United States Department of the Interior
FISH AND WILDLIFE SERVICE
Lower Snake River Comp Plan Office
1387 S Vinnell Way, Suite 343
Boise, Idaho 83709

TAKE PRIDE IN AMERICA

April 4, 2011

Mr. Rob Jones
NOAA Fisheries Service
Salmon Recovery Division
1201 NE Lloyd Blvd., Suite 1100
Portland, Oregon 97232

Dear Mr. Jones:

Attached is the final Hatchery and Genetic Management Plan (HGMP) for the U.S. Fish and Wildlife Service's, Lower Snake River Compensation Plan (LSRCP), WDFW – Lyons Ferry stock (on station releases), as required for compliance under the Endangered Species Act (ESA). The LSRCP Office is submitting this HGMP and requesting initiation of Section 7 consultation under the ESA for the program.

The Lyons Ferry stock steelhead (on station) HGMP was completed by the WDFW's Snake River Lab Office, reviewed by co-managers, and submitted to the LSRCP Office for submittal under Section 7. The proposed production is consistent with the 2008-2017 *US v OR* Management Agreement. The LSRCP Office has concluded that while the Lyons Ferry stock steelhead (on station) program may affect listed salmonid species, the effects will not threaten the survival and recovery of any listed salmonid species.

If you have any questions regarding the Lyons Ferry stock steelhead (on station) HGMP please contact Joe Krakker or me at the LSRCP Office.

Sincerely,

Scott Marshall
LSRCP Program Manager

Enclosures (1)

cc: Rich Johnson (FWS, Portland, OR)
Heather Bartlett (WDFW)
Mark Schuck (WDFW)
Jon Lovrak (WDFW)
Glen Mendel (WDFW)

Becky Johnson (NPT)
Brian Zimmerman (CTUIR)
Ron Costello (BPA)

State of Washington
Department of Fish and Wildlife
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April 1, 2011

Mr. Scott Marshall
Lower Snake River Compensation Plan Office
1387 Vinnell Way, Suite 343
Boise, Idaho 83705

Dear Mr. ~~Marshall~~ Scott:

Attached is the final Hatchery Genetic Management Plan (HGMP) for the Washington Department of Fish and Wildlife's (WDFW) Lyons Ferry stock summer steelhead stock program at Lyons Ferry Hatchery covering releases of steelhead into the Snake River, as required for compliance under the Endangered Species Act. We are submitting this HGMP for program consultation under Section 7 of the ESA.

Production and operational changes to this program as agreed to in the spring of 2010 by WDFW, LSRCP, and the co-managers (Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation) have been incorporated into the HGMP. The production change was submitted through the U.S. *v.* Oregon PAC approval process, was discussed and agreed upon, and has been incorporated into the U.S. *v.* Oregon Production Plan.

If you have questions or wish to discuss the HGMP, please don't hesitate to contact Mark Schuck at the Snake River Lab, Jon Lovrak, Lyons Ferry Complex Manager, or me.

Sincerely,

Heather Bartlett

Heather Bartlett
Hatchery Division Manager

cc: Jon Lovrak
Glen Mendel
Mark Schuck
Joe Bumgarner
James Dixon
Jon Anderson
Scott Marshall, LSRCP
Joe Krakker, LSRCP
Brian Zimmerman, CTUIR
Becky Johnson, NPT

WDFW LFH Stock Summer Steelhead
Lyons Ferry Hatchery On-Station Release

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Snake River Summer Steelhead –Lyons Ferry Hatchery Stock: Lyons Ferry Complex**
Species or Hatchery Stock:	**Summer Steelhead – Lyons Ferry Stock** *Oncorhynchus mykiss*
Agency/Operator:	**Washington Department of Fish and Wildlife**
Watershed and Region:	**Snake River Basin, Washington State**
Date Submitted:	**July 1, 2005**
Date Last Updated:	**March 21, 2011**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Lyons Ferry Complex (LFC).
Program: Snake River Summer Steelhead – Lyons Ferry Hatchery (LFH) Stock

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

Summer Steelhead *(O. Mykiss)*, Snake River, LFH Stock (not-listed)

1.3) Responsible organization and individuals

Hatchery Evaluations Staff Lead Contact

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Hatchery Operations Staff Lead Contact

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Fish Management Staff Lead Contact

Name (and title):	**Glen Mendel**, District Fish Biologist
Agency or Tribe:	Washington Dept. of Fish and Wildlife
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Fax:	(509) 382-1267
Email:	Glen.Mendel@dfw.wa.gov

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

1. U. S. Fish and Wildlife Service – Lower Snake River Compensation Plan (LSRCP) – Provides Program funding/oversight, provides coordination responsibility between all LSRCP cooperators.
2. Nez Perce Tribe (NPT) – Co-manager within the Grande Ronde Basin.
3. Confederated Tribes of the Umatilla Indian Reservation – Co-manager within the Grande Ronde Basin.

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

The LSRCP funds production of these compensation fish (LFH stock summer steelhead). The program was established as compensation for lost fish resources and fisheries resulting from construction and operation of hydroelectric projects in the Snake River. The LSRCP in Washington also has programs for spring and fall Chinook salmon, resident trout, and other summer steelhead (Wallowa Stock, Tucannon Endemic Stock, and Touchet Endemic Stock). Previously, the LSRCP mitigation goal in the Snake River area near Lyons Ferry was managed to provide 630 returning adult hatchery steelhead annually.

However, in 2010, a decision was reached by all managing parties to no longer release LFH stock fish into the Tucannon River (goal=875 adults to project area), but for the short term to move that portion of the mitigation program to the on-station release for a period of three years while other options can be explored. Hence, the new adult return goal at for the on-station release is 1,505 adults, from a 160,000 smolt release. Both Operational and Evaluation costs are covered by the LSRCP.

The LFC staff includes the Hatchery Complex Manager, and 11 permanent Fish Hatchery Specialists, one plant mechanic, and seasonal workers. Not all hatchery staff are needed for the LFH Stock steelhead program on an annual basis, as other programs require staff time. Annual operation and maintenance costs for the entire Lyons Ferry stock steelhead program is estimated at $574,000. A staff of 8-10 permanent and seasonal biologists and technicians conduct evaluations for each species produced at LFC. The LFH Stock program released on-station from LFH into the Snake River represents about 8.7% of the annual evaluation budget ($57,000).

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

Adult collection, holding, spawning, incubation, rearing, marking, release - Lyons Ferry Hatchery – along the lower Snake River in Franklin County, Washington (RM 58), just below the mouth of the Palouse River (Figure 1). Other locations associated with Lyons Ferry stock steelhead are Dayton Acclimation Pond (Touchet River), and the Walla Walla River, where LFH stock steelhead are released (see Walla Walla River HGMP for description of those programs). Historically, LFH stock were released into the Tucannon at Curl Lake acclimation pond (until 1997), or the lower Tucannon River (until 2010).

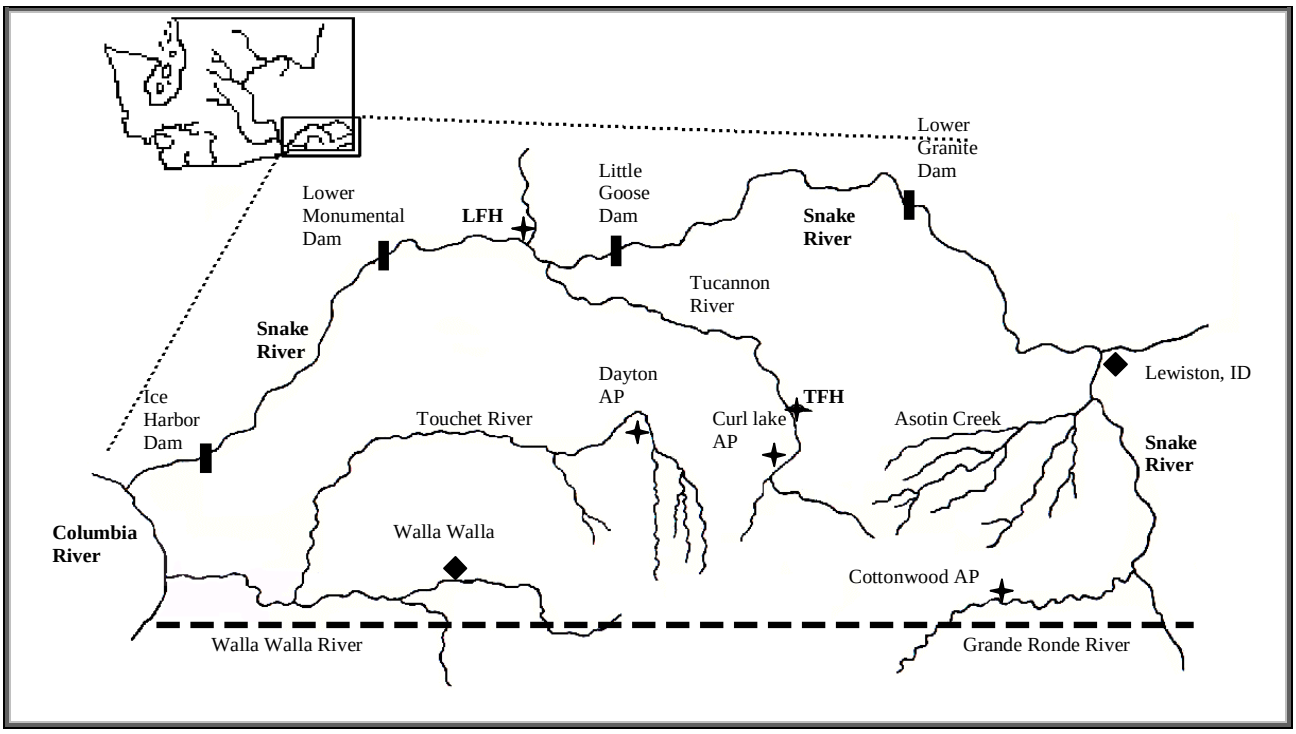

Figure 1. Map of Lyons Ferry Complex and major rivers and streams in southeast Washington.

There are two summer steelhead population groups within the lower Snake River summer steelhead MPG, the Tucannon River and Asotin Creek populations. Each of these populations are comprised of fish returning to their respective basins, but also include steelhead from small tributaries that empty directly into the Snake River (ICTRT 2009). The Tucannon River population is defined by the Tucannon River and its main tributaries (Pataha Cr., Cummings Cr., Panjab Cr.) and Alkali Flat Cr., Meadow Cr., Deadman Cr., Penawawa Cr., and Almota Cr. (Figure 2). The Asotin Creek population is defined by Asotin Creek and its main tributary (George Cr.) and Alpowa Cr., Tenmile Cr., and Couse Cr. (Figure 2). Status of summer steelhead in these small tributaries (with the exception of Alpowa Creek; 2008-2010 trapping data is available) is relatively unknown, but WDFW is implementing adult trapping in 2011 for some of these tributaries, and will expand monitoring of these tributaries over the next few years.

1.6) Type of program.

Mitigation Harvest

1.7) Purpose (Goal) of program (based on priority).

In the short term (next 3 years of release; 2011-2013), the preferred alternative is to release 160,000 steelhead smolts annually from LFH. During this time period, other mitigation harvest options for steelhead or Chinook for the Washington Mitigation within the Snake River will be explored with the co-managers.

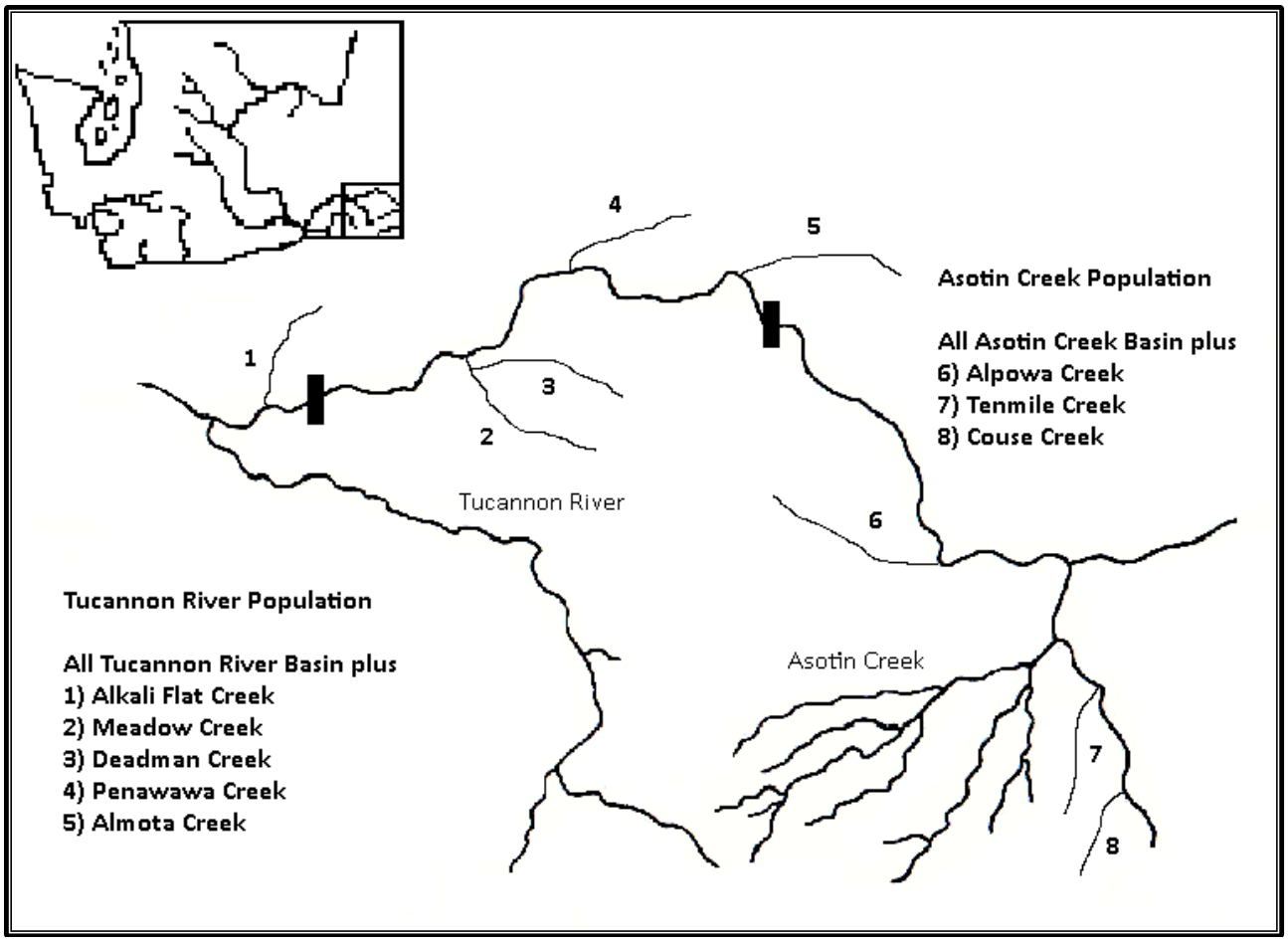

Figure 2. Map and description of Tucannon River and Asotin Creek summer steelhead populations.

This hatchery program is part of the Lower Snake River Compensation Plan (LSRCP). The purpose of the LSRCP is to replace adult salmon, steelhead and rainbow trout lost by construction and operation of four hydroelectric dams on the Lower Snake River in Washington. Specifically, the stated purpose of the plan is:

> *"…[to]….. provide the number of salmon and steelhead trout needed in the Snake River system to help maintain commercial and sport fisheries for anadromous species on a sustaining basis in the Columbia River system and Pacific Ocean" (NMFS & FWS 1972 pg 14)*

Mitigation goals for the LSRCP were established in a three-step process (COE 1975). First the escapement that occurred prior to construction of the four dams was estimated. Second an estimate was made of the reduction in escapement (loss) caused by construction and operation of the dams (e.g. direct mortality of smolt). Last, a catch to escapement ratio was used to estimate the future production that was forgone in commercial and recreational fisheries as result of the reduced spawning escapement. Assuming that the fisheries below the project area would continue to be prosecuted into the future as they had in the past, LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area. For steelhead, the escapement above Lower Granite Dam prior to construction of these dams was estimated at 114,800. Based

on a 15% mortality rate for smolts transiting each of the four dams (48% total mortality), the expected reduction in adults subsequently returning to the area above Lower Granite Dam was 55,100. This number established the LSRCP escapement mitigation goal. Based on a catch to escapement ratio of 2:1, the anticipated benefit to fisheries below Lower Granite Dam was expected to be 110,200 fish.

Component	Number
Escapement Above Lower Granite Dam	55,100
Commercial Harvest	37,000
Recreational Harvest Below Lower Granite Dam	73,200
Total	165,300

One component of the steelhead mitigation computations was accounting for the estimated loss of 130,000 recreational angler days of effort caused by transforming the free flowing Snake River into a series of reservoirs. The COE recommended purchasing land to provide access for sportsman to compensate for this loss. When computing expected benefits for this loss, the COE assumed this access would be provided, that the 130,000 anger days would be restored and that that one fish would be caught for each five hours of effort. As such, the COE expected that 26,000 of the 110,200 steelhead would be caught in the Snake River below Lower Granite Dam. Location of the hatchery facilities was a key decision and the COE recommended: " These [steelhead hatcheries] should be constructed upstream of the Lower Snake River Project to provide for the sport fisheries of eastern Oregon, Washington and Idaho as well as the downriver fisheries". While recognizing that some steelhead crossing Lower Granite Dam would be caught, and some used for hatchery broodstock, no other specific priorities or goals were established regarding how the remaining fish might be used.

Since 1976 when the LSRCP was authorized, many of the parameters and assumptions used to size the hatchery program and estimate the magnitude and flow of benefits have changed.

- The survival rate required to deliver a 2:1 catch to escapement ratio has been less than expected and this has resulted in fewer adults being produced in most years.
- The listing of Snake River fall Chinook and Snake River Steelhead under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the mainstem Columbia River. This has resulted in a much higher percentage of the annual run returning to the project area than was expected.
- The U.S. v. Oregon court-stipulated Fishery Management Plan has established specific hatchery production agreements between the states, tribes and federal government and this has diversified the hatchery program by adding new off station releases to meet short term conservation objectives.

The Lyons Ferry On-Station Release/LFH stock program is currently designed to escape 1,505 steelhead back to the project area after a harvest of 3,010 in downriver fisheries. While

recognizing the overarching purpose and goals established for the LSRCP, and realities regarding changes since the program was authorized, the following objectives for the beneficial uses of steelhead returns have been established for the period through 2017:

1. To contribute to the recreational, commercial and tribal fisheries in the mainstem Columbia River consistent with agreed abundance based harvest rate schedules established in the 2008 – 2017 U.S. vs. Oregon Management Agreement.

2. To trap 210-315 broodstock to perpetuate the stock. LFH stock steelhead are also released into the Walla Walla River, and the Touchet River for mitigation harvest (see specific HGMP's for further details).

3. Release up to 160,000 smolt (short-term 1-3 years) and contribute 1,505 adult steelhead to the project area where they are available for sport and tribal fisheries

    a. Manage program to support the recovery of natural populations of steelhead in the Snake River basin. The primary means to accomplish this goal will be to undertake actions that will limit the frequency of adult strays from this hatchery program such that their relative proportion in the nearby natural populations is 5% or less.

    b. Maximize the beneficial uses of any fish that return to the project area, that are not used for broodstock, or harvest by distribution of such excess fish to tribal members upon request and to local food banks. Those fish not utilized for any of the previous purposes will be euthanized and buried to prevent the spread of waterborne fish diseases.

4. The Snake River is the largest tributary to the Columbia River, and given the nature of reservoirs created by the hydroelectric dams on the Snake River, no natural origin summer steelhead stock exists in the Snake River in Washington. Hatchery fish in excess of broodstock needs are returned to the Snake River for sport fishing opportunities. Controlling pHOS in the Snake River portion of Washington between Lower Granite and Ice Harbor Dams is not an issue. However, excess hatchery fish from the on-station releases could stray and spawn in local tributaries of the Snake River (e.g. Tucannon River and Asotin Creek population groups as described above).

1.75 - Draft recovery plan goals

Background

The program goal is to support the maintenance and restoration of the Snake River natural steelhead populations. This effort will be guided in part by the recovery plan currently under development for the Snake River ESU of steelhead. The primary units of the recovery plan are Major Population Groups (MPGs). There are no designated MPG's for the mainstem lower Snake River summer steelhead. However, two tributary steelhead populations (Asotin and Tucannon) are within close distance to Lyons Ferry hatchery, and could be impacted by the hatchery releases from Lyons Ferry into the Snake River. The Asotin and Tucannon populations include not only those streams, but by ICTRT definition,

also include smaller tributaries that empty directly into the lower Snake River (see Figure 2).

Currently, hatchery origin steelhead are released into the lower Snake River at Lyons Ferry Hatchery, but not elsewhere in the lower Snake River (Lower Granite Dam Pool). The incidence of hatchery fish from the Lyons Ferry on-station release into the natural populations of Asotin Creek and the Tucannon River is relatively low (see tables provided later in this document), but further monitoring is needed and is being implemented in 2011. WDFW is initiating trapping on some of the smaller tributaries of the Snake River, and continues to monitor straying of hatchery fish into the Tucannon River (PIT Tag Array) and the Asotin Creek population (BPA funded adult traps). Where adult trapping is conducted in the Tucannon River or Asotin Creek populations, identified hatchery origin fish (adipose fin clipped) are removed and not allowed to spawn.

Recovery Plan Strategy

Currently, there is no Recovery Plan Strategy for a lower Snake River steelhead population. Short and long-term management of the Lyons Ferry on-station hatchery program will be to minimize the incidence of hatchery fish spawning with natural-origin fish in the Asotin Creek and Tucannon River population groups, such that they represent no more than five percent of the natural spawning population in either MPG.

1.8) Justification for the program.

The Lower Snake River Compensation Plan is a congressionally mandated program pursuant to PL 99-662. The project was authorized under the Rivers and Harbors Act of 1945. It consists of Ice Harbor Dam (IHR), completed in 1962; Lower Monumental Dam, 1969; Little Goose Dam, 1970 and Lower Granite Dam, 1975. The project affected over 140 miles of the Snake River and tributaries from Pasco, Washington to upstream of Lewiston, Idaho. The authorized purposes of the project were primarily navigation and hydroelectric power production. The original authorizing legislation for the project made no mention of fish and wildlife measures needed to avoid or otherwise compensate for the losses or damage to these important resources.

