HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Wenatchee Upper Columbia River Spring Chinook: Chiwawa Spring Chinook
Species or Hatchery Stock:	UCR Spring Chinook (*Oncorhynchus tshawytscha*) – Wenatchee River – Chiwawa Sub-Population
Agency/Operator:	Chelan County Public Utility District No. 1 (Chelan PUD) Washington Department of Fish and Wildlife (WDFW)
Watershed and Region:	Wenatchee River – WRIA 45 Upper Columbia Region
Date Submitted:	Oct 14, 2009
Date Last Update	August 18, 2009

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DIRECTORY OF TABLES

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Wenatchee Upper Columbia River Spring Chinook: Chiwawa Spring Chinook Program

1.2) Species and population (or stock) under propagation, and ESA status.

Upper Columbia River Spring Chinook – Wenatchee River Chiwawa Population
ESA status – Endangered (Listing reaffirmed June 28, 2005)

1.3) Responsible organization and individuals.

Name (and title): Keith Truscott, Natural Resource Department Manager
Agency or Tribe: Public Utility District No. 1 of Chelan County (Chelan PUD)
Address: Post Office Box 1231; 327 N. Wenatchee Avenue, Wenatchee, WA 98801
Telephone: (509) 661-4831
Fax: (509) 661-8108
Email: keith.truscott@chelanpud.org

Name (and title): Joe Miller, Hatchery Program Manager
Agency or Tribe: Public Utility District No. 1 of Chelan County (Chelan PUD)
Address: Post Office Box 1231; 327 N. Wenatchee Avenue, Wenatchee, WA 98801
Telephone: (509) 661-4473
Fax: (509) 661-8108
Email: joseph.miller@chelanpud.org

Name (and title): Jeff Korth, Region 2 Fish Program Manager
Agency or Tribe: Washington Department of Fish and Wildlife
Address: 1550 Alder NW, Ephrata, WA 98823
Telephone: (509) 754-6032
Fax: (509) 754-5257
Email: korthjwk@dfw.wa.gov

Chelan PUD and WDFW are hatchery section 10 co-permit holders for the current permit (number 1196) for Chiwawa spring Chinook.

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

- Rock Island Habitat Conservation Plan (HCP) Hatchery Committee: Oversee development of recommendations for implementation of the hatchery elements of the HCP. Hatchery Committee members include: Chelan PUD, WDFW, Confederated Tribes of the Colville Indian

Reservation, Confederated Tribes and Bands of the Yakama Nation, National Marine Fisheries Service, and U.S. Fish and Wildlife Service.

- Washington Department of Fish and Wildlife (WDFW): Co-manager; current contracted hatchery operator, co-permittee for the current permit (number 1196) for Chiwawa spring Chinook
- Confederated Bands and Tribes of the Yakama Nation (YN): Co-manager.
- Confederated Tribes of the Colville Indian Reservation (CCT): Co-manager
- National Marine Fisheries Service (NMFS): Administration of the Endangered Species Act
- U.S. Fish and Wildlife Service (USFWS): Administration of the Endangered Species Act
- Joint Fisheries Parties (JFP): USFWS, NMFS, WDFW, the Confederated Tribes of the Colville Reservation, the Confederated Tribes and Bands of the Yakama Nation, and the Confederated Tribes of the Umatilla Indian Reservation

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Chelan PUD is responsible for funding elements of this hatchery program that arise from the ESA conservation and recovery goals of its HCP. Multiple full time staff at the Eastbank Hatchery and Chiwawa Acclimation Facility performs necessary responsibilities while fish are on station. For 2009, annual hatchery program operation costs pertinent to these facilities are roughly $2,914,768. For 2009, hatchery monitoring and evaluation activities for all HCP programs are $943,990. These costs are inclusive of all HCP Plan Species, excluding Okanogan sockeye, Coho, and Okanogan spring Chinook, as it is difficult to isolate spring Chinook costs. Funding and staffing will be modified by Chelan PUD as appropriate to implement decisions of the HCP Hatchery Committee, consistent with Chelan PUD's obligations under the terms of the HCP, and to accommodate changes in other budgeted items (i.e. fish food, labor rates, etc.).

WDFW is the funding source for elements of the hatchery program that are not Chelan PUD's obligation under the HCP or respective hydroelectric license. In particular, WDFW is responsible for coordinating the funding for manual adult management activities from the point at which fish are placed in holding containers when manually removed and/or for a conservation fishery. The Co-managers will determine the disposition of the fish placed in the holding containers.

Finally, Chelan PUD has agreed to voluntarily provide funding to WDFW for up to approximately one full time employee (FTE) (for both steelhead and spring Chinook hatchery programs) for WDFW's adult management activities provided that equivalent savings can be found by WDFW through implementation of efficiencies in carrying out Chelan PUD's hatchery programs, under the current contract between WDFW and Chelan PUD, such that Chelan PUD's total funding obligations do not increase. This funding includes manual adult management activities up to the point at which spring

Chinook are removed at TWD and placed in holding containers. Chelan PUD does not believe (though this is not necessarily endorsed by the JFP) that it has an obligation for adult management activities under the HCP but has agreed to fund adult management activites as described above.

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

Table 1. Hatchery facility locations associated with the Chiwawa spring Chinook program (located in WRIA #45)

Activity	Location
Broodstock source	Wenatchee and Chiwawa Rivers
Broodstock collection location	Chiwawa Weir - Chiwawa River, RKm 1.0, Chiwawa sub-basin Tumwater Dam - Wenatchee River, RKm 49.6 - Wenatchee Basin
Adult holding	Eastbank Hatchery - Columbia River, ~RKm 790, Columbia River Mainstem
Spawning	Eastbank Hatchery - Columbia River, ~RKm 790,Columbia River Mainstem
Incubation	Eastbank Hatchery - Columbia River, ~RKm 790, Columbia River Mainstem
Rearing	Eastbank Hatchery - Columbia River, ~RKm 790/ Columbia River Mainstem Chiwawa Acclimation Ponds - Chiwawa River, Rkm 1.0, Chiwawa sub-basin

1.6) Type of program.

The Chiwawa spring Chinook program is an integrated program that includes both recovery and harvest components.

1.7) Purpose (Goal) of program.

With respect to Chelan PUD, the purpose of this hatchery program is to satisfy the hatchery compensation terms of the Rock Island Hydroelectric Project (Project) HCP[1].

[1] Chelan PUD's ESA authorizations consist of two regulatory approval tiers: (1) the general ESA approval of all Chelan PUD operations, which consists of the Section 10 incidental take permits ("ITPs") issued for each of Chelan PUD's habitat conservation plans ("HCPs"), and (2) the specific approvals (Section 10(a)(1)(A) permits) issued for each of Chelan PUD's hatchery programs (such as Permit No. 1196). An overarching adaptive management framework is relevant to both tiers of Chelan PUD's ESA approval. Under this adaptive management framework, the HCP Hatchery Committees are required to develop monitoring and evaluation plans and to make relevant management decisions on an ongoing basis (these functions are described in more detail in Section 1.8.1 below). The adaptive management framework is relevant to the HCP/ITPs because the HCPs specifically establish the terms of the HCP Hatchery Committees' responsibilities. The adaptive management framework is also relevant to the hatchery permits because, through the HCPs, the HCP Hatchery Committees are charged with incorporating adaptive management into the hatchery-related activities authorized by the hatchery permits. This adaptive management framework allows for flexible management of hatchery operations under the terms of the HCPs and the Section 10 permits.

The Project HCP was executed pursuant to Section 10 of the Endangered Species Act (ESA) as a vehicle to permit Chelan PUD to carry out its functions in a manner consistent with the ESA. The overriding goal of the Project HCP – developed in accordance with the ESA's goals of conserving and facilitating the recovery of natural populations – is to achieve no net impact (NNI) on anadromous salmonids as they pass the Project. NNI goals should be met in a manner consistent with the objective of rebuilding natural populations. Under the terms of the HCP, NNI for hatcheries consists of providing funding and capacity required to meet the seven (7) percent hatchery compensation for all Plan Species that results from unavoidable losses at the Project.

Section 8 of the Rock Island HCP details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Project. Section 8.1.2 includes the following objective:

> *8.1 Hatchery Objectives*
> *8.1.2 The District shall implement the specific elements of the hatchery program consistent with overall objectives of rebuilding natural populations and achieving NNI. Species specific hatchery program objectives developed by the JFP[Joint Fisheries Parties] may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.*[2]

The JFP developed program goal statements that were documented in the 2005 Conceptual Framework for Chelan PUD Hatchery Programs (Hillman et al. 2007). The spring Chinook program goal is supporting the recovery of ESA-listed species by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity (Murdoch and Peven 2005; HCP HC July 2005).

1.8) Justification for the program.

The UCR spring Chinook (O*ncorhynchus tshawytscha)* Evolutionarily Significant Unit (ESU) was listed as endangered on March 24, 1999 (50 CFR 14308). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids. In the Upper Columbia River Region, hydropower facilities and habitat destruction are the major causes of population declines, although past over-harvest in fisheries and some hatchery practices are other factors. Poor ocean conditions prior to 2000 that have suppressed fish survival, and vastly increased avian predation in the Columbia River estuary, have also affected the basin's spring Chinook populations.

[2] Taken from Page 20 of the Rock Island HCP.

The artificial propagation program associated with the Chiwawa spring Chinook program specifically addresses the unavoidable losses associated with the operation of Rock Island Dam, and has the potential to contribute to the long term persistence of ESA-listed Upper Columbia River spring Chinook through increases in the abundance of the ESA-listed population. The program is likely necessary to prevent the extinction of the ESU until habitat conditions that limit the productivity of naturally-produced spring Chinook in the region can be improved.

While the proposed artificial propagation program has the potential to cause deleterious direct and indirect effects on the ESA-listed species, such as maladaptive genetic, physiological, or behavioral changes in donor or target populations (Hard et al. 1992), the proposed program implementation includes special conditions to ensure the programs are implemented to the benefit of the ESA-listed species. Annual broodstock collection protocols will be developed and approved by NMFS prior to spring Chinook retention to ensure that the activities do not pose a substantial risk to recovery. Other risk management steps include annual consideration of run size and composition, measures to purposefully manage returning artificially propagated adult spring Chinook, long-term monitoring and evaluation of the efficacy of the programs, and a means to modify the programs through the HCP Hatchery Committee. When implemented, these measures would help to minimize the risk of genetic and/or ecological hazards to the ESA-listed species and support the recovery of ESA listed spring Chinook, while mitigating for the unavoidable losses associated with the operation of Rock Island Dam. The JFP have determined that any risks associated with the Chiwawa spring Chinook hatchery program are outweighed by the benefits of the program to the ESU.

1.8.1) Legal Agreements & Requirements

This HGMP includes actions required of Chelan PUD pursuant to its Rock Island HCP, as well as other actions that are beyond Chelan PUD's HCP obligations but represent important fishery management activities that may be implemented by WDFW and the other JFPs. This section is intended to provide background and context to aid in the interpretation and application of the terms and obligations of this HGMP. Specifically, this section (1) identifies and describes the purposes and objectives of the HCP relevant to this HGMP; (2) outlines certain responsibilities and obligations of Chelan PUD based on the commitments and assurances provided in the HCP; and (3) describes certain obligations and responsibilities under the terms of this HGMP.

Chelan PUD's HCP

Included in the Rock Island Hydroelectric license (FERC No. 943) is a separate Anadromous Fish Agreement and HCP detailing the long term adaptive management of Plan Species and their habitat as affected by the Project. Parties to this agreement include: Federal agencies (US Fish and Wildlife Service, National Marine Fisheries Service), WDFW, Tribal governments (Confederate Tribes of the Colville Reservation and the Yakama Nation) as well as Chelan PUD. Section

8 of the Rock Island HCP details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Project; specifically, Section 8.1.1 says:

8.1 Hatchery Objectives
8.1.1 The District shall provide hatchery compensation for Plan Species (spring Chinook salmon, summer Chinook salmon, fall Chinook salmon, sockeye salmon, Coho salmon upstream of Rock Island Dam origin, and summer steelhead). This compensation may include Measures to increase the off-site survival of naturally spawning fish or their progeny.

Adaptive Management & Section 10 Permits

As described in footnote 1 above in Section 1.7, Chelan PUD's spring Chinook hatchery program obligations under the HCP are implemented through an adaptive management process set forth in the HCP and overseen by the HCP Hatchery Committee. Specifically, the HCP Hatchery Committee may periodically adjust Chelan PUD's hatchery production levels (*see* HCP at section 8.4.3) and make program modifications to achieve program objectives, including changes to facilities, release methods, and rearing strategies necessary to achieve and maintain "no net impact" pursuant to the HCPs (*see* HCP at section 8.6.1). The HCP's adaptive management processes are integral to the spring Chinook program described in this HGMP.

Any updated section 10 permit and associated environmental reviews should incorporate, rely on, and anticipate compliance with such process provisions. This will minimize the need for future modification of the section 10 permit for normal, ongoing HCP Hatchery Committee program oversight decisions, recognizing that NMFS will play an integral role in determining any future program modifications as an HCP Hatchery Committee member.

Chelan PUD HGMP Actions Implementing the HCP

Within this HGMP, the following are Chelan PUD's obligations intended to implement the HCP in order to meet the seven (7) percent compensation requirement:

- Provide water sources and implement risk aversion measures as described or similar to those described in Section 4 "Water Source";

- Provide facility capacity to rear the fish as described in Section 5 "Facilities";

- Provide broodstock collection facilities - Chiwawa Weir and Tumwater Dam (TWD) only – and funding for an operator for broodstock collection as described in Section 6 "Broodstock Origin and Identity" and Section 7 "Broodstock Collection";

- Provide funding for an operator to perform the activities described in Section 8 "Mating", Section 9 "Incubation and Rearing" and Section 10 "Release";

- Provide funding for implementation of the hatchery monitoring and evaluation plan as approved and modified by the HCP Hatchery Committee.

Under the terms of this HGMP, Chelan PUD is also obligated to:

- Complete and submit all hatchery Section 10 permit reporting associated with Chelan PUD's hatchery obligations;

- Provide funding to WDFW for up to approximately one FTE (for both the steelhead and spring Chinook programs) for WDFW's adult management activities provided that equivalent savings can be found by WDFW through implementation of efficiencies in carrying out Chelan PUD's hatchery programs, under the current contract between WDFW and Chelan PUD, such that Chelan PUD's total funding obligations do not increase.

WDFW HGMP Actions

WDFW is the funding source for elements of the hatchery program that are not Chelan PUD's obligation under the HCP or respective hydroelectric license. In particular, WDFW is responsible for coordinating the funding for manual adult management activities from the point at which fish are placed in holding containers when manually removed and/or for a conservation fishery. The Co-managers will determine the disposition of the fish placed in the holding containers. In addition, WDFW is responsible for the research activities described in Section 12 of this HGMP related to relative reproductive success study on spring Chinook.

Definitions

In this HGMP, the following definition shall apply:

Adult Management:

Adult Management is the selective removal of excess hatchery-origin spring Chinook by means of harvest, translocation, culling, or other method of physical removal of returning adult fish for purposes other than broodstock collection or HCP Hatchery Committee-approved monitoring and evaluation activities.

1.8.2) Program Description

The only existing spring Chinook adult based supplementation program in the Wenatchee Basin is the Chiwawa spring Chinook salmon program. As other spring Chinook hatchery programs come on-line or are envisioned, the Yakama Nation, WDFW, and the CCT, as the entities having primary stewardship responsibilities for fishery resources in the Wenatchee watershed, have developed a Draft Wenatchee Basin spring Chinook Management Implementation Plan (draft MIP) (Yakama Nation, 2009) intended to address all spring Chinook salmon hatchery programs in the Wenatchee River basin. The draft MIP proposes to ensure that spring Chinook salmon artificial propagation programs in the Wenatchee River basin achieve the following objectives:

- Operate in a manner that is consistent with and contributes to the recovery of the species,
- Meet negotiated court mediated agreements,
- Compensate for lost or degraded habitat function from hydropower projects[3],
- Benefit society through existence values and harvest opportunities.

The draft MIP proposes various methods to meet these objectives for the entire Wenatchee basin such as escapement goals, broodstock collection targets, terminal fisheries, adult management, and other options for beneficial uses of surplus hatchery fish. The program proposed in this HGMP, however, only contemplates Chelan PUD's Chiwawa spring Chinook mitigation obligation and therefore, all methods described herein relate only to Chelan PUD's program. For larger Wenatchee basin components, please refer to the draft MIP.

Currently, Chelan PUD operates a 672,000 smolt program. It is anticipated that the program will be reduced to 298,000 smolts, with HCP Hatchery Committee concurrence and consistent with the adaptive management principles outlined in the HCP, in 2010 (broodstock collection for 298,000 smolts would begin in 2010), as some program components are proposed to be tested in 2010 (see Section 7.2). For the purposes of this HGMP, both the current and proposed program are discussed.

The Chiwawa spring Chinook artificial propagation program is described in the subsequent subsections and includes (1) broodstock collection and program size, (2) spawning, incubation, rearing and release of juvenile spring Chinook (3) escapement and returning adult management, and (4) monitoring and evaluation.

The Chiwawa Spring Chinook hatchery program will be operated with two

[3] Chelan PUD's Chiwawa spring Chinook program is mitigation for passage losses only. Compensation for lost or degraded habitat function from hydropower projects applies to other programs in the Wenatchee River basin.

components:

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

2) a "safety net"[4] component that completes the full production level of the program, is genetically linked to the natural population, and guards against catastrophic run failure.

Fish produced to satisify the two components of the program, respectively, will be reared separately until marking occurs. Post marking the components could be combined for final rearing and release, or remain separate if multiple small acclimation sites are developed in tributary areas as approved by the HCP Hatchery Committee.

1.8.2.1 Artificial Propagation Activities

Broodstock Collection and Program Size

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Broodstock collection typically involves a weir or barrier that forces migrating adults to enter a ladder and trap. This effectively blocks their upstream migration and the trapped spring Chinook are counted and either retained for use in the hatchery, or released upstream of the collection facility to continue their migration and spawn naturally.

The broodstock collection numerical goals 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. See Table 2.

It is the intent of the Co-managers to collect broodstock in a manner that achieves mitigation program needs for each program component and contributes to an

[4] The "safety net" colloquialism refers to the ability to utilize all or a portion of the hatchery fish return to supplement otherwise dangerously small returns of natural origin spring Chinook. This hatchery component is otherwise known as a 'segregated' component since the broodstock is partially or fully composed of hatchery fish, with little or no natural origin fish. In that sense this hatchery program component is segregated from the natural run. The genetic linkage to the natural run may be weaker than that of the fully integrated hatchery component (all wild x wild crosses) since some or all of the broodstock have not included naturally-produced parents for varying numbers of generations.

increased proportionate natural influence (PNI)[5]. A 33 percent extraction rate will be used for natural origin fish collected for broodstock. In years when the proportion of natural-origin fish (pNOB) is 1.0 the actual extraction rate will be lower than 33 percent. In years of an emergency, such as extremely low abundance that could cause long term impacts to the Chiwawa spring Chinook program, with HCP Hatchery Committee approval and as described in the annual broodstock protocol, natural-origin returns (NOR) adults from the Nason and Chiwawa programs may be pooled in a composite broodstock if necessary to meet the program goal. See Table 2 below for broodstock collection totals needed. Additionally, collection for Bacterial Kidney Disease (BKD) management may necessitate collecting up to an additional 20 percent hatchery origin fish to allow for culling of high virus titer females (see Appendix 1 for additional information regarding BKD managment).

Table 2. Total broodstock collection necessary to meet production targets for Wenatchee Chiwawa spring Chinook hatchery program.

Sub-Basin	Conservation Smolt Objective	Approx. Conservation Brood Need [a]	Safety Net Smolt Objective	Approx. Safety Net Brood Need
Chiwawa River	150,000	80	148,000	80

[a] All values based on a current mean fecundity of 4,785 and an egg to smolt survival of 0.8187 (Hillman et al. 2008). Numbers may be greater to allow for BKD management.

The current Chiwawa spring Chinook salmon program collects natural origin broodstock at the Chiwawa Weir and hatchery origin broodstock at TWD. The proposed program would collect natural and/or hatchery broodstock at Chiwawa Weir and/or TWD and includes the development of annual site-based broodstock collection protocols approved by the HCP Hatchery Committee (including NMFS). The objectives and protocols may be adjusted in season to meet changes in the abundance and location of adult returns, and minimizing impacts on non-target fish. The protocol described below will be used to facilitate the collection of hatchery broodstock at TWD throughout the run while achieving the desired target extraction rate and ensuring full broodstock collection.

1. Based on forecasted run size, the JFP will identify a target PNI level. Based on the target PNI level, WDFW, as the current authorized agent for Chelan PUD performing broodstock collection, will develop weekly broodstock collection goals. In-season check-ins will be used by the JFP to ensure that the selected PNI level is appropriate.

[5] Mathematically, PNI = *pNOB /pHOS + pNOB*, where *pNOB* is the proportion of natural-origin fish in the hatchery broodstock and *pHOS* is the proportion of hatchery-origin fish on the spawning grounds. Biologically, PNI is a measure of the proportion of time the population spawns in the wild, where it is subjected to natural selection.

2. Weekly broodstock collection goals are used to collect broodstock from throughout the run.

When in operation, trap facilities will be checked and emptied daily with adults to be used as broodstock transported to a hatchery facility for holding and spawning, and all other fish either released upstream of the trap or removed as part of hatchery fish influence (pHOS) control.

The following procedures will be employed to minimize potential adverse impacts on spring Chinook associated with broodstock collection activities:

- All species will be held for a minimal duration in the traps – less than 24 hours;
- Traps and holding areas will be locked or secured against tampering or vandalism;
- All natural origin spring Chinook in excess of broodstock goals will be released upstream immediately without harm, consistent with run escapement objectives; and
- Spring Chinook transfers will be done using water-to-water techniques.

The removal of adults from the naturally spawning population has potential adverse impacts. These include numerical reduction of the natural population (mining) and selection effects. Selection is the intentional and unintentional collection of adults for broodstock based on one or more of the life history characteristics such as run timing, age, morphology, and sex ratio that do not fully represent the natural population. The effects of selection or selection effects can change the characteristics of the natural population, as well as cause the hatchery-produced fish to diverge genetically or demographically from the naturally produced population.

Spawning, Incubation, Rearing and Release of Juvenile spring Chinook

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Spawning currently occurs at the Eastbank Hatchery. The spawning facilities are integrated into the broodstock holding facilities. The spawning facilities allow for broodstock to be sorted for "ripeness" and then spawned. Fertilization and incubation also occurs at the Eastbank Hatchery.

To meet both the conservation and recovery goal, along with providing societal benefits of hatchery fish, the following juvenile release strategy will be employed. A portion of each hatchery program, the conservation component (approximately 150,000 smolts), in the Chiwawa River would be used to supplement the natural population in a manner consistent with the principles and recommendations of the Hatchery Scientific Review Group (HSRG), the Interior Columbia Technical Recovery Team (ICTRT), and the Upper Columbia River Salmon, Steelhead, and Bull Trout Recovery Plan (Recovery Plan). The remaining mitigation production obligation (approximately 148,000 smolts) would be produced in the safety net component using hatchery origin fish. The conservation component smolts would be used to augment the natural spawning populations on an as-needed basis while the safety-net component would provide a back-up for spring Chiwawa spawners as well as other societal benefits including harvest and potentially restoring production in minor spawning areas (miSAs). Table 3 provides a summary of the proposed juvenile release strategy.

Table 3. Proposed release levels of supplementation and segregated components of the spring Chinook salmon hatchery program in the Chiwawa River.

Program	Conservation[1]	Safety Net[1]	Total Production[1]
Chiwawa River	150,000	148,000	298,000

[1] Number of smolts.

Spring Chinook pre-smolts will be transferred to the Chiwawa Acclimation Facility for over-wintering and be released in early May.

Through the Columbia River Fish Accords, additional acclimation sites may be developed in the Chiwawa River basin upstream or downstream of the current facility. These will be relatively small, natural ponds and side-channels that can be modified with minimal ground disburbance for use as acclimation sites and potentially rearing habitats after smolts are released. Natural or semi-natural acclimation ponds may include either man-made earthern ponds or exising ponds.

