<5% Between populations , <10% within population	RH*RHN*RN> RN*RN*RN (more great grandchildren if a fish is taken into hatchery than left to spawn in the natural environment).	H=W (see table 1)

BKD Concentration	Broodstock	Escapement	Hatchery Replacement Rate	Natural Replacement Rate	Reproductive Success	Harvest[1]
<Baseline values	132-160	500 Nason upstream of Tumwater Dam	>Expected value (from BAMP)	>Non-supplemented population.	>0.85	≤A-K-B-P

[1] Prioritize harvest of hatchery origin fish to meet PNI objectives

Table 4. Survival standards within hatcheries for PRCC hatchery salmon programs.

	Collection to spawning		**Unfertilized egg-eyed**	**Eyed egg-ponding**	**30 d after ponding**	**100 d after ponding**	**Ponding to release**	**Transport to release**	**Unfertilized egg-release**
	Female	**Male**							
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

1.11) Expected size of program.

Up to 250,000 artificially produced smolts are planned to be released annually from Nason Creek acclimation sites and are a component of Grant PUD's overall UCR spring Chinook mitigation obligation for the operation of the Priest Rapids Projects. The 250,000 smolt production for Nason Creek is based upon the expected smolt-to-adult survival (SAR) for hatchery spring Chinook in the Wenatchee Basin, preliminary adult intrinsic spawner capacity estimates derived from data provided in the Draft Viability Criteria for Application to Interior Columbia Basin Salmonid ESU's Report (ICTRT 2007a), habitat capacity estimates summarized in Ford et al (2001), and historical adult escapement to Nason Creek.

Proposed annual broodstock collection level.
Approximately 160 adults will be collected (see attachment 3) to achieve the 250,000 (plus 10%) production objective.

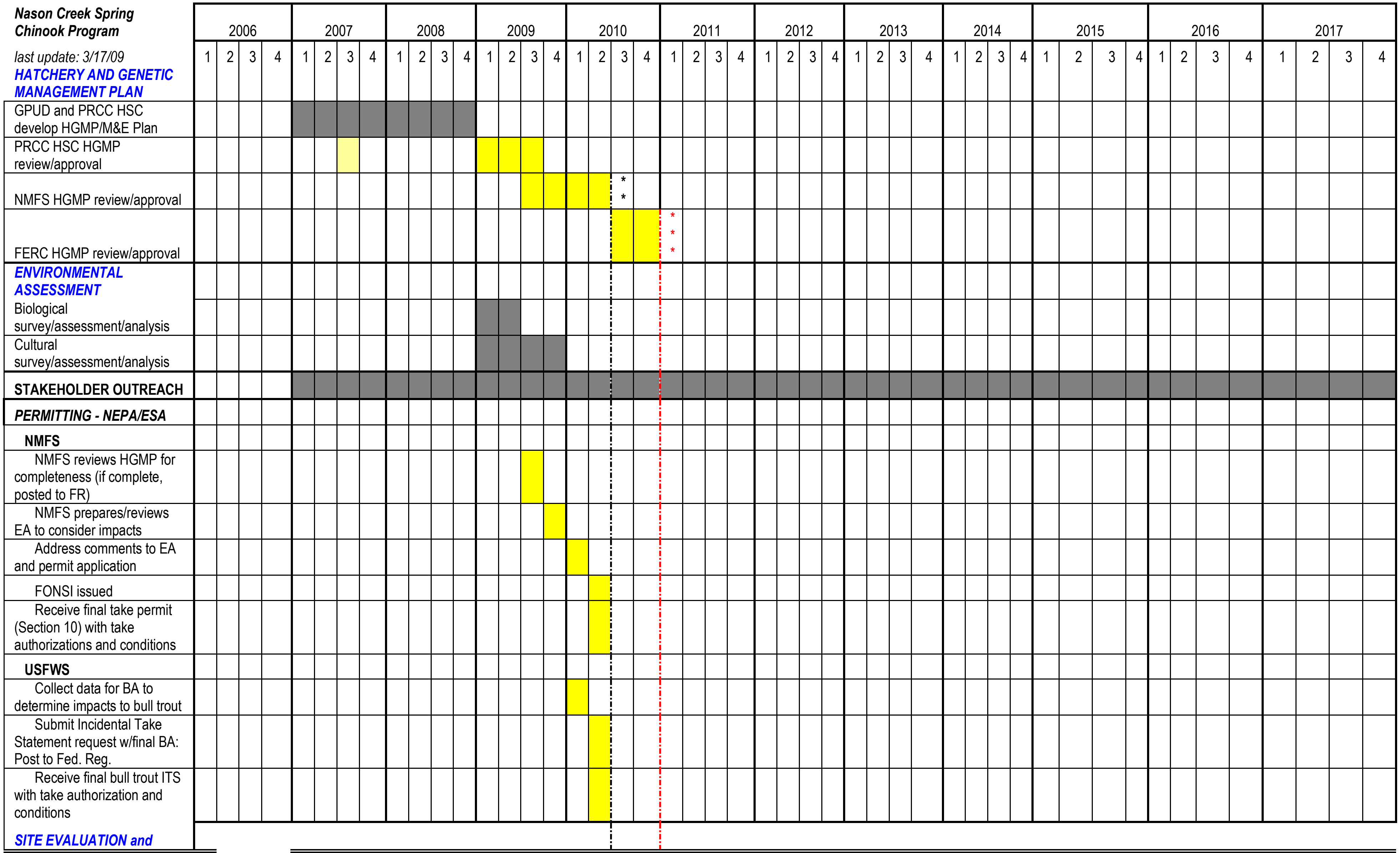
Table 5. Proposed annual fish release levels.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Nason Creek	Up to 250,000

1.12) Current program performance.
Supplementation Program not operating yet. Initial release expected in 2017.

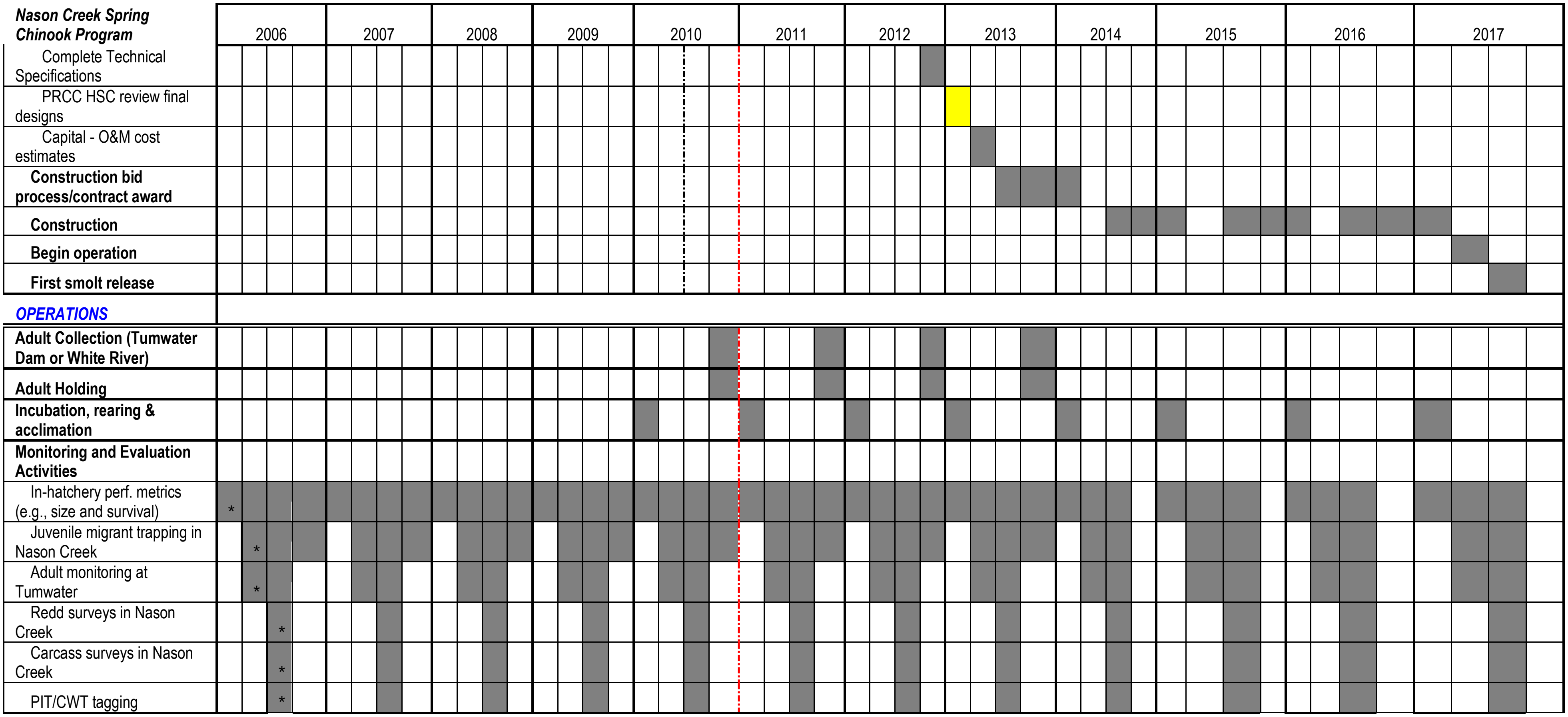
1.13, 1.14) Project schedule.
The chart below summarizes the timing of past, present, and future program related activities. See the draft project development schedule chart below for details. This schedule may change as a result of unknowns associated with permitting and facilities development issues. The HSC will work to try and decrease the time till implementation.

Figure 3. Draft Nason Creek supplementation project development schedule:



Nason Creek Spring Chinook Program	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CONCEPTUAL DESIGN												
Boyce/Youngsman Property												
Develop conceptual hatchery designs												
HSC review of conceptual design												
Dig test wells - evaluate												
Analyze impacts to water sources												
Refine groundwater capacity												
Determine whether sufficient groundwater for full facility												
Streamflow depletion mitigation												
PRCC HSC review of water use												
Redevelop preliminary hatchery designs based on well capacity												
PRCC HSC review of preliminary hatchery designs												
Permitting level design												
Revise Site Plan Based on Well Field Development												
Review and Incorporation of County Habitat Project												
Redesign Intake Concept based on bathymetric survey												
Structural and Mech. Design of Intake (adapt Nason?)												
Incorporation of Std. (Nason) Acclimation Pond												
PRCC HSC review of permitting designs												
Capital - O&M cost estimates												
PERMITTING - SEPA (adotpion of NEPA documents)												
SEPA												
Analyze environmental and cultural resource data to												

Nason Creek Spring Chinook Program	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
determine sig.												
Submit SEPA checklist and determination for publication and SEPA register posting (adopt NEPA docs)												
Address comments (including additional data collection and further dev. Of mitigation)												
Amend SEPA if necessary												
Re-submit SEPA checklist and determination												
Federal, State, Local												
Submit JARPA w/SEPA docs to request permits to proceed												
Corps: Section 404												
WDOE: 401 WQC												
WDOE: NPDES (if applicable)												
WDOE: Stormwater Construction Permit												
WDFW: HPA												
WDNR: Aquatic Lease (If necessary)												
Chelan County SMA Substantial Development Permit/Critical Area/SMP Criteria												
Address comments at Chelan County Public Meeting												
Chelan County SMA permit issuance												
WDOE Appeal period to issuance of SMA permit												
WDOE: Water right												
FINAL FACILITY DESIGNS and CONSTRUCTION												
Review and Incorporate HGMP Approval Comments												
Incorporate Permit Comments/Conditions												
Complete Design Drawings and QA/QC												



** denotes NMFS approval of HGMP

*** denotes FERC approval for HGMP

Denotes Grant PUD activities

Denotes non-Grant PUD activities

* Denotes activities which began prior to 2006

This schedule assumes development (and associated timeline) of an EA, rather than EIS.

1.15) Watersheds targeted

Nason Creek, Wenatchee River system, Washington –WRIA #45.

1.16) Alternative actions considered.

Alternative actions were considered during development of the BAMP. The co-managers, NMFS, WDFW, USFWS, CCT, CTUIR and Chelan, Douglas, and Grant PUDs concluded in the BAMP that many populations are at high risk for extinction and artificial propagation is essential for recovery.

The discussion of alternative actions is summarized in the BAMP as follows:
"The co-managers concluded that many populations are at high risk of extinction, and artificial propagation was essential for their recovery. However, there was substantive debate on how to categorize and propagate the populations. Critical uncertainties were: (1) the level of population structure of mid-Columbia spring Chinook salmon, (2) which strategies posed the least risk to the populations while having the highest likelihood of recovering them, and (3) whether these recovery measures were logistically feasible. The co-managers investigated several alternatives that could be used in the recovery process, while promoting within- and among-population genetic variability for the nominal populations. Some alternatives either presented an increased risk to the sustainability of the populations, or have low feasibility in implementation. As a result, the most appropriate plan included a limited use of many strategies to spread the overall risk to the populations and to test the effectiveness of each strategy. "Spreading the risk" includes the use of more than one artificial propagation strategy, collecting broodstock at more than one life stage, predetermined means to manage stray fish, variable levels of population separation, and designation of "reference" populations that will not be artificially propagated. All strategies will be monitored to allow comparison of the effectiveness of each alternative and subsequently, adaptive management of the program."

Several basic alternatives for using artificial propagation for recovery of spring Chinook salmon were evaluated in the BAMP. These included various levels of supplementation, captive rearing of a portion of the natural population, infusion of non-native gametes into the gene pool, and consolidation of several populations. The preferred strategy for Nason Creek was developed after considering these alternatives and the regional guidelines of establishing reference populations and reducing large scale risk by implementing multiple recovery methods.

For the Nason Creek population, alternatives that did not involve artificial propagation were determined to not be adequate to avoid the immediate risk of extinction. One of several significant mortality factors facing this stock is passage mortality experienced while passing through mainstem hydropower facilities during their downstream smolt migration. Passage improvements to hydropower facilities have been underway for decades. However, even when passage protection is maximized there will still be a level of mortality that is expected to require continued artificial propagation.

Other program options considered:

- Make collections for all the Wenatchee spawning aggregates above Leavenworth (which includes all the Wenatchee population major spawning areas) at Tumwater Dam. Managing the upper Wenatchee as a single unit would help insure that abundance targets for each spawning area could be met which would reduce short-term extinction risks. However, it would eliminate any population structure that may currently exist and preclude it's development (ICBTRT 2007b).

- End the supplementation program after 3 generations whether or not performance standards for ending the program (see standard 2.5 in section 1.6) are met. The ICBTRT (2007b) concludes that hatchery supplementation programs that continue for more than 3 generations do not, in most cases, meet viability criteria. However, ending the program prior to abundance criteria being met may leave the Nason Creek MaSa with a high extinction risk (ICBTRT 2007b).

SECTION 2. PROGRAM EFFECTS ON NMFS LISTED POPULATIONS

USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A.

2.1) ESA permits and authorizations.

Section 10(a)(1)(B) Permit Number 1482 (1203) authorizes the annual take of listed salmonids while conducting research designed to collect biological data on the salmonid populations in question, determine where salmonids are present, genetically identify individual salmonid stocks, and examine habitat conditions where the salmon and steelhead are found. Issued to WDFW. Expired December 31, 2008.

Section 10(a)(1)(A) Permit Number 1196. The Permit Holders are authorized annual take of adult and juvenile, endangered, naturally produced and artificially propagated, UCR spring chinook salmon associated with artificialpropagation supplementation programs for the Wenatchee River and Methow River Basin populations of the species. The programs are intended to supplement the species' naturallyspawned production in the two watersheds. The authorized programs includes the collection of ESA-listed adults for broodstock, the use of artificial propagation in a hatchery environment, the rearing of artificially spawned progeny in the hatchery facilities, and the release of artificially propagated juveniles into the respective stream of origin. All aspects of the program will be monitored in the hatchery and natural environments in a manner that allows comparison of the effectiveness of programs. Issued to WDFW, Chelan PUD, Douglas PUD. Expires January 20, 2014.

This HGMP, when completed, is expected to be submitted to NMFS as part of a new ESA consultation and permitting process.

2.2) Descriptions and projected take actions for ESA listed populations.

2.2.1) Description of affected NMFS ESA-listed salmonid population(s).