The Fish and Wildlife Coordination Act (FWCAR) of 1958 (48 Stat. 401, 16 U.S.C. 661 et seq. as amended) requires an analysis of fish and wildlife impacts associated with federal water projects as well as compensation measures to avoid and/or mitigate for loss of or damage to wildlife resources (refer to Section 662 (b) of the Act). The U. S. Fish and Wildlife Service (USFWS) and NMFS provided the U.S. Army Corps of Engineers with a FWCAR on the Lower Snake River Project in 1972. Using the FWCAR, the U.S. Army Corps of Engineers (COE) wrote a report to Congress in 1975 (USACE 1975) detailing losses of fish and wildlife attributable to the Project. Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (Public Law 94-587).

The LSRCP is funded by the USFWS through the LSRCP with power production revenues provided by the Bonneville Power Administration. The WDFW administers and

implements the Washington portion of the program. Specific mitigation goals include "in-place" and "in-kind" replacement of adult salmon and steelhead. The LSRCP program for steelhead and trout in Washington was begun in 1982 and for salmon in 1984. The LSRCP program in Washington has been guided by the following objectives: 1) Establish broodstock(s) capable of meeting egg needs, 2) Maintain and enhance natural populations of native salmonids, 3) Return adults to the LSRCP area which meet designated goals, and 4) Improve or re-establish sport and tribal fisheries.

Indicate how the hatchery program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

The LFH stock summer steelhead program provides adult steelhead for recreational and tribal harvest within the LSRCP compensation area (Snake River and tributaries above Ice Harbor Dam). The LFH Stock program utilizes a non-endemic steelhead hatchery stock originally developed from Wells Hatchery (Wells Stock) on the upper Columbia River. Other steelhead stocks were also used in the past to fulfill production as needed (Wallowa, Pahsimeroi, Oxbow, and Ringold stocks). Hatchery origin adults (mainly Wells and to a lesser extent Wallowa stocks) were later trapped on site at LFH to build what WDFW currently labels the LFH stock summer steelhead. A large number of returning hatchery origin adults are trapped each year at LFH for broodstock (currently about 1,650 fish annually). Those not needed for the LFH broodstock (1,000-1,200) are eventually returned to the Snake River for harvest opportunities.

Currently, about 160,000 smolts of the 345,000 total LFH stock steelhead will be released on-station directly into the Snake River. The remaining 185,000 LFH stock smolts are release into the Touchet (85,000) and Walla Walla (100,000) rivers. The program emphasis has been to release smolts at 4.5 fish/pound to 1) reduce residualism, 2) produce fish that are ready to migrate quickly, 3) reduce interactions with natural fish in the Snake River, 4) increase smolt-to-adult survival of the hatchery reared smolts to increase hatchery cost-efficiency, and 5) meet adult return mitigation goals. Harvest limits in the lower Snake River have been increased (3 fish/day/angler) in an attempt to remove more harvestable fish from the system (See WDFW Snake River FMEP) that will lessen impacts to native stocks in the area.

1.9) List of program "Performance Standards".

Program standards are listed in Table 1 with additional associated detail discussed in the following Section See 1.10.1 and 1.10.2 below.

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

***Recommended by the ICTRT for Monitoring and Evaluation (referenced as presented in the ICTRT document* "Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs" (March 2007)**

Abundance/Productivity:

1. Snake River steelhead population specific abundance and productivity data: A majority of populations had little or no recruit/spawner information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set. Population level assessments for steelhead can be difficult given environmental conditions at the time of spawning, the potential distribution across stream drainages, etc. Alternative techniques should be considered (e.g., redd based surveys, weir counts combined with juvenile surveys, etc), incorporating probabilistic sampling protocols for estimating abundance.
2. Snake River steelhead population specific hatchery fraction and age structure data: A majority of populations had inadequate or no hatchery fraction information to assess abundance and productivity criteria. In addition, there is inadequate data to estimate the number of hatchery spawners in the aggregate recruit/spawner analysis. A majority of populations had no or inadequate age structure information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set.
3. SARs and juvenile productivity estimates for all Chinook ESUs and steelhead DPSs: Improve or collect information on SARs and juvenile productivity (i.e. smolts per spawner). SARs are essential for taking into account variability in survival during smolt outmigration and marine life stages in evaluating A&P criteria. The goal is to estimate SARs that are representative at the population level. There are a number of approaches to accomplish estimating these SARs (e.g. marking wild or hatchery smolts or estimating natural origin smolts and adult production). In addition, measures representing survival from spawning to out-migrating smolts would aid in partitioning productivity between freshwater and marine life-stages.
4. Population level effects of hatchery spawners on natural productivity for all ESUs and DPSs: For populations with hatchery spawners, develop representative estimates of the effects of hatchery spawners on population level productivity. Topics of interest include the effect of hatchery spawner contributions to the average natural productivity of a population and the relative effectiveness of hatchery spawners. In combination with adequate estimates of the relative levels of hatchery fish contributing to natural spawning for a particular population, this information would allow for more representative estimates of current and potential natural productivity levels.

Spatial Structure and Diversity

1. Steelhead populations spawner distribution and habitat preference data: Many of populations had inadequate spawner distribution information to assess spatial structure and diversity criteria. In addition, estimates of historical distribution are dependent upon habitat preferences derived from available empirical studies. Those studies are limited in scope and number. Additional information on habitat/steelhead preference or production relationships could improve the assessment of steelhead populations against SS/D criteria.
2. Phenotypic characteristics for populations in all ESUs/DPSs: Little information was available to assess phenotypic changes. Representative estimates of current morphological, life history or behavioral traits are not available for many populations. Additional analysis of relationships between habitat characteristics and phenotypic traits would improve the ability to assess changes from historical patterns at the population level.

3. Steelhead genetics information, particularly for Upper Columbia and Mid Columbia populations: Genetic baseline information and periodic follow-up surveys specifically designed to evaluate the level of variation or differentiation among subcomponents within populations and among populations. Periodic follow-ups would support evaluation of responses to management actions designed to promote restoration of natural patterns of population structure.
4. Spawner composition for steelhead populations with hatchery spawners: Collect specific spawner composition information including proportion and source of hatchery spawners. Information on the relative distribution of hatchery spawners among production areas within populations would also improve the ability to assess status against ICTRT spatial structure criteria.
5. Selective mortality effects for populations in all ESUs/DPSs: Little information was available to assess selective mortality resulting from differential impacts of human induced mortality. Additional information is needed to better assess human induced mortality effects in each of the four Hs (habitat, hatcheries, harvest and hydropower).

1.10.1) "Performance Indicators" addressing benefits.

A NPCC "Artificial Production Review" document (2001) provides categories of standards for evaluating the effectiveness of hatchery programs and the risks they pose to associated natural populations. The categories are as follows: 1) legal mandates, 2) harvest, 3) conservation of wild/naturally produced spawning populations, 4) life history characteristics, 5) genetic characteristics, 6) quality of research activities, 7) artificial production facilities operations, and 8) socio-economic effectiveness. The NPCC standards represent the common knowledge up to 2001. Utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin wide ESU scale is warranted.

In a report prepared for Northwest Power and Conservation Council, the Independent Scientific Review Panel (ISRP) and the Independent Scientific Advisory Board (ISAB) reviewed the nature of the demographic, genetic and ecological risks that could be associated with supplementation, and concluded that the current information available was insufficient to provide an adequate assessment of the magnitude of these effects under alternative management scenarios (ISRP and ISAB 2005). The ISRP and ISAB recommended that an interagency working group be formed to produce a design(s) for an evaluation of hatchery supplementation applicable at a basin-wide scale. Following on this recommendation, the *Ad Hoc* Supplementation Workgroup (AHSWG) was created and produced a guiding document (Galbreath et al. 2008) that describes framework for integrated hatchery research, monitoring, and evaluation to be evaluated at a basin-wide ESU scale.

The AHSWG framework is structured around three categories of research monitoring and evaluation; 1) implementation and compliance monitoring, 2) hatchery effectiveness monitoring, and 3) uncertainty research. The hatchery effectiveness category addresses regional questions relative to both harvest augmentation and supplementation hatchery programs and defines a set of management objectives specific to supplementation projects.

The framework utilizes a common set of standardized performance measures as established by the Collaborative System wide Monitoring and Evaluation Project (CSMEP). Adoption of this suite of performance measures and definitions across multiple study designs will facilitate coordinated analysis of findings from regional monitoring and evaluation efforts. This is needed to address management questions and critical uncertainties associated with the relationships between harvest augmentation and supplementation hatchery production, and ESA listed stock status/recovery.

The NPCC (2006) has called for integration of individual hatchery evaluations into a regional plan. While the RM&E framework in AHSWG document represents our current knowledge relative to monitoring hatchery programs to assess effects that they have on population and ESU productivity, it represents only a portion of the activities needed for how hatcheries are operated throughout the region. A union of the NPCC (2001) hatchery monitoring and evaluation standards and the AHSWG framework likely represents a larger scale more comprehensive set of assessment standards, legal mandates, production and harvest management processes, hatchery operations, and socio-economic standards addressed in the 2001 NPCC document (sections 3.1, 3.2, 3.7, and 3.8 respectively). These are not addressed in the AHSWG framework and should be included in this document. NPCC standards for conservation of wild/natural populations, life history characteristics, genetic characteristics and research activities (sections 3.3, 3.4, 3.5, and 3.6 respectively) are more thoroughly developed by the AHSWG, and the later standards should apply to this document. Table 1 represents the union of performance standards described by the Northwest Power and Conservation Council (NPCC 2001), regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the Ad Hoc Supplementation Work Group (Galbreath et al. 2008).

Table 1. Compilation of performance standards described by the Northwest Power and Conservation Council (NPCC 2001), regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the Ad Hoc Supplementation Work Group (2008).

Category	Standards	Indicators
1. LEGAL MANDATES	1.1. Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. OR and U.S. v. Washington.	1.1.1. Total number of fish harvested in Tribal fisheries targeting this program. 1.1.2. Total fisher days or proportion of harvestable returns taken in Tribal resident fisheries, by fishery. 1.1.3.Tribal acknowledgement regarding fulfillment of tribal treaty rights.
	1.2. Program contributes to mitigation requirements.	1.2.1.Number of fish released by program, returning, or caught, as applicable to given mitigation requirements.
	1.3. Program addresses ESA responsibilities.	1.3.1.Section 7, Section 10, 4d rule and annual consultation
2. IMPLEMENTATION AND COMPLIANCE	2.1. Program contributes to mitigation requirements.	2.1.1.Hatchery is operated as a segregated program. 2.1.2.Hatchery is operated as an integrated program 2.1.3.Hatchery is operated as a conservation program
	2.2. Program addresses ESA responsibilities.	2.2.1.Hatchery fish can be distinguished from natural fish in the hatchery broodstock and among spawners in supplemented or hatchery influenced population(s)
	2.3. Restore and maintain treaty-reserved tribal and non-treaty fisheries.	2.3.1.Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities. 2.3.2.Hatchery adult returns are produced at a level of abundance adequate to support fisheries in most years with an acceptably limited impact to natural-spawner escapement.
	2.4. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	2.4.1.Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 2.4.2.Number if adult returns by release group harvested 2.4.3.Number of non-target species encountered in fisheries for targeted release group.
	2.5. Hatchery incubation, rearing, and release practices are consistent with current best management practices for the program type.	2.5.1.Juvenile rearing densities and growth rates are monitored and reported. 2.5.2.Numbers of fish per release group are known and reported. 2.5.3.Average size, weight and condition of fish per release group are known and reported. 2.5.4.Date, acclimation period, and release location of each release group are known and reported.

Category	Standards	Indicators
	2.6. Hatchery production, harvest management, and monitoring and evaluation of hatchery production are coordinated among affected co-managers.	2.6.1. Production adheres to plans, documents developed by regional co-managers (e.g. US vs. OR Management agreement, AOPs etc.). 2.6.2. Harvest management, harvest sharing agreements, broodstock collection schedules, and disposition of fish trapped at hatcheries in excess of broodstock needs are coordinated among co-management agencies. 2.6.3. Co-managers react adaptively by consensus to monitoring and evaluation results. 2.6.4. Monitoring and evaluation results are reported to co-managers and regionally in a timely fashion.
3. HATCHERY EFFECTIVENESS MONITORING REGIONAL FOR AUGMENTATION AND SUPPLEMENTATION PROGRAMS	3.1. Release groups are marked in a manner consistent with information needs and protocols for monitoring impacts to natural- and hatchery-origin fish at the targeted life stage(s) (e.g. in juvenile migration corridor, in fisheries, etc.).	3.1.1. All hatchery origin fish recognizable by mark or tag and representative known fraction of each release group marked or tagged uniquely. 3.1.2. Number of unique marks recovered per monitoring stratum sufficient to estimate number of unmarked fish from each release group with desired accuracy and precision.
	3.2. The current status and trends of natural origin populations likely to be impacted by hatchery production are monitored.	3.2.1. Abundance of fish by life stage is monitored annually. 3.2.2. Adult to adult or juvenile to adult survivals are estimated. 3.2.3. Temporal and spatial distribution of adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.2.4. Timing of juvenile outmigration from rearing areas and adult returns to spawning areas are monitored. 3.2.5. Ne and patterns of genetic variability are frequently enough to detect changes across generations.
	3.3. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	3.3.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 3.3.2. Number if adult returns by release group harvested 3.3.3. Number of non-target species encountered in fisheries for targeted release group.
	3.4. Effects of strays from hatchery programs on non-target (unsupplemented and same species) populations remain within acceptable limits.	3.4.1. Strays from a hatchery program (alone, or aggregated with strays from other hatcheries) do not comprise more than 10% of the naturally spawning fish in non-target populations. 3.4.2. Hatchery strays in non-target populations are predominately from in-subbasin releases. 3.4.3. Hatchery strays do not exceed 10% of the abundance of any out-of-basin natural population.
	3.5. Habitat is not a limiting factor for the affected supplemented population at the targeted level of supplementation.	3.5.1. Temporal and spatial trends in habitat capacity relative to spawning and rearing for target population. 3.5.2. Spatial and temporal trends among adult spawners and rearing juvenile fish in the available habitat.

Category	Standards	Indicators
	3.6. Supplementation of natural population with hatchery origin production does not negatively impact the viability of the target population.	3.6.1. Pre- and post-supplementation trend in abundance of fish by life stage is monitored annually. 3.6.2. Pre- and post-supplementation trends in adult-to-adult or juvenile to adult survivals are estimated. 3.6.3. Temporal and spatial distribution of natural origin and hatchery origin adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.6.4. Timing of juvenile outmigration from rearing area and adult returns to spawning areas are monitored.
	3.7. Natural production of target population is maintained or enhanced by supplementation.	3.7.1. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish. 3.7.2. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish. 3.7.3. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish. 3.7.4. Productivity of a supplemented population is similar to the natural productivity of the population had it not been supplemented (adjusted for density dependence). 3.7.5. Post-release life stage-specific survival is similar between hatchery and natural-origin population components.
	3.8. Life history characteristics and patterns of genetic diversity and variation within and among natural populations are similar and do not change significantly as a result of hatchery augmentation or supplementation programs.	3.8.1. Adult life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics observed in the natural population prior to hatchery influence. 3.8.2. Juvenile life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics in the natural population those prior to hatchery influence. 3.8.3. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations.
	3.9. Operate hatchery programs so that life history characteristics and genetic diversity of hatchery fish mimic natural fish.	3.9.1. Genetic characteristics of hatchery-origin fish are indistinguishable from natural-origin fish. 3.9.2. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish. 3.9.3. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal.
	3.10. The distribution and incidence of diseases, parasites and pathogens in natural populations and hatchery populations are known and releases of hatchery fish are designed to minimize potential spread or amplification of diseases, parasites, or pathogens among natural populations.	3.10. Detectable changes in rate of occurrence and spatial distribution of disease, parasite or pathogen between the affected hatchery and natural populations.

Category	Standards	Indicators
4. OPERATION OF ARTIFICIAL PRODUCTION FACILITIES	4.1. Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.	4.1.1. Annual reports indicating level of compliance with applicable standards and criteria. 4.1.2. Periodic audits indicating level of compliance with applicable standards and criteria.
	4.2. Effluent from artificial production facility will not detrimentally affect natural populations.	4.2.1. Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.
	4.3. Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	4.3.1. Water withdrawals compared to applicable passage criteria. 4.3.2. Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria. 4.3.3. Number of adult fish aggregating and/or spawning immediately below water intake point. 4.3.4. Number of adult fish passing water intake point. 4.3.5. Proportion of diversion of total stream flow between intake and outfall.
	4.4. Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	4.4.1. Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence. 4.4.2. Juvenile densities during artificial rearing. 4.4.3. Samples of natural populations for disease occurrence before and after artificial production releases.
	4.5. Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	4.5.1. Number and location(s) of carcasses or other products distributed for nutrient enrichment. 4.5.2. Statement of compliance with applicable regulations and guidelines.
	4.6. Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	4.6.1. Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.
	4.7. Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	4.7.1. Mortality rates in trap. 4.7.2. Prespawning mortality rates of trapped fish in hatchery or after release.
	4.8. Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	4.8.1. Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present. 4.8.2. Number of fish in stomachs of sampled artificially produced fish, with estimate of natural fish composition.

Category	Standards	Indicators
5. SOCIO-ECONOMIC EFFECTIVENESS	5.1. Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	5.1.1.Total cost of program operation. 5.1.2.Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.
	5.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	5.2.1.Total cost of program operation. 5.2.2.Average total cost of activities with similar objectives.
	5.3. Non-monetary societal benefits for which the program is designed are achieved.	5.3.1.Number of adult fish available for tribal ceremonial use. 5.3.2.Recreational fishery angler days, length of seasons, and number of licenses purchased.

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities.

1.10.2) "Performance Indicators" addressing risks.

The suite of performance measures developed by the CSMEP represents a crosswalk mechanism that is needed to quantitatively monitor and evaluate the standards and indicators listed in

Table 1. The CSMEP measures have been adopted by the AHSWG (Galbreath et. al. 2008). The adoption of this regionally-applied means of assessment will facilitate coordinated analysis of findings from basin-wide M&E efforts and will provide the scientifically-based foundation to address the management questions and critical uncertainties associated with supplementation and ESA listed stock status/recovery.

Listed below (Table 2) are the suite of Performance Measures (modified from the management objectives listed in Beasley et al. (2008), and the assumptions that need to be tested for each standard.

Table 2. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Beasley et al. 2008).

Performance Measure		Definition	Related Indicator
Abundance	Adult Escapement to Tributary	Number of adults (including jacks) that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach for DIDSON and underwater video monitoring. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available	2.3.2, 3.1.2, 3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.4, 5.3.1
	Fish per Redd	Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Female Spawner per Redd	Number of female spawners divided by the total number of redds above weir. Applied in 2 ways: 1) The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female prespawn mortalities, divided by the total number of redds located upstream of the weir, and 2) DIDSON application calculated as in 1 above but with proportion females from carcass recoveries. Correct for mis-sexed fish at weir for 1 above.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.6.1
	Spawner Abundance	In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female prespawning mortalities and expanded for redds located below weirs. Calculated in two ways: 1) total spawner abundance, and 2) wild spawner abundance which multiplies by the proportion of natural origin (wild) fish. Calculations include jack salmon. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Number of hatchery carcasses divided by the total number of known origin carcasses sampled. Uses carcasses above and below weirs, 2) Uses weir data to determine number of fish released above weir and calculate as in 1 above, and 3) Use 2 above and carcasses above and below weir.	2.2.1, 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.7.2, 3.7.4
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Harvest Abundance in Tributary	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Index of Juvenile Abundance (Density)	Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2) are recorded using protocol described in Thurow (1994). Hanken & Reeves estimator.	3.2.1, 3.5.1, 3.5.2
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) issued to estimate emigration estimates. Estimates are given for parr, pre-smolts, smolts and the entire migration year. Calculations are completed using a Modified Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst 2000).	3.2.1, 3.6.1, 3.7.4
	Smolts	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, presmolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	3.2.1, 3.6.1, 3.7.4
	Run Prediction	This will not be in the raw or summarized performance database.	2.3.1,

Performance Measure		Definition	Related Indicator
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior. Calculated for wild and hatchery origin conventional and captive brood fish separately. Adult data applied in two ways: 1) SAR estimate to stream using population estimate to stream, 2) adult PIT tag SAR estimate to escapement monitoring site (weirs, LGR), and 3) SAR estimate with harvest. Accounts for all harvest below stream. *Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary. *First mainstem dam to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the estimated number of PIT tagged juveniles at first mainstem dam. Variances around the point estimates are calculated as described above. *Tributary to tributary* SAR estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific SAR's. Direct counts are calculated by dividing the estimated number of natural and hatchery-origin adults returning to the tributary (by length break-out for natural fish) by the estimated number of natural-origin fish and the known number of hatchery-origin fish leaving the tributary. *Tributary to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the number of PIT tagged juveniles tagged in the tributary. There is no associated variance around this estimate. The adult detection probabilities at first mainstem dam are near 100 percent. *First mainstem dam to tributary* SAR estimates are calculated by dividing the number of PIT tagged adults returning to the tributary by the estimated number of PIT tagged juveniles at first mainstem dam. The estimated number of PIT tagged juveniles at first mainstem dam is calculated by multiplying life stage specific survival estimates (with standard errors) by the number of juveniles PIT tagged in the tributary. The variance for the estimated number of PIT tagged juveniles at first mainstem dam is calculated as follows, where X = the number of PIT tagged fish in the tributary and Y = the variance of the life stage specific survival estimate: $Var(X \cdot Y) = X^2 \cdot Var(Y)$ The variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam: $Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$	3.2.1, 3.2.2, 3.7.4
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric.Two variants calculated: 1) escapement, and 2) spawners.	3.2.1, 3.2.2, 3.7.4

Performance Measure		Definition	Related Indicator
	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance adusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the prespawning mortality estimate. Adjusted for redds above juvenile Trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize two measures: 1) juvenile abundance (parr, presmolt, smolt, total abundance) at the tributary mouth, and 2) smolt abundance at first mainstem dam .	3.2.1, 3.2.2, 3.7.4
	Pre-spawn Mortality	Percent of female adults that die after reaching the spawning grounds but before spawning. Calculated as the proportion of "25% spawned" females among the total number of female carcasses sampled. ("25% spawned" = a female that contains 75% of her egg compliment].	3.2.3, 4.5.1
	Juvenile Survival to first mainstem dam	Life stage survival (parr, presmolt, smolt, subyearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam . Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure "Survival to first mainstem dam and Mainstem Dams". No additional points of detection (i.e. screw traps) are used to calculate survival estimates.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
Distribution	Adult Spawner Spatial Distribution	Extensive area tributary spawner distribution. Target GPS red locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1
	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	3.4.1, 3.4.2, 3.4.3
	Juvenile Rearing Distribution	Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994).	
	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity	3.10, 4.4.3
Genetic	Genetic Diversity	Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	3.2.5, 3.8.3, 3.9.1
	Reproductive Success (Nb/N)	Derived measure: determining hatchery: wild proportions, effective population size is modeled.	3.7.2
	Relative Reproductive Success (Parentage)	Derived measure: the relative production of offspring by a particular genotype. Parentage analyses using multilocus genotypes are used to assess reproductive success, mating patterns, kinship, and fitness in natural populations and are gaining widespread use of with the development of highly polymorphic molecular markers.	3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.2 3.7.4, 5.3.1
	Effective Population Size (Ne)	Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration.	3.2.5

Performance Measure		Definition	Related Indicator
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	3.8.1, 3.8.2, 3.9.2
	Age–at-Emigration	Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only.	3.8.1, 3.9.2
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	3.8.2, 3.9.2
	Condition of Juveniles at Emigration	Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	3.8.2, 3.9.2
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	3.8.1, 3.9.2
	Adult Run-timing	Arrival timing of adults at adult monitoring sites (weir, DIDSON, video) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Spawn-timing	This will be a raw database measure only.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap and Lower Granite Dam. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam .	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
	Mainstem Arrival Timing (Lower Granite)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
Habitat	Physical Habitat	TBD	
	Stream Network	TBD	

Performance Measure		Definition	Related Indicator
	Passage Barriers/Diversions	TBD	
	Instream Flow	USGS gauges and also staff gauges	
	Water Temperature	Various, mainly Hobo and other temp loggers at screw trap sights and spread out throughout the streams	
	Chemical Water Quality	TBD	
	Macroinvertebrate Assemblage	TBD	
	Fish and Amphibian Assemblage	Observations through rotary screw trap catch and while conducting snorkel surveys.	2.4.3, 3.3.3, 3.4.1
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	2.5.2, 2.5.3, 2.6.1, 4.4.2
	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, presmolt, parr, etc.).	
	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, presmolt, parr, etc.).	2.5.1, 2.5.3
	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	2.5.3,3.8.2, 3.9.2
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	3.8.1, 3.8.2, 3.9.2
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawning mortality.	2.2.1
	Hatchery Broodstock Prespawning Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	4.7.2
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum.*	3.10, 4.4.3
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	3.10, 4.4.3
	Length of Broodstock Spawner	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	3.9.2
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent"	3.1.1, 3.1.2
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks).	3.1.1, 3.1.2

Performance Measure		Definition	Related Indicator
	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases).	2.5.4, 4.8.1
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia (NH_3) nitrite (NO_2), -measured weekly only at reuse facilities	4.2.1
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	

1.11) Expected size of program.

