HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Issaquah Fall Chinook Program
Species or Hatchery Stock	Fall Chinook *(Oncorhynchus tshawytscha)* Issaquah Creek
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Lake Washington Puget Sound
Date Submitted	August 04, 2005
Date Last Updated	July 25, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Issaquah Fall Chinook (Lake Washington) Fingerling Chinook Program

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

Issaquah Creek Fall Chinook (*Oncorhynchus tshawytscha*) – listed as "threatened" June 2005

1.3) Responsible organization and individuals

Name (and title):	Chuck Phillips, Region 4 Fish Program Manager Doug Hatfield, Snohomish Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
Address:	600 Capitol Way North, Olympia, WA 98501-1091	
Telephone:	(425) 775-1311 Ext 120	(360) 793-1382
Fax:	(425) 338-1066	(360) 793-9558
Email:	**phillcep@dfw.wa.gov**	**hatfidgh@dfw.wa.gov**

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

In addition to the on-station production at Issaquah Hatchery, eggs are given to local schools.

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

Operational Information	Number
Annual operating cost (dollars)	$282,224
The above information for annual operating cost applies cumulatively to the Issaquah Creek Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund – State and General Fund – Federal.	

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

Broodstock Collection; Incubation; Rearing and Release:
Issaquah Hatchery: Issaquah Creek (08.0178) RM 3 in downtown Issaquah.

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 Issaquah Creek fall chinook fingerling program is to release 2,000,000-fingerling fall chinook and provide adult fish for sustainable fisheries (Magnuson/Stevens Act) and *US v Washington* (tribal harvest opportunity). Also provides educational opportunities for the citizens of the Tri-County area through its Interpretative Center and docents.

To maximize natural-origin fish in the broodstock, the co-managers recommended and approved the program to be integrated. In this context, the management goal of an integrated program is to maintain the genetic characteristics of "wild" fish among hatchery-origin fish, not vice-versa. 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.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse genetic, demographic or ecological effects on listed fish. This will be accomplished in the following manner:

1) Juvenile (fingerling) chinook will be released as zero-age smolts to mimic the size of the naturally produced out-migrants and to minimize emigration time to saltwater thereby minimizing potential competition with and predation on natural-origin fish.

2) Juvenile chinook will be released after the majority of the natural-origin chinook have out-migrated 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 fingerling chinook will be adipose fin clipped and/or coded-wire tagged/adipose-fin clipped to distinguish them from any naturally produced returning 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 Issaquah fingerling chinook program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Issaquah fingerling chinook program.

Potential Hazard	**HGMP Reference**	**Risk Aversion Measures**
Water Withdrawal	4.2	Surface water rights are formalized through trust water right permit # S1-04730. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	The upper intake screens do not meet NOAA Fisheries screening guidelines, but changes are forthcoming. WDFW and the Corp of Engineers are developing plans, under the COE 206 Habitat Restoration Authority, to replace and/or remodel the intake structure to bring it into full compliance for adult and juvenile passage. The lower intake screens meet current state and federal guidelines (NMFS 1995, 1996).
Effluent Discharge	4.2	The hatchery operates in compliance with NPDES discharge permit guidelines (# WAG13-3010).
Broodstock Collection & Adult Passage	2.2.3, 5.1, 7.9	The hatchery weir on Issaquah Creek diverts all returning adult chinook into the hatchery adult pond where they are sorted for spawning or passage upstream. This occurs during the normal adult return time of September and October. In addition, the fish ladder at the gravity intake upriver may cause passage delay during extremely low or high flows. For chinook the delay risk is low to moderate/low because the withdrawal of water for the hatchery is curtailed for low flow periods when chinook are present. Beginning with the 2004 adult returns, WDFW will be able to differentiate hatchery-origin chinook that have been mass marked from naturally produced chinook.
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".

See section 1.10.

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

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. Need to achieve a 10-year average of at least 0.50% 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.	A minimum of 500 adults (1,600) is collected throughout the spawning run in proportion to timing, age, and sex composition of return.	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.	Use mass-mark (adipose-fin clip only) for selective fisheries with additional groups Ad + CWT'd (200,000 for 2004 release) for evaluation purposes.	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).

1,600 adults.

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Issaquah Creek (08.0178)	2,000,000
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.

Fish have not recently been coded-wire tagged to provide current smolt-to-adult survival rates. The last broodyears tagged were 1985-1987 (average survival ~ 0.50%). Most recent tagging took place with the 2002 brood group. Preliminary information won't be available until 2005-2006.

Escapement to the hatchery for return years 1995 through 2003 were 2,180, 1,248, 3,940, 4,877, 2,246, 4,134, 10,519, 5,903 and 5,842, respectively.

