HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Soos Creek Fall Chinook Fingerling Program
Species or Hatchery Stock	Fall Chinook (*Oncorhynchus tshawytscha*) Green River
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Green River (Duwamish) Puget Sound
Date Submitted	August 04, 2005
Date Last Updated	July 27, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Soos Creek Fingerling Chinook Program.

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

Green River Fall 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:

In addition to the WDFW on-station production, 600,000 eyed-eggs are transferred to the Muckleshoot Tribe at the Keta Creek Hatchery, and approximately 2,000-eyed eggs are given to local school groups.

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

Operational Information	Number
Annual operating cost (dollars)	$318,524
The above information for annual operating cost applies cumulatively to the Soos Creek Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund – State and Puget Sound Recreational Enhancement Fund	

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

Broodstock Collection; Incubation; Rearing and Release:

Soos Creek Hatchery: Located on Big Soos Creek (09.0072) at RM 1, tributary to the Green River (09.0001) at RM 33.5.

1.6) Type of program.

Integrated harvest. 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.

The goal of the Soos Creek chinook fingerling program is release 3,200,000 fish to provide adult fish for sustainable fisheries (Magnuson/Stevens Act) and Treaty Indian fishing right entitlements (*US v. Washington*).

In the past, the program has incorporated stray natural-origin fish for use as broodstock at an average annual proportion of 39% of annual spawner population needs. In 2004, 8.9% of the broodstock consisted of known natural-origin chinook. A more formal plan will be developed in the future as per HSRG guidelines. Contribution of natural-origin returns (NORs) into the hatchery broodstock will be monitored on an annual basis.

1.8) Justification for the program.

This program is operated to provide fish for harvest while minimizing adverse genetic, demographic or ecological effects on listed fish. The Soos Creek Hatchery fall chinook fingerling program is used as a Double-Index Tag (DIT) group. Of the 3,200,000 released, 2,800,000 are mass marked (adipose-fin clip only), 200,000 adipose-fin clip/coded-wire tagged (Ad + CWT) and 200,000 coded-wire tagged only. The 2,800,000 mass marked can provide NOR/HOR (hatchery-origin returns) ratios on the spawning grounds in the Green River watershed. The DIT group can serve as an index group for wild fingerling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds. This will be accomplished in the following manner:

1) Juvenile chinook will be released as smolts to minimize emigration time to saltwater thereby minimizing potential competition with and predation on natural-origin listed fish.

2) Juvenile chinook will be released in May and at a size that resembles the usual wild chinook emigration time and size to minimize potential adverse interactions.

3) All juvenile chinook released will be acclimated at a hatchery facility capable of trapping the majority of returning adults. This practice will minimize straying and make possible the removal or regulation of hatchery fish allowed to spawn naturally.

4) All juvenile chinook will be marked to distinguish them from wild or naturally spawning chinook.

5) Adult chinook produced from this program will be harvested at a rate that allows adequate escapement of listed chinook.

To minimize impacts on listed fish by WDFW facilities operation and the Soos Creek Hatchery chinook fingerling program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Soos Creek Hatchery chinook fingerling program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1	Surface water rights are formalized through trust water right # S1-21122. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	Intake screens at Soos Creek Hatchery are not compliant with current NOAA Fisheries screening guidelines to minimize the risk of entrainment of juvenile natural-origin fish.
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 - 3014.
Broodstock Collection & Adult Passage	7.9, 2.2.3	Beginning in 2004, the potential for adverse removal effects to listed natural chinook salmon population during broodstock collection will be reduced by concentrating collection on marked and tagged hatchery-origin chinook. A certain level of natural origin fish will continue to be incorporated into the broodstock as a measure to minimize genetic divergence of the propagated population from the natural population. Intent is to pass upstream 2,000 - 3,000 adults annually without regard to origin.
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".

Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Puget Sound Salmon Management Plan (US v Washington), the Shared Strategy for Salmon Recovery, production and harvest objectives.	Contribute to a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 10-year average of 0.46% smolt-to-adult survival that includes harvest plus escapement.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock needs.
Maintain outreach to enhance public understanding, participation and support of WDFW hatchery programs.	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments.	Participate in annual coordination meetings between the co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity. Maintain effective population size	A minimum of 500 (2,400) adults are collected throughout the spawning run in proportion to timing, age, and sex composition of return. As of 2005 all returning hatchery adults will be adipose marked. An integration plan will identify a prescribed level (goal) of natural origin fish (by percentage of the total) to be incorporated into the hatchery broodstock.	Annual run timing, age, and sex composition and return timing data are collected. Adhere to HSRG (2004) and WDFW spawning guidelines (WDFW 1983)

Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery-origin fish.	The Soos Creek Hatchery fall chinook sub-yearling program is used as a Double-Index Tag (DIT) group. Of the 3,200,000 released, 2,800,000 are mass marked (adipose-fin clip only), 200,000 adipose-fin clip/coded-wire tagged (Ad + CWT) and 200,000 coded-wire tagged only. Sampling of mass marked adult returns can provide NOR/HOR ratio's on the spawning grounds in the Green River watershed. The DIT group can serve as an index group for wild sub-yearling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.	Returning fish are sampled throughout their return for length, sex, mass marks and coded-wire tags.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-Managers Fish Disease Policy (1998).	Necropsies of fish to assess health, nutritional status and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-Managers Fish Health Policy.
	Inspection of adult broodstock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to Co-managers Fish Health Disease Policy.

Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish.	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt-size (80 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups).	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification, or spread of fish pathogens that might negatively affect the health of both hatchery and natural reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, if needed.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and in-stream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	All fish entering the hatchery are documented: Hatchery records. Visual observations recorded. Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities.	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Agencies and tribes to provide up-to-date information needed to monitor harvests.

1.11) Expected size of program.

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

At an average fecundity of 4, 500 eggs per female, a pre-spawning mortality of 10%, and a 1:1 male: female sex ratio, approximately 2,400 adults are needed for an egg take goal of 4.8 million. Fecundity may vary each year so adults needed for broodstock may vary as well.

For a release of 3,200,000 fingerlings, with an egg-to-smolt mortality of 15%, 3,800,000 million eggs are needed for the program. Out of the 2,400 adults, 1,688 (844 males: 844 females) would be needed for the fingerling program.

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

WDFW shall limit, as the management intent, annual production of fall chinook for on-station release at Soos Creek Hatchery to a total, maximum of 3,200,000 fingerlings. Limiting juvenile production to current (proposed) levels will help retain, and not forestall, potential future options for the recovery of the listed chinook ESU.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Soos Creek (09.0072)	3,200,000*
Yearling		

* An additional 600,000 fry will be transferred to the Muckleshoot Tribe's Keta Creek facility for rearing through the fingerling size, and release into the upper Green River watershed. 2,000- eyed eggs are given to local "Salmon in the Classroom" programs.

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

For broodyears 1991 through 1998, the average sub-yearling smolt-to-adult survival rate was 0.47% (RMIS coded-wire tag data base).

Fisheries in the terminal area are managed to achieve an aggregate hatchery and wild adult fall chinook escapement goal of 5,800 fish. In the 1999 return year, naturally produced chinook comprised 57% of the total natural spawning escapement and hatchery produced chinook comprised 43%.

Escapement levels back to the hatchery rack for broodyears 1995 through 2003 were 10, 640, 13,464, 12,084, 9,313, 10,576, 5,967, 11,751, 10,461 and 6,606, respectively.

Based on the average smolt-to-adult survival rate of 0.47% and the programmed release goal of 3,200,000 sub-yearling chinook smolts, the estimated adult production (goal) level would be 15,040.

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

1901

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Soos Creek (09.0072)

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

An alternative action would be to reduce sub-yearling fall chinook release numbers at Soos Creek Hatchery as a measure to decrease ecological risks to natural-origin chinook salmon and reduce listed chinook salmon adult removal levels required each year for broodstock collection at the hatchery rack. WDFW has not pursued this alternative because it does not meet fisheries enhancement objectives for the program, including treaty Indian fishing right entitlements (*US v. Washington*) and the Magnuson/Stevens Act for sustainable fisheries.

In order for any alternative actions to be considered for attaining program goals, the affected parties (co-managers) must approve any changes. The Puget Sound Salmon Management Plan (PSSMP), a federal court order, describes the co-management responsibilities of WDFW and the tribes with regard to fishery management and artificial production. The PSSMP explicitly states that "no change may be made to the Equilibrium Brood Document (program production goals) without prior agreement of the affected parties." In the Green River/Duwamish River watershed any changes in the production at the Soos Creek Hatchery have to be reviewed and approved by WDFW and the Muckleshoot 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 HGMP's to cover all stock/programs produced at the Soos Creek 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.

Duwamish/Green River/Summer-Fall Chinook

Most naturally-spawned Green River chinook migrate to salt water after spending only a few months in freshwater. Arrival of both hatchery and naturally produced smolts in the estuary peaks in May, and after a few weeks, most begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean. Sexually mature fish begin arriving back at the river mouth as early as July. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October, and is generally complete by early November.

Adults spawn in the mainstem Green River from about RM 25.4 in Kent to the City of Tacoma diversion dam at RM 61. Approximately 70% of natural spawning occurs upriver from the mouth of Soos Creek (RM 33.7). Tributary spawning occurs in the lower 4 miles of both Soos and Newaukum creeks. Natural spawners in Newaukum Creek are genetically similar to Green River Hatchery fish (Marshall et al. 1995) and are now considered the same genetic population.

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

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Preliminary critical and viable population thresholds under ESA have been determined by the Co-manager's (Puget Sound) Technical Review Team (PSTRT) to be at 1,800 and

5,800, respectively (PSTRT 2003). NOAA Fisheries thresholds are 835 and 5,523, respectively. The SaSI report (draft, WDFW unpublished 2002) determined this population (Duwamish/Green Summer/Fall Chinook) to be "healthy".

- 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.

On average (return years 1987-98), each Green River natural spawner (an aggregate of natural-origin and F1 hatchery-origin adults) produces 2.33 adults returning to Washington waters (WDFW Chinook Run-reconstruction Tables). Productivity for the natural-origin population only is unknown at this time. The high annual proportion of F1 hatchery-origin fish escaping to spawn naturally confounds the ability to determine the productivity of the natural proportion.

- 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.

Escapements have exceeded the 5,800 fish goal in 9 of the past 12 years (1988-99), with a range of 2,476 to 13,173. The 12-year average escapement is 8,080. (WDFW RR Tables)

- 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.