Chelan PUD is responsible for providing the funding for the activities described in this sub-section, except that Chelan PUD's obligations with respect to the development of additional acclimation sites other than the existing Chiwawa acclimation site, will be determined in accordance with the processes outlined in the HCP. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

1.8.2.2 Escapement Goals for Natural Spawning Areas

The conservation component of the hatchery program is specifically intended to increase the number of natural origin adults on the spawning grounds. The increased number of fish spawning in the natural environment is expected to ensure that available habitat is properly seeded and results in an increase in the number of naturally produced juvenile fish that migrate to the ocean, thereby increasing the number of adults that return to spawn. However, escapement of hatchery fish on the spawing grounds in excess of an escapement goal serve no useful purpose and can result in negative impacts on the natural population through density-dependent ecological effects or genetic impacts.

To achieve the positive benefit of boosting the number of natural spawners without adversely affecting the reproductive success of the natural population, both the total number of natural origin spawners and the proportion of hatchery origin spawners (pHOS) in the spawning escapement should be managed to achieve the objectives described below.

To set escapement goals for spring Chinook in the major and minor spawning areas in the Wenatchee basin the Co-managers considered several ways to estimate the available habitat in each spawning area (see Appendix 1 in the draft MIP, 2009 for methods) and have established goals outlined in Tables 4 and 5. In addition to calculating a habitat-based escapement estimate, monitoring data collected over the last nine years suggest that many spring Chinook salmon that are passed over TWD do not survive to spawn (unpublished WDFW data, Andrew Murdoch). This pre-spawning mortality estimate ranges from 17 to 62 percent and appears to be closely related to the density of the spawners. Thus, the escapement goals stated herein are adjusted by up to 35 percent to compensate for pre-spawn mortality. These estimates could change as survival, habitat capacity, and productivity conditions within and outside the Wenatchee basin change, estimates of pre-spawning mortality are refined, and stock-recruitment models are updated.

Fundamental elements of the proposed management to attain spawning escapement and promote local adaptation relating to abundance and diversity are listed below.

- **Proportionate Natural Influence (PNI):** Hatchery fish will be managed at TWD according to the sliding scale in Table 4.
- **Minimum spawning escapement:** At least 50 effective spawners in the Chiwawa River, of which half should be natural origin spawners.
- **Abundance Objective:** Manage for a maximum run escapement passed at TWD of 900 fish and a maximum spawning escapement of 777 (Table 5) to achieve sufficient seeding based on current habitat availability. NOR escapement will be unrestricted.

Table 4. Sliding scale of PNI goals based on natural origin (NOR) spring Chinook run size expected to the Chiwawa River and Wenatchee River basin.

NOR Run Size		PNI
Chiwawa River	**Wenatchee River Basin**	
>372	>910	≥ 0.80
278-372	631-909	≥ 0.67
208-277	525-630	≥ 0.50
176-207	401-524	≥ 0.40
<175	<400	Any PNI

Table 5. Interim Wenatchee River Basin spring Chinook escapement targets at TWD. All values are for natural and hatchery origin fish combined.

Spawning Area or Hatchery Program	Max. Spawning Escapement Target	Max. Run Escapement at TWD[a]
Wenatchee Rover Basin	155	238
Chiwawa River	777	900

[a]NOR escapement will be unrestricted at all run sizes. In some years total escapement will be lower than the listed value so that PNI targets can be achieved. As NOR runsizes increase, pHOS will approach 0.00. The maximum run escapment at TWD is higher than the spawning escapment to allow for pre-spawn mortality (adjusted up to 35 percent).

The maximum spawning and run escapement targets (NOR escapement will be unrestricted) for the Wenatchee and Chiwawa Rivers are listed in Table 5. However, the Co-managers recognize that in some years varying marine survival make it impossible to meet the targets listed in Table 5 while achieving PNI goals. Pre-season forecasts and in-season adjustments by WDFW will be needed to determine what PNI will be targeted in any given run year. For example, the PNI goal in a year when the expected NOR run size to the Chiwawa River is 500 fish would be 0.80 or better. Thus, an accurate enumeration of run size is very important to choosing the correct PNI target in a given year.

1.8.2.3 Monitoring and Evaluation

Monitoring and evaluation plays an important role in helping measure program results and determining potential future modifications (adaptive management). This information is collected directly from, or derived from spawning ground surveys, broodstock sampling, stock composition sampling (stock assessment), hatchery juvenile sampling, smolt trapping, PIT tagging, adipose clipping, genetic sampling, disease sampling, and snorkeling. Monitoring and Evaluation objectives for this program are detailed in Section 11.1; specific actions are detailed in Murdoch and Peven (2005) and Hays et al. (2006), and risk aversion measures are detailed in Section 11.2.

Chelan PUD funds the monitoring and evaluation activities for this program as agreed to by the HCP Hatchery Committee in accordance with the processes outlined in the HCP. WDFW, Yakama Nation, and BioAnalysts, Inc. currently provide the personnel and equipment for conducting these activities. For the implementation of the monitoring and evaluation activities for this HGMP, Chelan PUD does not expect significant changes in the entities above who are performing the work. Although these entities are authorized agents and Chelan PUD and WDFW are co-permit holders for this activity, Chelan PUD is ultimately responsible for ensuring these activities are complete.

1.8.2.4 Terminal Fisheries to Reduce the Proportion of Hatchery Fish on the Spawning Grounds

This program 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 less than 5.5 percent on total runs of less than 27,000 fish to a maximum of 17 percent on runs of 488,000 fish or more.

The safety net component fish returning to the Chiwawa River in excess of escapement and broodstock needs may be removed through selective conservation fisheries as determined on a yearly basis by the JFP. 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 JFP will attempt to release safety net program fish at locations where adults can be harvested in selective and non-selective conservation fisheries.

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 TWD, and whether there should be a conservation fishery to remove HORs.

WDFW is responsible for funding and conducting the management activities described in this sub-section. Accordingly, WDFW will be the permit holder for the activities described above in this sub-section.

1.8.2.5 Other Options for Beneficial Uses of Surplus Hatchery Returns

Additional options for disposition of surplus HORs are:

- Restoration/reintroduction efforts at appropriate numbers and suitable locations (e.g. Peshastin Creek, Mission Creek, Chumstick Creek and/or other newly opened or created habitats to complement on-going habitat restoration activities);
- Fishery benefits;
- Removal at TWD:
    a. To appropriate public entities for consumption;
    b. Nutrient enrichment in historic spawning areas;
    c. or other beneficial uses.

See Appendix 8 in the draft MIP (Yakama Nation, 2009) for more detail on the potential distribution of surplus hatchery fish.

Responsibilities:
Funding, permit holder, and agent for the activities discussed in this section are as follows:

Reintroductions into Minor Spawning Areas

Funding: WDFW

Permit Holder: WDFW

Agent: WDFW

Harvest

Funding: WDFW

Permit Holder: WDFW

Agent: WDFW

Adult removal at TWD

Funding: Chelan PUD has agreed to voluntarily provide funding to WDFW for up to approximately one FTE (for both steelhead and spring Chinook hatchery programs) for WDFW's adult management activities provided that equivalent savings can be found by WDFW through implementation of efficiencies in carrying out Chelan PUD's hatchery programs, under the current contract

between WDFW and Chelan PUD, such that Chelan PUD's total funding obligations do not increase. This funding includes manual adult management activities up to the point at which spring Chinook are removed at TWD and placed in holding containers. Chelan PUD does not believe (though this is not necessarily endorsed by the JFP) that it has an obligation for adult management activities under the HCP but has agreed to fund adult management activites as described above.

WDFW is responsible for coordinating the funding for manual adult management activities from the point at which fish are placed in holding containers when manually removed and/or for a conservation fishery. The Co-managers will determine the disposition of the fish placed in the holding containers.

Permit Holder: Chelan PUD and WDFW will be co-permit holders for manual adult management activities up to the point at which spring Chinook are removed at TWD and placed in holding containers.WDFW will be the permit holder for manual adult management activities, including a conservation fishery, from the point at which fish are placed in holding containers.

Agent: For Chelan PUD's permit, WDFW is designated as the authorized agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Reintroductions into Minor Spawning Areas

In previous years, about 350 spring Chinook adults were transported from Leavenworth National Fish Hatchery and released into Peshastin Creek in an effort to re-establish a self-sustaining population. The use of non-listed fish in this manner is not consistent with the Recovery Plan, however; using surplus hatchery origin ESA-listed fish collected at TWD would be consistent. Under this option, marked hatchery spring Chinook would be trapped at TWD throughout the run to ensure that the appropriate run timing characteristics are maintained.

The transfer and release of excess ESA-listed fish into minor spawning areas could occur in tributaries such as Peshastin Creek, Mission Creek, Chumstick Creek and/or other newly-opened or created habitats to complement on-going habitat restoration activities. This process could continue until a self-sustaining population (i.e., naturally produced) has been re-established and the carrying capacity of the basin is met or exceeded. Adult transfers could be stopped if the Co-managers decide to release smolts into the tributary area instead. This proposed action would increase the spatial distribution of an endangered population, consistent with Recovery Plan and ICTRT guidance regarding viable salmonid population (VSP) criteria.

The maximum number of adults released into any minor spawning area will be developed by the Co-managers. The minor spawning areas receiving fish will be prioritized based on current adult access and overall habitat conditions.

A combination of conservation harvest and removal at TWD may be used to prevent over-escapement of HORs. The Chiwawa Weir could also be used to remove excess hatchery fish if too many fish have been passed upstream of TWD, or for monitoring and evaluation activities discussed in more detail in Section 11.

Harvest

If safety net HORs are expected to be surplus to escapement and broodstock needs (including restoration efforts) a conservation fishery in the Wenatchee River could also be utlized to reduce HOR escapement. The JFP will develop criteria (e.g. number of excess HOR population, population trend towards viability and minmim number of natural origin spring Chinook) necessary to initate a conservation fishery.

Total natural origin take will be 2 percent or less of the NOR, unless the projected NOR run to TWD will meet the full natural escapement and broodstock goals for the basin.

Table 6 below demonstrates the recommended take at different estimates of NOR run size predicted upstream of TWD for the entire Wenatchee Basin run. However, much depends on the actual encounter rate observed in Wenatchee River fisheries If take is limited to 2 percent, and the encounter rate is 30 percent or less, the total take would range between 3 and 20 NOR at run sizes between 250 and 1,000. At no time should NOR be targeted (direct take) in a fishery unless the geomean NOR run size over 12 years is over 2,500 upstream of the mouth of the Wenatchee River. Intensive creel surveys (at least 4 days per week) would be used to monitor catch and harvest totals."

Table 6. Estimated take of natural origin spring Chinook in a Wenatchee River fishery implemented to remove excess hatchery origin fish (based on the entire Wenatchee Basin run).

Projected NORs 1/	Take at 2% of NORRs 2/	Potential Encounter Rate 3/	Estimated Take in Fishery 4/	Percent Take
250	5	0.15	3	1.00%
500	10	0.15	5	1.00%
750	15	0.15	8	1.00%
1000	20	0.15	10	1.00%
250	5	0.20	4	1.70%
500	10	0.20	9	1.70%
750	15	0.20	13	1.70%
1000	20	0.20	17	1.70%
250	5	0.30	5	2.00%
500	10	0.30	10	2.00%
750	15	0.30	15	2.00%
1000	20	0.30	20	2.00%

1/ A range is presented in three encounter rates. Future NOR run sizes may be >1,000.

2/ A uniform application of 2% to the run size.

3/ Encounter rates between 15% and 25% are most likely, determined through creel survey.

4/ A hooking mortality rate of 6.8% is assumed based on Bendock and Alexandersdottir (1991).

Removal at TWD

Fish removed at TWD could be distributed to appropriate public entities or used for nutrient enhancement in tributaries. The need for nutrient enhancement was identified in the Upper Columbia Salmon Recovery Plan (UCSRB 2007) and in the UCTRT Biological Strategy (Appenix H to the Recovery Plan). Fish of good condition surplused in the first half of the run could be distributed for human consumption, while fish in the second half of the run could be used for nutrient enrichment.

1.8.3) Marking Strategy

Responsibilities: Chelan PUD is responsible for providing the funding for the marking activities described in this Section 1.8.3. WDFW is currently responsible for conducting these activities. Consistent with these responsibilities, Chelan PUD

and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

All smolts will be given an external mark or otherwise tagged as agreed to by the HCP Hatchery Committee. Marking and tagging strategies will be sufficient to allow differential harvest between conservation and safety net production components and to allow efficient broodstock collection and removal of HORs at TWD and/or Chiwawa Weir.

1.9) List of program "Performance Standards".

The hatchery program has survival performance standards for each life stage, from adult collection to spawning, egg incubation, and survival from ponding to release. The original standards were established in the BAMP (1998), but because actual hatchery survivals for the spring and summer Chinook programs routinely exceeded the BAMP standards, the performance target was increased in the current five-year M&E Plan (Murdoch and Peven 2005). In most years, the in-hatchery survival of the Chiwawa spring Chinook program has met or exceeded the survival standards for all categories, except for survival from transport to release which failed to meet the 95 percent survival standard in 3 out of 15 years.

Table 7. Brood year survival averages 1989-2005

Brood year	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							
Average 1989-2005	98.3	97.5	92.8	98.1	98.7	98.1	90.0	92.9	81.9
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

Also refer to Section 11.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1) "Performance Indicators" addressing benefits.

Table 8 outlines the performance indicators (taken from the current five-year M&E Plan [Murdoch and Peven 2005]) monitored for this program with the expected benefit and risk identified for each objective.

Table 8: Performance indicators with expected benefits and risks

Objective #	Benefit (B) or Risk (R)	Indicator	Target	Preliminary results	Frequency of monitoring
1	B	Natural replacement rate	≥ Non-supplemented pop.	> 10 yrs	on going
2/3	R	Run timing	= Naturally produced run timing	5 yrs	on going
2/3	R	Spawn timing	= Naturally produced spawn timing	5 yrs	on going
2/3	B/R	Redd distribution	= Naturally produced spawning distribution	5 yrs	on going
3	R	Genetic variation	= Donor population	5 yrs	periodically
3	R	Genetic structure	= Baseline condition	5 yrs	periodically
3	B/R	Effective population size	Δ Spawning population size	5 yrs	on going
3	R	Size and age at maturity	≥ Naturally produced fish	5 yrs	on going
4	B	Hatchery replacement rate	≥ Expected value1	5 yrs	on going
5	R	Stray rate	< 5% of adult returns	5 yrs	on going
6	B	Number and size of fish	± 10% of production level	5 yrs	on going
7	R	Smolts/redd	≥ Non-supplemented pop.	> 10 yrs	on going
8	B	Harvest	≤ Maximum level	5 yrs	on going

1.10.2) "Performance Indicators" addressing risks.

See section 1.10.1 above.

1.11) Expected size of program.

Currently, the program release goal is 672,000 smolts. Upon implementation of this proposed program, the program release goal is expected to decrease to 298,000 smolts. Additionally, per the Rock Island HCP, Section 8.4.3, hatchery production levels may be adjusted after 2013.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Currently, local stock requirements for the Chiwawa stock are not to exceed 400 fish, comprised of up to 70 percent of hatchery origin. From 1998 - 2007, the annual broodstock collection has averaged 183 adults, with a male/female ratio of 1.22/1.0. Since 1998, natural origin adults have averaged 31 percent of the broodstock collected and 32 percent of the broodstock that were spawned.

For the 298,000 smolt program local stock requirements for Chiwawa spring Chinook are estimated to be no greater than 160 fish (comprised of 80 brood for the conservation component and 80 brood for the safety net component). Up to 20 percent additional hatchery-origin females may be collected to meet any production shortfalls related to culling for high virus titer fish.

After 2013, the local stock requirements are not specifically defined, however it is expected that it will be less than the local stock requirements needed for the current program of 672,000 smolts.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or

renegotiated.

The current maximum annual fish release levels are 672,000 smolts and up to 298,000 smolts under the proposed program. After 2013 proposed annual fish release levels will be agreed to by the HCP Hatchery Committee, and while the specific number is not known, it is expected to be less than 672,000 smolts. The current release location is from Chelan PUD's Chiwawa Acclimation Facility.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The following discussion is based on data that have been reported in the 2007 annual M&E report for the Chelan County PUD funded hatchery programs as compiled by Hillman, et al. (2008).

The program has released fewer than the 672,000 smolt target during most years since 1989, in large part due to broodstock shortages. From 1989 – 2005 brood years, the average number of smolts released per year has been 175,764 (range 15,176 (BY 1996) – 494,517 (BY 2004)), not including the two years when no fish were produced.

Adult returns from the Chiwawa spring Chinook program are estimated from detection of CWT tagged fish in fisheries sampling, hatchery broodstock collection, and spawning ground carcass recoveries. The smolt-to-adult survival rates (SARs), adjusted for tag loss, have averaged 0.005 from BYs 1989 – 2001. Based on the number of smolts released for each brood year and the associated SAR for that brood year, the adult production from this program has averaged 590 adults produced per brood year (range 21 (BY 1996) – 1,657 (BY 2001)).

The estimated adult spring Chinook spawning escapement contributed by brood year to the Chiwawa River has averaged 226 hatchery origin for brood years 1989 – 2007 (from Hillman et al. 2009, Table 5.34). Natural origin spawners have averaged 265 for brood years 1989 – 2007 (Hillman et al. 2009, Table 5.34). Hatchery replacement rates (HRR) have averaged 6.19 (6.99 if harvest included), whereas the natural replacement rate (NRR) has averaged 0.45 (1.63 if harvest included) (Hillman et al. 2009, Table 5.35).

1.13) Date program started (years in operation), or is expected to start.

The hatchery production of spring Chinook for release into the Chiwawa River began in 1989, with the first release of fish in 1991, as required in the FERC license for the Rock Island Hydroelectric Project. The broodstock for the initiation of this hatchery program was collected from the Chiwawa River.

Currently, Chelan PUD operates a 672,000 smolt program. It is anticipated that the program will be reduced to 298,000 smolts, with HCP Hatchery Committee concurrence and consistent with the adaptive management principles outlined in the HCP, in 2010

(broodstock collection for 298,000 smolts would begin in 2010), as some program components are proposed to be tested in 2010 (see Section 7.2). For the purposes of this HGMP, both the current and proposed program are discussed.

1.14) Expected duration of program.

No Net Impact mitigation for unavoidable mortality at the hydroelectric project is expected to continue until 2054. This program is part of the mitigation package. If and when Chiwawa spring Chinook exhibit recovery for all four viability criteria as defined by the Recovery Plan (UCSRB 2007) and attain Low Risk extinction status, the scope of the hatchery program will be re-evaluated and adaptively managed as necessary and as provided under the terms of the HCP.

1.15) Watersheds targeted by program.

Wenatchee and Chiwawa River watersheds (WRIA 45).

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

This hatchery program has been developed over the course of many years (decades). As described in more detail in footnote 1 in Section 1.7 above, this program is adaptively managed by the Rock Island HCP Hatchery Committee. Many alternatives have been, and will continue to be considered within that Committee. This HGMP is based on HCP Hatchery Committee unanimous agreement that the program described meets the current biological, agency, and program goals.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS.

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

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Under the existing permit structure, Chelan PUD, Douglas County Public Utility District No.1 (Douglas PUD) and WDFW are joint permit holders for spring Chinook hatchery operations in the Upper and Mid-Columbia. Permit 1196, issued pursuant to ESA Section 10(a)(1)(A) permits the annual take (artificial propagation) of listed spring Chinook authorized to WDFW, Chelan PUD, and Douglas PUD of ESA listed adult and juvenile, endangered, naturally produced and artificially propagated, UCR spring Chinook salmon associated with artificial propagation supplementation programs for the Wenatchee River and Methow River Basin populations of the species. This permit expires January 20, 2014.

Moving forward, this HGMP proposes that NMFS modify its permit structure so that there are separate permits related to the activities described in this HGMP. The first permit should encompass Chelan PUD hatchery program obligations arising out of its HCPs and currently implemented by WDFW as its agent. Chelan PUD and WDFW should be designated as co-permit holders and WDFW as its agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

A second permit should be issued to WDFW encompassing the adult management activities described in this HGMP.

A third permit should be issued to WDFW encompassing the relative reproductive success study detailed in Section 12 of this HGMP.

The Douglas PUD hatchery program should be covered in a separate permit not further described in this HGMP.

Authorizations

FERC processes:

Rock Island FERC License 943

Habitat Conservation Plan (contained within FERC license) and associated ITP

The overriding goal of the Project HCP – developed in accordance with the ESA's goals of conserving and facilitating the recovery of natural populations – is to achieve no net impact (NNI) on anadromous salmonids as they pass the Project. Chelan PUD is responsible for implementing specific elements of the hatchery programs consistent with overall objectives of rebuilding natural populations and achieving NNI. Species-specific program objectives developed by the JFP may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

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

The NMFS ESA-listed salmonid species most likely affected by the Chiwawa spring Chinook program are Upper Columbia River spring Chinook and steelhead. An extensive volume of literature exists to describe these species and specific ESA-listed stocks of concern. This extensive literature has been thoroughly summarized by Mullan et al. (1992) and Chapman et al. (1995).

Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Upper Columbia River ESU spring Chinook (*Oncorhynchus tshawytscha*). All spring Chinook in the Upper Columbia ESU except the Carson-origin stock returning to the Leavenworth National Fish Hatchery and the Okanogan River were listed as Endangered under the ESA on March 24, 1999. Adult spring Chinook destined for the upper-Columbia Basin enter the Columbia River beginning in March and reach peak abundance (in lower river) in April and early May (Chapman et al. 1995). Spring Chinook enter the mainstem portions of tributaries from late-April to July. Spawning occurs from late-July through September, usually peaking in mid to late August (Chapman et al. 1995). From 1991 to 2000, the average date for peak spawning in the upper Wenatchee River and tributaries ranged from August 25th to September 4th (Mosey and Murphy 2002).

Data from post-spawn adults collected and sampled in mid-Columbia tributaries, 1986 to 1993, show that on average, 5 percent of males return at age 3, 58 percent at age 4, and 37 percent at age 5. Female averages are 58 percent at age 4, and 42 percent return at age 5 (Chapman et al. 1995). On the spawning grounds, Chapman et al. (1995) indicated that females may dominate the males in numbers, but state that the ratio may be closer to 1:1. This is because there is a greater likelihood of recovering females on the spawning grounds than males (Chapman et al. 1994).

From 1994 to 2001, the average length (hypural length) of wild males (including jacks) collected from Wenatchee Basin natural spawning areas is 64 cm (range of averages = 52 to 71 cm). For females, the average is 66.5 cm (range of averages = 63 to 71 cm) (Mosey and Murphy 2002).

Wild juvenile spring Chinook salmon originating in the upper-Columbia Basin emigrate towards the ocean during their second year. Average size at emigration (April and May) ranges from about 91.8 mm to 100.5 mm (averages from three emigration studies) (Chapman et al. 1995). Trapping results on the Wenatchee River showed that wild yearling spring Chinook averaged 97.3 mm in length with peak catch occurring on April 10th, reaching 50 percent of their passage date by April 12th, and 90 percent passage by May 17th of 2004. (Volkhardt et al. 2005).

From 1985 to 1993, the average 10th, 50th, and 90th percentile passage at Rock Island Dam was April 21st, May 10th, and June 3rd respectively (Chapman et al, 1995). Although these percentages are strongly influenced by releases from Leavenworth NFH, Chapman et al. (1995) believe that the naturally produced migrants have a run timing similar to the hatchery component.

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Upper Columbia River summer steelhead trout (*Oncorhynchus mykiss*) ESU was listed as Endangered on August 18, 1997. NMFS reviewed this listing in light of the decision to include hatchery produced UCR steelhead in the ESU. The UCR steelhead, including the hatchery produced component of the population, was reclassified as a Distinct Population Segment (DPS) and determined to be Endangered in June of 2007. The primary local population of concern is the Wenatchee steelhead population, including any sub-populations.

Steelhead destined for the upper-Columbia region enter the Columbia River between May and September (WDF et al. 1990). They pass Rock Island Dam from July through the following May. All steelhead spawn in the spring regardless of when they enter the Columbia River.