Based on the average smolt-to-adult survival rate back in the mid-80's of 0.50% and the programmed release goal of 2,000,000 chinook, the estimated adult production level (goal) would be 10,000 fish.

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

The chinook program at Issaquah Hatchery started in 1939.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Lake Washington and Issaquah Creek (08.0178).

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

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 Lake Washington watershed any changes in the production at the Issaquah Hatchery have to be reviewed and approved by WDFW and the Muckleshoot Tribe (the WDFW and the Muckleshoot Tribe agreed to and signed a "Production/Mass Marking Agreement" in April 2000. The parties agree that production at the Issaquah Hatchery will be 2.0 million chinook fingerlings).

To maximize natural-origin fish in the broodstock, the co-managers recommended and approved the program to be integrated. See section 2.2.3 for more information.

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 Issaquah 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.

Issaquah (Lake Washington) Summer/Fall Chinook

Age information for naturally spawning chinook in the Lake Washington basin is very limited. The mean age ratio of chinook sampled at the Cedar River Sockeye Broodstock collection weir in 1998 was 5.88% age 2, 23.53% age 3 and 70.59 age 4. There were no age 5 or age 6 in the sample. The adult sex ratio of sampled chinook in 1998 was 79% male and 21% female. Age 3 adults averaged 65.5 centimeters (cm) and age 4 adults averaged 86.4 cm.

Most naturally-spawned Lake Washington chinook migrate to salt water after spending only a few months in freshwater. Juvenile chinook salmon appear to have two rearing strategies: 1) rear in the river (Cedar) and then emigrate to the lake in May or June as a pre-smolt, and 2) emigrate to the lake as fry in January, February or March and rear in the lake for several months (Tabor et al. 2004). Arrival of both hatchery and naturally produced smolts in the estuary peaks in June/July, and after a few weeks, most begin moving to near-shore feeding grounds in Puget Sound and the Pacific Ocean. Sexually mature fish begin arriving back at the Ballard Locks as early as June. The peak counts at the Chittenden Locks is usually in early to mid-August.

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

N. Lake Washington Tribs Summer/Fall Chinook, Cedar River Summer/Fall Chinook

There are naturally spawning adult chinook in tributaries throughout the Lake Washington basin, however, their genetic origin is uncertain. Adults spawn in the mainstem Cedar River from about RM 1.0 in Renton to the City of Seattle water pipeline crossing at RM 21.3. In 1999, 81% of the chinook redds were observed above RM 6.5 and the first redd observed was

on August 18. Spawning activity peaks in early October and is generally complete by early to mid-November. Big Bear/Cottage, Issaquah, and Kelsey Creeks also have significant numbers of spawners. Recent genetic testing (Marshall 1999) of Bear and Cottage Lake creek (N. Lake Washington tributaries) chinook implies that the population is a discrete, self-sustaining unit. Currently, analysis is being done to determine if there is genetically distinct chinook in the Cedar River. It was also indicated that the Bear/Cottage Lake Creek stock is least differentiated from the Issaquah Hatchery (Green River lineage) population.

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

A preliminary viable population threshold for Lake Washington chinook under ESA has been determined by the Co-manager's (Puget Sound) Technical Review Team (PSTRT) to be at 1,550 (PSTRT 2003). No critical population threshold has been identified. For Cedar River, preliminary critical and viable population thresholds under ESA have been determined to be at 200 and 1,200, respectively (PSTRT 2003). The SaSI report (draft, WDFW unpublished 2002) determined this population (Issaquah (Lake Washington) Summer/ Fall Chinook) status to be "healthy" while the North Lake Washington tributaries and Cedar River Summer/Fall chinook stocks are "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.

Table 2. Lake Washington chinook broodyear escapement, subsequent reconstructed run size and return per spawner information for natural spawners in Bear/Cottage creeks and the Cedar River mainstem. The source of this data is from WDFW run reconstruction tables.

Return Year	Run size	Escapement	Return/Spawner
1988	2,769	1,252	2.2117
1989	1,832	949	1.9305
1990	1,214	1,470	0.8259
1991	1,517	2,038	0.7444
1992	1,407	792	1.7765
1993	321	1,011	0.3175
1994	924	787	1.1741
1995	969	661	1.4660
1996	345	790	0.4367
1997	305	245	1.2449
1998	700	888	0.7883
1999	791	930	0.8511
2000		336	
2001		294	
2002		697	
2003		778	

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

Table 3. Live count Area Under the Curve index spawning escapement estimates for the Cedar River mainstem, Bear Creek and Cottage Lake creeks. There is no expansion to un-surveyed sections or for fish not seen (WDFW data).

