HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Lower Snake River Compensation Plan (LSRCP) Imnaha Spring/Summer Chinook Program**
Species or Hatchery Stock:	**Spring/summer Chinook (Stock # 029)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**Imnaha / Snake River / Columbia Basin / Oregon**
Date Submitted:	**December 20, 2002**
Date Last Updated:	**Final Phase 1 - December 2002**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lower Snake River Compensation Plan (LSRCP), Imnaha Spring/Summer Chinook Hatchery Program.

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

Snake River ESU/Imnaha Spring-Summer Chinook, *Oncorhynchus tshawytscha*, (stock 029).
ESA status: threatened. (permit number 1128)

1.3) Responsible organization and individuals

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ODFW Hatchery Managers:

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Co-Management Organizations:

1. U. S. Fish and Wildlife Service – Lower Snake River Compensation Plan - Program (LSRCP) funding/oversight
2. Confederated Tribes of the Umatilla Indian Reservation – Co-manager
3. Nez Perce Tribe – Co-manager

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 spring/summer chinook program in Northeast Oregon includes Lookingglass Hatchery, integrated with Grande Ronde chinook basin program, Irrigon and Oxbow hatcheries. Irrigon Hatchery, also a LSRCP facility, has no funding allocated directly for the Imnaha program although eggs are received and shipped from this facility. Oxbow and Lookingglass hatchery staff is shared between two programs at an approximately 30% Imnaha basin and 70% Grande Ronde basin level. Combined program staff includes: (1) Hatchery Manager at Lookingglass Hatchery and (7 ¾) technician and laborer positions. Annual operation and maintenance costs for the Imnaha portion of the FY 2001 program were estimated at $225,479 for Lookingglass Hatchery and $4,434 for Oxbow Hatchery (estimations do not include overhead and capital outlay).

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

- *Adult holding, spawning, egg incubation, and rearing:*
  - Lookingglass hatchery is located 18 miles north of the town of Elgin, Oregon adjacent to Lookingglass Creek (ODFW watershed code 080440000) 2.2 miles above its confluence with the Grande Ronde River at about river mile 86. Elevation at the hatchery is 2,550 feet above sea level. Adult facilities consist of two adult traps, two adult concrete raceways (4,560 ft^3), and three adult circular holding tanks 942 $ft.^3$ (20'x3'). Incubation is in 288 vertical incubator trays with a capacity of 1.3 million eggs (4,500 eggs/tray) to hatching. There are 32 Canadian troughs for early rearing fish each with a capacity of 100 to 125 pounds of fish. Final rearing is in 18 concrete raceways (3,500 ft^3) each with a capacity of 4,000 lb (Lewis 1996).
  - Oxbow Hatchery is located 2 miles east of the town Cascade Locks, Oregon, adjacent to the Bonneville River. Elevation at the hatchery is 100 feet above sea level. Incubation facilities consist of 240 trays, 10 deep and 11 shallow troughs. Eleven Canadian troughs are used for inside rearing. One outside raceway (3,500 ft^3) is available.
- *Adult collection, acclimation and release:*

  Imnaha adult collection and smolt acclimation facility is located two to three hours from Lookingglass hatchery, approximately 30 miles south from the town of Imnaha, Oregon adjacent to the Imnaha River (ODFW watershed code 0800200000) at river mile 45.5. Elevation at the Imnaha facility is 3,760 feet above sea level. Facilities consist of an adult trap, spawning area and one pond (13,000 ft^3). The pond can be used for adult holding in the

summer and juvenile acclimation and release in the spring. Capacity for juveniles is about 19,500 pounds (390,000 fish at 20 fpp).

- *Other organizations involved and intent*

  The U.S. Fish and Wildlife Service, through the Lower Snake River Compensation Plan (LSRCP), funds operation and maintenance expenditures at Lookingglass hatchery and Imnaha satellite facility. The Nez Perce Tribe, Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation are co-managers of the Imnaha River spring/summer chinook salmon program.

1.6) Type of program.

Integrated Recovery. The Imnaha River spring/summer chinook salmon (stock 029) fish propagation program is funded through LSRCP "mitigation" and managed for "supplementation" and in some years, integrated harvest.

1.7) Purpose (Goal) of program.

The goal of this program is the restoration of spring/summer chinook salmon in the Imnaha River using the indigenous stock and to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River Dams. The program mitigation goal is to return 3,210 hatchery adults to the area above Ice Harbor Dam. Based upon this adult goal and an estimated 0.65% smolt-to-adult survival rate the target for smolt production was set at 490,000 fish.

Program specific goals include:

- Establishing an annual supply of brood fish that can provide an egg source capable of meeting mitigation goals.
- Restore and maintain the natural spawning population.
- Reestablish sport and tribal fisheries.
- Establish a total return of adult fish resulting from LSRCP activities in Oregon that meets the mitigation goal.
- Minimize the impacts of the program on resident stocks of game fish.

1.8) Justification for the program.

The Imnaha River hatchery program provides adult chinook for hatchery broodstock and limited recreational and tribal harvest within the Lower Snake River Compensation Plan mitigation area (Snake River and tributaries above Ice Harbor Dam). The program also provides fish for harvest in Columbia River fisheries. The program utilizes an endemic chinook hatchery stock that was founded on spring/summer chinook indigenous to the Imnaha River. Wild adults from Imnaha are incorporated within the broodstock annually and hatchery origin adults are allowed to spawn naturally in Imnaha River each year. A portion of returning adults is also released into Big Sheep Creek and Lick Creek to "supplement" natural adult escapement numbers.

1.9) List of program "Performance Standards".

Legal Mandates - Provide adult spring/ summer chinook within the LSRCP mitigation area while minimizing adverse impacts to listed fish.
Performance Standard (1): Imnaha basin chinook production contributes to fulfilling tribal trust legal mandates and treaty rights

Indicator 1(a): Estimated number of program chinook harvested in tribal fisheries by run year.
Indicator 1(b): Estimated number of Imnaha basin wild chinook harvested in tribal fisheries by run year.
Performance Standard (2): Program contributes to annual mitigation requirements
Indicator 2(a): Estimated number of recreational angler days in the Imnaha basin chinook fishery by run year
Indicator 2(b): Estimated annual harvest in LSRCP mitigation areas and annual escapement to the hatchery facility.
Indicator 2(c): Estimates total return to compensation area.

Harvest

Performance Standard (3): Fish are produced in a manner enabling effective harvest while avoiding over-harvest of non-target fish
Indicator 3(a): Estimated run year harvest and harvest related mortality for hatchery and wild fish, by fishery
Indicator 3(b): Estimated number of recreational angler days in the Imnaha basin chinook fishery by run year.
Performance Standard (4): Release groups are marked to enable determination of impacts and benefits in fisheries
Indicator 4(a): Number of recovered marked fish reported in each fishery produces accurate estimates of harvest.
Indicator 4(b): Verify that mark rate, at release, is 95% to 100% for all smolt release groups.
Performance Standard (5): Non-monetary societal benefits for which the program is designed are achieved
Indicator 5(a): Number of recreational fishery angler days

Hatchery Performance

Performance Standard (6): The hatchery program produces smolts at a higher efficiency than would be achieved in nature.
Indicator 6(a): Survival of chinook, by life stage in the hatchery
Performance Standard (7): Artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation
Indicator 7(a): Scientifically based experimental design, with measurable objectives and hypotheses
Performance Standard (8): Facility operation complies with applicable fish health and facility operation standards and protocols
Indicator 8(a): Results of monthly fish health examinations
Indicator 8(b): Annual reports indicating level of compliance with applicable standards and criteria.
Performance Standard (9): Releases do not introduce new pathogens into local populations, and do not increase the levels of existing pathogens
Indicator 9(a): Results of monthly fish health examinations
Indicator 9(b): Certification of juvenile fish health immediately prior to release
Indicator 9(c): Juvenile rearing density
Performance Standard (11): Any distribution of carcasses or other products for nutrient enhancement meets appropriate disease control regulations and interagency agreements.
Indicator 11(a): Number and location of carcasses distributed for nutrient enrichment
Indicator 11(b): Disease examination of all carcasses to be used for nutrient enrichment
Indicator 11(c): Statement of compliance with applicable regulations and guidelines (MOU with DEQ)
Performance Standard (12): Effluent from artificial production facilities will not detrimentally

affect populations.
Indicator 12(a): Verify that hatchery effluent is in compliance with existing NPDES permit conditions and water quality standards.
Performance Standard (13): Juvenile production costs are comparable to or less than other regional programs designed with similar objectives.
Indicator 12(a): Total cost of program operation
Indicator 12(b): Average cost of similar operations
Performance Standard (14): Hatchery program is sustainable.
Indicator 14(a): Number of broodstock collected is sufficient to maintain the hatchery brood.
Indicator 14(b): Number of smolts released achieves smolt production goals.

