HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	White River Winter Steelhead Supplementation Program
Species or Hatchery Stock:	*Oncorhynchus mykiss*
Agency/Operator:	Washington Department of Fish & Wildlife Puyallup Indian Tribe/Muckleshoot Indian Tribe
Watershed and Region:	Puyallup River, Puget Sound
Date Submitted:	
Date Last Updated:	September 5, 2006

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

White River Winter Steelhead Supplementation Program

1.2) Species and population (or stock) under propagation, and ESA status.
State common and scientific names.

White River Winter Steelhead (*Oncorhynchus mykiss*) proposed for listing 2006.

1.3) Responsible organization and individuals
Indicate lead contact and on-site operations staff lead.

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Name (and title):
Agency or Tribe:
Address:
Telephone:
Fax:
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Puyallup Indian Tribe and the Muckleshoot Indian Tribe

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

Funding Source: Puyallup Tribe of Indians

Cost estimate for rearing 35,000 wild steelhead smolts at Diru Creek Hatchery

# of fish	#/pound	biomass	Gain	F.C.	Food	Cost/pound		feed size	Bags
46,500	1100	42							
45,945	530	87	44	0.86	38	0.95	36	0	
45,390	349	130	43	0.94	41	0.95	39	1	1
44,835	197	228	98	1.02	99	0.9	90	0.8	2
44,280	129	343	116	1.1	127	0.87	111	1	3
43,725	91	480	137	1.18	162	0.84	136	1.3	4
43,170	57	757	277	1.26	349	0.81	283	1.5	8
42,615	25	1,705	947	1.34	1,269	0.78	990	2	29
42,060	16	2,629	924	1.42	1,312	0.75	984	2.5	30
41,505	8	5,188	2,559	1.5	3,839	0.72	2,764	3	87
							$5,432.24		

Formilin	Size	Qty		
	55 gal	2		**$500.00**
Electricity	Month	Qty		
	$1,100.00	9		**$9,900.00**
			TOTAL	**$15,832.24**

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

Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

Broodstock Collection:

White River Trap At RM 23.4 near Buckley, Washington

Broodstock Holding; Spawning and Incubation:

Voights Creek Hatchery: Located at RM 0.5 on Voights Creek (10.0414), a tributary of the Carbon River (10.0413). Voights Creek enters the Carbon River at RM 4. The Carbon River is a tributary to the Puyallup River (10.0021) and joins it at RM 17.8.

Rearing:

Diru Creek Hatchery: Located at RM 0.25 on Diru Creek (10.0028), a

tributary of Clarks Creek (10.0027). Clarks Creek enters the Puyallup River (10.0021) at RM 5.7.

Rearing and Release:

White River Hatchery: White River Hatchery located on the White River (10.0031) at RM 24.3. The White River is a tributary of the Puyallup River (10.0021) and the confluence is located at RM 10.1.

1.6) Type of program.

Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest (see Attachment 1 - Definitions" section for guidance).

Integrated Recovery

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6.

The goal of this program is the restoration of naturally spawning winter steelhead in the White River (Puget Sound) to a self-sustaining population that will consistently provide utilization opportunities.

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

Given the long-term depressed nature of winter steelhead in this watershed, the current emphasis on stock rebuilding for all anadromous species in the watershed, current efforts at making substantial improvements in habitat quantity and quality, and changes in flow regime and quantity, the Co-managers agree that a substantial increase in natural spawning escapement (provided through integrated supplementation) and rearing over the long term is necessary before determining an escapement goal for fishery management. The emphasis of the rearing program is on the earliest returning components of the run as this is the segment of the population most impacted by past fishery and hatchery management activities. Moreover, it allows resulting steelhead juveniles from the program to reach smolt size by Spring of the following year. Run timing of adults at the Buckley Trap that is located at RM 24.3 is not correlated with entry timing of adults into the Puyallup River. Furthermore,the depressed status of the stock has narrowed the return timing into a three month window (March April, and May). In 2006, 88% of the adults returned in May.

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPPC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

1) Conserve the genetic and life history diversity of White River winter steelhead population through eight (8) steelhead broodyears beginning in 2006.

2) Augment, restore and create viable naturally spawning populations using supplementation strategies

3) ***Provide ready access to smolts and adults to support research. This includes the ability to apply acoustic tags to monitor smolt emigration from river to ocean, differential survival of specific families, reconditioning of kelts, and acoustic tag monitoring for kelts in a manner similar to smolts.***

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

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

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

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

1.10.1) "Performance Indicators" addressing benefits.

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

1. Evaluate smolt to adult return rates, smolt to adult stray rates, smolt migration

patterns, and age composition of returning adults; comparing this information to naturally produced fish of the same stock. This will allow determination of impacts of culture on supplementation fish.