Return Year	Cedar	Cottage	Bear	System Total
1983	788	403	141	1,332
1984	898	264	90	1,252
1985	766	124	59	949
1986	942	386	142	1,470
1987	1,540	226	272	2,038
1988	559	50	183	792
1989	558	208	245	1,011
1990	469	161	157	787
1991	508	93	60	661
1992	525	75	190	790
1993	156	44	45	245
1994	452	186	250	888
1995	681	143	106	930
1996	303	11	22	336
1997	227	42	25	294
1998	432	192	73	697
1999	241	258	279	778
2000	120	97	130	347
2001	810	239	220	1,269
2002	369	146	122	637
2003	562	144	68	774

-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.

There are initial estimates of hatchery-origin chinook on the spawning grounds from 2003 returns (4 year olds). The 2000 releases (1999 BY) were 100% mass marked (adipose-fin clip only) so hatchery / wild percentages may be calculated. For the Cedar River, estimates showed approximately 39% of all fish sampled were of hatchery origin. Issaquah Creek showed 72.2% and Bear and Cottage creeks had approximately 54% of fish on the spawning grounds being of hatchery origin. This could expected because of their proximity to Issaquah Creek (Bruce Sanford, WDFW, pers. comm. 2004).

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:
Take associated with broodstock collection is unknown at this time. Beginning with the 2004 adult returns, WDFW was able to differentiate hatchery-origin chinook that have been mass marked from naturally produced chinook. As a result, per co-manager agreement, 137 natural-origin fish were incorporated into the total spawning population of 1,905 fish. This represents 7.2% of the total fish spawned.

Upstream Passage:
The hatchery weir/intake on Issaquah Creek diverts all returning adult chinook into the hatchery adult pond where they are sorted for spawning or passage upstream. This occurs during the normal adult return time of September and October. In addition, the fish ladder at the gravity intake upriver may cause passage delay during extremely low or high flows. For chinook the delay risk is low to moderate/low because the withdrawal of water for the hatchery is curtailed for low flow periods when chinook are present.

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).

Predation/Competition:
The ecological interaction risk of newly released juvenile Issaquah Creek Hatchery fall with listed natural-origin Issaquah Creek chinook juveniles in freshwater is low. Juvenile fall chinook salmon are released through the program at life stages and sizes that are roughly equivalent to co-occurring wild smolt out-migrants, decreasing the likelihood for predation. Also, most of the hatchery fish are released after the majority of natural-origin fish have emigrated seaward each year, minimizing overlap in freshwater areas where hatchery fish densities are likely to be greatest and where food may be limiting (Seiler et al., 2003). Smolts from both the hatchery and wild components may compete for food in Lakes' Sammamish and Washington during their out-migration. Recent studies of the early life history and lake residency of chinook in Lake Washington by the Muckleshoot Tribe and USFWS (Tabor et al. 2004) illustrate the potential for competition between natural and hatchery-origin chinook.

Tabor et al. (2004) reported that chinook in the Cedar River were mostly preyed upon by rainbow trout while fry that were entering the lake were found to be consumed only by cutthroat trout, prickly sculpin, smallmouth bass and largemouth bass. Based on consumption estimates and expected abundance of juvenile chinook salmon, predatory fishes probably consumed less than 10% of the fry entering the lake from the Cedar River. In the ship canal, Tabor (2004) indicated that chinook smolts were most vulnerable to northern pikeminnow, smallmouth bass, and largemouth bass.

Genetic Effects

To reduce genetic effects such as loss of genetic diversity, domestication or inbreeding depression, the co-managers have agreed to integrate the hatchery broodstock with natural-origin adults at a 10-20 % level of program as per the recommendations of the Hatchery Scientific Review Group (HSRG).

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

Unknown. Because WDFW has not been able to distinguish hatchery and listed natural-origin chinook, we do not know the numbers taken (injury and mortality levels for listed fish). Beginning with the 2004 adult returns, WDFW will be able to differentiate hatchery-origin chinook that have been mass marked from naturally produced chinook.

- 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).

Unknown (see above).

-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. WDFW will consult with NOAA Fisheries to develop a contingency plan and in any case where take levels are exceeded or are projected to exceed the take levels in the plan.

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 Issaquah 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 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.

The WDFW and the Muckleshoot Tribe agreed to and signed a "Production/Mass Marking Agreement" in April 2000. The parties agree that production at the Issaquah Hatchery will be 2.0 million chinook fingerlings.

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 (PSSMP) (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.