Steelhead spawning ground surveys have been on-going since 2001 (Hillman et al. 2008). Fish generally spawn from late March through early June. The areas of most importance (in descending order) are: Upper Wenatchee River mainstem, Nason Creek, Chiwawa River, Peshastin Creek, lower Wenatchee River mainstem, and Icicle Creek.

Females make up about 65 percent of adults sampled at Wells Dam; of smolts sampled at Rock Island Dam in 1988, 63 percent were female (Chapman et al. 1994).

Howell et al. (1985) reported age estimates from creel surveys in the Wenatchee River from the late 1970s to the early 1980s. Scale samples from these surveys were used for age determination. In the Wenatchee River, they report naturally produced steelhead of five different age classes (2.1, 2.2, 2.3, 3.1, and 3.2), with the largest percentage in the 2.1 class. The "European Method" was used for age determination where the first digit represents the number of winters spent in freshwater, and the second digit indicates the number of winters in saltwater.

Migrating steelhead smolts captured at Rock Island Dam average 163 to 188 mm. Similarly, smolts trapped on the lower Wenatchee River averaged 169.5 mm in length for the age-2 migrants which dominated 66.3 percent of the catch. These smolts emigrated primarily in late-April through May with peak catch occurring on April 27th and 50 percent passage by May 7th of 2004 (Volkhardt et al. 2005). Adults returning after one year average 59 to 64 cm, whereas those spending two years at sea average 67 to 76 cm when returning to freshwater. Between 1986 and 1993, wild adults of both sexes combined, averaged 66.5 cm (Chapman et al. 1994).

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

Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (see definitions in "Attachment 1").

Both Wenatchee River spring Chinook salmon and UCR summer steelhead are described as having overall "high" risks in abundance, productivity and viability. Both listed stocks are currently considered below minimum thresholds in these categories. See Tables 9 and 10 below reproduced in part from: ICTRT (Interior Columbia Technical Recovery Team) (2008a).

Table 9. Viability assessments for steelhead populations in the North Cascades MPG. Table reproduced in part from ICTRT (2008a).

		Population Level: Abundance and Productivity					**Population Level: Spatial Structure and Diversity**			**Population Level: Overall Viability Rating**
		Abundance		***Productivity***		***Overall A/P***	***Goal A***	***Goal B***	***Overall SS/D***	
Population	***Extant/ Extinct***	***Current Natural Abundance***	***Minimum Threshold***	***Current Estimate (R/S)***	***Minimum R/S @ threshold***	***Integrated A/P Risk***	***Natural Processes Risk***	***Diversity Risk***	***Integrated SS/D Risk***	
Wenatchee River	Extant	1,172	1,000	0.825 (0.87)	1.20	**High**	Low	High	**High**	**HIGH RISK**
Entiat River	Extant	79	500	0.48 (0.82)	1.35	**High**	Low	High	**High**	**HIGH RISK**
Methow River	Extant	281	1,000	0.28 (0.49)[1]	1.20	**High**	Low	High	**High**	**HIGH RISK**
Okanogan River	Extant	89	500 (U.S. section only)	0.20 (0.28)	1.35	**High**	High	High	**High**	**HIGH RISK**

Table 10. Viability assessments for Upper Columbia spring Chinook salmon populations in the North Cascades MPG. Table reproduced in part from ICTRT (2008a).

		Population Level: Abundance and Productivity					**Population Level: Spatial Structure and Diversity**			**Population Level: Overall Viability Rating**
		Abundance		***Productivity***		***Overall A/P***	***Goal A***	***Goal B***	***Overall SS/D***	
Population	***Extant/ Extinct***	***Current Natural Abundance***	***Minimum Threshold***	***Current Estimate (R/S)***	***Minimum R/S @ threshold***	***Integrated A/P Risk***	***Natural Processes Risk***	***Diversity Risk***	***Integrated SS/D Risk***	
Wenatchee River	Extant	650	2000	0.53	1.62	**High**	Low	High	**High**	**HIGH RISK**
Entiat River	Extant	59	500	0.72	1.76	**High**	Moderate	High	**High**	**HIGH RISK**
Methow River	Extant	180	2000	0.80	1.62	**High**	Low	High	**High**	**HIGH RISK**
Okanogan River	Functionally Extirpated	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

The ICTRT (2008b) has assessed the current natural abundance and productivity of Wenatchee steelhead (Brood Years 1987-2006) as 1,172 adults with a geomean of 0.87 returns per spawner (R/S) (Table 8). Likewise, Wenatchee spring Chinook (Brood Years 1999-2008) natural abundance is 650 adults and 0.53 R/S.

- 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 11. Chiwawa River spring Chinook recruits per spawner, 1981-2003. Data provided by Andrew Murdoch – WDFW. Adjusted for harvest impacts.

Brood Year	Spawners	Adjusted Recruits	Recruits/ Spawner
1981	621	2207	3.6
1982	605	1604	2.7
1983	1082	1260	1.2
1984	1213	1215	1.0
1985	1722	911	0.5
1986	1072	455	0.4
1987	995	688	0.7
1988	587	1029	1.8
1989	713	257	0.4
1990	347	39	0.1
1991	242	19	0.1
1992	676	51	0.1
1993	222	105	0.5
1994	184	55	0.3
1995	33	50	1.5
1996	58	178	3.1
1997	182	911	5.0
1998	86	343	4.0
1999	94	11	0.1
2000	312	600	1.9
2001	2416	329	0.1
2002	707	253	0.4
2003	270	86	0.3

- Provide the most recent 12 year (e.g. 1995-2007) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 12. Chiwawa River Chinook annual redd counts and estimated run size, 1990-2007. Compiled from WDFW, unpublished data and NMFS 1999

Year	Redd Count	Expansion Factor	Escapement + Broodstock
1992	302	2.24	793
1993	101	2.20	322
1994	82	2.24	197
1995	13	2.51	33
1996	23	2.53	76
1997	82	2.22	300
1998	39	2.21	134
1999	34	2.77	94
2000	128	2.44	360
2001	1046	2.31	2792
2002	345	2.05	788
2003	111	2.43	389
2004	241	3.56	1122
2005	332	1.80	882
2006	297	1.78	924
2007	283	4.58	1463
Geomeans	*123, range=13-1046*		*381, range=33–2792*

Provide the most recent 12 year (e.g. 1988-2007) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural Chiwawa River spawning grounds, if known.

Table 13. Estimates of annual proportions of direct hatchery and listed natural origin fish on natural Chiwawa River spawning grounds

Brood	Origin of spawners	
Year	Wild	Hatchery
1993	0.98	0.02
1994	0.60	0.40
1995	0.51	0.49
1996	0.57	0.43
1997	0.30	0.70
1998	0.45	0.55
1999	0.67	0.33
2000	0.44	0.56
2001	0.26	0.74
2002	0.37	0.63
2003	0.55	0.45
2004	0.56	0.44
2005	0.17	0.83
2006	0.22	0.78
2007	0.16	0.84

The 12-year (1996-2007) mean hatchery contribution (pHOS) was 0.61 for Chiwawa River spring Chinook.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

See Table 14 below for the estimated annual levels of take.

Hatchery Monitoring and Evaluation Activities

Hatchery and monitoring activities that may lead to take include broodstock collection, BKD management, adult enumeration, genetic sampling, smolt trapping, juvenile snorkel surveys, stock assessment, and spawning surveys.

Chelan PUD is responsible for providing the funding for the activities described

in this sub-section as agreed to by the HCP Hatchery Committee in accordance with the processes outlined in the HCP. WDFW, BioAnalysts, Inc., and the Yakama Nation are currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW, BioAnalysts, Inc., and the Yakama Nation as designated agents under current contracts and until that contract expires and is not renewed or renegotiated.

Broodstock Collection

The current 672,000 smolt spring Chinook mitigation program in the Wenatchee Basin uses broodstock collections at Chiwawa Weir and TWD located on the Chiwawa and Wenatchee Rivers, respectively. The general broodstock protocol is based on these limitations and the assumptions listed in Table 14 below. Actual broodstock take will depend on possible variability in fecundity (currently 4,785) and average egg-to-smolt survival (currently 0.819). Given the variability in survival and fecundity, current need for the 672,000 smolt program is 200 females (400 total broodstock (per 1196 hatchery Section 10 permit) to achieve the current mitigation requirement of 672,000 smolts.

For the 298,000 smolt program local stock requirements for Chiwawa spring Chinook are estimated to be no greater than 160 fish (comprised of 80 brood for the conservation component and 80 brood for the safety net component). Up to 20 percent additional hatchery-origin females may be collected to meet any production shortfalls related to culling for high virus titer fish.

Section 1.8.2.1 discusses the broodstock collection protocols for the program.

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Smolt Trapping

Smolt trapping using rotary traps occurs in the Chiwawa River below the hatchery outfall and in the Wenatchee River at Monitor. These traps are generally operated from mid-February through the fall until icing conditions begin.

The adult and smolt encounter rates in sampling activities varies with the water year and run sizes. The values for proportions handled in Table 14 are intended to be conservative, i.e. at the higher end of observed rates in recent years.

Chelan PUD is responsible for providing the funding for the activities described in this sub-section. WDFW is currently responsible for conducting the activities described in this sub-section. Consistent with these responsibilities, Chelan PUD will be the permit holder for the activities described in this sub-section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Adult Management Activities

Takes of hatchery and natural origin spring Chinook may also occur as a result of adult management of hatchery spring Chinook to meet spawn escapement objectives (abundance and hatchery/origin composition on the spawning grounds). See Section 1.8.2.3 and 1.8.2.4 for more details.

Responsibilities:

The funding, permit holder, and agent for the activities discussed in this section are as follows:

Harvest

Funding: WDFW

Permit Holder WDFW

Agent: WDFW

Adult removal at TWD

Funding: Chelan PUD has agreed to voluntarily provide funding to WDFW for up to approximately one FTE (for both steelhead and spring Chinook hatchery programs) for WDFW's adult management activities provided that equivalent savings can be found by WDFW through implementation of efficiencies in carrying out Chelan PUD's hatchery programs, under the current contract between WDFW and Chelan PUD, such that Chelan PUD's total funding obligations do not increase. This funding includes manual adult management activities up to the point at which spring Chinook are removed at TWD and placed in holding containers. Chelan PUD does not believe (though this is not necessarily endorsed by the JFP) that it has an obligation for adult management activities under the HCP but has agreed to fund adult management activites as described above.

WDFW is responsible for coordinating the funding for manual adult management activities from the point at which fish are placed in holding containers when manually removed and/or for a conservation fishery. The Co-managers will determine the disposition of the fish placed in the holding containers.

Permit Holder: Chelan PUD and WDFW will be co-permit holders for manual adult management activities up to the point at which spring Chinook are removed at TWD and placed in holding containers. WDFW will be the permit holder for manual adult management activities, including a conservation fishery, from the point at which fish are placed in holding containers.

Agent: For Chelan PUD's permit, WDFW is designated as the authorized agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

Table 14. Estimated annual numerical or proportional non-lethal and lethal take of spring Chinook associated with hatchery activities for the Chiwawa spring Chinook artificial propagation program.

	Take					
	Harass		**Mortality**			
			Intentional		**Unintentional**	
Activity	**Adult**	**Juvenile**	**Adult**	**Juvenile**	**Adult**	**Juvenile**
Broodstock collection	Up to 100% of run-cycle return [1/]	0	Up to 400	0	<5	0
Juvenile emigration monitoring	NA	20%	0	0	NA	2% of fish captured
Conservation Fishery	Up to 40% of the run-cycle return	0	Hatchery - up to 100% of run-cycle	0	Natural origin fish – up to 2% of run-cycle	0
Adult Extraction (TWD)	Up to 100% of run-cycle return above TWD [1/]	0	Hatchery - up to 100% of run-cycle return above TWD	0	<5	0
Parental Based Tagging	Up to 90% of run-cycle return at Priest Rapids Dam[2/]	0	0	0	<5	0
Reproductive Success Study	Up to 100% of run-cycle return above TWD [1/]	0	0	0	<5	0

[1/] Concurrent activities.

[2/] In recent years, left bank fishway use by spring Chinook has averaged approximately 83 percent, peaking at just over 90 percent in 2007. Since the OLAFT would not be operated 24/7, 90 percent is a conservative maximum take estimate.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies. Explain any proposed deviations from the plan or policies.

UCSRB Regional Salmon Recovery Plan

The Upper Columbia Salmon Recovery Board (UCSRB) coordinates recovery planning in the Upper Columbia basin, with funding from the Washington State Governor's Salmon Recovery Office. The UCSRB lead the development of the Upper Columbia River Salmon, Steelhead, and Bull Trout Recovery Plan (Recovery Plan) (UCRSRB 2006). A link to the NMFS webpage describing the plan is at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/upload/UC_Plan.pdf.

The excerpts below provide a brief description of the Recovery Plan's Spring Chinook recovery criteria.

"Recovery of the spring Chinook ESU will require the recovery of the Wenatchee, Entiat, and Methow populations (ICBTRT 2005a, b). This deviates from the recent recommendation of the ICBTRT that at least two populations must meet abundance/productivity criteria that represent a 1% extinction risk over a 100-year period. This plan requires that all spring Chinook populations within the ESU must meet abundance/productivity criteria that represent a 5% extinction risk over a 100- year period."

Recovery Criteria[6]

Abundance/Productivity
"*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." More specifically, the Wenatchee population requires a minimum of a 12-yr geometric mean of 2,000 spawners and a minimum 12-yr geometric mean of Spawner:spawner production of 1.2.*

[6] See page 119 of Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (2007)

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 and) throughout the ESU according to the following population-specific criteria"*

> *Wenatchee*
> *Naturally produced spring Chinook spawning will occur within the four of the five major spawning areas in the Wenatchee sub-basin (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 sub-basin or at least 20 redds within each major area, whichever is greater (adapted from Ford et al. 2001).*

***"Criterion 4:** The **mean** score for the three metrics of natural rates and levels of spatially mediated processes (Goal A) 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 (Goal B) 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…"*

Where information is available to compare, this HGMP is consistent with current Recovery criteria, however, it is expected that the Chiwawa spring Chinook program will continue to evolve to meet new recovery standards. The HGMP relies on the HCP Hatchery Committee to continually evaluate the success of the program within the recovery context and provide feedback to on-the-ground operations. This requires the collection and analysis of monitoring and evaluation data to determine the efficacy of the supplementation program and its contribution to recovery. Ultimately, the Chiwawa spring Chinook program is not solely responsible for recovery, but instead contributes through supplementation of one major spawning area (e.g., Chiwawa River).

More specifically this HGMP is expected to increase the abundance of naturally spawning spring Chinook to contribute to the goal of 2,000 natural origin spawners and productivity of 1.2 or greater for the Wenatchee Basin (Criterion 1&2). Additionally, the HGMP is expected to ensure that natural origin spawners persist in the Chiwawa major spawning area (Criterion 3) at 20 redds or greater per year.

This HGMP also attempts to meet the following specific hatchery objectives that are described in the Recovery Plan:

Short-Term Objectives

- Continue to use artificial production to maintain critically depressed populations in a manner that is consistent with recovery and avoids extinction.

- Use artificial production to seed unused, accessible habitats.

- Use artificial production to provide for tribal and non-tribal fishery obligations as consistent with recovery criteria.

- Use harvest or other methods to reduce the proportion of hatchery-produced fish in naturally spawning populations.

- To the extent possible use local broodstock in hatchery programs.

- To the extent possible, integrate federal, state, and tribal-operated hatchery programs that use locally derived stocks.

- Reduce the amount of in-basin straying from current hatchery programs.

Long-Term Objectives

- Help develop ongoing hatchery programs that are consistent with recovery.

- Provide for tribal and non-tribal fishery obligations.

- Use harvest or other methods to reduce the proportion of hatchery-produced fish in naturally spawning populations

- Manage hatcheries to achieve sufficient natural productivity and diversity to de-list populations and to avert re-listing of populations.

The Recovery Plan incorporates and relies on some elements of the HCP to achieve recovery. The Recovery Plan describes the relationship with this HGMP in the context of the HCP and mitigation commitments therein. The following excerpts from the Recovery Plan address the relationship more specifically:

From Section 5.3.3 Hatchery Objectives:

"This plan recognizes the need to balance recovery objectives with legal obligations and mandates under Habitat Conservation Plans (HCPs), the Mitchell Act, federal government and tribal agreements, Hatchery and Genetic Management Plans (HGMPs), U.S. v. Oregon, and relicensing agreements. For example, these recovery objectives are consistent with the Biological Assessment and Management Plan (BAMP) developed by parties negotiating the HCPs for Chelan and Douglas PUDs. BAMP identified the

following overriding objectives for hatchery programs associated with the HCPs within the Upper Columbia Basin."

- *Contribute to the rebuilding and recovery of naturally spawning populations throughout the Upper Columbia Basin to the point that these populations can be self-sustaining, support harvest, while maintaining genetic and ecologic integrity.*
- *Compensate the resource for a 7 percent per hydroelectric project unavoidable loss as needed to meet the No Net Impact standard of the HCPs.*
- *Compensate the resource for the original construction impacts of the Upper Columbia River PUD dams in a manner that is consistent with recovery efforts for natural salmonids."*

From Section 5.4.8, Compliance:

HCPs, relicensing agreements, and Section 7 Consultations outline operating conditions, goals, and objectives that are incorporated into operating licenses. Hydroelectric project activities are currently monitored through these agreements. The PUDs are primarily responsible to fund implementation and monitoring associated with mitigation requirements and to track progress of hydro actions in the Upper Columbia Basin. Committees established through the FERC processes will be primarily responsible for developing and coordinating the implementation of plans developed in these processes and evaluating monitoring activities.

From Section 5.5.7, Coordination and Commitments:

"This plan assumes an Implementation Team will engage in discussions associated with habitat actions. This Team will be involved in all issues related to recovery actions, and will work within the framework of the Upper Columbia Salmon Recovery Board (UCSRB), HCPs for Chelan and Douglas PUDs, Grant PUD BiOp and Anadromous Fish Agreement, Section 7 consultations, and federal trust responsibilities to the tribes."

From Section 7, Relationship to Other Efforts:

"Some of the efforts currently being developed or implemented in the basin include the mid- Columbia HCPs for the operation of Wells, Rocky Reach, and Rock Island dams; Biological Opinions on the mid-Columbia HCPs; the Federal Columbia River Power System Biological Opinion and Remand; Biological Opinion on the operation of Priest Rapids and Wanapum dams; Hatchery and Genetic Management Plans (HGMPs) for federal hatcheries; Biological Opinions on the operation of state hatcheries (designed for PUD mitigation)…"

From Section 8.3.8, Consistency with Other Monitoring Programs:

"An important aspect of this recovery plan is that it will rely on existing monitoring programs to evaluate the status/trend and effectiveness of recovery actions within the Upper Columbia Basin, to the extent that existing programs are consistent with NOAA guidance and are sufficient for recovery needs. Specifically, this plan incorporates by reference the Upper Columbia Monitoring Strategy (Hillman 2004), the Okanogan Basin Monitoring and Evaluation Program, and the Draft Monitoring and Evaluation Plan for PUD Hatchery Programs (Murdoch and Peven 2005). The former two address status/trend and effectiveness monitoring of habitat actions, while the latter addresses status/trend and effectiveness of hatchery actions. The PUDs currently have monitoring programs identified in their HCPs and Biological Opinions to address hydro project actions."

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which the program operates.

Rock Island Habitat Conservation Plan

The artificial propagation activities of this program are included within Chelan PUD's HCP; see Sections 1.7 and 1.8, and footnote 1 in Section 1.7 for more detailed information regarding the HCP.

2008-2017 / United States v. Oregon / Management Agreement

The purpose of this management agreement is to provide a framework within which the signatory fishery Co-managers can use their authorities to protect, rebuild, and enhance upper Columbia River fish runs while fairly sharing harvestable fish between Treaty and non-Treaty fisheries. The Agreement specifies harvest limits and artificial production measures for stocks of salmon and steelhead originating above Bonneville Dam. The Agreement is entered as an order of the 7th US District Court in US v. Oregon and, as such, its terms are binding on the parties to that litigation. Some signatory parties to US v. Oregon are the same signatory parties to the Rock Island HCP Hatchery Committee. While the hatchery production goal for Chiwawa spring Chinook is shown in Appendix B Table B1 of the Agreement as 672,000 smolts to be released at the Chiwawa River Acclimation Site, it is within the purview of the HCP Hatchery Committee to modify production goals at any time. Beginning with the 2010 brood year, the Chiwawa spring Chinook hatchery program is proposed to be reduced to 298,000 smolts, with concurrence from the HCP Hatchery Committee.

Hatchery Scientific Review Group – Upper Columbia Review

The Hatchery Scientific Review Group (HSRG), as part of the Hatchery Reform Project, has completed a review of Puget Sound hatcheries (HSRG 2005) and has recently completed a similar review process for the Columbia River watershed (HSRG 2008). The project was conducted by an independent science team in conjunction with a Steering

Committee comprised of representatives from regional agencies. The objective is to produce recommendations that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The Chiwawa spring Chinook review occurred in 2008. The HSRG recommendations (HSRG 2009) were finalized March 27, 2009. While the HSRG recommendations are not binding, the principles of the recommendations were considered in the development of this HGMP.

Draft Guidance for Monitoring Recovery of Pacific Northwest Salmon and Steelhead Listed under the Federal Endangered Species Act (Idaho, Oregon, and Washington)

Generally, the Draft Guidance for Monitoring Recovery of Pacific Northwest Salmon and Steelhead (NMFS, 2009) NMFS has proposed is consistent with the principles and practices contained within the monitoring and evaluation program (Peven and Murdoch 2005) developed and adopted by the HCP Hatchery Committee. Throughout the guidance document, however; NMFS has proposed recommended targets for precision and certainty that may not be achievable for some populations (primarily steelhead). For the purposes of this HGMP this document has been treated only as a guidance document since precision targets identified in the report are considered recommendations only (not requirements), and since these targets cannot be met for all populations.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

There have been no recreational fisheries on Wenatchee spring Chinook since 1999. (Sport and tribal fisheries occur nearly annually on the unlisted Carson stock returning to the Leavenworth National Fish Hatchery.)

3.4) Relationship to habitat protection and recovery strategies.

The Chiwawa spring Chinook hatchery program is designed to at least maintain, and will likely improve the abundance and productivity of natural spring Chinook. A recovered spring Chinook population will be able to occupy improved and re-opened habitat that will likely follow implementation and completion of the Upper Columbia Salmon Recovery Plan, HCP Tributary Funds, and similar initiatives. The co-managers and others are managing both the habitat and hatchery programs so that they provide VSP benefits that will trend toward recovery of Upper Columbia spring Chinook.

It is unlikely that the Chiwawa spring Chinook program will hinder the restoration of habitat conditions within the Wenatchee Basin. Indeed, it is likely that the program will aid in seeding re-opened habitat and restored habitat with adult spawners.

The ability of the proposed conservation component of the Chiwawa program to recover Wenatchee spring Chinook is based on ICTRT guidance (ICTRT 2007). Long term risk to diversity within the population, and risk to abundance/productivity received particular attention in this program. Natural origin spring Chinook are currently found in all of the extant major spawning areas. However ESA recovery criteria requires spring Chinook to spawn in at least one minor spawning area, where there are currently no natural or endemic hatchery populations. A portion of the safety net smolt component could be released into minor spawning areas (such as Mission Creek, Chumstick Creek, and/or Peshastin Creek) to help meet the delisting criteria for spring Chinook in the Wenatchee Basin.

3.5) Ecological interactions.

Potential effects of the spring Chinook hatchery supplementation program on salmonids and non-salmonids as well as the physical environment have been evaluated in the NMFS Biological Opinion (2004) and Environmental Assessment (NMFS 2002) for a multi-year authorization for an annual take of Upper Columbia River (UCR) spring Chinook salmon and UCR steelhead associated with the spring Chinook supplementation program (Permit 1196). Potential effects from the program are regulated by existing policies regarding hatchery operations, maintenance protocols, fish health practices, genetic effects, ecological interactions, and fish cultural practices, as prescribed in the 1994 Integrated Hatchery Operations Team annual report (IHOT 1995).

