Oregon
John A. Kitzhaber, MD, Governor

Department of Fish and Wildlife
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May 2, 2011

Mr. Rob Jones
NOAA Fisheries Service
Salmon Recovery Division
1201 NE Lloyd Blvd., Suite 1100
Portland, Oregon 97323

Dear Mr. Jones:

Attached is the Hatchery and Genetic Management Plan (HGMP) for the Imnaha summer steelhead hatchery program operated by Oregon Department of Fish and Wildlife. This HGMP was completed in consultation with program co-managers and is consistent with provisions of U.S. v. Oregon and associated co-manager agreements. We are submitting this HGMP as an application for federal Endangered Species Act Section 10 permit.

Should you have questions regarding this HGMP please contact Ms. Colleen Fagan at 541-962-1835 or myself at 541-962-1825.

Sincerely,

Bruce Eddy
Grande Ronde District Manager
Oregon Department of Fish and Wildlife

Enclosure

c: Joe Krakker – LSRCP
Mark Chilcote – NMFS
Jonathan McCloud – BPA
Ron Costello – BPA
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HATCHERY AND GENETIC MANAGEMENT PLAN
(HGMP)

Hatchery Program:	**Lower Snake River Compensation Plan (LSRCP) Little Sheep Creek Summer Steelhead Hatchery Program**
Species or Hatchery Stock:	**Summer Steelhead (Stock # 029)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**Imnaha / Snake River / ColumbiaBasin**
Date Submitted:	**December 2002**
Date Last Updated:	**May 2011**

SECTION 1.GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lower Snake River Compensation Plan (LSRCP), Little Sheep Creek Summer Steelhead Hatchery Program.

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

Imnaha Basin wild summer steelhead (*Oncorhynchus mykiss)* and Oregon hatchery steelhead stock # 029 are part of the Snake River Steelhead Distinct Population Segment (DPS), listed as a threatened species under the federal Endangered Species Act (ESA), in August 1997. Their listing status was reaffirmed in January 2006. As a result of incorporating listed wild fish from Little Sheep Creek into the Little Sheep Hatchery broodstock, hatchery progeny are considered part of the DPS; however, only naturally produced fish and hatchery fish with an intact adipose fin are covered by Section 4(d) protective regulations in the 2006 rule. Additionally, Imnaha Basin summer steelhead are within the range of the Columbia Basin bull trout DPS, which was listed as threatened under the ESA in June 1998 and Snake River spring/summer and fall Chinook ESU's, which were listed as a threatened species under the ESA in April 1992. The bull trout, steelhead, and resident Columbia basin redband trout are also listed as sensitive species under Oregon's Sensitive Species Rule (OAR 635-100-0040).

1.3) Responsible organization and individuals.

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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 - Program funding/oversight
2. Confederated Tribes of the Umatilla Indian Reservation – Co-managers
3. Nez Perce Tribe – Co-managers

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

The program is part of the federally mandated Lower Snake River Compensation Plan (LSRCP) mitigation program funded through the US Fish and Wildlife Service and designed to mitigate for fish losses at the Lower Snake River dams. The LSRCP steelhead program in Oregon includes an integrated Grande Ronde basin program as well. Staff are shared between the two programs at an approximately 70% Grande Ronde basin and 30% Imnaha basin level. Combined program staff includes: (2) Hatchery Managers, one at Wallowa Hatchery and one at Irrigon Hatchery, (7 ½) technician positions, (1) trades maintenance worker position and (1) office manager position.Annual operation and maintenance costs for the Imnaha portion of the FY 2009 program include: an estimated $150,000 for Wallowa Hatchery, which includes Little Sheep Creek facility operations and $260,000 for Irrigon Hatchery.

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

Adult Collection and Holding: Adult summer steelhead are collected in the Imnaha basin (HUC-17060105) at the Little Sheep Creek facility located on Little Sheep Creek (RK 8.4), 11 km southwest of the town of Imnaha, Oregon (Figure 1).

Spawning: Fish are spawned at the Little Sheep Creek facility. Gametes (eggs and sperm) are either fertilized at Little Sheep or transported to the Wallowa Hatchery for fertilization and incubation.

*Early Incubation:*Incubation of eggs from green egg to eyed egg stage occurs at Wallowa Hatchery. Wallowa Hatchery is located along Spring Creek (RKM 1), a tributary to the Wallowa River at RK 66.8, and one km west of Enterprise, Oregon (Figure 1).

Final incubation and Rearing: Final incubation (eyed egg to hatching) and rearing to smolt size occurs at Irrigon Hatchery. Irrigon Hatchery is located along the south bank of the Columbia River, above John Day Dam, near Irrigon, Oregon.

Acclimation to Little Sheep on-station release: Smolts are transferred from Irrigon Hatchery in March to an acclimation pond at the Little Sheep Creek facility. Smolts are acclimated for four weeks, at which time a screen is pulled and a four week volitional release begins into Little Sheep Creek.

Direct Stream Release: In addition, smolts are transported from Irrigon Hatchery in April and released directly into Big Sheep Creek (RKM 14.5).

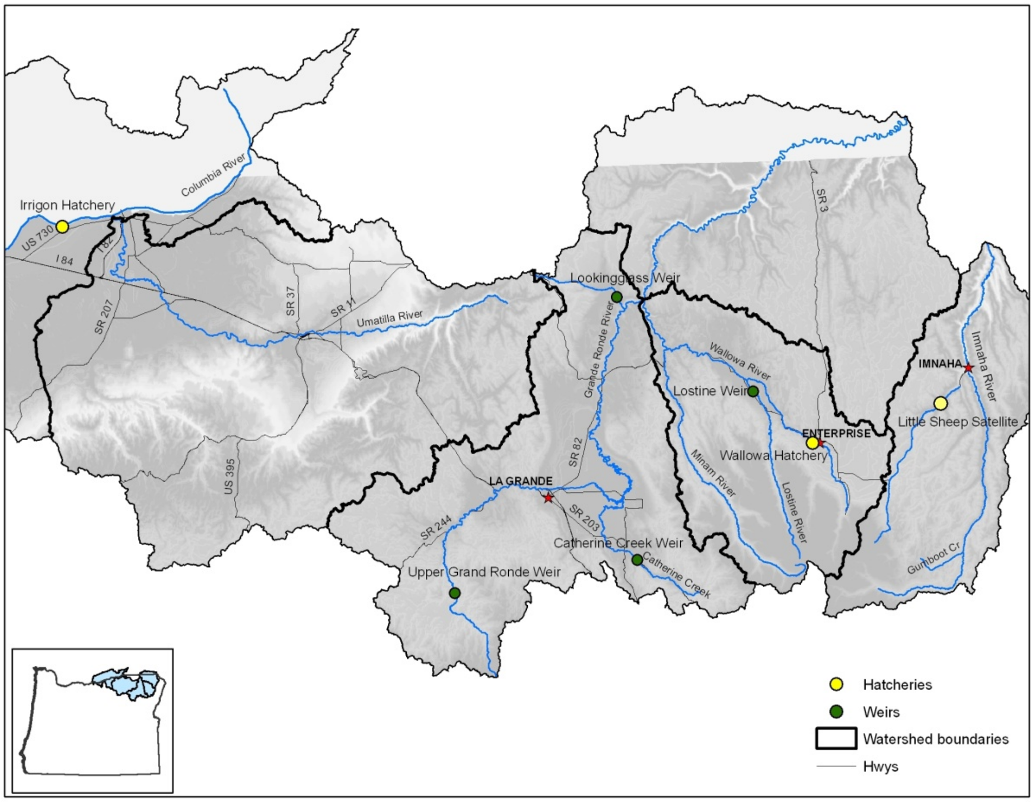


Figure 1. Map of the Grande Ronde and Imnaha basins indicating the location of Wallowa Hatchery and Little Sheep Creek Facility.

1.6) Type of program.

Integrated Harvest: A combination of harvest augmentation “to increase sport and/or commercial harvest opportunities by releasing artificially propagated salmon smolts" (IMST 2001) and supplementation “to increase the abundance of an existing, but depleted population". IMST has defined supplementation as "the use of artificial propagation in the attempt to maintain or increase natural production while maintaining long-term fitness of the target population, and keeping the ecological and genetic impacts on non-target populations within specified biological limits" (RASP 1992).

1.7) Purpose (Goal) of program.

The goal of this program is to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River Dams, and to provide supplementation to natural spawning adults. This hatchery program is part of the Lower Snake River Compensation Plan (LSRCP). The purpose of the LSRCP is to mitigate for 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, page 14)

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. vs. 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 Little Sheep Creek summer steelhead hatchery program was designed to escape 2,000adults to above Ice Harbor Dam for harvest, broodstock, and natural escapement. Based upon this adult goal and an estimated 0.61% smolt-to-adult survival rate, the target for smolt production was set at 330,000 fish. In recent years smolt production goals have been lowered to 215,000 to reduce surplus adult escapement. Escapement goals back to the project area are 500 adults to Big Sheep and 250 adults to Little Sheep. 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:

- 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;
- Reestablish sport and tribal fisheries;
- Establish an annual supply of brood fish that can provide an egg source capable of meeting mitigation goals. The mitigation goal is 215,000 smolts (165,000 to Little Sheep and 50,000 to Big Sheep) which requires trappingapproximately 126 broodstock adults annually;
- Restore and maintain the natural spawning population;

- Provide adults that contribute towards meeting the LSRCP mitigation goal for the Imnaha Basin; and
- Minimize the impacts of the program on other indigenous fish species.

1.75) Draft Recovery Plan Goals

Background

The program goal to restore a viable natural population of summer steelhead in the Imnaha River will be guided in part by the recovery plan currently under development for steelhead belonging to the Snake River DPS. The primary units of the recovery plan are Major Population Groups (MPGs). The steelhead that exist in the Imnaha basin represent one of these MPGs. For the DPS to achieve recovery, all MPGs must be viable. A determination of whether or not a MPG is viable is dependent on the status of the constituent populations. In the case of the Imnaha MPG, there is only one population (the Imnaha) and therefore this population must achieve low risk status for the MPG to be classified as viable. The Imnaha population is believed to have been historically distributed throughout the Imnaha basin (ICTRT 2010a). From a conservation perspective the goal for the Imnaha hatchery steelhead program is to balance the adverse short-term impacts on diversity versus the long-term risk of population extirpation.

1.8) Justification for the program.

The Lower Snake River Compensation Plan is a congressionally mandated program pursuant to PL99-662.The Little Sheep Hatchery Program provides adult steelhead for recreational and tribal harvest within the Lower Snake River Compensation Plan mitigation area (Snake River and tributaries above Ice Harbor Dam). The program utilizes an endemic steelhead hatchery stock that was founded on summer steelhead indigenous to Little Sheep Creek. Wild adults from Little Sheep Creek are incorporated within the broodstock annually and hatchery origin adults are allowed to spawn naturally in Little Sheep Creek each year. A portion of returning adults and smolts are also released into Big Sheep Creek with the intention that they will help boost natural steelhead production.

- Current program smolt production is reduced by 35% from the original LSRCP goal of 330,000 smolts at 5 fish per pound (fpp) to an adjusted goal of 215,000 smolts at 5 fpp. This program reduction responded to exceeding the established goal of 2,000 adults to the Compensation Plan area. We plan to continue a reduced level of production into the future in order to diminish potential program impacts by reducing potential strays, surplus adult escapement, and the number of residual smolts.

- Release of all production fish will occur at the smolt stage thereby reducing potential interaction with rearing of naturally produced fish.

1.9) List of program “Performance Standards” and associated “Performance Indicators”, shown in Table 1.

1. Imnaha basin steelhead production contributes to fulfilling tribal trust responsibility mandates and treaty rights.
   - *1.1. Estimated number of program steelhead harvested in tribal fisheries by run year.*
   - *1.2. Proportion of program harvest by tribal fisheries by run year.*

2. Program contributes to mitigation requirements.
   - *2.1. LSRCP compensation area harvest and total return estimates by run year.*
   - *2.2. Estimated recreational angler days in the Imnaha basin by run year.*
   - *2.3. Estimated total hatchery adult harvest and escapement.*

3. Fish are produced in a manner enabling effective harvest while avoiding over-harvest of non-target fish.
   - *3.1. Run year harvest estimate by fishery.*
   - *3.2. Estimated run year catch of listed species in associated fisheries.*
   - *3.3. Run year recreational angler days in the Imnaha basin fishery.*

4. Release groups are marked to enable determination of impacts and benefits in fisheries.
   - *4.1. Number of marked and unmarked fish reported in each fishery produces accurate estimates of catch and harvest.*

5. Efficiency of hatchery program in producing smolts.
   - *5.1. Survival by life stage for hatchery progeny.*

6. Hatchery program achieves sustainability.
   - *6.1. Number of broodstock collected.*
   - *6.2. Number of smolts released.*
   - *6.3. Adult returns to compensation area.*
   - *6.4. Angler days and harvest in annual fisheries.*

7. Broodstock collection does not reduce potential juvenile production in natural rearing areas.
   - *7.1. Number of wild spawners passing to natural spawning areas.*
   - *7.2. Number of wild fish handled during broodstock collection.*

7.3. Observed mortality of wild adults at trapping locations.

8. Releases are marked to allow evaluation of effects on local natural populations.
   8.1. Visible mark ratio in hatchery release groups.

9. Hatchery produced adults do not exceed appropriate proportions of natural spawners.
   9.1. Monitor proportion of hatchery fish in key natural spawning areas and use this plus other information to estimate the proportion of hatchery fish in the entire Imnaha population on an annual basis.
   9.2. Marked proportion of adults observed during annual spawning surveys.

10. Juveniles are released after sufficient acclimation to maximize homing ability to intended locations.
    10.1. Length of acclimation period.
    10.2. Proportion of adult returns to intended location.
    10.3. Proportion of hatchery fish in key steelhead natural spawning areas.

11. Artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.
    11.1. Scientifically based experimental design, with measurable objectives and hypotheses.

12. Monitoring and evaluation occurs on an appropriate schedule and scale to assess progress toward achieving the experimental objective and evaluate the beneficial and adverse effects on natural populations.
    12.1. Monitoring and evaluation framework including detailed timeline.
    12.2. Annual and final reports.

13. Facility operation complies with applicable fish health and facility operation standards and protocols.
    13.1. Annual reports indicating level of compliance with applicable standards and criteria.

14. Effluent from artificial production facilities will not detrimentally affect populations.
    14.1. Discharge water quality compared to applicable water quality standards and guidelines.

15. Water withdrawals and diversion structures used in operation of artificial production facilities will not prevent access to natural spawning areas, affect spawning behavior of listed natural populations, or impact juvenile rearing.
    15.1. Water withdrawals compared to applicable passage criteria.
    15.2. Water withdrawal compared to NMFS juvenile screening criteria.
    15.3. Proportion of diversion of total stream flow between hatchery facility

intake and out-fall.

16. Releases do not introduce new pathogens into local populations, and do not increase the levels of existing pathogens.
    16.1. Certification of juvenile fish health immediately prior to release.

17. Any distribution of carcasses or other products for nutrient enhancement meets appropriate disease control regulations and guidelines.
    17.1. Number and location of carcasses distributed for nutrient enrichment.
    17.2. Disease examination of all carcasses to be used for nutrient enrichment.
    17.3. Statement of compliance with applicable regulations and guidelines.

18. Weir/trap operations do not result in significant stress, injury or mortality in natural populations.
    18.1. Adult trapping mortality rate for wild fish.

19. Juvenile production costs are comparable to or less than other regional programs designed with similar objectives.
    19.1. Total cost of program operation.
    19.2. Average cost of similar operations.

20. Non-monetary societal benefits for which the program is designed are achieved.
    20.1. Recreational fishery angler days.

21. Fish health problems associated with hatchery production does not adversely impact wild fish productivity.
    21.1. Health condition and history of fish released.

In addition, Table 1 also represents the union of performance standards described by the Northwest Power and Conservation Council, 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 (Beasley 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.

Table 1. - Standardized Performance Measures and their associated Definitions and Performance Standards for status, trends, and hatchery effectiveness monitoring.