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

Age composition and fecundity of adults varies from year to year. To meet current smolt production levels of the LFH stock (345,000), we estimate that 105 females are needed for spawning. Additional females may also be spawned because of the incidence of Infectious Hematopoietic Necrosis virus (IHNV). The number of males used on an annual basis may vary, but for genetic reasons, we typically use one male for every spawned female; total broodstock is about therefore about 210 fish. Only marked fish (those with adipose or ventral fin clips) are retained for broodstock; unmarked fish are returned to the Snake River. Marked (CWT) fish in excess of broodstock are retained and sacrificed to obtain the CWT information. All unmarked fish in excess of broodstock needs are released back to the Snake River.

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

The total LFH stock smolt production is currently 345,000 yearling smolts (Table 3) that are scattered among three release locations. The original LFH smolt production goal was 681,200 smolts, but it has been reduced over the years because of study results or ESA concerns (Table 4). Currently, 160,000 smolts will be released on-station for the next three years (2011-2013) while other management options are explored.

Table 3. Summer steelhead (LFH Stock) production from LFC.

Life Stage	Release Location (release method)	Stock	Production Goal	Maximum Annual Release Level [A]
Yearling	Lyons Ferry (direct)	LFH	160,000	176,000
Yearling	Touchet River (acclimated)	LFH	85,000	93,500
Yearling	Walla Walla River (direct)	LFH	100,000	110,000

[A] Represents a 10% allowance above the production goal because of difficulties in keeping accurate inventory at the hatchery (i.e. 2.1 acre rearing lakes).

Table 4. Release of LFH Stock steelhead smolts directly from LFH into the Snake River, 1982-2010 release years.

Release Year	Stock	Release Location [1]	River Kilometer	Number of smolts
1982	Wallowa	LFH	58	27,940
1983	Wells, Wallowa	LFH	58	138,552
1984	Wells, Wallowa	LFH	58	138,378
1985	Wells, Wallowa	LFH, IHD, LGO	58, 35, 71	170,706
1986	Wells, Wallowa, LFH	LFH, IHD, LGO	58, 35, 71	197,350
1987	Wells, Wallowa	LFH, IHD, SM	58, 35, 10	196,361
1988	Wallowa, LFH	LFH	58	105,117
1989	LFH	LFH	58	98,504
1990	Pahsimeroi	LFH	58	43,479
1991	LFH	LFH	58	57,655
1992	LFH	LFH	58	66,688
1993	LFH, Oxbow	LFH, TEX	58, 66	247,950
1994	LFH	LFH, LGR	58, 83	119,039
1995	LFH	LFH	58	66,972
1996	LFH	LFH	58	71,942
1997	LFH	LFH	58	81,162
1998	LFH	LFH,TEX	58, 66	93,212
1999	LFH	LFH	58	87,992
2000	LFH	LFH	58	59,942
2001	LFH	LFH	58	53,551
2002	LFH	LFH	58	62,612
2003	LFH	LFH	58	60,001
2004	LFH	LFH	58	59,993
2005	LFH	LFH	58	63,036
2006	LFH	LFH	58	61,431
2007	LFH	LFH	58	59,983
2008	LFH	LFH	58	60,360
2009	LFH	LFH	58	65,050
2010	LFH	LFH	58	66,393

[1] Abbreviations are as follows: LFH-Lyons Ferry Hatchery, IHD-Ice Harbor Dam, LGO-Little Goose Dam, LGR-Lower Granite Dam, TEX-Texas Rapids (Lower Monumental Pool), SM-Mouth of Snake River.

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

Returns rates of LFH stock summer steelhead released into the Snake River have been estimated through coded-wire tag recoveries from fisheries and adult traps, or freeze-brand recoveries at Lower Granite Dam (Table 5). Data have been consolidated from WDFW's LSRCP Annual Reports for the Steelhead/Trout program at LFC. Under the original LSCRP goals, smolt-to-adult returns of 0.5% back to the LSRCP area (above Ice Harbor Dam) would satisfy WDFW compensation responsibilities in the Snake River. Based on recoveries, releases of steelhead into the Snake River from LFH have returned enough fish to satisfy the mitigation goal of 630 fish to the project area (170% of goal), but fall short (66%) for entire mitigation back to the Columbia River.

Table 5. Recoveries and estimated smolt-to-adult return rates from LFH stock steelhead released directly

into the Snake River from LFH (1982-2005 BY)

Brood year	Freeze Brand Recoveries at LGD [1] SAR to LSRCP area (%)	Maximum Return (FB+CWT Recoveries) SAR to LSRCP area (%)	Maximum Return (FB+CWT Recoveries) SAR to Columbia R. (%)
1982	499 (0.99)	588 (1.20)	883 (1.80)
1984	723 (1.28)	904 (1.74)	1227 (2.37)
1985	1,148 (0.94)	1466 (1.45)	2431 (2.41)
1986	1,602 (1.61)	2247 (2.22)	3001 (2.96)
1987	1,414 (1.42)	2039 (2.04)	2575 (2.57)
1988	350 (0.39)	1015 (1.05)	1251 (1.30)
1989	353 (0.94)	489 (1.27)	626 (1.63)
1994	581 (1.45)	1426 (3.59)	1531 (3.85)
1995	298 (0.51)	699 (1.19)	841 (1.43)
1996	248 (0.31)	417 (0.52)	429 (0.54)
1997	542 (0.68)	1194 (1.47)	1242 (1.53)
1998	502 (0.64)	1080 (1.38)	1193 (1.52)
1999	314 (0.62)	746 (3.72)	812 (4.05)
2000	48 (0.24)	270 (1.37)	328 (1.66)
2001	47 (0.25)	293 (1.52)	354 (1.84)
2002	--------	393 (1.87)	460 (2.19)
2003	--------	262 (1.31)	326 (1.62)
2004	--------	320 (1.66)	371 (1.93)
2005	--------	465 (2.29)	512 (2.52)
2006	--------	441 (2.22)	513 (2.58)
Mean	0.82 %	1.75%	2.09%

[1] Freeze Branding has been stopped following the 2001 brood year. Changes in the trapping operations at Lower Granite Dam has made the mark unusable for adult return data, and are reflected in the poor return rates noted in 2000 and 2001 brood year returns.

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

Releases of steelhead into the Snake River from Lyons Ferry Hatchery began in 1982.

1.14) Expected duration of program.

Compensation/Mitigation will continue under the LSCRP as long as the four Lower Snake River dams are in place. Some changes to this program are expected as efforts to minimize impacts of this hatchery stock mitigation program on natural fish are implemented. Changes will occur through discussions with co-managers and NOAA fisheries.

1.15) Watersheds targeted by program.

As a compensation/mitigation program, the primary function is to provide harvestable fish to the Lower Snake River within Washington. These fish will provide sport and tribal harvest opportunities within the Columbia River basin as well.

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

1.16.1) Brief Overview of Key Issues

The LSRCP summer steelhead compensation program in the Snake River has been active since 1982. Non-endemic hatchery-origin summer steelhead stocks (mainly Wells and Wallowa stocks) were used to develop the current Lyons Ferry Hatchery (LFH) stock to achieve the mitigation goals. Returning adults are trapped for broodstock at LFH. Stock history and long-term use in the hatchery is known to have caused hatchery domestication. The NOAA Fisheries Biological Opinion (1999) concluded that continued use of LFH steelhead stock constituted jeopardy for the listed Snake River natural steelhead populations. The program has been very successful in returning adults to the Snake River (and other tributaries where the LFH stock fish are released) for the mitigation fishery. Reduction in the overall production of the LFH stock in recent years because of ESA concerns, and development of endemic broodstocks has caused inefficient use of hatchery rearing space. LFH was not originally designed to accommodate multiple stocks of fish, so current rearing vessels (large lakes) while excellent for rearing fish, do not allow efficient use of water and space. Further, bird predation on steelhead in the lakes in recent years (as high as 25%) has caused inefficient rearing, and prompted installation of covers for the lakes (completed in 2004). Modifications at the hatchery to make more efficient use of rearing space for the different stocks need to occur.

In 2009 and 2010, scientific review groups have assessed the program extensively. Their findings are summarized as follows:

The Hatchery Scientific Review Group (HSRG) made one recommendation to improve the hatchery program.

The HSRG recommends that managers determine the disposition of unaccounted for hatchery strays from this segregated program and ways to reduce them (i.e. leave the trap open longer at Lyons Ferry Hatchery to recover a higher proportion of hatchery returns and if necessary to meet the manager's conservation goals, utilize temporary weirs to exclude hatchery fish from nearby natural populations). **WDFW Response: WDFW will explore installation of additional traps/weirs and/or PIT tag arrays to assess the straying of On-station released fish. Trapping more fish at Lyons Ferry is a possibility; however, an outlet for these fish, other than killing them, should be determined. A possible solution would be to out-plant the excess adults into area lakes for harvest. This strategy has been implemented in other areas of Washington State, but the success of this strategy is unknown. The WDFW is developing alternatives cooperatively with co-managers and will put forward a preferred alternative to the current program after completing a SE Washington Steelhead Management plan, which will be fully vetted through a public process.**

The Hatchery Review Team (HRT) provided 17 preliminary recommendations and 5 draft programmatic alternative actions. The draft recommendation should be considered to maintain the current program, which is alternative 1, and address the recommendations provided. Individual recommendations on the Facility, RM&E, Management, or Education and Outreach are presented below.

Program Goals and Objectives

Issue LF-SS1: Based upon the history of the Lyons Ferry stock steelhead program, harvest downstream of the project area is much lower than the assumptions used to establish project area harvest goals. *Current mitigation and, subsequently, harvest goals have been based upon the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio). Harvest data (broodyears 2000-2003) indicates that 75.7% as opposed to 33% of the returning Lyons Ferry steelhead are harvested in the Snake River project area.*

Recommendation LF-SS1: Continue to size the program based upon current and anticipated harvest regimes. Restate program goals in management documents based upon current and anticipated returns and harvest. **WDFW response: At recent meetings/ negotiations with co-managers, the parties have agreed to re-state the adult return goals. Rather than using the LSRCP target area as the return goal, the original program goal of 1,890 adults (for the on-station release only) to the Columbia River system should be used. The fact that the downriver fisheries have decreased in recent years, allowing more fish to return to the LSRCP project area is not within our local control and could increase again in the future. Reducing the program beyond the recent reductions that have taken place would seem premature at this point in time. Current data suggests that 1,250 adults on average have returned to the Columbia River (2000-2006 brood years); approximately 66% of the total return goal. Calculations suggest that to meet the entire mitigation goal, ~90,000 smolts should be released annually. As stated previously, the current release number will be higher due to the temporary movement of the mitigation program from the Tucannon River to the Lyons Ferry on-station release.**

Broodstock Choice and Collection

None identified

Hatchery and Natural Spawning, Adult Returns

Issue LF-SS2a: The pooled spawning of two males with one female reduces the genetic effective number of breeders and potentially imposes some level of artificial selection for life-history traits that are correlated with sperm potency.

Issue LF-SS2b: The effective number of breeders per year is minimal.

Recommendation LF-SS2: Continue to spawn two males with every female, but subdivide the eggs of each female in approximately equal proportions and fertilize each subgroup separately with a different male. The two subgroups from a female can be combined after approximately one minute to increase fertilization rates, if desired. **WDFW Response: this could be accomplished; though additional materials will be needed for splitting the females' egg lots. WDFW also disagrees that the number of breeders (N_b) is minimal, as current spawning practice provides 600-700 adults per generation for broodstock; which exceeds the generally accepted goal of 500 for genetic stability.**

Issue LF-SS3: The proportion of Lyons Ferry stock hatchery-origin adults allowed access to the lower extent of the primary spawning area on the Tucannon River (below river mile 36) is high.

Recommendation LF-SS3: Either (a) reduce the number of Lyons Ferry hatchery steelhead spawning naturally in the Tucannon River to less than 5% of the total number of steelhead spawning annually, or (b) discontinue the release of Lyons Ferry steelhead in the Tucannon River. This will require modifications to the temporary weir located below the lower extent of the primary spawning habitat (river mile 25) because the existing weir is not a good exclusion mechanism (see Issue and Recommendation TR-SS11 in the Tucannon River steelhead section). Also, discontinue the practice of recycling Lyons Ferry steelhead in the Tucannon River. **WDFW Response: In the spring of 2010, WDFW and the co-managers made the decision to cease all further releases of the Lyons Ferry stock steelhead in the Tucannon River. This co-insides with an expansion of the Tucannon endemic stock program. Further, the Lyons Ferry stock production eliminated from the Tucannon River, was temporarily shifted to the on-station release at Lyons Ferry (three years) while other options for harvest mitigation are explored.**

Issue LF-SS4: Lyons Ferry hatchery-origin compose greater than 5% of the adult steelhead that escape to the spawning grounds on the Touchet River.

Recommendation LF-SS4: Continue to monitor spawning escapement upstream of the Touchet River weir to ensure that Lyons Ferry stock steelhead compose less than 5% of the adult steelhead upstream of the weir. If this latter proportion is greater than 5%, then consider either (a) additional improvements to the weir or (b) reductions in the number of Lyons Ferry steelhead released into the Touchet River. **WDFW Response: WDFW continues to make improvements to the weir at the Dayton adult trap. In 2010, through hatchery fish removal at the trap, and from the barrier curtains, WDFW estimated that less than 1% of the spawners above the trap were Lyons Ferry stock steelhead. WDFW will continue to monitor the weir, and passage of adult hatchery steelhead into the upper Touchet River Basin.**

Issue LF-SS5: The continued release of an out-of-basin stock into the Walla Walla River poses genetic and ecological risks to the naturally spawning steelhead population in the Walla Walla River. *However, the proportion of hatchery-origin adults escaping to the spawning grounds in the Walla Walla River, exclusive of the Touchet River, appears to be below the 5% threshold.*

Recommendation LF-SS5: Continue to monitor the composition of steelhead spawning naturally (hatchery and natural) in the mainstem Walla Walla River to ensure that the 5% threshold is not exceeded. **WDFW Response: WDFW, in cooperation with ODFW and Umatilla tribe will continue to monitor the occurrence of Lyons Ferry stock steelhead at the Nursery Bridge fish ladder. Should stray rates increase above 5%, options to reduce the program level, or change the release location will be explored.**

Incubation and Rearing

Issue LF-SS6: All steelhead female broodstock are tested for IHNV. The progeny from the females with virus titers of <10^4 pfu/ml (in the ovarian fluid) are kept for rearing. Management practices have improved adult returns so there is less need to keep excess progeny that may be infected with IHNV.

Recommendation LF-SS6: Cull progeny from all females that are positive for IHNV. **WDFW response: In effect, we have been culling progeny of IHN virus positive females for many years. However, if the prevalence is very high, and there no other options for obtaining fish for program needs, we could retain eggs from lower level IHN virus (< 10^3 pfu/ml) positive females. We have successfully done this on two occasions at LFH.**

Issue LF-SS7a: Rearing densities in the indoor nursery tanks "shallow troughs" (1.21 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond the recommended maximum rearing density index (D.I.) for steelhead (D.I. <0.5). This protocol results in density indexes attaining D.I. = 1.21 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Issue LF-SS7b: High rearing densities during early rearing may be contributing to the later onset of cold water disease.

Recommendation LF-SS7: Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH. **WDFW response: The WDFW will continue to investigate the possibility of expanding the number of intermediate rearing tanks at LFH. The area that used to hold the Spring Chinook Captive Broodstock Program is essentially unused at this time. The 20ft circular round tanks could be removed, and additional intermediate rearing tanks could easily be installed. The area is currently uncovered, and at a minimum a cover would be required over new rearing tanks. However, it would be preferable with an enclosed building. Stock reductions and program changes are currently being considered, but mitigation responsibilities and US v OR agreements may limit this action.**

Issue LF-SS8: Delayed treatment of coldwater disease may make it difficult to control mortality associated with the progression of the disease. *Coldwater disease causes 3.5-5% mortality in the Lyons Ferry stock steelhead annually. When fish mortalities reach about 100 per raceway per day, they are treated with medicated feed (florfenicol). Formerly, fish were fed pills coated with 15 mg drug/kg of fish weight as prescribed by a veterinarian. New regulations now require the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. The medicated feed is less effective in controlling disease and delivery time from the feed company is slow, resulting in less efficacious treatment.*

Recommendation LF-SS8: Test the therapeutic value of early fluorfenicol treatment by comparing treated and untreated (control) fry in the shallow troughs (i.e., before coldwater mortality starts). In conjunction with this, test new diagnostic methods (e.g., PCR, QPCR) and/or culturing alternate tissues (such as brain) for earlier detection of cold water disease to ascertain if medication is warranted prior to ponding into the raceways. Also consider investigating different densities (1.21, 0.5, and 0.2 DI) of fry in the troughs to determine whether early rearing densities influence the development of coldwater disease. Continue working with the Bacterial Coldwater Disease Research Group, as supported by the Pacific Northwest Fish Health Protection Committee, to develop fish culture practices and treatment options to control or eliminate coldwater disease. **WDFW response: Yes, bacterial coldwater disease has caused problems in rainbow and steelhead at Lyons Ferry Hatchery. The BCWD outbreaks have been successfully controlled with florfenicol medicated fish feed. Any experimental efforts will be first tested on rainbow trout and if successfully will be applied to steelhead.**

Release and Outmigration

Issue LF-SS9: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors for infecting other aquatic animals . Pre-release inspections, conducted 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713 713 and the Integrated Hatchery Operations Team (IHOT) Policy and Procedures.

Recommendation LF-SS9: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers. **WDFW response: Additional testing for other pathogens such as *Nucleospora sp.* should be accomplished since past efforts have been sporadic and localized. However, *Nucleospora sp*. surveillance using PCR testing is expensive with cost at $ 30.00 per sample and will depend on available funds and laboratory facilities.**

Issue LF-SS10: Crowding, loading and transport is stressful to fish and may affect post-release survival. *Fish within raceways and lakes are crowded and pumped into transport trucks for direct-stream release. The level of stress in the fish and oxygen content in raceways and lakes during crowding and loading of the trucks has not been assessed.*

Recommendation LF-SS10: Assess the level of stress and oxygen content in the water in the raceways and lakes during crowding and loading and assess post release survival 24 to 48 hours after release to ensure that there are no issues. Take actions based on results of studies to reduce stress points. **WDFW Response: WDFW does not believe that this represents a**

problem for fish at the LFH, however tests for oxygen levels under stressed conditions of crowding for loading will be conducted.