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

1. ***Evaluate, through existing in-stream and Commencement Bay monitoring programs, the predation load imposed by project fish on co-migrating salmon.***
2. ***Evaluate natural spawning success of project fish to determine if supplementation benefits or impacts listed fish.***

1.11) Expected size of program.
In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates effected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

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

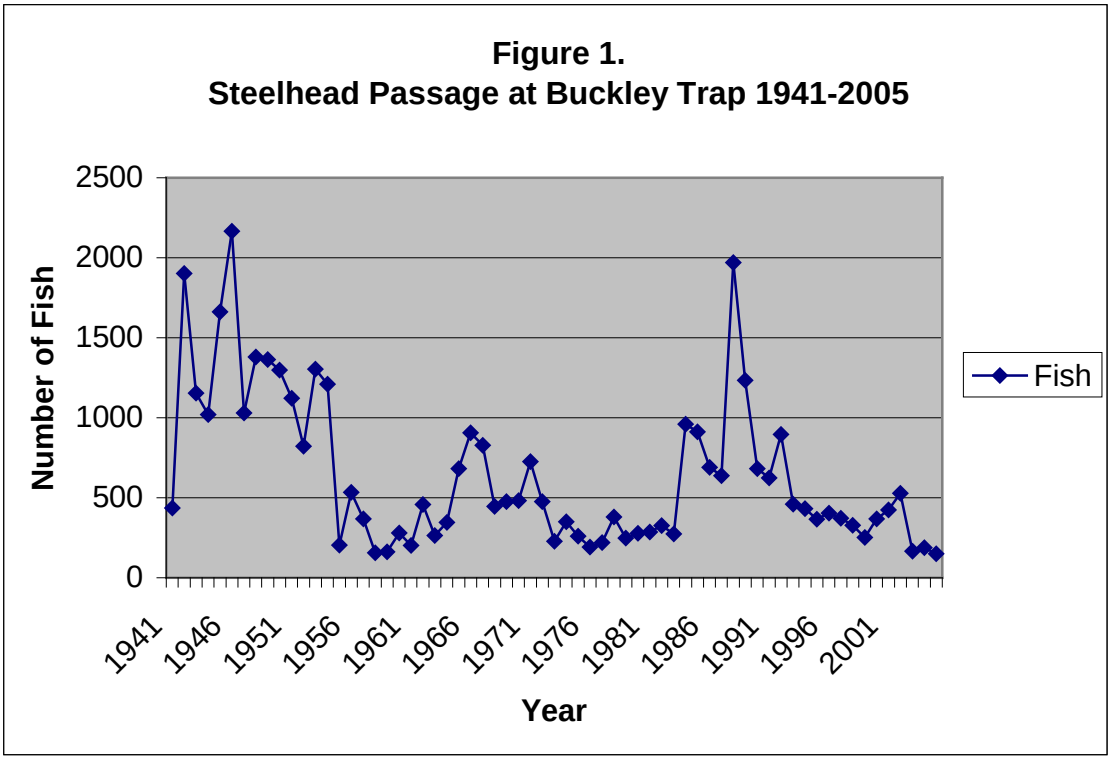
15 females and 20 males

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
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	White River	35,000

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.
Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

Escapements of wild winter steelhead to the White River are considered to be in decline since the mid 50's. The 50-year average return in the White River has been 479 (range of 156 in 1958 to 1,971 in 1988). Since 1990, the average has been 433 fish and since the mid 90's it has been less than 360. In the most recent years it has been less than 200.



Since this is a new program there are no smolt-to-adult survival rates at this time.

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

Winter/spring of 2006.

1.14) Expected duration of program.

The project is intended to include eight (8) steelhead broodyears (egg takes) with subsequent monitoring and evaluation extending through 2018.

1.15) Watersheds targeted by program.
Include WRIA or similar stream identification number for desired watershed of return.

Puyallup River (10.0021)
- White River (10.0031)

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

Alternative 1: No action. But escapements of wild winter steelhead to the White River are considered to be in decline since the mid 50's. The 50-year average return in the White River has been 479 (range of 156 in 1958 to 1,971 in 1988). Since 1990, the average has been 433 fish and since the mid 90's it has been less than 360. In the most recent years it

has been less than 200.

Alternative 2: Increase program to further increase the effective population size.

Alternative 3: Recondition kelts after spawning. Steelhead have the ability to spawn more than once given the proper survival conditions. Projects in the Columbia River basin have successfully reconditioned post-spawned fish, and released them back into the natural stream for additional spawning. This management alternative provides an option to increase natural spawning in the river, and maintain genetic diversity

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

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

No ESA permits or authorizations (proposed for listing in March of 2006-**listed as "threatened in May 2007**) exist for the wild broodstock program identified in this HGMP. This HGMP will be submitted to NOAA Fisheries to determine impacts to listed Puget Sound chinook, summer chum and proposed listed Puget Sound steelhead.

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

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

Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

This would include PS Chinook (Puyallup fall and White River spring), PS Steelhead (proposed***), and PS summer chum.***

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program. *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).*

PS Steelhead (proposed listing March 2006).

White River (Puyallup) winter steelhead spawn in the upper reaches of the White, Greenwater and Clearwater rivers and their tributaries. Spawning occurs from early March through mid-June.

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

the program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

Puget Sound Chinook:

Puyallup River Fall Chinook.