The proportion of Soos Creek hatchery-origin adults observed in mainstem Green River natural spawning areas averaged 33.4% of the total escapement in 7 years between 1989 and 1997 (WDFW coded-wire tag data). Small sample sizes (<4%) in 5 of these years, and the limited area sampled (RM 33.8 to 41.4 only), make these data less than reliable when applied to the entire river. For 2002 and 2003, the estimate of hatchery-origin contribution in the mainstem was 20 and 55 percent, respectively. For Newaukum Creek, the estimates for those two years were 35 and 59 percent, respectively

The ratio of Soos Creek hatchery-origin adults to Newaukum Creek natural spawners averaged 23.3% in 9 years between 1989 and 1997 (WDFW coded-wire tag data). Sample rates averaged 30% per year.

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

- 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 removal effects:
Substantial numbers of apparently natural-origin chinook return to the Soos Creek hatchery in most years. Historically, natural-origin chinook adults were thought to make up 39% (average, 1990-1997; range 26% to 45%) of the return to the Soos Creek Hatchery each year. 2004 was the first return year where the natural origin fish could be distinguished from the hatchery-origin fish. The unmarked fish were incorporated into the broodstock at an 8.9% proportion. Since the Soos Creek chinook fingerling program requires about 1,688 adults to supply the required number of fish for release (3.2 million), approximately 150 adults are from the natural component of the Green River stock.

Capture, handle and release effects:
The Soos Creek Hatchery adult weir is capable of trapping 100% of the adult chinook returning to Soos Creek at RM 0.8. Intent is to pass upstream 2,000 - 3,000 adults annually without regard to origin. The collection and handling of these fish may result in takes of listed fish through migration delay, injury during holding or through handling and incidental mortality through trapping or handling. In 2004, approximately 270 natural –origin chinook were assumed to be passed upstream (3,000 X .09 = 270)

Entrainment effects:
Upstream of the hatchery weir is the hatchery pump intake that may cause a very low take risk to adults passing the intake dam. The pump intake screens are believed to pose a low level risk to juvenile migrants due to the small screen size and the high volume of bypass water associated with the structure. The weir and hatchery intake has been identified for improvements in the WDFW capital budget process.

Predation/Competition:
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 (Seiler et al., 1998-2002). 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 enough 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;

With fish from the Soos Creek facility being released at a similar size and after most of their wild counterparts have left (88%) the system (Seiler et al., 2002), the potential for predation/competition with natural-origin listed fish is low. The June release timing for the hatchery fish reduces the likelihood for interaction with the majority of natural origin

juvenile chinook rearing and emigrating each year. Food resource competition risks to listed chinook juveniles in the Green River are reduced by delaying release of the hatchery-origin chinook until June.

Disease Effects:
The risk of disease transmission to wild chinook in the area (Puget Sound) 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). These 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).

Genetic Effects:
The program has incorporated natural-origin fish for use as broodstock at an average annual proportion of 39% of annual spawner population needs. This level of natural-origin fish spawning has likely reduced genetic divergence of the propagated population from the naturally spawned Green River population. At Soos Creek in 2004, 8.9% of the broodstock consisted of chinook with an adipose fin and is considered a within population genetic diversity preservation measure. This will continue in the future, following the HSRG guidelines. Contribution of NOR's into the hatchery broodstock will be monitored on an annual basis.

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

In the past, on average, 39.4% of the adult chinook returning to the Soos Creek hatchery was of natural origin (Cropp et al. 1999). Since 3,500 brood fish were needed to achieve the egg-take goal at that time, between 780 and 1,380 natural-origin adults may have been killed each year for spawning. With a permanent rack in place, all returning adults can be captured. With the first 100% mass marked group (2000 brood) returning in 2005, the facility will be able to differentiate hatchery and natural-origin chinook. The 1999 broodyear was not 100% mass marked, so in 2004 8.9% of the broodstock consisted of known natural-origin chinook. This will be continued in the future as per HSRG guidelines. Contribution of NOR's into the hatchery broodstock will be monitored on an annual basis. Since the 1996 brood, it has been the practice to pass adults upstream to spawn naturally. Additional surplus fish are killed and sold for commercial processing or donated to food banks.

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).

Projected annual take levels for the Soos Creek Hatchery yearling program are presented in Table 1. As noted, take levels that may be associated with certain hatchery program activities are unknown.

- 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.

The ability to assess listed adult chinook salmon takes will be improved with returns of mass marked hatchery-origin fish over the next few brood years, which will allow ready differentiation between listed and non-listed chinook. On-going juvenile out-migrant trapping, and predation studies conducted in association with that program, will provide information regarding takes occurring as a result of hatchery production. If identified listed chinook salmon take levels exceed expected authorized levels, WDFW will consult with the NOAA Fisheries in a timely manner.

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 Soos Creek Hatchery sub-yearling 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, 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).

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 HGMP and hatchery reform efforts, the Co-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.

WDFW has signed an agreement with the Muckleshoot Tribe (see citations) linking mass marking with production goals. Production goals shall be maintained at 3.2 million, at a minimum, for agreement, from the Tribe, to mass mark for the next two years.