Performance Measure	Definition	Performance Standards

Abundance	Adult Escapement to Weirs on Little Sheep, Lightning and Cow creeks	Number of hatchery and natural adults (including residuals) that have escaped to weirs on each Creek. Population based measure. Calculated with mark-recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries. Provides total escapement and wild only escapement.	2.1, 2.3, 5.1, 9.1, 9.2, 18.1
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas, in Camp Creek as an index area. Reported as redds and/or redds/km.	6.3, 7.1, 9.1, 9.2
	Spawner Abundance in Little Sheep Creek	In-river: Estimated total number of spawners on the spawning ground. Calculated as the number of fish that return to the Little Sheep Creek weir, minus broodstock removals and weir mortalities. Calculated in two ways: 1) total spawner abundance, and 2) wild spawner abundance which multiplies by the proportion of natural-origin (wild) fish. Total number of fish actually used in hatchery production. Partitioned by gender and origin.	6.1, 6.3, 7.1, 7.2, 7.3, 9.1
	Estimate of Total Spawner Abundance for Imnaha Population	Using survey and count information collected via activities described above and additional information and surveys as appropriate to develop an estimate of the annual number of steelhead that spawn in the Imnaha basin.	
	Hatchery Fraction at Little Sheep, Lightning and Cow creeks	Percent of fish on the spawning ground that-originated from a hatchery. Uses weir data to determine number of fish released above weir.	6.1, 6.3, 7.1, 7.2, 7.3, 9.1
	Hatchery Proportion of Entire Imnaha Population	Using data collected via activities described above and additional information and surveys as appropriatedevelopan estimate of the proportion of hatchery fish in the steelhead population for the entire Imnaha basin.	
	Ocean/Mainstem Harvest	Number of hatchery fish caught in ocean and mainstem (tribal, sport, or commercial), identified as to-origin	1.1, 1.2, 2.3, 3.1, 4.1, 6.4
	Harvest Abundance in Tributary	Number of fish caught in tributary fisheries (tribal, sport, or commercial), identified as to-origin - hatchery or natural. Made using creel surveys.	1.1, 1.2, 2.3, 3.1, 4.1, 6.4
	Index of Juvenile Abundance on Little Sheep Creek	Parr and hatchery residual abundance estimates using 3-pass electrofishing are made at pre-established transects. Densities (number per 100 m2) are recorded.	5.1, 10.3, 11.1
	Juvenile Emigrant Abundance on Little Sheep Creek	Estimates are made for parr pre-smolts, smolts and the entire migration year using screw trap captures.	5.1, 10.3, 11.1
	Smolts on Little Sheep Creek	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance at the tributary comprised of each juvenile life stage (parr, presmolt, smolt) that survive to first mainstem dam encountered (or other common point in mainstem). 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: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	5.1, 10.3, 11.1
	Run Prediction	Made for hatchery returns (± 95% C.I.) using regression approaches	2.1, 6.3, 10.2

Survival – Productivity	Smolt-to-Adult Return Rate (SAR) and Smolt-to-Adult Survival (SAS)	Smolt-to-Adult Return (SAR), is the number of adult from a given brood year returning to the LSRCP area above Lower Granite Dam divided by the number of smolts that were released 1-5 years prior. Smolt-to-Adult Survival (SAS) is similarly calculated to Bonneville Dam. Adult data is calculated two ways, using coded-wire-tag mark and recovery, and with PIT-tag detections at mainstem dam sites. SAR accounts for all harvest below the LSRCP area. The adult PIT tag detection probabilities at mainstem dams are assumed to be near 100 percent. The number (± 95 confidence intervals) of PIT tagged juveniles arriving at Lower Granite dam is estimated using SURPH 2.2 or PIT Pro 4.8 programs. The variance around the SAR estimate using PIT tags is then 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: $Var\left(\frac{X}{Y}\right)=\left(\frac{EX}{EY}\right)^2\cdot\left(\frac{Var(Y)}{(EY)^2}\right)$	1.1, 1.2, 2.1, 2.2, 3.1, 3.3, 4.1
	Progeny-per-Parent Ratio (P:P)	Adult to adultcalculated for naturally spawning fish and hatchery spawning fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir.Two variants calculated: 1) escapement, and 2) spawners. For P:P ratios calculated for the natural environment, the confounding effect of spawner density on this metric will be accounted for.	1.1, 1.2, 2.1, 2.2, 3.1, 3.3, 4.1
	Juvenile Survival to first mainstem dam	Smolt survival calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Total number of smolts surviving to Lower Granite Dam is then found by multiplying the survival rate to Lower Granite Dam by the number of smolts released.	5.1, 10.1, 11.1
	Juvenile Survival to all Mainstem Dams	Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s) - estimatedusing PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tagged fish are released from the hatchery.	5.1, 10.1, 11.1
	Post-release Survival	Post-release survival of hatchery-origin fish is calculated as described above in the performance measure “Survival to first mainstem dam and subsequent Mainstem Dams”. No additional points of detection (i.e. screwtraps) are used to calculate survival estimates.	5.1, 10.1, 11.1
	Comparative Survival Study	Using PIT tag technology as described above, smolt survival to Bonneville Dam will be compared for fish that outmigrate through the hydrosystem versus those that are collected at Lower Granite Dam and transported to Bonneville Dam.	5.1, 11.1
	Out-of-Basin Stray Rate (percentage)	Estimate of the number and percent of hatchery-origin fish returning to a river basin other than that into which they were released. Calculated from total known-origin CWT recoveries. Data is expanded for un-tagged fish released.	9.1, 10.2, 10.3, 11.1
Geneti c	Genetic Diversity	Indices of genetic diversity - measured within a tributary (heterozygosity - allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	5.1, 9.1, 11.1

	Relative Reproductive Success (RRS) (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 with the development of highly polymorphic molecular markers. All fish released above the weir are being sampled for pedigree genetic analysis.	5.1, 9.1, 11.1
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. Assessed via scale method, or mark recoveries.	
	Age–at–Return	Age distribution of hatchery spawners. Assessed via scale method or mark recoveries.	6.1, 6.3, 11.1
	Size-at-Return	Size distribution of spawners using fork length (mm). Raw database measure only. Data obtained at weirs or during carcass surveys.	6.1, 6.3
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected from hatchery juveniles sampled prior to release.	10.1
	Condition of Juveniles at Emigration	Condition factor is calculated from pre-release length and weight measurements 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).	10.1
	Percent Females (adults)	The percentage of females returning to hatchery facilities.	2.3, 6.1
	Adult Run-timing	Arrival timing of adults at hatchery facilities calculated Using PIT tag detections at facilities. Reported as the range, 10%, median, 90% percentiles.	11.1
	Spawn-timing	Numbers, gender, and date of spawning recorded by hatchery personnel.	6.1, 7.2
	Juvenile Emigration Timing	Unique detections of juvenile PIT-tagged fish at LGD are used to estimate migration timing for each hatchery-origin release group. 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.	5.1, 10.1, 11.1
	Mainstem Arrival Timing	Unique detections of juvenile PIT-tagged fish at LGD are used to estimate migration timing for each hatchery-origin release group. 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.	5.1, 10.1, 11.1
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).	6.2

	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juveniles. 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 CW 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 hatch, hatch 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.	5.1
	Size-at-Release	Mean fork length measured in millimeters (mm) and mean weight measured in grams (g) of a hatchery release groups. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff.	5.1
	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 (g) and l is the length (mm) (Everhart and Youngs 1992).	5.1
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female - calculated by weight or enumerated by egg counter.	11.1
	Spawn Timing	Spawn date of broodstock by age, sex and-origin. Also reported as cumulative timing and median dates.	11.1
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality.	6.1
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	6.1
	Hatchery broodstock genetics	Fin clips of all hatchery broodstock are collected for genetic analysis. This is a Snake River Basin wide project to genotype each hatchery steelhead stock.	11.1
	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*	13.1, 16.1, 21.1
	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	13.1, 16.1, 21.1
	Length of Broodstock Spawner	Mean fork length (mm) by age of male and female broodstock. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for ageing.	6.1
	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 as either "present" or "absent." ("Marks" refer to adipose or ventral fin clips)	4.1
	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 through a CWT detector or PIT tag detector. (All types of tags)	4.1
	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).	6.1, 10.1
	Chemical Water Quality	Hatchery operational measurements include dissolved oxygen (DO) measured with a hand-held DO meter, pH, and on a quarterly basis measurements of un-suspended and suspended solids in the hatchery effluent.	13.1, 14.1

	Water Temperature	Hatchery operational measure: temperature (°Celsius) – measured continuously at the hatchery with thermographs and daily at acclimation facilities with hand-held devices.	13.1, 14.1

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

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential "Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

Performance indicators that we use to evaluate the performance standards listed in section 1.9 are presented in Table 1. These performance measures are taken from Beasley et al. (2008). The performance indicators are broken into the categories of abundance, survival-productivity, distribution, genetic, life history, habitat, and in-hatchery groups. Within each of these groups are the specific indicator(s) and brief description of the definition/method(s).

1.10.1) "Performance Indicators" addressing benefits.

(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Evaluation of the Little Sheep program utilizes the performance standards and associated performance indicators in section 1.9. Table 1 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Little Sheep project performs a comprehensive review of the program to include adaptive management recommendations addressing the benefits and risks of the program. The recommendations will incorporate the findings from studies conducted on the Imnaha and other hatchery programs that may lead to greater program benefits to the natural Imnaha population and attainment of mitigation level adult returns.

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Evaluation of the Little Sheep program utilizes the performance standards and associated performance indicators in section 1.9. Table 1 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Little Sheep project performs a comprehensive review of the program to include adaptive management recommendations addressing the benefits and risks of the program. These recommendations will incorporate the findings from studies conducted on the Imnaha and other hatchery programs that may lead to a further reduction in program risks to the Imnaha population.

1.11) Expected size of program.

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

Collection is not expected to exceed 120 males and 120 females. Age composition and fecundity of adults varies from year to year which may reduce the number of adult required. However, given normal program adult survival, female fecundity and egg to smolt survival 220 adults (50/50 sex ratio) will produce approximately 330,000 smolts. To produce 215,000 smolts, the current target, only67 males and 63 females will be collected. Naturally-produced fish are incorporated into the broodstock, based annually on the number of natural fish returning to Little Sheep Creek (see section 6.2.3)

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location (Table 2).

Table 2. Target release numbers of Little Sheep Creek stock steelhead in the Imnaha Basin.

Life Stage	Release Location	Annual Release Level
Yearling	Big Sheep Creek	50,000[1]
Yearling	Little Sheep Creek Facility	165,000[1]
Fingerling	Big Sheep Creek or KinneyLake	50,000[2]

[1] Current level may be adjusted upon agreement among co-managers and acceptance through *U.S. vs. Oregon* process.
[2] Represents a place holder for occasional egg-take overrun and residual fish.

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

The 1989 to 1993 summer steelhead (stock 029) brood reared at Irrigon Hatchery and released into Little Sheep Creek survived at an average rate of 0.49% and were caught primarily in tribal gillnet (Columbia Basin) and other freshwater sport fisheries (Lewis, 1999). The harvest rate of summer steelhead stock 029 within the Imnaha basin averaged 110 per year for run years 1991 through 1996. Harvest and escapement has only occasionally met the mitigation goal of 2,000 fish above Ice Harbor Dam through 1999, but has consistently exceeded adult returns from 2000 to 2006 (Table 3). Returns in 2010 are predicted to be in excess of 10,000 adults. Smolt to adult survival data has not been updated since 2000 (Table 4).

Table 3. Adult harvest and escapement (run reconstruction) for Little Sheep Creek hatchery summer steelhead, 1988-2006.

Run Year	Ocean	Columbia R. Net[1]	Columbia R. Sport	Deschutes[2]	Snake R. Sport[3]	Escapement[4]	Run Year Total
1987-88	0	168	14	7	2	802	993
1988-89	0	306	73	0	147	306	832
1989-90	15	494	181	159	302	1,051	2,202
1990-91	0	269	12	237	218	411	1,147
1991-92	0	908	255	92	481	947	2,683
1992-93	0	1,120	478	102	410	2,017	4,127
1993-94	4	183	101	20	32	144	484
1994-95	2	62	61	19	35	294	473
1995-96	0	89	257	6	172	465	989
1996-97	0	141	40	33	224	1,480	1,942
1997-98	0	171	15	16	254	1,127	1,583
1998-99	0	59	95	6	246	405	811
1999-00	0	82	199	6	24	555	866
2000-01	4	66	271	46	226	1,326	1,939
2001-02	0	224	423	227	1,301	4,029	6,204
2002-03	0	56	430	88	521	2,661	3,756
2003-04	0	120	154	33	1,067	3,843	5,217
2004-05	0	38	108	35	514	3,057	3,752
2005-06	3	86	507	26	939	3,526	5,087
Ave Harvest/ Escapement	**1**	**253**	**178**	**73**	**465**	**1,287**	**2,257**
Ave % of run	**0.1%**	**11.2%**	**7.9%**	**3.2%**	**20.6%**	**57.0%**	**100.0%**

[1]Includes Treaty net, ceremonial and subsistence, and test fisheries.
[2] Includes sport and tribal ceremonial and subsistence fisheries.
[3] Includes Snake River and tributaries (Program Compensation Area).
[4] Includes recoveries at hatchery weirs and within and outside the SnakeRiver Basin (includes some strays; most recoveries are within the Program Compensation Area).

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

Initial adult collection for the program occurred in 1982. Resulting smolt releases began in 1983.

Table 4. Smolt-to-adult survival for Little Sheep Creek hatchery steelhead based on coded-wire tag recoveries, 1986-2001 brood years. An acclimated versus direct-release experiment was conducted from brood years 1989-1995.

Brood Year	Tag Code	Date Released	Number Released	Experimental Group	Total Adult Recoveries	Estimated Survival
1986	74122	5/5/87	47,836	Production	85	0.18%
1987	74033	4/14/88	27,329	Production	123	0.45%
1987	74034	4/14/88	27,545	Production	167	0.61%
BY87 Totals			54,874		290	0.53%
1988	74656	4/24/89	27,461	Production	80	0.29%
1988	74657	4/24/89	27,235	Production	91	0.33%
BY88 Totals			54,696		171	0.31%
1989	75124	4/17/90	26,363	Production	267	1.01%
1989	75125	4/17/90	26,164	Production	315	1.20%
BY89 Totals			52,527		582	1.11%
1990	75355	4/23/91	23,948	Direct Stream	134	0.56%
1990	75356	4/23/91	19,516	Direct Stream	102	0.52%
1990	75357	4/23/91	24,282	Acclimated	327	1.35%
1990	75358	4/23/91	26,644	Acclimated	336	1.26%
BY90 Totals			94,390		902	0.96%
1991	75859	4/27/92	26,895	Acclimated	5	0.02%
1991	75860	4/27/92	24,828	Direct Stream	0	0.00%
1991	75861	4/27/92	27,195	Direct Stream	3	0.01%
1991	75862	4/27/92	26,752	Acclimated	1	0.00%
BY91 Totals			105,670		9	0.01%
1992	76061	4/28/93	24,357	Acclimated	64	0.26%
1992	76062	4/28/93	24,806	Acclimated	52	0.23%
1992	76063	4/28/93	22,560	Direct Stream	52	0.23%
1992	76101	4/28/93	23,382	Direct Stream	62	0.27%
BY92 Totals			95,105		236	0.25%
1993	70321	4/25/94	24,658	Acclimated	107	0.43%
1993	70322	4/25/94	23,876	Acclimated	45	0.19%
1993	70323	4/25/94	22,900	Direct Stream	35	0.15%
1993	70324	4/25/94	24,187	Direct Stream	38	0.16%

BY93 Totals			95,621		225	0.24%
1994	70919	5/1/95	54,985	Direct Stream	159	0.29%
1994	75820	5/1/95	26,980	Acclimated	122	0.45%
1994	75821	5/1/95	26,630	Acclimated	197	0.74%
BY94 Totals			108,595		478	0.44%
1995	71217	4/29/96	26,025	Acclimated	113	0.43%
1995	71218	4/29/96	26,986	Acclimated	127	0.47%
1995	71219	4/29/96	26,342	Direct Stream	39	0.15%
1995	71220	4/29/96	26,315	Direct Stream	23	0.09%
BY95Totals			105,668		302	0.29%
1996	91832	4/15/97	26,175	Acclimated	83	0.32%
1996	91833	4/15/97	28,070	Acclimated	80	0.29%
BY96Totals			54,245		163	0.30%
1997	092323		26,467	Acclimated	158	0.60%
1997	092322		25,399	Acclimated	126	0.50%
BY97 Totals			51,866		284	0.57%
1998	92560	4/13/1999	25,459	Acclimated	204	0.80%
1998	92634	4/13/1999	26,175	Acclimated	223	0.85%
BY98Totals			51,634		427	0.83%
1999	92927	4/12/2000	25,826	Acclimated	578	2.24%
1999	92928	4/12/2000	25,098	Acclimated	502	2.00%
BY99Totals			50,924		1,080	2.12%
BY00 Total	93210	4/11/01	25,282	Acclimated	278	1.10%
BY01 Total	93402	4/10/02	24,695	Acclimated	362	1.47%

1.14) Expected duration of program.

The hatchery program is ongoing and expected to continue as long as the four Lower Snake River dams are operating.

1.15) Watersheds targeted by program.

Little Sheep (0207212) and Big Sheep (020721) creeks

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

The Hatchery Scientific Review Group (HSRG 2009) made two recommendations to managers.

1. Managers should suspend the existing smolt and adult plants into Big Sheep until population status is determined and the releases deemed warranted Managers should identify specific conservation objectives for the Big Sheep Creek component. To accomplish this, managers need to develop abundance and productivity estimates for this population and determine the current population status. Align production goals to meet objectives.

2. Develop a 2-stage stepping stone program for releases into Little Sheep only. The program would consist of an integrated conservation component producing approximately 87,000 smolts (PNI=0.50; pNOB = 65%; pHOS = 65%). This component would initially be produced by collecting 100% of its brood stock from natural-origin adults. Subsequent broods would be maintained with 65% from natural origin and 35% from the conservation hatchery component. The balance of production, 126,000 to 243,000, would be collected from excess conservation hatchery origin adults. The two groups would have differential marks. This solution requires an ability to collect natural-origin adults in the appropriate number (~40 adults).

   The Hatchery Review Team (HRT) considered many benefits and risks while reviewing the Little Sheep program and associated facilities: Irrigon, Wallowa, and Little Sheep (USFWS 2009). The review is located at:http://www.fws.gov/Pacific/fisheries/Hatcheryreview/reports.html.

   The HRT recommends retention of the current Little Sheep steelhead program with implementation of all program-specific recommendations outlined below. The Review Team is very concerned about the continued releases of smolts and large numbers of excess adults into Big Sheep Creek without clearly defined management goals (LI2 and LI11). HRT also asked managers to seriously consider a stepping-stone program consistent with HSRG (2009) recommendations.

Little Sheep	Brief Description of Recommendations	Priority	Additional Costs	Comments
LI1	Restate Goals	Low	$0	HGMP
LI2	Discontinue release of smolts in Big Sheep or SS11	Low	$0	US v Oregon issue
LI3	Adjust adult sliding scale	Low	$0	US v Oregon issue
LI4	Incubation 8,000/tray	Low	$32,000	Expense for potentially no benefit
LI5	Reduce early rearing density	Low	< $200,000	Very expensive for little benefit
LI6	Evaluate early density to predict disease out breaks	Medium	$25,000	Coldwater disease is suspected to be vertically transmitted
LI7	Sample IHNV & Mc 4 weeks prior to release	High	$0	Ongoing, but 4 to 6 week prior to release, Mc not every year
LI8	Retain Spawning Waste	Low	$0	Ongoing in 2010 O&M budget
LI9	Construct permanent storage shed	High	$35,000	Ongoing in 2010 O&M budget
LI10	Consult, and eliminate weir scouring and facilitate passage	High	$100,000	Under discussion with LSRCP
LI11	Monitor Big Sheep releases or discontinue	Low	<$100,000	US V Oregon to discontinue
LI12	Monitor residualism	High	$0	Ongoing
LI13	Review tagging composition	Low	$0	Ongoing

The co-managers have considered the recommendations of HSRG and HRT; however, at this time have decided to retain the current program as proposed in this plan. One of the primary reasons for this decision was the lack of reliable estimates forpHOS for the entire Imnaha population and therefore, the inability to assess the potential impact of hatchery steelhead on the overall population. Likewise, without this information and a means to collect natural fish for hatchery broodstock from across the Imnaha population (not just Little Sheep Creek), implementing HSRG and HRT recommendations as they stated are unlikely to yield significant gains in terms of conserving the Imnaha steelhead population. Once basin-wide estimates of pHOS become available, the co-managers will be in a better position to devise the best approach for managing this hatchery program in a manner that will support the recovery of the natural population. Until this critical information is obtained the managers believe it is premature to make significant changes in this program.