Conservation Objectives - Conserve genetic and life history diversity of chinook within the Imnaha River.
Performance Standard (15): Broodstock collection does not reduce potential juvenile production in natural rearing areas (Table 5.1).
Indicator 15(a): Number of wild spring/summer chinook retained for broodstock collection does not exceed 50% of the annual natural-origin escapement population.
Indicator 15(b): Percentage of natural-origin fish returning to the facility taken for broodstock comprises at least 20% of the brood population.
Performance Standard (16): Weir/trap operations do not result in significant stress, injury or mortality in natural populations
Indicator 16(a): Adult trapping mortality rate for natural-origin fish does not exceed 5%
Indicator 16(b): Adult trap is checked daily when in operation
Performance Standard (17): Juveniles are released after sufficient acclimation at the Imnaha facility to maximize homing to target sub-basins.
Indicator 17(a): Smolts are acclimated for 3-6 weeks prior to release.
Indicator 17(b): The proportion of marked spring/summer chinook returning to the Imnaha facility is equal to or greater than 95% of reported escapement.
Performance Standard (18): Patterns of genetic variation within and among natural-origin spring/summer chinook populations do not diverge as a result of artificial production programs.
Indicator 18(a): Compare genetic profiles and divergence of naturally produced juveniles from indicator areas within the Imnaha Sub-basin over time
Performance Standard (19): Hatchery produced adults do not exceed an maximum of 70% of natural spawners in the Imnaha River above the facility.
Comment [TL1]:
Indicator 19(a): Proportion of hatchery and natural-origin fish in key natural spawning areas.
Performance Standard (20): Broodstock selection strategies effectively maintain genetic and life history characteristics in the hatchery population.
Indicator 20(a): Natural-origin fish comprise at least 20% of the hatchery broodstock.
Indicator 20(b): Timing of hatchery adult returns to the Imnaha facility mimics natural-origin chinook returns.
Indicator 20(c): Genetic profile of natural-origin and hatchery fish in Imnaha does not significantly diverge.
Indicator 20(d): Size and age composition of returning adults is consistent with natural-origin run over time.
Performance Standard (21): Broodstock collection does not significantly alter spatial and temporal distribution of naturally spawning spring/summer chinook populations
Indicator 21(a): Number of adult fish aggregating or spawning immediately below the adult weir does not exceed historical distributions and spawning activity.
Indicator 21(b): Natural-origin spring/summer chinook are captured and sorted, and either retained, transported, or released according to annual run timing and run size.

Ecological Impacts

Performance Standard (22): Release numbers do not exceed an assumed habitat capacity for spawning, rearing, migration corridor, and estuarine and near-shore rearing.

Indicator 22(a): Smolts are released in March through April and are released into targeted locations to promote smolt emigration.

Indicator 22(b): Proportion of residual hatchery smolts in key natural rearing areas does not exceed 10%.

Indicator 22(c): Emigration behavior of hatchery smolts matches that of their wild counterparts.

Performance Standard (23): Water withdrawal 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

Indicator 23(a): Water withdrawals compared to applicable passage criteria

Indicator 23(b): Water withdrawal compared to NMFS juvenile screening criteria

Indicator 23(c): Proportion of diversion of total stream flow between hatchery facility intake and out-fall

Indicator 23(d): Length of stream impacted by water withdrawal

Performance Standard (24): Predation by artificially produced fish on natural produced fish does not significantly reduce numbers of natural fish

Indicator 24(a): Size at, and time of juvenile release compared to size and timing of natural fish present

Monitoring and Evaluation:

Performance Standard (25): Monitoring and evaluation occurs on an appropriate schedule and scale to assess progress toward achieving program objectives and evaluating the beneficial and adverse affects on natural populations

Indicator 25(a): Monitoring and evaluation framework including detailed timeline

Indicator 25(b): Annual and final reports

Performance Standard (26): Release groups are marked to allow evaluation of effects on local natural populations

Indicator 26(a): Visible mark (Ad-clip) in hatchery-origin release groups

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

1.10.1) "Performance Indicators" addressing benefits.

See section 1.9

1.10.2) "Performance Indicators" addressing risks.

See section 1.9

1.11) Expected size of program.

Mitigation hatchery production goal for Imnaha spring/summer chinook salmon is 490,000 smolts. Production includes:

- 420,000 smolts released into the Imnaha River.
- 70,000 smolts released into the Big Sheep and Lick creeks (Imnaha Sub-basin).

Actual production is based on adults collected from the adult sliding scale and the resultant egg numbers. The Imnaha River release is first priority. The hatchery production target has been lowered to 360,000 smolts for the Imnaha River due to space limitations at Lookingglass

Hatchery and foregone hatchery production to Big Sheep and Lick creeks.

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

Collection is not expected to exceed 166 males and 166 females. Age composition and fecundity of adults varies from year to year. However, given normal program adult survival, female fecundity and egg to smolt survival 332 adults (1:1 sex ratio) will produce approximately 490,000 smolts. For the year 2002, co-managers targeted a collection of 118 males and 118 females to produced 360,000 smolts

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Yearling	Imnaha River (Acclimated)	420,000
Yearling	Lick Creek (Direct Stream)	35,000
Yearling	Big Sheep Creek (Direct Stream)	35,000
Adult	Lick Creek (Direct Stream)	150 (75 pairs)
Adult	Big Sheep Creek (Direct Stream)	150 (75 pairs)

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 number of spring/summer chinook salmon collected at the Imnaha weir since 1990 is presented in Table 1.12. Estimated total adults produced from juvenile Imnaha spring/summer chinook salmon released for this program is reported in Table 2.

Table 1.12 Summary of spring/summer chinook salmon collected at the Imnaha weir and their disposition since 1990 (adults and jacks combined). Released = released alive above the weir and out-planted. Retained = transferred to Lookingglass hatchery for brood stock. Data taken from ODFW Annual Report Series, Evaluation of Lower Snake River Compensation Plan Facilities in Oregon.

Brood	Unmarked Fish			Marked Fish		
Year	Collected	Released	Retained	Collected	Released	Retained
1990	183	102	81	221	68	153
1991	223*	126	97	282	67	215
1992	413*	280	133	431	179	252
1993	650*	543	107	593	248	345
1994	72	52	20	91	60	31
1995	38	0	38	30	0	30
1996	145	73	72	99	23	76
1997	84	61	23	204	55	149
1998	150	73	77	236	136**	96
1999	73	51	22	323	69	254
2000	150	73	77	233	135**	96
2001	1,495	1,392	103	1,985	1,523**	462

* = In 1990 and 1991 not all the Imnaha spring/summer chinook salmon juveniles released were marked. Estimates of unmarked hatchery fish included in the above numbers are: 1991 = 92; 1992 = 253; and 1993 = 302.

** = Includes fish out-planted to Big Sheep Creek and Lick Creek.

Table 2: Estimated total adult spring/summer chinook salmon produced from juveniles released as part of this program. Data taken from ODFW Annual Report Series, "Evaluation of Lower Snake River Compensation Plan Facilities in Oregon". Strays = non-harvest freshwater recoveries outside the Imnaha Basin.

Run Year	Harvest		Imnaha Return *	Strays	Total Return
	Ocean	Columbia R.			
1990	2	18	276		296
1991	0	8	142		150
1992	9	23	1,214		1,246
1993	8	0	973		981
1994	0	1	151	7	159
1995	0	1	190	4	195
1996	3	0	200	1	204

*** = Compensation goal area.**

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

Lookingglass Hatchery was completed in 1982. The Imnaha Acclimation Satellite modifications were completed in 1989. The first releases of spring/summer chinook salmon for this program occurred at the Imnaha site in March 1984 (1982 brood).

1.14) Expected duration of program.

The Imnaha spring/summer chinook salmon (stock 029) program is an ongoing project.

1.15) Watersheds targeted by program.

The Imnaha watershed (0800200000) is the target area.

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

Given the listed status of Snake River spring/summer chinook, maintaining a hatchery program is currently the only method of supplementing the natural population and providing harvest opportunity on hatchery produced fish in the LSRCP mitigation area.

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

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

ESA Section 10 permit #1128.
Lower Snake River Compensation Plan program
NPDES 0300J (site number 64492)
Aqui-S INAD 10-541-0202 (permit number for 2002)
Erythromycin INAD 020RLOSCS1 (permit number for 2002)

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.

Spring/summer chinook –Adults spawn in headwaters of the Imnaha River and Big Sheep Creek sub-basins. Many areas of the basin including reaches below spawning areas and tributaries that maintain suitable habitat conditions are utilized by rearing juveniles. The combined natural and hatchery returns to the basin have ranged from several hundred in the late 1980's and 1990's to several thousands in the early 2000's. An escapement of 6,296 was expected in 2002.

Imnaha basin adults typically return as four-year-olds in both hatchery (65%) and natural (58%) fish. However, age composition of returning adults differs from hatchery and natural produced fish, inasmuch as, 20% to 40% of the hatchery males mature at age-three (jacks) compared to <10% of natural males. In contrast, at age-five an inverse age composition relationship occurs with more age-five spawners in natural fish (Carmichael et al 1998). Returning adults range in size from 45 to 110 cm and 1.4 to 11.5 kg.

Adult spring chinook enter the Columbia River from March through May. Spring chinook move into summer holding areas from May through July. Spawning occurs from early August through late 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 begin in late January and extends through early July.

Comment [TL2]:

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 returns as two-salt adults with an occasional three-salt fish observed. 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.

Imnaha summer steelhead begin spawning 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. few adult summer steelhead have been encountered at the Imnaha weir.

Fall chinook – Fall chinook in the lower reaches of the Imnaha are considered segments of the Snake River population and exhibit similar life histories. 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 it's 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 river kilometer 67 on the Imnaha and river kilometer 40 on Big Sheep and Little Sheep creeks.

The bull trout population in the Imnaha River appears reasonably robust based on recent spawning inventory. Spawning counts on the Imnaha River 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 Imnaha River 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).

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

. ESA listed naturally produced spring/summer chinook returning to Imnaha River are collected and utilized in the hatchery broodstock (Table 5.1). Notably, progeny from hatchery and wild fish spawned are listed as well.