(1) *negatively impact program*

Juvenile hatchery Chiwawa spring Chinook salmon are liberated as yearling smolts through forced and volitional releases. Because fish are released as yearling smolts, potential predation by both native and non-native predators is thought to be reduced compared to sub-yearling releases.

Fish, mammals, and birds are the primary natural predators of spring Chinook in the Upper Columbia Basin. Several fish species may consume spring Chinook. Northern pikeminnow, walleyes, and smallmouth bass have the potential to negatively affect the abundance of juvenile Chinook (Gray and Rondorf 1986; Bennett 1991; Poe et al. 1994; Burley and Poe 1994). Adult salmonids within the Upper Columbia Basin are opportunistic feeders and are therefore capable of preying on juvenile spring Chinook. Those likely to have some affect on the survival of juvenile salmonids include adult bull trout, rainbow trout, cutthroat trout, brook trout, and brown trout. Of these, bull trout and rainbow trout are probably the most important.

Predation and delayed mortality for returning adult salmon as a result of wounding by marine mammals may negatively affect spring Chinook salmon. The incidence of wounds noted at Lower Granite Dam during 1991was 20.9 percent for adult spring migrants and 9.4 percent for summer migrant salmon (Park 1993). In 1992, the numbers were 17.4 percent and 7.6 percent, respectively. Although Upper Columbia Chinook do

not pass Lower Granite Dam, the losses there may be similar to losses experienced by Upper Columbia Chinook along their migration route.

Predation by piscivorous birds on juvenile salmonids may also represent a large source of mortality. The NMFS (2000) identified gulls *(Larus* spp.), cormorants (*Phalacrocorax* spp.), and Caspian terns *(Sterna caspi*a) as the most important avian predators in the Columbia River Basin. In the Columbia River estuary, avian predators consumed an estimated 16.7 million smolts (range, 10-28.3 million smolts), or 18 percent (range, 11-30 percent) of the smolts reaching the estuary in 1998 (Collis et al. 2000). Caspian terns consumed primarily salmonids (74 percent of diet mass), followed by double-crested cormorants *(P. auritu*s) (21 percent of diet mass) and gulls (8 percent of diet mass).

Competition and potentially predation could also occur with hatchery steelhead that reside in the mainstem and in the Wenatchee Basin. Although the degree of steelhead residualism is unknown, it is thought to average between 5 percent and 10 percent of the number of fish released (USFWS 1994). Competition for food and space with other hatchery released fish (e.g., Coho salmon) throughout the Columbia Basin may occur as hatchery spring Chinook rear and migrate downstream through the Columbia River.

(2) ***negatively impacted by program***

Some salmonid and non-salmonid fishes could potentially be negatively impacted by Chiwawa hatchery spring Chinook. Disease transmission from hatchery-raised fish to natural-origin fish in the natural environment may be a source of pathogen transmission. This impact may occur from release sites in headwater spawning and/or rearing areas and throughout the entire migration corridor (BAMP 1998; Murdoch and Peven 2005). However, pathogens responsible for diseases are present in both hatchery and natural populations, although hatchery fish are probably more susceptible to disease pathogens because of the high rearing densities and resultant stress.

Direct competition for food and space between juvenile hatchery raised and natural origin fish may occur in spawning and/or rearing areas, the migration corridor, and in ocean habitat. Direct competition is most likely to occur between hatchery raised and natural origin spring Chinook salmon in these areas. Impacts are expected to be greatest in the spawning and nursery areas and at points of highest fish density (release areas) and are expected to diminish as hatchery smolts disperse (BAMP 1998). Competitive effects of hatchery fish on natural origin fish are reduced by providing volitional releases of smolts that are physiologically ready to migrate, thus reducing their residence in spawning and rearing areas.

Returning adult hatchery spring Chinook that stray to natural spawning areas may compete for spawning gravel and/or breed with native fish, potentially altering genetic fitness and influencing their ability to survive in the ecosystem. Hatchery spring Chinook from the Chiwawa Program have strayed to non-target streams (Nason Creek, Upper Wenatchee River, and Little Wenatchee River) within the Wenatchee Basin exceeding

the program's target of less than 10 percent of the spawning escapement (Hillman et al. 2008). Chiwawa hatchery strays to the Methow and Entiat basins have remained low and within the program's target of less than 5 percent except for one year in the Entiat Basin. Stray rates of Chiwawa hatchery fish should decrease with the change in source water that was implemented in 2006-2007 for the Chiwawa rearing ponds.

Potential adverse impacts to steelhead and bull trout during spring Chinook broodstock collection are negligible because WDFW has established specific procedures for handling non-target species to reduce negative effects (NMFS 2002). In addition, impacts to bull trout from the spring Chinook supplementation program are expected to be negligible (NMFS 2002; NOAA 2003). Bull trout co-evolved with Chinook in the Wenatchee Basin and thus niche segregation should limit competitive interactions.

Negative effects to other species that may result from the spring Chinook hatchery program could occur from impacts to water quantity and water quality. To limit impacts to water quantity the program complies with water-right permits established for the hatchery to prevent over appropriation of surface water. Hatchery surface water intakes are screened to current criteria. Water quality will be affected by effluent from the hatchery, but the hatchery facility is required to operate under National Pollutant Discharge Elimination System (NPDES) permits issued by Washington Department of Ecology. Hatchery effluent standards and state point-source discharge criteria are set forth in the permit to protect aquatic life, and the habitat in the area below the discharge points. Considering that the effluent produced from the hatchery facility complies with Environmental Protection Agency standards, coupled with the low percentage of effluent to discharge (dilution factor), there is probably minimal impacts to other species.

(3) positively impact program

Chinook, steelhead, and Coho carcasses of both hatchery and natural origin deposited within the Wenatchee Basin are likely to have a positive influence on nutrient levels within the basin (Stockner 2003). Increased nutrient levels are likely to provide a more productive environment within which the hatchery spring Chinook can rear and migrate. Marine-derived nutrients brought to the Chiwawa Basin by adult spring Chinook should benefit all species there, because the Chiwawa Basin is considered a nutrient-poor system (Mullan et al. 1992).

(4) positively impacted by program.

The Wenatchee Basin native fish assemblage is expected to benefit from increased nutrients provided by hatchery spring Chinook carcasses. Increased numbers of spawning salmon will likely have a positive effect on bull trout, resident rainbow trout, and westslope cutthroat trout populations. These salmonids are piscivorous and will consume salmon eggs, fry, and parr. These species will also benefit from marine nutrients added to the ecosystem by natural spawning hatchery fish and the outplanting of hatchery spawned salmon carcasses (Stockner 2003).

Overall, implementation of the program proposed in this HGMP, such as increasing the number of natural spawners, and associated benefits to the ESU and DPS outweigh the risks to productivity and diversity from genetic and ecological interactions between hatchery and natural origin fish.

SECTION 4. WATER SOURCE

Responsibilities: Chelan PUD is responsible for funding and carrying out the activities described in this Section 4. Chelan PUD and WDFW will be co-permit holders for the activities described in this section.

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Eastbank Hatchery

Eastbank Hatchery water is supplied by the Eastbank Aquifer, a high quality ground water source with connectivity to the Columbia River. The Eastbank Aquifer is used by both the Eastbank Hatchery Complex and the Regional Water System which provides municipal water to the customers of Chelan County PUD, the City of Wenatchee, and the East Wenatchee Water District. The Eastbank Hatchery water right permit provides for 55 cubic foot per second (cfs) of instantaneous water supply. On an annual basis, temperatures range from approximately 7.5 Celsius to 15.0 Celsius. Spring Chinook are held for broodstock, incubated, and early-reared on this water.

Chiwawa Acclimation Facility

The primary source of water at the Chiwawa Acclimation Facility for spring Chinook is 21 cfs diversion of Chiwawa River surface water with the Wenatchee River providing secondary supply for emergency situations and for deicing of the manifold for the Chiwawa River intake. For emergency purposes, up to 12 cfs Wenatchee River water may be used as a source for the Chiwawa spring Chinook program. For deicing purposes approximately 6 cfs is used for roughly 110 days to allow for maximum use of the Chiwawa River by keeping the intake screens ice free.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Water withdrawal for hatchery use is monitored through the Washington State Department of Ecology and the Washington State chapter 90.03 Revised Code of Washington (RCW) water code. None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing.

All hatcheries owned and/ or operated by WDFW monitor their discharge in accordance with the National Pollutant Discharge Elimination System (NPDES) permit. This permit is administered in Washington by the Washington Department of Ecology under

agreement with the United States Environmental Protection Agency. The permit was renewed effective June 1, 2005 and will expire June 1, 2010.

Specifically, the following measures will be employed to minimize the likelihood for the take of listed natural fish:

- Ensure that water intakes into artificial propagation facilities be property screened in compliance with 1995 NMFS screening criteria and as per the 1996 addendum to those criteria (NMFS 1996). As an alternative, they shall comply with transitional criteria set forth by NMFS in 1999 for juvenile fish screens constructed prior to the establishment of the 1995 criteria (NMFS 1996), to minimize risks to listed salmon and steelhead. The water intake screen structures will be inspected and monitored at their hatchery facilities to determine if listed salmon and steelhead are being drawn into the facility; the results of this monitoring shall be included in annual reports.

- Hatchery operations will be conducted and hatchery effluent will be monitored in compliance with applicable National Pollutant Discharge Elimination System (NPDES) (EPA 1999) permit limitations.

SECTION 5. FACILITIES

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 5, except that Chelan PUD's obligations with respect to the development of additional acclimation sites other than the existing Chiwawa acclimation site, will be determined in accordance with the processes outlined in the HCP. WDFW is currently responsible for conducting the activities described in this Section 5. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

5.1) Broodstock collection facilities (or methods).

Adult spring Chinook broodstock are currently trapped and collected on the lower Chiwawa River and at TWD, which is the secondary broodstock collection site on the Wenatchee River. Annual broodstock collection and spawning protocols in coordination with the HCP Hatchery Committee will be developed to allow for consideration of annual variation in run sizes, ages, and origins (natural and hatchery). Broodstock collection facilities are designed to minimize impacts to broodstock; impacts are visually monitored during collection.

Refer to Section 7 for additional options regarding the methods used or proposed to be used at the facilities.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Fish transportation equipment used will ensure safe transportation of ESA listed fish. Equipment will be mechanically reliable and will allow for ease of disinfection to occur. Dissolved oxygen levels will be monitored within the tanks. Salt will be used as a stress reduction measure when hauling adults.

5.3) Broodstock holding and spawning facilities.

Broodstock holding will occur in facilities that:

- Allow for safe containment of adults;
- Provide measures to try to calm adults (e.g. spray system);
- Provide adequate flow of water under normal operating conditions; and
- Are alarmed for low flow.

Currently broodstock holding occurs at the Eastbank Hatchery.

The spawning facilities are integrated into the brood stock holding facilities. The spawning facilities allow for brood stock to be sorted for "ripeness" and then spawned. The spawning area can be cleaned easily. Spawning currently occurs at the Eastbank Hatchery.

5.4) Incubation facilities.

Incubation occurs at the Eastbank Hatchery in vertical Heath Tray incubators. The incubation facilities:

- Provide adequate flow of pathogen free water under normal operating conditions;
- Allow for manipulation of water temperatures;
- Are alarmed for low flow, and;
- Provide for individual female segregation throughout viral sampling/analysis.

5.5) Rearing facilities.

Initial rearing of spring Chinook occurs at the Eastbank Hatchery.

5.6) Acclimation/release facilities.

Currently, pre-smolts are acclimated on Chiwawa River water and released directly to the Chiwawa River when exhibiting smolting behavior.

Through the Columbia River Fish Accords, additional sites may be developed in the Chiwawa River basin upstream and downstream of the current facility. These will be relatively small, natural ponds and side-channels that can be modified with minimal ground disburbance for use as acclimation sites and, potentially, rearing habitats after smolts are released. Natural or semi-natural acclimation ponds may include either man-made earthern ponds or exising ponds.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

The Chiwawa spring Chinook suffered substantial mortality at the Chiwawa River acclimation ponds during November and December 2002. Mortality increased beginning October 30, 2002 as a result of an external fungus outbreak. Formalin treatments began immediately in an attempt to control the fungus. Even with formalin treatments, mortality was estimated at approximately 43 percent. The causative factor to the fungus outbreak is unknown, however, it may be associated with compromised fish immune systems due to

rapid and significant variations in rearing water temperatures. All moribund fish removed as a result of the 2002 epizootic were enumerated and buried on-site.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Potential adverse impacts identified with the physical operation of hatchery facilities include impacts from water withdrawal, release of hatchery effluent and facilities failure (NMFS, 1999a). Hatchery effluent may transport pathogens (disease) out of the hatchery and infect natural-origin fish. Aside from the potential impacts on water flow and quality, operations failures due to power/water loss, flooding, freezing, vandalism, predation, and disease may also result in catastrophic losses to rearing adults and juveniles.

Flow reductions, flooding, and poor fish culture practices may all cause hatchery facility failure or the catastrophic loss of ESA listed fish under propagation. To protect endangered spring Chinook, all efforts should be made to ensure that the survival of adult spring Chinook held for broodstock collection at the hatchery facility be maximized. The following measures are included to address risks associated with operational failures, including:

- Protection of fish from vandalism and predation is provided by fencing, locks, and security lights at all hatchery facilities;
- Rapid response in the event of power or water loss or freezing is provided by a combination of staffing, automatic alarm paging systems, and redundant power supplies to the facilities.

In addition, Chelan PUD has developed an emergency/incident response protocol in the event that activities occur that could result in take. This protocol defines the notification pathway that should occur and ensures that 24 hours/7 days a week Chelan PUD hatchery facilities are monitored and supported to minimize take.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 6. WDFW is currently responsible for conducting the activities described in this Section 6. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

6.1) Source.

Natural and hatchery-origin Chiwawa River spring Chinook are used for broodstock; fish arriving at the Chiwawa Weir are presumed to be of Chiwawa River basin origin. At TWD, only Chiwawa hatchery origin fish are collected. Diversity is maintained by randomly selecting broodstock from across the run timing regardless of size (age). Both naturally produced Chiwawa spring Chinook and hatchery-origin Chiwawa spring Chinook are listed as endangered under the ESA.

See Section 7 regarding additional options for broodstock collection methods and source of fish.

6.2) Supporting information.

6.2.1) History.

The Chiwawa spring Chinook program was initiated in 1989 by collecting natural origin broodstock from the Chiwawa River. Broodstock for the first brood year were collected at a floating weir constructed on the lower Chiwawa River at the site of the rearing ponds. Due to low trapping success, some broodstock were also collected by angling and snagging of adult Chinook from the upper Chiwawa River. Broodstock are still collected at the weir, supplemented by collection of hatchery origin returning Chiwawa adults collected at TWD.

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 exists 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. Previous coded-wire tag (CWT) recoveries (2001 to 2003) indicates on average that 2.6 percent (SD=0.6 percent) of returning adults of Leavenworth NFH origin stray into the upper Wenatchee Basin (Cooper, 2006). Although the Leavenworth NFH program stray rates are low they are estimated to have comprised between 3-27 percent of some spawning aggregates above TWD (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 percent of any spawning aggregates above TWD (WDFW unpublished data). Within-population hatchery spawners (Chiwawa stock) have comprised 56 percent of the spawning population above TWD since 1993 and have routinely comprised greater than 10 percent 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; the first results will be monitored in 2009.

6.2.2) Annual size.

Broodstock numbers have been limited by low run sizes and the requirement that natural origin fish compose at least 30 percent of the broodstock, but no greater than 33 percent of the natural origin run can be taken for broodstock. Under the current 672,000 smolt program, up to 400 fish will be collected for broodstock, and under the proposed 298,000 smolt program, up to 160 fish will be collected for broodstock.

After the program is reduced to 298,000, up to an additional 20% hatchery-origin females may be collected to meet any production shortfalls that may result from culling high and very-high virus titer fish for managing BKD.

See section 1.11.1 for program size. Historic broodstock collection is summarized in Table 15.

Table 15. Numbers of wild and hatchery spring Chinook collected for broodstock, numbers that died before spawning, and numbers of spring Chinook spawned, 1998-2007. Unknown origin fish (i.e., undetermined by scale analysis, no elastomer, CWT, or fin clips, and no additional hatchery marks) were considered naturally produced. [From Hillman, et al. 2008]

Brood year	Wild spring Chinook					Hatchery spring Chinook					Total number spawned
	Number collected	Pre-spawn loss	Mortality[1]	Number spawned	Number released	Number collected	Pre-spawn loss	Mortality[1]	Number spawned	Number released	
1989	28	0	0	28	0	0	0	0	0	0	28
1990	19	1	0	18	0	0	0	0	0	0	18
1991	32	0	5	27	0	0	0	0	0	0	27
1992	113	0	0	78	35	0	0	0	0	0	78
1993	100	3	3	94	0	0	0	0	0	0	94
1994	9	0	1	8	0	4	0	0	4	0	12
1995	No Program										
1996	8	0	0	8	0	10	0	0	10	0	18
1997	37	0	5	32	0	83	1	3	79	0	111
1998	13	0	0	13	0	35	1	0	34	0	47
1999	No Program										
2000	10	0	1	9	0	38	1	16	21	0	30
2001	115	2	0	113	0	267	8	0	259	0	372
2002	21	0	1	20	0	63	1	11	51	0	71
2003	44	1	2	41	0	75	2	20	53	0	94
2004	100	1	16	83	0	196	30	34	132	0	215
2005	98	1	6	91	0	185	3	1	181	0	279
2006	95	0	4	91	0	303	0	29	224	50	315
2007	45	1	1	43	0	124	2	18	104	0	147
Average[2]	***52***	***1***	***3***	***47***	***2***	***81***	***3***	***8***	***68***	***3***	***115***

[1] Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for the program or were immature fish killed at spawning.
[2] Origin determinations should be considered preliminary pending scale analysis.

6.2.3) Past and proposed level of natural fish in broodstock.

In the 1989 through 1993 brood years, broodstock consisted entirely of natural origin fish. Broodstock collected in recent years has consisted of up to 70 percent hatchery origin fish (table above).

Under the proposed program, natural origin fish for broodstock will be collected broodstock using an extraction rate of up to 33 percent. In years when pNOB is 1.0 the actual extraction rate will be lower than 33 percent. 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.

See Section 6.2.2 for additional information regarding collection of natural fish.

6.2.4) Genetic or ecological differences.

The broodstock source is from the population being targeted for smolt releases. See Section 6.2.3 regarding proposed compositing.

6.2.5) Reasons for choosing.

The Chiwawa spring Chinook program was designed to mitigate for dam passage losses at Rock Island Dam, with the dual objective of using hatchery supplementation to increase the number of Chiwawa spring Chinook spawning naturally in the Chiwawa River. The broodstock trapping protocols and location of the Chiwawa Weir were designed to maintain and promote local adaptation of the Chiwawa River population of spring Chinook.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The broodstock protocols were designed to mitigate for potential genetic effects from hatchery domestication and to avoid introgression with fish from other spawning aggregates.

SECTION 7. BROODSTOCK COLLECTION

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 7, except for the PBT component of the program for which the funding, permit holder, and agent have yet to be identified and agreed to by the HCP Hatchery Committee in accordance with the processes outlined in the HCP. WDFW is currently responsible for conducting the activities described in this Section 7 for which Chelan PUD is responsible for funding. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section (with the exception of PBT as noted above) with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only adults are collected for broodstock.

7.2) Collection or sampling design.

Annual broodstock collection and spawning protocols in coordination with the HCP Hatchery Committee will be developed to allow for consideration of annual variation in run sizes, ages, and origins (natural and hatchery).

Broodstock collection currently occurs at Chiwawa Weir and/or TWD and will be used for broodstock collection until such time as the HCP Hatchery Committee agrees to an alternative method that is demonstrated to be biologically successful and cost effective as defined in the Rock Island HCP Section 8.2.2. Chelan PUD is committed to investigating other broodstock collection methods, such as parental based tagging (PBT), as suggested in the draft MIP (June 2009). A Statement of Agreement (SOA) will be developed with the goal of having it approved by April 1, 2010 by the HCP Hatchery Committee that reflects Chelan PUD's participation in the larger partnership of Co-managers and other PUDs regarding testing and/or implementation of PBT.

Parental Based Tagging (PBT)

In general, all unmarked fish captured at the Priest Rapids Dam Off-Ladder Adult Fish Trap (OLAFT) will be genetically sampled and a PIT tag inserted into the dorsal-sinus cavity (regardless of mitigation program). Genetic samples will then be sent to an appropriate genetics lab where they will be given high priority for processing. Within 10 days, the results from the genetic samples will be available for Co-managers and Chelan PUD to review based on the genetic sampling, spring Chinook will be partitioned at TWD into the spawning aggregates (major spawning areas) based on PIT tags, for either inclusion into broodstock (for all Wenatchee basin programs), or for release upstream of TWD. Hatchery fish in excess of broodstock and escapement needs will be removed

through conservation fisheries and/or manually at TWD.

Broodstock Collection Using PBT

OLAFT Operations

A feasiblity test of PBT-based broodstock collection protocols is expected to start in 2010 by running the Priest Rapids Dam (PRD) OLAFT for two or three, one to three day periods to verify the following assumptions:

- Continuous operation of the OLAFT on the left bank (LB) ladder 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 OLAFT test periods with those between test periods. The test is considered successful if the LB ladder use remains at 85 percent or higher during continuous operation of the OLAFT.
- Approximately 60 percent of the fish passing PRD are destined for the Wenatchee River based on relative PIT tag detections between Rock Island and Rocky Reach Dams.
- The "conversion rate" of PIT-tagged Wenatchee adult spring Chinook from PRD to TWD is at least 90 percent.
- Very few or no fish will arrive at TWD in less than 10 days.

The preferred OLAFT test operating periods are at the peak of the run in the first two weeks of May, and on the descending portion of the run in the last week of May or first week of June. Jacks and mini-jacks will not be sampled, only enumerated.

Potential future operational details are shown in Appendix 3 of the draft MIP (Yakama Nation, 2009).

TWD Operations

For PBT to be used successfully to manage Wenatchee Basin spring Chinook, the following needs to occur:

- Determine the MaSA of origin at TWD to meet the Wenatchee basin overall escapement and spatial distribution goals, and
- Estimate the proportion of fish to be identified to enable broodstock collection at a given extraction rate per MaSA to avoid over-extraction in any sub-population.

This approach relies on the following assumptions:

- Approximately 83.3 percent of Wenatchee natural origin spring Chinook sampled at PRD are expected to arrive at TWD (based on PIT-tagged spring Chinook conversion rates from 2008); see (Table 15).

- Of the sampled fish arriving at TWD, predicting a 90 percent 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, it is anticipated that up to 80 percent of the parental generation will be identified to its stream of origin. Currently, released PIT-tagged spawners cannot be detected in the upper mainstem Wenatchee River except at river spanning arrays. This MaSA constitutes a small percentage of the whole spring Chinook population and is predominantly comprised of hatchery origin fish.

Based on these testable assumptions, it is anticipated that the stream of origin (major spawning area) can be identified for up to 61 percent of the total run of NOR adult progeny returning to TWD (Table 16). Actual percentages will likely vary annually. Unidentified NORs will be released to continue upstream.

Table 16. Stepwise estimation of the number of spring Chinook arriving at TWD which can be assigned to at least one parent with a known spawning location.

Hypothetical Range in Wenatchee NOR Run Size at PRD	Number of Wenatchee Fish Sampled at OLAFT[a]	Est. Number of PIT-tagged NOR fish arriving at TWD[b]	Est. Total Number of NOR fish arriving at TWD[b]	Number of PIT tagged fish assignable to at least one parent[c]	Proportion of parental generation with known spawning origin in tributary[d]	Proportion of total arriving NORs with parental assignment to tributary
150	127	106	125	95	80% (76)	61%
500	424	353	417	318	80% (254)	61%
1500	1272	1060	1250	954	80% (763)	61%

[a] PRD LB ladder use averaged 84.8 percent between 1999 and 2008 and was less than 90 percent in 2006-2008. Values are the numbers of fish expected to use the OLAFT

[b.] Based on PIT tag detections in 2008, an 83 percent conversion rate is assumed between PRD and TWD. Values in the fourth column represent the total return, including tagged and un-tagged fish that did not use the OLAFT.