Facilities/Operations

Lyons Ferry FH

(See the Lyons Ferry FH Fall Chinook section for additional facility issues and recommendations)

Issue LF-SS11: The number of stocks reared at Lyons Ferry FH is not consistent with the design of the facility. *This creates the potential for exceeding maximum rearing densities in raceways that are over loaded, and adds complexity to marking schedules and evaluation. Lyons Ferry FH, with its few, large rearing containers, was designed to produce a large number of a few stocks of fish. Endangered Species Act considerations have led to the development of multiple endemic hatchery programs (each with a specific stock to be reared) tailored to conserve threatened natural populations and to provide harvest opportunities where non-endemic stocks have historically been released. Additionally, Lyons Ferry FH is authorized under the LSRCP to rear catchable rainbow trout for Washington and Idaho lake fisheries. In addition to the 2 stocks of rainbow trout 7 salmonid stocks are reared at Lyons Ferry FH (Lyons Ferry fall Chinook, Tucannon spring Chinook, Lyons Ferry steelhead, Wallowa steelhead, and Tucannon and Touchet endemic program steelhead) with several distinct tag groups associated with release locations, creating several lots that must be reared separately.*

Recommendation LF-SS11: Reduce the number of stocks reared at Lyons Ferry FH or modify Lyons Ferry FH so that it can appropriately accommodate the number of programs. One option may be for LSRCP to provide funding for rearing rainbow trout at an existing Washington State trout hatchery. Facility modification options brought to the attention of the Team include:

- Dividing the three lakes into multiple rearing ponds.
- Dividing the adult holding containers.
- Expanding early rearing space (LF-SS12).
- Establishing water heating/chilling capacity to appropriately manipulate production.

WDFW response: These issues and suggested ideas have been a common theme at Lyons Ferry since 2000, when the Touchet and Tucannon endemic steelhead programs were started. WDFW realized that should these programs expand, and with the expanding fall Chinook and spring Chinook programs at Lyons Ferry, that there just wasn't enough flexible rearing space at the hatchery. One action proposed by the team, "dividing adult holding containers" was completed in 2009. The possibility of rearing the rainbow program off Complex has been discussed, and will continue to be evaluated in relation to other proposed program changes at the LFH complex, such as expanding water capacity and rearing space at LFH. Further, the summer steelhead programs at Lyons Ferry will likely change to some degree as WDFW finishes the Steelhead Management Plan for SE

Washington. These options and/or program changes, as well as others that have been identified by WDFW staff, will all be considered for possible modifications to Lyons Ferry Hatchery.

Issue LF-SS12: Existing early rearing space is not sufficient for the numbers and types of fish reared at Lyons Ferry FH resulting in high densities during early rearing (see LF-SS7a).

Recommendation LF-SS12: Consult with Engineering to increase early rearing capacity by modifying the existing, underutilized tank pad formerly used for captive brood production. Include multiple rearing vessels and, at a minimum, cover the area with a shed roof to provide shade and protection. **WDFW response: See Recommendation LF-SS7 above.**

Issue LF-SS13: The discharge of untreated effluent from the steelhead and spring Chinook spawning area directly into the Snake River poses a fish health risk and potential water quality risk to fish and other species downstream of Lyons Ferry FH. The health risk is increased since adults are transferred from other watersheds and may not maintain the same disease profile as returns to Lyons Ferry.

Recommendation LF-SS13: As a best management practice, investigate retaining or redirecting spawning effluent to the pollution abatement pond or to a special containment area with possible effluent disinfection. **WDFW response: Since this issue is one that concerns all hatcheries, LSCRP should contract with an engineering firm to evaluate the feasibility and cost of treating adult holding pond effluent at all LSRCP hatcheries**.

Dayton Acclimation Pond

Issue LF-SS14: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all the facilities which divert water for fish production that are operated by the comanagers. *Although ownership of several of the facilities has been transferred to the Service, the appropriate documentation to transfer the water rights may not have been filed in the respective state agency which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law . Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation LF-SS14: Work with the Lower Snake River Compensation Plan office to ensure water diverted to Dayton Acclimation Pond for fish production is measured and reported correctly and the information is maintained by the Service's, Region 1 Engineering, Division of Water Resources. **WDFW Response: WDFW will work directly with the LSRCP office to report water diversion amounts at the Dayton Acclimation Pond. Water diversion are measured daily, and will be reported to the Service's Water Resource Division.**

Research, Monitoring, and Accountability

Recommendation LF-FC24: Continue to work with the comanagers to establish such a consistent mechanism, such as within the AOP process and including the finalization and

approval of all HGMPs. **WDFW response: The WDFW will work with the Lower Snake River Compensation Plan office to ensure completion of HGMPs and timely updating of management documents.**

Issue LF-FC25: The evaluation and dissemination of sampling data for LSRCP programs is inadequate, inhibiting the ability for managers to make decisions based on current information. *There exists a backlog of annual reports. The LSRCP office has increased staff and has begun reducing the backlog. However, reporting is not yet timely enough.*

Recommendation LF-FC25: Continue work through the backlog of annual reports. Complete annual reports in a timely fashion (e.g. within one year of the previous year's work). **WDFW response: The WDFW agrees that timely reports are desirable. However, data retrieval time lags will likely prevent completion of annual reports within one year of run year completion.**

Issue LF-FC26: The evaluation and dissemination of sampling data are inadequate, inhibiting the ability for managers to make decisions based on current information. *Data reporting does not meet the specified standards of the Pacific Salmon Commission.[1] Those standards require preliminary reporting of data for the current calendar year no later than January 31 of the following year" reference.*

Recommendation LF-FC26: The Service should work with LSRCP comanagers to develop a data management plan that incorporates tagging goals and objectives, data management, and reporting requirements of coded-wire tag data at both the program and regional levels. The Service should incorporate reporting requirements of coded-wire tag data into the cooperative agreement between the LSRCP office and comanagers (WDFW and tribes). **WDFW response: The WDFW agrees that timely reporting of data is important for proper management, but such regional data retrieval and recording protocols need to be applied across all geopolitical boundaries for the data to be useful in a timely manner.**

Issue LF-SS15: Steelhead in the Tucannon River (natural-origin steelhead and Tucannon endemic and Lyons Ferry stock steelhead released into the Tucannon River) have a high degree of straying upstream of Little Goose and Lower Granite dam and into tributaries including Asotin Creek(?). *Off-site releases of hatchery reared salmon and steelhead (regardless as to whether they were acclimated or direct stream released) have consistently demonstrated reduced homing abilities in returning adults (Evenson 1992, Vander Haegen 1995, Johnson 1990). Current hatchery practices may be contributing to these stray rates, including the practice of rearing the fish to smolt stage at Lyons Ferry FH, then transporting them and direct stream releasing them in the Tucannon River, posing genetic and ecological risks to other steelhead stocks. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

Recommendation LF-SS15a: Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of incubating and rearing Tucannon steelhead at the Tucannon FH to increase homing and reduce straying.

WDFW Response: WDFW will continue to PIT tag representative groups from all hatchery releases, and as well as continuing PIT tagging of natural origin steelhead from the Tucannon River. Rearing and release strategies may be modified, but will depend on the direction of the new endemic stock program in the Tucannon River, and agreement with co-managers. WDFW and LSRCP have discussed the option of rearing all Tucannon stock fish at the Tucannon FH. After some research, it was determined that the current water supply is inadequate for the entire endemic stock program. Further, based on hydrological surveys, there is not enough additional water available near Tucannon FH where facility modifications could be done to accomplish the needs. As such, WDFW is looking at expansions/additions to Lyons Ferry FH to fulfill the rearing needs of the endemic stock program.

Recommendation LF-SS15b: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams. **WDFW Response: WDFW will continue to PIT tag groups of hatchery and natural origin summer steelhead from the Tucannon River to monitor passage of adults, and determine stray rates upstream of Lower Granite Dam.**

Issue LF-SS16: Coded-wire tagged fish (including other marking strategies such as PIT tagging) may not accurately represent each release group from Lyons Ferry FH. *Steelhead removed from Lake One, coded-wire and PIT tagged, then reared in raceways may not accurately represent their respective production groups at the time of release because they are reared in different containers (lake versus raceway). Because the fish in different rearing containers can differ (e.g., size and behavior) and the container environments can differ (e.g., flow index and flow pattern), tagging fish and rearing them in containers separate from the rest of the production group may not represent the entire release group for that year.*

Recommendation LF-SS16: Ensure that the tagging strategy accurately represents each respective production group. For example, all spawn groups should be proportionately represented among tag groups and raceways. This recommendation applies to any marking strategy, including PIT tags. **WDFW Response: space and rearing limitations, and the time when fish are marked for production evaluation do not allow all released groups to be reared in the same manner for the entire time. However, all LFH stock steelhead from all tagged groups are mixed into Lake 1 prior to marking. When fish are pulled out for marking, they should be a mixed group of all spawn groups.**

Issue LF-SS17: Counts of returns to the project area (harvest, hatchery and spawning grounds) are critical to evaluating the program. *The current coded-wire tag sampling rate does not meet coast-wide standards in all fisheries and does not accurately account for adult returns harvested. Sampling rates are less than 5-10%, well below the 20% standard advocated by the Lower Snake River Compensation Plan Coordinator (20% of the fish harvested, according to catch record cards). The use of PIT tags is increasing to compensate for this inadequacy. PIT tag arrays may be insufficient to provide accurate estimates for the number of returning adults, escapement to the spawning grounds, and straying.*

Recommendation LF-SS17: WDFW should continue to work with comanagers to assess the mark-sampling program with the goal of increasing the percent of CWTs recovered in terminal fisheries. Alternatively, continue prospecting the use of PIT tags in combination with coded-wire tags to compensate for the low coded-wire tag sampling rate. **WDFW Response: WDFW will work with comanagers and NOAA fisheries to ensure all release groups continue to have representative coded-wire and PIT tags. Increasing the CWT recovery rates from fisheries has been a focus for the last two years through innovative reward based sampling, and will likely continue. The WDFW intends to utilize PIT tags where possible to assess the returns of natural and hatchery adults to tributaries like the Tucannon. The expansion of the PIT tag assessment effort will depend on future funding levels.**

Education and Outreach

Issue LF27: The Lyons Ferry FH displays and handouts are outdated. *The existing Lyons Ferry FH displays were installed in the 1980's-early 90's when the facility was constructed.*

Recommendation LF27: Update the displays and handouts so that they accurately reflect the present state of salmon and steelhead and the associated programs at Lyons Ferry FH. **WDFW Response: WDFW and LSRCP will work together as needed to update displays, signs, and handouts.**

Issue LF28: The information available to the public in regards to the Lyons Ferry FH and its associated programs is inadequate. *The LSRCP web site lacks information for public consumption. Additionally, WDFW does not currently manage a web page for Lyons Ferry FH.* **WDFW Response: WDFW and LSRCP will work together as needed to update and/or add information about Lyons Ferry Hatchery on the Federal and State Internet Sites.**

Recommendation LF28: Information in regards to the harvest and conservation benefits the programs provide should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. This information should include contribution of hatchery-origin Snake River fall Chinook to marine fisheries in Canada and Alaska. If the LSRCP web site is the primary source of information for the program, any WDFW page for Lyons Ferry FH should be linked to this site. **WDFW Response: WDFW and LSRCP will work together as needed to update and/or add information about Lyons Ferry Hatchery on the Federal and State Internet Sites.**

1.16.1a) Hatchery Review Team Alternatives to the Current Program

Alternatives to Current Program

The Review Team considered the benefits and risks of the LFH stock steelhead program at LFH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the —no hatchery option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Alternative 2: Terminate all releases of Lyons Ferry stock steelhead in the Tucannon, Touchet, and Walla Walla rivers and replace with increased on-site releases of Lyons Ferry steelhead from Lyons Ferry FH and/or with larger-sized endemic programs for the off station releases in the Tucannon and Touchet rivers.

Alternative 3: Terminate the Lyons Ferry steelhead stock and replace with an indigenous Snake River stock.

Alternative 4: Terminate the Lyons Ferry program (and stock) and increase steelhead production at a location(s) upstream of Lower Granite Dam (e.g. Grande Ronde River, Little Salmon River)

Alternative 5: Terminate the Lyons Ferry steelhead program and use the space at Lyons Ferry FH for Chinook and endemic steelhead programs

Recommended Alternatives

Short term goal - The Team favors the immediate implementation of Alternatives 2 and applicable elements of Alternative 1: (1) terminate off-station releases of Lyons Ferry steelhead into the Tucannon, Touchet and Walla Walla rivers, (2) expand the Tucannon and Touchet river endemic programs and/or increase the number of steelhead released on-site from Lyons Ferry Hatchery, and (3) implement all elements of Alternative 1 that apply to the on-station releases. These short-term goals and recommendations are consistent with the recommendations for the endemic steelhead programs in the Tucannon and Touchet rivers (see following sections). **WDFW Response: See other response to issues and recommendations. Also, see other elements of this HGMP about Lyons Ferry stock reductions, changes in release locations, addition of traps/weirs to remove excess hatchery fish, increases of PIT tags to monitor returns, etc.**

Long-term goal- Implement Alternative 3: Replace the Lyons Ferry stock of steelhead with a stock indigenous to the Snake River. The Team concluded that the out-of-basin Lyons Ferry stock is inappropriate for long-term use in the Snake River Basin. Potential candidate stocks are listed in the narrative for Alternative 3. The pros and cons of each of those candidate stocks would need to be evaluated by co-managers before a specific stock is selected. **WDFW Response: WDFW will complete the Steelhead Management Plan for SE Washington. Through that process, WDFW will explore all alternatives for future programs and mitigation needs, including replacement of stocks cultured at LFH. Further, while replacing the LFH stock with an indigenous stock would be preferred, there is no indigenous stock of summer steelhead in the mainstem of the Snake River.**

1.16.2) WDFW Potential Alternatives to the Current Program

Alternative 1: Continue with the current program. Due to other changes in the LFH stock program (i.e. reduction or elimination of some release groups), the mitigation may be moved or changed to other locations where the risk to ESA listed populations is lower. For example, elimination of the LFH stock in the Tucannon River currently means that more fish will be

released on-station at Lyons Ferry to support the lost opportunity in the Tucannon River.

Alternative 2: Develop a new broodstock and eventually eliminate the LFH stock summer steelhead from the Snake River basin. Should a new endemic stock be developed, the primary purpose would be continued compensation/mitigation under the LSRCP for sport fisheries, while lessening the potential effects on natural populations because of use of an endemic stock. Unfortunately, the potential to develop a new endemic stock in the lower Snake River is very low due to hydropower construction, and long-term use of non-endemic stocks within the basin. Further, any small tributaries within the lower Snake River that could be considered a source of endemic Snake River stock may have been introgressed with LFH and other non-native steelhead stocks currently used throughout the Snake River Basin in the last 20 years. Further, while we have started an endemic stock in the Tucannon River, results to date have been less than expected (lower SAR's). Until some of the problems with the Tucannon endemic stock can be worked out, WDFW is taking a precautionary approach to the development of any additional endemic stocks at this time.

Alternative 3: Eliminate the releases of LFH stock from LFH to protect the listed populations of concern in the Snake River basin. This action would decrease potential impacts to the remaining natural populations from further introgression with the LFH stock. This alternative is not considered acceptable as Washington is still legally due compensation under the LSRCP. Currently these mitigation fish (LFH stock) provides very popular sport fisheries in the Snake, Tucannon, Walla Walla, and Touchet rivers that add to the economic value of the area.

Alternative 4: Further reduce the LFH Stock releases to a point where negative impacts to listed fish that may stray into other rivers with natural populations would be at an acceptable level. This alternative does not fully meet the intent of NOAA Fisheries Biological Opinion. However, NOAA Fisheries has determined that non-native stocks that stray into other populations at less than a 5% stray rate do not jeopardize native stocks. If it was determined that the LFH stock made up less than 5% of spawning steelhead in the Tucannon and Asotin populations then the LFH Stock releases could continue to provide for harvest mitigation. WDFW has tagged (CWT) continuously since the 1994 brood year on-station releases in an attempt to determine stray rates and provide program changes based on those results. Recoveries of these tagged fish into other streams have been low, but also limited by the ability to sustain traps during high springtime flows.

Alternative 5: Development of endemic broodstocks in the Tucannon and Touchet rivers (and potentially in the Walla Walla River – Mill Creek). If these endemic stocks prove successful, they could replace the current releases of LFH Stock fish into those rivers. Since these fish would be intercepted in fisheries in the Snake River, mitigation goals for the Snake River could potentially be fulfilled with the use of these other stocks. Under this potential option, releases may no longer have to occur at LFH, and trapping for adult steelhead broodstock at LFH would also cease. If that were to happen, endemic stock program goals may be increased to offset the elimination of current steelhead releases at LFH to fulfill the mitigation requirements. Full evaluation and program expansion for the endemic programs needs to occur before this option can be pursued.

Alternative 6: Develop alternative rearing facilities at LFH for the LFH stock and endemic stock if necessary. Development of the endemic programs (Touchet and Tucannon) has left the hatchery short on rearing space during some times of the years. The rearing lakes with steelhead are being underutilized. One solution would be split the lakes in half to allow smaller production groups to be reared. However, major modification will have to occur to the existing structures for this to work. In addition, the LFH stock would have to be moved into standard raceways. This would not provide a benefit to the stock, as the lakes (semi-natural rearing environment) are known to produce very high quality smolts that survive beyond program expectation.

WDFW Preferred Alternative: WDFW is beginning the development of a Steelhead Management Plan for SE Washington. Under the management plan, we will evaluate alternatives to maintain hatchery mitigation under the LSRCP, and decrease the impacts of this program on natural populations. Under the management plan, we are currently evaluating the potential to completely eliminate, reduce, or modify the LFH stock releases into some streams where releases occur. However, until the Steelhead Management Plan can be completed, and we have provided time for the citizens of the State to provide input on this program (which they are legally due compensation for), the current program (160,000 smolts released at Lyons Ferry) will remain for the next three years (2011-2013 release years). Within the next three years, we anticipate the management plan will be completed for all steelhead populations in SE Washington.

1.16.3) Potential Reforms and Investments

Reform/Investment 1: Modify existing lakes, construct additional rearing ponds, or construct additional raceways at LFH for rearing more distinct groups of summer steelhead (i.e. more endemic broodstocks from local rivers instead of the LFH stock). Local broodstock may help reduce the overall risk of having non-native stock spawning in the local rivers. The current lakes are being underutilized, given their capacity, and rearing endemic stocks in the lakes could potentially increase their survival. The cost to perform such a modification is currently estimated to be in the range. Cost Estimate 500,000-1,000,000.

Reform/Investment 2: Construct additional rearing ponds at LFH for rearing more distinct groups of summer steelhead. Small to medium size semi-natural ponds could improve smolt quality and out-migration success for traditional hatchery broodstocks and endemic broodstock. Additional rearing ponds will need new water well development as the current water supply is used at capacity. Costs for such construction are currently estimated to be in the range. Cost Estimate 1,000,000-5,000,000.

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

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

For the Lyons Ferry LSRCP program, USFWS Consultation with NMFS for LSRCP actions and the NMFS Biological Opinion; and a statewide Section 6 Consultation with USFWS (Bull Trout). In addition, HGMPs have been developed for the Tucannon and Touchet River Endemic Steelhead Broodstock programs. Concurrent with this HGMP to satisfy Section 7 consultations, WDFW is writing HGMPs to cover all stock/programs produced at LFC (Snake River Fall Chinook (Snake River Stock), Tucannon Spring Chinook (Tucannon Stock), Walla Walla Basin Summer Steelhead (LFH Stock), and Snake River Summer Steelhead (LFH Stock).

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

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

The two local steelhead population that are potentially affected by this hatchery program are the Tucannon River and Asotin Creek populations. The Asotin and Tucannon populations, in addition to Asotin Creek and the Tucannon River, includes several small tributaries to the Snake basin (see Figure 2) that contain a limited amount of natural steelhead production. Snake River hatchery steelhead released from the LFH program may stray into both of these populations. However, the extent of LFH strays in the smaller Snake River tributaries that are part of the Asotin and Tucannon population range is still relatively unknown, although some data are available and provided in Table 6. **Note: data provided in Table 6 are considered DRAFT, as calculations of wild and hatchery escapement and spawner escapement are being re-examined by the Asotin Creek project staff.** We would expect the Tucannon River, given its close proximity to the LFH, likely has the highest incidence of strays from the LFH on-station releases. However, based on the low recovery rate (~5-7% average based on CWT's recoveries in the Tucannon River from creel surveys during the fishery), and the high returns back to the hatchery based on broodstock collections, it appears that on-station released fish don't stray to high degree into other nearby tributaries, but additional data is needed.

The Lower Snake MPG is one of the six extant MPGs that comprise the listed Snake River steelhead DPS. A considerable amount of the historical production area for this MPG in the mainstem Snake River between Ice Harbor Dam to near city of Asotin, has been lost due to inundation as a result of the construction of the four Lower Snake River dams.

Natural-origin adult steelhead (as distinguished from hatchery fish which all bear fin marks) are not directly collected for broodstock at LFH, but may be incidentally captured during broodstock collection. The number of unmarked fish captured on an annual basis since program inception has varied between 3-66 fish (generally <2% of total fish trapped). Historically, trapping typically began in July and continued into mid-November. Since 2003, trapping has begun on 1 September, with weekly trapping goals based on broodstock needs (150 fish/week). Trapping continues until mid-November. Sorting of collected broodstock takes place in late November. Any natural origin fish captured are delayed from their migration until they can be sorted and released back into the Snake River.

Table 6 (DRAFT). Estimated number of LFH stock fish (by release location) recovered from the Asotin Creek (2005-2010) and Alpowa Creek (2008-2010) adult steelhead traps (expanded CWT data based on mark rate). Data provided by Kent Mayer and Ethan Crawford from the BPA funded WDFW Asotin Creek Assessment project.

Year	Stream name	Total wild steelhead	Total hatchery steelhead	Touchet (LFH)	Walla Walla (LFH)	Tucannon (LFH) [a]	Lyons Ferry (LFH)	Endemic Hatchery stock [b]	Percent hatchery steelhead	Percent LFH Stock	Percent Endemic Stock
2005	Asotin	611	46	0	0	46	6	11	7.5	113.0	23.9
2006	Asotin	509	42	0	0	8	0	23	8.3	19.1	54.8
2007	Asotin	284	49	0	0	32	0	17	17.3	65.3	34.7
2008	Asotin	300	67	4	0	0	0	20	22.3	6.0 [a]	29.8
2009	Asotin	363	37	4	0	0	0	15	10.2	10.8 [a]	40.5
2010	Asotin	1,411	98	4	0	25	3	51	6.9	32.7	52.0
2008	Alpowa	75	95	13	5	0	6	20	55.9	25.3 [a]	21.0
2009	Alpowa	145	266	17	10	0	6	63	64.7	12.4 [a]	23.7
2010	Alpowa	307	198	9	0	75	33	56	39.2	59.1	28.3

[a] Tucannon LFH stock fish were not Coded-Wire Tagged from the 2006 and 2007 release years, which would have returned as adults in 2008 and 2009, hence they appear to be missing from the Asotin and Alpowa creek recoveries for those two years, when they were very likely present in the returns.

