HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Whitehorse Pond Summer Chinook Program
Species or Hatchery Stock	Summer Chinook (*Oncorhynchus tshawytscha*) Stillaguamish River
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Stillaguamish River Puget Sound
Date Submitted	August 04, 2005
Date Last Updated	July 28, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Whitehorse Pond Summer Chinook Program

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

Stillaguamish River Summer Chinook *(Oncorhynchus tshawytscha)* - listed as "threatened" June 2005

1.3) Responsible organization and individuals

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

Stillaguamish Tribe (Harvey Cr. Hatchery): collect broodstock, incubate and provide early rearing of fish before transfer to WDFW 's Whitehorse Hatchery.

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

Operational Information	Number
Annual operating cost (dollars)	$91,891
The above information for annual operating cost applies cumulatively to the Whitehorse Ponds Fish Programs and cannot be broken out specifically by program. Funding source is Wildlife Fund - State	

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

Rearing & Release:
Whitehorse Pond (WDFW): Located 1.5 miles upstream of the mouth of Whitehorse Springs Creek (WRIA 05.0254A), a tributary to the N. F. Stillaguamish River (05.0135) at RM 28 from its confluence with the mainstem Stillaguamish River (05.0001).

Adult Holding, Spawning, Incubation and early Rearing:
Harvey Creek Hatchery (Stillaguamish Tribe): Located 2 miles upstream of the mouth of Harvey/Armstrong Creek (05.0126), a tributary to the Stillaguamish River (05.0001) at RM 15.3.

1.6) Type of program.

Integrated recovery. The proposed integrated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery stock and local natural populations, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing programs as integrated, and NOAA's final listing determinations (64 FR 14308, June 28, 2005). Modification of the proposed strategy may occur as additional information is collected and analyzed.

1.7) Purpose (Goal) of program.

Restoration

The goals for this program is to release 220,000 summer chinook fingerlings and to provide technical information on harvest rates and locations, migration timing and productivity for north Puget Sound summer/fall natural chinook populations. Also, to insure the short-term preservation and long-term restoration of native Stillaguamish River chinook populations/stocks to levels that will sustain fisheries, non-consumptive fish benefits and other related cultural and ecological values (STAG 2000).

In the context of these goals, it is possible that this program may transition from an integrated recovery program to an integrated harvest program and over time, when habitat recovery is complete be terminated all together.

1.8) Justification for the program.

The hatchery program will enhance or benefit the survival of the listed natural population (integrated recovery program) by:

1) Egg to emigrant survivals rates will be increased over rates attainable in the natural environment that will increase the abundance of adult fish returning to the river.

2) Natural spawning hatchery fish will hopefully lead to increases in abundance of self-sustaining, natural-origin recruit based summer chinook salmon.

3) All summer chinook salmon juveniles produced at the hatchery will be coded-wire tagged only (starting with 2000 brood year) prior to release. This application will likely affect the ability to monitor fisheries contribution, but it will protect fish from selective fisheries and enhance the recovery efforts. Beginning with the 2003 BY, coded-wire tags along with adipose-fin clips will be applied to juveniles to allow for the evaluation of contribution rates to fisheries, survival rates and possible straying to other watersheds.

To minimize impacts on listed fish by WDFW facilities operation and the Whitehorse Rearing Pond summer chinook program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Whitehorse Rearing Pond summer chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	The spring water rights for the Whitehorse Rearing Pond are formalized through trust water right # S1-00825. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	The intake screens are in compliance with NOAA Fisheries screening criteria and no fish are passed upstream.
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System administered by the Washington Department of Ecology (DOE) - WAG 13 - 3008.
Broodstock Collection & Adult Passage	7.2, 2.2.3	Broodstocking begins in early August and continues until early September (4-8 times during this time period). Fish are captured using a small mesh gill net drifted down through the holding pools located within the geographic area of spawning. In 2003-04, WDFW and the tribes shall conduct an evaluation of alternative broodstock collection methods (an adult fish wheel trap) that are available and feasible to supplant the use of small mesh gill nets to procure chinook broodstock for the program.
Disease Transmission	9.2.7	Co-Managers Fish Disease Policy. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	See sections 2.2.3 & 10.11

1.9) List of program "Performance Standards".

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

Refer to the Stillaguamish Tribal HGMP for the "Performance Standards" and "Performance Indicators", designated by "benefits" and "risks".

1.11) Expected size of program.

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

Target broodstock collection levels are 130-150 fish (50:50 ratio male to female).

See Stillaguamish Tribal Summer Chinook HGMP.

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	Whitehorse Pond (05.0254A)	220,000
Yearling		

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

Stillaguamish chinook abundance (1980-1997) ranged from a low of 350 to a high of 1,600. 1976 was the last year that an escapement of 2,000 was met. The lowest escapement of 350 was in 1984.

North Fork Summer Chinook
Reconstruction of total recruitment and recruits per spawner

Brood Year	Original Escapement	Subsequent Escapement	Broodyr Exp. Rate	Recruitment	Recruits per Spawner
1986	980	505	.66	1,505	1.54
1987	1,065	695	.46	1,278	1.20
1988	516	654	.64	1,832	3.55
1989	537	458	.82	2,544	4.99
1990	575	488	.67	1,457	2.53
1991	1,331	486	.53	1,040	.78
1992	486	596	.38	959	2.06
1993	583	585	.50	1,165	2.07

North Fork Summer Chinook
Natural and Program Fish Survival Rates

Broodyear	Recruits per spawner	Supplementation Survival Rate
1986	1.54	1.31%
1987	1.20	0.63%
1988	3.55	1.10%
1989	4.99	0.97%
1990	2.53	1.70%
1991	0.78	0.09%
1992	2.06	0.31%
1993	2.07	0.40%
1994		0.57%
1995		0.48%
1996		0.54%
1997		0.54%
1998		0.23%

Data source: K. Rawson & RMIS database

Based on the average smolt-to-adult survival rate of 0.68% (1986-1998 BY's) and the programmed release goal of 220,000 fingerlings, the estimated adult production (goal) level would be 1,496.