[c]. Preliminary estimate of a 90 percent assignment success using a 15-allele database, July 2008 geneticists' assessment.

[d.] Preliminary projection of an 80 percent average PIT tag detection rate in Wenatchee River basin tributaries for the parental generation through a combination of PIT tag antenna arrays and spawning ground survey detections.

Chiwawa River Weir Operation

The Chiwawa spring Chinook program collects natural origin broodstock at the Chiwawa Weir and hatchery origin broodstock at TWD. A review of recent (2001-2008) natural origin collection and encounter rates at the Chiwawa Weir indicate the weir, under operations for those years, would meet the conservation program goal of 150,000 smolts 38 - 63 percent of the time (at a 95 percent confidence interval and a mean of 63 percent). Operating the Chiwawa Weir with greater frequency may allow the program goal to be met in most years. Based on

this analysis, it is recommended that the Chiwawa Weir be operated as directed by the HCP Hatchery Committee and as described in the annual broodstock protocols to optimize collection of natural origin brood at the Chiwawa Weir. This may include operation of the Chiwawa Weir on a daily basis for low run years and at a lesser frequency for high return years.

7.3) Identity.

See 6.3 above.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

For the 672,000 smolt program, actual broodstock take depends on possible variability in fecundity (currently 4,785) and average egg-to-smolt survival (currently 0.819). Given the variability in survival and fecundity, current need is for 200 females (400 total broodstock (per 1196 hatchery Section 10 permit). Under the proposed 298,000 smolt program, up to 160 fish will be collected for broodstock, using the same fecundity and average egg-to-smolt survival estimates.

After the program is reduced to 298,000 smolts, up to an additional 20 percent hatchery-origin females may be collected to meet any production shortfalls that may result from culling high and very-high virus titer fish for managing BKD.

7.4.2) Broodstock collection levels for the last twelve years, or for most recent years available:

Table 17. Chiwawa spring Chinook broodstock collections, 1998-2007

Chiwawa spring Chinook broodstock collections, 1998-2007.		
Brood Year	Brood NOBs	Brood HOBs
1998	13	35
1999	No Program	
2000	10	38
2001	115	267
2002	21	63
2003	44	75
2004	100	196
2005	98	185
2006	95	303
2007	45	124

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Currently, hatchery origin spring Chinook excess to broodstock needs and/or not spawned are killed, bio-sampled and disposed of in the local landfill. See Section 1.8.2.4 and 1.8.2.5 for proposed disposition of surplus hatchery-origin fish and associated responsibilities.

7.6) Fish transportation and holding methods.

Fish are removed from traps daily or more often as needed to minimize capture and handling effects on listed fish, placed in truck-mounted transport tanks using fish socks or other water-to-water handling methods, the tanks are supplied with river water from the trapping site, and fish are transported to the adult broodstock pond at Eastbank Hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish Health maintenance, management and sanitation procedures/criteria for all life stages will be consistent with the Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection Committee (PNFHPC), Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State July, 2006, and WDFW's Fish Health Manual November 1996.

To help prevent vertical transmission of BKD to progeny the following will occur:

- Female (hatchery- and natural-origin) spring Chinook broodstock will be injected during pre-spawning with an appropriate antibiotic (e.g., azithromycin at 40 mg/kg fish) and the resulting eggs will be surface disinfected with an iodophor.

- All females will be screened for probability of transmitting BKD vertically to their progeny through use of the enzyme-linked immunosorbent assay (ELISA) to determine their titer score [e.g., optical density (OD)].

- Hatchery-origin eggs/progeny with ELISA titers of OD $\geq$ 0.12 will be culled from the program.

- Wild-origin eggs/progeny with ELISA titers of OD $\geq$ 0.12 will be raised at lower density of 0.06.

- All hatchery and natural-origin eggs/progeny with ELISA titers of OD >0.19 will be culled from the broodstock population.

- When less than 5 percent of the program production is in the 0.12 $\leq$ OD $\leq$ 0.19 titer range, the HCP Hatchery Committee may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

See Appendix 1 BKD Management for additional information.

7.8) Disposition of carcasses.

Carcasses will be disposed in a local landfill or distributed in spawning areas to augment natural nutrient transfer from the marine environment. See Section 1.8.2.5 for additional information and responsibilities for these activities.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Specifically, the following measures will be employed to minimize the likelihood of adverse effects to listed natural fish (NMFS 2003a):

- ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. When using methods that capture a mix of species, ESA-listed fish must be processed first. The transfer of ESA-listed fish must be conducted using equipment that holds water during transfer.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining the presence of anadromous fish.
- In trapping operations directed at the collection of broodstock, measures that minimize the risk of harm to listed salmon and steelhead shall be applied. These measures include, but are not limited to: limitations on the duration (hourly, daily, weekly) of trapping in mainstem river areas to minimize capture and handling effects on listed fish; limits on trap holding duration of listed fish prior to release; application of procedures to allow safe holding, and careful handling and release of listed fish; and allowance for free passage of migrating listed fish through trapping sites in mainstem and tributary river locations when those sites are not being actively operated.
- ESA-listed juvenile fish must not be handled if the water temperature exceeds 21°Celsius at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.
- If water temperature at adult trapping sites exceeds 21°Celsius, the trap operation shall cease pending further consultation with NMFS to determine if continued trap operation poses substantial risk to ESA-listed species.
- Annual broodstock collection and spawning protocols shall be developed for the UCR Region ESA-listed salmon artificial propagation programs. Protocols should be coordinated with the Co-managers and HCP Hatchery Committee which must be submitted to NMFS Salmon Recovery Division by June 15 of the collection year. Protocols will include consideration of collecting additional broodstock to allow for culling for BKD management.
- Monitor the incidence of, and minimize capture, holding, and handling effects on, listed salmon and steelhead encountered during trapping. Incidentally captured

listed UR spring Chinook salmon adults that are not intended for use as broodstock in concurrently operated and previously authorized listed stock recovery programs shall be carefully handled and immediately released upstream.

- Ensure that the hands of fish handlers are free of sunscreen, lotion, or insect repellent.
- Non target species are bypassed, minimally handled, or will be fully recovered (if anesthetized) and immediately released upstream of the trapping site.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 8. WDFW is currently responsible for conducting the activities described in this Section 8. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

8.1) Selection method.

Ripe females are spawned as they mature to meet juvenile program goals and are spawned on a 1:1 male to female ratio. Ripe males are randomly selected with priority given to ripe natural origin adults to maximize the contribution of natural origin gametes.

8.2) Males.

Ripe males are used, as needed, for a 1:1 pairing with each female. Eggs from each female receive milt from the primary male, with some milt from a backup male added after the initial fertilization. Males are not selected by size and smaller males and jacks are represented in the mating protocol proportional to their presence in the broodstock collected at random from the trapping sites.

8.3) Fertilization.

Fertilization occurs at Eastbank Hatchery. Ovarian fluid from each female is tested for viral and other pathogens. The eggs from an individual female are fertilized with milt from the primary male, milt and eggs mixed, then later milt from the backup male is added to the mix. After water hardening in pathogen-free well water, the eggs are placed in iodophore according to standard fish health protocol. Individual egg lots are incubated in isolation until pathogen testing has confirmed them free of pathogens. Any egg lots from BKD and other listed pathogens may be destroyed in accordance with fish health protocols.

8.4) Cryopreserved gametes.

None.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Broodstock are trapped as the fish ripen naturally over the course of the migration and

spawning.

SECTION 9. INCUBATION AND REARING

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 9. WDFW is currently responsible for conducting the activities described in this Section 9. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holder for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Table 18. Hatchery life stage survival rates (percent) for spring Chinook, brood years 1989-2005.

Brood year	Number of eggs taken	Unfertilized egg-eyed	Eyed egg-ponding	Ponding to release	Transport to release	Unfertilized egg-release
1989	45,311	98.0	99.1	96.4	99.3	93.6
1990	60,287	91.8	98.1	97.9	99.2	88.2
1991	73,601	94.4	96.1	93.2	95.0	84.5
1992	111,624	98.4	96.7	80.0	80.6	76.2
1993	257,208	89.7	98.0	98.9	99.7	86.9
1994	35,539	98.6	100.0	77.0	78.9	75.9
1995	No Program					
1996	18,579	88.3	100.0	89.9	97.7	79.4
1997	312,182	93.2	95.7	95.6	99.3	85.3
1998	90,521	94.5	99.0	89.6	99.1	83.9
1999	No program					
2000	55,256	91.0	98.1	95.4	99.3	85.2
2001	1,099,630	88.9	98.1	51.3	51.8	44.7
2002	196,186	82.1	98.0	94.8	99.1	76.3
2003	247,501	93.2	97.7	98.5	98.1	89.7
2004	538,176	93.3	98.4	93.9	97.2	86.2
2005	536,490	95.9	98.0	97.9	99.1	92.1
2006	744,344	-	-	-	-	-
2007	359,739	-	-	-	-	-
Standard	***251,693***	***92.0***	***98.0***	***90.0***	***95.0***	***81.0***

9.1.2) Cause for, and disposition of surplus egg takes.

The broodstock collection plan described above sets forth an adult collection target that minimizes egg surpluses. No more adults would be collected and crossed than are expected to be needed given the running average fecundity of the stock. In the case where unanticipated, higher than average fecundity results in a surplus of eggs, the excess eggs will be culled in a manner consistent with

achieving program goals.

In the event that higher than expected egg-to-fry survival or lower than expected BKD incidence occurs that would lead to the inadvertent possession of spring Chinook substantially in excess (greater than 110 percent) of the program production levels, then surplus fish will be culled from the population in a manner consistent with achieving program goals.

9.1.3) Loading densities applied during incubation.

Eggs from individual females will be incubated individually in (16 tray) vertical stack incubators at a density of eggs from one female fish per tray and roughly 4,500 eggs per tray after eye-up stage. The flow rate to each incubator is maintained at 3 gpm throughout the incubation period.

9.1.4) Incubation conditions.

Eggs are incubated full-term (green egg-emergence) at the Eastbank Hatchery. Individual female/matings are incubated individually to the eyed-egg stage to segregate for ELISA (BKD) values. Eggs of the sub-yearling production component are incubated on ambient temperature well water that results in fry emergence around mid-January. Eggs of the yearling production component are incubated on chilled temperature well water that results in fry emergence around the latter part of April.

Influent and effluent gas concentrations at the hatcheries and within the acclimation ponds, including dissolved oxygen concentrations, are kept within parameters optimal for juvenile salmonid production and survival. For Eastbank Hatchery, influent and effluent gas concentrations, including dissolved oxygen concentrations, are measured and within parameters optimal for salmonid egg and juvenile fish survival (Brown 1997). Incubators are equipped with a chilled water supply. This water varies in temperature from a low of 7.7° Celsius in May to a high of 13.9° Celsius in December.

9.1.5) Ponding.

Fry are transferred from Heath trays for ponding upon button-up and swim-up. Ponding generally occurs after the accumulation of 1,650 to 1,750 Fahrenheit temperature units. Unfed fry are transferred to the rearing ponds from early May through early June.

9.1.6) Fish health maintenance and monitoring.

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by the contracted operator, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry

are removed by bulb-syringe. Adherence to WDFW, Pacific Northwest Fish Health Protection Committee, and IHOT (1995) fish disease control policies reduces the incidence of diseases in fish produced and released from the Eastbank Hatchery. No fish disease outbreaks have been experienced during the incubation to ponding period in the spring Chinook programs in recent years and mortality levels have remained within program standards. Fish health is continuously monitored in compliance with Co-Manager Fish Health Policy standards (WDFW and WWTIT 1998). Rearing space at Eastbank was designed to maintain maximum loading densities below the criteria of Piper et al. (1982), as modified by Wood (Chelan PUD and CH2MHILL 1988).

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Eggs will be incubated in pathogen free, silt free well water to ensure maximum egg survival and minimize potential loss from disease. In order to minimize the likelihood for adverse genetic and ecological effects as a result of fish mortality, redundant power supplies are provided to Eastbank Hatchery for supplying power to the pumps as well as an alarm to alert hatchery personnel of electrical failure or water flow/elevation changes.

Regarding BKD, the following will occur:

- Hatchery-origin eggs/progeny with ELISA titers of OD $\geq$ 0.12 will be culled.

- Wild-origin eggs/progeny with ELISA titers of OD $\geq$ 0.12 will be raised at lower density of 0.06.

- All hatchery- and natural-origin eggs/progeny with ELISA titers of OD > 0.19 will be culled from the program.

- At the first signs of infection with BKD, juvenile spring Chinook will be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings.

- When less than 5 percent of the program production is in the $0.12 \leq OD \leq 0.19$ range, the Hatchery Committee may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Please refer to Table 18 in Section 9.1.1.

9.2.2) Density and loading criteria (goals and actual levels).

The following table represents current density and loading criteria. The HCP Hatchery Committee may adjust criteria as deemed necessary.

Table 19. Density and fish loading criteria for spring Chinook fish culture facilities (Sapere, 2004).

Rearing Criteria	Spring Chinook	
Early Rearing (to 200 fish/lb)	ELISA ≤0.119[1] 61.2%	ELISA ≥0.12 38.8%
Density index (lbs/cf-in)	0.125	0.06
Flow index (lbs/gpm-in)	0.75	0.60
Rearing Criteria (>200 fish/lb)		
Density index (lbs/cf-in)	0.125	0.06
Flow index (lbs/gpm-in)	0.75	0.60
Acclimation Criteria		
Density index (lbs/cf-in)	0.10	0.06
Flow index (lbs/gpm-in)	1.00	0.60

[1] The 0.119 threshold was developed jointly by the USFWS and WDFW. Fish with an ELISA >0.19 will be culled.

9.2.3) Fish rearing conditions.

Outside rearing vessels at the Eastbank Hatchery are conventional rectangular or circular concrete raceways or ponds. Fish are initially reared on well water at the Eastbank Hatchery, then are reared on primarily Chiwawa River water. (Wenatchee River water is mixed with Chiwawa River water at the intake for periods of time in mid-winter for deicing the Chiwawa River intake.) Temperature, dissolved oxygen and pond turnover rate are monitored. Procedures are followed for: water quality, alarm systems, and predator control measures to provide the necessary security for the cultured stock, loading, and fish density. Settleable solids, unused feed and feces are removed regularly to ensure proper cleanliness of rearing containers. All ponds are broom cleaned as needed and vacuumed monthly. Ponds are pressure washed between broods. Temperature and dissolved oxygen are monitored and recorded daily during fish rearing. Ponds are equipped with a predation exclusion system.

9.2.4) Indicate biweekly or monthly fish growth information (average program

performance), including length, weight, and condition factor data collected during rearing, if available.

Table 19. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of spring Chinook smolts released from the hatchery, 1998-2005. Size targets are provided in the first row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
Targets		***176***	***9.0***	***37.8***	***12***
1998	2000	143	9.1	39.5	12
1999	2001	No Program			
2000	2002	150	6.8	46.7	10
2001	2003	142	7.1	37.6	12
2002	2004	146	8.5	40.3	11
2003	2005	161	6.1	50.2	9
2004	2006	143	4.9	36.7	12
2005	2007	136[a]	4.6	30.8	15
		129[b]	5.8	26.6	17
Average		***152***	***6.9***	***38.5***	***12***

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4 above.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Bio-Oregon feed is currently used. Bio-Diet Starter is used for early growth. The fish are started on Mash, and will be fed size 0, 1, and 2, based upon fish size. Bio-Olympic feed is fed from sizes 1.2mm, 2.0mm, and 2.5mm. Feed rates will vary from 2 to 4 percent B.W./day for fry feeds, and 1 to 2.5 percent B.W./day on grower feeds. Fish are fed to satiation when hand feeding– the daily amounts are fed as quickly as the fish will accept the feed without waste. This assures all fish will have an opportunity to feed. Demand feeders are also used. When demand feeders are used, the feed needed for an entire week is calculated, and the feeders refilled as the feed is eaten. This assures that the more aggressive fish are not the only ones getting fed. When the feed for the current week has been fed, the feeders are not filled until the next week. When the temperature drops below 3.3 degrees Celsius, fish activity diminishes, and feed is fed lightly or not at all. Feed conversion is excellent. The starter feeds convert at 0.5 to 0.7 pounds of feed to produce 1 pound of growth, and the grow-out feeds convert at 0.7 to 0.9 pounds

of feed to produce 1 pound of growth.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

For all production programs under the Mid and Upper Columbia Hatchery Program, standard fish health monitoring will be conducted by a fish health specialist at frequencies appropriate to the life stage and susceptibility to disease. Significant fish mortality to unknown cause(s) will be sampled appropriately for study (i.e., viral assay, bacterial culture, histopathology). Fish health maintenance strategies are described in IHOT (1995). Incidence of viral pathogens in spring Chinook broodstock will be determined by sampling fish at spawning in accordance with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State. Populations of particular concern may be sampled at the 100 percent level and may require segregation of eggs/progeny in early incubation or rearing.

Fish are monitored daily by staff during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. A fish health specialist will monitor fish health often as determined necessary. More frequent care will be provided as needed if disease is noted. Hatchery Specialists under the direction of the Fish Health Specialist will provide treatment for disease. Sanitation will consist of raceway cleaning as necessary by brushing, and disinfecting equipment. Fish health examinations are performed on all spring Chinook production lots throughout the rearing period and pre-release.

All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

The general policy is to bury juvenile fish mortalities and dead eggs to minimize the risk of disease transmission to natural fish. Adult spring Chinook carcasses will be buried or disposed of in an approved landfill if individuals have been treated with antibiotics and died within the withdrawal period identified by the FDA. All adults injected with maturation accelerating hormones (such as sGnRHa implants) will be disposed of in an approved landfill, consistent with INAD requirements.

Programs can experience elevated losses associated with bacterial kidney disease (BKD) which were treated at least twice for BKD with erythromycin. Other problems can be enteric redmouth which is treated with a five-day treatment of Romet feed.

Current 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.
Chloramine T – bath to treat external bacteria.

Culling protocols relevant to females with the potential to vertically transmit BKD to their progeny are planned. Treatment and rearing protocols for the progeny of the females with ODs greater than 0.12 are also planned to reduce the risk of the fish breaking with BKD. The program will continue to use the most effective treatment methods available. In addition, fish health specialists are present during spawning at which time they take pathogen and viral screening samples.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Use of lethal or high stress indicators is not preferred for this ESA-listed aggregate. Degree of smoltification is monitored through monthly collection of data indicating average condition factor (Kfl) of the populations. Gill ATPase levels have been monitored in the past to attempt to indicate degree of smoltification. However, this index has not been found to be a useful tool for determining when to begin releases due to the delay in obtaining results from sampling, and the finding that ATPase levels do not actually increase until the smolts are actively migrating in the Columbia River (Petersen et al. 1999b). Indicators of smoltification such as coefficient of variation in length and condition factor may continue to be used.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

No “natural” rearing methods are currently used in the program. As additional acclimation sites are developed, however, use of natural rearing at low technology sites is possible.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Risk aversion measures that are employed include:

- Water supply, facility, and fish health risk aversion measures described previously are employed.
- Fish are segregated according to the BKD status of the parents. Parental culling programs are also in-place to minimize the risk of propagating BKD.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this Section 10, except that Chelan PUD's obligations with respect to the development of additional acclimation sites other than the existing Chiwawa acclimation site, will be determined in accordance with the processes outlined in the HCP. WDFW is currently responsible for conducting the activities described in this Section 10 for which Chelan provides the funding. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

10.1) Proposed fish release levels.

The current maximum annual fish release levels are 672,000 smolts and up to 298,000 smolts under the proposed program. After 2013 proposed annual fish release levels will be agreed to by the HCP Hatchery Committee, and while the specific number is not known, it is expected to be less than 672,000 smolts.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Chiwawa River, Wenatchee River watershed (WRIA 45)

Through the Columbia River Fish Accords, additional sites may be developed within the Chiwawa River basin upstream and downstream of the current facility. These will be relatively small, natural ponds and side-channels that can be modified with minimal ground disburbance for use as acclimation sites and, potentially, rearing habitats after smolts are released. Natural or semi-natural acclimation ponds may include either man-made earthern ponds or exising ponds.

10.3) Actual numbers and sizes of fish released by age class through the program.

The following table gives spring Chinook smolt releases into the lower Chiwawa River between 1991 and 2007.

Table 20. Spring Chinook smolt releases into the lower Chiwawa River, 1991-2007

Yearling Releases			
Release Year	**Number**	**Date**	**Average Size (fpp)**
1991	43,000	May 2-19	12.0
1992	53,170	April 20 – May 5	14.0
1993	62,138	April 21-28	15.0
1994	85,113	April 14-26	16.0
1995	223,610	April 14-26	15.0
1996	27,226	April 15-26	15.0
1997*			
1998	15,176	April 29	9.0
1999	266,148	April 19-26	12.0
2000	75,906	April 10	12.0
2001*			
2002	47,104	April 22-29	10.0
2003	377,544	April 21 – May 12	11.8
2004	149,668	April 19 – May 14	11.0
2005	222,131		9.0
2006	494,517		12.0
2007	494,012		

* Denotes that the release year has been adjusted to reflect for the 1995 and 1999 brood years.

10.4) Actual dates of release and description of release protocols.

See Section 10.3, above, for release dates. Releases from the Chiwawa River acclimation ponds at the beginning of the release period in April are volitional for approximately 20 days with the remaining fish forced out by mid-May.

10.5) Fish transportation procedures, if applicable.

Sub-yearling fish are transported from the Eastbank Hatchery to the Chiwawa rearing/acclimation ponds in September or October by tanker truck. Current fish transport procedures include crowding and loading into distribution tucks via a fish pump. Distribution trucks are reliable and safe and water is tempered as appropriate. Fish are tempered to within 3^0 Celsius of the receiving water prior to release into the ponds. Fish are released directly from the ponds to the river and do not require additional transportation.

10.6) Acclimation procedures.

Sub-yearling fish are transported from the Eastbank Hatchery to the Chiwawa rearing/acclimation ponds in September or October. The juveniles are reared and

acclimated over the winter on primarily Chiwawa River water. Warmer Wenatchee River water is dispersed across the Chiwawa River intake screens during mid-winter rearing to minimize the risk of water loss due to icing that occurs if only Chiwawa River water is used (generally between early December through late February). Pumped Wenatchee River inflow provides 3,000 gpm to the screens; however the volume of total inflow to the ponds varies, as does the proportion of Wenatchee River water in the rearing ponds during these months. Pre-smolts are on 100 percent Chiwawa River water for at least two complete months prior to initiation of volitional releases. Fish are reared to a size of 30 gms (15 fpp) and allowed to volitionally migrate into the Chiwawa River at RK 1.0 between mid-April and mid-May.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Currently, fish are released 100 percent coded wire tagged (CWT) and adipose fin clipped; the exceptions being brood year 2001 (no adipose fin clips) and brood year 2002 (45 percent adipose fin clipped).

All smolts will be given an external mark or otherwise tagged as agreed to by the HCP Hatchery Committee. Marking and tagging strategies will be sufficient to allow differential harvest between conservation and safety net production components and to allow efficient broodstock collection and removal of HORs at TWD and/or Chiwawa Weir.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Broodstock and egg collections will be designed to minimize the potential for egg surpluses. Egg surpluses, if any, will be culled (see Section 9.1.2). Surplus smolts are not expected.

10.9) Fish health certification procedures applied pre-release.

Fish health and disease condition are continuously monitored in compliance with the requirements of the "Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State" (Co-managers 2006), requirements of the Section 10 ESA permit issued, and guidelines of IHOT (1995). Spring Chinook are monitored daily by the contracted operator during rearing for signs of disease, through observations of feeding behavior, and monitoring of daily mortality trends. A fish health specialist has been monitoring fish health as often as determined necessary with these inspections adhering to the disease prevention and control guidelines established by the Pacific Northwest Fish Health Protection Committee; More frequent care will be provided as needed if disease is noted. Prior to release, the population health and condition is established by the Area Fish Health Specialist. This is commonly done 1-3 weeks pre-release and up to 6 weeks on systems with pathogen free water and little or no history of disease.

10.10) Emergency release procedures in response to flooding or water system failure.