<u>Upper Columbia River Spring-run Chinook Salmon</u>

Adult spring Chinook salmon (*Oncorhynchus tshawytscha*) enter the Columbia River from March through mid-May (Myers et al. 1998). Peak abundance of the run in the lower Columbia River occurs in April and May (Chapman et al. 1995). Upper Columbia-origin spring Chinook exhibit peak migration at Rock Island Dam in mid-May. The fish spawn in the Wenatchee, Entiat, and Methow rivers from late July through September, peaking about mid-August. The majority of adult spring Chinook salmon mature at four years of age (58%). A significant proportion of age-5 spring Chinook may also be present (~40%). Adults will average 66 cm for females and 67 cm for males (Chapman et al. 1995). Fecundity for female Chinook may range between 2,600 and 8,100, based on data for the Chiwawa and Methow river populations.

Juvenile wild UCR ESU spring Chinook salmon are present at various life stages year-round in the Wenatchee, Entiat, and Methow rivers and tributaries, and may rear and over-winter in the mainstem upper Columbia River. Eggs incubate from late July through late fall or early winter, when the eggs generally hatch (Chapman et al. 1995). Alevins remain in the gravel 4-6 weeks or more, emerging as fry in late winter or early spring. Spring Chinook salmon fry disperse extensively downstream after emergence, although some fry assume residence in the natal stream near the spawning site. A second downstream movement occurs during late fall when Chinook emigrate to suitable over-wintering habitat, usually from the tributaries to the river mainstem. A third and final downstream movement takes place in the spring when the Chinook migrate as yearling smolts to the sea. The average 10%, 50%, and 90% passage of the seaward smolt migration measured at Rock Island Dam was April 21, May 10, and June 3, respectively from 1985–1994 (Chapman et al. 1995). Wild fry and sub-yearling spring Chinook may range in size from 30-40 mm in the spring, average 54 mm in June, and average 88 mm by October. Upper Columbia River spring Chinook migrating seaward as yearling fish may average 87 to 127 mm.

The proposed program will focus on the Nason Creek subpopulation within the Wenatchee River basin. Murdoch et al. (2006) conducted population genetic analysis, pedigree reconstruction and fitness estimation of hatchery and natural origin spring Chinook spawning aggregates in the upper Wenatchee River Basin for brood years 2004 and 2005 and concluded that population genetic structure appears to exist within Wenatchee basin spring-run Chinook. It is anticipated that the population genetic analysis, pedigree reconstruction, and fitness estimation efforts will continue for the next 8-10 years and compilation of multiple years of data will provide greater insight to the population structure of spring-run Chinook in the Wenatchee River basin.

<u>Upper Columbia River Summer Steelhead</u>
Steelhead (*Oncorhynchus mykiss*) display the most complex life history traits of any Pacific salmonid (Busby et al. 1996). They can be anadromous or resident and the anadromous form can spend up to seven years in freshwater before smoltification and seaward migration. They can spend up to three years in saltwater before returning to spawn (Busby et at. 1996). Two major run types are identified: ocean-maturing and stream-maturing. The ocean-maturing run type (winter steelhead) usually enters freshwater coastal and lowland streams in November through April and spawns soon thereafter. The stream-maturing run type (summer steelhead) generally enter freshwater from May through October and are sexually immature, requiring several months to spawn (Busby et al. 1996). The stream-type runs typically spawn in inland steams.

The UCR Steelhead ESU occupies the Columbia River upstream of the Yakima River (excluded) to Chief Joseph Dam (62FR43937). NMFS has identified three independent populations within the ESU: the Wenatchee, Entiat, and Methow populations (Interior Technical Recovery Team 2003). Steelhead of the UCR ESU is classified as stream-maturing type, similar to other inland steelhead ESUs (Snake and mid-Columbia rivers). Detailed descriptions of the UCR ESU are provided in Busby et al. (1996), WCSBRT (2003), and ITRT (2003).

Adult steelhead from the UCR ESU return to the Columbia River from May through September and quickly migrate into the tributaries, usually beginning in mid-July and peaking in mid-September through October (Busby et al. 1996, WCSBRT 2003, NOAA Fisheries 2002). The predominant adult age class is 2-salt (51%) followed by 1-salt (47%). Two percent return as 3-salt (WDFW 2002). Some may stay in mainstem reservoirs and migrate into tributaries in April or May of the following year (WCSBRT 2003). Typically they spawn in late spring of the calendar year after entering freshwater. In the Wenatchee River, summer steelhead arrive in mid-July and through April the following year. Spawning is from April through June (WDFW 2002, WDFW 1993). Eggs incubate late March through June and fry emerge late spring through August (WDFW 2002). Life stages are present year-round in the tributaries of the UCR ESU. Fry and smolts disperse downstream in late summer and fall. Outmigration occurs during April and May and is dominated by 3+ (46.6%) and 2+ (43.2%) age-class smolts (Peven 1990).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.
UCR ESU spring Chinook (*Oncorhynchus tshawytscha*). All spring Chinook in the Upper Columbia ESU were listed as endangered under the ESA on March 24, 1999.

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.
UCR ESU summer steelhead trout (*Oncorhynchus mykiss*) ESU was listed as threatened in 2006.

2.2.2) Status of affected NMFS ESA-listed salmonid population(s).

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (see definitions in "Attachment 1").
Upper Columbia River Spring-run Chinook Salmon
The following status summary is from the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

"On March 24, 1999, NMFS listed UCR spring Chinook salmon as an endangered species under the ESA (64 FR 14308). In that listing determination, NMFS concluded that the UCR spring Chinook salmon were in danger of extinction throughout all or a significant portion of their range. NMFS also determined that six hatchery stocks in the UCR basin which propagate local stocks of spring Chinook salmon should be included as part of the species because they were considered essential for recovering the fish. When NMFS re-examined the status of the UCR Chinook in 2005 (70 FR 37160), they came to the same conclusion that the species warranted listing as endangered. The UCR Spring Chinook Salmon Evolutionarily Significant Unit (ESU) is made up of three extant populations; Methow, Entiat, and Wenatchee.

As summarized in the Recovery Plan, when considering the factors that determine diversity and spatial structure, the Wenatchee spring Chinook salmon population is currently considered to be at a high risk of extinction because of the loss of naturally produced Chinook salmon spawning in tributaries downstream from Tumwater Canyon. In addition, the Wenatchee spring Chinook salmon population is currently not viable with respect to abundance and productivity and has a greater than 25% chance of extinction in 100 years. In sum, the Wenatchee spring Chinook salmon population is not currently viable and has a high risk of extinction. The Wenatchee population includes five major and four minor spawning areas. The number of spring Chinook salmon redds built in each major spawning area has varied widely in the last 20 years (Hillman et al 2008).

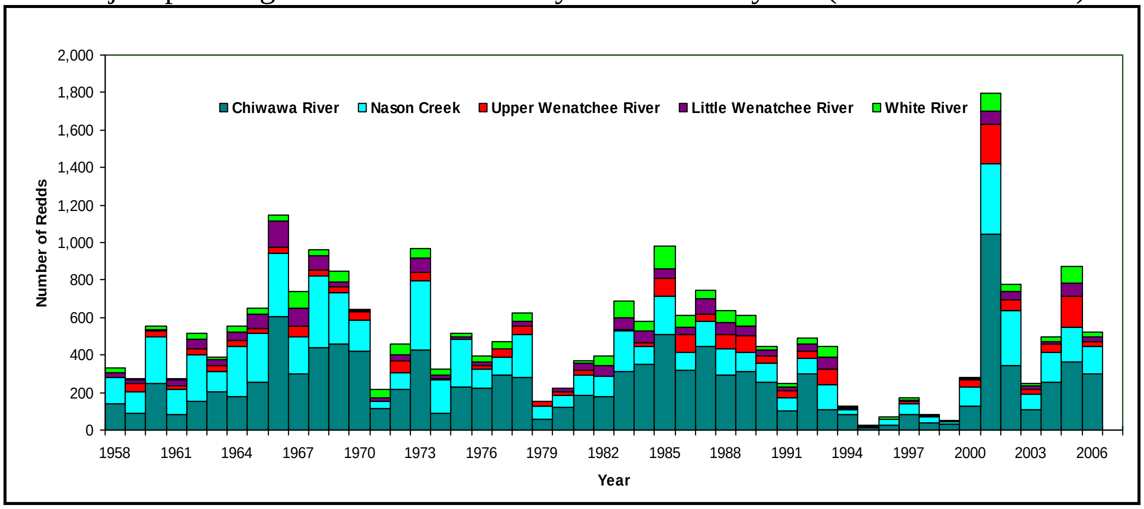


Figure 4. Number of redds in each major spawning area of the Wenatchee spring Chinook salmon population.

Abundance and Productivity

The following data summarizes the recent abundance and productivity assessment of the Wenatchee spring Chinook salmon population:

- The 1960-2003 Wenatchee Basin UCR adult spring Chinook abundance is estimated to have ranged from 6,718 (1966) to 51 (1995).
- The most recent 10-year (1999-2008) contribution of naturally produced adults averaged 30.4% (or about 70% hatchery fish) measured at Tumwater Dam, ranging from 10.5%-87.4%.
- The most recent 10-year (1999-2008) geometric mean of natural origin returns (for the entire population) was 650 adults and the most recent 12-year (1990-2002) geometric mean of Recruits/Spawner was 0.56 (unpublished WDFW Tumwater Dam data provided by Andrew Murdoch).

Overall run sizes are primarily composed of hatchery fish produced as mitigation for impacts from mainstem Columbia River hydroelectric projects. Natural origin run sizes have remained below 1,000 for most years since 1999, while hatchery run sizes are increasing.

Spatial Structure

Wenatchee spring Chinook consist of five major spawning areas; Chiwawa River, Nason Creek, White River, Little Wenatchee River and Upper Wenatchee mainstem. These areas are all accessible to and currently occupied by spring Chinook salmon. The minor spawning areas include; Chumstick Creek, Peshastin Creek, Icicle Creek, and Mission Creek in the lower watershed (below Tumwater Dam). These areas support few spring Chinook salmon.

Genetic Diversity and Spawner Composition

The Wenatchee Basin spring Chinook population has been partially homogenized with other UCR populations due to past hatchery practices. This was primarily due to the Grand Coulee Fish Maintenance Program of the 1940s. However, allozyme samples (1980s) and recent microsatellite data (late 1990s and early 2000s) indicate that some substructure still might appear to exist within the Wenatchee population (ICTRT 2007d; Blankenship et al. 2007; Ken Warheit pers. comm. 2008).

Spawner composition within the Wenatchee River Basin includes local and non-local stocks. Non-endemic (out-of-ESU) spawners are predominately from strays associated with the Leavenworth NFH program. Although the Leavenworth NFH program stray rates are low (<1% of the total fish returning), they are estimated to have comprised between 3%-27% of some spawning aggregates above Tumwater Dam (WDFW unpublished data). Spawners from outside the Wenatchee population, but within the Upper Columbia ESU, occur in small numbers and generally comprise less than 2% of any spawning aggregates above Tumwater Dam (WDFW unpublished data). Within-population hatchery spawners (Chiwawa stock) have comprised 56% of the spawning population above Tumwater Dam since 1993 and have routinely comprise greater than 10% of the spawning population in Nason Creek, White River, Little Wenatchee, and Upper Wenatchee mainstem in past years (Tonseth 2003; 2004). Modifications to the Chiwawa Rearing Ponds water intake in 2005 may reduce the incidence of straying by Chiwawa-origin hatchery adults; first results will be monitored in 2009.

Viability / Extinction Risk Analysis

The ICTRT developed criteria for assessment of anadromous salmonid population viability (ICTRT 2007b). In development of the Recovery Plan (UCSRB 2007), the ICTRT criteria were considered, and primarily followed. However, there were some differences, and since NMFS has accepted the Recovery Plan (72 FR 57303), those criteria should be considered when comparing the recommendations within this Implementation Plan. The population level viability guidelines are organized around four major parameters: abundance, productivity, spatial structure and diversity that define a Viable Salmonid Population (VSP).

For the Wenatchee spring Chinook population, the Recovery Plan (UCSRB 2006) calls for a 12-year geometric mean for abundance and productivity of 2,000 naturally produced spawners and at least 1.2 recruits per spawner, respectively. For spatial structure at least 5% of the total number of redds need to be within each of the five major spawning areas, or at least 20 redds per major spawning area, whichever is greater. For viability, the score of the eight metrics needs to result in a moderate category for risk in a spreadsheet developed by the ICTRT.

Based on VSP parameters and current status of the Wenatchee spring Chinook population, the population is believed to be at high risk of extinction over the next 100 years (i.e. >25% risk). The natural origin population cannot achieve any level of viability without substantial improvements in abundance and productivity (ICBTRT 2007a,b; UCSRB 2006). Because of historic practices, genetic homogenization within and among UCR spring Chinook populations was also rated as a high risk factor for spatial structure and diversity, further increasing the overall risk of extinction (ICBTRT 2007a,b)."

<u>Upper Columbia River Summer Steelhead</u>
The steelhead BRT (BRT, Busby et al. 1996) assessed the status of west coast steelhead (*O. mykiss*) from Washington, Idaho, Oregon, and California. The BRT identified 15 ESUs including the UCR summer steelhead ESU which includes all Columbia River tributaries above the Yakima River. All UCR steelhead are summer steelhead. Busby et al. 1996, citing Chapman 1994, reported pre-1960s fish counts at Rock Island Dam (1933 – 1959) averaged 2,600 – 3,700. The 1989 – 1993 natural escapement estimates were 800 for the Wenatchee River and 450 for the Methow and Okanogan rivers combined. Average total escapements for these stocks were 2,500 and 2,400, respectively. Trends in total (natural and hatchery combined) escapement between 1962 and 1993 showed a 2.6% increase. A 12% decline was reported for the Methow and Okanogan rivers combined. Nehlsen et al (1991) identified six stock in this region that were either at risk or stocks of concern. WDFW (1993) identified three stocks and characterized all as depressed.

Spawning escapement within the ESU is strongly dominated by hatchery production with estimates of recent contributions averaging 65% in the Wenatchee River and 81% in the Methow and Okanogan rivers (Busby 1996). Adult replacement ratios were 0.3:1.0 in the Wenatchee and 0.25:1.0 in the Entiat (WDFW 1993) and were believed not to be self-sustaining without continued hatchery supplementation.

Busby et al. (1996) concluded that the UCR steelhead ESU was in danger of extinction. Even though total abundance of populations within the ESU was relatively stable or increasing, it was thought to be occurring only because of major hatchery supplementation programs. The major concern of the BRT was the clear failure of natural stocks to replace themselves. In addition, the BRT was strongly concerned about problems of genetic homogenization due to hatchery supplementation within the ESU. There was also concern for high harvest rates on steelhead smolts in rainbow trout fisheries and degradation of freshwater habitats within the region.

In August 1997, NMFS listed the UCR Steelhead ESU as endangered (62 FR 43937). Subsequently, using the VSP guidelines described by McElhany (2000) an initial set of population definitions for the UCR steelhead ESU identified the Wenatchee River, the Entiat River, and the Methow River as separate populations within the ESU (Ford 2000).

More recently, the WCSBRT (2003) completed an updated status review of west coast steelhead, including the UCR steelhead ESU. The BRT found that returns of both hatchery and naturally produced steelhead in the upper Columbia River have increased in recent years. The average combined return through Priest Rapids Dam was 12,900 steelhead between 1997 and 2001. The average for the previous five years (1992-1996) was 7,800. The total returns, however, continue to be dominated by hatchery-origin fish. Although the percentage of natural-origin returns had increased to about 25% during the 1980s, the median percent of natural-origin fish between 1997-2001 was 17% (2,200 of 12,800), a slight improvement of the period between 1992 and 1996 when the percentage of natural-origin fish in the run was less than 10% (1,040 of 7,800). The five-year geometric mean natural-origin escapement for the Wenatchee and Entiat rivers for 1997-2001 was 900, well below the interim recovery goal of 3,000 (Lohn 2002). While there is an increasing growth trend of approximately 3.4% per year, the natural-origin proportion in the Wenatchee/Entiat has declined from 35% to 29%.