Recently, there has been little harvest opportunity on these artificially produced chinook. Because the hatchery chinook inter-mix with naturally produced Lake Washington stocks, we have not had a targeted chinook fishery on adult chinook in marine areas. There has been a limited sport fishery in Lake Sammamish in 1998 and 1999 to target Issaquah hatchery chinook. It is believed that very few of the naturally produced north Lake Washington tributary stocks and Cedar River chinook migrate into Lake Sammamish. There is a need to coded-wire tag a portion of the Issaquah Creek chinook release to evaluate the migration routes, catch contributions, total survival, run timing and straying into other watersheds (see section 10.7).

The Co-managers continue to explore options for increased harvest opportunity. As with all new fishery opportunities these are subject to review by the North of Falcon process. There is potential for increased opportunity in Lake Washington as well as marine areas prior to the Lake.

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.

The last brood year of fingerling chinook that was coded-wire tagged and released from the Issaquah Hatchery was the 1987 brood year (see section 10.7). Therefore, recent detailed harvest contributions are not possible. However, it is reasonable to assume that they contribute to fisheries similar to Soos Creek fingerling releases. Below is the fisheries contribution table (4) for the Soos Creek chinook fingerling program for broodyears 1990-1999.

Table 4. **Soos Creek Chinook Fingerling Broodyears 1990-1999 Fisheries Contibutions.**

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**

Source: Regional Mark Information System (RMIS) and WDFW Hatchery release records.

3.4) Relationship to habitat protection and recovery strategies.

A major factor affecting natural production are losses at the Hiram Chittenden Locks at Ballard. There have been numerous improvements at the locks to improve downstream migration past the facility. Efforts have concentrated upon getting smolts past the facility without going through the filling culverts in the large locks. Operating procedures have changed during the spring and Corps of Engineers' (COE) personnel are now slowly filling the locks to reduce smolt entrainment. In addition to slow filling, there have been four smolt passage flumes installed at two of the spill gates to attract smolts and provide a safer exit from the fore bay to salt water. There have been other improvements and a more detailed report is available from COE fishery biologists.

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 Issaquah Creek (Sammamish Lake watershed) is King County (WRIA 8). It also covers the Cedar River watershed and Lake Washington. As work is completed (state and local resource management jurisdictions) on assessing the habitat factors limiting natural production and identifying and implementing habitat restoration and protection strategies in the Issaquah Creek watershed, WDFW will incorporate relevant information into this document.

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 Issaquah 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
- Rainbow trout
- Smallmouth bass
- Largemouth bass
- Perch
- Lake trout
- Coho salmon

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 Issaquah 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

There are ongoing predation studies in Lake Washington and the ship canal by the USFWS and the Muckleshoot Tribe to determine chinook losses by smallmouth and largemouth bass, perch, cutthroat trout and other predators. Concerns are that the predation losses are significant to both hatchery and natural chinook. Tabor et al. (2004) reported that chinook in the Cedar River were mostly preyed upon by rainbow trout while fry that were entering the lake were found to be consumed only by cutthroat trout, prickly sculpin, smallmouth bass and largemouth bass. Based on consumption estimates and expected abundance of juvenile chinook salmon, predatory fishes probably consumed less than 10% of the fry entering the lake from the Cedar River. In the ship canal, Tabor (2004) indicated that chinook smolts were most vulnerable to northern pikeminnow, smallmouth bass, and largemouth bass.

(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

(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 Issaquah Creek and Lake Washington watersheds 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.

(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
- Pacific staghorn sculpin
- Numerous marine pelagic fish species
- Small and largemouth bass
- Perch

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The main source of water is from the main fork of the Issaquah Creek. There are two intake sources on this stream. Located approximately three quarters of a mile up stream is a small dam with intake screens that feed water to the hatchery by gravity. This produces about 5,000 gallons per minute (gpm). There are also five pumps that provide 5,500 gpm. This is a small urban stream whose flow rates and heights change rapidly with weather conditions. The daily temperature differences can be 10º Fahrenheit between day and night and range from 30º to 75º Fahrenheit depending upon the time of year.

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 upper intake screens do not meet NOAA Fisheries screening guidelines, but changes are forthcoming. WDFW and the Corp of Engineers are developing plans, under the COE 206 Habitat Restoration Authority, to replace and/or remodel the intake structure to bring it into full compliance for adult and juvenile passage. The lower intake screens meet current state and federal guidelines (NMFS 1995, 1996). The facility complies with NPDES permit # WAG 13-3010. The main source of water for the hatchery is from the mainstem Issaquah Creek. The two intakes supply up to 10,500 gpm. The water right permit # is S1-04730.