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

The hatchery production program may incidentally affect listed Snake River summer steelhead populations. In addition, listed Snake River spring chinook populations, Snake River fall chinook and Columbia Basin bull trout may be affected to a lesser degree. Bull trout are most affected during chinook trapping activities.

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

The narrative below is adapted from Permit for Scientific Research and to Enhance the Propagation or Survival of Imnaha River Chinook Salmon application under the Endanger

Species Act of 1973 (Carmichael 1998).

Spring/summer chinook salmon populations in the Imnaha River basin have decline precipitously during the 1970's, 1980-'s and 1990's. Escapement in 1957 was estimated at 3,459 (Carmichael et al 1990). Wild population levels had declined to levels below 150 individuals in ,id-1990. Population declines are principally attributed to reduced population production that has resulted from juvenile and adult mortalities that occur during migration at Snake and Columbia River dams and reservoirs. Historically, chinook salmon spawned in Lick Creek, Big Sheep Creek, and the Mainstem Imnaha River. In recent years, few redds were observed in Lick and Big Sheep creeks. The current spawning distribution is the mainstem extends from the South Fork Imnaha River to Freezeout Creek with a majority of spawning in the 17.7 miles from the "Blue Hole" to Crazyman Creek.

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

The most recent progeny-to-parent ratios have not been analyzed. ODFW research staff located in La Grande Oregon, directed by Richard Carmichael, is completing this work. Data presented is from 1982 to 1992. During this period, the average P:P ratios were 3.55 for hatchery origin and 0.51 for natural origin fish.

Table 2.2.2. Comparison of progeny to parent ratios for the Imnaha hatchery program and the natural spawning population in the Imnaha river (age-three males included).

Year	Hatchery	Natural
1982	8.82	1.05
1983	1.25	1.15
1984	3.08	0.26
1985	1.96	0.17
1986	1.52	0.41
1987	3.73	0.44
1988	12.60	0.72
1989	3.81	0.55
1990	0.51	0.20
1991	1.09	0.20
1992	0.62	0.50

- 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.

Table 2.2.2A. Redd counts observed in selected tributaries in the Imnaha sub-basin, 1990-2001 (per. comm. Knox).

Year	Imnaha River		Big Sheep Cr.		Lick Cr.		Total Redds Imnaha Basin
	Index Redds	Total Redds	Index Redds	Total Redds	Index Redds	Total Redds	
1990	29	54	0	2	0	0	56
1991	51	92	1	6	1	1	99

1992	75	118	0	3	0	0	121
1993	219	372	1	12	0	24[1]	408
1994	17	36	0	0	0	0	36
1995	15	32	0	0	0	0	32
1996	52	71	1	1	0	0	72
1997	101	216	9	19	29	51	286
1998	39	146	0	0	4	11	157
1999	87	189	0	1	0	0	190
2000	90	261	0	0	0	0	261
2001	153	612	0	1	5	5	618

[1] 24 redds were observed on 9/8 following outplanting of 33 female and 16 male hatchery chinook from Imnaha facility

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

For the period 1990 through 1999, the proportion of marked fish among the fish released from the Imnaha weir has averaged 43.6% and ranged from 24.0% to 65.1%. However, spring/summer chinook salmon do spawn in areas below the weir and the weir only traps about 54% of the run (Keniry per comm.). The proportion of marked carcasses recovered during 1994 through 2001 spawning ground surveys in the Imnaha River Basin is reported in 2.2.2B.

Table 2.2.2B: Origin of spring/summer chinook salmon carcasses, based on marking of hatchery fish, recovered during spawning ground surveys in the Imnaha River. Data from: 1994 and 1996 (Keniry 1999); 1995 (Parker et. al. 1995); and 1997 (Parker and Keefe 1997).

Run Year	Marked	Unmarked	Percent Marked
1994	24	30	44.4%
1995	5	23	17.9%
1996	8	60	11.8%
1997	109	59	64.9%

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 marked and unmarked listed chinook returning to the Imnaha satellite weir. Adults collected are incorporated into a matrix spawning protocol to maintain genetic similarity between hatchery-origin and natural-origin

populations. Adults are collected from June (as early as stream conditions allow trap installation) to September based on systematic approach to pass fish above the weir, out-plant, or retaining for broodstock based on origin, sex, and age. The approach is based on a preseason estimate of returning adults and is modified as the run develops.

Spawning, incubation and rearing – Adults fish are killed during the spawning process. Eggs and resulting progeny are subject to mortality during incubation and rearing due to developmental, disease, injury and other causes. Every effort is made in the hatchery environment to ensure maximum survival of chinook 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 are conducted to determine natural spawning abundance and distribution, density and proportion of hatchery-origin fish in key natural spawning areas. These surveys are conducted annually in various reaches of spawning habitat from August through September. 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 juvenile chinook and to collect genetic samples from naturally produced chinook. Juvenile chinook are also PIT tagged to monitor survival and migrations. These activities, which generally occur from May through October, will result in take of juvenile listed steelhead and occasionally spring chinook 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.

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

Imnaha River adults were held at both Imnaha facility and Lookingglass hatchery since 1988. Since 1993, all adults have been held at Lookingglass Hatchery

Table 2.2.3A. Adult pre-spawning and handling mortality occurring at the Imnaha and Lookingglass Hatchery facilities 1988-1998.

Adult Mortality						
Year	Imnaha			Lookingglass		
	Adult	Mortality	Percent	Adult	Mortality	Percent
1988				208	16	7.7
1989	292	22	7.5			
1990	240	35	14.6			
1991	313	12	3.8			

1992	385	88	22.9			
1993				452	50	11.1
1994				51	6	11.8
1995				68	7	10.3
1996				133	26	19.6
1997				172	52	30.2
1998				134	21	15.7
Totals	*1,240*	*157*	*12.7*	*1,218*	*178*	*14.6*

The NPDES 0300 J permit does not allow formalin treatments at the Imnaha facility due to dilution requirements.

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

- **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 2.2.3B includes projected takes for the adult collection, program monitoring, and hatchery reared fish which as a group include progeny of listed wild fish and are therefore part of the ESU.

Table 2.2.3B. Estimated take levels of listed salmonids by hatchery activities.

Listed species affected: Spring/Summer Chinook **ESU/Population:** Snake River

Activity: Imnaha River spring/summer chinook 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)	675,000	500	1,000	280
Collect for transport b)	675,000	0	660	280
Capture, handle, and release c)	0	10,000	7,500	0
Capture, handle, tag/mark/tissue sample, and release d)	490,000	490,000	7,500	0
Removal (e.g. broodstock) e)	0	0	100W/232H	0
Intentional lethal take f)	67,500	480	100W/232H	0
Unintentional lethal take g)	135,000	50,000	70	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay 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.

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.

- 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.
In 1992, pre-spawning mortality exceeded 70 adults. Mortality was attributed to turbid water caused by an upstream landslide. Formalin treatments were suspended for 3-weeks due to the turbid water. Since 1993, all adult fish have been transported and held at Lookingglass Hatchery.

In 1997, pre-spawning mortality was higher than expected due to head burns, presumably from exposure to high nitrogen levels in the Columbia and Snake Rivers.

In 2000 and 2001, the returning numbers of three-year-old males (jacks) have exceed the permitted number to be released above the weir and used in brood stock. In both years hatchery surplus jacks were retained and out planted in late September in Lick Creek and Big Sheep Creek. The intent was to use these fish as an added nutrient source without interacting with females on spawning grounds.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.
The proposed program outlined in this HGMP is consistent with the NPPC Annual Production Review (Report and Recommendations), draft Imnaha sub-basin summary, current section 10 permit (1128), and address issues of concern outlined in the NMFS Hatchery Biological Opinion (1999).

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

- *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.
- *US vs Oregon* - The hatchery program outlined within this HGMP is consistent with the now out-dated Appendix B hatchery smolt production agreements of the *US vs Oregon* negotiations and the intent to provide fish for harvest in tribal and sport fisheries into the future.
- *Columbia River Fish Management Plan* – The program would continue to provide substantial harvest in Zone 6 tribal net fisheries as well as in-basin tribal harvest opportunity.
- *Annual Operation Plan (AOP 2002 LSRCP)*—The program is consistent with co-

manager agreements outlined in annual operations.

3.3) Relationship to harvest objectives.

The Imnaha sub-basin harvest plan has not been developed with co-managers.

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

In the 1900's, Imnaha River stock hatchery fish were not intercepted in sport fisheries from the ocean to the Imnaha River. However, in 2001 and 2002, fish were available to sport harvest from the ocean to the Imnaha River. This information has not been summarized.

Tribal harvest from the ocean to the Grande Ronde River is unknown.

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia Basin affect chinook production in the Imnaha basin. Major impacts to the Imnaha chinook habitat are from roads, past logging practices, and land development. There are some impacts from livestock grazing and feedlots. State programs in place through the Department of Environmental Quality, Department of Forestry and Division 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 chinook and 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 (EQIP and CREP). Efforts include fencing streamside corridors to promote riparian vegetative recovery, improved fish passage at road crossings and diversions, reduce 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) improving habitat, and productivity, for the basin's wild spring/summer chinook.

3.5) Ecological interactions.

The narrative below is adapted from Biological Assessments completed by ODFW for Imnaha spring chinook salmon hatchery program and submitted, as part of LSRCP Programmatic Assessments, to NMFS in 1993 and 1997.