The WCSBRT (2003) concluded that the UCR steelhead ESU continues to be in danger of extinction based on evaluation of natural production. The most serious risk to the natural population is the low growth rate and productivity within the ESU. Although there has been an increase in naturally-produced fish in recent years, mean abundance is still only a fraction of the interim recovery goal. The ratio of naturally produced adults to combined parents escapement is still low (about 43%, Murdoch et al. 1998) and detailed information on productivity is lacking.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Table 6. Progeny-to-parent ratios for the Nason Creek spring Chinook salmon population

Nason Creek spring Chinook recruits per spawner 1981-2003. Data provided by Andrew Murdoch – WDFW. Not adjusted for harvest impacts.			
Brood year	Spawners	Recruits	Recruits/Spawner
1981	349	549	1.58
1982	370	386	1.04
1983	746	462	0.62
1984	349	387	1.11
1985	710	236	0.33
1986	318	203	0.64
1987	457	169	0.37
1988	486	304	0.63
1989	222	132	0.60
1990	231	21	0.09
1991	156	29	0.18
1992	181	34	0.19
1993	491	89	0.18
1994	60	11	0.19
1995	18	86	4.92

1996	83	167	1.99
1997	122	275	2.25
1998	64	381	5.95
1999	22	9	0.42
2000	270	312	1.16
2001	598	73	0.12
2002	603	127	0.21
2003	202	62	0.31

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.
See table below. Data are total escapement estimates based on redd counts in Nason Creek (http://wdfw.wa.gov/fish/sasi/).

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.
See table below.

Table 7. See table header.

Spring Chinook redds, total escapement and natural-origin spawn escapement in Nason Creek, 1989-2006 (unpublished data from WDFW).					
Run-Year	**Number Redds**	**Redd Expansion**	**Total Spawn Escapement**	**% Natural-origin**	**Natural-origin Spawn Escapement**
1989	98	2.27	222	100%	222
1990	103	2.24	231	100%	231
1991	67	2.33	156	100%	156
1992	81	2.24	181	100%	181
1993	223	2.2	491	56%	274
1994	27	2.24	60	77%	46
1995	7	2.51	18	100%	18
1996	33	2.53	83	67%	55
1997	55	2.22	122	38%	46
1998	29	2.21	64	81%	52
1999	8	2.77	22	100%	22
2000	100	2.44	244	76%	185
2001	367	2.31	848	39%	331
2002	294	2.05	603	51%	309
2003	83	2.43	202	82%	166
2004	159	3.46	507	56%	286
2005	186	1.8	347	19%	66
2006	152	1.78	271	41%	111
Average	***115***		***260***	***71%***	***153***

2.2.3) Hatchery activities.

Include associated monitoring and evaluation and research programs.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock Collection:

Collection of adults for hatchery propagation will result in removal of a portion of the natural spawning population. Implementation of adult collection strategies may result in delay of migration for some spawners or displacement of spawners below the collection site. Specific M&E actions (i.e. snorkeling above and below the collection site to assess extent of possible delay and PIT-tag interrogation of fish passing though the collection site) will be conducted to assess potential impacts to migration. During adult collection/monitoring activities, a portion (those fish handled) that did not originate in the target tributaries (e.g., Chiwawa River) might be removed and transported to their natal tributaries or hatchery programs for spawning. Also, adults will be handled at Tumwater during the potential reproductive study or for stock identification. Natural origin adults may also be trapped and handled/PIT tagged at Priest Rapids Dam as a component of the Parental-based broodstock trapping collection protocol currently under development and discussion/review by signatories to the HCP and Priest Rapids Settlement Agreement. Should the parental based tagging be determined as a viable option for broodstock collection, a pilot program will be conducted prior to full-scale implementation to assess potential negative impacts to migration behavior and post trapping survival associated with the parental based tagging. Impacts to listed species during adult collection/monitoring of spring Chinook will be minimized through development and implementation of NMFS, USFWS and PRCC HSC approved adult spring Chinook collection/monitoring methods/schedules, fish handling protocols, and take provisions provided by NMFS and USFWS.

Juvenile Rearing, Acclimation and Release:
Listed spring Chinook will be propagated from green egg to smolt size through this portion of the program. All freshwater juvenile life stages, up to yearling smolt, will therefore be taken. Green eggs, eyed eggs and alevins will be incubated to produce swim-up fry averaging approximately 0.45 grams each. Fry will be reared to fingerling size (1.1 – 7.0 g) through the summer months, with sub-yearlings (~15 g) produced by the fall. Yearling smolts at an average size of ~32 g will be produced by late spring. Pre-smolts will be transported to facilities on Nason Creek for acclimation prior to release.

Adult Management:
Both natural and hatchery origin spring Chinook may be handled at Tumwater Dam for purposes of managing escapement to the Nason Creek consistent with JFP identified escapement and PNI objectives. Hatchery origin Chinook may be removed from the spawning escapement throughout the spring Chinook run timing at Tumwater Dam as necessary to achieve the identified escapement and PNI objectives. Takes associated with this activity may include delayed migration, delayed mortality, and unintentional immediate mortality associated with handling. Although these takes may occur, past trapping/tagging/sampling efforts at Tumwater Dam through the on-going spring Chinook reproductive success study have not identified any immediate unintentional mortality associated with the trapping effort. Delayed mortality is difficult to assess; however the calculated pre-spawn mortality (PSM) during years of the reproductive success study are generally within the PSM ranges calculated for years prior to the initiation of the reproductive success study. Pre-spawn mortality may be affected more by abundance than by handling at Tumwater Dam as PSM is positively correlated with female abundance. Potentially, PSM may be reduced through adult management actions that reduce over-escapement.

Selective conservation harvest activities conducted in the Wenatchee Basin below Tumwater Dam may also occur during years of escapement that exceed the necessary number of hatchery origin adults to achieve the spawning and PNI objectives for this program. If harvest occurs in the terminal areas (i.e. Wenatchee River downstream of Tumwater Dam), indirect mortality of natural origin spring Chinook will occur. The fisheries will be managed not to exceed 2% mortality of natural origin spring Chinook returning to the Wenatchee River Basin. Total natural origin take will be 2% or less of the NOR, unless the projected NOR run to Tumwater Dam will meet the full natural escapement and broodstock goals for the basin.

If safety net HORs are expected to be surplus to broodstock and escapement needs (including reintroduction / restoration efforts), a selective conservation fishery in the Wenatchee River could also be utilized to reduce the HOR escapement. The JFP will develop criteria (e.g. number of excess safety net HORs, a population trend towards viability, and minimum number of NOR spring Chinook) necessary to initiate a conservation fishery.

Monitoring and evaluation activities.
Both juveniles released by the program and naturally produced fish in Nason Creek will be monitored. Also, hatchery and natural adult returns are part of the M&E program.

Take may result from adult and juvenile capture, handling, tagging, release and unintentional injury. Juvenile emigration monitoring may include up to a 0.20 encounter rate (capture) and up to 0.02 mortality rate for those encountered. Takes associated with juvenile monitoring activities will include tagging/marking, biological sampling and genetic tissue sampling. Adult spring Chinook takes associated with M&E activities may include capture/handle/release (including enumeration, origin determination, biological data collection and genetic sampling) and possibly translocation of non-Nason Creek hatchery-origin spring Chinook. No injury or mortalities are expected during the Nason Creek adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased, spawned out fish

Incidental and possible lethal take of steelhead may occur during juvenile M&E activities. This activity may supply valuable information on steelhead to resource managers.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

Table 8. Summary of eggs/fry collected from Nason Creek spring Chinook redds since 1998 (Murdoch and Hopley 2005).

Brood year	Spawning escapement (redds)	Number of redd/families collected	Number of eggs/fry collected	Number of eggs/fry transferred	Mean (SD) family size
1998	29	23	1,054	771	43 (12)
1999	8	7	235	211	30 (15)

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program

See above and Table 1 in section 14.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Take levels at the adult trapping facilities will be projected prior to the trapping season. Adjustments to collection rates will be made in season if the planned trapping schedule will result in excess collection of adults.

2.3) Long-term impacts to ESA listed populations.

Wenatchee Population Recovery

This program is consistent with the goals of Upper Columbia River Spring Chinook Salmon and Steelhead Recovery Plan (UCRSB 2006). That plan was summarized in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

"The Recovery Plan provides the following recovery objective:
"Increase the abundance of naturally produced spring Chinook and steelhead spawners within each population in the Upper Columbia ESU and Distinct Population Segment to levels considered viable. Increase the productivity (spawner:spawner ratios and smolts/redds) of naturally produced spring Chinook and steelhead within each population to levels that result in low risk of extinction. Restore the distribution of naturally produced spring Chinook and steelhead to previously occupied areas where practical and allow natural patterns of genetic and phenotypic diversity to be expressed."

The Recovery Plan provided criteria of naturally produced spring Chinook salmon to address quantitative and qualitative measurements of abundance, productivity, spatial structure, and diversity on a population basis.

Abundance and Productivity

Recovery Plan criteria require that the 12-year geometric mean for abundance and productivity of naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations must reach levels that would have less than a 5% risk of extinction over a 100-year period. At a minimum, the Upper Columbia Spring Chinook ESU will have productivity greater than 1.0 and maintain at least 4,500 naturally produced spawners distributed among the three populations.

Spatial Structure/Diversity

Specific to the Wenatchee population, the Recovery Plan states that naturally produced spring Chinook salmon spawning must be present over a 12-year period within four of the five major spawning areas in the Wenatchee subbasin (Chiwawa River, White River, Nason Creek, Little Wenatchee River, or Wenatchee River) and within one minor spawning area downstream from Tumwater Canyon (Chumstick Creek, Peshastin Creek, Icicle Creek, or Mission Creek). The minimum number of naturally produced spring Chinook redds within each major spawning area will be either 5 percent of the total number of redds within the Wenatchee subbasin or at least 20 redds within each major area, whichever is greater. The Recovery Plan does not provide a numeric goal for any of the minor spawning areas but simply states that natural origin spring Chinook salmon spawning should occur in one minor spawning area downstream from Tumwater Dam. The Recovery Plan redd distribution meets the defined criteria but does not reflect the observed redd distribution in the basin. Applying the average observed redd distribution among the five major spawning areas from 1958 to 2003 provides a distribution of spring Chinook salmon ranging from a low of 57 redds in the upper Wenatchee River, historically the smallest major spawning area, to 409 redds in the Chiwawa River which is the largest major spawning area.

In addition, specific to the Wenatchee population, the Recovery Plan states that the mean score for the three metrics of natural rates and levels of spatially mediated processes will result in a moderate or lower risk assessment for naturally produced spring Chinook and all threats for "high" risk have been addressed. The Recovery Plan further states that the score for the eight metrics of natural levels of variation will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee population and all threats for "high" risk have been addressed."

Risks

Supplementation may impose genetic and ecological risks to the natural-origin Nason Creek spring Chinook MaSa. The long-term impacts of supplementation on natural salmonid stocks are being studied in several locations. For example, a recent study of Oregon steelhead (Araki et al. 2007) has shown a reduction in the reproductive fitness of native populations due to hatchery fish after several generations of interaction.

The Independent Scientific Advisory Board (ISAB), which was formed to help make funding recommendations to the Bonneville Power Administration, produced an assessment of the risks and benefits of supplementation (ISAB 2003). Most of the recommendations of the ISAB report have been adopted by this program. Also, the ISAB review of existing literature stated "The conclusions that can be drawn from the collective body of existing empirical information relevant to supplementation is that there is credible potential for a benefit to very small wild populations and credible potential for harm at any population size."

The ISAB recommends a cautious, limited approach to the use of supplementation. Other regional fishery experts have different viewpoints. Discussions of the benefits of using hatcheries to supplement natural populations are presented in several papers (Brannon et al. 2004, Cuenco et al. 2003).

A commonly accepted definition of supplementation (RASP 1992) is: "…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." Supplementation programs have demonstrated their ability to make at least short term increases to natural production.

The Yakima/Klickitat Fisheries Project (YKFP) is a large-scale, sophisticated hatchery supplementation program targeting the Yakima River spring Chinook population that began releasing fish in 1999. It is designed to test whether artificial propagation can be used to increase natural production and harvest opportunities while limiting ecological and genetic impacts. Permanent counting and collection facilities at Roza Dam and the Chandler Bypass Juvenile Facility, production facilities at the Cle Elum Supplementation and Research Facility (CERSF) and three acclimation sites, and an experimental spawning channel (at CESRF) are project components that are operated to support supplementation monitoring and evaluation objectives.

Annual reports and peer reviewed papers are being produced that describe YKFP test procedures and results. Estimates are that complete evaluations will take from 8-30 years; however, early data is available and is being evaluated. A 2005 summary is presented in: Spring Chinook Salmon Supplementation in the Upper Yakima basin; Yakima/Klickitat Fisheries Project Overview (Pearsons et al. 2005). As described in more detail in the Overview, the program is designed to answer four basic questions. Those questions and YKFP preliminary findings are:

1) Can integrated hatchery programs be used to increase long-term natural production? The program has increased the number and distribution of adult spawners in the Yakima River. However, reproductive success and domestication experiments are showing some differences between hatchery-origin and natural-origin that may impact natural production over long periods. Most measured variables are similar, however hatchery origin fish were smaller-at-age than natural origin fish and slight changes in predation vulnerability and competitive dominance were documented.
2) Can integrated hatchery programs limit genetic impacts to non-target Chinook populations? Genetic impacts to non-target populations appear to be low because of the low stray rates of YKFP fish.
3) Can integrated hatchery programs limit ecological impacts to non-target populations? Ecological impacts to valued non-target taxa have been within program containment objectives.
4) Does supplementation increase harvest opportunities? Tribal subsistence and Yakima River sport fisheries have increased since the start of the program.

A NMFS analysis (see section 1.5) of the UCR spring Chinook population concluded that the benefits of using supplementation to recover the Nason Creek MaSa offsets the risks of long-term genetic impacts. Without supplementation, loss of fitness in this small spawning aggregation will likely occur due to both inbreeding by Nason Creek origin adults and outbreeding with other stocks. Supplementation, as demonstrated by YKFP results, can reduce the short-term threat of extinction of the Nason Creek MaSa.

2.4) Critical habitat

Identify the Action Area, Critical Habitat that lies within the Action Area, and any impacts to Critical Habitat from the proposed action.

The action area for the Wenatchee component of the Upper Columbia River Spring-run

Chinook Salmon – Nason Creek Supplementation Program is the Wenatchee River basin. NOAA (Federal Register / Vol. 70, No. 170 / Friday, September 2, 2005 / Rules and Regulations) designated the Wenatchee basin as critical habitat for the upper Columbia River Spring-run Chinook Salmon ESA and the Upper Columbia River Steelhead ESU.

Impacts to the critical habitat due to proposed program actions are being evaluated through the NEPA and facility permitting processes. Potential impacts may result from water withdrawals for acclimation site operation, pond discharges entering receiving waters, and construction of facilities.

SECTION 3. RELATIONSHIP TO OTHER MANAGEMENT OBJECTIVES

3.1) Alignment of the hatchery program with ESU-wide hatchery plans.

The UCR Salmon Recovery Plan has been completed. A link to the NMFS webpage indicating its progress is http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Index.cfm. The Upper Columbia Salmon Recovery Board directs recovery planning in the Upper Columbia Basin, with funding from the Governor's Salmon Recovery Office, Upper Columbia Region.

Recovery objectives and criteria for the proposed plan were identified by the Interior Columbia Basin Technical Recovery Team (ICBTRT) in collaboration with Upper Columbia technical committees. Local stakeholder assistance with recovery planning in the upper Columbia involves Douglas, Chelan, and Okanogan counties, state and tribal-sponsored recovery efforts, sub-basin planning, and watershed planning. The Nason Creek supplementation program is consistent with the objectives of the proposed plan (UCRSRB 2006). A listed objective is: "Continue to use artificial production to maintain critically depressed populations in a manner that is consistent with recovery and avoids extinction."

The BAMP is a consensus plan by fish co-managers for development, operation, and evaluation of anadromous salmonid hatcheries in the Columbia River upstream of the Yakima River confluence. It is designed to bolster the productivity of salmonid populations in a manner that is compatible with self-sustaining populations. Guidance for the Nason Creek supplementation program, in addition to all artificial propagation programs for spring Chinook in the upper Columbia River, is provided in the BAMP.