Adults spawn in the mainstem Puyallup River from approximately RM 10.4 upstream to the anadromous barrier at Puget Sound Energy's Electron diversion facility (RM 41.7). Sexually mature fish begin arriving back at the river mouth in late July and continue to enter the river until mid-October. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October and is generally complete by November. Fall chinook spawning habitat is available in the Carbon River from its mouth up into Mt. Rainier National Park. Tributary spawning takes place in Clarks Creek, Fennel Creek, Canyon Falls Creek, South Prairie Creek, Wilkeson Creek, Kapowsin Creek and ***above Electron dam***

Most naturally produced Puyallup River chinook migrate to salt water as zero age smolts after spending only a few months in freshwater (Out-migration timing was not currently well defined but a study initiated in 2000 by the Puyallup Tribe, to determine juvenile production levels and migration timing, has indicated that the peak of out-migration occurs in mid-May. Size of the chinook out-migrants at the peak was 80-90 mm). After a few weeks of estuarine acclimation, most juveniles begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean.

White River Spring Chinook.

Adults spawn in the mainstem White River from the Puget Sound Energy project tailrace at Dieringer (river mile 3.5) up to the Puget Sound Energy diversion dam at river mile 24.3. Sexually mature fish begin arriving back at the river mouth in May and enter the river through mid-September. Collection and passage (upstream 12 miles) at the Buckley trap commences in late May or early June and ends in early October. Spawning takes place from early September through mid-October. Tributary spawning takes place in Boise Creek, below the diversion dam, and in the Greenwater River, Clearwater River, Huckleberry Creek and the West Fork White River, all above Mud Mountain Dam.

Like the Puyallup fall chinook, the White River spring chinook juveniles are predominantly zero age out-migrants.

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

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

The SaSI report (2002) determined the White River (Puyallup) winter steelhead stock

status to be “depressed” based on a long-term negative trend and chronically low trap counts since 1992.

Preliminary critical population threshold has been determined by the Co-manager’s (Puget Sound) Technical Review Team (PSTRT) to be at 500 for the Puyallup River chinook (PSTRT 2003). No viable population threshold has been identified at this time. For the White River chinook, the critical and viable population thresholds were determined by the PSTRT to be at 200 and 1,000, respectively (2003). The SaSI report (2002) determined the Puyallup River fall chinook stock status to be "unknown" and the White River spring chinook to be "critical".

- 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.

- 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. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

Escapements of wild winter steelhead to the White River are considered to be in decline since the mid 50’s. The 50-year average return in the White River has been 479 (range of 156 in 1958 to 1,971 in 1988). Since 1990, the average has been 433 fish and since the mid 90’s it has been less than 360. In the most recent years it has been less than 200.

Estimates of Puyallup River fall chinook spawning naturally in the South Prairie Creek sub-basin[1]

1994	798
1995	1335
1996	1225
1997	622
1998	1028
1999	1422
2000	695
2001	1154
2002	840
2003	740
2004	573
2005	**379**

[1.] Historic Puyallup River fall chinook escapement estimates listed in Run Reconstruction are not considered accurate by the co-managers and are not relative to estimates made by a new method, beginning in 1999. The South Prairie Creek sub-basin has been chosen as an indicator of Puyallup River escapement, with a local spawning objective of 500 adults.

Numbers of adult White River spring chinook passed above Mud Mountain Dam[1] (From Army Corps of Engineers trucking records):

1988	127
1989	83
1990	275
1991	194
1992	406
1993	409
1994	392
1995	605
1996	628
1997	402
1998	320
1999	553
2000	1,523
2001	2,002
2002	718
2003	1,423
2004	1,479
2005	**1,757**

1. **The number of Chinook estimated to be spawning in Boise Creek and the White River mainstem downstream of the Buckley Dam currently are not included in the White River spring Chinook escapement estimates. Spawning ground surveys are conducted annually in these river sections. Boise Creek is a tributary of the White River located at RM 23.25, about one mile downstream of Buckley Dam.**

- 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.

All steelhead passed upstream are unmarked and considered wild winter steelhead.

Puyallup River fall chinook - **The estimated HORs on the spawning ground in 2004 was about 26 percent, and about 17.5 percent in 2005. Returning Chinook prior to 2004 were not 100 percent marked. Mass marking of hatchery fall Chinook (adipose fin clipping) at Voights Creek hatchery began in 1997. A total of 13 percent of the broodyear 1997 released were marked. A little more than 50 percent of the Chinook were marked for the 1998-broodyear releases. Starting with the 1999 broodyear releases, not counting the missed-clips, 100 percent were adipose fin clipped. The 2004 return year is the first with assumed full marking of hatchery-origin Chinook.**

In South Prairie Creek, a spawning index tributary of the Carbon River (no glacial runoff in South Prairie Creek), preliminary hatchery-origin ratios are available for the 1997

brood CWT group that were released from Voights' Creek. The CWT release was 206,000 fish out of a hatchery total of ~ 1.6 million or 1:8 ratio. Marked adults are recorded during the routine spawner surveys.