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

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

- An abbreviated HGMP was forwarded to NMFS in 2000 without response.
- An HGMP was forwarded to NMFS in 2002 without response.
- The program has operated under NMFS program Biological Opinions and subsequent remands since 1993. The most recent Biological Opinion was released in 2008.
- Research activities associated with the existing steelhead hatchery program are covered within ODFW 4(d) take allowance.
- Oregon recreational fisheries associated with this program were described in a Regional Fish Management Plan (RFMP) submitted to NMFS in1998 and described again in 2009 using the Fisheries Management and Evaluation Plan (FMEP) format.

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.

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

ESA listed naturally produced summer steelhead belonging to the Imnaha population and returning to Little Sheep Creek are collected and utilized in the hatchery broodstock (see below). Notably, progeny from the Little Sheep Creek hatchery program and wild fish spawned are listed as well; however, adipose fin-clipped hatchery fish are not covered under ESA Section 4(d) protective regulations.

- 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 fallChinook and Columbia Basin bull trout may be affected to a lesser degree (Section 15).

Summer steelhead - Imnaha basin summer steelhead are typical of A-run steelhead from the mid-Columbia and Snake basins. Most adults (60-70 %) return to the basin after one year of ocean rearing. Most of the remainder return as two-salt adults. Occasional three-salt fish are observed among returning spawners. Females generally predominate with a 60/40 sex ratio on average. Returning adults range in size from 45 to 91 cm and 1.4 to 6.8 kg. Adults generally enter the Columbia River from May through August subsequently entering the Imnaha from September through May. Adults utilize accessible spawning habitat throughout the Imnaha basin including Little Sheep Creek above the facility weir.

Spawning begins in March (in lower elevation and spring-fed tributaries) and continues through early June in higher elevation snowmelt systems. Juveniles utilize a wide range of habitats throughout the basin including areas adjacent to smolt release locations. Most (~75-80 %) naturally produced smolts migrate after rearing for two years in freshwater tributaries. A much lower percentage (~20-25 %) migrates after one or three years. Smolt out-migration from the Imnaha basin extends from late winter until late spring; however, peak smolt movement is associated with increased flow events, generally between mid-April and mid-May.

Spring Chinook – Spring Chinook from the Imnaha and Big Sheep populations are potentially impacted by steelhead from this hatchery program. However, the ICTRT in their assessment of these populations concluded that the Big Sheep Chinook population was functionally extinct (ICTRT 2010b). Therefore, the primary concern would be the potential for an adverse impact of the hatchery steelhead program in the Little Sheep Creek (Big Sheep watershed) with respect to the Imnaha Chinook population. The number of natural spawners belonging to this population over the past 10 years has averaged 397, only 0.527 of the Minimum Abundance Threshold (MAT) determined by the ICTRT for this population of 750 fish.A conservation hatchery program also exists for the Imnaha spring Chinook population and has resulted in a substantial number of hatchery fish returning and spawning in the Imnaha basin. In recent years the combined natural and hatchery returns have ranged from several hundred to over 8,000 in 2001.

Adult spring Chinook enter the Columbia River in March through May. Spring Chinook move into summer holding areas in the ImnahaBasin from May through July. Age 4 fish typically dominate returns to the Imnaha basin. Spawning occurs from early August through September and generally peaks in late August. Fry emergence begins in February and extends into May. Fry expand their spatial distribution after emergence in the spring; the extent depending on annual environmental conditions. A substantial portion of the basin population will move into lower river reaches in the fall, and over-winter until smoltification. Generally, juveniles will rear for one year in freshwater, then smolt and begin migration the following spring; smolt migration begins in late January and extends through early July.

Fall Chinook – Fall Chinook in the lower reaches of the Imnaha are considered a segment of the Snake River population and exhibit similar life history. Spawning is generally limited to a few redds located in the lower five miles of the river. Adult Snake River fall Chinook enter the Columbia River in July and migrate into the Snake River from mid-August through October. Spawning occurs from late October through early December, with fry emergence during March and April. Smolt emigration occurs within several months following emergence with peak migration past Lower Granite Dam in late June.

Bull Trout – Both fluvial and resident life history forms of bull trout inhabit the Imnaha River and a number of tributaries. Bull trout utilize suitable habitat within the Imnaha River basin including; mainstem Imnaha River, it's north and south forks and the lower reaches of several smaller tributaries to the upper Imnaha system, Big Sheep Creek and tributaries, Lick Creek, and Little Sheep Creek and several of its small tributaries. Fluvial adults migrate into headwater areas during spring and summer after over-wintering in mainstem tributaries and the Snake River. Spawning for both resident and fluvial adults occurs in September and October. Fry emerge during the spring. Juvenile rearing is restricted to headwater areas where water remains cooler above approximately rkm 67 on the Imnaha and rkm 40 on Big Sheep and Little Sheep creeks.

In 1992, two-pass electro-fishing density estimates in Big Sheep, Lick, Salt and Little Sheep creeks were conducted. That work suggested moderate to high densities of rearing bull trout in streams except Little Sheep Creek. No bull trout were collected from sample reaches of Little Sheep Creek. Densities ranged from 5.6 to 15.8 (1+ and older) fish per $100m^2$ within sample sections containing bull trout in the other Imnaha tributaries, in addition to varying densities of 0-age bull trout (Smith and Knox, 1992). More recent research suggests the resident bull trout population in Big Sheep Creek is less than 2,000 individuals, above and below the WVIC and including all tributaries (USFS 2001). The resident bull trout population in Little Sheep Creek is fewer than 500 (USFS 2003). The resident population of McCully Creek, which formerly flowed into Little Sheep Creek, is estimated at approximately 2,500 individuals (Smith and Knox as referenced in Buchanan et al. 1997). The WVIC is a water diversion in northeastern Oregon that has impacted bull trout and their habitat. The canal was constructed in the 1880s and diverts water from several Imnaha River basin streams between Big Sheep Creek and McCully Creek to Prairie Creek in the Wallowa River Basin.

More recent work summarized by Sausen (2010) suggests the Imnaha bull trout population is one of the regional strongholds as it has multiple age classes, contains fluvial fish, has an anadromous prey base, connectivity with the Snake River, and bull trout are distributed throughout the habitat. Primary spawning activity on the Imnaha River has been documented to occur in the headwaters which lie within wilderness (G.Sausen, USFWS, and B. Knox, ODFW, pers. comm. 2005). Both fluvial and resident life history forms are present. Habitat conditions vary widely across the basin and affect bull trout productivity in some areas. The Imnaha River is rated at low risk of extinction, Little Sheep is rated at high risk of extinction, and Big Sheep is rated "of special concern" (Buchanan, et al 1997). Collectively, the local bull trout populations in the Imnaha and Big Sheep and Lick Creek appear to be relatively stable for the survey period (1999-2008); although, a minimum of 15 years is needed to determine population trends.

Bull trout spawning ground surveys on the Imnaha have been conducted since 2001 and in Big Sheep and Lick Creek since 2000 (Sausen 2010). Between 2001 and 2010, the number of redds counted on surveys on the Imnaha has ranged from 101-262 (Figure 5). In 2006 and 2007, there was a significant shift in documented spawning distribution from past years. In 2006 through 2008, the majority of the spawning bull trout were located from the Imnaha falls to Indian Crossing, whereas, in past years the distribution had higher numbers above the Blue Hole (two miles upstream of Indian Crossing), as well as in the upper tributary streams (S.F. and N.F. Imnaha).

On Big Sheep and Lick Creek, the number of redds counted has ranged between 8 and 34 redds (Figure 5). Redd surveys for bull trout in the Big Sheep system have been limited in miles of survey (8.4 to 14.1 miles from 2000 to 2010) and in frequency, (2000-2001 surveys were conducted once late season, and in 2002, 2003, 2005-2010 surveys were conducted twice, mid and late season). In 2004, the survey was conducted once late season for BigSheep and twice, mid and late season for Lick Creek.

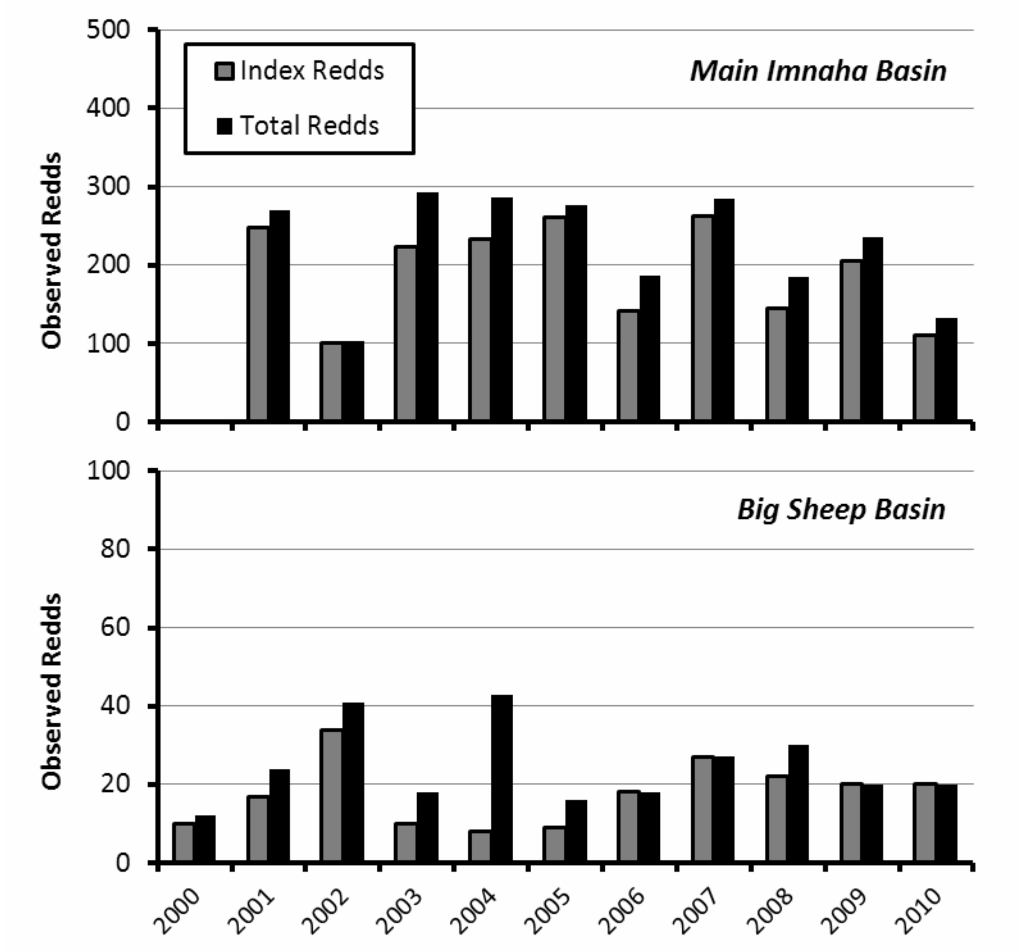


Figure 2. Comparison of bull trout redds in index reaches and total surveys in the main Imnaha basin (top panel) and Big Sheep Creek basin (bottom panel) from 2000 to 2010 (Sausen 2010). Note difference in y-axis between panels.

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 – Abundance trends for the ImnahaRiver population cannot be determined, as no data or expansion methods exist to create whole-population estimates. Estimates of abundance and productivity for a six-mile section of a tributary, Camp Creek (Zumwalt Unit), are the only source of long-term estimates in this population. Camp Creek abundance in recent years has been moderately variable (Appendix Table 1). The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 68. During the period 1980-1999, Camp Creek steelhead productivity (measured as Recruits per Spawner) ranged from 0.22 in 1988 to 7.40 in 1982.If the productivity estimate from Camp Creek represents the total population, the abundance/productivity risk of extinction for the ImnahaRiver population is between moderate and low. However, the ICTRT (2010a) concluded that the Imnaha River population warranted a "maintained" viability level due primarily to uncertain population abundance.

Spring Chinook – Hatchery origin fish have made up 60 to 75 percent of spring Chinook returning to the Imnaha basin recently (Figure 3; Appendix Table 2). Prior to initiation of the spring Chinook hatchery program and resulting adult returns as well as the completion of four major dams on the Snake River, estimated run size to the mainstem Imnaha River exceeded the TRT draft guideline of 750 natural origin spawners in all but four years between 1957 and 1984 (ICTRT 2010b). Since hatchery produced fish began returning in 1985, natural origin returns have failed to meet that same level in 15 of 20 years (Figure 3). Natural origin spawners in Big Sheep Creek have remained at extremely low numbers in recent years (Table 5). Big Sheep Creek spawning surveys accounted for relatively greater numbers of redds in some recent years. However, higher counts occurred only during years when surplus Imnaha River hatchery origin fish were outplanted to that system.

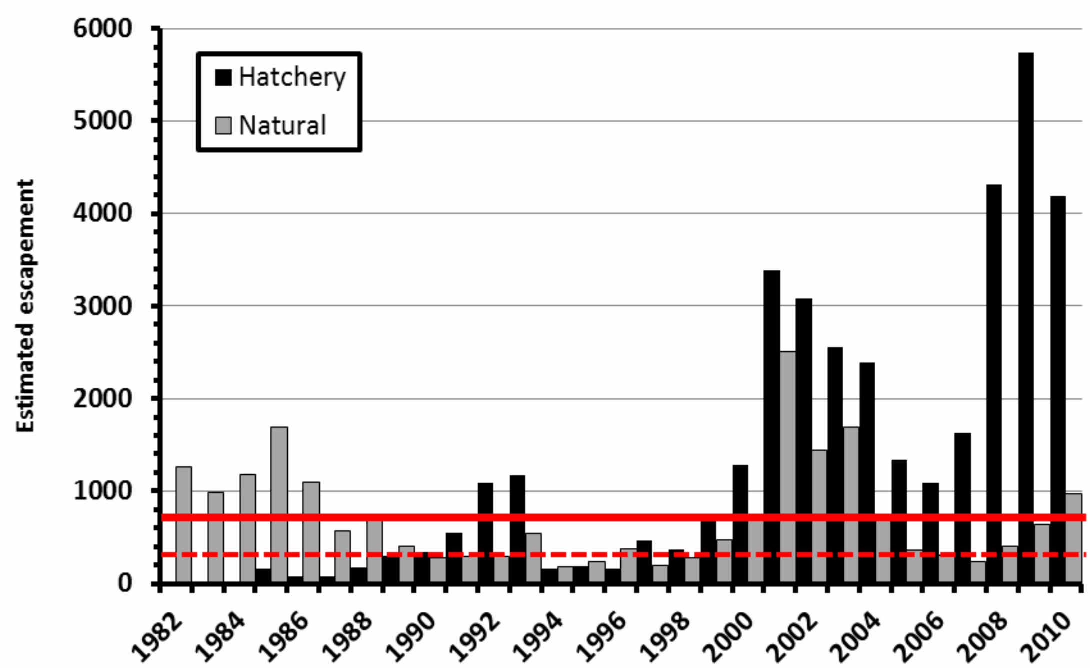


Figure 3. Estimated combined natural and hatchery origin spring Chinook escapement to the Imnaha population for years 1985 – 2010 (does not include Big Sheep Creek). The population critical threshold (300, red dotted line) and minimum abundance threshold (750, solid red line) are shown according to the ICTRT viability analysis (2010b).

Fall Chinook - The Snake River fall Chinook salmon ESU currently has one extant population, the Lower Mainstem Snake River fall Chinook salmon population, which occupies approximately 15% of the historical range of this ESU. The ICTRT (ICTRT 2010c) has concluded that the Snake River drainage historically supported three populations of fall Chinook salmon. At present, only the Lower Mainstem (and tributaries below Hells Canyon) population is extant (Appendix Table 3).

Table 5. Redd counts observed in selected tributaries in the Imnaha Basin, 1997-2010.

Year	Imnaha River				Big Sheep Basin[1]		Imnaha Basin Total
	Index Redds	Above Weir	Below Weir	Total	Index Redds	Total Redds	
1997	101	145	79	224	38	70	286
1998	39	97	49	146	4	11	157
1999	87	119	71	190	0	1	191
2000	90	195	66	261	0	0	261
2001	182	416	219	635	5	6	641
2002	352	853	258	1,111	22	78	1,189
2003	269	535	192	727	11	27	754
2004	129	305	190	495	8	74	569
2005	49	183	166	349	45	98	447
2006	57	152	83	235	18	52	287
2007	24	129	123	252	7	25	277
2008	164	377	159	536	37	106	642
2009	93	162	229	391	23	77	468
2010	203	374	377	751	29	103	854

[1] Includes both Big Sheep and Lick Creeks

- 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.

Steelhead productivity data (Recruits per Spawner)for Camp Creek, an Imnaha River tributary, is shown in Appendix Table 1. Productivity data for the entire Imnaha River population is not available due to a lack of data. 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.

Spring Chinook productivity data (Recruits per Spawner) used for the ICTRT viability analysis (ICTRT 2010b) is shown in Appendix Table 2.

Fall Chinook productivity data (Recruits per Spawner) used for the ICTRT viability analysis (ICTRT 2010c) is shown in Appendix Table 3.

Estimates of bull trout productivity are not available due to a lack of data.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Time series adult steelhead abundance data for the Imnaha sub-basin is limited to two sources; an index redd count in Camp Creek (Figure 4) and adult counts at the Little Sheep facility (Figure 5). Although accurate counts of adults are obtained at the weir, adult escapement is not representative of the basin due to the impacts of broodstock collection and the level of hatchery fish interaction, unique to the Little Sheep system. The HSRG review of this population in 2009 estimated that the current abundance of natural steelhead was 1,180 fish. However, this estimate is only an approximation because empirical data on spawner abundance across the entire Imnaha basin have not been collected. This is a serious data shortcoming that needs to be corrected in the future.