In the event of a water system failure, screens would be pulled to allow fish to exit the ponds, or in some cases they can be transferred into other rearing vessels to prevent an emergency release. Chiwawa satellite rearing and acclimation phase: outlet screens/stop logs of the ponds would be pulled, and fish would be forced out or allowed to volitionally move into the Chiwawa River. This would only occur if the survival of the program is in jeopardy. In cases of severe flooding the screens are not pulled because flood waters rise to the point where they breach the ponds. Every effort will be made to avoid pre-programmed releases including transfer to alternate facilities. Emergency releases, if necessary and authorized, would be managed by removal of outlet screens and pull sumps of the rearing units. If possible, portable pumps would be set up to use river water to flush the fish.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin spring Chinook 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.
- Spring Chinook smolt releases will be timed with releases from Columbia River 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.
- Hatchery spring Chinook smolts will be released when environmental conditions exist that promote rapid emigration.
- Total number of smolts released with expected adult contribution to natural spawning will be calibrated to be within the tributary carrying capacity when historical productivity has been restored.
- All artificially propagated UCR spring juveniles shall be externally or internally marked prior to release.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Monitoring and evaluation plays an important role in helping measure program results and determining future directions (adaptive management). The HCP Hatchery Committee has developed a rigorous monitoring program for the Chiwawa River spring Chinook program (see Murdoch and Peven 2005; Hays et al. 2006). It is within the purview of the HCP Hatchery Committee to modify this program at any time. The program monitors survival and growth within the hatchery and the effects of hatchery fish on population productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information is collected directly from or derived from spawning ground surveys, broodstock sampling, stock composition sampling (stock assessment), hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, genetic sampling, disease sampling, and snorkeling. Importantly, the monitoring and evaluation program is consistent with the draft monitoring and evaluation plan prepared by NMFS for the Upper Columbia Spring Chinook and Steelhead Recovery Plan (see Appendix P to the Recovery Plan) and the Ad Hoc Supplementation Monitoring and Evaluation Workgroup recommendations (Galbreath et al. 2008).

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

The initial five-year Monitoring and Evaluation Plan proposed for the Wenatchee summer spring Chinook program is described in Murdoch and Peven (2005) and Hays et al. (2006). The plan objectives and subsequent hypotheses were generated from Chelan and Douglas PUDs' Monitoring and Evaluation Plan (see Habitat Conservation Plan Hatchery Committees 2006 and Chelan PUD Habitat Conservation Plan's Hatchery Committee 2005), the BAMP, and the HCP and PRCC hatchery subcommittees. The objectives were developed to assess progress toward reaching the hatchery program goals defined by the JFP in the Murdoch and Peven 2005 plan. The HCP Hatchery Committee approved this plan at the July 2005 HCP Hatchery Committee meeting. The HCP Hatchery Committee may modify the monitoring and evaluation plan to ensure that the program goals are being appropriately monitored.

Summarized below are the objectives, their respective hypotheses, measured variables, derived metrics, and analyses. For detailed descriptions of survey designs, sampling protocols, and spatial and temporal scales see Murdoch and Peven (2005) and Hays et al. (2006). It is important to point out that the Monitoring and Evaluation Plan for the Wenatchee spring Chinook program intends to use reference streams for comparative analysis (i.e., to tease out hatchery effects). Availability, feasibility, and viability of using reference streams are currently being evaluated by the Mid-Columbia Hatchery

Evaluation Technical Team. Because of the difficulty in finding suitable reference streams (systems similar to the Wenatchee, but with no hatchery influence) and the ability to detect impacts, it has not yet been decided whether this approach is practical.

The following discussion of objectives is taken both from the 2005 Conceptual Monitoring and Evaluation Plan and the 2006 Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs (Hays et al. 2006).

Objective 1: Determine if Chiwawa spring Chinook program increases the number of naturally spawning and naturally produced adults in the Chiwawa Basin relative to a non-supplemented population(s) (i.e., reference condition) and if the change in the natural replacement rate (NRR) of the Chiwawa population is similar to that of the non-supplemented population.

At the core of Chiwawa River spring Chinook supplementation program is the objective of increasing the number of spawning adults (i.e., the combined number of naturally produced and hatchery fish) in order to affect a subsequent increase in the number of returning naturally produced fish or natural origin recruits (NOR). This is measured as the Natural Replacement Rate (NRR) or the ratio of NORs to the parent spawning population.

Differences in carrying capacities of supplemented and non-supplemented streams can confound the effects of supplementation on total number of spawners returning to the streams. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on total spawners, the capacity of the habitats should be estimated and removed from the analyses.[7]

Adult Return Rates of Hatchery Fish

Monitoring Question:

- Is the annual number of hatchery spring Chinook that spawn naturally greater than the number of naturally and hatchery produced spring Chinook taken for broodstock?

Hypothesis:

- The annual number of hatchery produced spring Chinook that spawn naturally is less than or equal to the number of naturally and hatchery produced spring Chinook taken for broodstock.

Measured Variables:

- Number of redds.
- Number of hatchery produced fish on spawning grounds.
- Number of naturally and hatchery produced fish removed for broodstock.

[7] The HETT is currently in the process of determining the capacity of habitats and/or maximum recruits within supplemented and un-supplemented streams.

- Number of males and females sampled at broodstock collection and stock assessment sites.

Derived Variables:

- Estimate spawners per redd.
- Estimate total number of hatchery produced spawners.

Analysis:

- Analyze annually based on return year.
- On a five-year period analyze return years for patterns that correlate with extraneous factors such as ocean conditions.
- Analysis over time (trend) may include correlating (regressions analysis) escapements with other extraneous variables (e.g., ocean conditions, climatic effects, etc.).

Hatchery Contribution to Recruitment of Naturally Produced Fish

Monitoring Questions:

- Is the annual change in the number of natural origin recruits (NORs) produced from the Chiwawa spring Chinook population greater than or equal to the annual change in NORs in a non-supplemented population?

Hypothesis:

- Ho: ΔNOR/Max Recruitment $_{\text{Chiwawa spring Chinook}} \geq \Delta$NOR/Max Recruitment $_{\text{Non-supplemented population}}$
    - This hypothesis incorporates carrying capacity.

Measured Variables:

- Number of redds.
- Origin of carcasses and/or brood stock (hatchery or naturally produced fish).
- Sex ratio of broodstock collected randomly over the run.
- Age composition from both broodstock and carcasses (from scale analysis).
- Number of naturally produced fish harvested

Derived Variables:

- Age structure of the spawning population.
- Number of naturally produced recruits by brood year for both naturally produced parents and hatchery parents (≥ age-3).
- May include ratio or difference scores of NORs (requires reference area).

- Spawner-recruit ratios.

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (trend; initially as a 5-year period; i.e., 5-year mean of annual change).
- Two-sample t-test (other tests may include RIA, ARIMA, DFA, or other tests) to evaluate difference scores or ratios over time (initial 5-year period).
- On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.

Natural Replacement Rates of Supplemented Populations

Monitoring Questions:

- Is the change in natural replacement rates (NRRs) of Chiwawa River spring Chinook greater than or equal to the change in natural replacement rates in a non-supplemented population?

Hypothesis:

- Ho: Δ NRR $_{\text{Chiwawa spring Chinook}} \geq \Delta$ NRR $_{\text{Non-supplemented population}}$

Measured Variables:

- Number of redds.
- Origin of carcasses and/or brood stock (hatchery or naturally produced fish).
- Sex ratio of broodstock collected randomly over the run.
- Age composition from both broodstock and carcasses (from scale analysis).
- Number of hatchery and naturally produced fish taken for broodstock.
- Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia).

Derived Variables:

- NORs (number of naturally produced recruits (total recruits) by brood year for both naturally produced parents and hatchery parents ($\geq$ age-3)).
- NRRs (calculated as NORs/spawner).
- May include ratio or difference scores of NRRs (requires reference area).

Analysis:

- Analyze annually based on brood year.

- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data; i.e., 5-year mean of annual change).
- Two-sample t-test (other tests may include RIA, ARIMA, DFA, or other tests) to evaluate difference scores or ratios over time (initial 5-year period).
- On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.
- The testing is appropriate if populations are below carrying capacity and density-dependent factors are <u>not</u> regulating the populations at high spawner abundances

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the Chiwawa spring Chinook population are similar.

Inherent in the supplementation strategy is that hatchery and naturally produced fish are intended to spawn together and in similar locations. Run timing, spawn timing, and spawning distribution may be affected through the hatchery environment (i.e., domestication). If supplemented fish are not fully integrated into the naturally produced spawning population, the goals of supplementation may not be achieved. Hatchery adults that migrate at different times than naturally produced fish may be subject to differential survival rates or spawning success. Hatchery adults that spawn at different times or locations than naturally produced fish would not be integrated into the naturally produced spawning population (i.e., segregated stock).

<u>Migration Timing</u>

Monitoring Questions:

- Is the migration timing of hatchery and naturally produced Chiwawa spring Chinook of the same age class similar?

Hypothesis:

- Ho: Migration timing $_{\text{Hatchery Age X}}$ = Migration timing $_{\text{Naturally produced Age X}}$

Measured Variables:

- Ages of hatchery and naturally produced fish sampled at broodstock collection sites, during carcasses surveys, and/or at stock assessment sites.
- Time (Julian date) of arrival at TWD.

Derived Variables:

- Mean Julian date for a given age class (also 10, 50, and 90 percentiles).

Analysis:

- Analyze annually based on return year and age class.
- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data).

- ANOVA by age and origin

Timing of Spawning

Monitoring Questions:

- Is the timing of spawning (measured as the time female salmon carcasses are observed) similar for hatchery and naturally produced Chiwawa spring Chinook?

Hypothesis:

- Ho: Spawn timing $_{\text{Hatchery spring Chinook}}$ = Spawn timing $_{\text{Naturally produced spring Chinook}}$

Measured Variables:

- Time (Julian date) of hatchery and naturally produced salmon carcasses observed on spawning grounds within defined reaches.

Derived Variables:

- Mean Julian date.
- Elevations (covariate)

Analysis:

- Analyzed annually based on return year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).
- ANOVA by sex and location

Distribution of Redds

Monitoring Questions:

- Is the distribution of redds (based on carcasses) similar for hatchery and naturally produced Chiwawa spring Chinook?

Hypothesis:

- Ho: Redd distribution $_{\text{Hatchery spring Chinook}}$ = Redd distribution $_{\text{Naturally produced spring Chinook}}$

Measured Variables:

- Location (GPS coordinate) of female salmon carcasses observed on spawning grounds.

Derived Variables:

- Location of female salmon carcass in RKm (0.01).
- Calculate percent overlap in distribution across available spawning habitat.

Analysis:

- Analyze annually based on return year (ANOVA).

- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data).
- ANOVA by origin and sex

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in the Chiwawa spring Chinook population as a result of the hatchery program. Additionally, determine if the hatchery program has caused changes in phenotypic characteristics of the natural Chiwawa spring Chinook population.

This objective addresses the long-term fitness of the supplemented population. Fitness, or the ability of individuals to survive and pass on their genes to the next generation in a given environment, includes genetic, physiological, and behavioral components.[8] Maintaining the long-term fitness of supplemented populations requires a comprehensive evaluation of genetic and phenotypic characteristics. Evaluation of some phenotypic traits (i.e., run timing, spawn timing, spawning location, and stray rates) is addressed under other objectives.

Assessing the genetic component of the Chiwawa spring Chinook program does not require annual sampling. Meeting stray-rate targets (hypotheses tested under Objective 5) should prevent significant changes in population genetics. Therefore, testing statistical hypotheses associated with genetic components should be conducted every three to five years, depending on the type of hatchery program. More frequent genetic sampling may be necessary if actual stray rates exceed targets.

Allele Frequency

Monitoring Questions:

- Is the allele frequency of hatchery spring Chinook similar to the allele frequency of naturally produced and donor spring Chinook?

Hypothesis:

- Ho: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop.}}$

Measured Variables:

- Microsatellite genotypes

Derived Variables:

- Allele frequency

Analysis:

- Analyze as a time series (trend).
- Compare samples within drainages.

[8] These metrics are difficult to measure, and phenotypic expression of these traits may be all that can be measured and evaluated.

- Population differentiation tests, analysis of molecular variance (AMOVA), and relative genetic distances.

Genetic Distances Between Populations

Monitoring Questions:

- Does the genetic distance among subpopulations within the Wenatchee spring Chinook population remain the same over time?

Hypothesis:

- Ho: Genetic distance between subpopulations $_{\text{Year X}}$ = Genetic distance between subpopulations $_{\text{Year Y}}$

Measured Variables:

- Microsatellite genotypes

Derived Variables:

- Allele frequencies

Analysis:

- Analyze as a time series (trend).
- Compare samples among drainages.
- Population differentiation tests, AMOVA, and relative genetic distances.

Effective Spawning Population

Monitoring Questions:

- Is the ratio of effective population size (N_e) to spawning population size (N) constant over time?

Hypothesis:

- Ho: $(N_e/N)_{t0} = (N_e/N)_{t1}$

Measured Variables:

- Microsatellite genotypes

Derived Variables:

- Allele frequencies

Analysis:

- Analyze as a time series (trend).
- Population differentiation tests, relative genetic distances, statistics to calculate effective population size (e.g., harmonic means).

Age at Maturity

Monitoring Questions:

- Is the age at maturity of hatchery and naturally produced Chiwawa spring Chinook similar?

Hypothesis:

- Ho: Age at Maturity $_{\text{Hatchery spring Chinook}}$ = Age at Maturity $_{\text{Naturally produced spring Chinook}}$

Measured Variables:

- Age of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Age of broodstock.
- Age of fish at stock assessment locations (e.g., Tumwater and Chiwawa Weir).

Derived Variables:

- Total age

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).
- Chi-square or ANOVA by origin and gender.
    - Whenever possible age at maturity will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling).

Size at Maturity

Monitoring Questions:

- Is the size (length) at maturity of a given age and sex of hatchery spring Chinook similar to the size at maturity of a given age and sex of naturally produced spring Chinook?

Hypothesis:

- Ho: Size (length) at Maturity $_{\text{Hatchery Age X and Gender Y}}$ = Size (length) at Maturity $_{\text{Naturally produced Age X and Gender Y}}$

Measured Variables:

- Size (length), age, and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Size (length), age, and gender of broodstock.

- Size (length), age, and gender of fish at stock assessment locations (Tumwater and Chiwawa Weir).

Derived Variables:

- Total age.

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).
- ANOVA by origin, gender, and age

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 HRR expected value of 5.30 (from Murdoch and Peven 2005).

The survival advantage from the hatchery (i.e., egg-to-smolt) must be sufficient to overcome the survival disadvantage after release (i.e., smolt-to-adult) in order to produce a greater number of returning adults than if broodstock were left to spawn naturally. If a hatchery program cannot produce a greater number of adults than naturally spawning fish, the program should be modified or discontinued.

Hatchery Replacement Rates (HRRs)

Monitoring Questions:

- Is the adult-to-adult survival rate of hatchery Chiwawa spring Chinook (HRR) greater than or equal to the adult-to-adult survival rate (NRR) of naturally produced Chiwawa spring Chinook?
- Is the adult-to-adult survival rate of hatchery Chiwawa spring Chinook (HRR) greater than or equal to the value of 5.30 (from Murdoch and Peven 2005)?

Hypothesis:

- Ho_1: $HRR_{Year\ x} \geq NRR_{Year\ x}$
- Ho_2: $HRR \geq 5.30$

Measured Variables:

- Number of redds.
- Origin of carcasses and/or brood stock (hatchery or naturally produced fish).
- Sex ratio of broodstock collected randomly over the run.
- Age composition from both broodstock and carcasses (from scale analysis).
- Number of hatchery and naturally produced fish harvested

Derived Variables:

- Age structure of the spawning population.
- Number of hatchery and naturally produced adults by brood year (≥ age-3).
- HRR (number of returning adults per brood year/broodstock)
- NRR (from above)

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (initially as a 5-year period but include pre-2006 data to the extent possible).
- For Question 1 a two-sample t-test to compare HRR to NRR
- For Question 2 a one-sample t-test to evaluate HRR to 5.30.
- On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.

Objective 5: Determine if the stray rate of hatchery Chiwawa spring Chinook is below the acceptable levels to maintain genetic variation between stocks.

Maintaining locally adapted traits of fish populations requires that returning hatchery fish have a high rate of site fidelity to the target stream. Hatchery practices (e.g., rearing and acclimation water source, release methodology, and location) are the main variables thought to affect stray rates. Regardless of the adult returns, if adult hatchery fish do not contribute to the donor population, the program will not meet the basic condition of a supplementation program. Fish that stray to other independent populations should not comprise greater than 5 percent of the spawning population. Likewise, fish that stray within an independent population should not comprise greater than 10% of the spawning aggregate.

Stray Rates among Populations for Brood Return

Monitoring Questions:

- Is the stray rate of hatchery Chiwawa spring Chinook less than 5% for the total brood return?

Hypothesis:

- Ho: Stray rate $_{\text{Hatchery spring Chinook}} \geq 5\%$ of total brood return

Measured Variables:

- Number of hatchery carcasses found in non-target and target spawning areas.
- Number of hatchery fish collected for broodstock.
- Number of hatchery fish taken in fishery.

- Age (from scale analysis) of all fish sampled (stock assessment, carcasses, and broodstock).

Derived Variables:

- Hatchery carcasses and take in fishery estimated from expansion analysis.
- Locations of live and dead strays (used to tease out overshoot).

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data).
- Analyze with a one-sample t-test to compare the actual stray rate with the target (5%) stray rate.

Stray Rates among Populations for Return Year

Monitoring Questions:

- Is the stray rate of hatchery Chiwawa spring Chinook less than 5% of the spawning escapement within other independent populations?

Hypothesis:

- Ho: Stray hatchery spring Chinook ≥ 5% of spawning escapement (based on run year) within other independent populations

Measured Variables:

- Number of hatchery carcasses found in non-target and target spawning areas.
- Number of hatchery fish collected for broodstock.
- Number of hatchery fish taken in fishery.

Derived Variables:

- Hatchery salmon carcasses estimated from expansion analysis.

Analysis:

- Analyze annually based on return year.
- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data).
- Analyze with a one-sample t-test to compare the actual proportion of strays with the target of 5% strays

Stray Rates within the Population

Monitoring Questions:

- Is the stray rate of hatchery Chiwawa spring Chinook less than 10% of the spawning escapement within other spawning aggregations within the Wenatchee spring Chinook population?

Hypothesis:

- Ho: Stray hatchery Chiwawa spring Chinook ≥ 10% of spawning escapement (based on run year) of any non-target streams within the Wenatchee spring Chinook population

Measured Variables:

- Number of hatchery carcasses found in non-target and target spawning aggregates.

Derived Variables:

- Hatchery salmon carcasses estimated from expansion analysis.

Analysis:

- Analyze annually based on return year.
- Analyze as a time series (trend; initially as a 5-year period and to the extent possible use pre-2006 data).
- Analyze with a one-sample t-test to compare the actual proportion of strays with the target of 10% strays.

Objective 6: Determine if hatchery Chiwawa spring Chinook were released at the programmed size and number.

Although many factors can influence both the size and number of fish released, past hatchery experience should assist in meeting program production levels.

Size of Hatchery Fish

Monitoring Questions:

- Are Chiwawa spring Chinook smolts released from the hatchery within 10% of the program goals of 176 mm (CV = 9.0), 37.8 g, and 12 fish/pound?

Hypothesis:

- Ho: Hatchery spring Chinook smolts $_{\text{Size at release}}$ = Programmed $_{\text{Size}}$

Measured Variables:

- Length (mm) and weights (g) of random samples of hatchery smolts.

Derived Variables:

- Means and CVs.

Analysis:

- Annually compare sizes of smolts released to program goals.

Number of Hatchery Fish

Monitoring Questions:

- Is the number of Chiwawa spring Chinook smolts released from the hatchery within 10% of the program goal of 672,000 smolts?

Hypothesis:

- Ho: Number of hatchery spring Chinook smolts = Programmed Number

Measured Variables:

- Numbers of smolts released from the hatchery.

Derived Variables:

- None

Analysis:

- Annually compare numbers of smolts released to program goal.

Objective 7: Determine if the proportion of hatchery spring Chinook on spawning grounds in the Chiwawa Basin affects the freshwater productivity (i.e., number of juveniles or smolts per redd) of Chiwawa spring Chinook compared to non-supplemented streams.

Out-of-basin effects (e.g., smolt passage through the hydro system and ocean productivity) have a strong influence on survival of smolts after they migrate from the tributaries. These effects introduce substantial variability into the adult-to-adult survival rates (NRR and HRR), which may mask in-basin effects (e.g., habitat quality, density related mortality, and differential reproductive success of hatchery and naturally produced fish). The objective of long-term juvenile and smolt monitoring is to determine the egg-to-smolt or egg-to-juvenile survival of target stocks. Juvenile production models generated from the information obtained through this monitoring will provide a level of predictability with greater sensitivity to in-basin effects than spawner-recruitment models that take into account all effects.

Differences in carrying capacities of supplemented and non-supplemented streams can confound the effects of supplementation on numbers of juveniles per redd. For example, if the supplemented population is at or above carrying capacity and the non-supplemented population is not, numbers of juveniles per redd in the non-supplemented population may be significantly greater than the number of juveniles per redd in the supplemented population. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on juveniles per redd, the capacity of the habitats must be included in the analyses.

Juvenile Productivity

Monitoring Questions:

- Is the change in numbers of juveniles (smolts, parr, or emigrants) per redd in Chiwawa spring Chinook greater than or equal to that in the non-supplemented population?

- Does the number of juveniles per redd decrease as the proportion of hatchery spawners increase?[9]

Hypothesis:

- Ho_1: Slope of Ln (juveniles/redd) vs redds $_{\text{Chiwawa spring Chinook}}$ = Slope of Ln (juveniles/redd) vs redds $_{\text{Non-supplemented population}}$
- Ho_2: The relationship between proportion of hatchery spawners and juveniles/redd is ≥ 1.

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds.
- Numbers of redds.
- Number of juveniles (smolts, parr, and emigrants).

Derived Variables:

- Number of juveniles (smolts, parr, and emigrants) per redd.

Analysis:

- Analyze annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).
- Two-sample t-test to evaluate differences between treatment and reference slopes (initial 5-year period).
- Regression analysis to examine relationships between hatchery adult composition and juveniles/redd.

Objective 8: Determine if harvest opportunities have been provided using hatchery returning adults where appropriate.

In years when the expected returns of hatchery adults are above the level required to meet program goals (i.e., supplementation of Chiwawa spring Chinook), surplus fish may be available for harvest. Harvest or removal of surplus hatchery fish from the spawning grounds would also assist in reducing potential adverse genetic impacts to naturally produced populations (loss of genetic variation within and between populations).

Harvest Rates

Monitoring Questions:

- Is the escapement of spring Chinook from the Chiwawa program, after meeting broodstock and natural production needs, high enough to provide opportunities for terminal harvest?

[9] Information is needed to estimate the effects of density dependence on these questions.

Hypothesis:

- Ho: Chiwawa spring Chinook escapement ≤ Maximum level needed to meet supplementation goals

Measured Variables:

- Numbers of hatchery fish taken in harvest.

Derived Variables:

- Total harvest by fishery estimated from expansion analysis.

Analysis:

- Direct comparison of harvest to surplus production estimates.

Two additional "regional" objectives identified in Murdoch and Peven (2005) are not explicit in the goals as specified above, but are included within the framework of this plan because they are related to the monitoring and evaluation goals of the Chiwawa spring Chinook program.

Objective 9: Determine whether BKD management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of Rs infection at various life stages from hatchery fish to naturally produced fish.

The hatchery environment has the potential to amplify diseases that are typically found at low levels in the natural environment. Amplification could occur within the hatchery population (i.e., vertical and horizontal transmission) or indirectly from the hatchery effluent or commingling between infected and non-infected fish (i.e., horizontal transmission). One disease that is particularly important to monitor is bacterial kidney disease (BKD), which is caused by *Renibacterium salmoninarum* (Rs). Although it is technologically possible to measure the amount of Rs in water or Rs DNA in smolts and adults non-lethally sampled, the biological meaning of these data are uncertain. Currently, the only metric available for monitoring and evaluation purposes is measuring the antigen level from kidney/spleen samples (i.e., ELISA). When available, non-lethal sampling may replace or be used in concert with lethal sampling.