The Chelan and Douglas PUDs worked cooperatively with state and federal fisheries agencies and tribes to develop the first Hydro Power Habitat Conservation Plans (HCPs) for anadromous salmon and steelhead. The plans commit the two utilities to a 50-year program to ensure that their hydro projects have no net impact on mid-Columbia salmon and steelhead runs. These HCPs were completed in 2002 and agreements are now in place that address recovery of several subpopulations of the upper Columbia River spring run Chinook salmon ESU. The HGMP presented herein for the Nason Creek spring Chinook salmon spawning aggregation will be consistent with the current HCPs. An additional HGMP addresses the White River spring Chinook subpopulation, thereby completing the integration of all augmented spring Chinook salmon subpopulations within the UCR spring-run Chinook ESU. It is expected that all current recovery efforts will be consistent with the anticipated recovery plan.

The Hatchery Scientific Review Group (HSRG), as part of the Hatchery Reform Project, has completed a review of Puget Sound hatcheries and hatcheries in the Columbia River watershed (HSRG 2005; 2009). The project was conducted by an independent science team in conjunction with a Steering Committee comprised of representatives from regional agencies. The objectives were to identify principles and recommendations that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The Nason Creek Supplementation Program was not reviewed because it has not been implemented yet. However, recommendations were made about broodstock management and other factors that pertain to hatchery operations in the upper Wenatchee watershed.

Wy-Kan-Ush-Mi Wa-Kish-Wit (CRITFC 1995) was developed by the four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama). It is a comprehensive plan put forward by the Tribes to restore anadromous fishes to rivers and streams that support the historical cultural and economic practices of the tribes.

3.2) Agreements under which program operates.

The overall direction for recovery of Nason Creek spring Chinook salmon is contained in the Biological Opinion for ESA Section 7 Consultation for the Priest Rapids Hydroelectric Project (FERC No. 2114; February 1, 2008). This HGMP is designed to be consistent with and implement the direction provided in the Biological Opinion.

The Priest Rapids Project Salmon and Steelhead Settlement (SSA 2006) between Grant PUD, State and Federal Agencies and Indian Tribes describes a comprehensive and long-term adaptive management program for the protection, mitigation and enhancement of protected species, which may pass or be affected by the Priest Rapids Project. The SSA lists 40 actions that are being undertaken for the protection of spring Chinook and steelhead. These actions involve: artificial propagation, passage conditions, spill, total dissolved gases, habitat protection and improvement, avian and fish predator control, adult fishways, performance monitoring and reporting, and program funding and management. Actions 28 and 30 provide direction specifically for the Nason Creek Spring-Run Chinook Program.

In 2009, representatives of the YN and WDFW developed a draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009). "It is designed to balance the management priorities of the Yakama Nation and WDFW with the regulatory guidelines for recovery of the ESA-listed Wenatchee spring chinook population. Accordingly, it considers new information developed by the Interior Columbia Technical Recovery Team (ICTRT), the Upper Columbia River Spring Chinook Salmon and Steelhead Recovery Plan (hereafter "the Recovery Plan"), and other information sources."

The program must also be consistent with NMFS policy for artificial propagation under the ESA, fulfillment of federal treaty obligations to Native Americans, fulfillment of court approved actions developed under the auspices of United States v. Oregon, the discharge of fisheries mitigation responsibilities incurred as a result of water development authorizations, and achievement of U.S./Canada Pacific Salmon Treaty obligations. The proposed program implements part of the BAMP (1998) as developed and agreed upon by the co-managers.

3.3) Relationship to harvest objectives.

Reference any harvest plan that describes measures applied to integrate the program with harvest management.

The draft Wenatchee Basin Spring Chinook Management Implementation Plan reviews the regional harvest management guidelines:

"This plan does not affect the management, assessment, or goals of fisheries that occur outside of the Wenatchee River basin. Low numbers of Wenatchee spring Chinook are harvested in ocean and lower Columbia River fisheries. Ocean fishery impacts are regulated under authority of the Pacific Salmon Commission and the Pacific Fishery Management Council. Fisheries under these jurisdictions have been reduced in recent years in response to ESA listings. Mainstem Columbia River fisheries are regulated under a co-management framework pursuant to litigation in US v Oregon. The 2008-2017 United States v Oregon Management Agreement provides the harvest management framework for spring Chinook fisheries below McNary Dam. The harvest schedule is designed to allow some level of harvest while protecting the great majority of ESA-listed NOR adults passing through the fisheries. Allowable harvest rates are scaled to the abundance of the total run destined to pass Bonneville Dam and the abundance of NOR spring Chinook projected to enter the Snake River. The allowable harvest rates for Treaty and non-Treaty fisheries are designed to achieve a 50/50 sharing of harvestable fish in the non-selective tribal fisheries and mark-selective non-tribal fisheries in accordance with treaty fishery case law standards. Total allowable fishery impacts in combined mainstem fisheries range from <5.5% on total runs of less than 27,000 to a maximum of 17% on runs of 488,000 or more. This implementation plan does not alter the management, assessment, or goals of fisheries that occur downstream of the Wenatchee River basin.

Safety Net program fish returning to the Wenatchee River in excess of escapement and broodstock needs may be removed through selective conservation fisheries. This management strategy is intended to support recovery and build public support for salmon recovery efforts in the Wenatchee basin and other UCR watersheds. The co-managers will attempt to release safety net program fish at locations where adults can be harvested in selective and non-selective fisheries.

If safety net HORs are expected to be surplus to broodstock and escapement needs (including reintroduction / restoration efforts), a selective conservation fishery in the Wenatchee River could also be utilized to reduce the HOR escapement. The JFP will develop criteria (e.g. number of excess safety net HORs, a population trend towards viability, and minimum number of NOR spring Chinook) necessary to initiate a conservation fishery. Total natural origin take will be 2% or less of the NOR, unless the projected NOR run to Tumwater Dam will meet the full natural escapement and broodstock goals for the basin.

In addition to determining which PNI level to manage for, pre-season tributary run size estimates (forecasts) will be used to determine if 'safety net' hatchery returns are likely to be in excess of what is necessary to promote recovery of the natural population.

Pre-season forecasts will be refined using in-season updates based on counts at dams, traps, and/or other monitoring locations (e.g., PIT tag detectors). This will be important so proper planning can be made as to the disposition of the fish once they reach Tumwater Dam, and whether there should be a fishery to remove HORs."

3.4) Relationship to habitat protection and recovery strategies.

At the watershed scale, analysis such as the Washington State Conservation Commission's Limiting Factors Analysis (LFA), and technical tools including Ecosystem Diagnosis and Treatment (EDT) and SSHIAP (Salmon and Steelhead Inventory and Assessment Program) will be used to identify factors that currently impact salmon and to prioritize actions needed in the watershed. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects and livestock grazing along riparian corridors. Mainstem passage through hydroelectric projects and ocean survival conditions are major determinants of productivity for spring Chinook salmon within the ESU. The Nason Creek supplementation program and the natural spawning population in the Nason Creek will benefit from any habitat improvement affecting spawning, rearing, or migratory locations used by the population. Coordination between the Nason Creek supplementation project and numerous regional habitat and recovery planning efforts is provided via members of the PRCC who participate in concurrent regional fish and wildlife planning, especially through the Upper Columbia Salmon Recovery Board (UCSRB), FERC relicensing activities, and the ICTRT. The ICTRT has the main task of establishing biologically based viability criteria for application to ESUs of salmon and steelhead under the ESA. The ICTRT has described criteria for habitat viability and habitat usage in the context of spatial distribution and diversity of listed populations. Three HCPs have been adopted in FERC re-licensing agreements for operation of hydropower projects in the Columbia River mainstem. These HCPs have the potential to provide improved habitat and contribute the recovery of the Nason Creek and other subpopulations of spring Chinook within the Upper Columbia ESU.

The Biological Opinion established a habitat conservation account with annual funding of $288,600 to be used to finance tributary and mainstem habitat funding projects, which includes the Nason Creek. Annual habitat contributions of $807,900 are also available through the Priest Rapids Project Salmon and Steelhead Settlement Agreement (SSA 2006). Additionally, the SSA requires annual contributions to a No Net Impact (NNI) fund – an amount based on survival percentages of covered species. All three funds are administered and allocated through the PRCC. As of the end of 2008 the available habitat funds were (from the Priest Rapids Coordinating Committee Habitat Subcommittee 2008 Annual Summary):

No Net Impact Fund	$3,792,220.00
Habitat Supplemental Fund	$1,858,084.00
Habitat Fund (BiOp)	$503,564.00
Total	**$6,153,868.00**

Six fish and wildlife plans (also known as "subbasin plans") have been developed for the following "subbasins" (commonly known as watersheds): Wenatchee, Entiat, Lake Chelan, Methow, Okanogan, and the mainstem Columbia River from Rock Island Dam to the Canadian border. Subbasin plans have been submitted to the Northwest Power Planning Council (2004). These subbasin plans will identify and provide the basis for prioritizing project proposals to be submitted to the Northwest Power Planning Council in future funding cycles and will be used, potentially, for salmon recovery planning in North Central Washington.

The Upper Columbia Salmon Recovery Board Final Draft Salmon Recovery Plan (UCSRB 2006) was developed to help guide federal agencies charged with species recovery. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through the collaborative, economically sensitive efforts, combined resources, and wise resource management of the upper Columbia region. Consistency of the Nason Creek supplementation program with objectives of ESU recovery planning and Priest Rapids Project mitigation objectives will be the goal of the PRCC.

Hydro actions proposed are:

- Hydropower Strategy 1— Operate the FCRPS to provide flows and water quality to improve juvenile and adult fish survival.
- Hydropower Strategy 2— Modify Columbia and Snake River dams to maximize juvenile and adult fish survival.
- Modify Columbia and Snake River dams to achieve biological and water quality performance standards.
- Hydropower Strategy 3— Implement spill and juvenile transportation improvements at Columbia River and Snake River dams.
- Hydropower Strategy 4— Operate and maintain facilities at Corps mainstem projects to maintain biological performance.

Proposed habitat actions:

- Habitat Strategy 1—Protect and improve tributary habitat based on biological needs and prioritized actions.
- Habitat Strategy 2—Improve juvenile and adult fish survival in estuary habitat.

Proposed predation actions:

- Predation Management Strategy 1—Implement piscivorous predation control measures to increase survival of juvenile salmonids in the lower Snake and Columbia rivers.
- Predation Management Strategy 2—Implement avian predation control measure to increase survival of juvenile salmonids in the lower Snake and Columbia rivers.
- Predation Management Strategy 3—Implement marine mammal control measures to increase survival of adult salmonids at Bonneville Dam.
- As an example of the levels of benefit that may be attained through FCRPS actions,

UCR spring Chinook may see a juvenile in-river survival increase of 9.5% over current rates (NOAA Fisheries 2007).

3.5) Ecological interactions.

Please review Addendum A before completing this section. Describe salmonid and non-salmonid fishes or other species that could:

(1) negatively impact program;

Progeny of fish from captured adults will be released as yearling smolts at which time they may interact with Nason Creek natural-rearing spring Chinook or other species. What is know and unknown about ecological interactions between hatchery and natural origin fish was reviewed by Pearsons (2008). The general findings in that paper can be applied to the Nason Creek program. Competition for food may play a role in the mortality of liberated Chinook. SIWG (1984) indicated that there is a high risk that competition between hatchery-origin Chinook, and Coho, Steelhead and other Chinook stocks will have a negative impact on the productivity of the supplementation progeny fish. Predation in freshwater areas also may limit the productivity of the spring Chinook releases. In particular, predation by northern pikeminnow (SIWG 1984) and bull trout pose a high risk of significant negative impact on productivity of enhanced Chinook.

(2) be negatively impacted by program;

What is know and unknown about ecological interactions between hatchery and natural origin fish was reviewed by Pearsons (2008). The general findings in that paper can be applied to the Nason Creek program. Hatchery-reared salmon and steelhead released into spawning and rearing areas of natural species may fail to emigrate (residualize), and may negatively interact with natural fish. SIWG (1984) reported that there is a high risk that enhanced Chinook salmon populations would negatively affect the productivity of wild sockeye in freshwater and during early marine residence through predation. The risk of negative effects to wild fish posed by hatchery Chinook through competition is low or unknown in freshwater and marine areas (SIWG 1984; although see Pearsons et al. 2008 for results from the Yakima River). Large concentrations of migrating hatchery fish may attract predators (birds, fish, and seals) and consequently contribute indirectly to predation of listed wild fish (Steward and Bjornn 1990; Pearsons 2008). The presence of large numbers of hatchery fish may also alter wild salmonid behavioral patterns, potentially influencing their vulnerability and susceptibility to predation. The potential also exists for diseases such as BKD to be transferred from hatchery-reared fish to natural populations or be amplified through increased stress or salmon carcasses.

(3) positively impact program;

Increased numbers of Chinook and other salmonid species that escape to spawn in upper Columbia River tributaries may contribute nutrients to the system upon dying that would benefit spring Chinook and listed steelhead productivity.

(4) be positively impacted by program.

Spring Chinook salmon juveniles released may benefit other species in several ways:

- A mass of hatchery fish migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring wild fish (e.g., Fritts and Pearsons 2008).
- Chinook salmon eggs, fry, and smolts (natural and hatchery) will increase the availability of prey, providing increased food supply for aquatic species including steelhead and bull trout (Pearsons and Hopley 1999; Pearsons 2008). As stated in the USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project (USFWS 2007), the primary impact of the spring Chinook salmon supplementation program on bull trout "may be beneficial" due to the increased availability of prey in the form of migrating smolts (see Addendum A). Other bird, fish and mammal species may benefit in a similar way.
- Increased numbers of spring Chinook that return and are allowed to spawn naturally may contribute important ocean-derived nutrients to the system upon dying that would benefit the productivity of other listed salmonid species (Quinn 2005). Juvenile steelhead, for example, congregate in areas where salmon carcasses are deposited and they show an increase in condition factor (Bilby et al. 1998).
- Increased numbers of spring Chinook salmon that return and are allowed to spawn naturally reduce the short-term genetic extinction risks to the Nason Creek MaSa associated with both inbreeding by Nason Creek origin adults and outbreeding with other stocks.
- Indirect positive impacts include strengthened justification for developing regional habitat conservation measures protecting all fish species.

SECTION 4. WATER SOURCE

4.1) Description of the water source.

Alternative facility locations, designs, and water supply systems are currently being evaluated. An adult holding, egg incubation, rearing, and acclimation facility option is proposed at the Boyce/Youngsman property on Nason Creek. Water will be pumped from Nason Creek and wells will supply tempering water that will be injected over the river intake screens to allow reliable winter operation. Specific flow requirements for rearing and acclimation facilities are discussed in section 9.2.2, Rearing Criteria.

General water quality guidelines will apply to the evaluation of all water supplies under investigation. The availability of pathogen free ground water is important for fish health during early rearing and surface water helps match natural growth profiles during extended rearing. Both supplies should be of appropriate quantity and quality. Parameters to consider when evaluating the water rearing environment include turbidity, dissolved gases, heavy metals, hardness, pH, and the potential for contamination. Very high turbidity levels (above 100,000 ppm) may cause problems such as gill irritation for fry; reduced growth rates when fish visibility is limited; and silt removal problems (low and moderate turbidity levels are not detrimental and may reduce stress). Air super-saturation, high dissolved carbon dioxide/low oxygen levels in groundwater (assumed for all supplies and easily corrected), and the presence of dissolved hydrogen sulfide are potential gas issues. Heavy metals are generally introduced to water through improper facility construction; however, natural supplies can also contain them. Sensitivity of fish to toxic pollutants, including metals, increases at low alkalinity. Chemical spills from truck accidents, agricultural pesticides, and herbicide applications are other sources of water supply contamination. Suggested upper limits for many of quality parameters are listed in Piper (1982) and in the Alaska Fish Culture Manual (ADFG 1986). Due to the interactive aspects of chemical reactions in water, developing specific criteria is difficult. Most water supplies have some values outside the published limits, yet Chinook are successfully reared in a variety of conditions throughout the Northwest. The standards can be used as general guidelines, but quality determinations will not be made until testing with live fish is completed.

4.2) Risk aversion measures used to minimize the take of listed fish.

Water supply risk aversion measures will include:

- Intake structures that meet NMFS screening criteria (NMFS 1996).
- Automatic alarm systems with sensors at the intake, incubators, and rearing units.
- Daily monitoring of water temperatures and reporting of any unusual fish behavior or culture incidents to hatchery supervisors.
- Backup power for pumped water supply systems, predator exclusion.
- Emergency release capabilities for cases of loss of water and flooding.