[b] Includes endemic hatchery stock from both the Tucannon River and Touchet River programs. Based on recoveries, about 98% of the endemic hatchery stocks recovered in Asotin Creek and Alpowa Creek have been from the Tucannon River program.

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

ESA listed Columbia Basin bull trout, and Snake River spring/summer Chinook, and fall Chinook are also present in the lower Snake River Basin at various times of the year. Bull trout have not, nor are expected to be encountered at the LFH Adult Trap when steelhead are being collected for broodstock. Listed spring/summer Chinook and fall Chinook will be captured if they swim into the trap at LFH. Any listed spring/summer/fall Chinook captured will be sorted to the fall Chinook holding ponds at LFH, where WDFW operates a fall Chinook mitigation program (See LFH Fall Chinook HGMP for impacts to listed spring/summer and fall Chinook).

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

The hatchery production program may incidentally affect listed Snake River summer steelhead populations. In addition, listed Snake River spring Chinook populations, Snake River fall Chinook and Columbia Basin bull trout may be affected to a lesser degree.

Summer steelhead – Snake River basin summer steelhead are comprised both of A-run and B-run components. Most A-run adults (70%) return to the basin after one year of ocean rearing. The remainder are two ocean age adults with an occasional three ocean age fish. Females generally predominate with an average 60/40 sex ratio. Returning adults range in size from 54 to 85 cm in length and weigh 1.4 to 6.8 kg. Adults generally enter the Columbia River from May through August, subsequently entering the Snake River from July through April. Adults in the lower Snake River Basin (Washington State) may utilize tributaries to the mainstem. Most B-run adults (60%+) return as two-ocean age fish, with less returning as 3-ocean, and the least as one-ocean age. Adults generally return in size

from 70-100 cm and 3.0-10.0 kg. B-run fish enter the Columbia River beginning in August and continue through early October. The extent of any lower Snake River mainstem spawning for both runs is not well documented, though likely does not occur, unless below the tailraces of the dams.

If spawning occurs in the mainstem, though we have no records of any documented spawning, it would likely begin in March and continue until May. Juveniles would utilize a wide range of habitats throughout the basin, and possibly areas adjacent to the smolt release location at LFH, though this would seem unlikely based on summer water temperatures. Based on studies in the tributaries, most naturally produced smolts migrate after rearing for two years. A much lower percentage migrates after one or three years. Smolt out-migration through the lower Snake River extends from late winter until early summer (July), thereby some overlapping with hatchery steelhead smolts releases as described for this program does occur. Peak smolt movement is associated with increased flow events between mid-April and mid-May.

Hatchery-origin steelhead released from this program have been shown to enter into the Tucannon River, Asotin Creek, and Alpowa creek (see tables presented in this HGMP) where natural origin steelhead may spawn. The frequency of this behavior into each of these three tributaries varies, and the effects may be dampened by a much larger number of natural fish using these same locations (i.e. Asotin Creek). Spawning with hatchery origin fish may reduce the reproductive success of natural spawners (Araki et al. 2008). In addition, hatchery-origin steelhead from this program are the target of a major sport fishery in the Snake River. Incidental hooking of natural-origin summer steelhead will occur, with some losses expected due to hooking mortality and handling.

Juvenile hatchery steelhead released as smolts may compete for food and space with naturally reared summer steelhead as some degree of extended rearing by hatchery steelhead following release is expected. However, this is generally minimized because of release size, condition of fish at release (smolts) are controlled such that they meet best management practices for producing smolts that will leave the release site and quickly migrate downstream to the ocean. In addition, the presence of natural origin juvenile steelhead is relatively low in the mainstem Snake River where the hatchery smolts are released. Another possible concern is that hatchery-origin steelhead from this program have the chance to spread diseases to natural ESA listed populations during the migration period. Strict protocols will be followed to ensure healthy fish upon release.

Spring Chinook –Spring Chinook adults utilize the Snake River primarily as a migration corridor to reach headwater streams. Spawning in the mainstem has not been documented, and summer/early fall water temperatures are likely too high for adult salmon to survive in. Juvenile utilization in the Snake River is minimal due to high summer water temperatures. Natural origin spring Chinook juveniles in the mainstem Snake River would likely rear for one year and smolt the following spring. Smolt migration from the basin begins in late January and extends through early July, thereby overlapping with the hatchery steelhead production from this program (Fish Passage Center).

Hatchery steelhead smolts released from LFH into the mainstem Snake River are unlikely to interact adversely with naturally reared spring Chinook because the period of exposure would be short (i.e. the hatchery smolts have been reared under specific hatchery protocol such that they will likely migrate quickly downstream to the ocean after their release). In addition, the mainstem Snake does not have conditions conducive to production of juvenile spring Chinook and as a consequence their densities would be very low and therefore, any interactions with hatchery smolts would likely have little impact on the spring Chinook population overall. Predation of Chinook smolts is unlikely due to size constraints (See Section 3.5).

Fall Chinook – Fall Chinook in the lower Snake River are considered a segment of the Snake River population. Spawning in the Snake River occurs in the free flowing section of the Snake River above Lewiston, Clearwater, Imnaha, Grande Ronde (Glen Mendel (WDFW) and Bill Arnsburg, (NPT) pers. comm. 2002), and Tucannon rivers (Milks et al 2000), and in the tailraces below the four Lower Snake River Dams (Dauble et al 1999). Adult Snake River fall Chinook enter the Columbia River in July and migrate into the Snake River from mid-August through November. Spawning occurs from mid-October through early December, with fry emergence during April or May. Outmigration occurs within several months following emergence with peak migration past Lower Granite Dam in late June or early July. Competition for food and space is possible, though likely minimal due to different microhabitat preference of steelhead smolts and juvenile fall Chinook, and migration timing differences between natural fall Chinook and steelhead released from LFH. Although unlikely because of timing, predation on juvenile fall Chinook from hatchery steelhead is possible (See Section 3.5).

Bull trout – Migration patterns of bull trout in the mainstem Snake River are unknown. It is suspected that some bull trout may pass through, or utilize as over-wintering habitat, the mainstem Snake River near LFH (Glen Mendel – WDFW pers comm. 2002). Bull trout exhibiting this migratory pattern would likely come from the Tucannon River, Asotin Creek, or the Grande Ronde River. It is hypothesized that bull trout would leave the mainstem Snake River by early spring to begin their migration to the headwaters of smaller tributaries for spawning. Fry typically emerge during the spring, but rearing is restricted to headwater areas in small tributaries of the Snake River, and therefore will not be located in areas where hatchery steelhead juveniles from this program are found. Further, it is unlikely that juvenile hatchery steelhead released as smolts would compete for food and space with the bull trout. Predation of hatchery steelhead from this program on bull trout in the migration corridor is likely limited due spatial separation. Any bull trout associated with areas influenced by migrating or residual hatchery steelhead would be the larger adults and are more likely to out-compete or prey on hatchery steelhead due to a significant size advantage. As with the other species, hatchery-origin steelhead from this program have the chance to spread diseases to natural ESA listed populations during the migration period, though this is unlikely due the spatial separation between the species. Regardless, strict protocols will be followed to minimize diseased fish upon release.

2.2.2) Status of 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.

Summer steelhead – Natural origin summer steelhead in the Snake River are listed as "threatened" under the ESA as part of the Snake River ESU. The Tucannon and Asotin populations are the primary units in the Washington portion of the Snake basin likely affected by the LFH program. Both of these populations include several small direct tributaries to the Snake basin, are classified as either depressed (due to their relatively small size), or unknown (WDFW SASSI 2002 Draft). Data is currently being gathered in some of these smaller tributaries to determine status.

Spring/summer Chinook – Natural origin spring/summer Chinook in the Snake River Basin are listed as "threatened" under the ESA as part of the Snake River spring/summer Chinook ESU. Local populations of spring/summer Chinook in the Washington portion of the Snake River are isolated to the Tucannon River and Asotin Creek. WDFW considers the Asotin Creek population extinct. Status of the population within the Tucannon is depressed (See Tucannon Spring Chinook HGMP). The mainstem Snake River in Washington does not contain a spring Chinook population due to limited spawning habitat, and rearing capabilities for juveniles (high summer water temperatures).

Fall Chinook – Natural origin fall Chinook in the Snake River are listed as "threatened" under the ESA as part of the Snake River ESU. The spawning population in the lower Snake River is considered part of the larger composite population for the entire Snake River Basin. Spawners consist of natural and hatchery origin fish (LFH – which rears the Snake River fall Chinook stock). Lyons Ferry fall Chinook hatchery releases occur throughout the Snake River Basin: from LFH and at acclimation facilities operated by the Nez Perce Tribe.

Bull trout – Natural origin fluvial, ad-fluvial, and resident bull trout in the Snake River Basin are listed as "threatened" under the ESA as part of the Columbia Basin Bull Trout Distinct Population Segment (DPS). In the Washington portion of the Snake River, sub-populations of bull trout exist only in tributaries of the Snake River because of habitat requirements for spawning and rearing. Observations of Bull Trout in the Snake River occur, but they are very rare.

- 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.

The primary populations potentially impacted by this hatchery program are the Tucannon River and the Asotin Creek populations. Progeny to parent ratios are **not currently available** for the steelhead production unit that utilizes the Tucannon River or Asotin Creek, but are being developed or the data is being collected to develop such measures. In addition, once developed for the Tucannon River or Asotin Creek, the results would not include the entire Tucannon or Asotin populations, which encompass several small tributaries to the Snake River for which steelhead production is not known or documented (see Figure 2). In addition, it is

noted that the interpretation of annual variations in progeny to parent ratios of naturally reproducing fish is difficult because the confounding effect of spawner density needs to be removed as one step of the analysis. The progeny to parent ratio observed when the parental numbers are many, will invariably be lower than when the parental numbers are few. Without means for standardizing this density dependent dynamic, the comparison of progeny to parent ratios among different years can easily lead to erroneous conclusions about population status. In addition, this population is exposed to large variations in downstream passage and ocean survival. These variations also can seriously confound the interpretation of progeny to parent ratios, unless standardization is developed for this factor as well. In the case of this population (Lyons Ferry stock on-station releases) smolt to adult survival estimates are available which could be used as a tool for this standardization.

- Provide the most recent 12 year (e.g. 1998-2010) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

As noted above, the primary populations potentially impacted by this hatchery program are the Tucannon River and Asotin Creek populations. Spawner abundance data (derived from redd surveys, adult trapping, or PIT tag returns are available for natural origin summer steelhead in both of those systems, and Alpowa Creek (Tables 7 and 8). **Note: data provided in Table 8 are considered DRAFT, as calculations of wild and hatchery escapement and spawner escapement to Asotin Creek and Alpowa creek are being re-examined by the Asotin Creek project staff.** Hatchery origin spawning estimates are available for the Asotin Creek and Alpowa Creek, but no hatchery spawning estimates are available for the Tucannon River. These estimates do not include estimates from the smaller tributaries that are included in each of these populations (see Figure 2). A WDFW project is beginning in 2011 to collect population status information in many of these smaller tributaries.

Table 7. Estimated number of Tucannon River natural origin summer steelhead that return to spawn based on adult PIT tag returns above Ice Harbor Dam, 2000-2009 run years.

Migration year	Estimated smolts [a]	Number PIT tagged	Adult return to Ice Harbor	Adjusted return to Ice Harbor [b]	Salt age [c]			Run year	Total return to Ice Harbor	50% of return to Tucannon River [d]
					1	2	3			
1998	29,067	465	3	3.05	63	125	0	1999	NA	NA
1999	23,451	363	7	7.10	258	193	0	2000	383	191
2000	22,681	555	19	20.74	322	483	0	2001	516	258
2001	19,754	333	0	0.00	0	0	0	2002	483	242
2002	18,558	1506	32	33.57	173	222	25	2003	173	86
2003	18,728	1556	29	30.84	169	229	12	2004	390	195
2004	13,586	1984	18	20.55	62	75	7	2005	315	157
2005	14,477	1835	20	22.39	63	126	0	2006	150	75
2006	8,289	1417	19	23.11	82	53	0	2007	215	107
2007	10,404	300	5	5.55	104	69	---	2008	157	78
2008	14,304	1087	37	51.73	684	---	---	2009	754	377

Average 2000-2009 Run Years	**354**	**177**	

[a] The estimated smolts presented are for spring (March-June) migrants only. PIT tags were only applied during the spring months, as that is when we typically get the largest number of smolt migrating past the smolt trap.

[b] Returns to Ice Harbor were adjusted based on total smolt production for each migration year. Smolts leaving during the fall and winter months (October-February) represent 5-25% of the total outmigration. We assumed that the fall/winter migrants survival as well as spring migrants.

[c] The number of fish presented in the salt age columns are calculated from the number of adult returns by age group divided by the PIT Tag mark rate (PIT Tagged Fish/Total Estimated Smolts).

[d] Based on adult detections at the Snake River dams, it appears that generally 50% of the fish passing Ice Harbor remain above Lower Granite Dam. The remaining 50% have been assigned to the Tucannon River for simplicity. The actual percentage based on the PIT tag array in the lower Tucannon River would suggest 35-40%, though the efficiency of the Tucannon River PIT tag array is unknown.

Table 8 (Draft). Number of wild and hatchery origin summer steelhead spawning above the Asotin Creek weir (2005-2010) , or the Alpowa Creek weir (2008-2010).

Year	Asotin Cr Wild Spawners	Asotin Cr Hatchery Spawners	% Hatchery Spawners	Alpowa Cr Wild Spawners	Alpowa Cr Hatchery Spawners	% Hatchery Spawners
2005	611	46	7.0			
2006	509	38	7.0			
2007	284	46	13.9			
2008	350	20	5.4	75	88	54.0
2009	393	12	3.0	145	258	64.0
2010	1411	7	0.5	307	107	25.9

- Provide the most recent 12 year estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

As noted and presented directly above, the primary populations potentially impacted by this hatchery program are the Tucannon and Asotin population. The incidence of hatchery fish from the on-station releases at Lyons Ferry into Asotin Creek and Alpowa Creek are presented in the above tables. It has been more difficult to describe the proportions of hatchery origin fish on the spawning grounds in the Tucannon River because of the difficulties in conducting spawning ground surveys on a consistent basis, and that very few steelhead carcasses are found during surveys to describe the composition of spawners. In Table 9, we've provided coded-wire tag recoveries of hatchery origin fish in the Tucannon River based on harvest estimates. The number of harvested fish in the Tucannon River from the on-station releases is relatively small given the close proximity of Lyons Ferry Hatchery to the Tucannon River.

However, the occurrence of hatchery strays is poorly understood for the small Snake River tributaries that are included as production units of the Tucannon and Asotin population.

Table 9. Expanded Coded-wire tag recoveries (based on harvest rate and expanded for mark rate) of Lyons Ferry, Wallowa, and other hatchery stock releases that have been recovered in the Tucannon River (1987-2006 run years).

Run Year	LFH Stock Tucannon Release	LFH Stock Snake Release	LFH Stock Walla Walla Release	LFH Stock Touchet Release	Wallowa stock GR Release	Snake River Release (ODFW IDFG)
1987	51	35	---	---	38	0
1988	26	33	---	---	0	0
1989	11	0	---	44	13	0

1990	136	24	---	176	0	0
1991	156	0	23	10	---	0
1992	163	0	0	53	---	21
1993	40	---	---	41	---	17
1994	57	---	0	34	---	72
1995	248	---	125	33	---	0
1996	255	0	185	342	---	0
1997	191	0	76	108	--	0
1998	56	0	---	54	0	0
1999	291	13	---	261	0	0
2000	541	0	---	10	0	0
2001	1118	67	---	127	0	0
2002	489	0	0	96	32	282
2003	125	54	89	74	0	0
2004	921	0	160	220	0	18
2005	340	15	24	0	0	43
2006	325	0	0	0	21	35

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

Broodstock Trapping: Listed summer steelhead adults (Snake River DPS) will be incidentally trapped from September through mid-November at the LFH adult trap, which constitutes an indirect take of listed fish (Appendix 1). All natural origin adults captured are eventually released back into the Snake River to spawn naturally in their tributary of choice (late November). Based on LFH trapping records, it is generally anticipated that less than 40 natural origin adults will be captured and handled in any given year. No wild origin (unmarked) fish have been trapped at Lyons Ferry in the last five years.

Spawning, Rearing and Releases: Release of summer steelhead from LFH has a potential for indirect take of listed summer steelhead that may be present in the mainstem of the Snake River. The release of LFH Stock summer steelhead may incidentally affect (take) other listed salmonids (bull trout, spring/summer Chinook, fall Chinook – see above sections) in the Snake River by displacement or competition. In addition, smolts that might residualize will also compete for food and space, though we believe this is kept at a minimum because of spatial separations between listed species and the release point for this program. An estimate of the annual take level to each of these species is not possible.

Monitoring and Evaluation in adjacent Watersheds: Expanded trapping in tributaries upstream of the LFH (e.g. – Asotin and Alpowa creeks) has recovered stray LFH stock origin fish, which had been released into the Tucannon River and from LFH as smolts. WDFW plans to increase trapping efforts in other small Snake River tributaries as part of stock status monitoring. WDFW removes identifiable hatchery fish from tributaries where traps exist to reduce their potential impact on natural populations.

The only other associated monitoring and evaluation activity that occurs on the Snake River is for conducting creel surveys during the steelhead fishery to obtain CWT's and

document harvest of LFH origin fish. Creel surveys are not anticipated to have any adverse effects on listed species.

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

Operation of the adult trap at LFH from September through mid-November to collect hatchery broodstock will indirectly take listed Snake River ESU summer steelhead. Current trap operations may prevent or delay upstream migration of a small number of summer steelhead that enter and are captured in the trap. However, the current trap is not operated every day for collection purposes, and fish entering the trap will be shunted immediately back to the river on days of non-collection.

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

The following (Table 10) provides the number of wild (unmarked) steelhead that died in the broodstock collection/holding/sorting at LFH for the last seven years. We believe this is representative sample of mortality to be expected during typical years at LFH. Since 2002, the total number of fish trapped for broodstock has been reduced, and the time that the trap is open for collection has been shortened. In the past, the trap was open from July to December, currently the LFH trap operates from 1 September to 15 November.

Table 10. Number and percent of listed (unmarked) summer steelhead captured and held during broodstock collection at LFH for the 1998 and 2010 run years.

Run Year	Total Collected	Wild Collected	% Wild Collected	Mortalities	Percent Died
1998	2,973	23	0.77	0	0.00
1999	3,808	12	0.32	0	0.00
2000	2,928	66	2.25	1	0.08
2001	7,596	7	0.09	1	0.04
2002	2,535	0	0.00	0	0.00
2003	2,109	3	0.14	0	0.00
2004	1,926	5	0.26	0	0.00
2005	1,674	1	0.06	0	0.00
2006	1,701	0	0	0	0.00
2007	1,666	0	0	0	0.00
2008	1,683	0	0	0	0.00
2009	1,657	0	0	0	0.00
2010	1,687	0	0	0	0.00

-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See Appendix 1.

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

At the LFH Adult Trap, natural origin fish are eventually returned back to the Snake River. Fish are sorted and returned to the river in late November. Exceeding expected take levels is therefore not likely.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

LFC and the resulting production of LFH stock steelhead is part of legally required compensation provided to Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated, "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." As such, managers will have to identify their legal mandates, and do their best to provide fish for harvest, while protecting naturally spawning populations. WDFW believes they have taken such actions with the proposed program outlined in this HGMP to be consistent with the Policy Recommendations in the APR.

In the 2 April, 1999 Biological Opinion, NMFS cited "great concern" regarding the large number of Snake River steelhead reported spawning in other rivers (specifically of the Wallow Stock fish in the Deschutes River, Oregon – See Wallowa Stock HGMP). NMFS based their opinion on preliminary data analysis that suggested Wallowa Stock and other Snake River origin hatchery steelhead stocks were straying above the 5% rate. However, analysis by ODFW (Carmichael et al 2004) indicates that the LFH stock of fish released from LFH does not show a high stray rate into the Deschutes River. A separate analysis conducted by WDFW for the on-station releases indicates the same (Table 11). Of the 68 total CWTs recovered in the Deschutes River from the LFH releases, 66 were recovered in the fishery at the mouth of the Deschutes from July to October. Only two of the CWT LFH steelhead have been recovered in upper reaches of the Deschutes basin. With the abundance of natural origin steelhead in the Deschutes basin in excess of 3,000 fish in most recent years (NOAA SPS Database accessed online at https://www.webapps.nwfsc.noaa.gov/apex/f?p=238:home:0) the hatchery strays from the LFH program represent a very small fraction of the natural spawning population.

Table 11. Number of LFH stock CWTs recovered from the Deschutes River, and expanded numbers based on mark rate.

Brood Year	Total CWTs recovered	CWTs recovered within Deschutes River		Percent of total CWTs recovered		Expanded number of fish in Deschutes River based on mark rate	
		Total	Sherars Falls and above recoveries	Total	Sherars Falls and above recoveries	Total	Sherars Falls and above recoveries
1982	883	2	0	0.23	0.00	6	0
1984	1,227	0	0	0.00	0.00	0	0
1985	2,431	9	1	0.37	0.04	18	2
1986	3,001	2	0	0.07	0.00	4	0
1987	2,575	9	0	0.35	0.00	9	0
1988	1,251	0	0	0.00	0.00	0	0
1989	626	1	0	0.16	0.00	1	0
1994	1,531	3	0	0.20	0.00	5	0
1995	841	3	1	0.36	0.12	4	1
1996	429	0	0	0.00	0.00	0	0
1997	1,242	2	0	0.16	0.00	2	0
1998	1,193	5	0	0.42	0.00	6	0
1999	812	2	0	0.25	0.00	6	0
2000	328	5	0	1.52	0.00	14	0
2001	354	3	0	0.85	0.00	10	0
2002	460	2	0	0.43	0.00	6	0
2003	326	1	0	0.31	0.00	3	0
2004	371	1	0	0.27	0.00	3	0
2005	512	1	0	0.20	0.00	3	0
2006	513	0	0	0.00	0.00	0	0
Totals	20,906	51	2	0.25	0.01	100	3
Average	1,045	2.6	0.1	0.25	0.01	5	0.15

Regardless, according to the BiOP (1999), NMFS proposed elimination of the LFH Stock by 2008, concurrent with development of a new stock from local populations. However, a recent analysis by Chilcote et al. (In Press) suggests that hatchery fish, whether from a local or non-native broodstock, can still reduce the reproductive success of the natural populations if they are allowed to intermix on the spawning grounds. As stated in Section 1.16, development of an endemic stock for the Snake River is no longer feasible.