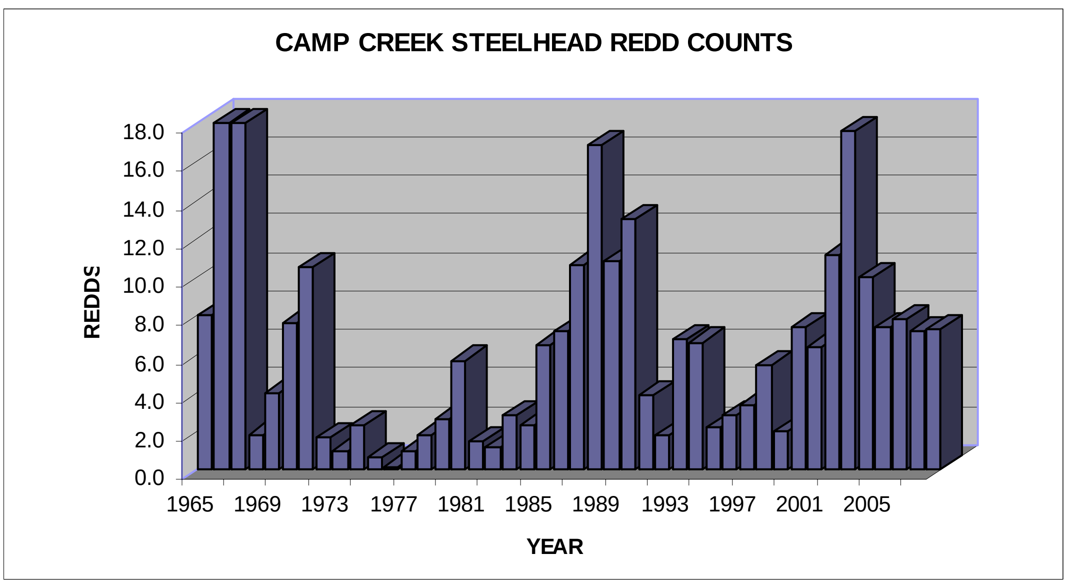


Figure 4.Spawning survey data for steelhead in Camp Creek, a tributary of Big Sheep Creek, 1988-2009 (Fish District files).

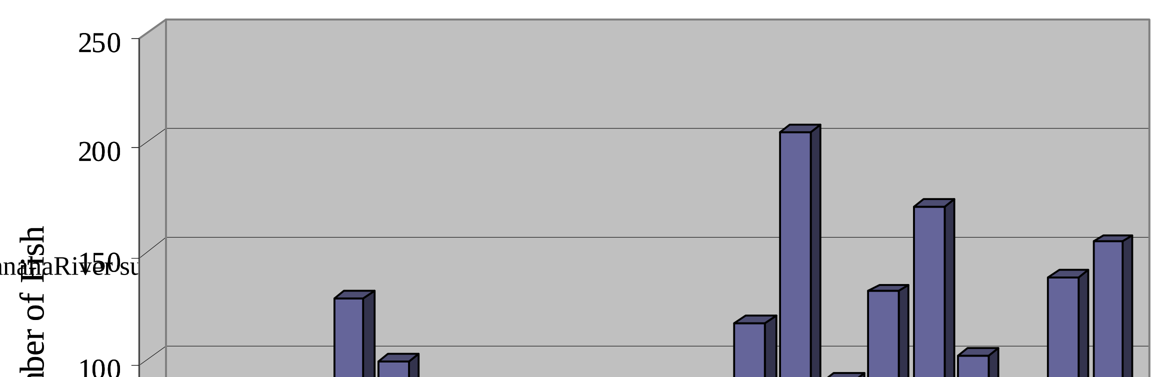


Figure 5. Annual number of natural origin steelhead passed above the weir on Little Sheep Creek.

- Provide the most recent 12 year (e.g. 2001-2010) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Few adults are observed during annual spawning surveys. Prior to 2003, no marked fish were identified during spawning surveys of Camp Creek (Table 6). However, beginning in 2006, 16.4%-33.3% of fish observed during spawning surveys on Camp Creek were hatchery fish. Additionally, in 2000 and 2001 less than 5% of the fish captured at Lightening Creek (NPT trap) in the Lower Imnaha tributaries were identified as being hatchery reared. However, a relatively large number of hatchery adults have been released into the Big Sheep drainage in recent years; and it is assumed that a high proportion of natural spawners there are of hatchery origin.

Table 6.Steelhead observed during spawning surveys in Camp Creek that were identified as marked, unmarked, or for which a mark assignment could not be made, 1994-2010.

Year	Known				Unknown
	Marked (Ad)	Unmarked	Total	Percent Marked	
1994	0	5	5	0	1
1995	0	2	2	0	0
1996	0	0	0	0	0
1997	0	0	0	0	0
1998	0	0	0	0	0

1999	0	0	0	0	2
2000	0	2	2	0	3
2001	0	4	4	0	0
2002	0	5	5	0	0
2003	3	7	10	30	2
2004	1	6	7	14.3	6
2005	0	3	3	0	7
2006	4	13	17	23.5	4
2007	1	3	4	25	0
2008	8	16	24	33.3	6
2009	5	25	30	16.7	4
2010	9	46	55	16.4	5

Refer to Table 10 for details regarding the number and proportion of hatchery and wild fish passed above the weir at Little Sheep Creek.

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.

- 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.

Adult broodstock collection - Annual broodstock collection includes unmarked listed steelhead returning to the Little Sheep Creek weir. Adults collected are incorporated into a matrix spawning protocol to enhance genetic diversity within the hatchery population. Adults are collected from March through June. Typically, less than 25% of the wild fish returning to the weir are collected and retained for broodstock; all others are passed upstream to spawn naturally. Recent program operation has attempted to incorporate at least 5% wild fish in the broodstock annually and has averaged 8.3% with a range of 1.1% to 21.8% wild fish since 1988 (Table 10).

Spawning, incubation and rearing – Most adult fish are killed during the spawning process. Wild males are live spawned and passed above the weir when their condition suggests they will survive and potentially spawn again. Eggs and resulting progeny are subject to mortality during incubation and rearing due to disease, injury and other causes. Every effort is made in the hatchery and at acclimation and adult collection facilities to ensure maximum survival of steelhead at all life stages.

Juveniles trapped – Wild juvenile steelhead moving upstream may enter the adult trap during operation. This may result in injury and/or mortality.

Spawning surveys – Foot surveys conducted to determine natural spawning density and proportion of hatchery fish in key natural spawning areas are likely to result in observation of natural listed summer steelhead adults and juveniles. These surveys are conducted annually in various reaches of spawning habitat from March through May. Experienced surveyors walk along the stream, crossing when necessary, avoiding and counting redds and observing fish. Although every effort is made to observe adults and determine their origin without disturbance, spawners are occasionally forced to seek cover. These encounters are brief and spawning fish generally resume their activity within a short period of time.

Juvenile surveys/collections – Electrofishing, snorkeling, and hook and line sampling may be used to monitor density, size and food habits of residual hatchery steelhead and to collect genetic samples from naturally produced steelhead. These activities which generally occur from May through October will result in take of juvenile listed steelhead and occasionally spring Chinook salmon and bull trout. Electrofishing efforts conform to NMFS electrofishing guidelines to minimize disturbance and injury to listed fish. Snorkeling is a low impact sampling method that may be used to identify relative proportion of residual hatchery steelhead in key stream reaches. Disturbance of rearing juveniles associated with snorkeling is generally limited to forcing individuals to seek cover and is a short duration effect. Snorkeling surveys will be conducted when stream temperatures are low, so as to minimize potential for stress and incidental mortality to listed fish.

Intake Maintenance – High water episodes can deposit large amounts of debris at the Little Sheep Facility intake structure. Gravel deposition can re-channel the stream away from the intake, which could cause significant problems during low flows. Although these events are infrequent, removal of material is required for operation of the facility. All efforts will be made to minimize impacts to ESA-listed fish, although some loss may result from efforts to remove debris. Material will be removed during the in-water work period, July 15 to August 30. Department of State Lands and the COE may issue an emergency permit to remove large amounts of material if it poses an immediate threat to fish survival.

Facility Maintenance – A plunge pool has developed on the downstream side of the Little Sheep weir. Concern exists about the flow undermining the structure and making it unstable. Also, during low flow there are fish passage concerns. Therefore, an engineering evaluation of these items is occurring at this facility. After the evaluation is completed, deficiencies or concerns will need to be provided. Instream flows will be maintained and sediment containment in place during this project. All appropriate procedures and guidelines will be followed to minimize impacts to ESA-listed fish, although some loss may result from these efforts.

- **Provide information regarding past takes associated with the hatchery program, (if**

known) including numbers taken, and observed injury or mortality levels for listed fish.

Refer to Tables 7 and 9 (Section 6.2) for a description of adult collection and egg take since 1990.

Table 7.Adult pre-spawning and handling mortality occurring at the Little Sheep Creek facility, 1988-2009.

Adult Mortality				
Year	Hatchery		Wild	
	Males	Females	Males	Females
1988	17	19	0	0
1989	11	2	9	0
1990	14	5	0	0
1991	10	1	0	0
1992	44	6	0	7
1993	7	3	0	0
1994	1	0	1	0
1995	7	0	0	0
1996	2	0	0	0
1997	2	12	0	0
1998	15	1	0	0
1999	2	0	0	0
2000	6	2	0	1
2001	1	0	0	0
2002	9	2	0	1
2003	0	0	0	0
2004	0	0	0	0
2005	8	1	1	0
2006	8	5	1	1
2007	2	0	0	0
2008	2	0	0	0
2009	2	0	0	0

Research/Monitoring Activities

Juvenile Trapping: A smolt monitoring trap is operated at river kilometer 7, downstream of the Imnaha River weir from March-November each year by Nez Perce Tribe research staff to estimate juvenile survival, timing, and production in the Imnaha. At a minimum, all fish captured are identified and enumerated. Most fish captured are counted and released or anesthetized, measured, weighed and then released. Smaller groups of fish are PIT-tagged and then released in order to estimate survival to Lower Granite Dam and to monitor migration.

Operation of Juvenile Trapping and Marking

The trap was operated from February to November each year. The trap is located 7 rkm from the confluence of the Snake River. The screw traps are attached to a cable suspension system anchored by gabion baskets, which allow side to side and upstream/downstream movement of the trap. This setup permits the trap to be fished in the optimum position during most flow conditions. The traps consist of a trapping cone (1.5 m diameter) supported by a metal A-frame, live box, two six-meter by one-meter pontoons for flotation, and a clean-out drum. Traps used on the Imnaha River have been modified to use a customized oversize live box 1.68 m wide x 1.25 m long x 0.55 m deep and fitted with a removable baffle to dissipate water velocity during high flows plus extra flotation on each pontoon to prevent the trap from sinking in high flows. Additionally, the Imnaha trap has been modified with a bypass that is equipped with a Biomark PIT Tag Racquet Antennae tuned for underwater use. Data is logged on a standard FS2001 transceiver.

The live box of the screw trap is checked at 0800 every morning and several times throughout each night and day, if warranted by large numbers of fish or excessive debris. Non-target piscivorous fish and large numbers of other non-target fish are removed from the live box first. Non-target piscivorous fish are scanned for PIT tags and then released 30-50 m downstream through a discharge tube. The precise location of the tube outlet depends on the observed existence of predator species. The outlet is located to minimize predation of examined smolts. Fish are processed as they were removed from the trap.

Two subsampling routines are used on occasion during trapping. These routines allow crews to continue sampling when the trap gets overwhelmed with smolts. One routine consists of 1) clearing the trap of all fish, 2) collect fish for a fixed period of time, 3) isolate the collected fish from incoming fish, 4) bypass incoming fish through a PIT Tag detector to monitor for recaptures or previously tagged fish, and 5) process all fish collected. The number of processed fish is multiplied by an appropriate time ratio. For instance if the crew collected fish for 15 minutes and then bypassed fish for 45 minutes the ratio would be 1:4. The estimated total number of fish passing would equal the total processed multiplied by four. The second subsampling routine is used when clearing the trap (step one listed above) becomes too difficult. This routine consists of 1) isolating all trapped fish within the livebox, 2) divert incoming fish through a PIT Tag detector, 3) collect one net-full of captured fish for processing, 4) collect roughly equal sized net-fulls of the remaining fish and feed them through a separate PIT Tag antenna. This estimate is scaled up in a similar way to the first routine except “net fulls” becomes the multiplier. The subsample consists of a remote monitoring (RM) file of PIT Tag numbers and a text file recording the scaled up fish numbers. The PIT Tag data collected are incorporated into recapture numbers and trap efficiency calculations. The scaled up fish numbers are included in the number of fish handled and incidental species counts.

Processing procedures are similar to those used by Ashe et al. (1995) and Prentice et al. (1990b). On a daily basis, juvenile summer Chinook captured in the trap are removed, placed in 18.9-liter plastic holding buckets, and transported (40-80 meters) to a data processing area. Fish are then transferred to flow-through work-up vats or vats with appropriate aeration where they are held prior to being moved to an aerated work-up tub.

All fish are interrogated for PIT tags using a Destron® loop-style detector and reader, examined for PIT tag scars, marks, and overall physical condition. Fish are measured to the nearest millimeter and weighted to the nearest gram. Fish are anaesthetized in a plastic tub filled with 6 liters of water, 15 milliliters of standard stock solution (15 grams/liter) of MS-222, and buffered with 15 milliliters standard stock solution (30 grams/liter) of sodium bicarbonate to decrease stress and mortality (e.g., McCann et al. 1994). Stress Coat® (1 part Stress Coat® per 1 part distilled water) is also used in work up tubs, on measurement boards and scale tubs in an effort to replace the natural protective slime coating that may have been compromised by handling or measurement-related stress.

Upon anesthetization, unmarked or non-tagged fish are identified for tagging or marking. Fish selected for PIT tagging will be examined for previous PIT tagging, descaling and general health before being tagged, measured (fork length-mm) and weighed (0.1 g). All fish greater than 60 mm are selected for tagging unless they have been damaged during the trap operation. All PIT tags are implanted using methods similar to those described by Prentice et al. (1990a, 1990b) and the CBFWA PIT Tag Steering Committee (1999). Tagging is done manually using a modified hand injector unit consisting of a 10cc syringe; steel rod, compression spring, push rod and 12-gauge hypodermic needle. Tagging needles and PIT tags are disinfected before each use by soaking them for 10 minutes in 70% ethyl alcohol, and subsequently dried for 10 minutes. The needles, which are pre-loaded with PIT tags, are inserted into the fish so that the beveled tip completely penetrated beneath the surface of the skin at a point on the midline of the ventral surface posterior to the pectoral fins. Fish are measured to the nearest millimeter (fork lengths), weighed to the nearest gram using an electronic scale, and placed in a flow-through recovery vat or vat with appropriate aeration. Tagging is discontinued when water temperatures exceed 18 °C. Tagging data are proofed for mistakes. Tagging and interrogation files are submitted to the Pacific States Marine Fisheries Commission’s PIT Tag Information System (PTAGIS) database within 48 hours following collection. PIT tag interrogation data are downloaded from the PTAGIS database for the annual reports.

Scale samples will be randomly collected from 25 Chinook salmon and 25 steelhead juveniles for each trap and each month to analyze early life history scale patterns. Only fish that are not going to be PIT tagged are sampled. Scales are collected from just behind the dorsal fin and above the lateral line using a blunt knife. Scale samples are filed by stream and date of collection at the Nez Perce Tribe’s Department of Fisheries Resource Management. Scales are filed in envelopes commercially available and are labeled with the following collection information: date, location, length, weight, and existing marks. Nez Perce Tribe staff will read the scales and provide the age information.

During certain time periods a large portion of the young of the year (YOY) juveniles collected in the screw traps are too small to be PIT-tagged (e.g., CBFWA 1999). In order to represent the entire population, a sub-sample of all fish for trap efficiency estimates are uniquely marked with a mark that could be applied to any size fish that were captured. Three times a week, a sub-sample of the total trap catch are selected for staining with Bismark-Brown dye, a mark that has proven effective in the identification of fish with fork lengths as low as 30 mm (Lockhart et al. unpublished data). Fish are held in dye (0.4g/16 L solution) for 1 h. Battery powered aerators are used to maintain oxygen saturation in the dye solution and the temperature is monitored constantly. To evaluate possible delayed mortality and to reduce predation, stained fish are held in live boxes until dusk and are released at the same time and at the same site as PIT tagged fish.

Freshly marked or tagged fish are placed into an ‘upstream’ live box, while recaptures or incidental catches are placed into a ‘downstream’ live box. Larger or piscivorous specimens are placed into a separate live boxes to reduce the potential of predation. The live boxes are large, drilled-out plastic shipping boxes with lids or covered 33 gallon perforated containers, which provide containment, protection, and acclimation of the fish back to the riverine environment. Marked fish spend no less than 12 h in the live boxes and are released at dusk. These protocols help ensure complete recovery from anesthetic, minimize risk of predation, and promote reintegration and mixing with other fish during peak movement periods. Following their release, boxes are checked for mortalities and shed PIT tags.

Marked or tagged fish that are placed into the ‘upstream’ live box are used to derive estimates of trap efficiency through their subsequent recapture at the screw trap. The ‘upstream’ fish are released approximately 800-1200 m upstream of the trap or at least two riffles and a pool upstream of the trap. All other fish are held in separate live boxes and released 200-800 m downstream of the trap.

- **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).**

Table 8 includes projected take for the program, including take of hatchery reared fish which as a group include progeny of listed wild fish and are therefore part of the ESU.

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

Take levels may vary depending on the number of returning adults, and survival rates (for all life stages) in the hatchery. We will notify NMFS regarding the situation, if it occurs. Hatchery disease outbreaks or high egg loss may also result in take levels above those indicated in Table 8 (Refer to Appendix A for specific disease prevention protocols).

Table 8. Estimated take levels of listed salmonids by hatchery activities.