SECTION 5. FACILITIES

As directed by the Biological Opinion for Operations for the Priest Rapids Hydroelectric Project (NOAA Fisheries 2008), facilities will be capable of meeting the programmed production objectives. Many of the program facilities needed to produce 275,000 smolts (250,000 for release plus 10%) for the program have not yet been completely designed or built. Draft design objectives have been developed and will be used to guide technology selection, site location, and construction (where needed) of the facilities.

The different program components that require facilities are: brood capture, brood holding, rearing, and acclimation. The general design preference is to combine as many life-stages as possible into a single location. However, due to their differing requirements and the availability of water, several separate facilities might be needed.

Objectives common to all the components that will be used during siting and design are as follows:
Low Environmental Impact - the potential environmental impacts of proposed facilities will be reviewed in detail during the NEPA, SEPA, ESA, and site permitting processes and will be considered during siting and design. Impacts may occur to plant and animal species in the air, water and land. Surface water withdrawals will impact streams for the distance between the removal and the return. Groundwater use can affect users within the area of influence of wells and infiltration galleries. Other environmental and permit considerations include local land use zoning codes, aesthetics, flood impacts, cultural resources, receiving water quality standards, and wetlands impacts.

Flexibility – allowing program managers the option of making future changes to the fish culture program in response to the adaptive management process will be considered during location and design.

Low Failure Risk – surface water supplies will need to function reliably in all river conditions, including icing, high flow, low flow, and during times when debris loads are heavy. Surface and ground water pumps, where needed, must have generator back up and alarm systems.

Functionality – land availability, utilities, and access are other site considerations.

Studies discussed in the following sections demonstrate the impact of facilities and culturing practices on survival rates. The general importance of the rearing environment is apparent when comparing the high adult return rates of genetically similar fish reared in the wild against those reared in hatcheries. Culturing conditions are proposed for the Nason Creek supplementation project that attempt to produce smolts with "wild" characteristics.

The table below summarizes the approximate facility water and space needs for the 250,000 smolt Nason Creek program (plus 10%). The calculations assume that all White and Nason broodstock are held at one location, one option that is being considered. They also assume that surface and ground water temperatures at all facilities are typical of those found in the area and that Nason fish are reared up to November before being moved to overwinter acclimation sites. The flow calculations do not include safety factors, they are minimums and are based on the criteria shown in section 9.2.2. The values should be increased by factors that depend on the reliability of the water flow systems that are used. The space calculations are based on criteria for progeny of 100% high-BKD parents. Space requirements for acclimating progeny of low- BKD parents is considerably lower at 24,445 cf.

Table 9. Flow and space targets for different life-stages that will be part of the Nason Creek hatchery production based on assumed egg incubation of 339,500 eggs (~81.0% unfertilized egg-to-release survival) from 86 females (~90% transfer-to-spawning survival and 4,400 eggs/female) and 91 males (~85% transfer-to-spawning survival and 1-to-1 spawn ratio) held in 8 cf/fish with a flow of 1 gpm/fish, transfer of 289,475 fish (~95% transfer-to-release survival) from rearing at 25 fpp (~5.13 in), and acclimation release of up to 275,000 fish at 15 fpp (6.08 in).

	Peak Minimum Flow (cfs)	*Water Type*	*Peak Minimum Space (cf)*
Nason Creek portion of broodholding/incubation	0.39	Ground / Treated Surface	1,416
Rearing, low BKD (FI=0.75, DI=0.125)	6.7	Ground / Treated Surface	18,057
Rearing, high BKD (FI=0.60, DI=0.060)	8.4	Ground / Treated Surface	37,619
Final acclimation/release (FI=0.60, DI=0.060)	11.2	Surface	50,256

5.1) Broodstock collection methods.

A brood collection strategy utilizing parental based tagging is proposed by the co-managers (see section 7.3) but this method has not been approved by the HSC yet. Returning adults are trapped, PIT tagged, genetically sampled, and released at Priest Rapids Dam. While migrating to the Wenatchee basin, the genetic samples will be processed and used to determine the spawning area of origin. Adults will be re-trapped at Tumwater dam, where decisions about brood management will occur. The draft Wenatchee Basin Spring Chinook Management Implementation Plan provides facility details:

Off-Ladder Adult Fish Trap Operations

We [WDFW and YN] propose to test the feasibility of the parental based tagging - broodstock collection protocol in 2010 by running the Priest Rapids Dam (PRD) Off-Ladder Adult Fish Trap for two or three 1-3 day periods to verify the following assumptions:

- Continuous operation of the Off-Ladder Adult Fish Trap on the left bank fishway will not change the proportion of the spring Chinook run using the LB fishway; this will be determined by comparing the relative percentages of ladder use during Off-Ladder Adult Fish Trap test periods with those between test periods. The test is considered successful if LB ladder use remains at 85% or higher during continuous operation of the Off-Ladder Adult Fish Trap.

- Approximately 60% of the fish passing PRD are destined for the Wenatchee River based on relative PIT tag detections between RRD and RIS.
- The "conversion rate" of PIT-tagged Wenatchee adult spring Chinook from PRD to Tumwater Dam is at least 90%.
- Very few or no fish will arrive at Tumwater Dam in less than 10 days.

Tumwater Operations.

Parental assignment rates.

For parental based tagging to be used successfully to manage Wenatchee Basin spring Chinook, we [WDFW and YN] need to ensure that we can:

- Determine the MaSA of origin at Tumwater Dam to meet the escapement and spatial distribution objectives, and
- Estimate the proportion of fish we are able to ID to enable brood collection at a given extraction rate per MaSA to avoid over-extraction in any sub-population.

An exercise was developed to give us an understanding of how this could be accomplished. This exercise used the following steps:

- Based on PIT-tagged spring Chinook conversion rates from 2008, approximately 83.3% of Wenatchee natural origin spring Chinook sampled at PRD are expected to arrive at Tumwater Dam.
- Of the sampled fish arriving at Tumwater Dam we predict a 90% assignment success to at least one parent using a 15-allele database (Ken Warheit [WDFW] and Michael Ford [NMFS] pers. comms.).
- Through a combination of existing remote PIT tag detection antenna arrays within each of the tributaries (Nason Creek, Chiwawa River, White River, and Little Wenatchee River), and detections of individual spawners during spawning ground surveys, we [WDFW and YN] anticipate that up to 80% of the parental generation will be identified to stream of origin. At this time we cannot detect released PIT-tagged spawners in the upper mainstem Wenatchee River. This MaSA constitutes a small percentage of the whole population and are predominantly hatchery origin fish.

Based on these rates, we [WDFW and YN] anticipate that the stream of origin (MaSA) can be identified for up to 61% of the total run of NOR adult progeny returning to Tumwater Dam. Actual rates will likely vary annually. Unidentified NORs will be released to continue upstream.

Escapement Management at Tumwater Dam

Escapement goals will be developed annually based upon the pre-season run forecast and appropriate PNI level. In-season adjustments to the Escapement Goal and/or target PNI may be necessary. A minimum escapement of 500 above Tumwater Dam will be targetted, of which at least half should be NORs – 769 when pre-spawn mortality is factored in. PNI is a running mean, although in any year 0.50 would be a floor target, and ideally would be 0.67 or higher. If the wild run size is extremely low, PNI would be what it ends up being after 769 fish are passed to meet the minimum escapement.

We [WDFW and YN] plan to manage escapement past Tumwater Dam in a similar manner as we plan to manage pNOB within the broodstock; through a combination of weekly escapement goals to be filled with NORs and then back filled with HORs as appropriate to achieve PNI targets.

1. Based on forecasted run size, a target PNI level will be chosen. Based on the target PNI level, weekly escapement goals will be developed. In-season check-ins will be used to ensure that the selected PNI level is appropriate.
2. All NORs not collected for broodstock will be passed upstream of Tumwater Dam.
3. Weekly escapement goals based on PNI targets will be used to determine how many HORs to pass upstream of Tumwater (HOR = Weekly Escapement Goal – NOS).
4. Starting with week one, passed NORs will count towards the weekly escapement goal. Any deficit in meeting the goal will be collected the following week.
5. The escapement deficit will be made up the following week with HORs or NORs (if available in excess of weekly escapement goal while maintaining the target extraction rate for broodstock). The deficit will accrue if not filled.
6. To prevent overseeding of any particular MSA, known MSA NOR fish passed above Tumwater will be counted towards that particular MSA. Unknown MSA NOR fish passed upstream of Tumwater will be counted towards each MSA proportionately to the mean spawning distribution for the brood years representing 3, 4, and 5 year old NORs.
7. While working within the weekly escapement goals, the numbers of HORs from each program which are passed upstream will be dependent upon the escapement goal for the MSA and the number of NORs for each MSA that have been passed.
8. If NOR fish have been passed in excess of weekly escapement goals, use the cumulative escapement distribution to determine when and how many HOR fish may need to be passed at a later date."

The WDFW and YN have identified the parental-based tagging strategy as their preferred approach for collectively managing the production components within the Wenatchee Basin but also propose that other alternative strategies such as a floating fish weir low in the Nason Creek basin.

5.2) Fish transportation equipment.

Adults – Adults will be transported from trapping facilities to adult holding facilities. Transport tanks will be designed for adult transfer and will operate within criteria provided by fish health and fish culture professionals.

Eggs and fry – Eyed eggs are transported in small buckets or custom-designed cylindrical tubes resting on insulating material over ice within a cooler.

Juveniles – Fingerling or pre-smolt spring Chinook will be transported from the Nason Creek rearing location to acclimation/release ponds on the Nason Creek. Fish will be transported in tanks designed for juvenile fish transport unless fish can be transported in less intrusive ways (e.g., pumping). Hauling protocols of trucked fish will include tempering of water temperature differences between the tanker truck water and the receiving water (no greater than 3º F/hr). Density, sodium (0.5%), loadings, temperature, and dissolved oxygen criteria will be defined prior to transport and monitored during the transfer.

5.3) Broodstock holding and spawning facilities.

Design criteria will require approximately 8 to 10 cubic feet of volume per adult with a water flow of approximately two gallons per minute per adult. Surface and groundwater will be supplied to the holding ponds in a manner that will facilitate maintenance of adult holding temperature below 55^{0}F. Some recirculation of water may be necessary to keep the entire program at one location. Design will facilitate crowding and sorting of fish by gender, ripeness, etc. Spawning will occur at a dedicated bio-processing area adjacent to the adult holding facilities. The area will be supplied with water, concrete slab flooring with wash down drain, buckets, troughs, and laboratory supplies to support fish health sampling and fertilization.

Locations that will accommodate both White River and Nason Creek broodstock are being evaluated for this facility, such as the Boyce/Youngsman property. Sites in the Wenatchee basin which are relatively close to the adult traps are being given priority in order to reduce logistical complexity and adult stress. Incubation of eggs to the eyed stage is a program function that may be included at such a facility.

5.4) Incubation facilities.

Future incubation facilities will likely use vertical stack incubators and may include chilling capability. Iso-buckets temporarily installed in shallow troughs may also be used during early incubation while viral and disease screening is completed.

5.5) Rearing facilities.

Objectives for either locating existing hatcheries with excess capacity or constructing a new facility include:

- <u>High Quality Fish</u>
    - Water Quality – see section 4.1. Ground water is preferred for early rearing, but surface water may be beneficial in providing similar physiologies as natural origin fish.
    - Rearing Criteria – this highly valuable stock will be reared using low volume density, which is critical for Chinook salmon, and high flow volume criteria (see sections 9.2.2).

- Rearing Environment – large scale experiments with spring Chinook at the Cle Elum Supplementation and Research Hatchery have not demonstrated advantages in survival due to the use of some rearing strategies. Painted walls, floating covers, and subsurface feed introduction did not substantially improve adult survivals when compared with standard raceways (BPA 2005). Rearing criteria and water conditions will be more important factors in designing the rearing environment than these strategies.
- Fish Health – the susceptibility of Chinook to BKD will be a critical program design consideration. Rearing systems, water quality, and site locations that can minimize disease effects will be used.

- Flexibility – an example of design flexibility is having enough of both ground and surface water available to operate the rearing program, allowing combinations of water supplies to be used.
- Low Failure Risk – rearing sites must capable of managing power failures, snow and ice accumulation, as well as flood risks.
- Functionality – designs need to incorporate the fish culture procedures required at hatcheries. Rearing units are frequently cleaned and must accommodate effective feeding practices, disease treatments when needed, vaccination, tagging, and the removal of fish to acclimation sites. Outdoor rearing units need to be fenced and covered with bird exclusion wiring to reduce predation. Shade cloth will be incorporated where summer temperatures and general stress levels need to be reduced.

5.6) Acclimation/release facilities.

Objectives used to determine the location and design of acclimation sites are as follows:

- High Adult Return Rates
  - Methods that have been shown to produce smolts with improved survival rates involve natural rearing conditions. An important environmental component for acclimation is surface water. The cold winter and warming spring temperatures of surface water encourage smoltification (Appleby et al. 2002) and produces fish that are motivated to migrate quickly. Also, acclimation sites with surface water will allow a more natural growth profile to be followed (see section 10.1).
  - Chinook smolt-to-adult survival rates increase when rearing occurs at low volume densities (Ewing et al. 1995). A study using raceways showed a 4x increase in survival when comparing Chinook reared at 1 lb/ft^3 vs. 3 lbs/ft^3 (Banks 1994), although there was not a significant difference in survival rates at flows that varied between 200 gallons per minute (gpm) and 600 gpm per raceway. Sites that have room to allow large, low density rearing units will have priority.
  - A third method of improving smolt survival is overwintering at the release site. Paired releases of summer Chinook salmon in the Mid-Columbia (Wenatchee, Methow, and Similkameen) have shown significantly higher smolt to adult return rates for fish acclimated on river water for 7 months over those acclimated for 2 months. Over the five year study, the overwinter acclimation period typically resulted in a 200% increase in SARS (A. Murdoch unpublished data).
  - Hauling has a negative impact on fish and on smolts in particular. However, the most stressful event in the trucking process is loading (Maule et al. 1988) so

trucking distances are not the major contributor to negative impacts. Acclimation (and rearing) systems should minimize the number of times fish are hauled.
    - Studies have shown a survival benefit of rearing in ponds when compared to raceways, as demonstrated for Coho (Fuss 2002), cutthroat (Tipping 2001), and spring Chinook (Beckman 1999).
- Low Environmental Impact – current National Pollution Discharge Elimination System (NPDES) policy allows the administering agency, Washington Department of Ecology (WDOE), to waive the requirement for a discharge permit if production gains at a specific site are less than 20,000 pounds per year or food fed is less than 5,000 lbs per month and if impacts are considered minor. The upstream acclimation sites will be well under these limits. However, WDOE is concerned with the cumulative impact of multiple acclimation sites in the region. Permits may be required in the future, which at a minimum may involve water quality monitoring. It is also possible that waste treatment procedures may have to be implemented. Also, where possible, the acclimation sites will be environmentally beneficial. Natural acclimation ponds and habitat restoration on land that is purchased for acclimation can benefit a variety of species. Sites will be designed so that when acclimation is no longer being conducted, they can be restored to a natural condition.
- Low Stray Rates – fish that migrate in their natal stream for long distances stray less than fish that move short distances (Garcia et al. 2004). Release locations should then be as far upstream as practical. Acclimation on surface water will also help imprint smolts to unique Nason Creek water characteristics.
- Flexibility – release locations, release numbers, and acclimation technology may change in the future. Systems that can adapt to these changes are preferred.
- Functionality – sites need to be accessible by truck for fish delivery.

Several methods are possible for final acclimation/release. Direct truck planting of smolts has been rejected because of low survival rates and the potential for high stray rates (Johnson et al. 1990 and Labelle 1992).

Current plans are for a long-term acclimation facility at the Grant PUD owned, Boyce/Youngsman property on Nason Creek. Planning and site evaluations for design and construction are advancing but facilities are not yet constructed. Conceptual plans for this site include naturalized ponds that will be used to rear and acclimate fish on surface water from November through May of each year.

5.7) Difficulties or disasters.

No disasters or major operational difficulties have occurred to date.

5.8) Back-up systems and risk aversion measures.