Year	Fish Sampled	Marks Recovered	Source	Hor/Nor Ratio
1998	104	none	na	na
1999	220	1	Fox Island	1/220
2000	71	2	1 Voights'	8/71
			1 ad clip only	unknown
2001	94	2	2 Voights'	16/94
2002	87	1		28/87
2003	161	5		88/161
2004	58			15/58

White River spring chinook – Unknown. Only unmarked, untagged fish are trucked above Mud Mountain Dam. This precludes identified hatchery-origin adults from being passed upstream, but unidentified hatchery-origin fish may be in the upper river natural spawning population. 1999 coded-wire-tag recoveries at the Buckley trap/White River Hatchery showed contributions of Skagit River spring chinook (released into Tulalip Bay), Fox Island Net Pen fall chinook, Voights Creek fall chinook, South Sound Net Pen fall chinook, Elliott Bay Net Pen fall chinook, Diru Creek fall chinook and Hoodsport Hatchery fall chinook. All of these strays were removed from the spawning population; however, unmarked elements of these production units (and others) may have been incorporated into the local broodstock, both above and below the barrier.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u> *(see "Attachment 1" for definition 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.
(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

Broodstock Collection:
Broodstock will be killed and spawned for viral sampling to develop an historical health database and to allow thorough pathogen screening. Only the fish required for broodstock will constitute a direct "take". Any fish over and above needs will be returned above the trap.

Operational guidelines for collection of broodstock, as per the Hatchery Scientific

Review Group (HSRG 2004), indicates that for wild populations having 150 fish or more limit collection of wild broodstock to 30% of the population. Although the run size has decreased to approximately 200 in recent years, the total number of broodstock (35) is 17.5% of the wild population.

Winter steelhead broodstock collection may take place November through May, although the stock has narrowed the return timing into a three month window (March April, and May). In 2006, 88% of the adults returned in May. Listed chinook salmon may be present from July through October.

Disease effects:
Pathogens are not unique to hatcheries. Hatchery-origin fish may have an increased risk of carrying fish disease pathogens because higher rearing densities of fish in the hatchery may stress fish and lower immune responses. Under certain conditions, hatchery effluent has the potential to transport fish pathogens out of the hatchery, where natural fish may be exposed. These impacts are addressed by rearing the steelhead at lower densities, within widely recognized guidelines (Piper et al. 1982), continuing well-developed monitoring, diagnostic, and treatment programs already in place (Co-manager's Fish Health Policy 1998).

Predation – Freshwater Environment
Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site-specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

> Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.
>
> Relative Body Size. The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of

their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River, Stilliguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stilliguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources: [1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001),- and Seiler et al. (2002).

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et al. (2002).

[5] Data are from Samarin and Sebastian (2002).

[6] Data are from Marlowe et al. (2001).

Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of

naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources: [1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002).
[2] Data are from Seiler et al. (2003).
[3] Data are from Seiler et al. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount

Hatchery on the Skagit River migrate approximately 11.2 river miles per day. Steelhead smolts released on-station may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to off-station release sites, particularly release sites located outside of the watershed in which the fish have been reared may slow migrations speeds (Table 3).

Table 3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (River miles per day)	Source
Cowlitz River	Smolts, on-station	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et al. (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et al. (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et al. (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation – Marine Environment

WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

> "1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984)."
>
> "2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington does not substantiate any indication of significant predation upon juvenile salmonids (Simenstad and Kinney 1978)."

"3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance."

Competition

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded "migrant fish will likely be present for too short a period to compete with resident salmonids."

2) NMFS (2002) noted that "where inter-specific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991; Murdoch and Kamphaus 2002). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."

3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."

4) Fresh (1997) noted "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships

may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

Potential White River Winter Steelhead HGMP Predation and Competition Effects on Listed Salmon:

Environmental Characteristics: The Puyallup River is a relatively large river that tends to carry sufficient flows and to be quite turbid (glacial melt) during the late spring hatchery steelhead release and juvenile chinook emigration months.

Relative Body size: The programmed steelhead release size through the White River winter steelhead program is 5 fish per pound (206 mm fl). Juvenile chinook salmon emigrating out of the Puyallup River during the month of May averaged 68 mm fl (data from Samarin and Sabastian 2002). Assuming the "1/3 size rule" (USFWS, 1994), chinook salmon smaller than 68 mm fl may be susceptible to predation by the average size hatchery coho released through the program. The average size for emigrating chinook salmon during May is the same as this threshold predation susceptibility size. Therefore, it would be advantages to release the steelhead closer to the end of May to reduce potential predation of listed chinook and natural-origin steelhead (see Table 2.2.3.1).

Date of Release: Steelhead smolts are to be released through the program no later than June 1. Data is incomplete on how much of the emigrating chinook have passed out of the system prior to the release of the steelhead. Although competition could occur with steelhead, studies on Cedar Creek (Lewis River tributary) indicate that most wild steelhead have vacated that system by mid-May (Rawding and Groesbeck 2006). Thus, as indicated above, it would be advantages to release the steelhead closer to the end of May to reduce potential predation/competition of listed chinook and steelhead.