Listed species affected: Summer Steelhead		**ESU/Population:** Snake River		
Activity: Little Sheep Creek steelhead hatchery program				
Location of hatchery activity: Imnaha and Snake Basin		**Dates of activity:** Annual		
Hatchery program operator: ODFW				
Type of Take	**Annual Take of Listed Fish By Life Stage** *(**Number of Fish**)*			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	500,000	1,500	0	280
Collect for transport b)	500,000	0	1,500	280
Capture, handle, and release c)	0	1,500	2,500	0
Capture, handle, tag/mark/tissue sample, and release d)	50,000	340,000	2,500	0
Removal (e.g. broodstock) with numbers of natural origin and hatchery origin fish as per section 6.2.3 of this plan e)	0	0	220H/W	0
Intentional lethal take f)	50,000	200	220H/W	0
Unintentional lethal take g)	50,000	50,000	20	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migration delays at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock (see section 6.2.3).
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES.

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

The proposed programs outlined in this HGMP are consistent with the NPPC Annual Production Review (Report and Recommendations) and address issues of concern outlined in the NMFS Hatchery Biological Opinions.

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

Lower Snake River Compensation Plan **–** The program is consistent with smolt production levels as outlined in original LSRCP. The proposed program will continue to support a substantial tribal and sport harvest level.

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

Columbia River Fish Management Plan – The program would continue to provide substantial harvest in Zone 6 tribal net fisheries as well as in-basin tribal harvest opportunity.

3.3) Relationship to harvest objectives.

Harvest objectives are described in ODFW Fishery Management and Evaluation Plan submitted to NMFS in 2009. This program is consistent with those objectives.

Proposed program modifications, including reductions in smolt numbers and smolt acclimation, are all designed to maintain harvest opportunity at the highest possible level while reducing impacts to listed species. Reductions in program smolt releases may result in fewer fish harvested if harvest rates remain at recently observed levels. Direct mortality to wild/natural fish shall remain below 15% for group-A steelhead runs of 75,000 or less. All steelhead released into Imnaha basin for harvest purposes are adipose clipped, such that they are externally distinguishable from naturally produced fish and those designated for supplementation in the ImnahaBasin. Further, only adipose fin clipped steelhead may be retained in the sport fishery.

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.

Little Sheep Creek stock hatchery fish are intercepted in fisheries from the ocean to the Imnaha River (Table 3).

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia Basin affect steelhead production in the Imnaha basin. Loss of channel diversity, sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawal, water temperature and fragmentation of habitat all affect productivity of natural steelhead populations within the watershed. State programs in place through the Department of Environmental Quality, Department of Forestry and Department of State Lands along with federal Clean Water Act and Corps of Engineer 404 regulations provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Protection Act (NEPA) review.

These protection programs in conjunction with ongoing private and publicly funded restoration efforts have resulted in an upward trend in steelhead habitat in many Imnaha basin streams. Most watershed restoration/improvement projects are funded through the Grande Ronde Model Watershed Program, Oregon Watershed Enhancement Board, Bonneville Power Administration funded Northwest Power Planning Council's (NPPC) Fish and Wildlife Program, Mitchell Act Program and Natural Resource Conservation Service's (NRCS) Conservation Reserve Enhancement Program (CREP). Efforts include fencing streamside corridors to promote riparian vegetative recovery, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland and screening of irrigation diversions. Some programs like the Mitchell Act screening program began almost 50 years ago while others like CREP are very recent. Taken together, habitat protection and improvement measures are (and will) continue to improve habitat for (and productivity of) the basin's wild summer steelhead populations.

3.5) Ecological interactions.

The narrative below is adapted from Biological Assessments completed by ODFW for the Grande Ronde summer steelhead hatchery program and submitted to NMFS in 1993 and 1994. NMFS developed Biological Opinions for guidance in operating the Grande Ronde steelhead hatchery program based on these documents.

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. Physical ability and predilection imply, in general, a steelhead at least 250mm in length with an individual prey item less than one third its length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Canamela 1992). Although Jonasson et al. (1995) found no significant relationship between residual hatchery steelhead size and salmonid prey size in net pen experiments.

The following discussion reviews these factors as they relate to the interaction between actively migrating and residualized hatchery steelhead smolts and emergent fry, fingerling and smolts of listed species. Relative size of proposed hatchery steelhead smolts (225 mm @ 4 fpp) compared to spring Chinook smolts (90 mm) and wild steelhead migrants, both yearlings (80-120 mm) and two year old smolts (150 mm +) should preclude any substantial predator/prey interaction among migrating fish based on some studies cited above.

Timing of hatchery steelhead smolt releases and distribution of fry of listed species limit potential interaction. Hatchery steelhead smolts are released in April and early May, approximately mid-way through the spring Chinook emergence period. However, hatchery release sites are downstream of documented spring Chinook spawning areas and opportunity for these fry to move into steelhead migration corridors is limited. Fry, both spring and fall Chinook, distributed downstream and potentially available to steelhead smolts would likely be seeking preferred 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.

Naturally produced steelhead fry generally emerge during June, after a high proportion of released hatchery steelhead smolts have migrated from the system. Yearling natural steelhead in areas accessible by migrating smolts achieve lengths of 80 to120 mm by the time of smolt releases making them less vulnerable to predation due to their size and ability to avoid predators. Bull trout fry tend to maintain themselves in headwater spawning areas and thus avoid interaction with smolts.

A varying percentage of hatchery steelhead releases do not migrate. ODFW considers hatchery steelhead remaining after June 15 to be residuals. These fish, by remaining in the Grande Ronde system, 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), some estimates have been higher than 25% (Viola and Schuck 1991; Crisp and Bjorn 1978).

Studies of the effect of size at release and acclimation on rates of hatchery steelhead residualism have been conducted in Idaho, Washington, and Oregon. In some cases results are 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 8km of the upper Salmon River release site.

Schuck (1993) reported steelhead residuals were found about 20km below and 10km above release sites in the Tucannon River, Washington. Steelhead residual densities were highest within 8km 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 SnakeRiver basin release areas. This may be due to harvest, other mortality, and outmigration. Partridge (1986) noted that where harvest was heavy, virtually no residualized steelhead were present for harvest after ten weeks in the upper Salmon River. In the East Fork Salmon River, where harvest pressure was light, he found residuals in the harvest sixteen weeks after the late May release date. 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 precipitously over time. For example, residuals from the 1992 BigCanyon release were present near the release site at densities (#/100 square meters) of approximately 55 in summer, 18 in fall, 7 in winter, and less than one in spring of 1993. Angling regulations target residual ad clipped steelhead in the resident fishery for 24 miles of the ImnahaRiver below Big Sheep Creek by allowing harvest of only adipose fin clipped trout.

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 the Nez Perce tribe at mile 4 of the Imnaha River. None of the smolt stomachs sampled contained fish. Residual steelhead smolts 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). Residual steelhead smolts do not appear to prey on juvenile Chinooksalmon in northeast Oregon and have low rates of predation on other salmonid.

<u>Competition</u>- Hatchery steelhead smolts have the potential to compete with Chinook, natural steelhead and bull trout juveniles for food, space, and habitat. Canamela (1992) concluded that effects of behavioral and competitive interactions would be difficult to evaluate or quantify. If significant interaction does occur, it is restricted to a short duration as smolts move downstream or to the immediate vicinity of release sites due to the limited dispersal of residual steelhead. 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.

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 due to a significant size advantage.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens that could affect wild Chinook, listed adult and juvenile steelhead and bull trout growth and survival. Because the hatchery produced summer steelhead for the mitigation program are reared at Irrigon Hatchery, outside these watersheds of concern, disease impacts by these stocks on basin wild salmonids are extremely unlikely. Irrigon 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 due to the almost ideal conditions at Irrigon. Further evidence for the relative disease-free status of these stocks at Irrigon is the very low mortality that occurs during rearing following typical early life stage losses. Documentation of disease status in these stocks is accomplished through monthly and pre-liberation fish health examinations. No transfers of steelhead juveniles with known clinical infections or infestations have been made to the Imnaha basin from Irrigon.

An additional pre-liberation fish health examination is conducted after fish are held for over 30 days at the Little Sheep Creek facility.

Returning adult summer steelhead held for artificial spawning at the Little Sheep Creek facility potentially creates a concentrated source for the pathogens and parasites they carry. 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, again, not conducive to infectious processes. This reduces the potential for transmission between adults in holding ponds and from those 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 five years indicate a low prevalence and incidence of serious fish pathogens and parasites in these stocks.

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.

Early incubation and rearing for Grande Ronde and Little Sheep Creek steelhead programs occur at Wallowa and Irrigon Hatchery. The facilities were designed for a combined program production of 1.68 million smolts at 5fpp (1.35 million smolts for the Grande Ronde program). Initial incubation (green to eyed egg) occurs at Wallowa Hatchery on spring water and well water (250 gpm). Some adjustment of water temperature can be achieved through mixing the two water sources. Incubation after eye-up occurs at Irrigon Hatchery and uses 120 gpm of temperature controlled well water. Rearing at Irrigon is accomplished in 68 circular starter tanks and 32 raceways with an approximate well water supply of 46.6 cfs. Combined program smolt production is limited by ground water available for rearing at Irrigon Hatchery. Water for the Little Sheep Creek facility is taken from Little Sheep Creek. Water use for those facilities includes 4,000 gpm for acclimation and 2,300 gpm for adult holding, well within the existing water rights. Water quality at acclimation is generally good. Occasionally, freshets result in increased sediment loads and reduced water quality of inflow water at the acclimation facility.

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.

Potential for entrapment of wild juvenile steelhead exists at the acclimation site. Intake screening at this location meets NMFS screening criteriaand minimizes risk to wild steelhead encountering the intake. Water withdrawals for acclimation utilize portions of natural flow from Little Sheep Creek. However, adequate stream flow is maintained to provide rearing habitat and juvenile passage within the bypass reach. Stocking densities in the acclimation ponds are adjusted to maintain quality of outflow water. Effluent water quality at Irrigon and Wallowa hatcheries is monitored quarterly under NPDES water quality standards and conditions. Compliance at these two facilities has been good.

SECTION 5. FACILITIES

5.1) Broodstock collectionfacilities (or methods).

The Little Sheep Creek adult trap consists of a fish ladder leading from the base of a concrete and radial gate weir to a finger weir at the upper end. Flow from Little Sheep

Creek is diverted through the trap and ladder. The weir excludes all migration upstream past the facility except through the ladder and trap, during the adult collection period.

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

Brood fish are held and spawned at the Little Sheep Creek facility. Pick-up slip tanks are usedfor out-planting adult fish.

5.3) Broodstock holding and spawning facilities.

Adults are held in a 40'x20'x4'concrete pond (3200 ft^3) at target maximum densities of 2.5 ft^3/fish and 2 gpm/fish. This pond is separated into different holding pens by picket aluminum dividers. The spawning shelter is located at the end of this holding area.

5.4) Incubation facilities.

Incubation facilities for the combined Imnaha and Grande Ronde steelhead program include:

- Wallowa Hatchery (incubation to eyed stage) 228 vertical stack incubation trays, 4 trays/stack.
- Little Sheep eggs are incubated in a separate incubation room at Wallowa Hatchery.
- Eggs are transferred from Wallowa Hatchery to Irrigon Hatchery at the eyed-egg stage via-pickup.
- Irrigon Hatchery (incubation eyed-egg to ponding) 288 vertical stack trays, 12 trays/stack.

5.5) Rearing facilities.

Rearing facilities for the combined Imnaha and Grande Ronde steelhead program at Irrigon Hatchery include:

- (68) 6' circular fiberglass tanks for initial rearing; and
- (32) 20'x100'x4' concrete raceways after initial rearing to smolt size.

5.6) Acclimation/release facilities.

- Little Sheep Acclimation pond is a concrete pond 195' long, 50' wide and 3.5' deep (34,125 ft^3).

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

In 1998, 1,112,000 surplus eggs were reared at a temporary facility at river km 26 on the

ImnahaRiver with the intent of releasing them as fry into the ImnahaRiver and Big sheep Creek. Unfortunately, a flood event occurred during spring thaws and resulted in early release of the fry; 287,511 were released into Big Sheep Creek and 39,074 were released into the Imnaha River. This occurrence was not a part of the planned program, and is not expected to happen again. No fish losses have occurred in the recent past.

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.

- Monitor facilities operation during high flow events.
- Maintain screens in working order.
- Keep trap and ladder area free of debris.
- Adjust diversions to maintain flow in passage facilities and bypass reaches.
- Adjust acclimation densities to maintain quality of facility outflow.
- Staff facility 24 hours a day, seven days a week during period of trap operation

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.

Broodstock is indigenous to Little Sheep Creek and has been collected at Little Sheep Creek facility annually since the start of the program in 1982. Little Sheep Creek stock is the only acceptable stock for release into the Imnaha River drainage (IHOT 1995).

6.2) Supporting information.

6.2.1) History.

Adult collection and subsequent egg-take and fry ponded since 1990 are reported in Table 9. There have been no out-of-basin transfers used to supplement egg-take and program needs. All adults needed for broodstock were collected, held and spawned at Little Sheep Creek acclimation facility. Following egg-take and fertilization, viable eggs are transferred to Wallowa Hatchery and incubated through eye-up. Eyed eggs are then transferred to Irrigon Hatchery to rear until pre-smolt, at which time many are returned to Little Sheep Creek Acclimation Pond to rear for another three-to-four weeks before release. An anomaly to the standard program occurred in 1998: 1,122,000 eggs were transferred to a temporary satellite incubation and early rearing facility on the lower Imnaha River. This allotment was incubated and reared for 4-6 weeks and was released as fry into the Imnaha River (139,074 into and 288,311 into Big Sheep Creek).

Table 9. Number of adult summer steelhead collected at the Little Sheep Creek trap, number of fish spawned, number of egg transferred, and number of fry ponded at Little Sheep Creek, 1999-2009 (Harrod ODFW).

Brood Year	Adults Counted	Adults Collected			Egg Take (in 1,000's) *Little Sheep Cr Facility*	Egg Transfers (in1,000's) [In/Out] *Wallowa Hatchery*	Fry Ponded (in 1,000's) [1] *Irrigon Hatchery*	Other Stock Transfers Ponded
		Males Spawned	Females Spawned	Spawning Ratio (M:F)				
1999	343	91	126	0.72	607	607 / 516	506	0
2000	520	99	120	0.83	569	569 / 465	459	0
2001	1354	112	109	1.03	480	480 / 359	351	0
2002	3464	111	105	1.06	515	515 / 425	419	0
2003	2003	90	84	1.07	467	467 / 408	404	0
2004	2754	96	95	1.01	432	432 / 398	394	0
2005	2213	96	95	1.01	439	439 / 397	391	0
2006	2469	83	81	1.02	408	408 / 351	347	0
2007	1712	79	79	1.0	398	398 / 342	338	0
2008	1837	67	66	1.02	297	297 / 263	260	0
2009	1255	67	67	1.0	362	362 / 318	313	0

[1] Fry are ponded and reared to pre-smolt age at Irrigon Hatchery.

6.2.2) Annual size.

Past hatchery escapement goals were based upon annual smolt production needs. In the recent past, a collection of approximately 138 adults is needed to meet the annual green egg-take goal (319,000) which supplies 215,000 smolts to the Imnaha River subbasin (AOP 2011). Annual number of adults collected, spawned and used for broodstock purposes are reported in Table 10.

Table 10.Number of wild and hatchery adults returning to and spawned at the Little Sheep Creek facility, 1999 to 2009(Harrod ODFW).

			Adults Passed Above the Weir to Spawn Naturally			Adults Spawned		
Return Year	Origin	Adults Counted	Male	Female	Percent Wild	Male	Female	Percent Wild
1999	Wild	11	2	3	6.3%	3	2	2.3%
	Hatchery	332	42	33		88	124	
2000	Wild	77	36	23	29.6%	14	14	12.8%
	Hatchery	443	49	91		85	106	
2001	Wild	127	37	74	14.1%	12	16	12.7%
	Hatchery	1227	330	344		100	93	
2002	Wild	203	62	130	16.0%	7	8	6.9%
	Hatchery	3261	360	646		104	97	
2003	Wild	99	47	46	22.5%	3	6	5.2%
	Hatchery	1904	164	157		87	78	
2004	Wild	141	76	60	16.5%	5	5	5.2%
	Hatchery	2613	395	292		91	90	
2005	Wild	188	79	100	38.2%	9	8	8.9%
	Hatchery	2025	159	130		87	87	
2006	Wild	120	36	75	31.2%	4	7	6.7%
	Hatchery	2349	121	124		79	74	
2007	Wild	91	46	39	35.9%	8	5	8.2%
	Hatchery	1621	77	75		71	74	
2008	Wild	151	72	73	49.8%	7	6	9.8%
	Hatchery	1686	81	65		60	60	
2009	Wild	184	64	105	66.3%	13	16	21.6%
	Hatchery	1071	48	64		54	51	

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

Refer to Table 10 regarding the past number and proportion of adult wild steelhead incorporated into the hatchery broodstock. Proposed levels of natural fish incorporated in the broodstock are based annually on the number of natural fish returning to Little Sheep Creek.

The guideline for the proportion of natural fish in the broodstock is as follows:

- At less than or equal to 100 natural returns, use 10% of natural run for broodstock.
- At greater than 100 natural returns, use 10 natural fish plus 40% of the natural run greater than 100 for broodstock (examples below).

Examples:

100 wild – 10 natural adults for broodstock
150 wild – 30 natural adults
200 wild – 50 natural adults
250 wild – 70 natural adults
300 wild – 90 natural adults

6.2.4) Genetic or ecological differences.

There are no identified genetic or ecological differences between the natural spawner population and the hatchery population. However, specific information regarding this program is not currently available. The broodstock was originally founded from the Little Sheep Creek population and wild steelhead comprise a component of the hatchery brood annually (Table 10), to minimize differences between the broodstock and wild fish.

6.2.5) Reasons for choosing.

Little Sheep Creek summer steelhead were chosen as the brood source for the Imnaha River program because they are indigenous to the Imnaha Basin, and because they were available and accessible.

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.

Broodstock are selected systematically from across the run of fish returning to Little Sheep Creek. Pass/keep ratio varies annually, depending on return projections and is adjusted in-season to insure representation from across the run. The current program only releases into the Big Sheep watershed (which contains Little Sheep Creek) and this is believed to reduce the number of stray hatchery fish into other portions of the Imnaha basin.