The LSRCP spring chinook hatchery program in the Imnaha basin has the potential to affect wild chinook, summer steelhead, and bull trout in a number of ways including predation, competition, behavior, and disease.

Predation - Little evidence exists of predation by hatchery released spring chinook on other salmonids. Hatchery spring chinook smolts are programmed for release in the Imnaha River at 20 fish per pound and should range in size from 100 to 150 mm fork length. Release timing and methods (volitional release following acclimation) are intended to result in rapid migration from the Imnaha and limit interaction with other species in the river. The small size of hatchery migrants, rapid migration from the Imnaha River, and limited time for conversion from a hatchery diet to a natural diet reduce the likelihood of predation by hatchery chinook on other salmonids in the Imnaha basin.

There is potential for predation by other salmonids, especially bull trout, on hatchery and natural chinook in the Imnaha basin. Releases of hatchery chinook and any potential increase in natural production of chinook resulting from the LSRCP program could enhance listed bull trout populations by increasing available forage.

Competition - Hatchery chinook smolts have the potential to compete with natural chinook, natural steelhead and bull trout juveniles for food, space, and habitat. If significant interaction does occur in the Imnaha basin, it is restricted to a short duration as smolts move downstream or to the immediate vicinity of release sites where hatchery fish are most concentrated. Rapid departure of hatchery chinook smolts from the basin is likely to limit competition with rearing wild chinook, steelhead, and bull trout. Differences in food habits and habitat preferences are also likely to limit competition with bull trout. Bull trout associated with areas influenced by hatchery chinook smolts are generally fluvial adults and are more likely to out compete and prey on hatchery chinook due to a significant size advantage.

There is potential for competitive interactions between hatchery chinook and wild chinook and steelhead smolts in migration corridors. We do not have information to assess competitive interactions during downstream migration, however, hatchery chinook smolts are released at a size similar to natural chinook smolts (20 fish per pound) and should not have a competitive advantage as a result of size.

Behavioral - There are limited data describing adverse behavioral effects of hatchery chinook salmon releases on natural/wild chinook salmon populations. Hillman and Mullan (1989) reported that larger hatchery fingerling chinook salmon, released in June and July in the Wenatchee River in Washington, apparently "pulled" smaller wild/natural chinook salmon with them as they drifted downstream resulting in predation on the smaller fish by other salmonids. While the effects of migrating hatchery smolts (yearlings) on wild/natural chinook salmon are unknown at this time the potential for similar effects exists especially with large concentrated releases within natural rearing areas.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens and parasites that could affect wild chinook, steelhead and bull trout growth and survival. Because the hatchery produced spring chinook for the Imnaha program are reared at Lookingglass Hatchery, outside the Imnaha watershed, potential disease impacts on wild salmonids are limited to periods of smolt acclimation and adult trapping and holding. Documentation of disease status of Imnaha hatchery chinook is accomplished through monthly and preliberation fish health examinations.

Incidental Take at Trapping Facilities - Installation of the Imnaha weir and trapping facilities for collection of adult chinook broodstock has the potential to effect wild steelhead and bull trout. These facilities could delay or otherwise alter migrations and some handling of listed species will

occur. In the Imnaha basin, chinook are trapped at the Imnaha satellite located 0.5 miles below the mouth of Gumboot Cr. Installation of the Imnaha weir will occur after most adult steelhead have completed upstream spawning migrations. If adult steelhead are trapped, they will be checked for marks and passed above the trapping facilities. Steelhead kelts moving downstream are more likely to encounter chinook trapping facilities. Kelts observed upstream of trapping facilities that can be captured (netted) will be checked for adipose clips and immediately passed downstream.

Bull trout have been captured at the Imnaha trapping facility. Bull trout that are trapped are passed upstream with minimal handling and an "eyeball" estimate of their length is recorded.

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.

The main water source for Lookingglass Hatchery is Lookingglass Creek (50 CFS water right). Water temperatures fluctuate daily and seasonally with mean daily temperatures ranging between 1 ^{o} and 16^{o}C. Additional water sources include 2 wells that are capable of pumping 5 CFS of 14.5^{o}C. Water discharged is monitored under the general NPDES 0300 J permits. High spring run-off has created problems with turbid water and sediment disposition. Compliance for screening criteria is currently (2002/03) being evaluated.

The main water source for Imnaha Satellite is the Imnaha River (9 CFS water right March/April and 15CFS June/October). Water temperatures fluctuate daily and seasonally with mean daily temperatures ranging between 0.5 ^{o} and 16^{o}C. Compliance for intake-screening criteria will be evaluated.

The water source for the Irrigon Hatchery consists of five remote wells that are capable of pumping 31,000 gpm (69 CFS) with temperature ranging from 10°C to 16°C. Water is chilled to 5^{o}C for incubation. Water discharged is monitored under the general NPDES 0300 J permits.

The water source at Oxbow Hatchery is spring water with a mean temperature of approximately 5^{o}C. Water can be chilled to 3^{o}C for incubation. Intake screens are in compliance with NMFS criteria. Water discharged is monitored under the general NPDES 0300 J permits.

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.

Intake Screens were replaced at Lookingglass Hatchery in 1999. Intake screens will be evaluated in 2002 or 2003 for compliance to the current criteria. The potential for entrapment of listed fish exists at the Imnaha acclimation site. These screens will also be evaluated in 2002 or 2003 for compliance.

Irrigon Hatchery is 100% well water. Oxbow hatchery conforms to the NMFS screening guidelines.

Effluent water quality at all three facilities is monitored quarterly under a general 0300J NPDES permit. Water quality standards and conditions have been good over the past 5 years.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities and methods.

Facilities

The Imnaha Satellite consists one support cabin (800 $ft.^2$), one outside acclimation pond with rearing volume of raceways 13,000 $ft.^3$ (125'x26'x4'), picket-style weir, and adult trap (1,040 $ft.^3$). Collected adults are transported to Lookingglass hatchery on a weekly or as needed basis.

The main water source for Imnaha Satellite is the Imnaha River. ODFW surface water rights on the Imnaha River total 4,443 gpm (9.9 CFS) from March 1 to April 30 and June 1 to June 30. Surface water rights increase to 6,732 gpm (15 CFS) from June 1 to October 31. Water temperatures fluctuate daily and seasonally with mean temperatures ranging between 0.5 ^{o} and 11^{o}C.

Collections

The Imnaha spring/summer chinook program uses the endemic population for hatchery broodstock. Because fish spawn below the weir location and some fish pass above the weir prior to installation, we trap an average of 65% of the Imnaha River adult escapement. Broodstock collection guidelines (sliding scale) are based on estimated escapement to the mouth of Imnaha River. The sliding scale was developed cooperatively with NPT (Table 5.1).

The following management guidelines were used to form the basis for implementation of the sliding scale. For adult escapement of 51-700, three uses of hatchery and natural fish are identified:

1. Collect for hatchery broodstock and spawn
2. Release above the weir to spawn naturally
3. Tribal ceremonial use

For adult escapement above 700, six potential uses of hatchery and natural fish are identified:

1. Collect for hatchery broodstock and spawn
2. Release above the weir to spawn naturally
3. Out plant up to 150 adult hatchery fish each (300 total) into Big Sheep and Lick Creeks
4. Tribal ceremonial use
5. Tribal subsistence purposes
6. Recreational fishing on hatchery origin fish

In addition, surplus jacks have been releases into Big Sheep and Lick Creek for nutrient enrichment.

Table 5.1. Sliding Scale Management Plan for the Imnaha River Spring Chinook Artificial Propagation Program.

Estimated total adult escapement to the Imnaha River mouth (hatchery plus natural)	Ratio of hatchery to natural adults at the mouth	Maximum % of natural adults to retain for broodstock	% of hatchery adults to retain for broodstock	% of adults released above the weir can be of hatchery origin	Minimum % of broodstock of natural origin
<50	Any	0	0	A	NA
51-700	Any	50	≤50	A	A

701-1,000	Any	40	A	70	20
1,001-1,400	Any	40	A	60	25
>1,400	Any	30	A	50	30
A—Percentage determined as result of implementing other criteria, therefore not a decision factor					

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

The adult holding trap is 1,040 ft.^{3}. The water flow of 4,000 to 6,000 gpm used to operate the ladder also flows through the adult trap. Fish are transported weekly or as needed to Lookingglass Hatchery in 800-gallon transport tank. Tanks are equipped with supplemental oxygen, aeration, and alarms.

5.3) Broodstock holding and spawning facilities.

The Lookingglass Hatchery consists of one Hatchery building complex (11,588 ft.^{2}). The complex includes an office, spawning room, incubation, rearing, cold storage, shop, lab, visitor center and dormitory. The spawning room consists of an anesthetizing tank, brail, spawning table, fish health and fish research stations, and adult return tubes to holding pond. All Imnaha origin adults are held in one adult pond 6,400 ft.^{3} (20'x80'x4') with a maximum inflow of 3,990 gpm. Maximum holding capacity is 560 adults (1 adult/8 ft.^{3}).

5.4) Incubation facilities.

Lookingglass Hatchery

Lookingglass Hatchery contains 32 inside rearing containers and 288 incubation trays in 36 stacks. Approximately 150 gpm of chilled well water is available for incubation and early rearing; however, incubation and early rearing doesn't currently occur at Lookingglass Hatchery. Green eggs are transported to either Irrigon or Oxbow hatcheries.

Irrigon Hatchery

The Irrigon Hatchery incubation facility includes 288 incubation trays in 24 stacks. Chilled well water is available for incubation. Irrigon was not used in 2002 for incubation of Imnaha chinook and its use is not expected in the near future.