As noted above, disease transmission from hatchery to naturally produced fish may occur at various life stages and locations. Of these, horizontal transmission from hatchery effluent, vertical transmission on the spawning grounds, and horizontal transmission in the migration corridor have been identified as disease interactions that could be examined under this objective, although others may also be relevant. Experimental designs addressing this objective may require technology not yet available, although in some instances samples may be collected, but not analyzed until a link can be established between bacteria levels in samples and disease prevalence.

Developing a complete set of questions and hypotheses statements for this objective may not be practical at this time, because there is currently no BKD Management Plan. However, while developing experimental designs for this objective, it may be feasible to incorporate both

hatchery and natural environment monitoring under a single study design. Integration of the different aspects of the objective would likely result in a more robust approach into understanding the effectiveness of disease management strategies.

Objective 10: Determine if ecological interactions attributed to hatchery Chiwawa spring Chinook reduce the abundance, size, or distribution of non-target taxa (NTT).

Supplementation of Chiwawa spring Chinook can increase demand for resources (food and space) and the potential for species interactions. Benefits in adult abundance gained from supplementation must be balanced with the ecological costs of releasing hatchery fish into the ecosystem. Resource managers must be aware of potential impacts of supplementation-related activities to non-target taxa. In extreme cases, the costs of such activities may negate benefits of similar activities within the same sub-basin. For example, predation by residualized hatchery steelhead may reduce the abundance of naturally produced spring Chinook fry that may subsequently result in a lower number of naturally produced adult spring Chinook.

Pearsons and Hopley (1999) categorized the types of ecological interactions as those that occur between NTT and hatchery fish (Type I) and those that occur between NTT and progeny of naturally spawning hatchery fish (Type II). While impacts to non-target taxa are often preconceived to be negative (e.g., competition, predation, behavioral, and pathogenic), positive interactions may also occur (e.g., nutrient enhancement and prey) (see Section 3.5).

Monitoring of all NTT is impractical. Only those NTT that overlap spatially with Chiwawa spring Chinook will be included in the monitoring program. Non-native species are not considered NTT. Prioritization for monitoring will be given to those NTT that are believed to be at the highest risk. The level of impact to NTT will be determined by the societal values of both the target and non-target taxa. The HCP Hatchery Committee will convene a panel of experts that will identify important NTT. Monitoring efforts will focus on those interactors that pose the highest risk of limiting the success of the Chiwawa program and those NTT deemed important for societal and ecological reasons.

Murdoch and Peven (2005) proposed the following hypotheses for this objective:

Ho: NTT abundance $_{\text{Year x through y}}$ = NTT abundance $_{\text{Year y through z}}$

Ho: NTT distribution $_{\text{Year x through y}}$ = NTT distribution $_{\text{Year y through z}}$

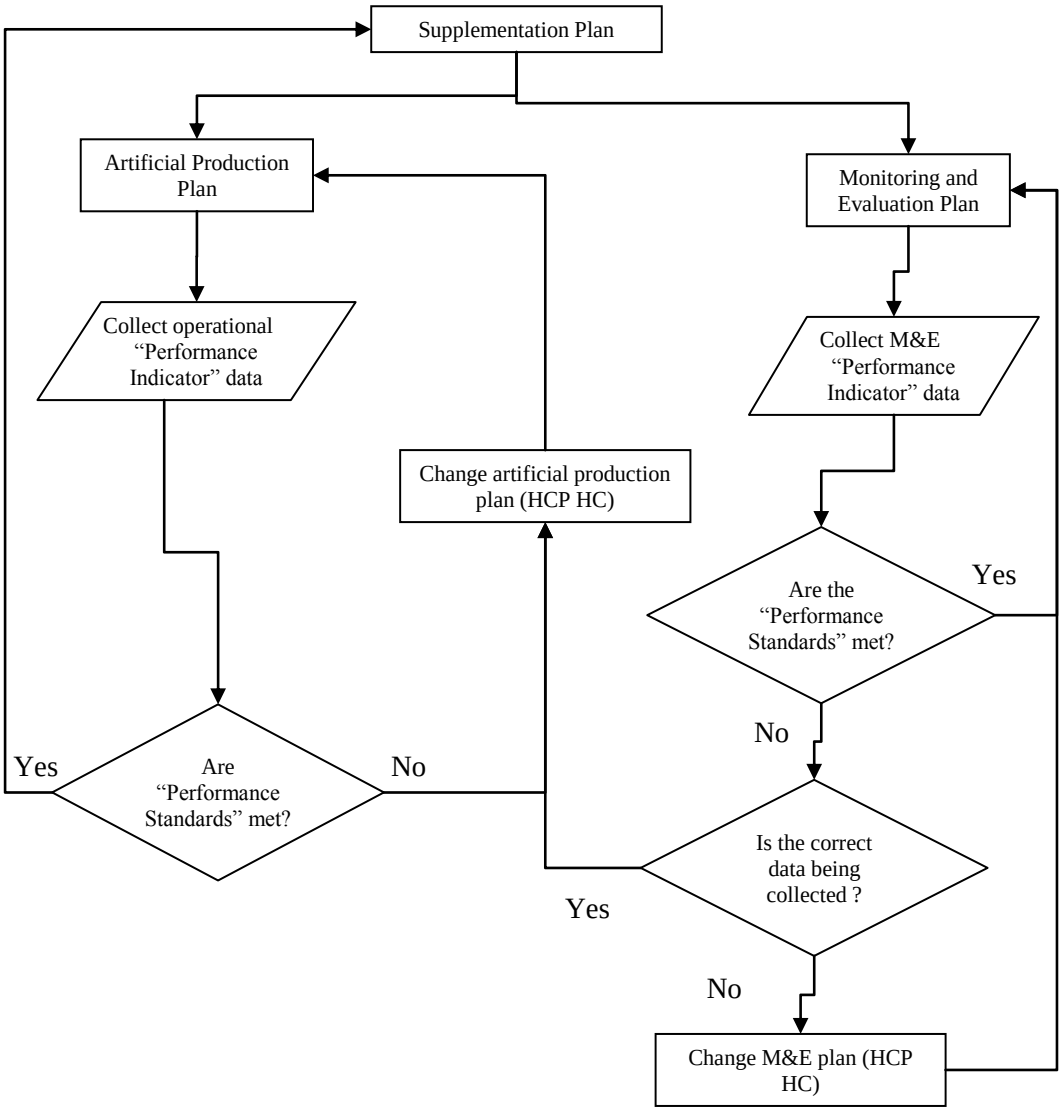
Ho: NTT size $_{\text{Year x through y}}$ = NTT size $_{\text{Year y through z}}$

It is important to note that a decline in NTT status (abundance, distribution, or size) does not indicate causation. Declines in status greater than the containment objectives could trigger species-specific studies designed to determine if hatchery Chiwawa spring Chinook were responsible for the decline. Investigating these effects will rely primarily on monitoring efforts outlined within objectives 1 – 8. However, in order to determine causation, additional studies may be required and will be determined by the HCP Hatchery Committee.

M&E Adaptive Management

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 HCP Hatcher Committee will be responsible for adapting the monitoring and evaluation program to new information. The flowchart below demonstrates how data are used to assess performance and make needed program changes.



11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Chelan PUD funds the monitoring and evaluation activities for this program as agreed to by the HCP Hatchery Committee in accordance with the processes outlined in the HCP. WDFW, the Yakama Nation, Chelan PUD, and BioAnalysts Inc. currently provide the personnel and equipment for conducting these activities. For the implementation of the monitoring and evaluation activities for this HGMP

Chelan PUD does not expect significant changes in the entities above who are performing the work however since these entities are authorized agents and, as a co-permit holder for this activity, Chelan PUD is ultimately responsible for ensuring these activities are complete. Copies of the Annual Report on M&E activities are routinely and regularly provided to NMFS through its representative on the Douglas and Chelan HCP Hatchery Committees.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Juvenile Monitoring: Injury to spring Chinook salmon, steelhead, and bull trout may occur through trapping, handling, and marking procedures. Primary injury and mortality events are associated with debris accumulation in the trap 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 allowing full recovery of fish before release. Other risk aversion measures include:

- No more than 20% of the natural or hatchery emigrants may be 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°F (21°C) 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.

The Section 10 Permit No. 1196 describes the risk aversion measures required of the current monitoring and evaluation activities associated with the juvenile-based captive brood phase. The juvenile monitoring and evaluation program is expected to be similar during the future adult capture based phase.

Adult Monitoring: No injury or mortalities are expected during the Chiwawa River 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. In addition, wading is restricted to the extent practical to minimize disturbance, and extreme caution is used to avoid adults and redds when wading is required.

SECTION 12. RESEARCH

Responsibilities: Bonneville Power Administration is responsible for providing the funding for the activities described in this Section 12, with some support from Chelan County PUD through other monitoring and evaluation efforts conducted by Chelan PUD. WDFW will be the permit holder for the activities described in this section.

To complement the monitoring described in Section 11, the HCP Hatchery Committee has approved of a genetically based relative reproductive success (RRS)[10] study that will quantify short-term impacts of supplementation on spring Chinook salmon productivity. The RRS study has been ongoing since 2004 and will help to determine the mechanisms by which artificial propagation (broodstock collection, spawning, rearing, and release) may result in the reduced fitness among hatchery-origin spring Chinook adults relative to natural-origin spring Chinook adults. The study is needed to determine whether the effects of supplementation on the abundance and productivity of natural populations identified through monitoring are attributable to reduced reproductive success of hatchery-origin steelhead or to other mechanisms (e.g., density-dependent effects) that do not reflect differential fitness of hatchery fish.

12.1) Objective or purpose.

Objective 1: Estimate the relative reproductive success of hatchery and natural origin spring Chinook salmon when they spawn in the natural and hatchery environments.

Objective 2: If differences in relative reproductive success are found between hatchery origin and natural origin fish, determine the degree to which these differences can be explained by, or are associated with, measurable biological traits that differ between hatchery origin and natural origin fish.

Objective 3: Determine if patterns of relative reproductive success of hatchery and natural spring Chinook salmon are consistent across diverse natural populations and hatchery programs. This is a long-term objective that will be done in collaboration with other investigators.

Objective 4: Estimate the relative fitness of hatchery-lineage spring Chinook after they have experienced an entire generation in the natural environment.

12.2) Cooperating and funding agencies.

The responsible funding agency is Bonneville Power Administration with some support from Chelan PUD through other monitoring and evaluation efforts conducted by Chelan PUD. WDFW and NMFS are collaborating in conducting the project.

[10] RRS is the ratio of recruits per spawner for hatchery fish to recruits per spawner for wild fish. If the ratio is ≥ 1, the hatchery has no negative impact on productivity. In contrast, if the ratio is < 1, then hatchery impacts may reduce the productivity of the target population, or the combination of fitness reduction and density dependence reduced productivity.

12.3) Principle investigator or project supervisor and staff.

Mike Ford – NMFS-NWFSC, Seattle, WA
Andrew Murdoch – WDFW, Wenatchee, WA
Travis Maitland – WDFW, Wenatchee, WA

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

This project will study Wenatchee spring Chinook, which are part of the Upper Columbia spring Chinook ESU listed as *endangered* on March 24, 1999. The status of the Wenatchee spring Chinook is described in Section 2 of this HGMP.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Adult Sampling.—All spring Chinook migrating upstream of TWD will be collected in a trap at TWD. The trap will operate 24 hours a day, seven days a week. During periods when low numbers of fish are expected (less than 20 fish per day), the trap will operate passively. Under this condition, fish will be collected in a large holding chamber with a continuous supply of water. Fish will be held in a live box for a maximum of four hours before they are processed and released. Each fish trapped will be measured (fork and post-orbital to hypural plate lengths) to the nearest centimeter (cm), weighed to the nearest gram (g), have scales collected, the gender determined based on secondary sexual characteristics or a portable ultrasound device, and will have a small piece (~0.5 cm^2) of caudal fin removed for genetic analysis. Each fish will also be scanned for internal tags and classified as either hatchery origin or natural origin, based on the presence or absence of a hatchery mark (adipose fin clip), coded wire tag, or scale pattern analysis. Depending on run sizes, about 2,000 – 5,000 adults will be sampled per year.

All captured spring Chinook will be implanted with a passive integrated transponder (PIT) tag in the dorsal sinus or body cavity. The exceptions are those fish already PIT tagged from various other studies. Recaptures of PIT tagged adults at PIT tag interrogation sites downstream of TWD can be removed from the pool of potential parents and increase the accuracy of estimates of reproductive success. In-stream PIT tag antenna arrays will be deployed in most major spawning areas in the Wenatchee Basin and depending on detection rates may also allow assessments of reproductive success at the tributary level (i.e., Chiwawa and Nason Creeks).

Juvenile Sampling.—A systematic sample of up to 2,000 fish will be collected from each brood year (wild and hatchery). Juvenile sampling will occur in conjunction with existing activities ongoing in the Wenatchee Basin.

Tissue samples of juvenile spring Chinook will be collected at existing rotary smolts traps operated in the Chiwawa River, Nason Creek, and lower Wenatchee River. As part of these ongoing activities, smolts will be weighed to the nearest 0.1 g, measured (fork length) to the nearest millimeter (mm), and PIT tagged.

12.6) Dates or time period in which research activity occurs.

Adult Sampling.—Spring Chinook will be collected in a trap at TWD beginning in May and ending in August. The trap will operate 24 hours a day, seven days a week. Videotapes will record the number of spring Chinook that migrate during the period the trap is not operated. Spawning grounds surveys will be conducted from August through September. Trapping at TWD is intended to occur through 2012, but may be extended throughout 2019 depending on funding availability.

Juvenile Sampling — Smolt trapping will occur throughout the smolt migration period (February to August) and continue through 2014.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

The HCP Hatchery Committee approved study design provides explicit details concerning the care and maintenance of live fish, holding duration, and transport methods. All HCP Hatchery Committee approved projects and activities include measures to prevent or minimize take. The primary concern in this study is minimizing the effects associated with trapping and subsequent sampling of adult fish at TWD and juveniles in tributaries.

The fish trap is capable of operating in either passive or active mode. In passive mode, fish are held in the primary collection chamber. In active mode, personnel are present to sort fish as they volitionally swim from the primary collection chamber into the Deniel (steep pass fishway). During periods when fish passage is low (less than 20 fish per day) the trap is operated passively and the trap is checked periodically throughout each day as needed. When fish passage is high (greater than 20 fish per day) the trap is operated actively during the hours of daylight and passively during the night when fish are less likely to migrate. During active trapping, personnel sort and divert fish into the secondary collection chamber using a series of pneumatic gates. Non-target species (i.e., summer Chinook, steelhead, and sockeye), if not collected for hatchery broodstock, are immediately diverted back into the river upstream of TWD. Trapping is temporarily shut down when between 10 and 15 spring Chinook have been diverted into the secondary collection chamber. At that time the water level in the secondary collection chamber is lowered and fish are crowded into the hopper. The hopper is hoisted to the work platform and a light concentration of MS-222 (14 ppm) is added before any fish are handled. Spring Chinook are transferred from the hopper into a sampling tank (0.38 m^3) containing a higher concentration of MS-222 (88 ppm). After sampling, fish are then placed either into a recovery tank or tanker truck if being collected as part of hatchery broodstock. Fish placed in the recovery tank are allowed to fully recover before being released upstream of TWD.

Injury to juvenile spring Chinook may occur through trapping, handling, and marking procedures. Primary injury and mortality events are associated with debris accumulation in the trap 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. Injury and mortality associated with

handling stress, anesthetizing, and post release predation will be pre-empted by applying MS-222 to all fish handled, and allowing full recovery of fish before release.

Other risk aversion measures include:

- When possible, ESA listed fish will be handled first.
- 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°Fahrenheit (21°Celsius) 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.

12.8) Expected type and effects of take and potential for injury or mortality.

Adult Sampling — Injury to spring Chinook may occur through trapping, handling, and sampling procedures. Primary injury and mortality events are associated with reaction to anesthesia, handling stress, and over-crowding in the live-box. 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, depending on the operation of the trap (passive versus active). Injury and mortality associated with handling stress, anesthetizing, and sampling will be pre-empted by applying MS-222 to all fish handled, and allowing for the full recovery of fish before release. Procedures and trapping equipment have been rigorously tested and refined over the last five years. Potential sources of injury have been identified and corrected by WDFW and Chelan PUD staff. Except for 2004, no spring Chinook mortality has occurred at TWD as a result of trapping. See Table 14 in this HGMP for potential take.

Juvenile Sampling —No additional juvenile take other than that described in Section 11 will be required for this project. See Table 14 in this HGMP for potential take.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See Section 2.

1**2.10) Alternative methods to achieve project objectives.**

There are approximately four basic approaches to conducting an RRS study. All of the approaches require sampling of all adult hatchery-origin and natural-origin fish, and a large probabilistic sample of juveniles (parr and/or smolts) produced from the adult matings. In the Wenatchee Basin, there are few alternative methods for sampling all adults and a probabilistic sample of juveniles. The proposed approach takes advantage of existing sampling methods used to collect adult and juvenile fish for other monitoring purposes. Although other methods may be used (e.g., hook-and-line sampling for adults, electrofishing, seining, etc.), they are far less effective than those proposed in this study

and may cause greater injury and mortality to fish than the proposed methods.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Juvenile steelhead, summer Chinook, coho, sockeye and bull trout may be captured during the juvenile sampling associated with this project. Total encounter rate of each species will be limited to 20 percent of the juvenile population with mortality no greater than 2 percent.

Adult steelhead, summer Chinook, coho, sockeye and bull trout may also be encountered during the adult sampling effort associated with this project. Based on previous adult handling efforts at TWD, unintentional mortality is expected to be zero.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Sections 12.7 and 12.8.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"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 HGMP 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 Applicants:

Name: _____ Name: _____

Title: _____ Title: _____

Certified by: _____ Certified by: _____

Date: _____ Date: _____

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS.

(Note: Anadromous salmonid effects are addressed in Section 2)

A.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 6(c)(1) Permit No. 6007.2100, 2/14/2000. This permit authorizes the operation of broodstock trapping facilities and hatchery evaluation activities (spawning ground surveys, snorkel surveys and smolt trap operations) conducted by the Washington Department of Fish and Wildlife as a contractor for Chelan PUD funded Hatchery Compensation Plan for the Rocky Reach and Rock Island Projects.

Section 10a1a Permit No. TE-001103-2, 3/24/2005. This permit authorizes Chelan PUD personnel and its listed contractors to conduct snorkeling surveys and spawning surveys in the Wenatchee River Basin for the Rock Island HCP Hatchery Conservation Program.

Section 7 Consultation on the FERC License Amendments to incorporate the Rocky Reach, Rock Island and Wells Anadromous Fish Agreements and Habitat Conservation Plans, FWS Reference: 04-W0203, 5/12/2004. This consultation provided an Incidental Take Statement and proposed critical habitat assessment for bull trout, which concluded that the proposed action is not likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout, and is not likely to destroy or adversely modify proposed critical habitat for bull trout. This consultation specifically consulted on the water withdrawals for hatcheries and hatchery effluent from facilities associated with the hatchery compensation plan in the HCPs. The consultation concluded that adherence to water right limits, water quality NPDES permits, and NMFS intake screening criteria are sufficient measures to protect bull trout from these effects. This consultation cited the previous consultations on the operation of broodstock trapping facilities and hatchery evaluation activities covered under Permit No. 6007.2100 as sufficient to provide ESA coverage for these effects of the hatchery program. Future actions contemplated in the HCP Hatchery Compensation Plan, for which specific implementation decisions have not yet been made, were not covered in this Section 7 Incidental Take Statement.

Section 7 Consultation on the effects on bull trout of the FERC Relicensing of the Rocky Reach Hydroelectric Project (FERC No. 2145), USFWS Reference 2007-F-0108, 2006-P-0006, 2008-F-0116, 12/5/2008. This consultation provided an Incidental Take Statement and critical habitat assessment for relicensing of the Rocky Reach Project, covering a number of activities including “implementation of the hatchery supplementation program and monitoring plans”, including operation of the Eastbank hatchery as it is linked to the obligations for the Rocky Reach Anadromous Fish

Agreement (AFA)/Habitat Conservation Plan (HCP). Although the Chiwawa River spring Chinook hatchery program is not a Rocky Reach hatchery obligation, the broodstock trapping facilities at TWD and hatchery evaluation programs for the Chiwawa River spring Chinook program are concurrent with the same operations consulted on for the Rocky Reach FERC Relicensing. The Incidental Take Statement concluded that the relicensing of the Rocky Reach "Project is "likely to adversely affect" the bull trout; however, the level of anticipated take is not likely to result in "jeopardy" to the species. Critical habitat for the bull trout does not occur within the action area; therefore, the Project will not destroy or adversely modify proposed critical habitat for bull trout." The Biological Opinion includes mandatory reasonable and prudent measures (RPMs), with implementing terms and conditions, designed to minimize the impact of incidental take that might otherwise result from the proposed action. The RPM 3 addresses the effects of the Hatchery Supplementation Program: RPM 3 - FERC shall require Chelan PUD, in coordination with the Service, to minimize the effects of the Hatchery Supplementation Program to all life stages of bull trout. Terms and Conditions required to implement RPM 3 are:

- FERC shall require Chelan PUD to operate Dryden[11] and TWD fishways to allow year-round upstream passage of bull trout, except during routine maintenance, to reduce impacts such as delay, temperature, and handling associated with operation of the trapping facilities. Measures to reduce these impacts shall be developed in coordination with the Service. Any future modifications to the existing adult fishways (e.g., to improve passage conditions for sturgeon or lamprey) shall not impair bull trout passage or use, or increase the potential for injury.
- FERC shall require Chelan PUD, in coordination with the Service, to implement appropriate and reasonable measures to minimize the injury or death of bull trout at Tumwater and Dryden Dams fishways and traps when collecting fish for Rocky Reach Project programs, and during use and holding of fish in the trap and holding tanks. Key considerations include holding time in traps, water temperature in the holding tanks, and the likelihood of injury/death in the holding tanks. Using this information, Project operations shall be modified to the extent practicable, consistent with the Settlement Agreement, to further minimize take.
- FERC shall require Chelan PUD, in coordination with the Service, to operate Rocky Reach Hatchery Supplementation facilities in a manner to meet the terms of the National Pollution Discharge Elimination System (NPDES) permit.

[11] The text included in Addendum A was produced in large part from the USFWS's 2008 Biological Opinion (BiOp) for the Rocky Reach Hydroelectric Project Proposed License. As such, the BiOp refers to Dryden Weir as Dryden Dam; however, this is not consistent with Chelan PUD's nomenclature for the facility.

RPM 5 addresses additional bull trout monitoring that includes incidental capture of bull trout at hatchery facilities: RPM 5 – FERC shall require Chelan PUD, in coordination with the Service, to design and implement a bull trout monitoring program that will adequately detect and quantify Rocky Reach Project impacts, including those associated with the Rocky Reach Dam, Dryden and TWDs trapping facilities, and hatchery facilities. This information will allow the Service to determine whether authorized take levels are exceeded. Terms and Conditions required to implement RPM 5 include (pertinent to hatchery activities):

- FERC shall require Chelan PUD, in coordination with the Service, to collect and fund the analysis of genetic samples of bull trout over 70 mm handled as part of all ordinary Rocky Reach Project operations to trap or sample fish at Tumwater and Dryden Dams. Beginning in year 10 of the New License (2019), and continuing every 10 years thereafter for the term of the New License, Chelan PUD shall collect tissue samples from up to 30 adult bull trout and up to 40 sub-adult bull trout over a period of one year and fund their genetic analysis.