This hatchery program, and all other WDFW anadromous salmon hatchery programs 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 to enter into agreement the function, purpose and release strategies of all hatchery programs. Two documents are completed each year, describing agreed hatchery fish production levels for each brood year. The "Future Brood Document" is a detailed listing of agreed annual juvenile fish production goals. This document is reviewed and updated each spring, and finalized in July. The "Current Brood Document" presents actual juvenile fish production levels relative to the annual production goals. This second document is developed in the spring after eggs spawned that year have been enumerated and actual resultant juvenile fish production levels can be estimated. Through this process, the co-managers document their agreement on the function, purpose and release strategies for all Puget Sound region hatchery programs.

3.3) Relationship to harvest objectives.

Adult chinook salmon produced through the Soos Creek Hatchery sub-yearling program are managed for harvest in fisheries in accordance with the co-managers' "Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component" that was submitted for ESA review and authorization by NOAA Fisheries in 2003. The "recovery exploitation rate" applied as a harvest impact limit on listed Green River natural-origin chinook salmon that are commingled with hatchery-origin chinook salmon in pre-terminal southern U.S. fishing areas is 15%. Marine and freshwater terminal area fisheries are managed to achieve an escapement goal to naturally spawning areas in the Green River of 5,800 natural and hatchery-origin chinook salmon.

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.

Annual releases of yearlings from Soos Creek Hatchery contribute, on average, 8,444 fish to marine and freshwater area recreational and commercial fisheries in the Pacific Northwest region (WDFW coded-wire tag data from 1990 through 1999 releases). Fisheries Contribution rates are shown in the table 2 below.

Table 2. Soos Creek Chinook Fingerling Broodyears 1990-1999 Fisheries Contributions.

Brood Year	Program Release #	# of Fish Program Contri. to Catch	Proportion (%) of Total Catch													
			AK Ocean Troll	Can. Ocean Troll	Can Estuarine Comm	OR Ocean Troll	WA Ocean Troll	WA Treaty Troll	PS Comm. (Treaty and Non Treaty)	Can. Ocean Sport	WA Ocean Sport	NMFS Ground-fish Observ.	PS Sport	WA Fresh-water Sport	WDFW Test Fishery	Misc. Fishery Contri. (<1%)
1990	2,837,800	10,007	0.0	19.9	8.0	0.0	0.0	2.5	40.7	12.9	0.0	0.0	15.2	0.0	0.0	0.8
1991	5,080,500	3,425	0.0	2.8	2.9	0.0	0.0	0.0	47.1	10.3	0.0	0.0	34.6	0.0	1.5	0.9
1992	4,797,938	12,297	1.3	3.6	0.0	0.0	0.0	9.0	40.7	13.5	0.0	0.0	31.0	0.0	0.0	1.1
1993	3,706,018	8,856	2.0	8.5	5.6	1.4	1.5	0.0	27.6	12.3	0.0	0.0	38.4	1.7	0.0	1.0
1994	3,344,400	4,307	3.4	5.9	5.3	0.0	1.3	1.3	35.2	21.0	0.0	0.0	25.3	0.0	0.0	1.3
1995	3,189,200	2,888	8.3	4.4	0.0	0.0	1.6	9.1	46.7	5.2	1.9	0.0	22.3	0.0	0.0	0.6
1996	3,231,100	7,095	1.1	21.3	0.0	1.1	1.4	1.8	51.0	11.2	0.0	0.0	8.6	0.0	0.0	2.6
1997	3,802,861	4,010	0.0	12.3	0.0	0.0	2.2	2.6	55.2	12.6	0.0	1.0	12.0	0.0	0.0	2.2
1998	3,532,100	23,558	0.0	17.7	0.0	0.0	1.7	2.5	53.3	8.4	0.0	0.0	14.5	0.0	0.0	1.9
1999	3,096,413	8,000	1.0	17.2	0.0	0.0	4.1	3.6	47.5	9.4	0.0	0.0	14.3	0.0	0.0	3.0
Avg	**3,661,833**	**8,444**	**1.7**	**11.3**	**2.2**	**0.3**	**1.4**	**3.2**	**44.5**	**11.7**	**0.2**	**0.1**	**21.6**	**0.2**	**0.2**	**1.5**

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 Lead Entity for the Green River/Duwamish River watershed is King County (WRIA 9). Howard Hanson dam, an impassable barrier to fish migration, prevents natural production of chinook salmon into 106 lineal miles of stream habitat of the Upper Green River. The lower portion of the Green River basin is highly developed, channelized, diked and industrialized. These factors have degraded or eliminated habitat important for chinook salmon, adversely affecting the survival and productivity of the natural population in the watershed.

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 Soos Creek Hatchery fingerling 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

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 Green River and Soos Creek to the detriment of population abundance and the program's

success in harvest augmentation. 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).

- Puget Sound chinook

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 trout and other salmonid species present in the Green River watershed through natural 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. Salmonid adults that return to the creek and any seeding efforts using adult salmon carcasses 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). With adult chinook having been passed upstream of the hatchery on Soos Creek, 2-3,000 adult chinook carcasses could contribute, assuming average size of adult chinook is 15 pounds, approximately 30,000-45,000 pounds of marine derived nutrients to organisms in the creek.

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
- Cutthroat trout
- Steelhead
- Coho salmon
- 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.

Soos Creek Hatchery is supplied by surface water from Soos Creek. Water is withdrawn via 4 pumps at the hatchery site. Pumps produce 13,500 gallons per minute (gpm). In addition, a small spring water supply (50 gpm) can be utilized in the incubation building. Soos Creek responds quickly to heavy rainfall and is prone to rapid fluctuations. Heavy bed loads are due to extensive watershed development. Winter floods are becoming an increasingly common occurrence due to continued watershed development.