Release Location and Release Type: Steelhead released through the White River program might encounter emigrating juvenile chinook salmon and steelhead in the Puyallup River from the release point (RM 22.3) to the river mouth. The duration of interaction between the two species may be limited. The steelhead are released as actively migrating smolts, which are likely to disperse seaward after release. WDFW data indicates that steelhead smolts released from the Palmer Pond (Green River) program emigrated quite rapidly downstream; reaching a trapping location located 23 miles downstream at RM 34.5 within days of release (data from Seiler et al. 2004).

Release Number: The release of up to 35,000 winter steelhead smolts (206 mm fl) into the Puyallup River via White River foster rapid downstream migration and; therefore; they are unlikely to pose significant predation and competition risks to juvenile chinook and steelhead.

Based on a review of general information applied to the proposed program, the steelhead are unlikely to pose significant predation and competition risks to listed chinook and

steelhead juveniles.

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

New program

- 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).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

New program

- 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.
(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish."*)

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.
(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

As affirmed in the co-manager's non-chinook RMP, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group. This report provides a detailed description of the HSRG's scientific framework, tools and resources developed for evaluating hatchery programs, the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (2004).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations (Seidel 1983).

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for each hatchery. It is designed to foster development of locally adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDFW 1991).

WDFW Steelhead Rearing Guidelines. Details rearing guidelines and parameters statewide (Dan Wrye, WDFW Memo with Attachments July 31, 2001).

Fish Health Policy of the Co-managers of Washington State. This policy designates zones limiting the spread of fish pathogens between watersheds, thereby further limiting the transfer of eggs and fish in Puget Sound that are not indigenous to the regions (WDFW, NWIFC 1998).

National pollutant Discharge Elimination System Permit Requirements This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

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.*

The Voights Creek hatchery, as well as other WDFW hatcheries, operates under *U.S. v Washington* that provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are collected.

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to

provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish .*

Co-managers do not intend to directly harvest any returning adults. Late returning fish may be harvested in fisheries targeting White River Chinook. Early returning fish may be harvested in fisheries directed at coho and chum. Harvest in the past has been minimal and is expected to remain so.

3.4) Relationship to habitat protection and recovery strategies.
Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

The Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and, as indicated earlier, the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan.

Shared Strategy

The Shared Strategy is based on the conviction that:
1) People in Puget Sound have the creativity, knowledge, and motivation to find lasting solutions to complex ecological, economic, and cultural challenges;
2) Watershed groups that represent diverse communities are essential to the success of salmon recovery;
3) Effective stewardship occurs only when all levels of government coordinate their efforts;
4) The health and vitality of Puget Sound depends on timely planning for ecosystem health and strong local and regional economies; and
5) The health of salmon are an indicator of the health of our region salmon recovery will benefit both human and natural communities.
The 5-Step Shared Strategy
1) Identify what should be in a recovery plan and assess how current efforts can support the plan.

2) Set recovery targets and ranges for each watershed.
3) Identify actions needed at the watershed level to meet targets.
4) Determine if identified actions add up to recovery. If not, identify needed adjustments.
5) Finalize the plan and actions and commitment necessary for successful implementation.

Salmon Recovery Funding Board
Composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). SRFB has helped finance over 500 projects. The Board supports salmon recovery by funding habitat protection and restoration projects. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities
Lead entities are voluntary organizations under contract with the Washington State Department of Fish and Wildlife (WDFW). Lead entities define their geographic scope and are encouraged to largely match watershed boundaries. Lead entities are essential in ensuring the best projects are proposed to the Board for funding in its annual grant process.
All lead entities have a set of technical experts that assist in development of strategies, and identification and prioritization of projects. The lead entity citizen committee is responsible under state law for developing the final prioritized project list and submitting it to the SRFB for funding consideration. Lead entity technical experts and citizen committees perform important unique and complementary roles. Local technical experts are often the most knowledgeable about watershed, habitat and fish conditions. Their expertise is invaluable to ensure priorities and projects are based on ecological conditions and processes. They also can be the best judges of the technical merits and certainty of project technical success. Citizen committees are critical to ensure that priorities and projects have the necessary community support for success. They are often the best judges of current levels of community interests in salmon recovery and how to increase community support over time with the implementation of habitat projects. The complementary roles of both lead entity technical experts and citizen committees is essential to ensure the best projects are proposed for salmon recovery and that the projects will increase the technical and community support for an expanded and ever increasing effectiveness of lead entities at the local and regional level. (http://www.iac.wa.gov/srfb/leadentities.htm).

The Lead Entity for the Puyallup watershed is Pierce County. The County has identified habitat management needs within the Puyallup basin that include:
1) Evaluate the newly completed fish passage facility (completed in 2000) at Puget Sound Energy's Electron Diversion Dam. Evaluate the downstream migrant passage facility at Puget Sound Energy's Electron Diversion Dam Intake.

Monitor in-stream flows in the upper Puyallup River to assure that minimum levels are met or exceeded.
2) Continue to restore estuarine fall chinook habitat in Commencement Bay and to identify and control sources of pollution in the lower Puyallup River and Commencement Bay.
3) Increase the amount of large woody debris in the watershed, maintain wooded riparian zones and enhance vegetation in damaged riparian areas.
4) Reduce channelization of the Puyallup River and pursue opportunities to develop levee setback projects and reconnect historic meander channels. This would include minimizing "infilling" of floodways and critical habitat with residential development in order to preserve future opportunities.
5) Reduce the number of logging roads in the watershed and replace culverts that currently block fish passage.
6) Further limit gravel removal operations in the Puyallup River.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]
Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

(1) Salmonid and non-salmonid fishes or other species that could negatively impact the program.