Oxbow Hatchery

The Oxbow Hatchery (located near Cascade Locks, Oregon) is a Mitchell Act Hatchery. A portion of the facility is used to provide incubation and early rearing for the Imnaha spring/summer chinook program. Inside incubation containers include 240 incubation trays in 16 stacks. Chilled spring water is available for incubation.

5.5) Rearing facilities.

Lookingglass Hatchery

Outside rearing containers include 18 raceways with rearing volume 3500 ft.^{3} (10'x100'x3.5'), 2 adult holding raceways 6,400 ft.^{3} (20'x80'x4'), three adult circular holding tanks 942 ft.^{3} (20'x3'). Inside rearing containers include 32 troughs and 288 incubation trays in 36 stacks.

Irrigon Hatchery

Inside rearing containers include 68 circular tanks each with a rearing volume of 70 ft.^{3} (6 diameter x 3 height). Irrigon was not used in 2002 for early rearing of Imnaha chinook and its use is not expected in the near future.

Oxbow Hatchery
Inside rearing containers include 11 Canadian troughs (volume of 63.4 ft.^{3}). One outside rearing container (volume 8,000 ft.^{3}) is available.

5.6) Acclimation/release facilities.
The Imnaha Satellite consists one support cabin (800 ft.^{2}) and one acclimation pond with volume of 13,000 ft.^{3} (125'x26'x4').

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

1. Water quality problems resulting from upstream landslides in the Eagle Cap Wilderness on Imnaha River (Imnaha satellite) lead to increased sedimentation and turbidity and that resulted in high adult pre-spawn mortality.

2. Icing events at Lookingglass Hatchery intake. Three scenarios can cause ice buildup and blockage of the intake:
    - Icing of Lookingglass Creek under a slow 1 to 3 week period brought on by sub-zero air temperatures.
    - Icing of Lookingglass Creek under a slow 1 to 3 week period followed by heavy snow that results in slush ice.
    - Icing events on Lookingglass Creek followed by quick warming temperatures that result in sheet ice dams that break loose and lodge against the intake.

3. Temperature control (too cold) for green egg transferred from Lookingglass Hatchery to either Irrigon or Oxbow hatcheries.

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.

- Transfer of adult holding from Imnaha satellite to Lookingglass Hatchery
- Operate intake well (TW2) for icing emergencies
- Maintain back-up diesel motor for TW2
- TW2 alarms
- Low water alarm
- 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.
- Staff facility 24 hours a day, seven days a week during hatchery operation.
- Transfer green eggs to either Irrigon or Oxbow hatcheries (pathogen "free" water sources)
    - Irrigon well water (multiple wells water supplies, back-up generators, low water alarms)
    - Oxbow spring water (low water alarms)

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.

Brood stock for the Imnaha River spring/summer chinook salmon program is collected from adult returns trapped at Imnaha weir and then transferred to Lookingglass hatchery for spawning. This includes both hatchery and naturally produced fish. The ratio of hatchery to wild fish collected for broodstock is based on adult escapement sliding scale (Table 5.1)

6.2) Supporting information.

6.2.1) History.

Since the beginning of this program in 1982 only natural or hatchery produced Imnaha River spring/summer chinook salmon have been used for brood stock.

Table 6.2.1 Imnaha River spring/summer chinook salmon spawning data for the 1990 through 2001 brood years.

Brood Year	Marked Males Spawned	Marked Females Spawned	Unmarked Males Spawned	Unmarked Females Spawned	% Un-marked	Spawning Ratio F/M	Average Fecundity	Egg Take (1,000's)	Fry Ponded (1,000's)	Smolts releases (1,000's)
1990	35	49	39	25	43.2%	1.00	4,414	327	270	0
1991	11	24	27	15	54.5%	1.03	4,954	193	163	0
1992	46	86	69	28	42.4%	0.99	4,754	542	465	0
1993	134	139	58	54	29.1%	1.01	5,425	1,047	1,010	283
1994	15	13	6	9	34.9%	1.05	5,082	112	96	0
1995	16	9	30	6	59.0%	0.33	4,541	68	51	0
1996	15	7	37	17	71.1%	0.46	4,276	103	102	0
1997	54	50	8	7	12.6%	0.92	4,962	283	206	0
1998	53	33	31	28	40.7%	0.59	5,059	309	183	0
1999	183	31	14	6	8.5%	*0.16				0
2000	240	58	46	10	15.8%	*0.19	5,048	334	311	0
2001	114	56	54	49	37.8%	*0.38	4,371	459	275	0

*Three-year olds males (jacks) are included in the marked males spawned. Milt is pooled and used to fertilize a maximum of 10% of the available eggs; therefore, the % marked fish and spawning ratio (F/M) are skewed.

6.2.2) Annual size.

The program annual brood stock collection goal is 322 adults spawned to produce 490,000 smolts; however, in the short term 242 adults (sex ratio 1:1) can be collected to produce 360,000 smolts. The green egg take goal for 2002 is 480,000 with a broodstock comprised of >30% unmarked fish (AOP 2002). Actual collection goals are established each year through development of the annual operation plan that is based on adult sliding scale (Table 5.1). Actual number of males and females spawned are reported in Table 6.2.1.

The program incorporates age-three males or jacks in the broodstock to fertilize a maximum of 10% of the eggs. A maximum of five jacks milt can be pooled to fertilize one cell of eggs. An egg cell is typically one-half or one-third of one females eggs. Utilizing jacks in the broodstock results in skewed sex ratio, i.e. BY1999, BY2000, BY2001 (Table 6.2.1).

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

Naturally spawning fish included in the brood stock, are reported in Table 6.2.1. The proportion of naturally produced fish (Unmarked) spawned has averaged 37% and ranged from 8.5% to

71.1% for the 1990 through 2001 brood years.

6.2.4) Genetic or ecological differences.
There is currently no information about genetic and ecological differences between the hatchery stock and wild Imnaha fish. Broodstock annually incorporates locally adapted naturally produced fish that should minimize differences (Table 5.1). However, our inability to install the weir during high flows (>900cfs), typically in June and early July, may result in differences in run timing between hatchery and natural origin fish.

6.2.5) Reasons for choosing.
Broodstock is collected at Imnaha weir and incorporates naturally produced fish in order to maintain local adaptation and wild type characteristics. Broodstock is indigenous to the Imnaha Sub-basin.

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 is selected systematically from across the run. Pass/keep ratio varies annually, depending on return projections and is adjusted in-season to insure representation from across the run. Only hatchery fish are released in the Big Sheep Creek and Lick Creek watershed to enhance the number of naturally spawning fish.

Comment [TL3]:

SECTION 7. BROODSTOCK COLLECTION

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

7.2) Collection or sampling design.
All adults that enter the Imnaha weir trap are sorted by origin (marked vs. unmarked), sex and age. Fish are retained for brood stock, out-planted, or released above the weir. Ratios vary annually depending on escapement estimates and the guidelines outlined in Table 5.1. Adults are selected randomly from the available ripe fish for the brood stock. Broodstock are marked with an opercle punch and in some years a jaw tag. Fish not retained for brood stock are marked with an opercle punch and released above the weir or out-planted. Hatchery jacks may be placed above the weir, up to 10% of the males passed above the weir.

Table 7.2. Imnaha satellite weir operation, spring/summer chinook salmon collected and spawning dates from 1994 to 2001.

Run	Operation of Imnaha weir		Collection at Imnaha Weir		Spawning at Lookingglass Hatchery	
Year	Beginning	Ending	Beginning	Ending	Beginning	Ending
1994	16-Jun	21-Sep	27-Jun	13-Sep	24-Aug	8-Sep
1995	26-Jul	07-Sep	2-Aug	30-Aug	17-Aug	7-Sep
1996	16-Jul	11-Sep	23-Jul	4-Sep	14-Aug	12-Sep
1997	03-Jul	10-Sep	8-Jul	3-Sep	15-Aug	12-Sep
1998	06-Jul	15-Sep	11-Jul	8-Sep	5-Aug	14-Sep

1999	21-Jul	07-Sep	27-Jul	24-Sep	6-Aug	9-Sep
2000	28-Jun	12-Sep	28-Jun	12-Sep	9-Aug	13-Sep
2001	24-May	29-Sep	25-May	19-Sep	14-Aug	18-Sep

7.3) Identity.

(a) Methods for identifying target populations (if more than one population may be present).
Naturally produced fish are identified based on lack of marks or tags. The Imnaha weir is in a location where only one natural population should be encountered.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.
All hatchery chinook released in the Imnaha basin starting from BY1990 (released in 1992) have been marked with an adipose fin clip (AD) and implanted with a coded-wire tag (CWT).

7.4) Proposed number to be collected:

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

Collection is not expected to exceed 332 adults (166 males and 166 females). Co-managers have targeted a collection of 236 adults (118 males and 118 females) to produced 360,000 smolts for brood year 2002.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1990-01), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Smolts
1990	74				246,386
1991	39				157,659
1992	114				438,627
1993	193				609,571
1994	22				91,240
1995	15				50,911
1996	24				93,108
1997	57				184,725
1998	61	47	37		179,716
1999	37	64	133		123,014
2000	68	76	210	333,824	303,769
2001	98	87	78	459,276	*270,000
*estimated release in 2003					

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

- Adults are passed upstream consistent with pre-season estimate using guidelines outlined in the adult sliding scale (Table 5.1).
- Out-plant a maximum of 300 adults (150 each (75 adult pairs) into Lick Creek and Big Sheep Creek) within the Imnaha Sub-basin.
- Tribal and recreational fisheries
- Tribal ceremonial purposes
- Nutrient enhancement (hatchery origin jacks)

7.6) Fish transportation and holding methods.