In 2009, Washington's Fish and Wildlife Commission adopted their "Policy on Hatchery Reform" Its purpose was: "To advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. Hatchery reform is the scientific and systematic redesign of hatchery programs to help recover wild salmon and steelhead and support sustainable fisheries. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries." This HGMP is consistent with the intent of the policy (see full policy at: Washington Fish and Wildlife Commission Policy: POL-C3619).

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

This HGMP is consistent with the following cooperative and legal management agreements. Where changes to agreements are likely to occur over the life of this HGMP, WDFW is committed to amending this plan to be consistent with the prevailing legal mandates.

– *Lower Snake River Compensation Plan* **–** LSRCP goals as authorized by Congress direct actions to mitigate for losses that resulted from construction and operation of the four Lower Snake River hydropower projects. The program is consistent with smolt production but lower than levels as outlined in original LSRCP. The proposed program will continue to support a substantial tribal and sport harvest.

– *US vs Oregon* - The hatchery program outlined within this HGMP is consistent with Appendix B hatchery smolt production agreements of the *US vs Oregon* negotiations and the intent to provide fish for harvest in tribal and sport fisheries into the future.

- *Columbia River Fish Management Plan* – Continue to provide substantial harvest in Zone 6 tribal net fisheries as well as in-basin tribal harvest opportunity.

- *Fisheries Management and Evaluation Plan (FMEP).* – FMEPs for Snake River fisheries have been drafted by WDFW and submitted to NOAA, and describe in detail the current fisheries management within the Snake River Basin (including the Grande Ronde). Fishery management objectives within the FMEP and this HGMP are consistent.

- *WDFW Wild Salmonid Policy.* Washington Department of Fish and Wildlife is directed by State and Departmental management guidelines to conserve and protect native fish and wildlife populations. No other comprehensive management agreements are in effect.

- *Washington Statewide Steelhead Management Plan* - Restore and maintain the abundance, distribution, diversity, and long-term productivity of Washington's wild steelhead and their habitats to assure healthy stocks. In a manner consistent with this goal, the Department will seek to protect and restore steelhead to achieve cultural, economic, and ecosystem benefits for current and future residents of Washington State.

- *Snake River Salmon Recovery Plan* – The Governor of the State of Washington committed WDFW to cooperate and partner with regional governments to develop a science based and community supported strategy for salmon recovery. A draft plan was completed in December 2006. The draft plan is being updated and combined with Oregon and Idaho plans to develop a DPS-wide plan for the Snake Basin. WDFW will continue to work with regional governments and processes to recover salmon and steelhead populations in the Snake River Basin.

3.3) Relationship to harvest objectives.

As a strictly Mitigation / Isolated Harvest Program, the use of the LFH Stock in the lower Snake River is intended to fulfill mitigation goals as outlined under the LSRCP.

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

Multiple fisheries benefit from the summer steelhead compensation program in the Snake River (Table 12). Historically, summer steelhead from LFH releases were caught heavily in Columbia River net and sport fisheries. However, in recent years (1994-2006) the distribution of catch has shifted such that >85% of the catch now occurs within the project area. They have also been harvested successfully in the Snake River, with a large percentage recovered at LFH. Recoveries

have not been observed in the Touchet or Walla Walla rivers. A small percentage of the total on-station release returns have been documented in the Tucannon River.

All of these fisheries are consistent with LSRCP goals, and with *U.S. v. Oregon* management plans and principles for tribal and sport fisheries. All sport fisheries within the region are selective for hatchery-reared fish and require release of natural-origin summer steelhead (See WDFW Snake River FMEP). Sport fishing regulations in the Snake River have been set to reduce the incidental mortality of natural fish in the catch by requiring barbless hooks and keeping the unmarked fish in the water while unhooking before release. The use of barbless hooks, and keeping fish in the water during hook extraction promotes a safer, less stressful release of natural origin fish in the fishery. These actions work in concert with focused fishing effort on hatchery-origin fish to minimize spawning escapement of LFH Stock summer steelhead into the Snake River and nearby tributaries.

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia and Snake River basins have affected natural steelhead production in the Snake River. Impact to the Snake River along Washington borders has been most affected from the construction of the four Lower Snake River Dams, and to a lesser extent from urban development and water usage. Current habitat conditions for salmonids can be described by the following taken from *Salmonid Habitat Limiting Factors Water Resource Inventory Areas 33, 34, & 35* (Kuttle 2002).

Table 12. Expanded Coded-wire tag recoveries of summer steelhead released into the Snake River from LFH.

Brood Year	Columbia River Location					LSRCP Recovery					
	Ocean	Sport	Net	Tributary	Other Trap/ Hatchery	Lyons Ferry Hatchery	Snake Sport	Other Trap/ Hatchery	Tucannon River	Walla Walla Basin	Other Tributary [A]
1982	3	38	252	2	0	89	71	3	0	0	61
1984	1	62	260	0	0	131	284	5	0	0	10
1985	25	109	821	9	1	200	270	5	18	0	50
1986	1	102	649	2	0	479	346	3	17	0	30
1987	14	130	382	9	1	405	410	5	0	0	75
1988	0	75	161	0	0	395	335	1	23	0	129
1989	2	7	127	1	0	75	137	1	0	0	72
1994	1	50	40	14	0	655	227	2	0	0	29
1995	0	25	36	79	2	366	89	2	0	0	16
1996	0	8	4	0	0	151	61	1	0	0	0
1997	0	31	13	3	1	559	115	0	11	0	0
1998	0	50	33	30	0	420	162	1	0	0	15
1999	0	38	25	2	1	297	123	0	22	0	169
2000	0	50	2	5	1	143	65	0	14	0	20
2001	0	33	25	3	0	189	58	0	5	0	41
2002	0	57	8	2	0	185	110	0	0	0	98
2003	0	58	5	1	0	144	95	0	5	0	18
2004	0	36	11	1	3	174	141	0	0	0	5
2005	0	19	27	1	0	137	219	1	0	0	108
2006	0	26	46	0	0	211	180	0	0	0	50
Sum 82-89	46	523	2652	23	2	1774	1853	23	58	0	427

Sum 94-06	1	481	275	141	8	3631	1645	7	57	0	569
% of Total 82-89	0.6	7.1	35.9	0.3	0.0	24.0	25.1	0.3	0.8	0.0	5.8
% of Total 94-06	0.0	7.1	4.0	2.1	0.1	53.3	24.1	0.1	0.8	0.0	8.3

[A] Other tributaries include major river above Lower Granite Dam such as the Clearwater, Salmon, and Grande Ronde.

"The four lower Snake River dams have inundated mainstem salmonid habitat from the mouth of the Snake River upstream to the city of Asotin, Washington. …. Passage of salmonids through the four lower Snake River dams and their associated reservoirs is the primary issue on the Washington portion of the mainstem Snake River. Adult fish passage facilities were originally incorporated into each dam when constructed…. juvenile passage was not well understood until 1997. Juvenile salmonid bypass and transportation systems are currently operated at each dam (to improve downstream survival). The reservoirs impounded by each dam have slowed river currents thereby increasing the outmigration time of juvenile salmonids……have also improved habitat for predatory fish species including northern pikeminnow, smallmouth bass, and channel catfish." In addition, the reservoirs have increased water temperatures in the lower Snake River.

There are currently very limited plans in place to restore the habitat in the lower mainstem Snake River for salmonids. However, the draft recovery plan describes strategies designed to improve conditions for natural steelhead in the Snake River tributaries occupied by steelhead belonging to the Tucannon and Asotin populations.

3.5) Ecological interactions.

Predation - Predation requires opportunity, physical ability and predilection on the part of the predator. Opportunity only occurs when distribution of predator and prey species overlaps. This overlap must occur not only in broad sense but at a microhabitat level as well. For hatchery steelhead released at LFH, predation on listed species is considered low due to spatial separation.

As hatchery steelhead smolts migrate downstream, avian (i.e. kingfishers, mergansers, gulls) and mammal predators will likely prey on hatchery steelhead smolts. While not always desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish.

Predation by hatchery fish on natural-origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Canamela 1992; CBFWA 1996). However, Jonasson et. al. (1995) found no significant relationship between residual hatchery steelhead size and salmonid prey size in pen experiments. Further, Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. Martin et al (1993) also concluded the summer steelhead residuals in the Tucannon River were not

affecting listed Chinook salmon populations based on stomach analysis.

Relative size differential of proposed hatchery steelhead smolts (210 mm @ 4.5 fpp) compared to spring Chinook smolts (90-110 mm) and wild steelhead smolts (130-200 mm) should preclude any substantial predator/prey interaction among migrating fish based on the above. However, fall Chinook (35-95 mm) could be consumed by hatchery steelhead.

With the exception of fall Chinook, timing of hatchery steelhead smolt releases at LFH and the distribution of listed species fry limit potential interaction. Hatchery steelhead smolts are released in mid-April. Further, the hatchery release site for this program is for the most part downstream of documented spring/summer and fall Chinook spawning areas and the opportunity for spring Chinook fry to move into the steelhead migration corridor is limited. Naturally produced steelhead fry are unlikely to be present in the migration corridor at this time, and bull trout fry tend to rear in headwater spawning areas and thus avoid interaction with steelhead smolts.

Juvenile fall Chinook from fish that spawn in the tailraces below the four Lower Snake River dams will overlap with the hatchery steelhead migration corridor. Fall Chinook fry will likely be seeking habitat areas near stream margins. Bjornn and Reiser (1991) reviewed literature on habitat preferences of juvenile salmonids and concluded that newly emerged fry prefer shallow areas of low velocity (<10 cm/s) and larger fish occupy deeper and faster areas. Partitioning of habitat by Chinook fry and steelhead smolts minimizes direct interaction between the two species.

A varying percentage of hatchery steelhead do not migrate from the system. WDFW considers hatchery steelhead remaining after June 15 to be residuals. These fish, by remaining in the lower Snake River have an increased opportunity to interact with juvenile listed fish. Although most residual rates vary from a few percent (Viola and Schuck 1991) to 10% (Partridge 1985, 1986), higher rates in the range of 25% have been observed by Viola and Schuck (1991) and Crisp and Bjornn (1978). Estimates of residual steelhead from the LFH releases are not available. Anglers interviewed during the fall season steelhead fishery on the Snake River report catching residual hatchery steelhead. These could be from Lyons Ferry, or other Snake River basin steelhead releases.

Studies of the effect of size at release and acclimation on rates of hatchery steelhead residualism have been conducted in Idaho, Washington, and Oregon. Results are in some cases contradictory. Larger smolts may residualize at a higher rate than smaller smolts (Partridge 1985, 1986) although some minimum size is necessary for outmigration (Crisp and Bjorn 1978). In northeast Oregon, ODFW found that residual steelhead remaining two to five months after release were significantly smaller at release than the mean length of the release group as a whole (Jonasson et. al. 1994 and 1995). Results of residualism studies suggest that direct stream releases residualize at a higher rate than acclimated fish (Schuck 1993; Jonnason et. al. 1995).

Steelhead residuals normally remain near their release point (Whitesel et. al. 1993; Jonasson et. al. 1994 and 1995; Canamela 1992). Partridge (1986) noted that most residual steelhead were

within about 8 km of the upper Salmon River release site. Schuck (1993) reported steelhead residuals were found about 20 km below and 10 km above release sites in the Tucannon River, Washington. Steelhead residual densities were highest within 8 km of release sites and decreased quickly above and below these sites in the Grande Ronde and Imnaha rivers in Oregon (Whitesel et al. 1993).

The number of residual steelhead appears to decline steadily throughout the summer in most Snake River basin release areas. This may be due to harvest, other mortality, and outmigration. Viola and Schuck (1991) noted that residual populations in the Tucannon River of Washington declined at a rate of about 50% per month from June to October (declining from 4.3 to 0.8% of the total released). Whitesel et al. (1993) found residual steelhead up to twelve months after release, however, densities declined rapidly over time.

The LSRCP program funded studies in Oregon, Washington, and Idaho to evaluate food habits of steelhead smolts and residuals. Whitesel et al. (1993) sampled 676 steelhead stomachs (65 smolts and 611 residuals) during spring of 1992 through spring of 1993. Stomachs were taken from smolts collected at the screw trap operated by Nez Perce tribe at river mile 4 of the Imnaha River. None of the smolt stomachs sampled contained fish. Residuals were sampled by angling and electrofishing in the Imnaha and Grande Ronde basins. No Chinook were observed in any of the residual hatchery steelhead stomachs, although 54 (8.0%) contained fish (mainly sculpins) and 8 (1.2%) contained salmonids (rainbow or whitefish). Subsequent sampling in 1993 resulted in examination of 358 residual hatchery steelhead stomachs. Fish or fish parts were found in only three stomachs including one 63mm *O. mykiss* and sculpins (Jonasson et. al. 1994). Martin et al. (1993) found similar levels of predation in residual steelhead on the Tucannon River. Based on this information, we conclude that residual steelhead do not appear to prey on juvenile Chinook and have low rates of predation on other salmonids.

Competition **-** Hatchery steelhead smolts have the potential to compete with Chinook, natural steelhead and bull trout juveniles for food, space, and habitat. The Species Interaction Work Group (SIWG, 1984) reported that potential impacts from competition between hatchery and natural fish are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue to occur at some unknown, but lower, level as smolts move downstream through the migration corridor. Canamela (1992) concluded that the effects of behavioral and competitive interactions would be difficult to evaluate or quantify.

The size difference between residual steelhead and Chinook fry will probably result in selection of different habitat areas (Bjornn and Reiser 1991) and further reduce the likelihood of interactions between species. Direct competition between hatchery smolts or residuals and natural smolts and rearing juveniles is likely due to the substantial overlap in macro and microhabitat. A study of interaction between resident rainbow and hatchery steelhead residuals concluded that in a situation where the two were held together in pens, the smaller resident rainbow showed decreased growth when compared to controls (McMichael, et. al. 1997). This suggests similar influence on smaller juvenile steelhead. In a natural situation

juvenile fish can move to alternate habitats to avoid the negative interaction. Although the ultimate result of this type of interaction in the natural environment is unknown, shifts to what may be less suitable habitat may also result in impacts to growth.

Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts may have different food and habitat preferences than natural fish, and that hatchery fish will unlikely be able to out-compete natural fish. Further, hatchery-produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with natural fish. Competition between hatchery-origin salmonids with wild salmonids, including steelhead, in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995). All production fish described in this program are released as smolts to minimize the likelihood for interaction, and adverse ecological effects to listed natural Chinook salmon juveniles, bull trout, and steelhead.

Bull trout associated with areas influenced by residual hatchery steelhead are generally fluvial adults and are more likely to out-compete and prey on hatchery steelhead because of a significant size advantage.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens that could affect listed Chinook, steelhead, and bull trout growth and survival. Because hatchery produced summer steelhead for the compensation program are reared at LFH for their entire life (except for Dayton Acclimation Pond), disease impacts by this stock on Snake River salmonids are reduced. LFH is supplied with constant temperature well water; as a result disease occurrence and the presence of pathogens and parasites are infrequent. When infestations or infections have occurred, they have been effectively treated. Further evidence for the relative disease-free status of this stock at Lyons Ferry is the low mortality that occurs during rearing following typical early life stage losses. Documentation of disease status in these stocks is accomplished through monthly and preliberation fish health examinations. No transfers of steelhead juveniles with known clinical infections or infestations have been made to the Snake River or other release sites by the LFH stock fish. Further, all eggs are tested for presence of the IHNV at spawning; infected eggs/fry are destroyed as necessary after results are obtained.

Returning adult steelhead held for spawning at the LFH adult trap potentially create a concentrated source of pathogens and parasites. The increase in risk posed to natural Chinook, steelhead and bull trout by these fish is considered minimal for several reasons. First, it is unlikely that the hatchery steelhead adults that return to the production facilities harbor any agents that naturally spawning steelhead do not also carry. Second, cold water temperatures during the winter and the combination of cool water temperatures and high flows during spring holding season for steelhead adults are not conducive to infectious processes. This reduces the potential for transmission between adults in holding ponds and from fish-to-fish in the natural habitat. Documentation of the disease status of the adult steelhead stocks is accomplished through annual fish health examinations of both spawning adults and pre-spawning mortality. Results of these examinations over the past years indicate a low prevalence and incidence of serious fish pathogens and parasites in these stocks. For the LFH Stock program described here, the viral pathogen IHNV has been most prevalent. Procedures described later (See

Section 8 and Section 9) limit or eliminate the possibilities of outbreaks of this viral disease in the hatchery.

SECTION 4. WATER SOURCE

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.

Presently, LFH is the rearing site for LFH stock summer steelhead. Adults are collected and spawned, eggs are fertilized, hatched and juveniles reared to the yearling smolt stage, and release at 4-5 fish/lb. Lyons Ferry has eight wells that produce up to 150 cfs or 67,970 gpm of nearly constant 52^0 F, well water. Discharge from LFH complies with all NPDES standards and enters the Snake River. Rearing space, not water supply, limits production at LFH.

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 at LFH is through wells, and effluent is discharged to the Snake River, in compliance with NPDES standards. The chance of a potential "Take" of listed species from water withdrawal, screening, or effluent discharge is very low.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock will be collected at the LFH adult trap. Depending on the trapping schedule, the trap will be checked and emptied daily. Collection protocols will determine if fish will be collected or returned to the river on any given day.

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

Captured adults are not transported beyond LFH. Adults are either diverted directly from the trapping structure to the adult holding raceways through a series of 12-inch PVC pipes with running water, or returned immediately to the Snake River.

5.3) Broodstock holding and spawning facilities.

Broodstock to be kept are diverted directly from the trapping structure to the adult holding raceways through a series of 12-inch PVC pipes with running water. The holding raceways are 10'(w) x 80'(l) x 6'(d). A permanent building covers 1/3 of the adult raceways. Sorting and spawning of the broodstock occurs within the building. Routine maintenance on broodstock holding facilities includes checking on water intake valves, gate valves at

the lower end of the holding ponds, water alarms, disinfection and formalin treatment systems, and general condition of the holding ponds.

5.4) Incubation facilities.

The incubation room at LFH is designed to accept and incubate eggs from individual females, through the eyed stage. Two nested square buckets receive water via individual plastic tubes. Isolated incubation vessels allow disease sampling, detection and control. After eyeing is complete and virus sample results are received, eggs are consolidated into hatching baskets and transferred to shallow hatching troughs. As the eggs hatch, fry fall through the hatching baskets, and settle to the bottom of the rearing troughs where they absorb their egg sacks, and eventually start feeding. Routine maintenance in the incubation and early rearing facilities includes checking on water intake valves, water alarms, disinfection and formalin treatment systems, and general condition of the incubation room.

5.5) Rearing facilities.

Four intermediate indoor rearing tanks and 47 outside raceways are available for rearing. Water supply is from wells as previously described. Feeding is by hand. After fish reach fingerling size, they are adipose fin clipped and transferred into one of three 2.1 acre rearing lakes at LFH. Each lake is supplied with up to 4,500 gpm well water. Fish rearing densities at this point are very low. Fish are fed commercial salmon or steelhead diet blown from a feeder truck.

5.6) Acclimation/release facilities.

LFH stock fish are reared in the 2.1 acre rearing ponds at LFH. A portion of the stock (~100,000) are moved each winter to concrete raceways (10'x 80') for marking purposes. Currently mark groups are allocated for all release points. In January each year ~ 20,000 of the 160,000 fish destined for the on-station release are marked (ADLV/CWT). In mid-April, fish are then pumped into a truck and released directly into the Snake River on-site. The remaining 140,000 fish are removed from the 2.1 acre pond via a concrete release structure, and then released directly into the Snake River. For acclimation purposes, LFH direct released fish spend their entire life cycle on LFH water, which probably enhances their ability to return to their point of release with little straying. Although release methods are forced, not volitional.

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

Catastrophic losses have occurred in the LFH summer steelhead stock due to IHNV in the past (BY1989 100% loss). Following the loss in 1989, strict spawning protocols and procedures were implemented to prevent a similar event. These protocols and procedures have and will continue to be strictly followed with the LFH stock program.

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.

Strict operational procedures as laid out by Integrated Hatchery Operation Team (IHOT 1993) are followed at LFH. Where possible, remedial actions identified in a 1996 IHOT compliance audit are implemented. Staff are available to respond to critical operational problems at all times. Water flow and low water alarm systems, and emergency generator power supply systems to provide incubation and rearing water to the facilities are installed at LFH. Fish health monitoring occurs monthly, or more often, as required in cases of disease epizootics. Fish health practices follow PNWFHPC (1989) protocol.

5.9) Maintenance

Annual Maintenance

- Annual water supply pump rehabilitation. (***Please reference Snake River Fall Chinook HGMP***).
- Rotating drum screen maintenance for rearing lakes ($1,000).
- Chemicals for egg disinfection and fungus control ($2,500)
- Vehicle maintenance ($500).
- Annual fish transportation; a total of 58,600 lbs. smolts hauled from Lyons Ferry to Dayton AF and direct releases to Tucannon River and Walla Walla River ($7,500).
- Dredge intake at Touchet River/Dayton AF. ($3,500)
- Fire safety and maintenance service (***Please reference Snake River Fall Chinook HGMP***).

Non-recurring Maintenance (next 5 years)

- Stop log replacement for Lake # 1 ($1,500).
- Asphalt seal Dayton AF pond. ($5,000)
- New fish culture equipment; items such as crowders, dipnets, scales, shallow trough baffle plates etc. ($1,500).
- Increase intermediate rearing capacity (***Please reference Snake River Fall Chinook HGMP***).
- Develop increased water supply to meet program diversity requirements for "stepping stone" approach. (***Please reference Snake River Spring Chinook and Fall Chinook HGMPs***).
- Replace formalin treatment pump ($1,200).
- Replace blower feeder motor ($1,500).

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.

6.1) Source.

Hatchery-origin steelhead (presumably LFH Stock) captured in the LFH adult trap will be used for the hatchery broodstock. Broodstock consists of AD and ADLV+CWT

marked/tagged fish. Based on CWT recoveries from spawning activities from 2000-2008 run years, only 40 CWTs (1% of the total CWTs recovered) have been from stocks other than LFH (Table 13). (*Note: not all groups shown in the Table 13 had equal numbers of CWT release, or were released every year)*. Figure 3 shows standardized recoveries (i.e. equal tag group sizes/year) for the WDFW LFH and Wallowa stocks for the 1999-2006 brood years.