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

Small-scale releases using native broodstock were initiated during the 1981-83 period (began capturing adults in the river in 1980).

1.14) Expected duration of program.

The short term interim time frame for the program is 8 to 12 years to rebuild the North Fork natural spawner population to a level where there are 4 consecutive years with natural origin recruit spawner escapements of 700 fish or greater. When this interim target is met, the co-managers will evaluate stopping the natural stock restoration program to assess the stock's ability to recover naturally.

The long term time frame for the program is that it will continue as an integrated recovery program until such time as the natural spawning chinook populations have increased to self-sustaining levels that will sustain fisheries (integrated harvest program), non-consumptive fish benefits and other related cultural and ecological values.

1.15) Watersheds targeted by program.

Stillaguamish River (05.0001).

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

The main alternative to the natural stock restoration program is the recovery of natural production through improved habitat conditions and reduced harvest. Reduced harvest levels on these stocks have been in place since 1991 without significant improvements to overall escapement (Stillaguamish Tribal chinook HGMP, 2003). Further reductions have been implemented and are scheduled. Basin wide habitat degradation has resulted in only 11% of the Stillaguamish riparian forests being intact and in fully functioning condition. Greater than 70% of the whole watershed had been logged at least once since the turn of the century (Pollack, 1997). Changes in hydrology, sediment levels and expected climate changes over the next 15-30 years will have a high probability of exacerbating the already degraded habitat.

Initial restoration and recovery plans are being implemented and additional basin wide plans are under development. However, the watershed scale of habitat degradation combined with the cost to restore impacted habitat will limit the speed of recovery. The natural stock integrated recovery program is intended to support natural spawning within the basin until such time that survival and productivity improve to self-sustaining levels.

A transition from an integrated recovery to an integrated harvest program would occur in a situation where the natural population(s) have recovered enough natural productivity to have some level of stability above the critical population level, but not enough productivity to support directed fisheries on the population. When this interim productivity level is reached, the natural stock restoration program would transition to an integrated harvest program contingent upon the implementation of selective, low impact commercial/tribal fisheries. The harvest rates would be set at levels that would not impede the continued recovery of the natural population.

As per the Puget Sound Salmon Management Plan (PSSMP), any alternative actions to be taken to attain program goals need to be agreed to by affected parties. The PSSMP, federal court order, describes the co-management responsibilities of WDFW and the tribes with regard to fishery management and artificial production and it explicitly states that "no change may be made to the Equilibrium Brood Document (production goals) without prior agreement of the affected parties." Any changes to production goals have to be reviewed by WDFW and the Stillaguamish Tribe.

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

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

During 2004-05, WDFW is writing the Whitehorse chinook HGMP in concert with the Stillaguamish Tribe to cover all stock/programs produced at the Whitehorse complex for authorization under the 4(d) rule of the ESA.

Harvest management of chinook populations within Puget Sound is implemented through the draft Puget Sound Comprehensive Chinook Management Plan (PSCCMP) - Harvest Management Component (Puget Sound Indian Tribes and WDFW, March 2004).

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

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

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

Stillaguamish Chinook

The Stillaguamish chinook has been divided into two distinct stocks (SASSI 1992). These are the summer and fall stocks. This division was based on spawning time and differences in geographical distribution. Subsequent genetic work has confirmed the validity of this separation. The summer stock is found in the North Fork of the Stillaguamish while the fall stock is found primarily in the South Fork. The chinook have been managed for natural production with a combined escapement goal of 2,000 adults for the two stocks.

The adults from the summer stock are seen in the North Fork as early as late May with numbers of adults increasing through July and August. Spawning activity begins in late August. Spawning peaks about mid-September and continues past mid-October. The fish are found throughout the North Fork (RM 0.0 to 34.4) as well as in the larger tributaries. The summer stock generally makes up about 80% of the total Stillaguamish basin chinook escapement.

The life history of the summer stock in particular and the Stillaguamish chinook in general is typical of most Puget Sound stocks. Puget Sound chinook has been classified as having an ocean type life history (nearly all the rearing occurs in the marine environment). This is contrasted with populations with stream type life histories; that is extended freshwater rearing (a year or more). The vast majority (about 95%) of the young Stillaguamish chinook migrate as smolts within a few months of hatching. The out-migration begins in February and continues through spring with a few continuing their out-migration through August. These young migrating smolts are often called fry, fingerling, age 0 and/or sub 1's. The remainder of the population (about 5%) migrates

after a full year of rearing in the river and is typically called yearlings. The yearling out-migration is typically later than the younger fish with most of it occurring during April, May and June.

The fall stock is found in the mainstem of the Stillaguamish River, South Fork and numerous other tributaries. The river entry timing of these fish is much later than that of the summers with most fish entering the system in August and September. Spawning typically takes place from mid-September through October with peak activity in early to mid-October. The origin of the Stillaguamish fall chinook is unknown. Their origin is confounded by the regular releases of "Green River type" fall chinook from the late 1950's to the early 1970's. The impacts from these releases are unknown. In the last 25 years there have been no releases except from the Stillaguamish tribal and WDFW facilities that have been North Fork summers. The fall population generally accounts for about 15% to 20% of the basin's escapement.