Big Sheep and Little Sheep represent a small fraction of the habitat utilized by the Imnaha population; therefore,this program's broodstock unlikely represents theinclusive genetic sample of the Imnaha population.Consistent with conservation objectives outlined in section 1.9, the program will operate at presentto ensure that the frequency of hatchery fish in the overall Imnaha population is less than 0.10. A key element is information on the proportion of hatchery fish for the Imnaha basin – which is currently lacking. This information need is identified in section 11.1.2.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Little Sheep Creek fish trap opens in late-February and runs until no adults have entered the trap for 10 days; typically in late-May. Fish are generally processed every Monday and Thursday and spawned every Tuesday. The existing facility provides a complete barrier to upstream passage at all flows. All fish moving upstream must enter the trap. Proportions of fish released and kept for broodstock vary annually, depending on run projections. In recent years, an attempt has been made to recover the maximum number of adipose left-ventral (AdLV) finclipped fish in order to evaluate harvest and return rates. It is assumed that AdLV clipped fish return to the trap in numbers representative of hatchery returns as a whole. Pass/keep ratios are based on broodstock needs and projected hatchery and wild returns and are used to determine fish collected for spawning and released on a weekly basis across the run. Female broodstock needs are determined based on; 1) green egg needs as determined by the smolt goal and recent egg to smolt survival, 2) expected fecundity as predicted by past average fecundity by ocean age, 3) the expected proportion of 1-salt and 2-salt females and 4) recent average adult survival. Males are collected at a 1:1 ratio with females. Broodstock needs and subsequent collection has declined over time as egg to smolt survival has improved. Wild fish are retained for spawning by sex at a rate that is outlined in (section 6.2.3). The remainder of the broodstock is made up of hatchery fish. Actual returns are monitored and compared to expected run development over the spawning season. In-season adjustments to collection rates are made as needed to maintain adequate broodstock collection or to release adults surplus to broodstock needs.

Wild adults not selected for broodstock are all released upstream in Little Sheep Creek. Pass ratios are developed based on projections based on the following guidelines. Prior to 1999, hatchery adult surplus to egg-take needs were either passed above the weir or killed. Since1999, hatchery adults not needed for broodstock are released upstream in Little Sheep Creek and into Big Sheep Creek in equal numbers up to 500 fish in each stream. Escapement surplus to egg-take needs above the 1,000 fish level are transported to Big Sheep Creek.

7.3) Identity.

(a) Methods for identifying target populations (if more than one population may be present).

A portion (25,000 steelhead smolts) of the Imnaha stock are tagged with a coded wire tag and marked with an adipose fin clip (Ad+LV+CWT). CWT tag data allow differing hatchery stocks to be differentiated based upon their tag code; hence, the number of out-of-basin stray adults returning to the ImnahaRiver drainage and alternate sub-basins can be monitored.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.

All smolts are currently adipose clipped for identification in the fishery and at the weir.

7.4) Proposed number to be collected:

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

Adult collection rate is adjusted annually based upon recent average adult and green egg to smolt survival rates. Recent broodstock collection includes approximately 138 adults with approximately a 50/50 sex ratio.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Refer to Table 9 for the number of summer steelhead collected, number spawned, green egg take, and number of fry ponded since 1999. Additionally review Table 10 regarding the number of adult returns and the number of adults retained for broodstock (by hatchery and wild fish); and the number of steelhead passed above the weir at Little Sheep Creek facility.

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

Hatchery adults in excess to broodstock needs are passed above the weir or out-planted to Big Sheep Creek. Excess hatchery adults may also be or used for local food banks upon agreement with co-managers.

7.6) Fish transportation and holding methods.

Adults selected for broodstock are held in a concrete pond and sorted for ripeness each week prior to spawning.

7.7) Describe fish health maintenance and sanitation procedures applied.

There are no disease treatments given to adult steelhead. However, steelhead are inspected for fish health throughout their development at Little Sheep Creek facility (adult and smolt life stage) and Irrigon Hatchery (egg to pre-smolt life stage). Refer to Table 11 for the disease history of this program and to Attachment A for a detailed description of the Fish Health Management Plan.

Table 11. Disease history (2003 to present)of Imnaha steelhead spawners at Wallowa Hatchery; progeny reared at Irrigon Hatchery and smolts at acclimation sites.[a]

	Life stage and Location of Examination		
Disease or Organism	Adults @ Little Sheep	Progeny @ Irrigon	Smolts @ Little Sheep
IHN Virus	Yes	No	No
EIBS Virus	No	No	No
Aeromonassalmonicida	No	No	No
Aeromonas/Pseudomonas	Yes	Yes	Yes
Flavobacteriumpsychrophilum	Yes	Yes	Yes
Fl. columnare	No	No	No
Renibacterium. salmoninarum	No	No	No
Yersinia ruckeri	No	No	No
Carnobacterium sp.	No	No	No
Ichthyobodo	No	Yes	No
Gyrodactylus	No	No	No
Ichthyophthiriusmultifiliis	No	No	No
Trichodinids	No	No	No
Epistylis	No	No	No
Ambiphyra (Scyphidia)	No	No	No
*Salmincola*species (gill copepods)	Yes	No	No
Coagulated Yolk Disease	No	Yes	No
External Fungi.	Yes	No	Yes
Internal Fungi	No	No	No
Myxoboluscerebralis	Yes	No	No[b]
Ceratomyxashasta	Yes	No	No

[a] "Yes" indicates detection of the pathogen but in many cases no disease or fish loss was associated with presence of the pathogen. "No" indicates the pathogen has not been detected in that stock.
[b] Smolts from Irrigon are negative for *M. cerebralis* but may get exposure to the infective stage during acclimation at the Little Sheep Creek facility or during outmigration.

Note, that the Little Sheep Creek steelhead Fish Health Monitoring Plan outlined in Attachment A is further explained in the Lower Snake Program Operation Plan document developed annually by the co-managers in this program. These monitoring plans are consistent with monitoring plans developed by the Integrated Hatchery Operations Team for the ColumbiaBasin anadromous salmonid hatcheries (see Policies and Procedures for the ColumbiaBasin anadromous Salmonid Hatcheries, Annual Report 1994, Bonneville Power Administration).

7.8) Disposition of carcasses.

Spawned out carcasses are transported to a landfill for disposal. ODFW may pursue use of carcasses for nutrient enrichment.

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.

The risk of fish disease amplification will be minimized by followingsanitation and fish health maintenance and monitoring guidelines outlined by ODFW Fish Health protocols.

SECTION 8. MATING

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

8.1) Selection method.

Spawners are selected systematically, according to previously established pass/keep guidelines, from fish returning to the weir each week across the run. Recovery of adipose left-ventral clipped fish is encouraged when selecting hatchery-origin spawners. Hatchery broodstock are selected at random for spawning as they mature. Wild fish contribution is maximized by attempting to incorporate them into the maximum number of matrices.

8.2) Males.

Target sex ratio for this program has been a 1:1 male-to-female spawning ratio. See Table 9 for actual spawning ratios from 1999 to present. Wild males are live spawned and passed upstream.

8.3) Fertilization.

Matrix spawning is accomplished in 3x3 combinations. Number of groups containing at least one wild fish is maximized. Current practice is to transfer gametes to Wallowa Hatchery at which time fertilization occurs. This practice has increased eyed egg survival.

8.4) Cryopreserved gametes.

There are currently no plans to use the cryopreserved sperm.

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.

Spawners are collected systematically by sex, from across the run. Wild fish are included in each brood and matrix-spawning strategies maximize contribution of wild fish to spawner groups. Matrix spawning attempts to utilize wild fish in as many groups as possible. Spawning groups are tracked. Those containing only hatchery by hatchery crosses may be culled subsequent to pathology determination. Wild x wild and hatchery x wild crosses are retained unless severe pathology conditions exist.

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-upand/or ponding.

Egg take has varied over time due to low escapement (1991, 1994 and 1995) and lower production goals (Table 12). Current production is 215,000 smolts due to high smolt-to-adult returns; however, production can increase to 330,000 smolts to meet adult return goals if necessary. Production is determined by using 5-year average fecundity and green egg to smolt survival to calculate the number of spawners needed. Adult's surplus to egg-take needs and any surplus progeny are released into Little Sheep and Big Sheep creeks. Surplus adults can be utilized in subsistence food banks or for nutrient enhancement.

Table 12. Egg take and egg loss data for Little Sheep Creek summer steelhead hatchery operations at Wallowa Hatchery, 1988-2008 brood years (Wallowa Hatchery data archives).

Year	Egg Take Total	Egg Loss		Percent Survival
		Total	% Loss	to eyed egg Stage
1988	827,255	288,244	34.8	65.2
1989	757,752	219,532	29.0	71.0
1990	849,432	313,187	36.9	63.1
1991	455,292	116,548	25.6	74.4
1992	749,330	121,430	16.2	83.8
1993	647,272	124,522	19.2	80.8
1994	454,140	101,720	22.4	77.6
1995	341,925	31,595	9.2	90.8
1996	728,244	169,489	23.3	76.7

1997	877,049	97,400	11.1	88.9
1998	1,066,307	176,100	16.5	83.5
1999	606,740	90,550	14.9	85.1
2000	568,500	103,770	18.3	81.7
2001	479,970	90,340	18.8	81.2
2002	514,480	89,005	17.3	82.7
2003	467,185	58,865	12.6	87.4
2004	429,571	31,451	7.7	92.3
2005	435,153	37,753	8.7	91.3
2006	363,474	31,534	8.7	91.3
2007	379,246	36,966	9.7	90.3
2008	293,580	30,280	10.3	89.7

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

Fecundity and survival vary from year to year. The program utilizes estimates of fecundity and survival based upon recent mean values, and hatchery spawner numbers are based upon these estimates. Surplus progeny can result when fecundity or survival exceeds what is expected. However, all eggs collected are utilized for program smolt production or for fry releases to Big Sheep Creek. Disagreement between co-managers regarding appropriate management of adults returning to Little Sheep Creek in 1998 resulted in collection of over 1,000,000 surplus eggs. Those eggs were targeted for release as fry in various locations in the Imnaha basin. Since 1998 co-managers have agreed to outplant all surplus adults to Big Sheep and Little Sheep creeks.

9.1.3) Loading densities applied during incubation.

At Wallowa Hatchery, 11,500 to 16,000 eggs are incubated per tray. This is equal to three females per tray. Flow is set at 4gpm and oxygen has been measured between 7.2-8.6ppm leaving the stacks.

Incubation at Irrigon Hatchery is set at 5gpm per tray and less than 10,000 eggs per tray.

9.1.4) Incubation conditions.

Incubation to the eyed-egg stage occurs on spring and well water at Wallowa Hatchery and from eyed-egg stage to hatching on temperature controlled well water at Irrigon Hatchery. Sediment is not a problem at either site (Table 13).

Table 13.Incubation water parameters at Wallowa and Irrigon hatcheries.

Hatchery	Source	D.O. (mg.L)	Temp. (F)	Conditions
Wallowa	Well	8.4	56º Avg.	Clear and silt free
Wallowa	Spring	9.8	42º-53º	Clear and silt free
Irrigon[1]	Well	10.0	42º-55º	Clear and silt free

[1] Well water temperature is mechanically controlled via a chiller.

Wallowaand Irrigon Hatcheries – Water temperature is continuously monitored via a recording thermograph or via chillers for water entering incubation trays.

9.1.5) Ponding.

Fry are ready to pond at about 950 TU and 2,800 fish per pound at Irrigon Hatchery. Forced ponding occurs in mid to late June.

9.1.6) Fish health maintenance and monitoring.

Disease treatments for Little Sheep Creek steelhead eggs are given at Wallowa and Irrigon Hatcheries. During spawning, ovarian fluid is drained, then eggs are fertilized and water hardened in 100ppm iodophor for a minimum of 15 minutes. Green eggs are transferred from the Little Sheep Creek facility to Wallowa Hatchery and, following fertilization, are disinfected in 100ppm iodophor. Formalin treatments are given @ 1:600 for 15 minutes two times per week for the prevention of fungus. Eyed eggs are transferred to Irrigon Hatchery and upon arrival are disinfected in 100ppm iodophor for 10 minutes. Formalin treatments @ 1:600 are continued three times per week until hatching, which is usually no more than two weeks after arrival to Irrigon Hatchery. Refer to Section 7.7 for additional details regarding the Fish Health Management Plan and disease history.

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

Eggs are incubated in pathogen free, silt free water to insure maximum survival.

9.2) Rearing

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

Eggs collected, fry and smolts produced are summarized in Table 14.

Table 14. Estimated number of fry produced, survival from fry to smolt, and smolts released for the Little Sheep Creek steelhead hatchery program, 1990-2008.

Year	Estimated eggs collected	Estimated survival to fry	Estimated Fry Produced	Estimated survival fry to smolt	Estimated Smolts produced
1990	849,432	50.03%	425,000	77.46%	329,217
1991	455,292	71.60%	326,000	85.54%	278,849
1992	749,330	60.85%	456,000	74.65%	340,386
1993	647,272	67.51%	437,000	80.22%	350,551
1994	454,140	76.41%	347,000	97.57%	338,570

1995			334,496	96.60%	323,125
1996			482,095	87.98%	328,523
1997			124,957	93.81%	117,219
1998			357,907	96.78%	335,810
1999			503,505	94.58%	329,376
2000			447,718	97.00%	343,362
2001			309,636	96.77%	299,650
2002	514,480	69.2%	355,976	97.93%	348,613
2003	467,185	71.3%	333,060	90.78%	302,353
2004	429,571	74.0%	317,738	93.88%	298,289
2005	435,153	82.0%	356,874	81.25%	289,967
2006	363,474	83.8%	304,724	88.36%	269,268
2007	379,246	77.1%	292,321	94.36%	275,835
2008	293,580	77.0%	225,987	85.64%	193,544

9.2.2) Density and loadingcriteria(goals and actual levels).

- Program goals:

5.67 lbs/gpm
1.20 lbs/ft^3

- Actual at end of rearing cycle:

35,000 @ 4.1/lb = 8,500 lbs/pond
1,500 gpm/pond = 5.66 lbs/gpm
7,000 ft^3/pond = 1.21 lbs/ft^3

During peak loading, liquid oxygen is used to maintain the dissolved oxygen in all ponds at a minimum DO concentration of 6 mg/L.

9.2.3) Fish rearing conditions

Fish are reared in well water (seasonal variations 50°F-62° F). Dissolved oxygen levels are monitored during peak production and maintained at a minimum of 6 mg/L. Raceways are cleaned weekly and mortalities are picked daily.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 15. End of month weight for samples of Little Sheep steelhead juveniles, 2008.

Month	Fish /Pound
June	1,446
July	610
Aug	135
Sept	62
Oct	24

Nov	17
Dec	9
Jan	6.7
Feb[1]	5.1
Mar[1]	4.4

[1] Larger fish are transferred to Little Sheep acclimation ponds beginning in February. Smolts scheduled for Big Sheep are grown more slowly in February and March and direct stream released in mid-April.

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

Growth rates are fairly constant. In October fish are programmed for size at release and fed no less than 70% AGR.

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

- Fish are started on Bio Diet Starter then switched to Silver Cup Salmon at ~ 800 fish per pound. Fish are reared through smolt on Silver Cup.
- Feed rate:
  - Start - 5.0% body weight/day
  - End - 0.9% body weight/day
- The feed is distributed to the raceways with LinTec feeders.
- Food conversions are 1.1.

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

Juvenile fish are treated for bacterial infections if necessary with Aquaflor using a Veterinary Feed Directive. Refer to Section 7.7 regarding the Fish Health Monitoring Plan and disease history for this program.

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

N/A

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

Acclimated release allows reduced rearing densities results in 4 week volitional release window during normal migration periods (April through early May).

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.

- No groups of fish are culled from the program except for disease considerations or mistaken inclusion of stray fish in the broodstock. Smolts are reared to a size and released at a time similar to size and migration timing of wild fish.
- Smolts are acclimated at Little Sheep Creek beginning in February and extending through April, and volitionally leave from April to May. This not only provides for extended acclimation before release, but also reduces rearing densities at Irrigon Hatchery.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels. The target production in 201 is 215,000 smolts; however, production can increase to 330,000 smolts to meet adult return goal of 2,000.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fry or fingerling[1]	50,000	100/30	July/October	Big Sheep Creek
Yearling	330,000	5	April/May	Little Sheep and Big Sheep creeks

[1] Fry/ fingerling numbers represent a placeholder for occasional unplanned surplus egg takes.

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

Stream, river, or watercourse: Little Sheep Creek
Release point: River km 5 (smolts)
Major watershed: ImnahaRiver
Basin or Region: Snake River

Stream, river, or watercourse: Big Sheep Creek
Release point: River km15 (smolts and fry)
Major watershed: ImnahaRiver
Basin or Region: Snake River

Stream, river, or watercourse: Big Sheep Creek
Release point: River km 30-52 (fry/fingerling)
Major watershed: ImnahaRiver
Basin or Region: Snake River

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

Summer steelhead have been released into Little Sheep Creek, a tributary to Big Sheep Creek, and the ImnahaRiver since 1983. Smolt releases into Little Sheep Creek have comprised a significant portion of each broodyear's production: between 61-91%. From 1990 to 2008, all steelhead released into Little Sheep Creek were of smolt age, and were released in the spring, approximately one year after parent fertilization with the exception of 1999 when approx. 60,000 were released in the fall as fingerlings (Table 16).

From 1991 to 1995, summer steelhead smolts were released directly into the mainstem ImnahaRiver. These releases comprised approximately 15-22% of broodyear production and averaged 6.51fpp (Table 16).

Beginning in 1998, summer steelhead juveniles (of fingerling size) were released into Big Sheep Creek during the fall after being reared in the hatchery environment for 5-6 months. In 1998, they comprised only 1% (5,015 fish) of total broodyear production. In 1999 this release group increased to 90,000 fish and in 2000, to 93,680 fish. Since 2001 no fall releases have been made. From 2001 to 2007, approximately 100,000 yearling smolts were liberated in Big Sheep Creek. Beginning with the 2008 BY, that target number was reduced to 50,000 (Table 16).