Negative impacts by fishes and other species on the White River Hatchery steelhead program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact wild White River Hatchery steelhead survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile steelhead while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile steelhead through predation include the following:

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons
- Mammalian predators, including mink, river otters, harbor seals, and sea lions

Rearing and migrating adult steelhead originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Puyallup River to the detriment of population abundance and the program's success in augmenting harvest. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Chinook salmon
- Puget Sound steelhead

(3) Salmonid and non-salmonid fishes or other species that could positively impact the program.

Fish species that could positively impact the program may include other salmonid species present in the Puyallup River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the steelhead during their downstream migration in freshwater. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating steelhead.

(4) Salmonid and non-salmonid fishes or other species that could be positively impacted by program.

The steelhead program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying hatchery steelhead carcasses may also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Chinook salmon
- Coho salmon
- Steelhead
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

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.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

Voights Creek Hatchery: Supplied by surface water from Voights Creek. Water is withdrawn from a gravity intake approximately ½ mile upstream from the hatchery. Gravity water is supplemented with water pumped at the hatchery site. The gravity intake supplies 2000 gallons per minute (gpm). The (three) pumps deliver 1,500 gpm each. Voights Creek responds quickly to heavy rainfall and is prone to rapid fluctuations. Heavy bed loads are due to landslides, timber harvest and watershed development. Winter floods are becoming a common occurrence. Late summer low flows with elevated temperatures into the high 60's have been the norm for several decades. Water withdrawals from the gravity intake divert a significant portion of the creek water from the area immediately below the intake. The screen box bypass channel and a tributary creek rejoin the creek several hundred yards below the intake. The fish ladder is accessible and operational even with the low flows. Natural salmon production is blocked, above RM 4, due to a series of impassable waterfalls.

Diru Creek Hatchery on-station water is supplied from one well producing 800 gpm. An additional 200 gpm is available as surface water gravity fed from Diru Creek (WDFW et al. 2000). Department of Ecology permit for water withdrawal is G2-25820.

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.
(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

Voights Creek Hatchery: Gravity intake screens and ladder are not compliant with code requirements for mesh size and ladder velocity but both are identified for replacement. WDFW secured 65% / 35% cost share funding from the United States Fish Wildlife Service ($161,956 USFWS / $87,206 WDFW...contract #s 38032261 and 38032259) for the express purpose of beginning the design phase and replacement of the gravity intake and ladder. Chinook have access to the habitat above the gravity intake ladder (three steps) in years of high flow during the time period when adult chinook are returning to Voights Creek. The frequency and number of chinook which access the habitat above the hatchery is directly correlated to the fall flows in Voights Creek. The pump intake is fitted with "wedge-wire" screening and is compliant with current standards. Surface water from Voights Creek is regulated under permit # S2-22190. Hatchery effluent meets or exceeds NPDES permit standards (permit # WAG13-1035) for discharge of pond cleaning waste or pond drawdown.

Diru Creek Hatchery has two back up wells that produce 800gpm if the primary well fails. There are no listed natural fish in Diru Creek.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also

describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

Adult winter steelhead to be used for broodstock will be collected at the White River trap near Buckley, Washington at RM 23.4.

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

Adult steelhead were/will be transferred in 360 gallon totes with oxygen and salt added.

5.3) Broodstock holding and spawning facilities.

Adult broodstock will be held at the Voights Creek Hatchery (WDFW) in two plywood covered 10' diameter circular ponds with approximately 3' operating depth. The fish are checked for ripeness (netted from pond) and, if ripe, spawned.

5.4) Incubation facilities.

Voights Creek Hatchery has 68 Heath Techna vertical incubators with the eyeing capacity of 11 million eggs and the hatching capacity of 5.5 million salmon. Portions of these are held separately for the specific purpose of incubating the steelhead eggs.

5.5) Rearing facilities.

Initial rearing at Diru Creek uses 16 shallow troughs in the hatchery building. Additional rearing will occur in a 6696 cubic foot pond until transfer to White River hatchery.

5.5) Acclimation/release facilities.

White River Hatchery

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

At Diru Creek Hatchery in December 1996 an ice storm knocked down trees crushing our hatchery supply line, which temporarily interrupted water flows to the incubator stacks, resulting in alevin mortality. It took two hours to repair the line. The alevin stage is where oxygen demand is at its peak in the incubators. Of the 1.0 million eggs received, 395,000 smolts were released for a 39.1% survival rate.

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.

(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system

to help prevent catastrophic fish loss resulting from water system failure.”).

The Voights Creek Hatchery is equipped with a backup generator and adequate fuel supply in the event of a power outage. Two on-site personnel are on rotating standby status year around in the event of a problem. An upgraded alarm system is designed to detect changes in flow and power status. The risk of disease transmission shall be limited by using effective theraputents, as prescribed and in a timely manner.