The proposed Nason Creek hatchery and acclimation facilities will be protected by at least the following:

- All sites with water pumps will have backup generators and alarm systems to assure continued electrical power in the event of power service failure.

- All water supplies and rearing vessels will have alarms for water flow and water level.
- Protocols will be in place to test standby generators and all alarm systems on a routine basis.
- All facilities will be staffed during operation to provide for protection of fish from vandalism and predation, and allowing for a rapid response in the event of power loss, water loss, or freezing.
- Fish collection facilities will be staffed as required during operations to ensure effective operation, safe capture and holding of fish, and to prevent poaching.
- Adult holding, incubation, and rearing facilities may be sited in areas that have low flood risk.
- All groups will be reared at minimum pond loading densities to minimize the risk of loss due to disease and to maximize survival.
- All hatchery staff responsible for collection and propagation will be trained in proper fish handling, transport, rearing, biological sampling, and accepted fish health maintenance procedures to minimize the risk of fish loss due to human error.
- All fish will be handled, transported and propagated in accordance with WDFW Fish Health Manual (1996), Co-Managers Salmonid Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (PHFHPC 1989) model program.
- Hatchery effluent will conform to conditions of the National Pollutant Discharge Elimination System (NPDES) permit.
- Water supply systems will be redundant where possible. Dual pumps and generators will be installed.
- Water intake systems will be screened according to NMFS and WDFW standards to prevent mortality from impingement or removal of listed species from the natural habitat.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source.

Eggs were collected during 1998 and 1999 by pumping redds built by naturally spawning adults in Nason Creek. In the future (see section 1.13, Project Schedule), broodstock will be a combination of hatchery and natural Nason Creek origin adults unless sufficient numbers of natural origin fish are available.

6.2) Supporting information.

6.2.1) History.

The broodstock source for this program is the spawning aggregate of the UCR spring-run Chinook salmon ESU spawning in Nason Creek, and tributary to the Wenatchee River (WRIA #45). The Nason Creek population segment as well as all other population segments within the ESU are endangered and at risk of extinction.

6.2.2) Annual size.

See section 2.2.2. Approximately 132 adults (66 females) are required to support a 250,000 smolt program, based on the latest life stage survival averages under culture. A 10% contingency add-on would require 145 adults.

6.2.3) Genetic or ecological differences.

There are no known genetic or ecological differences between the hatchery and natural components of the Nason Creek natural spawning aggregation. As of June, 2009, there has been no known natural spawning of adult returns generated by the captive broodstock program. The M&E program will assess any changes to the natural population subsequent to the return of adults from the captive broodstock program. The program is designed to retain genetic and ecological traits of the listed target populations.

The Chiwawa hatchery stock, which strays into the Nason Creek watershed, may have significant allele frequency differences from the Nason Creek MaSa (see section 2.2). There may also be phenotypic differences between Chiwawa hatchery and Nason Creek natural origin brood but comparisons have not yet been made. Chiwawa hatchery and natural origin adults differ in average age, average size, sex ratio, spawning distribution, and fecundity (Hillman et al. 2009).

6.2.4) Reasons for choosing.

Broodstock will be selected to prevent extinction of the Nason Creek spawning aggregation and to conserve the spatial structure and diversity of spring Chinook subpopulations within the Wenatchee River.

SECTION 7. ADULT MANAGEMENT

7.1) Objectives.

Adult management strategies are proposed in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009). Fundamental elements of the proposed management to attain spawning escapement and promote local adaptation relating to abundance and diversity are listed below:

a. Proportionate Natural Influence (PNI): Hatchery fish will be managed at Tumwater Dam according to the sliding scale as shown in the table below. PNI goals are based on the natural origin spring Chinook run size expected. (Percentiles are of run returns observed between 1989 and 2008).

Table 10. Sliding scale that is proposed to manage hatchery fish.

Percentile	NOR Run Size		PNI
	Nason	Wenatchee River	
>75th	>350	>910	≥ 0.80
50% - 75%	259-349	631-909	≥ 0.67
25% - 50%	176-258	525-630	≥ 0.50
10%-25%	80-175	400-524	≥ 0.40
<10th	<80	<400	Any PNI

b. Minimum spawning escapement: At least 500 effective spawners above Tumwater Dam of which half should be natural origin spawners after an assumed average pre-spawn mortality of 35% (at least 769 adults passed above Tumwater Dam).

c. Abundance Objective: Manage for a maximum run escapement passed at Tumwater Dam of 1,748 and a maximum spawning escapement of 1,569 to achieve sufficient seeding based on current habitat availability. NOR escapement will be unrestricted. The table below shows the interim Wenatchee River Basin spring Chinook escapement targets at Tumwater Dam. All values are for natural and hatchery origin fish are combined. Escapement of natural origin fish will be unrestricted at all run sizes.

Table 11. Target maximum spawning escapement and run escapement.

Spawning Area or Mitigation Program	Max. Spawning Escapement Target	Max. Run Escapement at Tumwater Dam [a]
Nason Creek	352	500
Escapement Goal Upstream of Tumwater Dam	**1,569**	**1,748**

[a] NOR escapement will be unrestricted. In some years total escapement will be lower that the listed value so that PNI targets can be achieved. As natural origin run sizes increase pHOS will

approach 0.00. Maximum run escapement at Tumwater Dam is higher than the spawning escapement to allow for pre-spawn mortality (adjusted up to 35%).

As a result of habitat evaluations, feedback from the M&E program, and due to the evolving nature of the science of salmon recovery, adaptive management will play an important role in guiding the implementation of the program and the management of adult returns in the future. The program is structured to allow adaptive management principles to direct supplementation strategies.

7.2) Disposition of surplus hatchery-origin fish.

As discussed in the Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009), a combination of harvest and removal at Tumwater Dam may be used to prevent over-escapement of HOR. If a Nason Creek weir is built it could also be used to remove excess hatchery fish if too many fish (e.g., 1,750) have been passed upstream of Tumwater Dam, or for M&E. Options include:

Reintroductions Into Minor Spawning Areas

Low numbers of excess hatchery adults that arrive at Dryden or Tumwater Dams may be translocated to lower Wenatchee River tributaries to facilitate restoration of spring Chinook use of these Minor Spawning Areas. Excess hatchery fish could be transported to Peshastin Creek, Mission Creek, Chumstick Creek and/or other newly-opened or created habitats to complement on-going habitat restoration activities.

Harvest

Harvest may be used as a tool to remove excess HORs, however, the estimated total NOR run size will need to be considered, and take should not exceed 2% of the NOR, unless the projected NOR run to Tumwater Dam will meet the full natural escapement and broodstock need of about 2,145 adults.

If safety net HORs are expected to be surplus to broodstock and escapement needs (including reintroduction / restoration efforts), a selective conservation fishery in the Wenatchee River could also be utilized to reduce the HOR escapement. The JFP will develop criteria (e.g. number of excess safety net HORs, a population trend towards viability, and minimum number of NOR spring Chinook) necessary to initiate a conservation fishery.

Removal at Tumwater Dam

Manual removals of excess hatchery origin fish at Tumwater Dam will be the third priority after minor spawning areas recovery and harvest in conservation fisheries. Fish removed at Tumwater Dam could be distributed to worthy publics or used for nutrient enhancement in tributaries. The need for nutrient enhancement was identified in the Upper Columbia Salmon Recovery Plan (UCSRB 2006) and in the UCTRT Biological Strategy (Appendix H to the Recovery Plan). We [WDFW and YN] suggest that fish of good condition surplused in the first half of the run be distributed for human consumption, while fish in the second half of the run be used for nutrient enrichment."

7.3) Broodstock collection.

7.3.1) Life-history stage to be collected.

The program will use adults captured that are destined to return to Nason Creek.

7.3.2) Collection or sampling design.

Broodstock collection goals for the adult-based supplementation program are proposed in the draft Wenatchee Basin Spring Chinook Management Implementation Plan. They were developed "based on the intended outcome of the release group (conservation or safety net), average fecundity, egg-to-smolt survival, and an assumed equal sex ratio. Initially statistics from the Chiwawa Program (4,785 eggs and 0.8187 egg-to-smolt survival) were applied to all three programs. In future years, if differences are observed for the program, values unique to each major spawning area will be applied to determine broodstock needs.

It is the intent to collect broodstock in a manner that achieves mitigation program needs for each program component and contributes to an increased PNI. We [WDFW and YN] propose to collect natural origin fish for broodstock using an extraction rate of up to 33%. In years when pNOB is 1.0 the actual extraction rate will be lower than 33%. Further, in years of small returns, NOR adults from the Nason and Chiwawa programs may be pooled in a composite broodstock if necessary to meet program goals."

Based on the current fecundity and egg to smolt survival data, a total of 132 adults are required to produce 250,000 smolts. The 10% additional production capacity and assumptions about adult holding mortality would require that the capability of collecting, holding, and spawning of approximately 160 adults be developed.

Broodstock collection methods are also proposed in the draft Implementation Plan but these methods have not been approved by the HSC yet: "we propose to manage the Wenatchee spring Chinook population to meet both mitigation and recovery objectives through parental based tagging (PBT). In general, all unmarked fish captured at the Priest Rapids Dam off-ladder adult fish trap will be genetically sampled and a PIT tag will be inserted into the dorsal-sinus cavity. Genetic samples will then be sent to the WDFW genetics lab in Olympia, where the samples will be given high priority for processing. Within 10 days, the results from the genetic samples will be available for managers in the Wenatchee basin. Based on the genetic sampling, we will then be able to partition spring Chinook at Tumwater Dam into the spawning aggregates based on their PIT tags, for either inclusion into broodstock, or for release upstream of Tumwater Dam. Hatchery fish in excess to broodstock and escapement needs will be removed through conservation fisheries and/or at Tumwater Dam." Other approaches to broodstock collection such as microarrays, micro elements, and multivariate techniques will also be explored.

7.3.3) Identity.

Adults will be collected only from their natal streams or, if feasible, at mainstem

Wenatchee facilities (Tumwater Dam) if individual adults can be identified by tributary of origin. Stray hatchery fish may be segregated from the broodstock.

7.4) Proposed number to be collected.

7.4.1) Program goal.

Approximately 160 adults will be collected. Ratios of natural to hatchery origin adults will be dependent upon PNI objectives.

7.4.2) Past broodstock collection levels.

This supplementation program has not started, so no broodstock has been collected yet.

7.5) Fish transportation and holding.

Facilities and transportation equipment will be designed and constructed to meet the following operating guidelines:

- Haul all adults in 0.5 to 0.6% salt, regardless of duration of haul.
- Haul all adults at loadings no greater than 4.5ft^3 per fish or 34 gallons per fish.
- Haul all adults in 10 ppm MS-222.
- Haul from trap site at least daily but 2x-3x per day or more, as necessary.
- Facilities for adult holding are described in section 5.3 above.

7.6) Fish health maintenance and sanitation.

Fish health management for adults is expected to follow guidance provided by Rogers, Brunson, and Evered (2002):

- Remove adults from elevated water temperatures as soon as possible to a pathogen free water source if available.
- Initiate formalin treatments for control of external parasites and/or fungus as listed on label, Investigational New Animal Drug (INAD) permit or through veterinary prescription. Treatments should be no less than three times per week, but may be daily based on recommendation of attending fish pathologist.
- Inject all fish, or at least all females, intraperitoneally with antibiotic within two weeks of collection or at time of first sorting of adults as recommended by the attending fish pathologist using the following guidelines.
  - If needed, repeat injections shall be administered no less than 20 days and no more than 30 days apart to all females.
  - Inject with not less than 15mg/kg of ERYTHRO-200 or equivalent.
  - Do not inject less than 14 days prior to spawn.
- Do not exceed holding parameters greater than 1gpm/adult and 8ft^3/adult.

Sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (1998), PNFHPC (1989), and IHOT (1993) guidelines.

7.7) Disposition of carcasses.

Carcasses will be disposed of following standard protocols which may include distribution into Nason Creek or other suitable locations in need of nutrient restoration.

7.8) Risk aversion measures used to minimize adverse effects to listed fish.

Risk aversion measures include (see details above):

- Collect known Nason Creek origin broodstock.
- Follow developed spawning ground and hatchery broodstock composition guidelines.
- Use broodstock collection procedures that minimize impacts to listed fish.
- Follow adult transportation, holding, and fish health maintenance guidelines.
- Stock carcasses in a form and way to minimize disease risks (e.g., heat carcasses to kill pathogens).

SECTION 8. MATING

8.1) Selection method.
Broodstock will be collected randomly within a collection period but the number collected during any period will be proportional to the numerical abundance of the run at large at that point in time.

8.2) Males.
Specific spawning protocols for adult-based supplementation may be developed that are similar to those currently in use for other spring Chinook salmon recovery and mitigation programs. They include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes in the ratio they occur in the natural-origin population.

8.3) Fertilization.
Specific spawning protocols for adult-based supplementation may be developed that are similar to those currently in use for other spring Chinook salmon recovery and mitigation programs. They include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes in the ratio they occur in the natural-origin population.

8.4) Cryopreserved gametes.
None.

8.5) Risk aversion measures used to minimize adverse effects to listed fish.
The greatest source of genetic risk is loss of within-population genetic variation. Current protocols in use for other spring Chinook salmon recovery and mitigation programs proposed to help conserve genetic variation include 1:1 male to female ratios, individual matings, factorial matings, and inclusion of all age classes (jacks).

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

9.1.1) Number of eggs taken and survival rates.
Data not available.

9.1.2) Disposition of surplus eggs.
Program goals are designed to avoid surplus eggs by estimating the required number of females required for the program. In the event surplus eggs exist, the PRCC HSC will make a decision as to the best use of the surplus eggs. Possible actions include placement of egg incubation boxes in Nason Creek and direct planting of unfed fry, fed fry, fingerlings, pre-smolts or smolts into Nason Creek.

9.1.3) Loading densities.
Each tray of a vertical incubator is populated with eggs from one female. Density per tray has ranged from 183 to 1,529 eggs collected from one or more natural redds. Average tray loadings for F2 progeny of captive broodstock has ranged up to approximately 1,600 eggs over three years. Vertical style incubators are arranged in half stacks (eight trays) and receive 5 gpm of water flow each, or in full stacks.

9.1.4) Incubation conditions.
Incubation at new rearing facilities will be done in pathogen free water. The ability to heat and chill that water will help adjust growth profiles to meet program goals.

9.1.5) Ponding.
Button-up fry will be placed into first feeding rearing units when yolk is approximately 95-100% absorbed. This is done with a visual check of a dozen fry.

9.1.6) Fish health.
Eggs in vertical incubators will be treated periodically with formalin to control fungus. Splash barriers are placed between incubation stacks. Vertical incubator trays are generally left undisturbed. Any mortality is removed by picking individual eggs at the eyed stage after shocking.

During the spawning process, organ tissue from each female is sampled by a fish health expert to screen for pathogens, especially BKD. Ovarian fluid is also sampled and submitted to USFWS or WDFW fish health laboratories for viral screening. Once fertilized, all eggs are water hardened in an iodophore solution to minimize transfer of disease organisms.

Additionally, sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (WDFW 1996), PNFHPC (1989), and IHOT (1993) guidelines.

9.1.7) Risk aversion measures used to minimize adverse effects to listed fish.

Eggs will be incubated in pathogen-free well water at all times. Eggs are left undisturbed to maximize survival. Fungus is controlled with periodic formalin treatment. The water source will be equipped with alarms and the power supply is protected by back-up generators.

9.2) Rearing.

9.2.1) Survival rates.

Survival rates are not available because the program has not started yet. See program objectives for survival goals.

9.2.2) Rearing criteria.

Table 12. Density and loading indices used for design and development of rearing and acclimation facilities.

REARING CRITERIA		
Volume Density	lbs/ft^3 (15fpp)	lbs/ft^3/inch (DI)
Hatchery Rearing, Low BKD	0.7	0.125
Hatchery Rearing, High BKD	0.3	0.060
Acclimation		
Flow Density	lbs/gpm (15fpp)	lbs/gpm/inch (FI)
Hatchery Rearing, Low BKD	4.0	0.75
Hatchery Rearing, High BKD	3.2	0.60
Acclimation, Low BKD	4.0	0.75
Acclimation, High BKD	3.2	0.60

9.2.3) Growth information.