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

Smolts are transferred into the Little Sheep acclimation facility around March 1. Starting about April 1st, a screen is pulled and a 28 day volitional release begins.Non-migrating smolts are subsampled to determine sex ratio in late April. If males comprise 70% or more of fish remaining, fish are transferred to a standing waterbody and utilized in resident fisheries. Otherwise, the remaining smolts are forced out of the acclimation pond and released around May 1.

If production increases to 330,000, two acclimation periods will be deployed with release dates in mid-April and early May. Volitional release periods will be reduced to two weeks. The sex ratio guidelines will only be applied to the second acclimation period.

Smolts are direct stream released into Big Sheep Creek from tankers at various accessible locations (Table 16). Release locations vary with season and weather.

10.5) Fish transportation procedures, if applicable.

Smolts are transported from Irrigon Hatchery to acclimation facilities via tanker trucks ranging in size from 2,000 to 5,000 gallon capacity. Loading density criteria are described in the Oregon State Liberation Manual.

10.6) Acclimation procedures and fish releases.

Smolts are transported to acclimation facilities from 3 to 6 weeks prior to intended release date. Smolts are forced from the pond on target release date.

Table 16. Juvenile and smolt releases of Little Sheep Creek facility steelhead in the Imnaha drainage, 1999-2009 (All data extrapolated from ODFW HMIS database).

Brood Year	Facility	Release Date	Location	Number Released	Pounds Released	Number Per Pound
1998	Little Sheep Cr.	04/13/99	Little Sheep Cr.	215,292	45,135	4.77
	Little Sheep Cr.	05/18/99	Little Sheep Cr.	119,379	22,107	5.4
1999	Irrigon H.	9/9/99	Big Sheep Cr.	95,000	760	125.0
	Irrigon H.	9/10/99	Little Sheep Cr.	59,986	479.89	125.0
	Little Sheep Cr.	04/12/00	Little Sheep Cr.	161,582	35,827	4.51
	Little Sheep Cr.	05/10/00	Little Sheep Cr.	66,624	17,260	3.86
	Irrigon H	Apr. 2000	Big Sheep Cr.	100,007	19,240	5.2
2000	Irrigon H	9/06/00	Big Sheep Cr.	93,730	910	103.0
	Little Sheep Cr.	4/11/01	Little Sheep Cr.	159,159	38,259	4.16
	Little Sheep Cr.	5/9/01	Little Sheep Cr.	83,297	18,510	4.50
	Irrigon H	Apr. 01	Big Sheep Cr.	100,216	19,203	5.2
2001	Irrigon H	Apr. 02	Big Sheep Cr.	101,694	19,745	5.1
	Little Sheep Cr.	04/11/02	Little Sheep Cr.	121,336	27,639	4.39
	Little Sheep Cr.	5/8/02	Little Sheep Cr.	74,239	16,425	4.52
2002	Irrigon H	Apr. 03	Big Sheep Cr.	114,114	21,320	4.7 – 6.0
	Irrigon H	4/9/03	Little Sheep Cr.	123,266	28,667	4.3
	Little Sheep Cr.	5/7/03	Little Sheep Cr.	110,776	25,762	4.3
2003	Irrigon H	Apr. 04	Big Sheep Cr.	100,002	20,241	5.1
	Little Sheep Cr.	4/12/04	Little Sheep Cr.	130,172	29,252	4.45
	Little Sheep Cr.	4/29/04	Little Sheep Cr.	71,839	14,812	4.85
2004	Irrigon H	Apr. 05	Big Sheep Cr.	136,570	29,610	4.6
	Little Sheep Cr.	4/11/05	Little Sheep Cr.	152,048	34,557	4.4
	Little Sheep Cr.	5/12/05	KinneyLake	8,470	1,709	4.73
2005	Irrigon H	Apr. 06	Big Sheep Cr.	128,044	28,625	4.6
	Little Sheep Cr	4/11/06	Little Sheep Cr.	151,860	32,311	4.7
	Little Sheep Cr	5/9/06	KinneyLake	9,187	2,170	4.23
2006	Irrigon H	Apr. 07	Big Sheep Cr.	100,038	22,775	4.4
	Little Sheep Cr.	4/10/07	Little Sheep Cr.	158,103	34,370	4.6
	Little Sheep Cr.	5/3/07	KinneyLake	9,701	2,109	4.6
2007	Irrigon H	Apr. 08	Big Sheep Cr.	103,320	21,525	4.8
	Little Sheep Cr.	4/1/08	Little Sheep Cr.	171,545	35,739	4.8
2008	Irrigon H	4/7/09	Big Sheep Cr.	45,298	10,295	4.4
	Little Sheep Cr.	3/31/09	Little Sheep Cr.	142,103	31,507	4.51
	Little Sheep Cr.	4/29/09	KinneyLake	4,733	1,125	4.21

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

All fish receive adipose clips (165,000 Little Sheep Creek and 50,000 Big Sheep Creek releases). One group of 25,000 from the Little Sheep Creek allocation additionally receives coded wire tags for harvest and return rate evaluations.

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

Fish are identified as surplus when projected numbers exceed capacity of the hatchery facilities for rearing to smolt (~250,000). Identified surplus steelhead are released as fry or fingerling into Big Sheep Creek (Section 10.3, 1998-2008 brood years).

10.9) Fish health certification procedures applied pre-release.

See section 7.7 and Attachment A.

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

Steelhead would not be directly released from Irrigon Hatchery; rather, they would be transferred to Little Sheep Creek and/or Big Sheep Creek for release. Additionally, fish held in the acclimation pond at Little Sheep Creek could be forced out if circumstances warrant.

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

Planned program fish releases occur only in the Big Sheep Creek drainage (includes Little Sheep Creek). Program direction is to avoid collecting eggs surplus to smolt production needs. The fish are released as smolts to minimize the likelihood for interaction and adverse ecological effects to listed natural Chinook and steelhead juveniles. Occasionally, shifts in fecundity result in excess egg collection. On these occasions, progeny surplus to smolt production needs are released as fry or fingerling. Close tracking of actual fecundity and estimated egg take are employed and number of adults spawned is adjusted during the spawning season in an effort to minimize taking of surplus eggs. Since 2001, all fish have been released as smolts.

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.

– Mark all harvest smolts and determine mark rate.
(*Indicators: 1a, 1b, 2b, 3a, 4a, 4b, 7a, 26a).*
– Analyze marked fish recovery data collected by others from Columbia, Deschutes,

Snake river fisheries to determine harvest numbers and rate.
(Indicators: 1a, 1b, 2b, 3a, 25a, 25b, 26a).

- Conduct statistically valid creel studies in the Imnaha system to determine effort and harvest of hatchery fish and incidental handling rate for other fish.
  (Indicators: 2a, 3a, 3b, 4a, 5a, 25a, 25b).
- Monitor smolt release size, numbers, timing, location and smolt movement.
  (Indicators: 7a, 14b, 17a, 22a, 22b, 22c, 24a, 25a, 25b).
- Monitor adult collection, numbers, status and disposition.
  (Indicators: 2b, 3a, 11a, 11b, 11c, 14a, 15a, 15b, 16a, 16b, 17b, 19a, 20a, 20b, 20c, 20d, 25a, 25b).
- Monitor survival, growth and performance of hatchery fish.
  (Indicators: 6a, 25a, 25b).
- Determine density of residual smolts and fingerling in key natural production areas.
  (Indicators: 22c, 25a, 25b).
- Determine proportion of hatchery adults in key natural spawning areas via observation and/or trapping.
  (Indicator: 19a, 25a, 25b).
- Develop genetic profiles for hatchery and natural steelhead populations in the basin and conduct regular monitoring.
  (Indicator: 18a, 20c, 25a, 25b).
- Monitor wild fish escapement trend in key natural spawning areas via observation and /or trapping.
  (Indicators: 15a, 17b, 19a, 20b, 21a, 21b, 25a, 25b).
- Develop and implement evaluation plans and report findings consistent with needs of the program for adaptive management.
  (Indicators: 25a, 25b).
- Monitor discharge water quality and water withdrawals and report annually on compliance with related permits and criteria, i.e., screening and fish passage criteria.
  (Indicators: 12a, 23a, 23b, 23c, 23d).
- Monitor health of adult and juvenile steelhead associated with hatchery production.
  (Indicators: 8a, 8b, 9a, 9b, 9c, 11b).

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.The following is a list of steelhead monitoring and evaluation activities that require additional funding for implementation.Obtaining this information as well as an estimate of population wide spawner abundance is critical for the long-term continuation of this program in a manner that will support the recovery of the Imnaha steelhead population and associated MPG.

Adult Straying [Moderate Priority]
Monitor the abundance and distribution of stray hatchery adults within the ImnahaRiver basin. Some empirical evidence suggests that acclimated hatchery releases do not stray within basin but direct releases are prone to stray. Develop and implement approaches to estimate proportion of stray hatchery spawners throughout the population. The approach could dovetail with expanded PIT tag detection antennas installed in the basin. However, finer spatial resolution would come from radio tagging efforts. Estimated cost to radio tag: $30,000 annually for two seasonal biologists and equipment.

Big Sheep Creek Supplementation [Low Priority]
Evaluate Big Sheep Creek hatchery steelhead supplementation. Currently there is no evaluation of whether supplementation is increasing natural steelhead abundance and productivity. Implementing such a project would involve construction of adult and juvenile trapping facilities, and hiring of new personnel. Estimated cost: $200,000 for facilities in the first year, $40,000 annually for personnel thereafter. The priority level of this objective would be elevated if the stocking of hatchery smolts into Big Sheep Creek had not been suspended pending repair of a bridge that must be crossed to reach the stocking location.

Residual Hatchery Fish [Moderate Priority]
Monitor the residualization of hatchery-reared steelhead and assess rearing and release methods to reduce residualization. Residualized steelhead will be sampled during river surveys. Residuals will be classified based on the presence of a fin clip or wire tag for hatchery fish. Our work will build upon residual studies conducted by this project in the 1990s, which quantified residual abundance for certain release strategies and investigated the predatory impact of residuals. These studies will focus on whether rearing and release strategies can be used to reduce residual abundance, and assess potential spawning interactions in nature between residual steelhead and the endemic population. Resident redband trout populations will be similarly noted, but are recognized as part of the Imnaha steelhead population. Estimated costs are for two seasonal biologists employed for 3 months each: $25,600 annually. This study links with a similar study for the Wallowa Stock steelhead hatchery program.

Genetic Stock Structure [Moderate Priority]
This work would initially re-analyze samples collected for three years (1999-2001) to help understand genetic stock structure and genetic diversity. The original analysis lacked resolution to address questions of genetic introgression by hatchery stocks, a primary question of interest to managers. Depending on sample re-analysis, collection of new samples may be warranted. Estimated cost for sample re-analysis: $30,000.

Database Development and Maintenance[High Priority]
We see the need for a “data steward” within the ODFW LSRCP Program to develop and

maintain the databases needed for organizing the data collected while monitoring the LSRCP hatchery programs and supplemented natural populations. These databases will allow us to conduct analyses within specific populations, as well as among LSRCP Chinook salmon populations, and will facilitate the effective compilation and transfer of information to the LSRCP databases. They will also have to be coordinated with those from LSRCP, BPA and NOAA Fisheries, the agencies to which we will submit these data, and be available to all co-management agencies.

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.

- NMFS guidelines will be followed in all electrofishing activities.
- Experienced surveyors will be utilized to conduct spawning surveys. Surveyors will walk along the stream, crossing when necessary, avoiding and counting redds and observing fish.
- Experienced fish culturists and fish pathologists will perform activities associated with fish production within the hatcheries.

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 index annual smolt survival and adult returns to Lower Granite Dam.
- Provide management recommendations aimed at improving program effectiveness and efficiency.
- Provide management recommendations aimed at reducing program impacts on listed fish.

Nez Perce Tribe recently started a new project (#201003200) to evaluate the steelhead population status and distribution of natural and hatchery fish in the Imnaha River Subbasin. The project goal is to establish steelhead population status information in the Imnaha River Subbasin to support a scientifically defendable fisheries management process and to provide society with information regarding recovery of the population. The project identified key management questions and those are:

- What is the status of wild steelhead adults in the Imnaha River Subbasin? (abundance and population growth rate)
- What behavior attributes of adult steelhead migration impact tributary specific population dynamics? (metapopulation structure)

- What is the genetic stock structure (gene flow, effective population size in relation to actual anadromous adult returns, genetic diversity/ heterozygosity) of anadromous steelhead across tributaries in the Imnaha River Subbasin? (genetic)
- What is the rate of dispersion of hatchery produced fish to non-outplanted tributaries in the Imnaha subbasin? (hatchery:natural interactions and distribution)
- Are returns of hatchery and wild origin adults to Little Sheep Creek or a subset of tributaries representative (abundance and characteristics) of wild steelhead to the entire Imnaha River Subbasin? (distribution and scale of needed monitoring)

Total natural and hatchery abundance and distribution of the Imnaha system will incorporate all available information obtained through operation of floating weirs, fixed weirs, resistivity weirs, and adult estimation through PIT tag recapture information (Figure 6). Results from these multiple methods will provide natural and hatchery adult abundance, distribution, life history, and genetic information in the entire Imnaha River drainage.

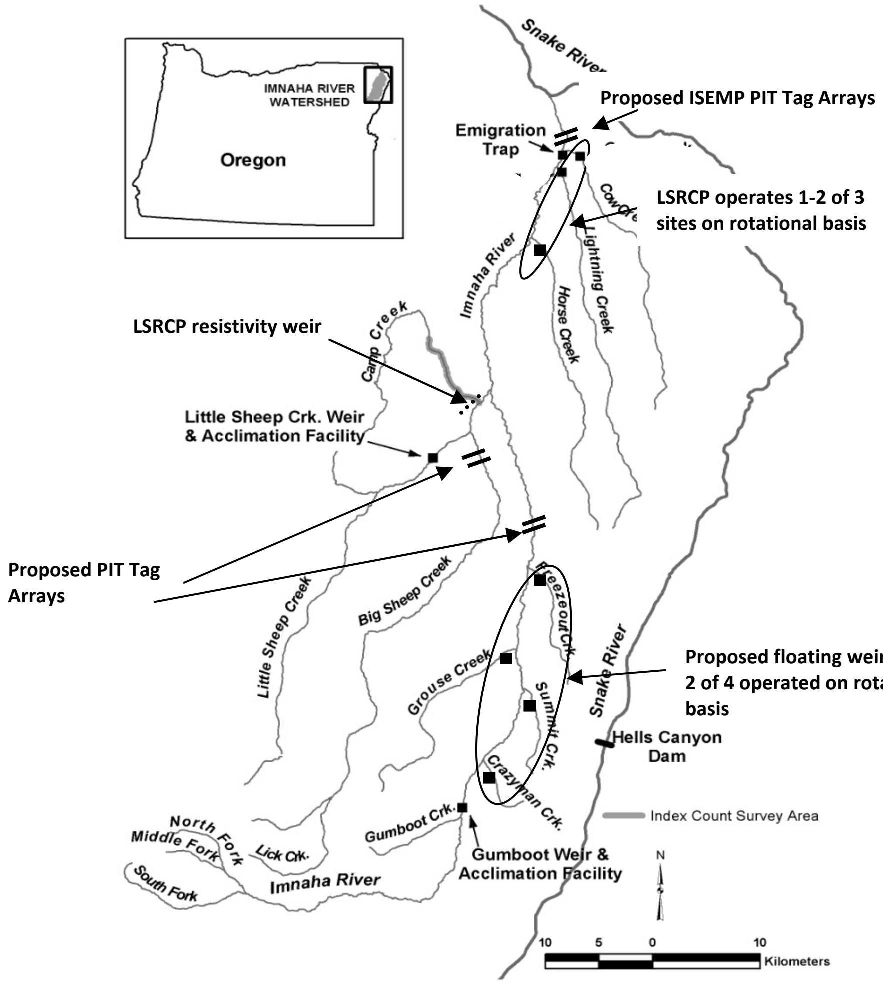


Figure 6.Imnaha River Subbasin with current and proposed steelhead research activities.

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.

Richard W. Carmichael
Lance Clarke
Michael W. Flesher
Debra Eddy
Shelby Warren

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 in natural spawning streams - Adult steelhead will be captured and enumerated at the existing Little Sheep Creek facility. See section 2.2.3.

2. Sampling to determine impacts of residual hatchery steelhead – Electrofishing, will be used to determine relative abundance of wild *O. mykiss* and hatchery steelhead residuals and fingerling in Big Sheep and Little Sheep creeks. Wild juveniles will be anesthetized measured for length and released after recovery. All sampling will occur when water temperatures do not pose additional risk to fish sampled.

3. Genetic monitoring – Wild juvenile *O. mykiss* will be sampled from various natural production areas in the course of genetic monitoring. Samples will be collected using electrofishing gear. Juvenile *O. mykiss* sampled will be captured and anesthetized with MS222 and measured for length. Non-lethal tissue samples will be removed for genetic analysis and the fish will be allowed to recover before they are released back into the stream segment from which they were collected.

4. Spawning surveys – In addition to adult trapping, density and hatchery/wild ratio of spawners in selected natural spawning areas will be monitored via observation. See section 2.2.3.

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

1. March 15 – June 15
2. April 1– September 30
3. July 1 – September 30
4. March 15 – June 15

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

Handling of listed fish will generally be restricted to enumeration, measurement and release at the site of capture. Fish will be held in containers with well-aerated water of suitable temperatures, less than 64°F. If handling involves more than determining species and enumeration, i.e. measurement, marking or tissue sampling, fish will be anesthetized with MS-222 before the procedure and allowed to recover before release. Transport will be by hand in water-filled containers with a holding period of up to two hours.

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

Monitoring and evaluation will involve take of all types (Table 8). Injury due to capture, marking and tissue sampling is inevitable. Hooking wounds, electrofishing injury and other physical damage is generally temporary in nature. Some fish, however, succumb to the effects of such injury. This mortality in addition to occasional direct loss due to capture and handling account for the lethal take estimates that may occur during monitoring and evaluation activities (Table 8).

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 Table 8.

12.10) Alternative methods to achieve project objectives.

- The use of cast nets or other devices to monitor hatchery/wild ratios in spawning areas has been considered. However, this type of sampling represents greater risk to sampled fish, produces increased sample bias and smaller expected sample size than trapping.