A new water filtration system was installed in the summer of 2003. This system has significantly reduced egg and fry mortality due to suffocation.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The Issaquah Hatchery has one adult collection facility. It is made up of two 100' X 20' X 6' adult capture ponds. An air-bladder weir is attached above the lower intake screens. This weir and a bar rack at the mouth of the by-pass fish ladder keep the fish from going upstream when trapping. Trapping begins at the end of August and ends in the middle of November. The fish are encouraged to migrate up the adult pond's fish ladder which its' entrance is at the base of the weir. The source of water for these ponds is pumped from the lower intake screens.

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

Fish are transported to the Ballard and Laebugton net pens via a 1,500-gallon tank truck with appropriate aeration.

5.3) Broodstock holding and spawning facilities.

The collection facilities described in section 5.1 also serves as spawning facilities.

5.4) Incubation facilities.

After the 2001 egg take, all eggs have been incubated in vertical incubators (Heath trays).

5.5) Rearing facilities.

There are four sizes of rearing vessels used at Issaquah: 100' X 10' X 4', 100' X 20' X 4', 100' X 20' X 5', and 80' X 20' X 5'. Fish are reared in any combination of these ponds and released from these ponds into Issaquah Creek.

5.6) Acclimation/release facilities.

See section 5.5

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

Because surface water is the source for the hatchery, the threats from diseases and parasites present the most significant threat to fish health. The high sediment loads during flood conditions caused loss of growth and environmental health problems with the eggs and fish. But in the summer of 2003 a new water filtration system was installed that has significantly reduced egg and fry mortality due to suffocation.

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.

Issaquah Hatchery is staffed with four full time employees one of which is on a standby status 24 hours a day seven days a week. All staff is very familiar with the workings of the hatchery and have received training in fish cultural techniques and disease recognition and prevention issues. Additionally, pathology staff makes frequent visits to the hatchery to check the health of fish stocks and are available immediately in case of a disease outbreak. The hatchery is equipped with a sophisticated alarm system that monitors flow and other conditions critical to hatchery operations. There is a standby power generator that is capable of supplying electrical needs to the pumps in case of a loss of power. Also in the summer of 2003 a new water filtration system was installed that has significantly reduced egg and fry mortality due to suffocation.

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.

Adults are trapped at the hatchery for Issaquah's needs.

6.2) Supporting information.

6.2.1) History.

Green River chinook were used to found production at the Issaquah Hatchery with transfers in 1937 (WDF, 1939). 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 Soos Creek program has depended upon volunteer returns to Soos Creek to meet broodstock needs for decades. 1992 was the last year Issaquah received eggs from Green River.

6.2.2) Annual size.

1,600 adults.

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

Lake Washington natural chinook adults that return to the Issaquah Hatchery have been physically indistinguishable from hatchery adults. Therefore, a substantial number of natural fish may have become part of the broodstock used for the hatchery program each year. Conversely, there are probably significant numbers of hatchery adults that do not return to the hatchery each year but, instead, become part of the naturally spawning component of the stock. WDFW shall continue to use gametes procured from fall chinook adults volunteering to the Issaquah Hatchery to affect this program (see section 6.3). The collection of localized marked hatchery-origin broodstock (2004) at this location will limit direct and incidental take effects on listed chinook salmon. In 2004, 137 natural-origin chinook were incorporated into the broodstock that represents 7.2% of the total population spawned.

6.2.4) Genetic or ecological differences.

There are no known differences between the Issaquah Creek Hatchery broodstock and the natural origin population. The fact that natural-origin chinook salmon most likely have been incorporated as broodstock each year likely reduced the risk of genetic divergence between the propagated and natural populations (see 6.2.3).

6.2.5) Reasons for choosing.

Locally adapted 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 program has likely incorporated natural-origin fish for use as broodstock over the years. This has likely reduced genetic divergence of the propagated population from the naturally spawned Issaquah Creek population. An integration plan is currently being developed with Co-managers. 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 as in 2004 when the facility began incorporating natural-origin fish into the broodstock at a level of 7.2%.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

The adult trap and air bladder weir is operated from the last week of August until mid-November. Trapping efficiency is very much dependent on water flows. During high water events (late October on) fish can either jump or swim over the air bladder weir.

7.3) Identity.

See section 6.3.

7.4) Proposed number to be collected:

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

A total of 1,600 adults need to be collected to support the fall chinook sub-yearly program.