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.

Soos Creek Hatchery is supplied by surface water from Soos Creek (water right permit # S1-21122). The hatchery water intake structure at Soos Creek Hatchery (the incubation and early rearing site for the Icy Creek Hatchery programs) is in compliance with NOAA Fisheries screening criteria (NMFS 1995, 1996). However, the intake does not meet the current NOAA criteria.

Soos Creek Hatchery complies with NPDES Permit # WAG 13-3014, which was issued by WDOE to ensure that effluent from the hatchery was not detrimental to downstream aquatic life. Monitoring at the hatchery water return location indicates that the hatchery effluent meets NPDES permit standards. Hatchery effluent is regularly monitored, in accordance with permit requirements, to determine continued compliance with discharge limits.

Currently, the Soos Creek Hatchery is in the design/planning stages for a new off-channel adult collection and sorting pond. This design is planned to occur just upstream from the lower Soos Creek bridge crossing. Also on the list is a new pollution abatement pond system and intake modifications.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock for the program are collected from Soos Creek adjacent to Soos Creek Hatchery. Upstream migrating fall chinook adults are collected in an in-stream, run-of-the-river trap situated in Soos Creek. The trap pond is the natural stream channel framed by a lower, semi-temporary weir (with a V entry) and an upper semi-temporary weir. The trap pond created by the two weirs measures approximately 150' X 200'.

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

NA.

5.3) Broodstock holding and spawning facilities.

Broodstock are held in the Soos Creek trap pond. Adults to be retained as broodstock are seined, sorted, killed and spawned at pond-side.

5.4) Incubation facilities.

Incubation utilizes 160 shallow troughs and 56 deep troughs.

5.5) Rearing facilities.

The facility utilize eight 10" X 80’ raceways, eight 17.5' X 95' concrete rearing ponds and three 0.14 acre asphalt ponds

5.6) Acclimation/release facilities.

All station releases are from individual ponds into the creek. Most releases are forced releases of smolts in early June.

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

In the past 12 years:

1. Heavy debris loads cause the pump intake screens to become plugged frequently during flood events.

2. Flood risks limit the use of eight, low lying, standard rearing ponds as the flood waters often inundate them and allow the premature release of the fish.

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.

Takes of listed chinook salmon are unlikely to occur as a result of the physical operation of the program. At Soos Creek, alarm systems are in place and personnel are on 24-hour standby to reduce the risk of catastrophic loss of the propagated population. Fish rearing is conducted in compliance with the Co-managers Fish Health Policy (1998). Adherence to artificial propagation, sanitation and disease control practices defined in the policy reduced the risk of fish disease pathogen transfer to listed natural-origin chinook salmon.

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.

Adult fall chinook salmon returns to Soos Creek, tributary to the Green River at RM 33.

6.2) Supporting information.

6.2.1) History.

The donor stock originated from native Green River fall chinook salmon adults trapped in the mainstem river, at the outlet of Soos Creek, beginning in 1902 (Becker, 1967). Chinook salmon did not enter Soos Creek to any extent at the time that the trapping program began in 1902. An adult chinook return to Soos Creek of sufficient size to sustain juvenile chinook production objectives for the program was established beginning in 1924 and the trapping in the mainstem was abandoned (Becker, 1967). Some additional stocks were occasionally imported in the early days of the hatchery operation (e.g., Columbia river-origin chinook in the 1920's), but genetic analyses (Marshall et al., 1995) indicate that the contribution of these transferred, out-of-basin stocks was not significant. The program has depended upon volunteer returns to Soos Creek to meet broodstock needs for decades.

6.2.2) Annual size.

Approximately 2,400 adults.

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

In the past, on average, 39.4% of the adult chinook returning to the Soos Creek hatchery was of natural origin (Cropp et al. 1999). Since 3,500 brood fish were needed to achieve the egg-take goal at that time, between 780 and 1,380 natural-origin adults may have been killed each year for spawning. With a permanent rack in place, all returning adults can be captured. Beginning in 2004, 8.9% of the broodstock consisted of known natural-origin chinook. This will be continued in the future as per HSRG guidelines. Contribution of NOR's into the hatchery broodstock will be monitored on an annual basis.

6.2.4) Genetic or ecological differences.

There are no known differences between the Soos Creek Hatchery broodstock and the natural origin population. The relatively high proportion of natural-origin chinook salmon incorporated as broodstock each year likely reduced the risk of genetic divergence between the propagated and natural populations.

6.2.5) Reasons for choosing.

The stock was chosen because it is the native Green River stock and is locally adapted to the broodstock collection, juvenile fish rearing and juvenile fish release locations.

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 program has incorporated natural-origin fish for use as broodstock at an average annual proportion of 39% (estimated prior to the return of mass-marked adults). This level of natural-origin fish spawning has likely reduced genetic divergence of the propagated population from the naturally spawned Green River population. At Soos Creek in 2004, 8.9% of the broodstock consisted of chinook with an adipose fin (natural-origin) as a within population genetic diversity preservation measure. This will continue in the future, following the HSRG guidelines. Contribution of NORs into the hatchery broodstock will be monitored on an annual basis.