Table 13. Coded-wire tag recoveries of summer steelhead at Lyons Ferry Hatchery, 2000-2008 run years.

	Run Year										
Release (stock)	'00	'01	'02	'03	'04	'05	'06	'07	'08	Total	%
Lyons Ferry (LFH)	432	398	141	165	184	97	199	127	195	1,938	46.9
Tucannon (LFH)	104	236	41	51	34	28	46	7	NA	547	13.2
Walla Walla (LFH)	NA	NA	85	75	84	127	84	73	86	614	14.8
Touchet (LFH)	79	367	102	87	69	78	49	85	81	997	24.1
Cottonwood (Wallowa)	5	8	2	3	0	3	1	1	0	23	0.6
Idaho (mixed stocks)	8	6	0	0	0	0	0	0	0	14	0.3
Oregon (Imnaha or Wallowa)	1	2	0	0	0	0	0	0	0	3	0.1

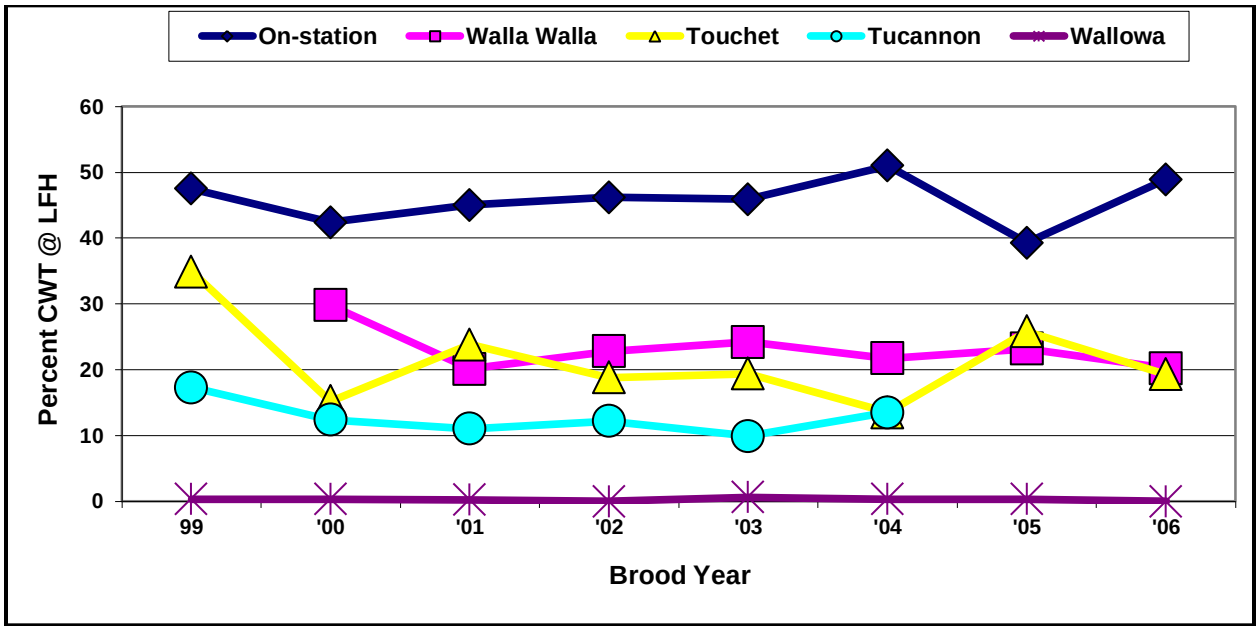

Figure 3. Composition of release group CWTs (LFH and Wallowa stocks) recovered from summer steelhead broodstock at Lyons Ferry Hatchery, 1999-2010 brood years.

6.2) Supporting information.

6.2.1) History.

The LFH stock of steelhead was originally derived in the early 1980's from a combination of Wells Hatchery and Wallowa Hatchery steelhead stocks released at LFH. The adult

returns from those releases were then used to create the LFH stock currently used. The LFH stock is considered an "A" run steelhead, typical of most Columbia River stocks.

6.2.2) Annual size.

The proposed use of 105 females captured in the LFH adult trap will provide program needs, of which the LFH on-station release is a part. Additional females may also be spawned for extra eggs in case IHNV is detected in the broodstock, or in case pre-spawn loss is higher than expected. Eggs in excess of program needs will be destroyed once virology results have been confirmed, or progeny from excess eggs may be stocked into area lakes for put-take fisheries. Eggs from all non-IHNV positive spawned adults are represented in the yearling program.

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

Unmarked fish (i.e. presumably natural origin) have not been included in the broodstock to date. Unmarked fish will continue to be excluded from the broodstock under present management practices.

6.2.4) Genetic or ecological differences.

The LFH hatchery broodstock is likely very genetically similar to Wells and Wallowa summer steelhead stocks, as it is unlikely any significant change has occurred over the last 10-15 years. Genetic samples (fin clips or punches) will periodically be collected from hatchery origin (LFH Stock) summer steelhead in the future for population structure and genetic variation.

Since the LFH stock was derived from these two stocks, the LFH stock is genetically distinct from other Snake River basin natural origin stocks. However, WDFW has documented significant genetic introgression in the Tucannon River natural steelhead population, with limited introgression documented in the Touchet and Walla Walla basin (See Touchet River Endemic Steelhead HGMP).

6.2.5) Reasons for choosing.

The LFH Stock steelhead has been propagated over many generations by WDFW. The primary founding stock (Wells Hatchery) was chosen as the initial stock by the Washington Department of Game when the program first started since it was a successful hatchery upriver stock. Collecting a localized Snake River stock for the founding population was discussed during initial program development, but not acted upon. The LFH stock performance indicates that it is highly successful in producing harvestable fish for the program.

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.

Continued use of the LFH Stock (at lower production levels than original LSRCP goals) will diminish the potential negative effects to the natural population's genetic structure. Broodstock (i.e. eggs) for the LFH stock program will be collected over the majority of run timing. Spawning will occur on four separate dates when possible (generally representing four consecutive weeks). Further reductions in the total number of LFH stock smolts (Tucannon, Touchet and Walla Walla releases) may occur in the future depending on survival estimates from more completed brood years of coded-wire tag returns.

SECTION 7. BROODSTOCK COLLECTION

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

7.2) Collection or sampling design.

Adult steelhead enter the Snake River from July through April. Returning fish find the LFH effluent water and enter the ladder that leads up to the fish trap. Because of the trap system, trapping has occurred each day the ladder/trap is supplied with water (every day). However, collection of fish for broodstock does not have to occur each day. Fish that enter the trap can easily be cycled back to the river through 12" PVC tubes. On days where broodstock are desired, slide gates in the sorting chute are used to divert fish into the adult holding raceways. Trapping for summer steelhead begins in September and continues through mid-November. Current trapping protocol is for 1,650 fish collected annually (150 fish / week from 1 September to 15 November). Between 15 November and 30 November, collected fish are sorted, with approximately 1,200 fish returned to the river for the sport fishery.

7.3) Identity.

Currently, 100% of the LFH stock steelhead are marked with an adipose fin clip for harvest management. In addition, a portion (~100,000 of the 345,000 production) are coded wire tagged, and the left ventral fin is removed. All of these marks allow for external identification upon adult return for fishery and broodstock purposes. Further, this will allow for a more complete evaluation of the success and/or failure of the program in the future and assess stray rates into other river basins. All unclipped fish, or fish with other fin marks and/or tags that cannot be confirmed as being possible LFH stock origin are released back the river and not incorporated into the LFH broodstock.

7.4) Proposed number to be collected:

7.4.1) Program adult broodstock goal :

Short Term: 210 Adults (105 females, 105 males).
Long Term: Unknown, will depend on future production goals and performance of endemic stock development.

7.4.2) Broodstock collection levels for the last twelve years, or for most recent years available: See Table 14.

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

Generally, all unspawned fish are released back into the Snake River for harvest. However, exceptions have been made to fish containing CWTs from study groups. These have been, and will continue to be killed to recover CWTs.

7.6) Fish transportation and holding methods.

Live adults are not transported from the hatchery. They are returned to the river adjacent to the LFH.

Table 14. Number of male and female summer steelhead collected and spawned at Lyons Ferry Fish Hatchery from 1987-2010 Brood Years.

Brood Year	Females Collected	Males Collected	Spawned Females	Spawned Males	Eggs Collected
1987	767	446	250	NA	1,111,506
1988	613	468	267	NA	941,756
1989	1314	1212	243	576	1,263,237
1990	1509	1039	437	955	2,570,676
1991	1436	998	261	532	1,296,249
1992	1348	687	240	100	1,239,055
1993	2034	1509	234	100	1,211,053
1994	2092	711	253	NA	1,352,296
1995	2151	1858	343	NA	1,772,477
1996	3537	2383	330	NA	1,614,636
1997	3073	2525	217	246	1,090,638
1998	3328	2619	279	280	1,460,967
1999	1,780	1,193	227	253	1,140,813
2000	2,238	1,570	183	188	871,856
2001	1,758	1,170	151	242	800,350
2002	4,254	3,342	194	231	941,223
2003	1,483	1,052	126	257	483,462
2004	1,129	1,016	133	259	494,380
2005	1,129	797	133	263	571,185
2006	983	691	120	241	529,379
2007	911	790	123	245	556,683
2008	998	653	116	193	563,765
2009	824	859	105	106	490,434
2010	865	792	99	99	520,127

7.7) Describe fish health maintenance and sanitation procedures applied.

Broodstock are held in the adult steelhead holding raceways at LFH. Treatments for fungal infections have not been applied to the broodstock, as pre-spawn loss has generally not been a problem. The number of adults kept at any one time is limited by the capacity of the holding area raceways. WDFW has determined that the maximum number of adults in the holding raceways is 3,000 fish. To maintain healthy broodstock, the current goal is to not exceed 1,200 fish in raceways for broodstock. Following sorting, there is generally about 400 fish in the broodstock raceway.

7.8) Disposition of carcasses.

All fish spawned for hatchery broodstock are eventually killed. Males may be live spawned if a shortage exists. Live spawned males will be opercule-punched to identify them in future spawns. All carcasses from killed fish are buried on-site at LFH. Nutrient enhancement has not been aggressively pursued because of disease concerns from LFH fish

into the natural environment.

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.

Hatchery-origin adults are collected over the migration period to minimize potential effects on spawn timing. Disease control efforts at LFH are in accordance with Pacific Northwest Fish Health Protection Committee (PNWFHPC 1989) and Integrated Hatchery Operations Team (HOT 1993) standards. Implementation of these standards is expected to control expansion of species specific or general salmonid diseases.

SECTION 8. MATING

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

8.1) Selection method.

All males and females that have been kept for broodstock following sorting will be examined weekly during the spawning season to determine ripeness. Fish will be selected at random during the spawning process. Two weeks prior to the first spawn, hatchery staff will divide the kept fish into male and females. At this time, all ripe females will be killed outright and removed. Fish ripe at this time have been found to be over-ripe at the first spawn date, and their eggs are generally not viable. All ripe females will be used once spawning begins. If possible, twice the number of males will be spawned as females. Spawned females are individually sampled for IHNV. Samples are sent to WDFW virology lab for culturing. Eggs from individual females with positive results for the virus will be discarded.

8.2) Matings.

Mating will occur in a 1x1 or 1x2 cross depending on broodstock kept. If program needs are met, the effective population size will be 210, as derived from the following formula:

Equation 1) $N_e = 4(N_M)(N_F) / (N_M + N_F) = 4(105)(105) / 210 = 210$ adults

Where: N_M = Number of spawned males
N_F = Number of spawned females

Discarded eggs from IHNV positive females will lower the effective population size.

8.3) Fertilization.

In the past, females were spawned directly into colanders and the ovarian fluid was drained off. This was done to prevent possible vertical transmission of IHNV into the egg from the sperm. Gametes were then hauled back to LFH in numbered buckets before fertilization

took place. Semen was added to the eggs and water was used to activate the semen to complete the fertilization process. Generally less than one minute was given for fertilization before the eggs were rinsed again with iodine solution, and then water hardened in iodine (100 ppm) for one hour

Hatchery personnel have recently questioned two parts of the fertilization process; 1) should the ovarian fluid be drained, and 2) should more time be allowed for the semen to complete fertilization. It was believed that one or both of these may be contributing to the poor green-egg to shock loss that has been documented for both the Wallowa and LFH stocks. As such, an experiment was conducted in 2003 with LFH stock fish to determine if changes in the fertilization/spawning process would increase fertilization success. Results from the LFH experiment were presented (Bumgarner et al 2003) and determined future fertilization procedures for all steelhead stocks at LFC. We continue to evaluate the success of fertilization following this experiment in 2003. Green egg to eyed-egg survival rates appear to have improved. As such, a reduction in the number of males and females required to meet broodstock may occur in the future.

After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and to remove unwanted organics from the fertilized eggs. They are then water hardened for one hour in the same solution. The volume of iodine solution to eggs should be at least 3:1.

8.4) Cryopreserved gametes.

Currently, no semen from hatchery-origin males has been preserved for use in the program, and is not planned for the future

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 collection protocol will ensure that hatchery origin adults represent a proportional temporal distribution of the run. The 1x1 mating scheme will be implemented to reduce the risk of loss of within-population genetic diversity.

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.

9.1) Incubation:

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

Lyons Ferry Hatchery staff collects LFH stock steelhead eggs annually. Following is the egg survival information at LFH for the ten most recent brood years of LFH Stock

steelhead collected (Table 15). (**Note:** IHNV control measures at LFH require the disposal of eggs from females that test positive for the virus. Discarded eggs are included in percent loss figures for the LFH Stock, so figures may not represent true egg survival, but correctly depict survival under existing hatchery management protocol). Current hatchery protocols call for 75% survival from green egg to fry, and 75% survival from fry to smolt stage. Data presented in Table 15 would indicate that these goals have generally been met for the LFH Stock.

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

Due to the unknown extent of IHNV possible in the eggtake collections, additional females will be spawned during each eggtake as necessary. These excess eggs will be retained until virology results can be obtained to ensure the eggtake goal is met in case of unexpected loss from IHNV or other unexpected circumstances. All eggs in excess of program needs will be destroyed, or reared and planted in area lakes as fry. (Note: present disease control protocol requires the disposal of eggs from IHNV positive females to control outbreaks of the disease within the hatchery).

9.1.3) Loading densities applied during incubation.

LFH stock steelhead females have averaged 5,130 eggs (224/oz) between the 1990 and 2002 spawning years (Total Samples = 2,803 females). Eggs from individual females will be incubated individually in nested buckets through eye-up. Water flow through each bucket is ~2g/min. After eye-up, eggs of similar size/oz are placed in hatching baskets in shallow troughs with a hatching capacity of 20,000 fry for each trough.

9.1.4) Incubation conditions.

Incubation, as with rearing, occurs with sediment free, 51-53 ^{0}F (11 ^{0}C) well water. The incubation building is fitted with back-up pumps to maintain flow through the troughs in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical.

9.1.5) Ponding.

Fish hatch in shallow trough baskets and drop from the baskets into the troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways. By late August when fish are about 30-40 fish/lb), they are adipose fin clipped, and placed into the 2.1 acre rearing pond.

Table 15. Numbers of males and females spawned, eggs taken, and survival by life state of LFH stock summer steelhead spawned at LFH, 1987 to 2010 brood years. Numbers provided in the final line are overall mean and (standard deviation).

BY	Spawned		Eggs taken	Eggs retained [a]	Percent retained	Fry	Percent egg to fry survival	Smolts	Percent fry to smolt survival	Percent egg to smolt survival
	Female	Male								
1987	250	NA	1,111,506	1,095,906	98.6	983,901	89.8	665,658	85.3 [b]	78.4
1988	267	NA	941,756	818,148	86.9	793,240	96.9	526,541	80.2 [c]	81.1
1989	243	576	1,263,237	957,074	75.8	941,000	98.3	0	0.0 [d]	0.0
1990	439	955	2,570,676	1,483,485	57.7	1,002,320	67.6	635,635	82.1 [e]	58.2
1991	261	532	1,296,249	1,165,315	89.9	1,115,368	95.7	407,422	47.9 [f]	57.6
1992	240	100	1,239,055	905,438	73.1	431,405 [g]	46.0	398,926	95.8 [h]	87.5
1993	234	100	1,211,053	940,022	77.6	860,983	91.6	585,837	70.0 [i]	64.9
1994	253	NA	1,352,296	899,350	66.5	845,316	94.0	543,627	65.4 [j]	62.0
1995	343	NA	1,772,477	929,597	52.4	895,882	96.4	604,756	67.9 [k]	65.6
1996	330	NA	1,614,636	1,151,363	71.3	1,148,114	99.7	596,834	63.6 [l]	70.1
1997	217	246	1,090,638	962,705	88.3	809,845	84.1	554,057	100.0 [m]	84.4
1998	279	280	1,460,967	934,247	63.9	768,522	82.3	567,732	73.9	60.7
1999	227	253	1,140,813	807,374	70.8	783,152	97.0	495,864	63.3 [n]	61.4
2000	183	188	871,856	650,867	74.7	617,380	94.9	381,686	61.8 [o]	65.2
2001	151	242	800,350	636,727	79.6	505,451	79.4	423,065	83.7	66.4
2002	194	231	941,223	768,832	81.6	732,566	95.3	378,917	60.4 [p]	63.0
2003	126	257	483,462	418,195	86.5	408,944	97.8	310,209	75.9	74.2
2004	129	259	494,380	414,258	83.8	408,462	98.7	355,362	87.0	85.8
2005	133	263	571,185	452,011	79.1	439,803	97.2	350,028	79.6	77.4
2006	120	241	529,379	430,667	81.4	423,397	98.3	341,424	84.2 [q]	83.4
2007	123	245	558,683	507,688	90.9	502,766	99.0	351,510	82.8 [r]	84.7
2008	116	193	563,765	507,791	90.1	496,183	97.7	366,111	73.8	72.1
2009	106	105	490,434	425,124	86.7	415,771	97.8	364,896	92.5 [s]	90.4
2010	99	99	520,127	451,318	86.8	442,652	98.1			
Avg(SD)					78.9 (11.2)		91.4(12.4)		78.9 (5.5)	69.3 (18.3)

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV are included).
[b] A total of 203,857 fry/parr/fingerlings were planted into area lakes/rivers from over production.
[c] A total of 137,021 fry/parr/fingerlings were planted into area lakes/rivers from over production.
[d] Losses due to IHNV outbreak of entire production.
[e] A total of 227,733 fry/parr/fingerlings were planted into area lakes from over production.
[f] A total of 92,116 fry/parr/fingerlings were planted into area lakes, plus an estimated 172,000 fish lost to bird predation
[g] A total of 378,257 destroyed to infection with IHNV
[h] A total of 15,140 fish retained in Curl Lake from residualism.
[i] A total of 23,898 fish retained in Curl Lake from residualism.
[j] A total of 14,212 fish retained in Curl Lake from residualism.
[k] A total of 5,244 fish retained in Curl Lake from residualism.
[l] A total of 191,100 fry/parr/fingerlings were planted into area lakes from over production, and 19,319 fish retained in Curl Lake from residualism.
[m] A total of 259,148 fry/parr/fingerlings were planted into area lakes from over production.
[n] Survival was low due to excessive bird predation.
[o] A total of 42,548 fry/parr/fingerlings were planted into area lakes from over production.
[p] A total of 105,502 fry/parr/fingerlings were planted into area lakes from over production.
[q] A total of 17,815 fry/parr/fingerlings were planted into area lakes from over production.
[r] A total of 78,334 fry/parr/fingerlings were planted into area lakes from over production.
[s] A total of 21,316 fry/parr/fingerlings were planted into area lakes from over production.

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 a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

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.

Not Applicable – Fish in this program are not listed.

9.2) Rearing:

9.2.1) Provide survival rate data by hatchery life stage for the most recent twelve years (1988-99), or for years where dependable data are available.

See Table 15 Above.

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

LFH raceway rearing density index criteria for steelhead will not exceed 0.26 lbs fish/ft^3. Where steelhead are reared in the large rearing ponds at LFH or in the acclimation ponds, densities can be 10% of maximum.

9.2.3) Fish rearing conditions

Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000-gpm (23 minute exchange rate) of water enters each north side raceway through secondary degassing cans. The north side of the hatchery was historically used to raise steelhead. The south side raceways will likely be included for steelhead rearing in the future due to program changes. South side raceways receive about 650 gpm (33.5 minute exchange rate) water to the raceway through a manifold. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Similar data are expected in the 2.1 acre rearing ponds (17.5 hour water exchange rate), but dissolved oxygen may be different upon exit due to lower densities, slower exchange rate, large surface area, and greater amounts of algae in lake compared to raceways. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. In the 2.1 acre lakes, feed is dispersed from truck mounted blower feeders.

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. See Table 16.

Table 16. Growth and size of LFH Stock Steelhead at LFH for the 1999-2001 Brood Years. Note: the data presented below represents program goals of 4.0 fish/lb at release, hence the relatively large size at release. Goals have been changed since this time to 4.50 fish/lb at release. Range of fish/lb from 2005-2010 has been 4.1-4.4 fish/lb.

Month/Year	FPP	g/fish	Month/Year	FPP	g/fish	Month/Year	FPP	g/fish
2/99	NA	NA	2/00	1,200.0	0.4	2/01	NA	NA
3/99	1,100.0	0.4	3/00	700.0	0.6	3/01	1,218	0.4
4/99	349.0	1.3	4/00	341.0	1.3	4/01	330.0	1.4
5/99	195.8	2.3	5/00	177.0	2.6	5/01	141.0	3.2
6/99	103.8	434	6/00	90.0	5.0	6/01	69.0	6.6
7/99	49.9	9.1	7/00	42.2	10.7	7/01	42.6	10.6
8/99	36.0	12.6	8/00	31.1	14.6	8/01	34.0	13.3
9/99	17.2	26.4	9/00	16.1	28.2	9/01	20.7	21.9
10/99	12.2	37.2	10/00	12.1	37.5	10/01	13.0	34.9
11/99	9.6	47.3	11/00	8.1	56.0	11/01	9.1	49.8
12/99	7.1	63.9	12/00	7.0	64.8	12/01	8.4	54.0
1/00	6.2	73.2	1/01	4.6	98.6	1/02	6.9	65.7
2/00	5.5	82.5	2/01	4.1	110.6	2/02	4.2	108
3/00	4.9	92.6	3/01	3.9	116.3	3/02	3.4	133.4
4/00	4.2	108.0	4/01	3.2	141.8	4/02	3.4	133.4

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

See Table 16 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 .