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

Year	Adults Females	Adults Males	Adults Jacks	Eggs	Juveniles
1995	677	461	1	3,041,800	
1996	330	348	2	1,240,000	
1997	645	758	9	2,829,000	
1998	577	605		2,894,000	
1999	544	574	39	2,394,500	
2000	559	603		2,454,000	
2001	579	592		2,766,000	
2002	506	512		2,608,000	
2003	528	586		2,480,000	

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

Adult fish collected in surplus of broodstock and not killed are passed upstream and allowed to spawn naturally at this time.

7.6) Fish transportation and holding methods.

There is no transportation of adult fish. All adults are held in ponds described in section 5.1 of this document. Virtually all of the fish arrive at the hatchery green and must be held for a period of time (up to 30 days) until they are ripe. No antibiotics or chemicals are used on the adults.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish health and sanitation measures are consistent with the Co-Managers Salmonid Disease Control Policy (NWIFC and WDFW 1998).

7.8) Disposition of carcasses.

Spawned or un-spawned carcasses are typically sold to a fish buyer otherwise all carcasses are disposed at a sanitary landfill.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

The program has incorporated an unknown amount of natural-origin fish for use as broodstock over the years. This has likely reduced genetic divergence of the propagated population from the naturally spawned Issaquah Creek population. With the ability now to differentiate hatchery and natural-origin chinook, the facility in 2004 began incorporating natural-origin fish into the broodstock at a level of 7.2%.

SECTION 8. MATING

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

8.1) Selection method.

The adults are chosen randomly over the whole run until the end of trapping.

8.2) Males.

No backup males are used. 2% of spawning males are jacks and no repeat spawners are used.

8.3) Fertilization.

Equal sex ratios and 1:1 individual matings are used. Extensive use of iodophore disinfectant is used to minimize contaminants and the spread of disease. Also a percentage of spawned adults are sampled for IHN.

8.4) Cryopreserved gametes.

Not used.

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 Issaquah Creek Hatchery program is 4,800 (1,600 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, Issaquah 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.

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.

See section 7.4.2 for number of eggs taken since 1988. No information given on survival rates to eye-up and/or ponding.

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

Extra eggs are normally taken as a safeguard against potential incubation loss. But in recent years a greater emphasis has been placed on not exceeding the program goals.

9.1.3) Loading densities applied during incubation.

Typically fall chinook eggs average 1,450 eggs/lb at the time of fertilization. They are placed in deep troughs at 450,000/trough at a flow of 12 gpm, shallow troughs loaded at 120,000/trough at 8 gpm and vertical Heath Techna incubators loaded at 84,000/ stack at 4 gpm.

9.1.4) Incubation conditions.

Temperature of inflowing water is monitored and recorded daily. Dissolved oxygen is checked on an infrequent basis and flushing trays and deep troughs and brushing screens accomplish silt management. The eggs in the shallows and verticals have to be gently washed to remove silt.

9.1.5) Ponding.

A KD index of 1.97 - 2.00 is used as the criteria for initial ponding of fry. Typical ponding dates range from mid-December to mid-January and all are forced.

9.1.6) Fish health maintenance and monitoring.

All incubators are subject to a daily 15-minute 1:600 drip of formalin for the control of fungus and disease in the trays. These treatments start 2 days after initial fertilization and continue until approximately 1 week from hatching. When eggs reach the "eyed" stage they are removed from the trays and shocked. At this point, all non-viable eggs are removed either by the use of an automated egg picker or by hand.

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.

Although listed natural-origin adult chinook have been incorporated annually as broodstock, chinook salmon reared through the Issaquah Creek Hatchery program are not listed under the ESA, or considered essential for recovery of the listed Issaquah Creek natural-origin chinook population. A new water filtration system was installed in the summer of 2003. This has significantly reduced egg and fry mortality due to suffocation.

Dead eggs are picked and discarded in a manner to prevent any disease transmission as per Co-manager Fish Health Policy (1998).

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: Average is 95.4%; Range is 88.8 to 99.3%

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

Numerous criteria are applied to these during their rearing cycle depending on their size, the pond style they reside in, water quality, water temperature, relative health and water condition. However, as a rule, these fish are limited to a maximum of 3 lbs fish/gpm of flow until they have reached a size of 100 fish per pound (fpp).

9.2.3) Fish rearing conditions

Water temperatures are monitored on a daily basis; water flows are checked at least weekly. Each pond is monitored for loss and picked daily. Ponds are vacuumed on an as- needed basis (typically weekly). Pathology staff on a monthly basis monitors the general health of fish.