The program has likely incorporated natural-origin fish for use as broodstock over the years. An integration plan is currently being developed with Co-managers for use beginning with the 2005 adult returns. This plan will identify a prescribed level (goal) of natural origin fish (by percentage of the total) to be incorporated into the hatchery broodstock. Actual number will be determined by availability.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

At the Soos Creek Hatchery, upstream migrating adult chinook salmon are trapped using an in-stream weir, run-of-the-river weir. Peak adult returns to the Soos Creek Hatchery trapping site occur between early September and mid October with the total return extending from August to late October. Each year, 2,000-3,000 adults are individually counted upstream, past the weir, to fully seed available natural spawning areas in upper Soos Creek. Except when hand counted, adults normally have no access past the hatchery. Remaining adult fish collected in the trap are retained for spawning, released downstream to spawn naturally or removed as surplus for distribution to food banks. Numerous adult chinook salmon produced through the Soos Creek Hatchery programs stop short of entering the weir and spawn in Soos Creek in the one mile of gravel bars downstream of the hatchery, and in the mainstem Green River. Green female adults are required to allow for inoculation with erythromycin for Bacterial Kidney Disease (BKD) control and suppression in the fingerling offspring (See section 7.4.1).

7.3) Identity.

The program has depended upon volunteer returns to Soos Creek to meet broodstock needs for decades. See sections 6.2.1 and 7.2 for more detail.

7.4) Proposed number to be collected:

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

Approximately 2,400 adults (1,200 males: 1,200 females)

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

Year	Adults Males	Adults Females	Adults Jacks	Eggs	Juveniles
1988	3700	3607	65	16,770,000	
1989	4800	4727	70	21,236,000	
1990	3600	3615	55	17,860,000	
1991	1800	1787	40	7,468,000	
1992	2200	2234	50	10,531,600	
1993	1300	1254	45	5,279,600	
1994	1900	1872	50	8,278,000	
1995	1766	1774	33	7,363,000	
1996	1532	1499	24	6,635,000	
1997	1499	1561	21	7,178,000	
1998	1099	992	8	4,876,700	
1999	1040	1024	4	4,805,000	
2000	952	885	7	4,664,800	
2001	994	982	7	4,722,000	
2002	873	877	14	4,554,000	
2003	946	1,153	1	5,147,000	

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

Un-spawned adults are either donated to local food banks or sold to the carcass buyer for processing for human consumption or sent upstream to spawn naturally. The intent is to: 1) pass 2,000-3,000 adults upstream proportional to the adult return timing to the trap and 2) to fully seed available natural spawning areas in upper Soos Creek.

7.6) Fish transportation and holding methods.

Adult fish are not transported through this program.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols, as defined in the Co-manager Fish Health Policy (1998), are adhered to.

7.8) Disposition of carcasses.

At the Soos Creek facility, spawned carcasses are utilized for nutrient enhancement or sold to a carcass buyer for rendering into meal. Un-spawned adults are either donated to local food banks or sold to the carcass buyer for processing for human consumption. Pond mortality is utilized for nutrient enhancement purposes.

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.

In 2004, 8.9% of the broodstock consisted of chinook with an adipose fin (natural-origin) as a measure to minimize genetic divergence of the propagated population from the natural population. This will continue in the future, following the HSRG guidelines. Contribution of NORs into the hatchery broodstock will be monitored on an annual basis. Also, will collect and spawn adults randomly with respect to time of return, time of spawning, size, and related characteristics.

SECTION 8. MATING

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

8.1) Selection method.

Females are chosen randomly from ripe fish. Depending upon the magnitude of the returns, the program goal is to spawn all ripe females each spawn day. Males are selected randomly. Matings are 1:1. About 1% of males used are "jacks". If female numbers exceed hatchery need, eggs are taken randomly from later spawning females, to represent that portion of the run, and the remaining females are "surplused", i. e., removed from the breeding pool. As prescribed, adult chinook exceeding hatchery need adults will be passed upstream to spawn naturally in Soos Creek.

8.2) Males.

Males are selected randomly. Matings are 1:1, but if a male killed for spawning is not fully ripe or has very little sperm, another male is used to assure fertilization of the eggs. About 1% of males used are "jacks".

8.3) Fertilization.

Matings are 1:1, but if a male killed for spawning is not fully ripe or has very little sperm, another male is used to assure fertilization of the eggs. The eggs from 1 female are collected in a bucket. The sperm from one male, or two, is expressed directly onto the eggs and mixed gently. The mix is allowed to sit for 30 to 60 seconds and then pooled in a common bucket with other eggs.

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.

The effective breeding population size (Ne) for the Soos Creek Hatchery program is 14,000 (3,500 adults spawned each year times a generation length of 4 years for chinook salmon). The genetic diversity and long-term adaptive potential of hatchery salmon populations may be conserved when the Ne is maintained above 200 to 500 individuals (FAO - UN, 1981; Allendorf and Ryman, 1987; Nelson and Soule, 1987). Waples (1990) suggested that 100 effective breeders per year (for chinook salmon with a four year generation length, an Ne of approximately 400 fish). At the parent facility, Soos Creek, one to one matings will be utilized to maximize the number of spawners incorporated in the gene pool and to ensure an effective breeding population equivalent to the number of adult fish collected and retained for spawning. Adults will be selected randomly from the entire run and will continue to include both hatchery and natural-origin adult fish. Although tag returns indicate that some stray adult fish produced through the Icy Creek Hatchery yearling program are collected as broodstock at the Soos Creek Hatchery trap, the proportions are not substantial and not likely to pose a genetic diversity reduction risk to the population propagated at Soos Creek Hatchery.