Adults moving upstream in the Imnaha River are impeded by a picket weir and diverted into a fish ladder. Fish ascend the ladder and jump into a covered 1040 $ft.^3$ holding area. Fish are sorted (release above the weir, broodstock, or out-plant) weekly. During peak collection and also during the late part of the run (ripe fish), fish are sorted twice per week. Fish may be held a maximum of 10 days during the early part of the run.

Adults are anesthetized at the Imnaha facility with MS 222 or Aqui-S prior to biological sampling and antibiotic injections. Fish are injected with oxytetracycline (10mg/kg) and erythromycin (Erthro-200 @ 20mg/Kg).

Adults retained for broodstock are transported to Lookingglass Hatchery in an 800-gallon tank. Transportation time is approximately 2.5 hours from Imnaha satellite to Lookingglass Hatchery.

All adults are held in one adult pond 6,400 $ft.^3$ (20'x80'x4') with a maximum inflow of 3,990 gpm. Maximum holding capacity is 800 adults (1 adult/8 $ft.^3$). Fish are treated with formalin at 167 ppm every other day to control fungus. On or about August 1, early arriving fish (before July 15) are injected a second time with oxytetracycline (10mg/kg) and erythromycin (Erthro-200 @ 20mg/Kg).

7.7) Describe fish health maintenance and sanitation procedures applied.

Collection--Adults retained for broodstock are injected with oxytetracycline (10mg/kg) and erythromycin (Erthro-200 @ 20mg/Kg) at the Imnaha facility.

Holding--At Lookingglass Hatchery, formalin is dripped into the inflowing water to achieve a maximum concentration of 167 ppm. The treatment is applied for one hour to control fungus and parasites three times per week. After September 1, the frequency is adjusted as necessary. On or about August 1, early arriving fish (before July 15) held at Lookingglass Hatchery are injected a second time at the same dose.

Spawning--All hatchery-spawned females are screened for *R. salmoninarum* using enzyme-linked immunosorbent assay (ELISA) techniques. Male kidneys are visually inspected for lesions. A minimum of 20 adults is examined by culture for systemic bacteria and *C. Shasta*. A minimum of 60 spawned fish is sampled for culturable viruses using ovarian fluid and caeca/kidney/spleen in 5 fish sample pools.

Progeny-- Eggs are water hardened in a75ppm iodophore solution for up to 60 minutes to control

vertical transmission of pathogen including IHNV. Vertical transmission of BKD (*R. Salmoninarum*) is a concern. Eggs are culled or segregated in groups based on ELISA titers. The following titer ranges identify groups:

- Less than .199 =Low
- 0.2 - 0.399 = Moderate/Low
- 0.4 - 0.799 = Moderate/High
- Greater than 0.800 = High

Progeny receive two 28-day erythromycin prophylactic feed treatments (INAD 020RLOSCS1) to control BKD.

There has been no epizootic outbreak in past 5 years; however, numerous facilitative pathogens have been detected in juveniles, as well as, obligate pathogens BKD and IHNV. Disease outbreaks are treated on a case-by-case basis. Therapies and remedial measures are based on conventional and available treatments, new information, and innovation. Warm water therapy may be used if EIBS becomes a problem. It would be used, based on priorities of stocks and raceways affected, after consultation with appropriate entities. Formalin treatments would be implemented for all parasitic infestations.
Disinfections and sanitation guidelines for Lookingglass Hatchery are outlined in Table 7.7.

Table 7.7 Summary of Recommended Disinfectants (Concentration and time) and Application

Disinfectant	Application	Concentration	Time	Comment
Iodophor	Nets, gear and equipment, clipping & tagging van, PIT tag stations, large tub disinfectant containers, spawning colanders and buckets, lib truck, footbaths	100 ppm Note: to make 100 ppm solution mix 6.7 oz of jug strength iodophor to 5 gallons H_2O or 6.7 oz.=189ml	10 min.	-Equipment should be pre-rinsed to remove dirt, mucus or other organic material which reduces the efficacy of disinfectant -Rinse equipment to remove harmful residue if equipment is going into standing water containing fish or fish are being placed into the equipment (tank or bucket) -Argentyne or other buffered iodophors such as Western Chemicals “PVP iodine” would be acceptable
Isopropyl Alcohol	PIT tag needles and any other apparatus used to insert into fish	70%	10 min. Note: Air dry	-No re-use until air dried -use drying oven to enhance air drying step
Vesphene-II	Recommended for footbaths	As per label 1 oz/ Gallon H_20	Per label	Effective activity holds longer than Iodophor
Chlorine or Aqueous solution as sodium hypochlorite (Household Bleach)	Lib truck tanks	100 ppm	10 min.	Organic matter binds and neutralizes

7.8) Disposition of carcasses.

Landfill for disposal. Carcasses maybe screened for pathogens BKD, IHN, and *m. cerebralis.* Adults testing negative can be used for nutrient enhancement adhering to MOA between ODFW and DEQ.

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 consulting with Fish Pathologist and following Fish Health Policy sanitation and fish health maintenance recommendations discussed annually with co-mangers during the development of the AOP (2002). Prudent fish health measures can be implemented to cull eggs from females with gross signs of BKD.
- Adult broodstock collection outlined in a sliding scale
- Natural origin adults incorporated in the broodstock (sliding scale management)

SECTION 8. MATING

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

8.1) Selection method.

Adults are collected daily through out the operation of the weir. From the collected fish, a predetermined number of adults by age, sex, and origin, are selected systematically based on the ratios outlined in the adult slide scale (Table 5.1). Hatchery broodstock are selected at random for spawning as they mature.

8.2) Males.

We do not expect to use additional males as "backup" to increase fertility rates. To include contribution of hatchery origin jacks, milt can be pooled from 5 jacks and used to fertilize a portion of one female. Total contribution is <10% of the available eggs. Occasionally, natural origin males are used multiple times to increase their contribution.

8.3) Fertilization.

The goal of the program is to produce a minimum mating of 100 family pairs. Matrix or factorial spawning is generally accomplished in 2x2 combinations; therefore each matrix generates four family pairs. The goal is that at a minimum each matrix contains at least one natural origin adult. Occasionally, natural origin males are used multiple times to increase their contribution.

Target sex ratio for this program has been a 1:1 male-to-female adult spawning ratio. However, due to the production of hatchery origin jacks, the ratios are often skewed towards males. In years of abundant jack returns, 10 hatchery jacks equal one adult male.

Refer to section 7 for fish health and sanitation procedures.

8.4) Cryopreserved gametes.

Cryopreserved sperm collected and maintained by the Nez Perce Tribe is available from past

brood years. However, 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.

A factorial or matrix-mating scheme is applied to ripe fish on specific spawning day. The number of ripe fish, their sex and age determines the matrices. Natural fish are included in each matrix to maximize contribution of natural fish.

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.

- An estimate of 75% survival from green egg to smolt survival is used to determine adult collections in the sliding scale.

9.1) Incubation:

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

While program smolt goal has remained constant since initiation, egg take has varied over time due to low spawners numbers some years (1991,1994 and 1995), elimination of across the run egg culling after 1997 and disagreement between co-managers regarding use of surplus adults (1998) (Table 9.1). The current program attempts to meet the 360,000 fish smolt goal by using average fecundity and survival to calculate the number of spawners needed (AOP 2002). Up to 300 hatchery origin adults surplus to escapement and broodstock needs are outplanted into Big Sheep and Lick creeks.

Table 9.1 Egg take and egg loss data for Imnaha spring/summer chinook at Lookingglass Hatchery, 1990-2001 brood years.

Year	Egg Take	Egg Loss		Percent Survival
	Total	Total	% Loss	to eyed egg Stage
1990	326,612	53,862	16.5	83.5
1991	193,206	27,256	14.4	85.6
1992	524,005	72,955	13.5	86.5
1993	1,047,064	35,085	3.4	96.6
1994	111,794	15,619	14.0	86.0
1995	68,121	15,471	22.7	77.3
1996	110,146	7,911	7.2	93.8
1997	282,823	76,112	26.9	73.1
1998	308,572	78,617	25.5	74.5
1999	168,930	40,153	23.8	76.2
2000	333,824	18,338	5.5	94.5
2001	459,276	180,427	39.3	61.7

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

During the past 12 years there have been no releases of spring/summer chinook salmon unfed fry in the Imnaha Basin. The only non-smolt release was 283,046 1993 brood year fingerlings released in July 1994 at 4.6 gm/fish (98 fish/lb). These fingerlings were excess to smolt production goals and were out-planted for natural rearing in the Imnaha Basin. Locations included in Big Sheep, Little Sheep, Cow, Freeze out, Horse, and Lightning Creeks and the main stem Imnaha River. These fish were 100% marked with an adipose fin clip. No unfed fry or fingerling releases are planned.

9.1.3) Loading densities applied during incubation.

Eggs are incubated in vertical Heath trays. Standard loading (@5,000 eggs/tray) is eggs from one female in one tray. On occasion, trays are loaded with two females worth of eggs. Flows are regulated at 4 to 6 gpm per vertical stack.

9.1.4) Incubation conditions.