Diru Creek Hatchery is equipped with a backup generator and adequate fuel supply in the event of a power outage. An upgraded alarm system along with two backup wells in the event of motor failure in the main well ensures adequate flow. The risk of disease transmission shall be limited by using effective theraputents, as prescribed and in a timely manner.

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.

List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

Natural ***spawned and reared*** winter steelhead arriving at the White River trap.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

New program. See section 6.1

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

15 females and 20 males

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

If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

100% ***NORs*** fish will be used in the broodstock.

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Broodstock will be solely wild natural-origin adults representative of the historical genetic structure of the natural population. Genetic samples (fin clips or scale samples) will be collected from each captive adult and preserved in alcohol for future genetic analysis (population structure and genetic variation). All adults that are surplus to project production goals will be returned to the upper White River.

6.2.5) Reasons for choosing.
Describe any special traits or characteristics for which broodstock was selected.

Indigenous stock

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

The risk of among population genetic diversity loss will be reduced by selecting the indigenous steelhead population for use as broodstock in this supplementation program.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.
Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

Unmarked adult steelhead will be collected at the White River trap located near Buckley, Washington at RM 23.4. Up to 50% of the adults entering the trap in any one day can be transported, however, not to exceed a maximum of 6 adults (sexually balanced when possible) per day. Individuals demonstrating ripeness should be given preference for transport. Adults will be collected over the entire portion of the run and held in gender-separate circular rearing tanks except that one male steelhead will be held with the females to help accelerate the maturation process.

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Unmarked (naturally ***spawned and reared***) winter steelhead arriving at the White River trap located near Buckley, Washington at RM 23.4.

7.4) Proposed number to be collected:

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

15 females and 20 males.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 2006-13), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
2006	12	13; 16 live spawned		47,000	
2007					
2008					
2009					
2010					
2011					
2012					
2013					

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

No hatchery-origin fish will be collected for broodstock. All natural-origin adult steelhead that are surplus to project production goals will be returned to the upper White River.

Future research opportunities that would increase our knowledge about steelhead biology may include live spawning and reconditioning of kelts.

7.6) Fish transportation and holding methods.

Describe procedures for the transportation (if necessary) and holding of fish, especially if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adults will be treated with formalin and salt to control fungal development.

7.8) Disposition of carcasses.

Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

Spawned carcasses are utilized for nutrient enhancement in Voights Creek.

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 Co-managers will make every attempt to collect broodstock from throughout the natural run period to provide for random selection of adults from the entire adult population, which should prevent run timing divergence of the hatchery-reared population from the natural population.

Also, the risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines

SECTION 8. MATING

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

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

Fish in good condition at the Buckley trap will be hauled by truck to the Voights Creek Hatchery. From there, ripe fish are selected and spawned. If fish captured at the trap are ripe they can be used to substitute for unripe fish being held at the hatchery.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

Males may be live spawned until completely spent after which they will be killed for viral sampling.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

Matings will be 2X2 factorial when possible to increase genotypic diversity. Eggs will be iodine disinfected. All adults will be sampled for pathogens per Co-managers Fish Health Policy initially for the first 5 years to develop a history for the stock.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

NA

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 2 X 2 factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small steelhead population that is the subject of this supplementation program.

After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

2006 – 47,000 eggs taken. No survival rates to eye up and/or ponding at this time.

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

Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceeding of programmed levels.

Approximately 48,000 eggs will be taken (goal) with the goal of producing 35,000

yearling smolts.

9.1.3) Loading densities applied during incubation.
Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Flows per incubator are 4 gallons per minute (gpm) and temperatures can be as high as the mid-60's. One female is utilized per stack of vertical incubators (8 trays per stack) to reduce disease risk (isolated incubation). Eggs per pound ranged from 2,141 to 3,243.

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

The top tray is used for settling of silt and organics while the eggs are put in the bottom trays.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Button-up fry were ponded at 1,529 cumulative temperature units (TU's) and transferred beginning in June of 2006 at approximately 1,750 fish per pound (fpp).

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

Eggs will be incubated in the smallest practical lots so that a positive viral finding will impact the minimal number of eggs. Eggs receive formalin drip treatments for fungus prevention.

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.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

Eggs are incubated in silt free (filtered) surface water to ensure maximum egg survival and minimize potential loss from disease. The hatchery incubation room is protected by a separate low water alarm system.

9.2) <u>Rearing</u>:

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.

New program.

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

Rearing densities dependent on fish size

500-1800 fpp: 0.5 lb/ft^3, 2 lbs/gpm (maximum threshold)

10-500 fpp: 0.75 lb/ft^3, 6 lbs/gpm (maximum threshold)

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

Diru Creek Hatchery
Temperatures range from 50-52 F
Influent DO approximately12 ppm, effluent 7ppm.

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.

New program

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.
Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

New program

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*).

Diru Creek Hatchery
Fry fed Biostarter once per hour, 8 hours a day, 7 days a week
Fingerlings on site fed Biovita with reduced frequency every two hours, 8 hours a day, 7 days a week. Feeding frequency and amount is based on BioOregon's recommendation for Biovita at prevalent water temperatures.