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

Stillaguamish Bull Trout

2.2.2) <u>Status of 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").*

Preliminary critical and viable population thresholds under ESA for the Stillaguamish summer chinook have been determined by the Co-managers (Puget Sound) Technical Review Team (PS TRT) to be at 650 and 2,000, respectively. The critical population threshold for the North Fork (NF) Stillaguamish was determined to be 500. No viable population threshold was determined for the NF. For the South Fork Stillaguamish there was no population thresholds determined by the PS TRT. NOAA Fisheries determined 300 and 552, respectively for the NF and 200 and 300 for critical and viable population thresholds, respectively, for the SF. The SaSI report (draft, WDFW unpublished 2002) determined this population, both SF and NF Stillaguamish Summer Chinook, to be "depressed".

- 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.

North Fork Summer Chinook
Reconstruction of total recruitment and recruits per spawner

Brood Year	Original Escapement	Subsequent Escapement	Broodyr Exp. Rate	Recruitment	Recruits per Spawner
1986	980	505	.66	1,505	1.54
1987	1,065	695	.46	1,278	1.20
1988	516	654	.64	1,832	3.55
1989	537	458	.82	2,544	4.99
1990	575	488	.67	1,457	2.53
1991	1,331	486	.53	1,040	.78
1992	486	596	.38	959	2.06
1993	583	585	.50	1,165	2.07

Source of data: K. Rawson

- 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.

Year	NF Escapement	SF Escapement
1985	1,148	75
1986	980	297
1987	1,065	256
1988	516	210
1989	537	274
1990	575	267
1991	1,331	301
1992	486	294
1993	583	345
1994	667	287
1995	599	223
1996	993	251
1997	930	226
1998	1,292	248
1999	845	253
2000	1,404	243
2001	1,029	283
2002	1,301	335
2003	962	105
2004	1,358	148

Source of data: WDFW (C. Kraemer)

- 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.

Return Year	% Natural Spawners	NORs	HORs
1985	100.0%	1,148	0
1986	100.0%	980	0
1987	100.0%	1,065	0
1988	100.0%	516	0
1989	95.0%	510	27
1990	92.8%	534	41
1991	92.3%	1,229	102
1992	86.9%	422	64
1993	65.2%	380	203
1994	68.4%	456	211
1995	71.9%	431	168
1996	68.9%	684	309
1997	65.9%	613	317
1998	47.6%	615	677
1999	40.0%	338	507
2000	74.1%	1,052	352
2001	81.6%	840	189
2002	58.1%	756	545
2003	63.4%	610	352

Source of data: J.Drotts, Stillaguamish Tribe (via Bruce Sanford, WDFW)

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

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

Broodstock Collection:
It has a potentially high "take" of the listed species. Fish are captured using a small mesh gill net drifted down through holding pools. Some fish that are initially caught in the net break free and may suffer scale loss and stress related impacts. Actual mortalities of escaped fish have not been observed. During years where warm water conditions exist, captured fish die during the holding and transport process. Broodstocking occurs 4 to 8 times during the August/September period (as per Stillaguamish Tribe).

Population size, habitat condition and utilization of snorkel assessments occur prior to broodstocking may result in stress to adult chinook holding in pools when snorkelers disturb them out of their holding area. These assessments occur, on average, once every 10 days. Foot surveys for redd counts and carcass sampling may disturb chinook holding in spawning areas.

Disease effects:
The risk of disease transmission to wild chinook in the area is low. Transmission of hatchery-origin diseases from the hatchery to wild fish in areas where they co-occur is an unlikely event. Although hatchery populations can be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990). Any potential impacts are addressed by rearing the chinook at lower densities, within widely recognized guidelines, continuing well-developed monitoring, diagnostic, and treatment programs already in place (Co-manager's Fish Health Policy 1998).

Juvenile Releases:
Fish rearing at the Whitehorse facility occurs in a large gravel bottom, spring fed pond, which runs directly into the North Fork Stillaguamish River. This is the same area used by natural-origin fish for rearing and migration. Fish are reared to sub-yearling smolt size that mimics the ocean-rearing life history of the natural population. Their residence time is minimal and interaction with natural fish is decreased. The mid-May hatchery release time coincides with the estimated peak seaward emigration period for naturally spawned fish, based on juvenile out-migrant studies by WDFW (Seiler 1984) and the Stillaguamish and Tulalip Tribes. Data from regression models presented in Griffith et al. (2001) and Griffith et al. (2003) indicate that the size of Stillaguamish River natural-origin chinook in mid-May are very similar to the chinook being released from the Whitehorse facility (see table 2 below). In a recent literature review of chinook salmon food habits and feeding ecology in Pacific Northwest marine waters, Buckley (1999) concluded that cannibalism and intra-generic predation by chinook salmon are rare events.

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

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

There have been mortalities associated with the transportation and holding of adult fish. During period of cool ocean, nearshore and river water temperatures, pre-spawning mortalities range from 3% to 8%. During stressful environmental conditions where ocean, nearshore and river water temperatures are at stressful/lethal levels, pre-spawning mortalities range from 12% to 32%.

Egg-to-smolt survivals have ranged from a low of 18% during a flow alarm failure to a high of 87%. Most years have survivals in the range of 70% to 80%.

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

See Table 1 for potential "take" information.