- The nature of our genetic sampling strategy, to develop a profile and monitor genetic characteristics of *O. mykiss* in a variety of streams across the basin, precludes use of steelhead smolts collected at traps used to monitor smolt movement. Alternate techniques such as smolt trapping are too labor intensive to consider feasible.

- Observation via snorkeling will be used in place of electrofishing for enumerating residual steelhead in streams suitable for effective use of that technique and where collection of residual hatchery smolts is not required.

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

Due to our inability to differentiate between listed anadromous and non-listed resident forms of *O. mykiss*, take estimates include both (Table 8). Occasionally, we expect to encounter spring Chinook juveniles and bull trout during sampling. However, the number of encounters and as a result the level of mortality, is expected to be less than ten juvenile fish per species.

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.

- Listed steelhead, Chinook and bull trout sampled during the residual steelhead study and genetic monitoring will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.
- Every effort will be made to insure that adult trapping facilities do not delay movement of or cause injury to listed fish, including daily trap checks.

SECTION 13. ATTACHMENTS AND CITATIONS

Attachment A

Little Sheep steelhead fish health monitoring plan

- A qualified fish health specialist will conduct all fish health monitoring.
- Annually examine a minimum of 60 brood stock for the presence of reportable viral pathogens. This sample size is great enough to assure a 95% chance of detection of a pathogen present in the population at the 5% level. American Fisheries Society "Fish Health Blue Book" procedures will be followed.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Annually examine up to 20 adult mortalities (if available) for systemic bacteria.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.

- Fish culture practices will be modified if deemed necessary after review with facility personnel. Pertinent discussion items are as follows: nutrition, water flow and chemistry, loading and density indices, handling, disinfection procedures, and disease treatments.
- If carcasses from this stock were used for nutrient enrichment there would be enhanced fish health monitoring requirements. Carcasses would need to be labeled and frozen for identification until laboratory results are complete and only carcasses cleared for out-planting could be used. All fish should be sampled for *Myxoboluscerebralis* (whirling disease). No fish determined to be positive for *M. cerebralis* spores would be used for this purpose. Other monitoring plans would be consistent with guidelines for the use of adult salmon and steelhead carcasses for nutrient enrichment (ODFW memorandum November 7, 2000). For example, if IHNV is found during a given spawning season and the prevalence exceeds 30%, then carcasses could no longer be used for this purpose for that spawning season.

Appendix Table 1. Summer steelhead population abundance and productivity data for Camp Creek, a tributary to the ImnahaRiver. Data is from the ICTRT (2010a).

Brood year	Spawners	% Wild	Natural Run	Natural Returns	R/S
1981	19	1	19	54	0.76
1982	15	1	15	86	4.53
1983	36	1	36	111	7.4
1984	29	1	29	169	4.7
1985	82	1	82	176	6.08
1986	90	1	90	148	1.81
1987	133	1	133	107	1.19
1988	211	1	211	33	0.25
1989	137	1	137	45	0.22
1990	163	1	163	77	0.56
1991	46	1	46	54	0.33
1992	18	1	18	29	0.64
1993	76	1	76	37	2.03
1994	79	1	79	51	0.67
1995	26	1	26	46	0.58
1996	33	1	33	55	2.1
1997	40	1	40	83	2.52
1998	64	1	64	98	2.44
1999	24	1	24	158	2.48
2000	89	1	89	157	6.53
2001	76	1	76		
2002	120	1	120		
2003	203	1	203		
2004	106	1	106		
2005	64	1	64		

Appendix Table 2. Imnaha River spring/summer Chinook abundance and productivity data from ICTRT (2010b).

Brood year	Spawners	% Wild	Natural Run	Natural Returns	R/S
1981	735	1	735	1263	1.72
1982	958	1	958	627	0.65
1983	706	1	706	818	1.16
1984	839	1	839	219	0.26
1985	1239	0.917	1239	197	0.16
1986	757	0.938	723	208	0.27
1987	488	0.898	472	178	0.36
1988	634	0.846	576	427	0.67
1989	294	0.733	253	178	0.6
1990	352	0.514	188	61	0.17
1991	379	0.307	183	108	0.28
1992	884	0.212	191	261	0.3
1993	1259	0.338	426	190	0.15
1994	251	0.454	116	100	0.4
1995	160	0.56	86	187	1.17
1996	339	0.662	255	573	1.69
1997	551	0.231	124	2242	4.07
1998	330	0.403	156	1316	3.98
1999	706	0.196	188	813	1.15
2000	850	0.325	324	294	0.35
2001	4485	0.443	2217		
2002	4005	0.222	923		
2003	3427	0.32	1461		
2004	1050	0.233	300		
2005	700	0.319	233		

Appendix Table 3. Snake River lower mainstem fall Chinook abundance and productivity data from ICTRT (2010c).

Brood year	Spawners	% Wild	Natural Run	Natural Returns	R/S
1981	340	1	340	335	0.99
1982	720	1	720	147	0.2
1983	540	0.793	428	808	1.5
1984	640	0.506	324	208	0.33
1985	691	0.634	438	235	0.34
1986	784	0.573	449	243	0.31
1987	951	0.266	253	239	0.25
1988	627	0.587	368	487	0.78
1989	706	0.418	295	846	1.2
1990	335	0.233	78	268	0.8
1991	590	0.539	318	269	0.46
1992	668	0.822	549	770	1.15
1993	952	0.779	742	646	0.68
1994	606	0.67	406	334	0.55
1995	637	0.549	350	961	1.51
1996	919	0.695	639	1671	1.82
1997	1007	0.791	797	3245	3.22
1998	962	0.318	306	3327	3.46
1999	1862	0.486	905	3422	1.84
2000	2664	0.431	1148		
2001	10507	0.484	5085		
2002	10115	0.207	2094		
2003	11700	0.333	3896		
2004	15582	0.305	4753		

Citations:

AOP. 2011. Lower Snake Program Annual Operation Plan (January 1, 2011 to December 31, 2011). Oregon Department of Fish and Wildlife, Salem, Oregon. 39pp.

Ashe, B.L., A.C. Miller, P.A. Kucera, and M.L. Blenden. 1995. Spring outmigration of wild and hatchery Chinook salmon salmon and steelhead smolts from the Imnaha River, March 1 - June 15, 1994. Fish Passage Center Technical Report.Nez Perce Tribe Fisheries Management, Lapwai, Idaho.76 pp.

Beasley, C.A. and 10 co-authors. 2008.Recommendations for Broad Scale Monitoring to Evaluate the Effects of Hatchery Supplementation on the Fitness of Natural Salmon and Steelhead Populations. Final Report of the *Ad Hoc* Supplementation Monitoring and Evaluation Workgroup (AHSWG).87 electronic pages. (http://www.pnamp.org/sites/default/files/final_report_ahswg.pdf)

Beauchamp, D.A., 1990. Seasonal and diet food habits of rainbow trout stocked as juveniles in Lake, Washington. Trans. of the American Fish Society 119: 475-485.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 in W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland.

Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's Bull Trout. Oregon Department of Fish and Wildlife, Portland, Oregon.

Canamela, D.A. 1992. Potential impacts of releases of hatchery steelhead trout smolts on wild and natural juvenile chinook and sockeye salmon. A White Paper, Idaho Department of Fish and Game, Boise, Idaho.

Columbia Basin Fish and Wildlife Authority – PIT Tag Steering Committee. 1999. PIT Tag Marking Procedures Manual. Ver. 2.0.

Crisp, E.Y. and T.C. Bjorn. 1978. Parr-smolt transformation and seaward migration of wild and hatchery steelhead trout in Idaho. Idaho Coop. Fish Res. Unit; Forest, Wildlife and Range Experiment Station. Final report from Project F-49-12. 117 pp.

Hillman, T.W. and J.W. Mullan, 1989. Effect of hatchery releases on the abundance and behavior of wild juvenile salmonids. Chapter 8 in D. W. Chapman Consultants, Inc. Summer and Winter Ecology of Juvenile Chinook Salmon and Steelhead Trout in the WenatcheeRiver, Washington. Final Report to Chelan Public Utility District, Washington. 301 pp.

Horner, N.J., 1978. Survival, densities and behavior of salmonid fry in stream in relation to fish predation. M.S. Thesis, University of Idaho, Moscow, Idaho. 115 pp.

Interior Columbia River Technical Recovery Team (ICTRT) 2010a. Current Status Review: Interior Columbia Basin Salmon ESU's and Steelhead DPSs. Part 4: Status Summary – Snake River Steelhead DPS. NOAA Northwest Fisheries Science Center, Seattle, WA.

Interior Columbia River Technical Recovery Team (ICTRT) 2010b. Current Status Review: Interior Columbia Basin Salmon ESU's and Steelhead DPSs. Part 4: Status Summary – Snake River Steelhead DPS. NOAA Northwest Fisheries Science Center, Seattle, WA.

Interior Columbia River Technical Recovery Team (ICTRT) 2010c. Current Status Review: Interior Columbia Basin Salmon ESU's and Steelhead DPSs. Part 5: Status Summary – Snake River fall Chinook Salmon ESU. NOAA Northwest Fisheries Science Center, Seattle, WA.

Independent Multidisciplinary Science Team. 2001. The scientific basis for artificial propagation in the recovery of wild anadromous salmonids in Oregon. Technicial Report 2001-1 to the Oregon Plan for Salmon and Watersheds.Oregon Watershed Enhancement Board Office. Salem, Oregon.

Integrated Hatchery Operations Team (IHOT). 1995. Policies and procedures for Columbia River Basin anadromous salmonid hatcheries. Bonneville Power Administration, Portland, OR.

Jonasson B.C., R.C. Carmichael and T.A Whitesel. 1994. Lower Snake River Compensation Plan - Residual steelhead characteristics and potential interactions with spring chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, 1994 Annual Progress Report, Portland, Oregon.

Jonasson B.C., R.C. Carmichael and T.A Whitesel. 1995. Lower Snake River Compensation Plan - Residual steelhead characteristics and potential interactions with spring chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, 1995 Annual Progress Report, Portland, Oregon.

McCann, J.A., D.W. Rondorf, H.L. Burge, and W.P. Connor. 1994. Evaluation of PIT tagging subyearling fall Chinook salmon during 1991 and 1992. Pages 63 to 91, in D.W. Rondorf and W.H. Miller, editors. Identification of the spawning, rearing, and migratory requirements of fall chinook salmon in the Columbia River basin. 1992 Annual report to the Bonneville Power Administration, Contract Number DE-AI79-91BP21708.

McMichael, G.A., C.S. Sharpe and T.N. Pearsons. 1997. Effects of residual hatchery-reared steelhead on growth of wild rainbow trout and spring chinook salmon. Trans. Am. Fish Soc.126: 230-239.

Partridge, F. E., 1986. Effects of steelhead smolt size on residualism and adult return rates. USFWS Lower Snake River Compensation Plan. Contract No. 14-16-001-83605 (1984 segment), Idaho Department of Fish & Game, Boise, Idaho. 59 pp.

Partridge, F.E., 1985. Effects of steelhead smolt size on residualism and adult return rates. USFWS Lower Snake River Compensation Plan. Contract No. 14-16-001-83605 (1983 segment), Idaho Department of Fish & Game, Boise, Idaho. 26 pp.

Prentice, E.F., T.A. Flagg, C.S. McCutcheon, D.F. Brastow, and D.C. Cross. 1990. Equipment, methods, and an automated data-entry station for PIT tagging. American Fisheries Society Symposium 7:335-340.

RASP (Regional Assessment of Supplementation Project). 1992. Supplementation in the Columbia Basin. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Summary Report Series, Final Report, Project 85-62, Portland, Oregon (http://pisces.bpa.gov/release/documents/documentviewer.aspx?pub=P01830-11.pdf).

Sausen, G. 2010. 2010 Bull Trout Redd Monitoring in the Wallowa Mountains. U.S. Fish and Wildlife Service, La Grande Field Office, La Grande, Oregon.42 pp.

Schuck, M.L., 1993. Biological assessment of Washington Department of Wildlife's Lower Snake River Compensation Plan Program. Washington Department of Wildlife, Olympia, Washington.

Smith, B. and W. Knox. 1992. Report of findings, bull trout density sampling. Unpublished report, Oregon Department of Fish and Wildlife, Wallowa Fish District, Enterprise, Oregon.

Viola, A.E. and M.L. Schuck, 1991. Estimates of residualism of hatchery reared summer steelhead and catchable size rainbow trout (Oncorhynchus mykiss) in the TucannonRiver and NF Asotin Creek in SE Washington, 1991. Unpublished report, Washington Department of Wildlife, Olympia, Washington. 16 pp.

Whitesel, T.A., B.C. Jonasson, and R.C. Carmichael. 1993. Lower Snake River Compensation Plan -- Residual steelhead characteristics and potential interactions with spring chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, 1993 Annual Progress Report, Portland, Oregon.

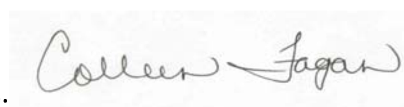
USFS. 2001. Imnaha Subbasin multi-species biological assessment (200-2001): assessment of ongoing and proposed activities. Wallowa-Whitman National Forest.Eagle Cap Ranger District, Hells Canyon Ranger District, Wallowa Valley Ranger District, Pine Ranger District.

USFS.2003. Imnaha Subbasin multi-species biological assessment (2003-2005).Wallowa-Whitman National Forest.

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:  , ODFW NE Region Hatchery Coordinator
Date: April 29, 2011

SECTION 15. PROGRAM EFFECTS ON OTHER (NON-ANADROMOUS SALMONID) ESA-LISTED POPULATIONS.

Species List Attached (Anadromous salmonid effects are addressed in Section 2)

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

Activities associated with the operation of this steelhead hatchery program as they affect bull trout are authorized under the Operation of the Lower Snake River Compensation Plan Program Biological Opinion (file # 1024.0000, 1-4-99-F-2) issued by the U. S. Fish and Wildlife Service's Snake River Basin Office, Boise, Idaho, April 8, 1999.

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

Bull trout – Both fluvial and resident life history forms of bull trout inhabit the ImnahaRiver and a number of tributaries. Bull trout utilize suitable habitat within the Imnaha River basin including; mainstem Imnaha River, it's North and South forks and the lower reaches of several smaller tributaries to the upper Imnaha system, Big Sheep Creek and tributary Lick Creek and Little Sheep Creek and several of its small tributaries. Fluvial adults migrate into headwater areas during summer and early fall after over-wintering in mainstem tributaries and the Snake River. Spawning for both resident and fluvial adults occurs in September and October. Fry emerge during the spring. Juvenile rearing is restricted to headwater areas where water remains cooler above approximately river kilometer 67 on the Imnaha and river kilometer 40 on Big Sheep and Little Sheep creeks.

The bull trout population in the ImnahaRiver appears reasonably robust based on recent spawning inventory. Spawning counts on the ImnahaRiver accounted for nearly 400 redds in 2001. Habitat conditions vary widely across the basin and affect bull trout productivity in some areas. As a result, the basins bull trout population(s) vary from areas of relative strength in wilderness streams (mainstem ImnahaRiver and upper Big Sheep Creek) to areas where bull trout are less productive (Little Sheep Creek and middle reaches of Big Sheep Creek). Two-pass electrofishing density estimates in Big Sheep, Lick, Salt and Little Sheep creeks were conducted in 1992. That work suggested moderate to high densities of rearing bull trout in streams except Little Sheep Creek. No bull trout were collected from sample reaches of Little Sheep Creek. Densities ranged from 5.6 to 15.8 (1+ and older) fish per $100m^2$ within sample sections containing bull trout in the other Imnaha tributaries, in addition to varying densities of 0-age bull trout (Smith and Knox 1992).

15.3) Analysis of effects.

The only identified direct effect of the hatchery operation on bull trout is trapping migrant fluvial fish in the adult steelhead trap at the Little Sheep Creek facility. The trap is operated in the late winter and spring. Number of fish trapped annually ranges from 0 to 10. Fish are held a maximum of four days, handled and passed upstream.

Hatchery operations - Water withdrawal for steelhead smolt acclimation occurs in the late winter and spring at a time when streamflow is high. Adequate bypass reach passage flow is maintained for adult steelhead as well as migrant fluvial bull trout. Facility maintenance, i.e. intake excavation, occurs in the summer months when water temperatures preclude the presence of bull trout.

Fish health – The Little Sheep Creek facility is located downstream of all juvenile/resident rearing areas. However, hatchery program juveniles are likely to encounter holding fluvial bull trout on their seaward migration in the Imnaha system. Adult hatchery steelhead are released into both Big Sheep Creek and Little Sheep Creek and are likely to move upstream into the lower reaches of bull trout juvenile/resident rearing areas. Also see section 3.5 and 7.7 and Attachment A.

Ecological/biological - Releases of smolts and juveniles occur downstream of most bull trout rearing areas minimizing potential competition and predation. Releases of listed hatchery steelhead may, however, provide substantial forage for larger fluvial bull trout over-wintering in the lower reaches of the system (see section 3.5).

Predation/competition – A small percentage of residual steelhead smolts have been found to migrate upstream in Big Sheep and Little Sheep creeks over 35 km, to reside at low densities in the lower reaches of bull trout rearing distribution (Whitesel et. al. 1993). Some limited predation of, and competition with, smaller bull trout may occur in this overlap zone.

Monitoring and evaluations - see section 12.11.

Habitat - The Little Sheep Creek facility does not affect juvenile/resident bull trout rearing habitat. Migratory behavior of fluvial bull trout is, however, disrupted briefly as they encounter the adult steelhead trap during its operation.

15.4) Actions taken to mitigate for potential effects.

- Smolts are released at a time and size designed to optimize the percentage migrating out of the system and minimize interaction with bull trout.
- Bull trout handled at the adult trap are sorted and released immediately upstream.

15.5) References

Smith, Brad and W. Knox. 1992. Report of findings, bull trout density sampling.

Unpublished report, Oregon Department of Fish and Wildlife, Wallowa Fish District, Enterprise, Oregon.

Whitesel, Tim A., B.C. Jonasson, and R.C. Carmichael. 1993. Lower Snake River Compensation Plan -- Residual steelhead characteristics and potential interactions with spring chinook salmon in northeast Oregon. Oregon Department of Fish and Wildlife, Fish Research Project, 1993 Annual Progress Report, Portland, Oregon.