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.

Green egg to fry survival averaged 95% for broodyears 1995 to 1998.

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

On occasion, a surplus of eggs results from inaccurate green egg sampling at the time of egg take. Extra eggs are normally taken as a safeguard against potential incubation loss. Surplus fry, less than or equal to 10% are normally reared as part of the programmed releases. Excess juveniles produced through this practice were commonly released as un-fed fry or short-term reared fry. In recent years a greater emphasis has been placed on not exceeding the program goals and surplus fry are no longer released.

9.1.3) Loading densities applied during incubation.

Eggs are eyed in shallow troughs 20,000 to 25,000 per basket. Eggs are hatched in deep troughs at about 26,000 per section.

9.1.4) Incubation conditions.

Eggs are hatched with Vexar substrate using ambient Soos Creek water. Water quality has deteriorated due to heavy silt load. Accumulated silt is flushed periodically from the trough sections.

9.1.5) Ponding.

Ponding occurs when the fry have achieved >95% button-up status. Ponding is forced and occurs between late December and mid-January.

9.1.6) Fish health maintenance and monitoring.

Egg fungus is controlled with a 15 minute formalin drip at 100 parts per million (ppm), 5 days per week, until the eggs are shocked and picked. Dead eggs are removed with the aid of a "Jen-sorter" power egg picker. Coagulated yolk-sac incidence level is low.

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.

The potential for adverse genetic effects to listed natural fish during incubation will be eliminated or greatly reduced by incorporating natural-origin chinook into the broodstock as a measure to minimize genetic divergence of the propagated population from the natural population. In 2004, 8.9% of the broodstock consisted of chinook with an adipose fin (natural-origin) at Soos Creek.

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..

Fry to smolt survival averaged 90% for broodyears 1995 to 1998.

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

Loading goals conform to best management practice guidelines defined in Fish Hatchery Management (Piper, 1982). Maximum loading goals, in terms of pounds per gallons per minute (lbs/gpm) at release, are 1.5 x fish length in inches. Maximum densities, in terms of lbs / cubic foot of rearing space, are 0.3 x fish length in inches.

9.2.3) Fish rearing conditions

All ponds receive ambient water from Soos Creek. Incoming oxygen levels are saturated, but are not normally monitored. Ponds are vacuumed as needed. Normal loss is vacuumed to the pollution abatement pond. Losses derived from disease epizootics are sent to a sanitary landfill.

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.

Not available.

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

Not available.

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*).

Feed type is a salmon formulation of dry crumbles or pellets. Feed brand varies with the contract price. Initially, fish are fed daily at a rate approximating 2% B.W./day. The maximum feed rate goal is approximately .1 lb feed per gpm inflow. Feed conversions depend upon the diet and formulation but range between .8 - 1.1: 1.

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

Ponds are vacuumed weekly or as needed. Fish Health Specialists make scheduled visits to check on fish health. Medications or alternate management plans derive from these checks. When emptied, all ponds are cleaned, air dried and sun-sanitized, if possible. All procedures are followed as per the Co-Managers Fish Health Policy (1998).

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.

Soos Creek was involved with "Natures" rearing with coho salmon for several rearing cycles, but data from adult returns has yet to be analyzed. Results from those efforts will guide the feasibility of incorporating these strategies for chinook fingerlings.

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.

The potential for adverse ecological effects to listed natural fish during propagation will be eliminated or greatly reduced by incorporating natural-origin chinook into the broodstock. Guidelines are followed for rearing (Piper et al. 1982) and fish health parameters (Co-managers Fish Health Policy 1998).

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	3,200,000	80	June	Soos Creek
Yearling				

Note: 80 fpp ~ 80 mm fork length

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

Stream, river, or watercourse: Soos Creek (09.0072)
Release point: Soos Creek, RM .8 (09.0072)
Major watershed: Green River
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 (fpp)	Fry	Avg size (fpp)	Fingerling	Avg size (fpp)	Yearling	Avg size
1988			11,706,195	289	251,406	23		
1989			9,862,026	150	360,500	29		
1990	4,749,000	1000			3,770,574	70		
1991			3,215,500	380	2,837,800	60		
1992					5,080,500	94		
1993					4,797,938	96		
1994					3,706,018	111		
1995	1,788,000	958	1,918,800	443	3,344,400	83		
1996	1,793,500	1000			3,189,200	62		
1997	1,459,200	1000	725,600	254	3,231,100	74		
1998	350,000	1000	303,066	365	3,802,861	72		
1999					3,532,100	82		
2000			414,800	321	3.096,413	77		
2001					3,395,665	77		
2002	844,917	992	4,020,855	315	3,502,054	76		
2003					3,036,900	81		
Average					3,183,464	73		

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

Most fish are forced released in early June. Any attempts to release later have been met by higher water temperatures and low flows, which have accentuated the problem with *Furunculosis.*

10.5) Fish transportation procedures, if applicable.

Not applicable.

10.6) Acclimation procedures.

Fish are reared their entire lifetime on Soos Creek water.