- 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.

Broodstocking "take" will not exceed 150 total fish or no more than 30% of the estimated North Fork spawning population during low census years. Should initial stressful environmental conditions exist where more than 25% of the captured chinook are lost during transport and holding, then broodstocking activities would cease until those conditions return to more normal levels.

Should egg-to-smolt mortalities exceed 50% within the hatchery, co-managers will evaluate holding the remaining fish to yearling size to maximize the return of adults from that genetic population.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

The Whitehorse Hatchery fingerling chinook salmon HGMP is included as one of 29 WDFW-managed plans under the co-managers' Resource Management Plan (RMP) for Puget Sound region chinook salmon hatcheries. This HGMP is in alignment with the RMP, which serves as the overarching comprehensive plan for state and tribal chinook salmon hatchery operations in the region.

As affirmed in the co-managers' RMP, this WDFW hatchery-rearing program 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).

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).

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 (HSRG 2004).

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).

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, WSFWS 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.

In 1999, several PS and coastal stocks were listed as threatened under the federal Endangered Species Act (ESA). State, tribal and federal managers need to ensure that their hatcheries do not present a risk to listed species. Through this Hatchery Reform Project, the managers have sought to go beyond merely complying with ESA directives. The new approach is to reform hatchery programs to provide benefits to wild salmon recovery and sustainable fisheries. Hatchery management decisions will be based on system-wide, scientific recommendations, providing an important model that can be replicated in other areas.

In addition, the Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and 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 (see section 3.4 for more details).

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

This hatchery, as well as other WDFW hatcheries within the Puget Sound Chinook ESU, 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 *Equilibrium Broodstock Programs* and enter into agreement the function, purpose and release strategies of all hatchery programs.

WDFW and the tribes shall develop a chinook escapement management plan for the Stillaguamish River.

3.3) Relationship to harvest objectives.

Stillaguamish chinook are vulnerable to fishing mortality throughout the year in the usual and accustomed fishing areas of many of the treaty tribes. However, in response to conservation concerns, tribal fisheries are closed in most areas and during times when Stillaguamish chinook are present. In recent years, there were no tribal fisheries specifically directed at Stillaguamish chinook.

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.

There are currently no fisheries directed at returning adults from this program. The fisheries contributions in the following table are incidental.

Whitehorse Summer Chinook Fingerling BY 1994-1999 Fisheries Contributions.

Brood Year	Program Release #	# of Fish Program Contributed	Proportion (%) of Total Catch									
			AK Ocean Troll	AK Estuarine Comm	Canadian Ocean Troll	CD Estuarine Comm	WA Ocean Troll	PS Comm. (Treaty and Non Treaty)	Canadian Ocean Sport	WA Ocean Sport	PS Sport	Misc. Fishery Contribution (<1% each)
1994	211,350	500	24.7	0.0	9.8	10.9	0.0	6.1	22.4	0.0	24.8	1.3
1995	35,500	54	22.3	2.1	23.3	2.1	0.0	0.0	21.1	0.0	28.4	0.7
1996	218,092	311	11.6	0.0	23.1	1.5	1.3	1.8	45.0	0.0	15.7	0.0
1997	95,278	68	7.8	0.0	17.7	0.0	2.0	4.7	46.5	0.0	21.5	0.0
1998	190,654	113	0.0	0.0	67.3	0.0	0.0	2.1	6.8	2.3	21.5	0.0
1999	172,350	198	0.0	0.0	69.6	0.0	3.6	6.1	3.8	0.0	15.2	1.7
Avg	**153,871**	**207**	**11.1**	**0.4**	**35.1**	**2.4**	**1.1**	**3.5**	**24.3**	**0.4**	**21.2**	**0.6**

3.4) Relationship to habitat protection and recovery strategies.

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 main alternative to the natural stock restoration program is the recovery of natural production through improved habitat conditions and reduced harvest. Reduced harvest levels on these stocks have been in place since 1991 without significant improvements to overall escapement (Stillaguamish Tribal chinook HGMP, 2003). Further reductions have been implemented and are scheduled. Basin wide habitat degradation has resulted in only 11% of the Stillaguamish

riparian forests being intact and in fully functioning condition. Greater than 70% of the whole watershed had been logged at least once since the turn of the century (Pollack, 1997). Changes in hydrology, sediment levels and expected climate changes over the next 15-30 years will have a high probability of exacerbating the already degraded habitat.

As per the Lead Entity (Snohomish SWM and Stillaguamish Tribe), initial restoration and recovery plans are being implemented and additional basin wide plans are under development. However, the watershed scale of habitat degradation combined with the cost to restore impacted habitat will limit the speed of recovery. The natural stock integrated recovery program is intended to support natural spawning within the basin until such time that survival and productivity improve to self-sustaining levels.

3.5) Ecological interactions.

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

Negative impacts by fishes and other species on the Stillaguamish River summer chinook 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 chinook 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 chinook 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 chinook 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
- Cutthroat trout
- Bass and sunfish

Rearing and migrating adult chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Stillaguamish River to the detriment of population abundance and the program's success in recovery. 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
- Bull trout

(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 and trout present in the Stillaguamish River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the chinook during their downstream migration in freshwater and into the marine area. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating chinook. Chinook adults that return to the river may provide a source of nutrients and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

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

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

- Northern pikeminnow
- Coho salmon
- Cutthroat trout
- 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.