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

Preventative care is promoted through routine juvenile fish health monitoring. Pathologists conduct fish health exams at each of the tribal hatcheries on a monthly basis from the time juveniles' swim-up until they are released as smolts. Monthly monitoring exams include an evaluation of rearing conditions as well as lethal sampling of small numbers of juvenile fish to assess the health status of the population and to detect pathogens of concern. Results are reported to hatchery managers along with any recommendations for improving or maintaining fish health. Vaccine produced by the TFHP may be used when appropriate to prevent the onset of two bacterial diseases (vibriosis or enteric redmouth disease). In the event of disease epizootics or elevated mortality in a stock, fish pathologists are available to diagnose problems and provide treatment recommendations. Pathologists work with hatchery crews to ensure the proper use of drugs and chemicals for treatment. The entire health history for each hatchery stock is maintained in a relational database called AquaDoc. (Northwest Indian Fisheries Commission Fish Pathology pers.comm.)

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.

NA

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. (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program. *Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.*

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearling	35,000	5	No later than June 1	White River

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA) number)*
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

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	Yearling	Avg size
2007								
2008								
2009								
2010								
2011								
2012								
2013								
2014								
Average								

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.
Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

10.5) Fish transportation procedures, if applicable.
Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

10.6) Acclimation procedures (*methods applied and length of time***).**

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

100% wire tagged to identify hatchery adults upon return at the Buckley Fish trap.

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

10.8) Fish health certification procedures applied pre-release.

Monthly fish health monitoring exams, as described in section **9.2.7**, are conducted by a fish pathologist from the Northwest Indian Fisheries Commission up until the time of release. Fish are usually examined within 2 weeks of their scheduled release. The exam includes an assessment of mortality rate, fish behavior, general condition of the fish, and rearing conditions. A necropsy is performed on representative fish from the population, including moribund and dead fish if these are available. An attempt is made to determine factors contributing to mortality. Parasites are routinely screened for by microscopic examination of gills and skin scrapes. Bacterial or viral assays may be conducted at the discretion of the pathologist if there is evidence of an infectious disease problem. Depending upon the findings of the exam, a recommendation will be made to either release the fish as planned, or if necessary, to take appropriate management actions prior to release.

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

In the event of catastrophic water failure fish would be released early.

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. (*e.g. "All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

See section 2.2.3

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.

Buckley Trap will be monitored throughout the run-timing of adult steelhead. Each adult steelhead returning will be sampled for presence of blank wire tag. This will give the agencies an overall smolt to adult survival rate and allow evaluation of the program.

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

Funds are committed to allow implementation of the monitoring and evaluation program.

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.
(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

Adult steelhead will be sampled at the Buckley Trap upon arrival and not held for more than 12 hours. Steelhead will be hand dipped and placed in a container and anesthetized with MS 222 before sampling and subsequent transfer above Mud Mountain Dam.

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.
Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

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

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

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

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

12.10) Alternative methods to achieve project objectives.

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

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.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

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.

Rawding, D. and M. Groesbeck. 2006. 2005 Cedar Creek juvenile salmonid production evaluation. Washington Department of Fish & Wildlife (Region 5), Vancouver, WA. 98661

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____ ESU/Population:_____ Activity:_____				
Location of hatchery activity:_____ Dates of activity:_____ Hatchery program operator:_____				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			41?	
Intentional lethal take f)			25?	
Unintentional lethal take g)				
Other Take (specify) h)				

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.

Instructions:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Natural origin recruit (NOR) - See *natural fish* .

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

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

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

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

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

Stock - (see “Population”).

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

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

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

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

SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	SIZE CRITERIA Grams/fish
• Chinook Yearling	<=20	>=23
• Chinook (Zero) Fingerling	>20 to 150	3 to <23
• Chinook Fry	>150 to 900	0.5 to <3
• Chinook Unfed Fry	>900	<0.5
• Coho Yearling 1/	<20	>=23
• Coho Fingerling	>20 to 200	2.3 to <23
• Coho Fry	>200 to 900	0.5 to <2.3
• Coho Unfed Fry	>900	<0.5
• Chum Fed Fry	<=1000	>=0.45
• Chum Unfed Fry	>1000	<0.45
• Sockeye Yearling 2/	<=20	>=23
• Sockeye Fingerling	>20 to 800	0.6 to <23
• Sockeye Fall Releases	<150	>2.9
• Sockeye Fry	> 800 to 1500	0.3 to <0.6
• Sockeye Unfed Fry	>1500	<0.3
• Pink Fed Fry	<=1000	>=0.45
• Pink Unfed Fry	>1000	<0.45
• Steelhead Smolt	<=10	>=45
• Steelhead Yearling	<=20	>=23
• Steelhead Fingerling	>20 to 150	3 to <23
• Steelhead Fry	>150	<3
• Cutthroat Trout Yearling	<=20	>=23
• Cutthroat Trout Fingerling	>20 to 150	3 to <23
• Cutthroat Trout Fry	>150	<3
• Trout Legals	<=10	>=45
• Trout Fry	>10	<45

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