Growth rates are not available because the program has not started yet. See program objectives for size-at-release goals. The HSC will also adaptively manage the Nason Creek supplementation program to produce an acceptable number of precocious males (see section 10.1 below).

9.2.4) Feed details.

Feed will be procured from various suppliers depending on recommendations of fish health specialists and availability. Feeding rates will range from 3.5% body weight per day immediately following ponding to about 1% in the later stages of rearing and before release. Fish food will be low in phosphorous to reduce nutrient inputs to hatchery discharge water.

9.2.5) Fish health.

Fish Health Monitoring: Fish health monitoring will be performed by WDFW fish health specialists or other qualified pathologists under contract to Grant PUD. During routine visits, fish health examinations are performed and cause of death determined on mortalities collected since the last visit and on moribund fish from the rearing tanks.

Disease Treatments: Typical treatments are as follows:

- Formalin – prophylactic fungal treatment and post-handling.
- Aquamycin – fed for BKD treatment and prophylaxis.
- Erythromycin – fed and injected to manage BKD.
- Azithromycin – fed and injected to manage BKD.
- Choramin T – bath to treat external bacteria.
- In addition, fish health specialists are present during spawning at which time they take pathogen and viral screening samples.

Sanitation Procedures: As recommended by IHOT (1995) facilities will implement the following sanitation procedures:
1) Disinfect/water - harden eggs in buffered iodophor disinfectant. Eggs will be disinfected prior to entering "clean" areas in incubation room.
2) Place foot baths containing disinfectant at the incubation facility's entrance and exit.
3) Sanitize equipment and rain gear utilized in broodstock handling or spawning after leaving adult area and before using in other rearing vessels or the hatchery building.
4) Sanitize equipment used to collect dead fish before use in another pond and/or fish lot.
5) Disinfect equipment, including vehicles used to transfer eggs or fish between facilities, before use with any other fish lot or at any other location. Disinfecting and disinfected water will be disposed in designated areas and not in streams.
6) Sanitize rearing vessels after removing fish and before introducing a new fish lot or stock either by using a disinfectant or by leaving dry for an extended time.
7) Properly dispose of dead fish and prevent fish that die of disease to enter natural waters.
8) Potential cross contamination is minimized by maintaining each rearing vessel as a separate unit. Equipment used is disinfected between use of different rearing units.

Additionally, sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (WDFW 1996), PNFHPC (1989), and IHOT (1993) guidelines.

9.2.6) Smolt development indices.

No biochemical smolt development indices have been used to date. Use of lethal or high stress indicators is not preferred for this ESA-listed aggregate. Indicators of smoltification such as coefficient of variation in length and condition factor may be used as production levels increase.

9.2.7) "Natural" rearing methods.

Facilities constructed in the future will use natural rearing conditions as described in sections 5.5 and 5.6. Important natural variables are a water temperature profile that can help produce smolts that survive at high rates and a low density rearing environment.

9.2.8) Risk aversion measures used to minimize adverse effects.

Risk aversion measures that may be employed include:

- Water supply, facility, and fish health risk aversion measures described previously will be employed.

- Lots will be segregated according to the BKD status of the parents.
- Survival will be maximized to the extent possible through the use of natural rearing conditions and rearing criteria to improve numerical abundance and retain maximum available genetic variation.

SECTION 10. RELEASE

10.1) Proposed fish release levels and sizes.

Table 13. Proposed fish release levels and size.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	Up to 250,000	15	April/May	Nason Creek

The planned release size is approximately 30 grams [at 15 fish/lb (ffp)]. This is larger than UCR spring Chinook smolts which typically migrate at 5 to 17 grams (87 – 127 mm). The bigger size has been adopted because larger smolts survive to adulthood at higher rates (Bilton 1984) and may spend less time moving through the freshwater system.

Recent research indicates that spring growth rates are also important to adult survival. Beckman et al. (1999) state: "Maintaining fish at a relatively small size initially, then inducing rapid growth in the final spring, may result in high-quality smolts…" Fast spring growth may allow smaller smolts to survive at high rates.

Studies at the Cle Elum Supplementation and Research Facility have shown that 37-49% of hatchery reared males undergo precocious maturation (Larsen et al. 2004) when reared using standard hatchery practices, which include releasing large smolts. Experiments now being done are showing that small smolts produced with a growth profile that includes fast spring growth will reduce the number of jacks in the population and increase the average weight of returning adults.

This research will be followed and may help determine future smolt release sizes for this program. For the present, due to the importance of increasing population sizes quickly, the program will adopt the strategy of using fast spring growth rates to produce large smolts.

10.2) Location(s) of proposed release(s).

Stream, river, or watercourse: (include name and watershed code (e.g. WRIA) number)

Release point: Nason Creek
Major watershed: Wenatchee (WRIA 45)
Basin or Region: Upper Columbia River

Figure 5. Main spawning area of spring Chinook salmon in Nason Creek.

10.3) Numbers and sizes of fish released.

No fish have been released yet.

10.4) Release protocols.

Future release strategies will include volitional migration from acclimation sites. Pond screens and barrier nets will be pulled to allow volitional release during April and May.

10.5) Fish transportation procedures.

Pre-smolts will be hauled by truck or transferred via other means from rearing and overwinter acclimation sites to the final release locations. Hauling criteria include (see IHOT 1995):

- Haul tank interiors and exteriors, when transporting between watersheds, will be disinfected prior to use.
- Increase O2 levels to 15 ppm prior to loading.
- Maintain temperatures at 42-48^{0}F.
- Haul at densities of less than 1.25 lbs/gallon.
- Prior to release, temper haul water with receiving water to keep the difference below 10^{0}F. The maximum rate of temperature change will be 2^{0}F/hr.

10.6) Acclimation procedures.

After acclimation sites are constructed, current plans call for fish to be reared at hatchery sites until November and then be transported or relocated to an overwinter acclimation site. In March, depending on site availability, suitability, and seasonal conditions, pre-smolts may be hauled from an overwinter acclimation site, which may be on the lower river, to upstream locations for final acclimation and release in May.

Acclimation could occur in large, natural rearing ponds and/or side channels. A density index of less than 0.06 lb/ft^3/inch will be maintained at the sites. Surface water will be used for acclimation. Dissolved oxygen levels will be maintained at greater than 7 ppm at the discharge of the ponds and a flow index of less than 0.75 lb/gpm/inch, depending on water temperature, will be used. Personnel will feed fish and will maintain a presence on location to help reduce predation. Volitional migration out of the upstream locations will be allowed in concert with the spring freshet and increasing discharge in the mainstem Columbia River.

10.7) Marks applied to identify hatchery adults.

All fish produced in the hatchery will be marked or tagged prior to release. An external or internal tag or mark that will provide positive identification as a Nason Creek hatchery adult (i.e., CWT in adipose fin or other body location and or PIT-tag) will be applied.

10.8) Disposition plans for surplus fish.

Fish produced in excess of the 250,000 target number will be reared to a sufficient size for tagging or marking and then released into the Nason Creek, as directed by the PRCC HSC. The program will be managed to minimize excess fish.

10.9) Fish health certification procedures.

Within two weeks prior to release a fish health specialist will document smolt health through such indices as condition factor, fin condition, descaling and, if necessary, autopsy-based analysis such as organosomatic indexing. Epizootics may trigger review and recommendations by the JFP before release.

10.10) Emergency release procedures.

Overwinter acclimation facilities will be designed and constructed with emergency alarms and back-up water supply systems. Depending on the type of permanent sites being considered, emergency release on-site procedures will be developed by the committees which could involve direct release to the Nason Creek if no other options are available.

Short-term acclimation rearing units will be designed to survive flooding but will not be designed to prevent fish escape. Fish may be allowed to volitionally migrate during flood events.

10.11) Risk aversion measures used to minimize adverse effects to listed fish.

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin spring Chinook salmon will be minimized through the following measures:

- Hatchery spring Chinook will be reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in the streams after release and promoting rapid seaward migration. Degree of smoltification may be assessed through measurement of coefficient of variation for fork length or average condition factor to avoid fish stress and mortality.

- Spring Chinook smolt releases will be timed with water budget releases from upstream dams to further accelerate seaward migration, to improve survival at mainstem dams, and to reduce the duration of interactions with wild fish.
- Acclimation in natal stream water will contribute to smoltification, reducing the residence time in the rivers and mainstem corridors.
- Release locations may be in upstream areas to improve imprinting and reduce straying to other watersheds.
- The long-term goal is to acclimate fish through the winter in natal stream water to further reduce straying.
- Hatchery spring Chinook smolts will be released when environmental conditions exist that promote rapid emigration (i.e., new moon phase, increasing water temperature and increase river discharge).
- Adult contribution to natural spawning will be calibrated to be within the tributary carrying capacity when historical productivity has been restored.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators".

Monitoring and evaluation will play an important role in helping measure program results and determining its future direction. The initial five-year M&E Plan proposed for the program identifies nine objectives, listed below. These plan objectives and subsequent hypotheses were generated from Chelan and Douglas PUDs' M&E plan (see Habitat Conservation Plans Hatchery Committee 2006 and Chelan PUD Habitat Conservation Plan's Hatchery Committee 2005), existing evaluation plans, the BAMP, and the HCP and PRCC hatchery subcommittees. They were developed to assess progress toward reaching the Hatchery Program Goals defined by the JFPs. Grant PUD patterned its M&E plan around the HCP plan to provide consistency. The Grant M&E plan is presented in Pearsons and Langshaw (2009) and this plan should be consulted if additional detail is desired.

The M&E plan document describes the data to be collected to test the hypotheses for each objective. The UCR Nason Creek Spring Chinook Supplementation Program has and will continue to use the M&E plan document as the basis for implementing a data collection plan. A number of adult and juvenile-based variables will be measured for both hatchery and naturally produced fish. Methods used during data collection will likely include: spawning ground surveys, broodstock sampling, hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, radio tagging, genetic sampling, disease sampling, and snorkel surveys (see field methods table).

A monitoring principle included in the HCP M&E plan is use of reference streams for comparative analysis. Availability, feasibility, and viability of using reference streams are currently being evaluated. Due to concerns about finding suitable streams and the ability to detect impacts, it has not yet been decided whether this method will be used. Until the comparison technique is determined, the term "reference condition" will be substituted for "reference stream" in the M&E plan as adopted by the program.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a reference condition and if the change in the natural replacement rate (NRR) of the supplemented condition is similar to that of the reference condition.
Hypotheses:
Ho: The annual number of hatchery produced fish that spawn naturally is less than or equal to the number of naturally and hatchery produced fish taken for broodstock.
Ho: The annual change in the number of naturally spawning fish is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the number of naturally produced adults is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the NRR is less than or equal to the annual change observed in

the reference condition.

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.
Hypotheses:
Ho: Migration timing Hatchery = Migration timing Naturally produced
Ho: Spawn timing Hatchery = Spawn timing Naturally produced
Ho: Redd distribution Hatchery = Redd distribution Naturally produced

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations*.
Hypotheses:
Ho: Allele frequency Hatchery = Allele frequency Naturally produced = Allele frequency Donor pop
Ho: Genetic distance between subpopulations Year x = Genetic distance between subpopulations Year y
Ho: Δ Spawning Population = Δ Effective Spawning Population
Ho: Age at Maturity Hatchery = Age at Maturity Naturally produced
Ho: Size at Maturity Hatchery = Size at Maturity Naturally produced

Objective 4: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).
Hypotheses
Ho: HRR Year x ≤ NRR Year x
Ho: HRR ≤ Expected value per assumptions in BAMP

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.
Hypotheses:
Ho: Stray rate Hatchery fish > 5% of total brood return
Ho: Stray hatchery fish > 5% of spawning escapement of other independent populations[1]
Ho: Stray hatchery fish > 10% of spawning escapement of any non-target streams within independent population[1].

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[1] This stray rate is suggested based on a literature review and recommendations by the ICTRT. It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program-specific basis and decisions made by the PRCC HSC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

Objective 6: Determine if hatchery fish were released at the programmed size and number.
Hypotheses:
Ho: Hatchery fish Size = Programmed Size
Ho: Hatchery fish Number = Programmed Number

Objective 7: Determine if the proportion hatchery fish on the spawning grounds affects freshwater productivity (i.e., number of smolts per redd) of the supplemented condition when compared to the reference condition.
Hypotheses:
Ho: juveniles/redd of the supplemented condition ≤ juveniles/redd of the reference condition
Ho: The relationship between proportion of HOS and juveniles/redd is ≤ 1.
Ho: Slope of Ln (juveniles/redd vs redds) of the supplemented condition ≤ Slope of Ln (juveniles/redd vs redds) of the reference condition.
Ho: The relationship between proportion of HOS and juveniles/redd is ≤ 1.

Regional Objectives
Two additional objectives are not explicit in the goals as specified above, but are included within the total framework of this plan because they are related to the goals and are concerns related to not only Grant's programs but also other artificial propagation programs in the region. These regional objectives will be implemented at various levels into all M&E Plans in the upper Columbia River (Chelan PUD, Douglas PUD, Grant PUD, USFWS, and CCT). Currently, a BKD management plan is being produced as an example of a coordinated effort to address a prevalent disease issue. These objectives may be more suitable for a specific hatchery or sub basin, the results of which could be transferred to other locations. As such, the PRCC HSC should ensure that these efforts are coordinated throughout the region so resources (e.g., fish, facilities, and cost) are used efficiently. Other objectives that are deemed more regional in nature, per the Hatchery Subcommittee, could also be included in the section.

Objective 8: Determine if the incidence of disease has increased in the natural and hatchery populations.
Hypotheses:
Ho: Conc. BKD supplemented fish Time x = Conc. BKD supplemented fish Time y
Ho: Conc. BKD hatchery effluent Time x = Conc. BKD hatchery effluent Time y
Ho: Conc. BKD supplemented stream Upstream Time x = Conc. BKD hatchery effluent Time x = Conc. BKD supplemented stream Downstream Time x
Ho: Hatchery disease Year x = Hatchery disease Year y

Objective 9: Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.
Hypotheses:
Ho: NTTOC abundance Year x through y = NTTOC abundance Year y through z
Ho: NTTOC distribution Year x through y = NTTOC distribution Year y through z

Ho: NTTOC size Year x through y = NTTOC size Year y through z

There are two additional central uncertainties associated with the implementation of Parental Based Trapping proposed in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

Objective 10: Will implementing a hatchery program so that a running mean PNI goal of 0.67 or greater is achieved, increase the long-term fitness of the population it is intended to supplement
Hypothesis:
Ho: If a PNI of 0.67 or greater is achieved, the productivity of the population will increase.
Ho: If a PNI of 0.67 or greater is achieved, the fitness of the population will increase.

Objective 11: Does handling at Tumwater Dam and/or Off-Ladder Adult Fish Trap negatively affect survival of natural spawning fish.
Hypothesis:
Ho: Handling fish at Tumwater Dam and the Off-Ladder Adult Fish Trap does not affect post-release survival of fish spawning in the natural environment.

Table 14. Field sampling for the Nason Creek spring Chinook salmon hatchery program M&E.

Task	Method	Location	Time	Sampling frequency	Data Collected
Adult migrant sampling	Adult trapping	Tumwater Dam	May-September	Daily	Date Count Length Origin Gender Scale sample Tissue sample Record mark and tag Apply tag
Adult spawning ground surveys	Walking surveys (redds and carcasses)	White River Nason Creek Little Wenatchee	August-September	Weekly	Redd count Redd date Redd location Carcass count Carcass date Carcass location Carcass gender Carcass length Carcass egg retention Record carcass mark and tag Carcass origin
Estimates of Adult harvest	Commercial, Tribal, and sport harvest surveys	Ocean Columbia R. Wenatchee R. Icicle	All year	Daily	Count Record mark and tag Location Scale
Broodstock sampling	Sampling broodstock at time of spawning	Nason Creek Hatchery or Little White Salmon NFH	August-September	Weekly	Date Count Length Origin Gender Scale sample Tissue sample Record mark and tag Fish health Egg weight
Juvenile migrant sampling	Rotary screw trap	White River Nason	March-November	Daily	Date Species Count Length

		Creek			Weight Record mark and tag Apply mark or tag Take scales Origin
In-Hatchery performance	Subsampling of abundance and size, Disease screening, tagging	White (Little White Salmon NFH, McComas) Nason (Nason Creek Hatchery)	All year	Generally monthly	Count Length Weight Fish health Tag or mark

The Biological Opinion for the Priest Rapids Hydroelectric Project contains requirements for development and funding of an M&E program. Proposals will be reviewed and approved by the PRCC hatchery subcommittee, prior to review and approval by the PRCC and approved proposals will be funded wholly or in part by Grant PUD. Habitat enhancement funds and monitoring dollars are also available through the Biological Opinion and Salmon and Steelhead Settlement Agreement.