Whitehorse Hatchery is supplied by spring water from Whitehorse Spring. It has a seasonal flow range of 90 gallons per minute (gpm) in low flow years to peak flows of 2,800 gpm in the spring. Minimum flows during the time chinook are reared at the hatchery are above 800 gpm. Dissolved oxygen (DO) levels in this water supply range from 9 parts per million (ppm) to 10.5 ppm and temperature range from a low of 41 degrees Fahrenheit to highs of 55 degrees Fahrenheit.

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.

The Whitehorse facility meets both NOAA Fisheries and WDFW fish screening criteria and the spring source is classified as pathogen free water. The water right permit # is S1-00825. The facility meets current NPDES standards for effluent discharge. The NPDES permit # is WAG13-3008.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock are captured in-river (within holding pools) by entanglement with small mesh (4") gill net. Once fish are removed from the net, they are transferred to 4' X 4' X 8' soft mesh holding pens and then moved, using wet burlap bags, to the fish transport truck.

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

Transportation of chinook occurs in standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 40 fish per 860 gallons of water. Compressed oxygen is provided during transport. Spare oxygen tanks are carried on the truck and oxygen flow to the tanks can be monitored from the cab while driving. Salt is added during transport as a therapeutic treatment. Hauling times do not exceed 2 hours from loading to unloading. Upon arrival at the hatchery, females are anesthetized and vaccinated to prevent the transfer of bacterial kidney disease to the offspring and then kept in separate covered circular tanks until ready to spawn.

5.3) Broodstock holding and spawning facilities.

The Harvey Creek Hatchery (Stillaguamish Tribe) has 6 discrete holding ponds for keeping broodstock separated by sex and for sorting ripe and unripe fish. Four 13' diameter X 4' deep circular tanks have a volume of 450 cubic feet and a flow of 45 to 65 gallons per minute. Two 20' diameter X 4' deep circular tanks have a volume of 940 cubic feet and a flow of 150 to 200 gallons per minute (gpm). Surface water from Harvey Creek is used for all circulars.

5.4) Incubation facilities.

At the Stillaguamish tribal facility, incubation occurs in vertical heath trays that are supplied with well water from a 65 foot deep well. Water flows from the well into a de-gassing tower and then to a head box where individual valves control flow rates of 3-5 gpm per 8 tray stacks.

5.5) Rearing facilities.

At the Whitehorse facility fish are reared in raceways 10' X 50' X 32' (180 fpp) at 250 gpm each. At 110 fpp they are tagged and moved to a 76,200 cubic foot dirt bottom semi-natural rearing pond. Flow is approximately 880 gpm.

5.6) Acclimation/release facilities.

The summer chinook are acclimated and released at the Whitehorse facility from a 76,200 cubic foot dirt bottom semi-natural rearing pond. Flow is approximately 880 gpm.

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

No operational difficulties have arisen at the Whitehorse facility. See Stillaguamish Tribe HGMP for more details.

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.

The Whitehorse Hatchery is an on-station facility with staff living on-site. The water supply is a screened gravity spring-fed system with alarm sensors alerting staff to any flow problems to the ponds. Both the intake and outflow structures have continuous rotating screens to assure continuous flow through the pond. Electrically driven aeration exists for emergency use in the event of water flow problems. Flooding has not been an issue since the spring water source is very stable.

Fish Health Specialists monitor the fish and staff follows the current Co-Managers Fish Health Policy (1998) recommendations and guidelines.

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.

Returning natural spawning adult summer chinook to the N.F. Stillaguamish River.

6.2) Supporting information.

6.2.1) History.

Broodstock collection began in 1980 with the capture of adults from the N.F. Stillaguamish River. From 1980 through 1986, the numbers of fish captured were generally less than 50 fish total.

6.2.2) Annual size.

The viability status of this stock has yet to be established. Approximately 30% to 60% of the fish returning to the spawning grounds are marked hatchery chinook originating from the restoration program. The target broodstock collection size is 130-150 fish (See Stillaguamish Tribal Summer Chinook HGMP).

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

Of the fish captured in the broodstocking effort, 30% to 70% are marked fish from previous releases (see Stillaguamish Tribal Summer Chinook HGMP for further details).

6.2.4) Genetic or ecological differences.

There are no known genetic or ecological differences between the broodstock fish and the natural spawners. Based on spawner/carcass surveys, returning tagged adults are found spawning throughout the current range of natural spawning within the N.F. Stillaguamish River (see Stillaguamish Tribal Summer Chinook HGMP for further details).

6.2.5) Reasons for choosing.

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 chinook salmon population for use as broodstock in the natural stock restoration program.

SECTION 7. BROODSTOCK COLLECTION

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

Adult summer chinook.

7.2) Collection or sampling design.

Fish are captured in pools between RM 15 and RM 30. Broodstocking begins in early August and continues until early September. Fish are captured using a small mesh gill net drifted down through the holding pools located within the geographic area of spawning and during the main time period for fish holding in pools prior to moving up on to the spawning grounds.

In 2003-04, WDFW and the tribes shall conduct an evaluation of alternative broodstock collection methods (an adult fish wheel trap) that are available and feasible to supplant the use of small mesh gill nets to procure chinook broodstock for the program.

7.3) Identity.

Hatchery-origin adult fish are 100% CWT'd.

7.4) Proposed number to be collected:

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

Target broodstock collection levels are 130-150 fish (50:50 ratio male to female).