Co-managers have agreed to transfer green eggs from Lookingglass to either Oxbow or Irrigon hatcheries for incubations and early rearing on pathogen "free" water. Incubation to first feeding fry occurs on chilled well water at Irrigon Hatchery (5^{o}C) and spring water (6^{o}C) or chilled spring water (3^{o}C) at Oxbow Hatchery. Sediment is not a problem at either site

Irrigon and Oxbow hatcheries– Water temperature is monitored via recording thermograph or via chillers for water entering incubation trays. Daily thermal units (CTU's) are calculated to determine developmental stages. Eggs are picked at approximately 275-300 CTU's. After picking, eggs incubated at Irrigon are transferred to Oxbow Hatchery for hatching and early rearing. At approximately 1,000 CTU's, feed is present to the swim-up fry. Water temperatures are controlled and moderated in individual vertical stacks to synchronize the date of first feeding in late January. Dissolved oxygen, typically greater than 90% saturation, has never presented a problem for egg survival.

Lookingglass Hatchery—Incubation has occurred at Lookingglass Hatchery using raw river water or chilled well water. Silt has been a concern. Dissolved oxygen has never presented a problem for egg survival. Incubation has not recently occurred at Lookingglass Hatchery due to the availability of pathogen "free" water source from chilled well water. If pathogen "free" water is available, eggs can be incubated at Lookingglass Hatchery.

9.1.5) Ponding.

Fry are ready to pond at about 1,000 CTU's (1,800 TU). Fry weigh approximately 0.3 grams (1,300 fish per pound) and measure 25 to 30 mm (1.0 to 1.2 inches) in length. Forced ponding can occur in January or February after fry are visually inspected.

9.1.6) Fish health maintenance and monitoring.

Fungus is controlled with formalin treatments at a concentration of 1,667ppm. Treatments are scheduled three times per week for 15 minutes; however, daily treatment will be applied if needed. Little mortality has been attributed to yolk-sac malformation. After eyeing, dead eggs are hand picked.

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.
Green eggs are transferred from Lookingglass Hatchery to Irrigon and Oxbow hatcheries. Eggs are fertilized at the receiving hatchery and water hardened in 75 ppm iodophore for a minimum of 15 minutes. Eggs are incubated on well water or spring water to minimize the risk of disease transfer from Lookingglass Creek and loss due to siltation.

9.2) Rearing:

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

Production goals are modeled using 75% survival of green eggs to smolt. The categorized survival assumptions include:

Green to eye-egg: 90%
Eye-egg to swim-up fry: 91%
Swim-up fry to fingerling (marking): 93%
Fingerling to smolt (marking to release): 99%

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

Lookingglass Hatchery
Co-mangers agreed to loading rate of 60,000 fish per raceway (2001 AOP).

Goals	Actual (2001)
Number fish/rcy: 60,000	Number fish/rcy: 77,000
Density: 0.86 lbs/ft.^{3}	Density: 1.1 lbs/ft.^{3}
Density Index: 0.16	Density Index: 0.21
Flow: 4 lbs./gpm	Flow: 5.1 lbs./gpm
Flow Index: 0.76	Flow Index: 0.97

Actual rearing density was higher due to failure of two intake valves. Co-managers agreed to increase the density rather release fish at an earlier life stage.

Imnaha acclimation

Goal	Actual (2002)
Number fish/rcy: 360,000	Number fish/rcy: 303,000
Density: 1.38 lbs/ft.^{3}	Density: 1.17 lbs/ft.^{3}
Density Index: 0.26	Density Index: 0.22
Flow: 4.5 lbs./gpm	Flow: 3.8 lbs./gpm
Flow Index: 0.85	Flow Index: 0.72

9.2.3) Fish rearing conditions

Oxbow--Fish are reared in spring water (seasonal temperature variations 4°C to 6°C) from late-January to April. Flows are adjusted to maintain dissolved oxygen levels at a minimum of 70% saturation (@ 8.4 mg/l). Troughs are cleaned and mortalities are picked daily.

Irrigon-- Fish are reared in well water (seasonal temperature variations 11°C to 13°C) from late-January to April. Flows are adjusted to maintain dissolved oxygen levels at a minimum of 70% saturation (@ 7.4 mg/l). Troughs are cleaned and mortalities are picked daily.

Lookingglass—Fish are transferred from either Oxbow and/or Irrigon hatcheries to Lookingglass

Hatchery in April and reared in Lookingglass Creek water (seasonal temperature variations 1°C to 16°C). Flows are adjusted to maintain dissolved oxygen levels at a minimum of 70% saturation (@ 6.1 mg/l). Water is typically rationed in late July and early August during low creek flows. Raceways are cleaned weekly and mortalities picked daily. During prophylactic feeding of erythromycin cleaning can be suspended.

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.

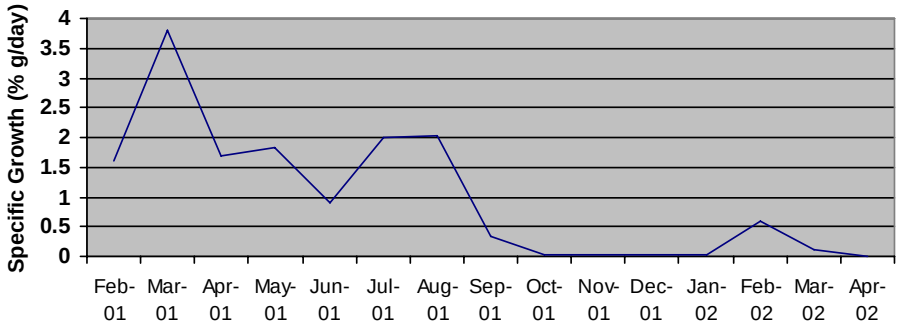
Table 9.2.4. Estimated monthly weight of brood year 2000 Imnaha Chinook juveniles, January 2001through April 2002.

Month	Weight (g)	Fish /Pound
January	0.35	1300
February	0.57	800
March	1.79	253
April	2.97	153
May	5.16	88.0
June	6.78	67.0
July	12.3	37.0
Aug	22.7	20.0
Sept	25.2	18.0
Oct	25.4	17.9
Nov	25.6	17.7
Dec	25.8	17.6
Jan	26.1	17.4
Feb	31.3	14.5
Mar	32.2	14.1
Apr	32.2	14.1

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

The specific growth rate was calculated from the modeled growth in Table 9.2.4. The highest growth rates occurred in March 2001, i.e., first feeding fry at Oxbow Hatchery. Growth rates varied from April through August. Most of the variations are attributed to off feeding days, such as, the April transfer to Lookingglass and June fish marking (Ad clip and coded wire tags). In August, daily rations were targeted at 2.2% per day for the prophylactic medicated feed treatment, which reflects an increase in growth rate. Specific growth rates declined in September 2001 with little weight gain in November, December, and early January 2002 with decreasing water temperatures. A slight increase in growth rates was observed in February prior to transfer to the Imnaha acclimation facility. Modest growth was observed at the Imnaha site, as fish are fed in moderation prior to release.

Figure 9.2.5. Specific growth rates for BY00 Imnaha Chinook.



No hepatosomatic index (liver weight/body weight) and body moisture content was collected to estimate body fat concentration during rearing.

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*).

- At Oxbow hatchery swim-up fry are started on Biodiet and transitioned to Moore Clark Nutra fry at about 250 fpp. One 28-day erythromycin medicated feed treatment is given using Biodiet at 4.4% body weight Feed is distributed by hand.
- At Irrigon hatchery, swim-up fry are started on Bio-Oregon moist. One 28-day erythromycin medicated feed treatment is given using Bio-Oregon moist diet at 4.4% body weight. Feed is distributed by hand.
- At Lookingglass Hatchery, fish are fed Moore Clark's Nutra plus diet. The feed is distributed to the raceways with Garon feeders. One 28-day erythromycin medicated feed treatment is given using Bio-Oregon moist at a target of 2.2% body weight. Medicated feed is fed by hand.
- Feed rate:
  Start - 5.0% body weight/day
  November through January fish are fed intermittently at "maintenance" ration 0.1%.
  End - 0.1% body weight/day
- Overall food conversions are 1.1

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

Monthly sample of about 10 (or available) moribund and/or dead fish will be examined for *R. salmoninarum* (BKD) and systemic bacteria. Every other month, examine 5 grab-sampled fish per raceway and any moribund fish for erythrocytic inclusion body syndrome (EIBS) using blood smears and hematocrits. Perform glucose assays on the plasma from the 5 grab-sampled fish. If EIBS is detected expand monitoring on that raceway to 10 fish per month. Examine gill and skin wet mounts by microscopy from a minimum of five fish. These may be from a combination of moribund and healthy fish. If bacterial gill or cold water disease is suspected, make smears from the gills on agar medium.

BKD – Two 28-day erythromycin prophylactic feed treatments are scheduled: The first in early February at Oxbow or Irrigon, the second at Lookingglass Hatchery in August. The target dose is 100 mg erythromycin per kilogram fish.

EIBS - There is no prophylaxis for EIBS except avoidance of the infectious agent. Bacterial coldwater disease is the most common secondary infection. Oxytetracycline prophylaxis will likely be implemented based on the sensitive nature of this stock if conditions warrant its use.
Fungus - Formalin flushes under a prescription from a consulting veterinarian. Flushes are one-hour treatments for two consecutive days after fin clipping operations, PIT-tagging and VIE marking--water temperatures allowing (>42^{o}F).
Disease Outbreak Plan - Disease outbreaks are treated on a case-by-case basis. Therapies and remedial measures are based on conventional and available treatments, new information, and innovation. Warm water therapy may be used if EIBS becomes a problem. It would be used, based on priorities of stocks and raceways affected, after consultation with appropriate entities. Formalin treatments would be implemented for all parasitic infestations.