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/g.p.m. inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

The diets used to grow these fish are supplied by two different manufactures, BioOregon and Moore-Clark. The diets are typically "semi-moist" or "dry" in nature and include starter diets, crumbles and pellet type feeds. Daily percent of body weight fed varies depending on the size of the fish, water temperature and time of year. However, the range is usually from 1 - 3% B.W./day. Overall food conversion is typically 1.1-1.2:1.

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

Sanitation procedures include the use of iodophore solutions as disinfectant for tools and nets and other equipment between ponds and stocks of fish. Fish Health staff monitor the fish on a bi-weekly basis and disease treatment is done on an as-needed basis (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.

NA

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

The Area Fish Health Specialist monitors fish health on a routine basis during rearing. If needed, treatment plans are prescribed in accordance with the 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	2,000,000	80	May-June	Issaquah Creek
Yearling				

Note: 80 fpp ~ 80 mm fork length

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

Stream, river, or watercourse: Issaquah Creek (08.0178)
Release point: Issaquah Creek, RM 3
Major watershed: Lake Washington
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 (fpp)	Fingerling	Avg size (fpp)	Yearling	Avg size
1995			177,471	313	2,003,000	70		
1996			158,000	543	2,033,353	72		
1997					1,694,052	79		
1998			683,800	675	2,042,400	80		
1999					2,172,100	75		
2000					1,522,377	63		
2001					2,194,773	71		
2002					1,862,300	62		
2003					2,237,792	74		
Average			339,757	510	1,973,572	72		

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

The fish are released the third week of May into June usually on a day of high water flows. They are released volitionally, at first, and then forced during high flows. No culling procedures are applied.

10.5) Fish transportation procedures, if applicable.

NA

10.6) Acclimation procedures.

Fish are incubated/reared strictly on Issaquah Creek water.

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

Since the 1999 broodyear (2000 release), all of these fish have been 100% mass marked by removing their adipose fin. Beginning with the 2002 broodyear (2003 release), approximately 200,000 sub-yearling fall chinook salmon at Issaquah Hatchery were adipose-fin clipped/coded-wire tagged to allow for evaluation of fishery contribution, survival rates and straying levels to other Puget Sound watersheds.

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

None

10.9) Fish health certification procedures applied pre-release.

Fish Health staff evaluate the stock a maximum of 2 weeks prior to release to determine if it is appropriate to plant them.

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

In the case of a catastrophic event (drought or flooding) critical to the fish's survival, the fish would be released early to prevent their loss in the ponds.

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 fingerlings are released from May – June as fingerling smolts (70 fpp). These 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 May-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 Issaquah Creek will be reduced by delaying release of the hatchery-origin chinook until May-June (see section 2.2.3).

In addition, a rearing parameter of the fingerling 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. The average CV for release years' 1995-2002 (excluding 96' and 97') was 6.3%.

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 (see section 10.7) 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 will 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 will monitor chinook escapement upon return as adults to estimate the numbers of tagged, untagged and mass marked fish escaping to the river each year not only in Issaquah Creek, but into other Lake Washington tributaries (Cedar River, for example). Need to coded-wire tag a portion of the release group (see section 10.7) to evaluate catch contribution, run timing, migration patterns, total survival and straying into other watersheds of the Issaquah Creek chinook. Also, need to monitor whether or not the smolts released from Issaquah Creek are migrating immediately to the Ballard Locks or are they spending time in the lake where they may be posing a risk to natural-origin chinook salmon or being preyed upon (Tabor et al. 2004) by other fishes.

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

SECTION 12. RESEARCH

None proposed in direct association with the Issaquah Creek Hatchery program.

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

Allendorf, F.W. and N. Ryman. 1987. Genetic management of hatchery stocks. P.141-159 IN Population genetics and fishery management. Edited by N. Ryman and F. Utter. University of Washington Press, Seattle, WA.

Becker, C.D. 1967. The Green River Hatchery, Washington: a historical and statistical review. Circular No. 67-1. Fisheries Research Institute. College of Fisheries, University of Washington. 37 p.

Food and Agriculture Organization of the United Nations (FAO-UN). 1981. Conservation of the genetic resources of fish: problems and recommendations. Report of the Expert Consultation on the Genetic Resources of Fish, Rome, Italy, 9-13 June 1980. FAO Fisheries Technical Paper 217. 43 p.

Fuss, H. and C. Ashbrook. 1995. Hatchery Operation Plan and Performance Summaries (HOPPS). Washington Department of Fish and Wildlife. Olympia, WA.

Hatchery Scientific Review Group. 2004. Hatchery Reform; Principles and Recommendations of the Hatchery Scientific Review Group. Long Live the Kings, 1305 Fourth Avenue, Suite 810, Seattle WA.