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

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988	9	7			
1989	11	16			
1990	17	49			
1991	45	51			
1992	62	91			
1993	61	108			
1994	81	100			
1995	11	78			

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1996	68	77			
1997	79	78		249,707	
1998	71	73		265,000	
1999	44	87		185,934	
2000	54	56		223,743	
2001	55	72		244,843	
2002	68	70		342,003	
2003	59	67		251,895	

Data source: Kip Killebrew, Stillaguamish Tribe

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

Surplus hatchery-origin males were killed and sampled for tags with the carcasses going to tribal elders unable to harvest chinook, the Sarvey Wildlife Recovery Center or back into the mainstem river below the spawner/carcass survey areas for nutrient enhancement.

7.6) Fish transportation and holding methods.

Transportation of chinook occurs in a standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 40 fish per 860 gallons of water (1.3lbs per gallon). Compressed oxygen, at 10-14psi, is provided during transport. Sodium chloride (salt) is added at a .5% to .8% concentration as a therapeutic treatment to reduce handling stress, help maintain osmotic regulation and as a parasite/fungus control.

When the fish arrive at the tribal hatchery, they are separated by sex. Beginning in 2002 all males and females will be anesthetized and receive a vaccination against bacterial kidney disease prior to being placed in a 20 ft. circular fiberglass tanks. The tanks have a complete cover made out of aluminum, with locked hasps and an intrusion alarm system. Flows range from 150 to 200 gpm for each tank. Males are held in an identical tank. Fish are held 2 to 4 weeks prior to spawning. Fish ripen and are spawned over variable times between Aug 27th and September 24th.

7.7) Describe fish health maintenance and sanitation procedures applied.

Females are vaccinated to prevent the transfer of bacterial kidney disease to the offspring and then kept in separate covered c circular fiberglass tanks until ready to spawn. Females are sampled for disease as per the Co-managers Fish Health Policy (1998). All broodstocking, transport, handling and spawning equipment is disinfected with a solution of 100-ppm active iodine solution.

7.8) Disposition of carcasses.

Non-injected carcasses are either given to tribal elders and staff or are returned to the main stem Stillaguamish below the spawner index/survey areas for stream nutrient enhancement. Injected carcasses are given to the Sarvey Wildlife Recovery Center where they are frozen and later used for wild animal rehabilitation. The wildlife center's consulting veterinarian has approved this use of these carcasses.

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.

Broodstocking in multiple locations at multiple times during the return of the run should minimize any biases towards catching a specific group of fish. Broodstocking occurs early in the morning to minimize handling stress due to warm water during the later part of the day. Fish are captured in the North Fork Stillaguamish where they have had time to adjust to freshwater conditions.

Beginning in 2001, hatchery staff implemented procedures to read all coded wire tagged broodstock prior to spawning and culled out any hatchery strays from outside the watershed.

Beginning in 2003-04, WDFW and tribal staff will be evaluating the use of an adult fish wheel to capture needed broodstock and enumerate escapement. This alternative method may allow for the capture of a broader sub-sample of the spawning population and reduce stress to fish that are not captured, but are holding in pools where broodstocking occurs.

SECTION 8. MATING

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

8.1) Selection method.

Fish are checked once a week to determine ripeness based on previous experience with maturation. Ripe fish that are ready are randomly spawned using the 5 X 5 spawning matrix (see section 8.3).

8.2) Males.

Both adult males and jacks are used randomly in the spawning process. Jacks are used in similar numbers to what have been found in previous spawner surveys. There is a separate backup male used from the day's ripe fish for each primary male.

8.3) Fertilization.

Each female and each male's gametes are initially placed in a separate container. Five individual females are then combined into one bucket and re-divided back into 5 buckets giving a sub sample of 5 females in each bucket. An individual male is added to each bucket of eggs for initial fertilization and then 5 males are each moved one-bucket to the right and used again as a separate backup fertilization. In summary, 10 males (5 primary, 5 backup) are used for each 5-pooled females.

8.4) Cryopreserved gametes.

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.

When the program first began, one to one crosses were used for the fertilization protocols. Concerns about the over representation of a small group of spawners in the next generation led to the current spawning protocols. The 5:5 crossing with 65 males and 65 females per year meets the guideline of having an effective spawning population (Ne) greater than 250 fish.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Expected survival from fertilization to ponding is 80 to 90% at the tribal hatchery. Lower survival rates (70-80%) are associated with stressful environmental conditions for returning adults associated with warm ocean, near shore, and in river water temperatures

Brood Year	Green Egg to Release Survival
1997	17%
1998	63%
1999	84%
2000	81%
2001	51%
2002	72%
2003	72%

The target green egg take goal varies with environmental conditions. During normal water temperatures, the goal is to collect 290,000 green eggs. When reduce survival is expected because of stressful conditions, the goal is increased to 340,000.

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

In the past, all eggs were reared to fingerling stage, tagged and released. Because these hatchery fish and their progeny are part of the listed species, we are unable to destroy any surplus eggs or fry. The proposal would be to continue tagging and releasing any surplus production contingent upon working closely with National Marine Fisheries Service to determine the best strategy for those surpluses.

9.1.3) Loading densities applied during incubation.

Loading densities range from 6,000 to 7,000 eggs per vertical Heath tray with flows of 3 to 5 gallons per minute per stack. Eggs are typically in the range of 1320 to 1390 per pound.

9.1.4) Incubation conditions.

At the tribal facility (Harvey Creek Hatchery), incubation water is well water that is run through a packed column to add oxygen. Dissolved oxygen levels range between 10 and 11 ppm. Loading densities are within the standards currently used by most hatcheries. Silt management is not required unless surface water is used in an emergency where well water is not available. Well water temperatures typically range between 49 and 50 F.