Table 9.2.7. Five year disease history (1998 to present) of Imnaha chinook by life stage.

	Life stage	
Disease or Organism	Adults	Juveniles
IHN Virus	Yes	No[b]
EIBS Virus	No	No[c]
Aeromonas salmonicida	Yes	No
Aeromonas/Pseudomonas	Yes	Yes
Flavobacterium psychrophilum	Yes	Yes
Fl. columnare	No	No
Renibacterium salmoninarum	Yes	Yes
Yersinia ruckeri	Yes	Yes
Carnobacterium sp	No	No
Ichthyobodo	No	Yes
Gyrodactylus	No	No
Ichthyophthirius multifilis	No	Yes
Epistylis	No	Yes
Scyphidia	No	Yes
Trichodinids	No	Yes
Gill Copepods	Yes	No
Coagulated Yolk Disease	No	Yes
External Fungi	Yes	Yes
Internal Fungi	No	Yes
Myxobolus cerebralis	No[d]	No
Ceratomyxa shasta	Yes	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] An epizootic of IHNV occurred in several Imnaha raceways in March-May 1995.
[c] EIBS was detected prior to 1996.
[d] Chinook salmon adults have been presumptively positive but have not been confirmed positive by histological methods.

Note: the Imnaha chinook Fish Health Monitoring Plan is explained in the Lower Snake Program Operation Plan document developed annually by the co-managers in this program.

Refer to section 7 for fish health and sanitation procedures.

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

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.
Traditional rearing methods are applied at Oxbow and Irrigon hatcheries; however, fish are reared with natural photoperiods. At transfer to Lookingglass Hatchery, fingerlings are reared with natural water temperatures and photoperiods. Daily feed rations are distributed with automatic feeders to limit human interaction; however, the 28-day prophylactic feeding of erythromycin is administered by hand to increase efficacy. Fish are reared with modest densities and flows (Section 9.2.2).

Fish are acclimated in the Imnaha sub-basin 2 to 6 weeks prior to release.

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.
Adults are collected using a sliding scale that incorporates natural origin fish into the broodstock (Table 5.1). The incorporation of natural fish into production is intended to reduce the long-term impacts of domestication. Progeny are reared and released at a smolt size. Fish are released to mimic natural fish emigration timing and reduce the natural and hatchery fish interactions in freshwater.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	0	NA	NA	NA
Unfed Fry	0	NA	NA	NA
Fry	0	NA	NA	NA
Fingerling	0	NA	NA	NA
Yearling	490,000	17-20	mid-April	420,000 Imnaha River, 35,000 Big Sheep Creek, 35,000 Lick Creek

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: Imnaha River-0800200000
Release point: River mile 45.5 (Latitude 117 51’ 45” Longitude 45 44’ 00”)
Major watershed: Imnaha River
Basin or Region: Snake River

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

*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Smolts	Avg size
1991							398,909	18.8
1992							262,586	16.2
1993							157,659	17.5
1994					283,046	98	438,627	18.9
1995							590,069	18.9
1996							91,240	18.5
1997							50,911	17.0
1998							93,108	21.1
1999							194,967	18.2
2000							179,716	19.1
2001							123,014	16.0
2002							303,769	14.1
Average							240,379	

Data source-Oregon Department of Fish and Wildlife Hatchery Management Information System (HMIS).

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

Smolts are released in mid-April to mimic natural fish emigration timing and reduce the natural and hatchery fish interactions in freshwater. During the last four years, fish have been acclimated for 3 weeks, allowed to volitional emigrate for 3 to 4 weeks before forced into the river in mid-April. The forced release occurs in late afternoon or early evening. No culling is applied to non-migrants.

Table 10.4. Summary of acclimation and release dates since 1998.

Year	Arrival	Volitional Release	Forced release
1998	March 10	NA	Aril 6
1999	March 1	March 22	April 15
2000	March 2 and 3	March 22	April 18
2001	March 1 and 2	March 21	April 19
2002	March 1, 4 and 5	March 21	April 17

In 1999 (BY97), 10,300 smolts (AdCWT) were direct stream released near the Imnaha satellite on April 5 and 6.

10.5) Fish transportation procedures, if applicable.

Chinook smolts are loaded with water using a fish pump. Fish are separated from the water and transferred into insulated liberation tankers ranging in capacity from 2,000 to 5,000-gallons. Fish are loaded at maximum rate of 1.0 lbs/gallon. Transport time averages 2.5 hours. Supplemental oxygen and aeration are provided.

10.6) Acclimation procedures

In general, chinook smolts arrive at the Imnaha satellite acclimation pond in early March and are held on Imnaha River water for a minimum of three weeks. After three weeks, screens are removed and fish are allowed to volitionally leave the pond for additional 3 weeks. All fish are forced out mid-April.

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

All smolt production are ad-clipped and implanted with a coded wire tag. An additional 21,000 fish are PIT tagged.

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

There is no plan for surplus smolt production. Fish surplus to programmed needs would be released at an earlier life stage or culled as eggs.

10.9) Fish health certification procedures applied pre-release.

A total of 60 normal appearing smolts will be sampled at Lookingglass Hatchery two weeks prior to transfer to the Imnaha acclimation site. Individual fish will be examined for *R. salmoninarum* by ELISA, EIBS, and plasma glucose. Gill/kidney/spleen are examined in 3-fish samples and assayed for viruses. Wet mounts of skin and gill tissue from a minimum of five fish will be examined by microscopy. At the acclimation site, thirty healthy appearing fish will be examined for *R. salmoninarum* (ELISA), EIBS and plasma glucose. Gill/kidney/spleen samples as 3 fish sample pools will be assayed for viruses. Wet mounts of skin and gill tissue from a minimum of five fish will be examined by microscopy. These will be sampled within one week of the forced release. A target of 10 (or available) moribund and/or dead fish will be sampled for *R. salmoninarum* (BKD) and systemic bacteria.

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

The Lookingglass Hatchery manager has authority to release fish in an emergency at Lookingglass Hatchery and Imnaha satellite. Section (5.7.2) describes winter icing conditions that can result in the intake blocked from inflowing water. In 1987, Imnaha fish were released into Lookingglass Creek due to icing events. Environmental conditions are a concern at the Imnaha and may lead to early releases.

In the event of an emergency release, the Lookingglass Hatchery Manager will notify the ODFW Region Manager, co-mangers, and federal cooperators.

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.

Chinook smolts are acclimated and volitionally released in late March with a forced release in mid-April. Releases coincide with warming water temperatures and increasing river flows. The intent is to reduce the time fish reside in freshwater, therefore, reducing the interactions with

naturally produced chinook and steelhead.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

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 smolts and determine mark rate
  - (*Indicators: 1a, 1b, 2b, 3a, 4a, 4b, 7a, 26a)*
- Analyze marked fish recovery data collected by others from Columbia, Snake River and other fisheries to determine harvest numbers and rate
  - *(Indicators: 1a, 1b, 2b, 3a, 25a, 25b, 26a)*
- Conduct statistically valid creel surveys 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 proportion of hatchery adults in key natural spawning areas via adult mortality recoveries
  - *(Indicators: 19a, 25a, 25b)*
- Develop genetic profiles for hatchery and natural steelhead populations in the basin and conduct regular monitoring
  - *(Indicators: 18a, 20c, 25a, 25b)*
- Monitor wild fish escapement trend in key natural spawning areas via redd count surveys and adult origin reconstruction via adult mortality recoveries
  - *(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.
  - *(Indicators: 12a, 23a, 23b, 23c, 23d)*
- Monitor health of adult and juvenile chinook 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, hatchery-origin contribution, creel surveys and genetic monitoring will require commitment of additional resources.

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

- 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.
- Experience fish culturists will respond to alarms 24 hours per day 7 days per week.

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.

12.2) Cooperating and funding agencies.

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

12.3) Principle investigator or project supervisor and staff.

Richard W. Carmichael
Tim Hoffnagle
Pat Keniry
Debra Eddy

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 summer/spring chinook will be captured and enumerated at the existing Imnaha facility. See section 2.2.3.

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

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

Research is an ongoing activity, March through October.

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 at 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.

Comment [CS4]:

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

Monitoring and evaluation will involve take of all types (Table 2.2.3B). 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.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 2.2.3B).

See Table 2.2.3B

12.10) Alternative methods to achieve project objectives.

Unknown.

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

Occasionally, we expect to encounter summer steelhead 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.

- Every effort will be made to insure that steelhead, chinook, and bull trout sampled during early life history studies will be not cause significant injury or 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

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if

feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

Citations

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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

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 Imnaha chinook 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 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 tributary Lick Creek and Little Sheep Creek and several of it's 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 Imnaha River appears reasonably robust based on recent spawning inventory. Spawning counts on the Imnaha River 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 Imnaha River 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 chinook trap at the Imnaha River facility. The trap is operated June through September. Number of fish trapped annually ranges from 0 to 20. Fish are held a maximum of four days, handled and passed upstream.

Hatchery operations - Water withdrawal for chinook smolt acclimation occurs in the late winter and spring at a time when stream flow 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 Imnaha River facility is located within 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 chinook are released into both Big Sheep Creek

and Lick Creek and are likely to encounter bull trout juvenile/resident rearing areas. Also see section 3.5 and 7.7.

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 in 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

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