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

The Soos Creek Hatchery fall chinook sub-yearling program is used as a Double-Index Tag (DIT) group. Of the 3,200,000 released, 2,800,000 are mass marked (adipose-fin clip only), 200,000 adipose-fin clip/coded-wire tagged (Ad + CWT) and 200,000 coded-wire tagged only. Sampling of mass marked adult returns can provide NOR/HOR ratios on the spawning grounds in the Green River watershed. The DIT group can serve as an index group for wild sub-yearling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

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

In the past, significant numbers of surplus fish were not reared full term but were planted as fry. In the future, egg takes will be carefully managed to minimize the likelihood of surplus eggs or fry.

10.9) Fish health certification procedures applied pre-release.

Routine and pre-release fish health inspections are conducted by the WDFW's Area Fish Health Specialist to certify the fish health status of Soos Creek Hatchery sub-yearlings.

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

In cases of severe flooding the screens are generally not pulled because floodwaters rise to the point where they breach the ponds. Past experience has shown that the fish tend to lie on the bottom of the pond during flooding events and only those that are inadvertently swept out are able to leave. 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.

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed chinook. To minimize the risk of residualization and impact upon natural fish, hatchery fish are reared to sub-yearling size (80 fpp). They are monitored closely for smolting activity in the spring of the year. Sub-yearlings are released during periods of high flow, if possible, and when they are displaying high levels of activity in the ponds (working the outlet screens and sides of the ponds). These observations are made to ensure that program fish will actively migrate downstream thus minimizing the time spent in the river and minimizing their interactions with natural-origin fish. The June release timing for the hatchery fish reduces the likelihood for interaction with the majority of natural origin juvenile chinook rearing and emigrating each year. Food resource competition risks to listed chinook juveniles in the Green River are reduced by delaying release of the hatchery-origin chinook until June.

In addition, a rearing parameter of the sub-yearling 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 more likely to residualize in fresh water and interact with listed wild fish. The average CV for release years' 1995-1998 and 2001-2002 was 6.57%.

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 selective harvest on hatchery stocks when appropriate, 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 annual chinook salmon escapement to hatchery release sites within the watershed and in Green River natural spawning areas to estimate the number and proportions of tagged, un-tagged and marked fish escaping each year. WDFW will also monitor straying of hatchery chinook salmon to other Puget Sound watersheds through mark recovery programs conducted during routine spawning ground surveys and sampling at other Puget Sound hatcheries.

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

WDFW mass marks and double-index tags 100% of the sub-yearling release from the Soos Creek Hatchery to allow for monitoring and evaluation of chinook escapement to the Green River. This monitoring will assist in the monitoring of the NOR/HOR spawning ground ratios and assessment of the status of the target population.
WDFW shall monitor chinook salmon escapement to the Green River, Soos Creek and Icy Creek natural spawning areas to estimate the number of tagged, untagged, and marked fish escaping each year. This monitoring will allow for assessment of the status of the target population and the success of the program in achieving restoration objectives. Also, will continue to monitor smolt emigration rate post-release, timing of emigration and predation assessment via smolt trapping (Seiler et al., 2002).

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

Funding is currently available to mass mark and coded-wire tag (see section 10.7) the entire program.

Biological staff continues to monitor the spawning grounds to determine natural spawning escapement and its composition. Additional funding will be required to expand assessment efforts and biological collections.

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, with consultation with NOAA Fisheries, in a manner that does not result in an unauthorized take of listed chinook.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Chinook emigration and predation assessment (Seiler et al., 2002)

12.2) Cooperating and funding agencies.

Washington Department of Fish and Wildlife (funding)
U. S. Corps of Engineers (funding)
Tacoma Public Utilities
US Fish and Wildlife
NOAA Fisheries
Muckleshoot Indian Tribe
Washington Department of Ecology

12.3) Principle investigator or project supervisor and staff.

Mr. Dave Seiler
Washington Department of Fish and Wildlife
Fish Program, Science Division
Olympia, Washington

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

Natural-origin Green River chinook are listed as "threatened" under the ESA

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

Refer to Seiler et al. (2002) for details.

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

February through the middle of July.

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

Fish are captured and gently moved into a solid sided, baffled live box. Held until they were removed for enumeration at dawn and at dusk. Fish that were to be sampled for stomach contents were anesthetized and a syringe without a needle was used to inject water into the stomach to flush out the gut contents.

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

The potential for injury or mortality was lessened by allowing the fish to revive (after being anesthetized) and observing them before release.

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).

Refer to Seiler et al. (2002) for details.

12.10) Alternative methods to achieve project objectives.

None

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.

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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)*- Green River
Activity	Soos Creek Fall Chinook Fingerling Program
Location of hatchery activity	Soos Creek Hatchery RM 1.0 Big Soos Creek (09.0072)
Dates of activity	August- June
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)	-	-	Up to 270*	
Capture, handle, tag/mark/tissue sample, and release (d)	-	-	-	-
Removal (e.g., broodstock (e)	-	-		-
Intentional lethal take (f)	-	-	135**	-
Unintentional lethal take (g)	30,375 (5%)**	57,712 (10%)**	15	-
Other take (indirect, unintentional) (h)	-	-	-	-

*Broodyear 2004 only- first year of known integration rate of 8.9% of natural-origin chinook into broodstock (3000 X .09 = 270)

** - Fish propagated from natural –origin chinook only. In addition, 1,538 (1,688-150) of hatchery origin used as broodstock. See sections 1.11.1 and 2.2.3 for further information.

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.