9.1.5) Ponding.

Button up and ponding occurs when there is approximately a 1mm belly slit remaining on the majority of the alevins in a given incubator tray. Typically, button up occurs when the alevins have between 1600 to 1650 Fahrenheit temperature units. Button up fry are manually transferred from incubation trays to early rearing troughs beginning the 1st week of December and continuing through the 1st week of January. Button up fry are typically 1000/lb and 38 mm in length when feeding begins.

9.1.6) Fish health maintenance and monitoring.

Eggs are given a pre-fertilization rinse with a 1.37% solution of sodium bicarbonate to reduce broken eggshell de-activation of sperm and increase fertilization success (Wilcox, 1984).

Eggs are treated on an as-needed basis with hydrogen peroxide at 500 ppm for 15 minutes or formalin at 1600 ppm for 15 minutes to control fungus development.

Coldwater disease and coagulated yolk are the primary problems seen at the hatchery. The problems are not consistently seen and typically do not cause major losses of alevins and fry.

Non-viable eggs are removed at the eyed stage after shocking using a Jensorter Model WB-4 optical egg sorter. Remaining dead eggs are removed and counted at the time of ponding.

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.

At the tribal facility, vexar substrate is used to reduce yolk sac abrasion and increase the size of ponded fry. There is a triple alarm system in place with a back up well, generator and surface water pump available in the event of water flow interruption from the primary well. Eggs are incubated on pathogen free, clear well water to reduce the potential loss from using surface water with high levels of silt.

9.2) Rearing:

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

Average survival rate from initial fry ponding through release (1995-99) is 93% (range: 79% to 99%). This is the combined mortality at both the Whitehorse Hatchery (WDFW) and the Harvey Creek Hatchery (Stillaguamish Tribe).

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

Early rearing densities (at tribal hatchery) are maintained at less than 0.75 lbs/cubic foot and < 7 lbs. of fish/gpm. Final rearing densities are less than 0.10 lbs./cubic foot and less than 4 lbs./gpm. Goal is to maintain rearing and pre-release densities below 0.5 lbs./cubic feet and < 5 lbs./gpm.

9.2.3) Fish rearing conditions

Fish reared at the Harvey Creek Hatchery are on surface water with temperatures ranging between 38 and 50 degrees Fahrenheit. Dissolved oxygen levels are monitored monthly at the hatchery intake in Harvey Creek. Temperatures at Whitehorse Pond are 46 to 48 degrees Fahrenheit and dissolved oxygen (DO) is between 9 and 10.5 parts per million (ppm).

At the Whitehorse facility, the Hatchery Scientific Review Group (HSRG) recommended that additional water be developed (increase flows) and infrastructure changes be made to support both steelhead and the recovery program for the NF Stillaguamish summer chinook. These changes are currently underway and focus on improving water quality and quantity that in turn, would improve smolt quality and eliminate any disease problems. This effort includes in the construction of three new raceways, two new wells (2 cfs), and a new incubation facility.

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.

Month (avg.)	Size (fpp)
3/31/00	152
4/30/00	106
5/18/00	78

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

Data not collected.

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*).

Chinook fingerlings at an average size of 400 fish per pound (fpp) are fed BioDiet Grower 4 times a day at approximately 2.5% B.W./day. When the fish reach an average of 100 fpp (at Whitehorse), the BioMoist Feed is provided 3 times per day at approximately 2.0% B.W./day.

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

Fish are sampled during rearing for the incidence of disease in accordance with the Co-Managers Fish Health Policy (1998). Monthly monitoring exams take place to detect pathogens of concern. Fish vaccines may be used to prevent epizootics associated with two bacterial diseases (vibriosis and enteric red mouth disease). In the event of disease epizootics or elevated mortality, fish pathologists are available to diagnose problems and provide treatment recommendations.

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

Gill ATPase activity is not monitored. The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development.

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

At the Whitehorse acclimation site, fish have access to significant populations of terrestrial and aquatic insects within the gravel-lined rearing pond.

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.

Fish rearing at the Whitehorse facility occurs in a large gravel bottom, spring fed pond, which runs directly into the North Fork Stillaguamish River. This is the same area used by natural-origin fish for rearing and migration. Fish are reared to sub-yearling smolt size that mimics the ocean-rearing life history of the natural population. All fish are coded-wire tagged prior to release.

The Hatchery Scientific Review Group (HSRG) recommended that additional water be developed (increase flows) and infrastructure changes be made to support both steelhead and the recovery program for the NF Stillaguamish summer chinook. These changes are currently underway and focus on improving water quality and quantity that in turn, would improve smolt quality and eliminate any disease problems. This effort includes in the construction of three new raceways, two new wells (2 cfs), and a new incubation facility.

SECTION 10. RELEASE

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

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	220,000	70-90	Mid-May	Whitehorse Spring Creek
Yearling				

Note: 70 fpp ~ 84 mm fork length
90 fpp ~ 77 mm fork length

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

Stream, river, or watercourse:

Release point: Whitehorse Spring Creek (05.0254A) RM 1.5 to confluence with N.F. Stillaguamish which is at RM 28 from confluence to mainstem Stillaguamish River.