A.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

General species descriptions, habitat requirements, local population status and habitat use pertinent to bull trout populations affected by the Chiwawa River spring Chinook program are described in the US Fish and Wildlife Service's Biological Opinion for the Rocky Reach Hydroelectric Project Proposed License, dated 12/5/2008. A summarization and synthesis of information, pertinent to the Chiwawa River spring Chinook program, contained in this Biological Opinion (citations to literature not included) follows:

Bull trout (Salvelinus confluentus) was listed as threatened on November 1, 1999 (64 FR 58910). The Wenatchee River population is part of the Columbia River recovery unit, which currently contains about 90 core areas and 500 local populations. The draft Bull Trout Recovery Plan (Service 2002)[12] identifies the following conservation needs for this unit: maintain or expand the current distribution of the bull trout within core areas; maintain stable or increasing trends in bull trout abundance; maintain/restore suitable habitat conditions for all bull trout life history stages and strategies; and conserve genetic diversity and provide opportunities for genetic exchange. Bull trout exhibit both resident and migratory life history stages (Wenatchee River population has both forms). The ability to migrate is important to the persistence of the bull trout. Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin. Factors that can influence bull trout ability

[12] Service (United States Fish and Wildlife Service). 2002. Bull trout (Salvelinus confluentus) draft recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 137 pp.

to survive in warmer rivers include availability and proximity of cold-water patches and food productivity.

Current bull trout presence in the mainstem Columbia River may reflect the strength of the local populations within tributaries and the presence of suitable migration corridors between the tributaries and the Columbia River. Bull trout occur in the greatest numbers in the upper Columbia River where populations are larger and suitable habitat conditions for migration exist in the lower reaches of tributaries (Methow, Entiat, and Wenatchee Rivers). There are 35 local populations of bull trout in the Yakima, Wenatchee, Entiat and Methow core areas (Rocky Reach Action Area), with 7 of these populations occurring in the Wenatchee River. No stable and clearly increasing population trends occur in any of the core areas analyzed in the Rocky Reach Biological Opinion Action Area.

All bull trout populations but one in the Wenatchee Core Area persist in low numbers and are at risk for genetic drift and inbreeding per the Service's 2004 Draft Bull Trout Recovery Plan. The range of redds in the Wenatchee Core Area varies from 283 in 2001 to 706 in 2006, with an average of 452 redds in the Wenatchee Core Area, which is greater than the 391 redds which existed at the time of listing. Overall, the trend for the Wenatchee Core Area seems to be stable and suggests a slightly increasing trend. This Core Area is considered to be at moderate resiliency and intermediate risk of extirpation from stochastic events.

Currently, 5 of the 7 local populations in the Wenatchee River basin are thought to contribute individuals into the mainstem Columbia River based on data from multiple radio-telemetry studies and some genetic analysis. About 21 percent of Wenatchee River bull trout make long movements and the redd survey data from these 5 populations indicate that a mean of 368 redds or 736 fish could be assumed to access the mainstem Columbia River. Approximately 154 fish (21 percent) could make long movements as summarized in radio-telemetry studies. Adult bull trout are observed at the Tumwater and Dryden Dam broodstock capture facilities on the Wenatchee River. Dryden Dam has limited information regarding bull trout, with only 3 bull trout recorded during broodstock collection activities there in 2007. Adult bull trout migrate upstream from the mainstem Columbia River through the TWD upstream fishway, predominately from late April to late August of every year. The mean number of bull trout ascending TWD (1998-2006) is 98 (range: 33-147). Numbers of bull trout have been collected from 1997-2006 at screw traps, during downstream movements within the Methow, Entiat and Wenatchee Rivers for multiple years. In the Wenatchee Basin, average numbers of juvenile bull trout collected at the screw traps are 302 in the Chiwawa River with a range of 76-605 juveniles, 4 in Nason Creek with a range of 0-13 juveniles, 2 in the Lake Wenatchee outlet with a range of 0-5 juveniles, 106 in Peshastin Creek with a range of 99-112, and 2 in the Wenatchee River at Monitor with a range of 0-4.

A.3) Analyze effects.

Operation of Hatchery Facilities

The Biological Opinion for the Rocky Reach Hydroelectric Project Proposed License analyzed the effects related to the Rocky Reach Fish Hatchery and associated Turtle Rock satellite facility, Eastbank Hatchery, Chelan Hatchery, the TWD upstream fishway broodstock capture facilities, and Dryden Dam. The Service assumed that effects to bull trout associated with water quality will be the primary effect resulting from the continued operation and maintenance of hatcheries associated with the AFA/HCP, which includes the Chiwawa River spring Chinook program. Water withdrawal for hatcheries located within the spawning and/or rearing areas can diminish stream flow from points of intake to outflow and, if great enough, can impede migration and affect spawning behavior. Hatchery operators are required to comply with water right permits administered by Washington Department of Ecology established for each hatchery or acclimation site. Hatchery facilities are also required to maintain all screens associated with water intakes in surface water areas to NMFS screening criteria.

Hatchery effluent may transport pathogens (disease) out of the hatchery that could infect bull trout. Hatcheries and fish rearing facilities supporting the Hatchery Compensation Plans are all operated in accordance with state and federal water pollution regulations. Each facility operates under an NPDES permit which specifies discharge requirements, in accordance with finfish culture specifications.

The Service finds that adherence to water right limits, water quality NPDES permits, and NMFS intake screening criteria are sufficient measures to protect bull trout within the action area from these effects.

The Service estimates 125 adults and 51 juvenile or sub-adult bull trout will use the Rocky Reach reservoir and may be impacted by the Rocky Reach Fish Hatchery and associated Turtle Rock Facility. Adult and juvenile/sub-adult bull trout will likely experience some effect as a result of increased forage base from release of smolts and increased competition for prey. The effects of these adult and juvenile/sub-adult bull trout being harmed or harassed depends in part on the resilience of the local population(s) impacted annually and over the 30-50 year term of the Rocky Reach Project.

Operation of Broodstock Collection Facilities

Collection of salmon and steelhead broodstock from the TWD and Dryden Dam broodstock collection facilities could result in injuries and stress to non-target fish, including bull trout. Adult and sub-adult bull trout, even when diverted immediately back to the river upstream of the facility, are likely to encounter effects resulting from the trapping operations. Since a significant portion of salmon and steelhead runs are sampled

for broodstock at these facilities, migratory delay effects resulting from the holding and processing of target species are likely. The potential also exists for adult bull trout migrating upstream through the fishway to experience contact with structural features of the dam, crowding within the broodstock holding pen, and potential injury. The facilities' fish holding pens are checked daily during collection activities, however, some fish including bull trout could be held for up to 24 hours. These types of conditions likely create additive physiological stress on adult bull trout during upstream passage through the fishway and associated broodstock facility due to elevated temperature regimes, injury, and even death. In addition, since the anesthetic MS-222 is utilized in the broodstock sampling of target species, a minimal degradation of water quality within the Wenatchee River is likely to occur from the disposal of this anesthetic.

For this reason, the Service believes 1 adult bull trout may be killed annually at TWD. Although fewer bull trout are handled at Dryden Dam, one bull trout mortality was documented at the Dryden left bank trap. The Service believes that 92 adults at TWD and 31 adults at Dryden Dam, and 112 juvenile/sub-adults at TWD and 4 juvenile or sub-adult bull trout at Dryden Dam may be harmed and harassed by these broodstock collection facilities. Approximately 11 of the 92 adults at TWD and 4 of these 31 adults at Dryden Dam will spend an extended amount of time in FMO habitats and may be impacted to a greater degree. The Service estimates that 11 of these 112 juveniles/sub-adults at TWD and one juvenile/sub-adult at Dryden Dam may die from predation.

Release of Juvenile Salmonids

Chelan PUD's Hatchery Compensation Plan entails numerous programs for the release of juvenile salmon and steelhead into the mainstem Columbia River and its associated tributaries. These hatchery programs are likely to provide some benefit to bull trout populations by increasing densities of an historically important prey item (smolts) in tributaries and mainstem habitats. Conversely, an increase in historically important prey items in tributaries and mainstem habitats will likely increase competition between bull trout and other fish species for these food resources. The Service assumes 204 adults and all associated progeny from the Methow core area, 90 adults and associated progeny from the Entiat core area and 904 adults and all associated progeny from the Wenatchee core area will be affected by the juvenile salmonid stocking program. These fish may be harassed but no lethal take is expected. Overall, the Service expects these effects to be minor but not discountable.

A.4 Actions taken to minimize potential effects.

The Service finds that adherence to water right limits, water quality NPDES permits, and NMFS intake screening criteria are sufficient measures to protect bull trout within the action area from the effects to water quality from operation of the hatchery facilities.

Because the consultation concluded that the proposed Project is "likely to adversely affect" bull trout, the Biological Opinion includes mandatory reasonable and prudent measures (RPMs), with implementing terms and conditions, designed to minimize the impact of incidental take that might otherwise result from the proposed action.

The RPM 3 addresses the effects of the Hatchery Supplementation Program: RPM 3 - FERC shall require Chelan PUD, in coordination with the Service, to minimize the effects of the Hatchery Supplementation Program to all life stages of bull trout. Terms and Conditions required to implement RPM 3 are:

- FERC shall require Chelan PUD to operate Dryden and TWD fishways to allow year-round upstream passage of bull trout, except during routine maintenance, to reduce impacts such as delay, temperature, and handling associated with operation of the trapping facilities. Measures to reduce these impacts shall be developed in coordination with the Service. Any future modifications to the existing adult fishways (e.g., to improve passage conditions for sturgeon or lamprey) shall not impair bull trout passage or use, or increase the potential for injury.
- FERC shall require Chelan PUD, in coordination with the Service, to implement appropriate and reasonable measures to minimize the injury or death of bull trout at Tumwater and Dryden Dams fishways and traps when collecting fish for Rocky Reach Project programs, and during use and holding of fish in the trap and holding tanks. Key considerations include holding time in traps, water temperature in the holding tanks, and the likelihood of injury/death in the holding tanks. Using this information, Project operations shall be modified to the extent practicable, consistent with the Settlement Agreement, to further minimize take.
- FERC shall require Chelan PUD, in coordination with the Service, to operate Rocky Reach Hatchery Supplementation facilities in a manner to meet the terms of the National Pollution Discharge Elimination System (NPDES) permit.
- RPM 5 addresses additional bull trout monitoring that includes incidental capture of bull trout at hatchery facilities: RPM 5 – FERC shall require Chelan PUD, in coordination with the Service, to design and implement a bull trout monitoring program that will adequately detect and quantify Rocky Reach Project impacts, including those associated with the Rocky Reach Dam, Dryden and TWDs trapping facilities, and hatchery facilities. This information will allow the Service to determine whether authorized take levels are exceeded. Terms and Conditions required to implement RPM 5 include (pertinent to hatchery activities):
- FERC shall require Chelan PUD, in coordination with the Service, to collect and fund the analysis of genetic samples of bull trout over 70 mm handled as part of all ordinary Rocky Reach Project operations to trap or

sample fish at Tumwater and Dryden Dams. Beginning in year 10 of the New License (2019), and continuing every 10 years thereafter for the term of the New License, Chelan PUD shall collect tissue samples from up to 30 adult bull trout and up to 40 sub-adult bull trout over a period of one year and fund their genetic analysis.

A.5 References

The above discussion is, in its entirety, taken from the Service's Biological Opinion for the Rocky Reach Hydroelectric Project Proposed License, dated 12/5/2008. The citations for this document are extensive and are not repeated here. For references to biological information contained above, please refer to the Service's Biological Opinion.

APPENDIX 1 - BKD MANAGEMENT

The overall objective of broodstock management for bacterial kidney disease (BKD) is to balance the needs of genetic diversity of the stock while minimizing the incidence of BKD in the hatchery and natural environments. In the case of the Chiwawa spring Chinook program, dealing with BKD is problematic because the broodstock are ESA listed and have been difficult to obtain in sufficient quantities to meet the program's production objective of 672,000 smolts. Moving forward, it is likely that balancing ESA concerns with the production requirements will be eased somewhat by the reduction in the program to 298,000 smolts, which is anticipated to occur by 2013. Additionally, the Hatchery Scientific Review Group (HSRG) has provided recommendations[13] that lay the groundwork for contemporary BKD management in an ESA context.

In this HGMP, Chelan PUD proposes to implement a BKD management approach that relies on HSRG recommendations as well as historic program data (from 1996-2008) to guide program actions. At present, many of the decisions in the program will depend on a lethal, enzyme-linked immunosorbent assay (ELISA) to determine the probability of broodstock transmitting BKD vertically to their progeny. In the future, non-lethal screening techniques may offer new opportunities to manage for BKD. Until that time however, the incidence of BKD in the Chiwawa spring Chinook program will be minimized using three management practices: Prevention, Treatment and Replacement.

Prevention:

- Prophylaxis: Female (hatchery- and natural-origin) spring chinook broodstock will be injected, prespawning with an appropriate antibiotic (e.g., azithromycin at 40 mg/kg fish) and the resulting eggs will be surface disinfected with an iodophor.

- Screening (present): Female broodstock will be assayed (ELISA) to determine titer score [e.g., optical density (OD)]

- Culling titer progeny of OD ≥ 0.12: Hatchery-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be culled from the program.

- Rearing titer progeny of OD ≥ 0.12: Wild-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be raised at lower density of 0.06.

- Culling titer progeny of OD > 0.19: All hatchery- and natural-origin eggs/progeny with ELISA titers of OD > 0.19 should be culled from the program.

[13] See HSRG recommendations at the end of this BKD HGMP section.

- Screening (future): The HCP Hatchery Committee will evaluate emerging technology to provide non-lethal BKD screening (e.g., near infrared spectroscopy and genetic tests) as these tools become commercially available.

Treatment:

- Antibiotics: At the first signs of infection with BKD, juvenile spring Chinook will be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings.

- Rearing Density: Chelan will provide adequate facilities to rear up to 20 percent of the conservation program (up to 30,000 fish) at a lower density (0.06 density index). The low density rearing environment would be designated for wild origin fish with titers of $0.12 \leq OD \leq 0.19$[14]. When less than 5 percent of the program production is in the $0.12 \leq OD \leq 0.19$ titer range, the HCP Hatchery Committee may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

Replacement:

- Broodstock Collection: Collect up to 20 percent extra hatchery-origin spring Chinook females to meet any production shortfalls related to culling titer fish of $OD > 0.19$.

Background: The Chiwawa program has been affected by BKD at some level in each of the past twelve brood years for which data has been collected (1996-2008; note that in 1999 the program was not implemented). In general, titer scores of $OD \geq 0.12$ and $OD > 0.19$ are more prevalent among hatchery-origin broodstock than natural-origin broodstock (Table 1).

The most recent 12 years of broodstock data indicate that titer scores of $OD \geq 0.12$ and $OD > 0.19$ in natural-origin broodstock are rare, as a percentage of the total number collected each year (Table 1). The only time that titer scores of $OD \geq 0.12$ and $OD > 0.19$ in females accounted for more than 10 percent of the total number collected, respectively, was during years when the overall collection of females was limited (e.g., less than 20 females collected in total; Figure 1). For this reason, the arithmetic means in Table 1 are heavily influenced by years of low female broodstock abundance, and are probably less relevant than the geometric means. The causative factor for the inverse correlation between the percentage of $OD \geq 0.12$ and $OD > 0.19$ titer fish and the numbers of females collected is unknown, but for the purposes calculating the amount of space necessary for low density rearing, the biggest consideration is the percentage of titer fish with a titer score of $OD \geq 0.12$ occurring when space is limited (i.e., when more than 20 females are collected). Under historic conditions, there has not been a year where more than 20 natural-origin females were collected and $OD \geq 0.12$ titer individuals (natural-origin) accounted for more

[14] These values may change depending on lab technologies and methodologies employed.

than 6 percent of the program (not including OD > 0.19 titer individuals).

Under the current proposal, the OD ≥ 0.12 titer natural-origin fish would be reared separately in a low density environment while the OD > 0.19 titer individuals would be culled. Based on the implementation of this approach and an examination of historic data, the geometric mean percentage of natural-origin fish that would be reared at a low density would be 3.5 percent while 3.3 percent would be culled (Table 1).

Hatchery-origin fish with OD ≥ 0.12 titer scores represented 13 percent of the total program on average and OD > 0.19 titer fish less than 4 percent (geometric means; Table 1). Similar to natural-origin Chinook, OD ≥ 0.12 titer hatchery-origin fish were contributed to the largest percentage of the broodstock when female collections were very small (<20 fish; Figure 2). However, unlike natural-origin Chinook, there were four years where broodstock collections exceeded 20 fish and the percentage of OD ≥ 0.12 titer fish exceeded 10 percent of the total (Figure 2). By collecting an additional 20 percent of the female broodstock goal (in hatchery-origin females), the OD ≥ 0.12 and OD > 0.19 titer individuals could be culled and replaced with OD < 0.12 titer individuals in most years. When complete replacement is not desired, there is a high likelihood that low density rearing space would remain available because OD ≥ 0.12 titer natural origin fish occupying the space have only accounted for an average of 3.5 percent of the program in the past. More specifically, if 20 percent additional space is provided for low density rearing, and 3.5 percent of the program (natural-origin OD ≥ 0.12 titer fish) occupied the space, 16.5 percent would remain for hatchery origin fish, if desired by the Hatchery Committee.

From the data examined here, it appears that providing 20 percent extra space for low density rearing would be an adequate contingency to cover the entire range of observed variation in the percentage of OD ≥ 0.12 titer fish, as a percentage of the program, assuming (1) OD > 0.19 titer natural-origin fish are culled (2) OD ≥ 0.12 and OD > 0.19 titer, hatchery-origin fish are culled.

Table 1: Geometric and arithmetic means for ELISA titer values of the Chiwawa spring Chinook program across brood years 1996-2008 (females only).

	ELISA Score					
	(OD < 0.12)		(0.12 ≤ OD ≤ 0.19)		(OD > 0.19)	
	Hatchery Origin %	Natural Origin %	Hatchery Origin %	Natural Origin %	Hatchery Origin %	Natural Origin %
Geometric mean	29.9	16.2	13.0	3.5	3.4	3.3
Arithmetic mean	41.9	19.9	17.8	6.8	7.5	6.0

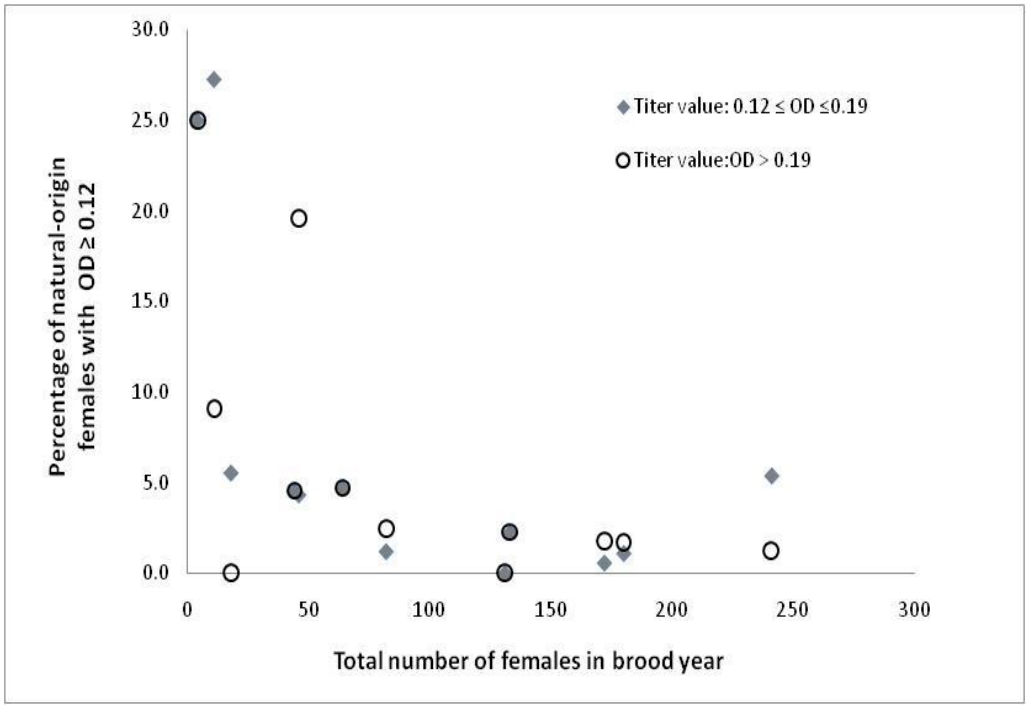

Figure 1. The observed percentages of natural-origin female broodstock with $0.12 \leq OD \leq 0.19$ titer values and OD >0.19 titer values plotted against the total number of females collected per corresponding brood year (1996-2008).

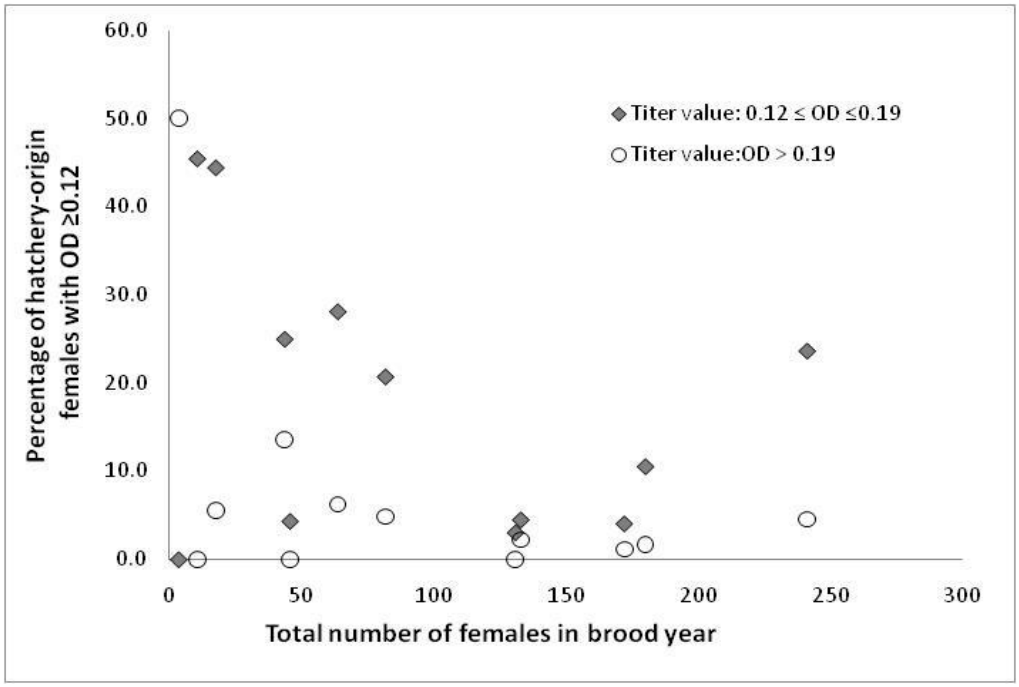

Figure 2. The observed percentages of hatchery-origin female broodstock with titer values of $0.12 \leq OD \leq 0.19$ and titer values of OD >0.19 plotted against the total number of females collected per corresponding brood year (1996-2008).

HSRG BKD Recommendations:

The HSRG recommends that managers implement a BKD control strategy for their spring and summer/fall Chinook hatchery programs where BKD has proved a recurring problem. Ideally, the strategy should include culling (destroying) eggs/progeny from hatchery- and natural-origin brood that are found to be infected with the BKD agent. However, because brood fish with high levels of the BKD agent are more likely to transmit the agent to their progeny than brood with lesser levels of the agent, the culling of eggs/progeny from infected brood fish, should, at the very least, be applied to those with high levels of the BKD agent (e.g., ELISA OD value of 0.4 and above when broodstock are not in short supply and ELISA OD value of 0.6 and above when broodstock are in short supply). In addition, in programs using ESA-listed natural-origin brood fish, the culling of their eggs/progeny may, at the managers' discretion, be dispensed with. However, the ESA-listed broodstock should be injected, pre-spawning, with an appropriate antibiotic (preferably, azithromycin at 40 mg/kg fish), and the resulting eggs should be surface-disinfected with an iodophor. All pre-spawning brood injections may be limited to females, ESA-listed or otherwise.

Finally, eggs and hatchlings derived from broodstock found to be heavily infected with the BKD agent should be incubated/reared in isolation from those obtained from broodstock with no or lesser levels of the BKD agent. In addition, the hatchlings should be reared at the lowest possible densities (below current standards), and, at the first signs of infection with the BKD agent, they should be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings.[15]

[15] *Excerpted from: Columbia River Hatchery Reform System-Wide Report, February 2009; "Hatchery Scientific Review Group Review and Recommendations, Wenatchee River Spring Chinook Population And Related Hatchery Programs, January 31, 2009."*