Due to the critical role that M&E plays, efforts were initiated in 1997 with an adult monitoring plan. Juvenile monitoring was added in 2007. Baseline data prior to supplementation being started are being collected through this effort.

The principles of adaptive management will be applied to the M&E program. As data are collected, as the recovery effort progresses, and as new science is developed, the program design will change to accommodate additional input. The PRCC HSC will be responsible for adapting the M&E program to new information. The flowchart below demonstrates how collected data is used to assess performance and make needed program changes.

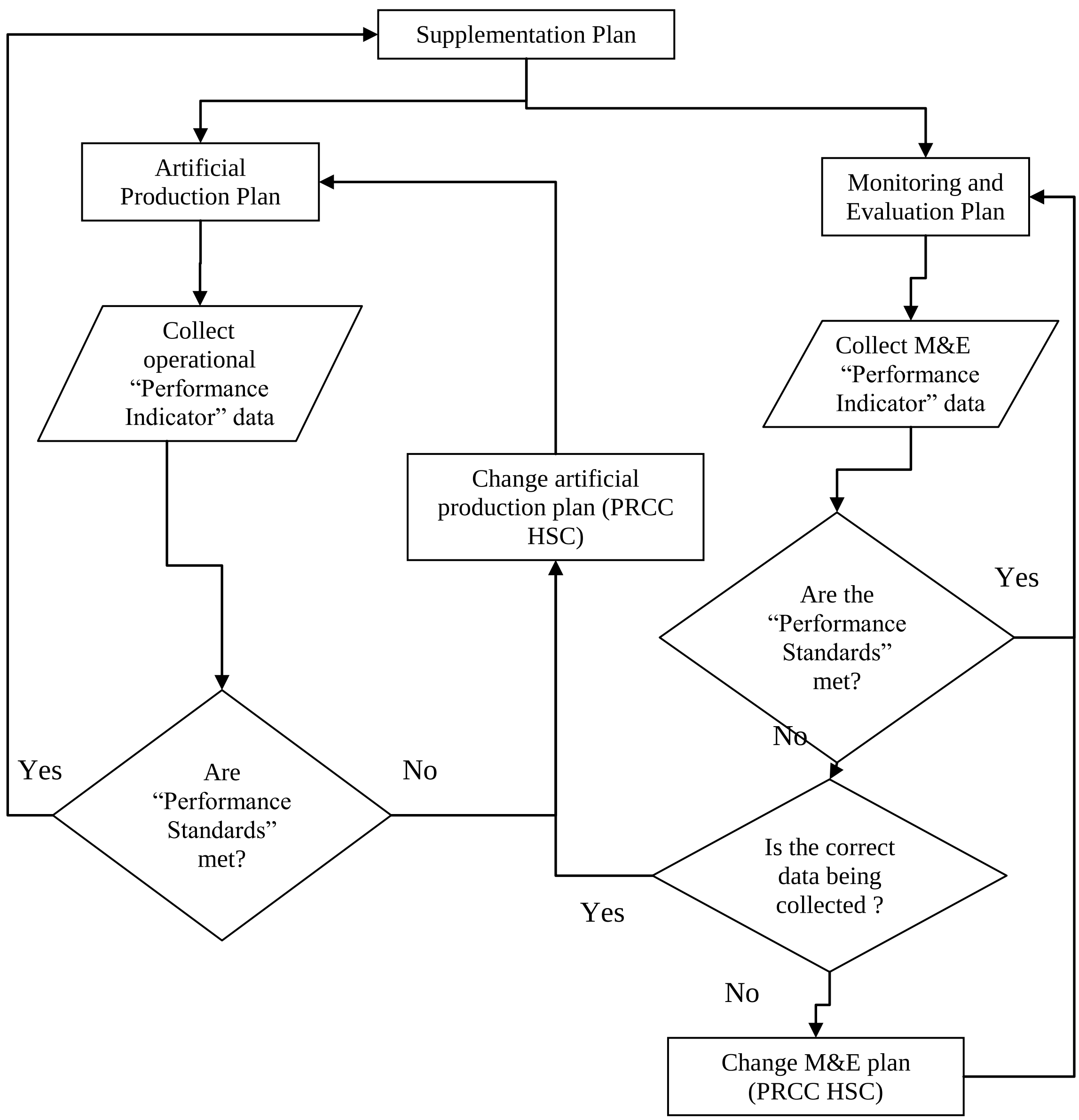

Figure 6. Flowchart that demonstrates how collected data is used to assess performance and make needed program changes.

11.2) Risk aversion measures used to minimize adverse effects to listed fish.

Juvenile Monitoring: Injury to juvenile spring Chinook salmon, juvenile steelhead and juvenile and adult bull trout may occur through trapping, handling and marking procedures. Primary injury and mortality events are associated with debris accumulation in the live-box, reaction to anesthesia, handling stress, over-crowding in the live-box, predation in the live-box and increased predation post release. Injury and mortality will be minimized through diligent trap attendance. Traps will be checked a minimum of once a day in the morning or more often as needed. Injury and mortality associated with handling stress, anesthetizing and post release predation will be address by applying MS-

222 to all fish handled and providing full recovery for fish prior to release. Other risk aversion measures include (see NOAA Fisheries 2007):

- No more than 20% of the natural or hatchery emigrants may be captured.
- Lethal take may not exceed 2% of the natural or hatchery fish captured.
- Tissue sampling shall be minimized to the extent possible.
- Fish must be kept in water to the maximum extent possible. Adequate water circulation and replenishment of water in holding units is required.
- Fish must be moved using equipment that holds water during transfer.
- Fish must not be handled if water temperatures exceed 69.8^{0}F at the capture site.
- The incidence of capture, holding, and handling effects shall be minimized and monitored.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible.

Adult Monitoring: No injury or mortalities are expected during the Nason Creek adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased spawned out fish. Field staff will minimize disturbance to any spawning spring Chinook salmon by identifying spawning sites and using a land route around their location.

The future adult trapping system may be used for M&E purposes. Protocols will be developed by the PRCC HSC for handling captured adults after the trapping method has been selected.

SECTION 12. RESEARCH

The project is not a research project.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this Hatchery Genetic Management Plan is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

ADDENDUM A. PROGRAM EFFECTS ON OTHER LISTED POPULATIONS.

(Anadromous salmonid effects are addressed in Section 2)
This section will be the cornerstone for any required consultation with the U.S. Fish and Wildlife Service under section 7 of the ESA. Accordingly hatcheries that may affect any federally listed/ proposed aquatic or terrestrial species under USFWS jurisdiction need to complete this section. By fully addressing the topics of this section, the HGMP will provide the information necessary to initiate formal or informal consultation under the ESA for species under USFWS jurisdiction.

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.
Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

Biological opinion (BO) prepared in accordance with section 7 of the ESA:
USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project Relicensing on Bull Trout (FERC No. 2114), March 14, 2007. USFWS Reference: 13260 -200 6-P -000 8, 1 3260 -2001 -F -0062

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.
General species description and habitat requirements.
Local population status and habitat use.
Site-specific inventories, surveys, etc.

Bull trout (*Salvelinus confluentus*) are listed as threatened. See the Biological Opinion (BO) for a description of the habitat requirements and population status.

15.3) Analyze effects.
Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects, including duration and area of effects). Please focus analysis on the impact of hatchery program on listed/proposed species reproduction, numbers, and distribution.
Identify potential level of take (past and projected future).
<u>Consider the following</u>:
<u>Hatchery operations</u> – e.g., water withdrawals, effluent, trapping, releases, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.), grounds management, including herbicide/pesticide use.
<u>Fish health</u> – e.g., pathogen transmission, therapeutics, chemicals.
<u>Ecological/biological</u> – e.g., competition, behavioral, etc.
<u>Predation</u>
<u>Monitoring and evaluation</u> – e.g., surveys (trap, seine, electrofish, snorkel, spawning,

carcass, boat, etc.).
Habitat – e.g., modifications, impacts, quality, blockage, de-watering, etc.

The USFWS offers this conclusion (see the BO for details):
"Summary of the Effects of the White River Supplementation Plan. Although there will be adverse effects, the primary effect of this action may be beneficial, with the release of smolts increasing the density and availability of a seasonal prey base. However, water quality impacts, disturbance of Bull trout during spawning, and the accidental capture of Bull trout is likely to occur and may result in the modification of the behavior of Bull trout or injury. Impacts to the prey base can also be substantial when thousands of smolts are released and compete for the same resources other fish, including the Bull trout, are expected to use."

15.4 Actions taken to minimize potential effects.

Identify actions taken to minimize potential effects to listed species and their habitat.

Actions have not yet been determined.

15.5 References

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: dispensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with natural origin recruit (NOR).

Natural origin recruit (NOR) - See natural fish.

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Supplementation - "…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." (RASP 1992)

Stock - (see "Population").

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations.

(generally from Washington Department of Fish and Wildlife, November, 1999).

SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
Chinook Yearling	<=20	>=23
Chinook (Zero) Fingerling	>20 to 150	3 to <23
Chinook Fry	>150 to 900	0.5 to <3
Chinook Unfed Fry	>900	<0.5
Steelhead Smolt	<=10	>=45
Steelhead Yearling	<=20	>=23
Steelhead Fingerling	>20 to 150	3 to <23
Steelhead Fry	>150	<3

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.

2/ Sockeye yearlings defined as meeting size criteria and 1 year old.

Attachment 3. Estimated production from supplementation.

Supplementation performance assumptions (does not include 10% surplus)	
Brood collection	
Number of smolts released	250,000
Green egg to smolt survival	81%
Eggs taken	308,642
Fecundity per female	4,785
Adults spawned	129
Adult holding survival	90%
Adults collected	143
Adult production (1989-2001 BY data - Chiwawa hatchery)	
Smolt to adult survival - low value	0.04%
Adult returns due to smolt release - low value	90
Smolt to adult survival - high value	1.54%
Adult returns due to smolt release - high value	3,845
Smolt to adult survival - average value	0.51%
Adult returns due to smolt release - average value	1,263

Attachment 4. Acronyms

AHA – All-H Analyzer
BAMP - Biological Assessment and Management Plan
BKD - Bacterial Kidney Disease
BO - Biological Opinion
BY - Brood Year
CFS - Cubic Feet per Second
CRFMP - Columbia River Fish Management Plan
CRITFC – Columbia River Intertribal Fish Commission
CWT - Coded Wire Tag
DNA - Deoxyribonucleic Acid, Genetic Information
ELISA - Enzyme-Linked Immunosorbent Assay
ESA - Endangered Species Act
ESU - Evolutionarily Significant Unit
FERC - Federal Energy Regulatory Commission
FFP – Fish/pound
FI – Flow Index
F2 – second generation
gpm – gallons per minute
USFWS - U.S. Fish and Wildlife Service
HOB – Hatchery Origin Broodstock
HOR – Hatchery Origin Recruit
HOS – hatchery Origin Spawner
HSRG – Hatchery Scientific Review Group
HCP - Habitat Conservation Plan
ICRT – Interior Columbia Technical review Team
IEAB - Independent Economic Analysis Board
IHOT – Integrated Hatchery Operations Team
ISAB - Independent Scientific Advisory Board
JFP - Joint Fisheries Parties
MaSa – Major Spawning Area
MiSa – Minor Spawning Area
NEPA - National Environmental Policy Act
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NOB – Natural Origin Broodstock
NOR – Natural Origin Recruit
NOS – Natural Origin Spawner
NPDES – National Pollutant Discharge Elimination System
NNI - No Net Increase
pHOB – Proportion as HOB
pHOS – Proportion as HOS
PIT - Passive Integrated Transponder
PNFHPC - Pacific Northwest Fish Health Protection Committee

PNI – Proportionate Natural Influence
pNOB – Proportion as NOB
pNOS – Proportion as NOS
PRCC – Priest Rapids Coordinating Committee
PRCC HSC – Priest Rapids Coordinating Committee Hatchery Sub-Committee
PSM – Pre-Spawn Mortality
PUD - Public Utility District
RM - River Mile
RPA – Reasonable and Prudent Actions
SAR - Smolt-To-Adult Return Rate
SSHIAP - Salmon and Steelhead Habitat Inventory and Assessment Project
TRT - Technical Recovery Team
UCR - Upper Columbia Region
UCRSRB - Upper Columbia River Salmon Recovery Board
UCRSRP – Upper Columbia River Salmon Recovery Plan
VI - Volume Index
VSP - Viable Salmonid Population
WDFW - Washington Department of Fish and Wildlife
WDOE - Washington Department of Ecology
WRIA - Watershed Resource Inventory Area
YKFP – Yakima Klickitat Fisheries Project
YN – Confederated Tribes and Bands of the Yakama Nation

Attachment 5. Take Table. Estimated listed salmonid take levels by activity.

Spring Chinook:

Listed species affected: O. tshawytscha; ESU/Population: Upper Columbia River (UCR) spring Chinook; Activity: Nason Creek Supplementation Program				
Location of hatchery activity: various Wenatchee basin locations; Dates of activity: Year-round; Hatchery program operators: WDFW, USFWS, YN				
Type of Take	Annual Maximum Take of Listed Fish By Life Stage (% of Run or Number of Fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			100% [N] - M&E (see section 11).	100% [N]
Collect for transport b)				
Capture, handle, release c)				
Capture, handle, tag/mark/tissue sample, release d)		275,000 [N] - hatchery marking and release (see section 9).	85% [N] of natural origin at PRD and 100% [N] passing Tumwater Dam – M&E and origin identification for brood collection (see section 7).	100% [N]
Removal (e.g. broodstock) e)			160 [N] – broodstock collection (see section 6).	
Intentional lethal take, including adult removal necessary to manage hatchery escapement to spawning grounds (PNI) f)		30 /1,000 [UCR] hatchery and 30/1,000 UCR natural origin – research (see #1482).	• 100% [N] hatchery origin adults – PNI management (see section 7). • 10 [UCR] hatchery and 10 [UCR] natural origin – research (see #1482).	
Unintentional lethal take g)		1,000 [UCR] hatchery and 1,000 [UCR] natural origin – research (#1482).	1 unintentional mortality/10 [UCR] encounters of hatchery and 1/10 [UCR] natural origin – research (see #1482).	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at traps or weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream

release, or through carcass recovery programs, or broodstock collection strategies.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

[N]. Nason Creek stock only.

[UCR]. UCR spring Chinook population. Takes are for all regional activities impacting the population, the portions of the take allowed by the Nason Creek program alone have not been calculated.

Takes of UCR spring Chinook are authorized through Section 10 permit #1482 for research activities in the basin (see section 2.1). The permit is subject to change during periodic renewals and through the annual authorization process.

Steelhead: Listed species affected: O. mykiss; ESU/Population: Upper Columbia River (UCR) Steelhead; Activity: Nason Creek Supplementation Program.				
Location of hatchery activity: various Wenatchee basin locations; Dates of activity: Year-round; Hatchery program operators: WDFW, USFWS, YN				
Type of Take	Annual Maximum Take of Listed Fish By Life Stage (% of Run or Number of Fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, release c)				
Capture, handle, tag/mark/tissue sample, release d)		20% [N] population – enumeration and sampling (see #1592).		
Removal (e.g. broodstock) e)				
Intentional lethal take, f)			10 [UCR] hatchery and 10 [UCR] natural origin – research (see #1482).	
Unintentional lethal take g)		1,000[UCR] hatchery and 1,000 [UCR] natural origin – research (see #1482).	1 unintentional mortality/10 [UCR] encounters of hatchery and 1/10 [UCR] natural origin – research (see #1482).	
Other Take (specify) h)				

[N]. Nason Creek stock only.
[UCR]. UCR steelhead population. Takes are for all regional activities impacting the population, the portions of the take allowed by the Nason Creek program alone have not been calculated.

Takes of UCR steelhead are authorized through Section 10 permit #1482 for research activities in the basin (see section 2.1). These permits are subject to change during periodic renewals and through the annual authorization process.