Major watershed: Stillaguamish River (05.0001)

Basin or Region: Puget Sound

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988					137,243	90		
1989					41,115	85		
1990					46,837	86		
1991					69,100	69		
1992					176,756	85		
1993					100,121	80		
1994					216,000	80		
1995					211,350	70		
1996					35,500	50		
1997					218,092	90		
1998					95,278	56		
1999					190,654	84		
2000				`	172,350	78		
2001					206,133	-		
2002					162,970	78		
2003					289,389	-		
Average					164,899			

Source: WDFW database & Kip Killebrew, Stillaguamish Tribe

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

Fish are released by removing outlet screens on the gravel rearing pond in mid-May. Pond screens are left open until most of the fish have volitionally exited the pond. Hatchery staff then lowers the pond to force any remaining fish out by Memorial Day. The mid-May hatchery release time coincides with the estimated peak seaward emigration period for naturally spawned fish, based on juvenile out-migrant studies by WDFW (Seiler, 1984) and the Stillaguamish and Tulalip Tribes.

10.5) Fish transportation procedures, if applicable.

Chinook fry are transported to the Whitehorse Hatchery during the first part of March each year. Transportation of the fry occurs in a fiberglass insulated fish-hauling tank. Loading densities are 300 pounds (lbs.) of fry per 680 gallons of well water. Salt is added as therapeutic treatment and water temperatures are within 5 degrees Fahrenheit of the receiving water. Compressed oxygen is fed into the transport tank and levels can be monitored from inside the cab of the truck. Transit time is typically 1 hour.

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

Fish are acclimated at the Whitehorse facility, on the average of 69 days, on Whitehorse Spring Creek water.

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

Beginning in 2000, all sub-yearlings produced were marked with a coded-wire tag only. All fish are wanded (CWT detector) to differentiate HOR's (hatchery-origin returns) from NOR's (natural-origin returns).

Because the original intent of the chinook program was as a US/Canada indicator stock and because of stable and slightly increasing escapement numbers for wild N.F. Stillaguamish River chinook, the co-managers have agreed to return to both adipose-fin clipping and coded-wire tagging program fish beginning in 2004 (2003 BY). This would allow for evaluation of the contribution rates to fisheries of this population, survival rates and possible straying to other watersheds. This decision will be reviewed annually to incorporate changes in either escapement numbers or additional harvest impacts.

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

Because these hatchery fish and their progeny are part of the listed species, no fish identified as surplus at the time of release are destroyed. The proposal would be to continue rearing, tagging and releasing any surplus production contingent upon working with NOAA Fisheries to determine the best strategy for those surpluses.

10.9) Fish health certification procedures applied pre-release.

The sub-yearlings are fish health certified in accordance with the Co-managers Fish Health Policy (1998) within two weeks of their scheduled release.

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

In the event of a natural catastrophe, dam boards and screens are pulled and the fish are released irrespective of their tagging status or size. If adequate time is available, it is technically feasible to transport fish to other hatcheries within the watershed to save them and avoid early release. During severe drought conditions, fish may be released early to prevent fish loss.

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.

Fish rearing at the Whitehorse facility occurs in a large gravel bottom, spring fed pond, which runs directly into the North Fork Stillaguamish River. This is the same area used by natural-origin fish for rearing and migration. Fish are reared to sub-yearling smolt size that mimics the ocean-rearing life history of the natural population. Their residence time is minimal and interaction with natural fish is decreased. The mid-May hatchery release time coincides with the estimated peak seaward emigration period for naturally spawned fish, based on juvenile out-migrant studies by WDFW (Seiler, 1984) and the Stillaguamish and Tulalip Tribes.

In addition, a rearing parameter of the program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). Such fish would be less likely to residualize in fresh water and interact with listed wild fish. Coefficient of variation (CV) for length is not available.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Elements of the annual Monitoring and Evaluation plan for this program are identified in Section 1.10. The purpose of a monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Each production group is identified with distinct otolith marks, adipose clips, coded wire tags, blank wire tags or other identification methods as they become available, to allow for evaluation of each particular rearing and/or release strategy. This will allow for monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats and assessment of the status of the target population. WDFW shall monitor the chinook salmon escapement into the target and non-target chinook populations to estimate the number of tagged, un-tagged and marked fish escaping into the river each year and the stray rates of hatchery chinook into the rivers.

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

WDFW shall monitor straying of the summer chinook program fish into the South Fork Stillaguamish River and take appropriate actions to prevent reduced genetic diversity in the South Fork chinook stock.

WDFW shall continue to collect and analyze genetic data from the hatchery program and natural spawners in the NF and SF Stillaguamish River.

WDFW and the tribes shall evaluate the consistency of time and size of release between the hatchery program fish and naturally produced chinook.

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

Some funding and resources are currently committed to monitor and evaluate this program as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002).

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

Monitoring and evaluation will be undertaken in a manner that does not result in an unauthorized take of listed chinook (see Stillaguamish Tribal Summer Chinook HGMP for further details).

SECTION 12. RESEARCH

12.1) Objective or purpose.

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.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Take Table. Estimated listed salmonid take levels by hatchery activity.

Chinook

ESU/Population	Puget Sound Chinook *(Oncorhynchus tshawytscha)*- Stillaguamish River Summer
Activity	Whitehorse Rearing Pond Summer Chinook Program
Location of hatchery activity	Whitehorse Pond, RM 1.5 Whitehorse Springs Creek-05.0254A
Dates of activity	March- May
Hatchery Program Operator	WDFW

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)	-	-	-	-
Intentional lethal take (f)	-	-	-	-
Unintentional lethal take (g)		Avg 3,248*	-	-
Other take (indirect, unintentional) (h)	-	Unknown	-	-

* The juveniles are only at Whitehorse for a short time. Additional loss may occur at the Stillaguamish Tribal Hatchery (see table in Tribal HGMP).

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.