Hershberger, W.K., and R.N. Iwamoto. 1981. Genetics Manual and Guidelines for the Pacific Salmon Hatcheries of Washington. Univ. of Wash. College of Fisheries. Seattle, WA. 83 pp.

Marshall, A., C. Smith, R. Brix, W. Dammers, J. Hymer and L. Lavoy. 1995. Genetic diversity units and major ancestral lineages for chinook salmon in Washington. IN Busack, C. and J. Shaklee (eds.), Genetic diversity units and major ancestral lineages of salmonid fishes in Washington, pp. 111-173. Technical Report # RAD 95-02. Washington Department of Fish and Wildlife. Olympia, WA.

Marshall, Anne R. 1999. Genetic Analysis of Bear Creek/Cottage Lake Creek Naturally Spawning Fall-Run Chinook. Washington Department of Fish & Wildlife Genetics Unit. 8 p.

NMFS (National Marine Fisheries Service). 1995. Juvenile fish screen criteria for pump intakes. Available at *http://www.nwr.noaa.gov/1hydrop/nmfscrit1.htm.*

NMFS (National Marine Fisheries Service). 1996. Juvenile fish screen criteria for pump intakes. Available at *http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm.*

Nelson, W.R. and M. Soule. 1987. Genetic conservation of exploited fishes. Pp. 345-368 IN Ryman, N. and F. Utter (eds.). Population genetics and fishery management. University of Washington Press, Seattle, WA.

Puget Sound Technical Recovery Team (PS TRT). 2003. (Draft) Independent populations of chinook salmon in Puget Sound - Puget Sound TRT public review draft (May 18, 2004 version). Northwest Fisheries Science Center. National Marine Fisheries Service. 92p.

Salmon and Steelhead Inventory (SaSI). 2002. Salmon and steelhead inventory - 2002. Introduction, Summary Tables, and North Puget Sound, South Puget Sound, Hood Canal and Strait of Juan de Fuca volumes. Fish Program, Science Division. Washington Department of Fish and Wildlife. Olympia, WA.

Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of Fish and Wildlife. Olympia, WA.

Seiler, D., G. Volkhardt, and L. Kishimoto. 2003. Evaluation of downstream migrant salmon production in 1999 and 2000 from three Lake Washington tributaries: Cedar River, Bear Creek, and Issaquah Creek. Report FPA 02-07. Washington Department of Fish and Wildlife, Olympia, Washington.

Steward, C. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish; a synthesis of published literature. Tech. Rpt. 90-1. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho, Moscow, ID.

Tabor, R. et al. 2004. Predation of juvenile chinook salmon by predatory fishes in three areas of the Lake Washington Basin. U.S. Fish and Wildlife Service, Lacey, Washington. 86 pp.

U.S. District Court of Western Washington. 1976. United States v. Washington, 384 F, Supp. 312.

United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) Order Adopting Puget Sound Management Plan, 1985

Waples, R.S. 1990. Conservation genetics of Pacific salmon II. Effective population size and rate of loss of genetic variability. J. Heredity 81: pp. 267-276.

Washington Department of Fisheries (WDF). 1939. Annual Report for 1938. Washington Department of Fisheries. Seattle, WA.

Washington Department of Fisheries. 1991. Stock Transfer Guidelines. Hatcheries Program, Washington Department of Fisheries. Olympia, WA.

Washington Department of Fisheries, Washington Department of Wildlife and Western Washington Treaty Indian Tribes. 1992. Washington State Salmon and Steelhead Stock Inventory. Olympia, WA.

Washington Department of Fish and Wildlife. 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife. Olympia, WA.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Washington Department of Fish and Wildlife. Olympia, WA.

Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, 2002, "Puget Sound Chinook Salmon Hatcheries, Resource Management Plan", a component of Comprehensive Chinook Salmon Management Plan, August 23, 2002. 103 pages.

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)*- Lake Washington
Activity	Issaquah Fall Chinook Program
Location of hatchery activity	Issaquah Hatchery, RM 3 Issaquah Creek (08.0178)
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)	-	-	Unknown	-
Capture, handle, tag/mark/tissue sample, and release (d)	-	-	-	-
Removal (e.g., broodstock (e)	-	-	-	-
Intentional lethal take (f)	-	-	160*	-
Unintentional lethal take (g)	Unknown	<5%	Unknown	-
Other take (indirect, unintentional) (h)	-	Unknown	-	-

* This represents the number of natural origin (adipose present) adult chinook taken for broodstock when the program is integrated at 10% (1,600x 0.10). In addition, 1,440 (1,600-160) hatchery-origin (adipose clipped) chinook will be used in the program's broodstock.

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.