Fry/fingerling will be fed an appropriate commercial dry or moist steelhead/salmon diet. Fry feeding starts at ~8 times daily and is reduced as the fish increase in size. Range of feeding varies between 0.5 – 2.8% B.W./day. Feed conversion is expected to fall in a range of 1.1:1 (dry feed)– 1.4:1 (moist feed) pounds fed to pounds produced. Feeding frequency, percent BWD and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals.

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

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Fish Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining when fish are removed. Water quality in the lakes is not affected due to low stocking density.

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

Program goal for the LFH on-station release will be to release fish in April at about 4.5 fish/lb. Size at release has ranged from 4.1-4.4 fish/lb from 2005-2010. Pre-liberation samples will note smolt development visually based on degree of silvering, presence/absence of parr marks, fin clarity and banding of the caudal fin. No gill ATPase activity or blood chemistry samples to determine degree of smoltification or to guide fish release timing is anticipated.

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

"NATURES" rearing concepts will not directly be applied to the LFH Stock Program. However, certain aspects of the "NATURES" techniques are used by default at LFH. For instance, the concrete rearing raceways are old enough that the walls and bottoms are of nearly natural coloration (after being cover with algae) and texture, and promote natural looking fish. Once the fish are removed from the raceways, they are placed in the large semi-natural rearing ponds at LFH, which greatly reduces density, and also lessens the incidence of fin erosion that is typical of hatchery steelhead reared to full-term smolts in traditional hatchery raceways. The large ponds at LFH are constructed with rock banks, and produce natural feed. While the fish must still come to the surface to feed, avian and mammal predators at Lyons Ferry add some learned avoidance behavior to the fish in the rearing ponds as well. The 2.1 acre rearing lakes have been covered with bird netting, so overall predation has been reduced.

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.

Professional personnel trained in fish cultural procedures operate LFC facilities. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use pumping systems to prevent catastrophic fish losses. The hatchery has water flow and low water alarm systems to monitor water supplies to its incubation, rearing and adult holding facilities. Because pumps supply LFH, it has several emergency power generation systems to operate its pumps during electrical power outages.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels

Refer to Table 3 (Section 1.11.2) that shows proposed WDFW LFH Stock smolt releases (goal and maximum).

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

Stream, river, or watercourse:	Snake River (WRIA 33,35)
Release point:	Rkm 58 (Lyons Ferry Hatchery)
Major watershed:	Snake River
Basin or Region:	Snake River Basin

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

The number of LFH Stock steelhead released into the Snake River has varied since program inception (see Table 4). For the next three release years (2011-2013) about 160,000 yearling smolts are programmed for release, at an approximate size of 4.5 fish/lb.

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

All LFH stock production in range of release goals will be direct released from LFH. Release will generally occur no earlier than 15 April, and may be as late as 25 April. Yearly adjustments may occur based on water conditions, smolt size, and other environmental conditions. Any proposed releases occurring earlier than stated above will coordinated with the co-managers and NOAA Fisheries.

10.5) Fish transportation procedures, if applicable.

Not Applicable.

10.6) Acclimation procedures.

Steelhead released on-station from LFH are acclimated to LFH water their entire life cycle. No acclimation is necessary.

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

Since this program is for Mitigation / Isolated Harvest, 100% of the smolts released are marked with an adipose fin clip so they can easily be identified in the fishery. In addition, marked fish (minimum of 20,000) may also left ventral fin clipped and Coded-wire tagged for evaluation purposes. Tagged fish allow for expanded harvest estimates both in the Snake and Columbia river fisheries, and to document stray rates. In addition, 4,000 PIT tags are applied to the on-station release. PIT tags will be in combination with coded-wire tags for adult return accounting and straying.

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

All LFH Stock summer steelhead in excess of program needs will be planted as resident rainbow trout in SE Washington area lakes for put-and-take fisheries. There is no route by which excess hatchery fish once planted into these lake can reach the Snake River.

10.0) Fish health certification procedures applied pre-release.

Fish will be examined by a WDFW fish health specialist and certified for release as required under the PNWFHPC (1989) guidelines.

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

Under conditions requiring release of fish, actions will be taken that are suitable for the incident point.

North Side Rearing Raceways: removing the discharge screen(s), pulling the wooden stoplogs and forcing the fish over the short concrete stoplog wall that the wooden stoplogs sit-on will flush fish down to the Snake River with the discharge water.

South Side Rearing Raceways: removing the discharge screen(s) and lowering the adjustable sump pipe into the discharge channel will flush the fish flushed down to the Snake River with the discharge water.

2.1 Acre Rearing Lakes: lifting the flush gate and pulling the discharge stoplogs will flush fish out of the pond along with the water into the Snake River.

Adult Salmon and Steelhead Ponds: For the Salmon ponds this would be accomplished by removing the discharge screen(s), pulling the discharge stoplogs and flushing the fish out of the pond along with the water into the Snake River. For the Steelhead ponds the slide gate valve would be opened and the fish will flush out of the pond into the Snake River

Note: The adult exclusion bar-screen located where the discharge water enters the river should be removed to prevent injury to juvenile fish during an emergency release. In addition, be sure the discharge water supply pump that provides water to the adult separation holding pond is turned off so it doesn't hurt fish going by it. It is currently not screened off.

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 juvenile fish releases.

For other potential interactions from juvenile releases, see Section 3.5.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

11.1.1) Describe plans and methods proposed to collect data necessary to respond to

each "Performance Indicator" identified for the program. Table 17.

Table 17. Monitoring and Evaluation performance measures and their status for LFH stock steelhead released from Lyons Ferry Hatchery into the Snake River.

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
Abundance	Adult Escapement to Tributary	Number of adults that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach for DIDSON and underwater video monitoring. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available	PARTIAL (Snake River Project Area)
	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Uses weir data to determine number of fish released above weir and calculate.	NO
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	PARTIAL hatchery fish only
	Harvest Abundance in Tributary	Number of fish caught in tributary (tribal, sport, or commercial) by hatchery and natural origin.	PARTIAL (Where possible)
	Run Prediction	This will not be in the raw or summarized performance database.	NO
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior.) SAR estimate with harvest. Accounts for all harvest below stream. The variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam : $Var\left(\frac{X}{Y}\right)=\left(\frac{EX}{EY}\right)^2\cdot\left(\frac{Var(Y)}{(EY)^2}\right)$	YES
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric Two variants calculated: 1) escapement, and 2) spawners.	YES
	Juvenile Survival to first mainstem dam	Life stage survival (parr, presmolt, smolt, subyearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam . Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	NO
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	NO
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure "Survival to first mainstem dam and Mainstem Dams". No additional points of detection (i.e. screw traps) are used to calculate survival estimates.	PARTIAL (Relative survival based on PIT Tags)
	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within the Asotin and Tucannon steelhead populations and as appropriate other steelhead populations outside of the Snake DPS, especially the two populations in the Deschutes River. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	PARTIAL
Life Hist ory	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	YES hatchery fish only

	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	YES hatchery fish only
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only.	YES hatchery fish only
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	YES hatchery fish only
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	YES
	Mainstem Arrival Timing (Lower Granite)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	NO
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	YES
	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, premolt, parr, etc.).	YES
	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, premolt, parr, etc.).	YES
	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	YES
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	YES
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	YES
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality.	YES
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	YES
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	PARITAL
	Length of Broodstock Spawner	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	YES
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent"	YES
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks).	YES

	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases).	YES
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities.	PARTIAL
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	PARTIAL

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

Current monitoring and evaluation funding covers most activities listed above. However, funding to monitor potential hatchery/wild interaction, including ratios of hatchery and wild fish in natural spawning areas and genetic monitoring will require commitment of additional resources.

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.

Monitoring and evaluation efforts for the LFH stock in the Snake River primarily consists of conducting creel surveys to document harvest and obtain CWT data. It is not anticipated that creel surveys will have any genetic or ecological effects to listed fish in the Snake River. Anglers fishing on a daily basis would likely have greater effects from disturbance or from incidental hooking (See WDFW's Snake River FMEP).

SECTION 12. RESEARCH

12.1) Objective or purpose.

The ongoing LSRCP program research is designed to:
- Document hatchery rearing and release activities and subsequent adult returns.
- Determine success of the program in meeting mitigation goals and adult returns to Lower Granite Dam, or the Snake River Basin.
- Provide management recommendations aimed at improving program effectiveness and efficiency.
- Provide management recommendations aimed at reducing program impacts on listed fish.

12.2) Cooperating and funding agencies.

Lower Snake River Compensation Program
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation

12.3) Principle investigator or project supervisor and staff.

Mark Schuck Glen Mendel Joe Bumgarner Jerry Dedloff

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

Same as described in Section 2.

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

1) *Monitoring hatchery/wild ratios at LFH Adult trap* - Adult steelhead will be captured and enumerated at the LFH adult trap. Additional ADLV fish may be sacrificed at other permanent or temporary trapping facilities on the Tucannon and Touchet River to document presence and stray rate of fish released into the Tucannon River. See section 2.2.3.
2) *Monitoring incidence of recurrent trapping and presence of stray steelhead and salmon in the adult Trap at LFH* – Adult salmon and steelhead are present at the entrance of the trap at LFH for several months each year. Only systematic trapping occurs to collect broodstock for steelhead or fall Chinook. During that process other fish are trapped, but returned to the river. Using PIT tag detection technology, WDFW will be operating the trap and directing fish immediately back to the river to assess the incidence of re-trapping of local and stray hatchery fish and wild stray fish.

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

September-May (Adult Trapping (LFH, Tucannon, and Touchet) and Creel Surveys). Creel surveys do not encounter unmarked fish. Trapping on the Tucannon and Touchet Rivers are covered under HGMP's for each rivers endemic stock program. Takes for these rivers are not listed in the take tables at the back of this document.

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

Handling of listed fish will generally be restricted to enumeration and release at the site of capture (LFH adult trap). Listed fish will be anesthetized prior to handling.

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

Injury due to capture is inevitable. Injuries from trapping can be lethal. However, precautions have been taken to make sure trapping PVC pipes are free of sharp objects that may injure fish.

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".

See "Take" Table 2.

12.10) Alternative methods to achieve project objectives.

Not Applicable.

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

Not Applicable.

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.

Not Applicable

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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 Applicant:

Certified by_____ Date:_____

SECTION 15. PROGRAM EFFECTS ON OTHER (NON-ANADROMOUS SALMONID) ESA-LISTED POPULATIONS. Species List Attached (Anadromous salmonid effects are addressed in Section 2)

As of August 5, 2009, there are 44 separate listings of Federal Status endangered/threatened species within the State of Washington (http://ecos.fws.gov), 58 listings in Oregon, and 22 listings in Idaho. In the lists below (Table 1-3), are all non-salmonid listed species and their current status ratings. Of the following species listed only the plant species Spalding's Catchfly is confirmed to be found in the area where the Snake River Stock production program occurs (i.e. Snake River, Grande Ronde River). Species such as the Gray Wolf, the Grizzly Bear, the Canadian Lynx, and the northern spotted owl were once likely found in the Grande Ronde River basin, but their current existence is not verified. The geographic distributions of the other listed species were generally limited to the Cascade Mountain Range, the Selkirk Mountains in NE Washington, the Willamette Valley (Oregon), Puget Sound and Coastal areas.

Table 1. List of current ESA listed species (animal and plant) within the State of Washington.

Status Rating	Species
	ANIMALS
Endangered	Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Threatened	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
Endangered	Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)
Endangered	Curlew, Eskimo (*Numenius borealis*)
Endangered	Deer, Columbian white-tailed (*Odocoileus virginianus leucurus*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Threatened	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
Threatened	Otter, southern sea except where EXPN (*Enhydra lutris nereis*)
Threatened	Owl, northern spotted (*Strix occidentalis caurina*)
Endangered	Pelican, brown (*Pelecanus occidentalis*)
Threatened	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Sea turtle, green (*Chelonia mydas*)
Endangered	Sea turtle, leatherback (*Dermochelys coriacea*)
Threatened	Sea-lion, Steller eastern pop. (*Eumetopias jubatus*)
Endangered	Sea-lion, Steller western pop. (*Eumetopias jubatus*)
Endangered	Whale, humpback (*Megaptera novaeangliae*)
Endangered	Whale, killer Southern Resident DPS (*Orchinus orca*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
	PLANTS
Threatened	Paintbrush, golden (*Castilleja levisecta*)
Endangered	Stickseed, showy (*Hackelia venusta*)
Threatened	Howellia, water (*Howellia aquatilis*)
Endangered	Desert-parsley, Bradshaw's (*Lomatium bradshawii*)
Threatened	Lupine, Kincaid's (*Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*))
Threatened	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
Endangered	Checkermallow, Wenatchee Mountains (*Sidalcea oregana var. calva*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Threatened	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

Table 2. List of current ESA listed species (animal and plant) listed and occurring in the State of Oregon.	
Status Rating	**Species**
ANIMALS	
Endangered	Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Endangered	Butterfly, Fender's blue (*Icaricia icarioides fenderi*)
Threatened	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
Endangered	Condor, California U.S.A. only (*Gymnogyps californianus*)
Endangered	Curlew, Eskimo (*Numenius borealis*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Threatened	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
Threatened	Otter, southern sea except where EXPN (*Enhydra lutris nereis*)
Threatened	Owl, northern spotted (*Strix occidentalis caurina*)
Endangered	Pelican, brown (*Pelecanus occidentalis*)
Threatened	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Sea turtle, green (*Chelonia mydas*)
Endangered	Sea turtle, leatherback (*Dermochelys coriacea*)
Threatened	Sea turtle, loggerhead (*Caretta caretta*)
Threatened	Sea-lion, Steller eastern pop. (*Eumetopias jubatus*)
Endangered	Sea-lion, Steller western pop. (*Eumetopias jubatus*)
Endangered	Whale, humpback (*Megaptera novaeangliae*)
Endangered	Whale, killer Southern Resident DPS (*Orchinus orca*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
PLANTS	
Threatened	Paintbrush, golden (*Castilleja levisecta*)
Endangered	Rock-cress, McDonald's (*Arabis macdonaldiana*)
Threatened	Howellia, water (*Howellia aquatilis*)
Endangered	Desert-parsley, Bradshaw's (*Lomatium bradshawii*)
Threatened	Lupine, Kincaid's (*Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*))
Threatened	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Endangered	Daisy, Willamette (*Erigeron decumbens var.decumbens*)
Threatened	Four-o'clock, MacFarlane's (*Mirabilis macfarlanei*)
Endangered	Fritillary, Gentner's (*Fritillaria gentneri*)
Endangered	Lily, Western (*Lilium occidentale*)
Endangered	Lomatium, Cook's (*Lomatium cookii*)
Endangered	Meadowfoam, large-flowered woolly (*Limnanthes floccosa ssp. Grandiflora*)
Endangered	Milk-vetch, Applegate's (*Astragalus applegatei*)
Endangered	Popcornflower, rough (*Plagiobothrys hirtus*)
Threatened	Thelypody, Howell's spectacular (*Thelypodium howellii spectabilis*)
Endangered	Wire-lettuce, Malheur (*Stephanomeria malheurensis*)

Table 3. List of current ESA listed species (animal and plant) listed and occurring within the State of Idaho.	
Status Rating	**Species**
ANIMALS	
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Endangered	Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)
Endangered	Curlew, Eskimo (*Numenius borealis*)Limpet, Banbury Springs (*Lanx sp*.)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Snail, Bliss Rapids (*Taylorconcha serpenticola*)
Endangered	Snail, Snake River physa (*Physa natricina*)
Endangered	Snail, Utah valvata (*Valvata utahensis*)
Endangered	Springsnail, Bruneau Hot (*Pyrgulopsis bruneauensis*)
Threatened	Squirrel, northern Idaho ground (*Spermophilus brunneus brunneus*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
PLANTS	
Threatened	Howellia, water (*Howellia aquatilis*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Threatened	Four-o'clock, MacFarlane's (*Mirabilis macfarlanei*)
Threatened	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

15.1) List all ESA permits or authorizations for all non-anadromous salmonid programs associated with the hatchery program.

Section 10 permits, 4(d) rules, etc. for other programs associated with hatchery program.
Section 7 biological opinions for other programs associated with hatchery program.

See Section 2.1

15.2) Description of non-anadromous salmonid species and habitat that may be affected by hatchery program.

Spalding's Catchfly

General species description and habitat requirements (citations).

Citation: Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular Plants of the Pacific Northwest, Part 2: *Salicaceae to Saxifragaceae*. University of Washington Press, Seattle. 597 pp.

The Spalding's Catchfly is a long-lived, herbaceous perennial, 8-24 inches tall, typically with one stem, but can have several. Each stem bears 4-7 pairs of lance shaped leaves 2 to 3 inches in length. The light green foliage and stem are lightly to more typically densely covered with sticky hairs. The cream-colored flowers are arranged in a spiral at that top of the stem. The outer, green portion of the flower forms a tube, ~1/2 inch long with ten distinct veins running it's length. The flower consists of 5 petals, each with a long narrow "claw" that is largely concealed by the calyx tube and a very short "blade", or flared portion at the summit of the claw. Four (sometimes as many as 6) short petal-like appendages are attached inside and just below each blade.

The species begins to flower in mid- to late July, with some individuals still flowering by early September. Most other forbs within it's habitat have finished flowering when *S. spaldingii* is just hitting its peak. A majority of individuals have developed young fruits by mid- to late August.

S. spaldingii occurs primarily within open grasslands with a minor shrub component and occasionally with in a mosaic of grassland and ponderosa pines. It is most commonly found at elevations of 1900-3050 feet, near the lower tree line, with a preference for northerly-facing aspects. The species is primarily restricted to mesic (not extremely wet nor extremely dry) prairie or steppe vegetation that makes up the Palouse Region in SE Washington.

Local population status and habitat use (citations).

Within the State of Washington, S. spaldingii, is found in Asotin, Lincoln, Spokane and Whitman counties, with a status listing of 'threatened". A total of 28 populations have been identified (FR# 1018-AF79, Vol 66, No. 196, p. 51598). This plant is threatened by a variety of factors including habitat destruction and fragmentation resulting from agricultural and urban development, grazing and trampling by domestic livestock and native herbivores, herbicide treatment and competition from nonnative plant species (Gamon 1991; Schassberger 1988). It is currently estimated that 98% of the original Palouse prairie habitat has been lost to the mentioned activities (Gamon 1991). Each of the populations documented are generally very small, and are currently quite fragmented, raising questions about their long-term viability.

Site-specific inventories, surveys, etc. (citations).

Site-specific findings in Franklin County not available.

15.3) Analysis of effects.

Spalding's Catchfly
Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects).

To the best of our knowledge, the program as described in this HGMP will not have direct, indirect, or cumulative effects on the listed species. The surrounding habitat associated with this hatchery mitigation program will not be altered, which would be the only source of "take" possible to the listed species. Interactions with the fall Chinook will not occur.

Identify potential level of take (past and projected future).

None (past or projected future)

Hatchery operations - *water withdrawals, effluent, trapping, releases, routine operations*

and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.)

Operation of the Adult Trap or incubation/rearing areas at Lyons Ferry will not affect (directly or indirectly) the existence of the listed species in the area. Habitat requirements for the species do not apply at the Lyons Ferry adult trap or hatchery facility. Activities at Lyons Ferry all take place on existing hatchery grounds. No new construction activities are planned for the program that could impact the listed species. Effluent from the hatchery falls below state water quality standards guidelines, and is therefore not a concern.

Fish health - pathogen transmission, therapeutics, chemicals.

Not Applicable – Pathogens would not be transmitted between the species.

Ecological/biological - competition, behavioral, etc.

Not Applicable - Non-overlapping habitats between the fall Chinook and the flower.

Predation -

Not Applicable - Hatchery fall Chinook do not prey on the flower.

Monitoring and evaluations - surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).

When/If electrofishing surveys occur to collect genetic samples, little to no impact should be expected as survey areas will likely be out of the range of the listed species.

Habitat - modifications, impacts, quality, blockage, de-watering, etc.

Modifications to the surrounding hatchery areas are not planned at this time, so no loss of potential habitat to the listed species is expected.

15.4 Actions taken to mitigate for potential effects.

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

No actions are considered necessary at this time. Disturbance to Bald Eagles will be minimal in the area, and land disturbance where Spalding's Catchfly may habitat will not occur over the course of the program.

15.5 References

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Appendix 1. Estimated listed salmonid take levels by hatchery activity (Broodstock Collection).

Listed species affected: _Summer Steelhead__ ESU/Population: Snake River Activity: Broodstock Collection, spawning, rearing and releases, and Genetic Monitoring of adult hatchery population

Location of hatchery activity: Lyons Ferry Adult Trap, Dates of activity: September-November Hatchery program operator: Jon Lovrak

Type of Take	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	0	100	0
Capture, handle, tag/mark/tissue sample, and released d)	0	0	0	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	0	0	5	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through migrational delay at LFH Adult Trap.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Estimated number of natural origin summer steelhead adults that may be handled on an annual basis at LFH adult trap.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish from adult trapping.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Appendix 2. Estimated listed salmonid take levels by Research/Monitoring/Evaluation activity.

Listed species affected: _Summer Steelhead_ ESU/Population: Snake River Activity: Research/Monitoring/Evaluation

Location of hatchery activity: Lyons Ferry Dates of activity: NA___ Research/ Monitoring / Evaluation program operator: Mark Schuck__

Type of Take	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	0	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	0	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	0	0	0	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish though snorkeling.
b. Take (non-lethal) of juveniles/smolts captured and marked for smolt trap efficiency tests.
c. Take associated with smolt trapping operations, electrofishing, and hook and line methods to estimate residuals, where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to juvenile bio-sampling (length/weight, scales, DNA) of fish collected through electrofishing surveys. Adults would be from trapping on tributaries for broodstock feasibility.
e. Listed fish removed from the wild and collected for use as broodstock
f. Intentional mortality of listed fish during electrofishing.
g. Unintentional mortality to listed fish from electrofishing surveys, or adult trapping.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.