HATCHERY AND GENETIC MANAGEMENT PLAN
(HGMP)

Hatchery Program: Fish Restoration Facility

Species or Hatchery Stock: Green River Fall Chinook

Agency / Operator: Muckleshoot Indian Tribe

Watershed and Region: 09.0001 – Green River (Duwamish)/Puget Sound

Date Submitted: _____

Date Last Updated: July 29, 2014

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Fish Restoration Facility – Fall Chinook fry/fingerling program

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

Green River Fall Chinook (*Oncorhynchus tshawytscha*) – Re-affirmed threatened by five-year status review, completed August 15, 2011 (76FR50448).

1.3) Responsible organization and individuals

Name (and title): Dennis Moore, Fish Enhancement Manager
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Agency or Tribe: Muckleshoot Indian Tribe
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Tacoma Water – the Tacoma Water Headworks trap and haul facility near RM 60.9 will be used to collect initial and supplemental adults for broodstock. Tacoma Water will transport and release juvenile fish produced in the program above Howard Hanson Dam if supplementation of juveniles in the upper watershed is determined to be beneficial.

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

Funding source: Muckleshoot Indian Tribe and Bureau of Indian Affairs
Staffing level and annual O&M: to be determined, facility not yet constructed

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

The Fish Restoration Facility site is located on the left bank of the Green River near RM 60. This facility will be constructed at a future date to be determined. The Tacoma Water adult fish trap is located at RM 60.9.

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

Mitigation. The goal of this program is to provide harvest opportunity to help mitigate lost production related to the construction and operation of Howard Hanson and Tacoma Water dams, and to assist in the potential restoration of Chinook salmon in the upper Green River watershed after verification of effective fish passage through the dam and reservoir.

Note: The Muckleshoot Indian Tribe reserves the right to discontinue or modify the current production level or change species reared to meet the needs and policy direction of the Tribe, in consultation with their co-manager and with appropriate federal agencies to ensure compliance with the ESA.

1.8) Justification for the program

The program will be operated to provide fish for harvest while minimizing adverse effects on listed fish species using measures listed in Section 1.10.2. Salmon harvest is essential to the culture and well-being of the Muckleshoot Indian Tribe. The harvest of fish to be supplemented by this program is an essential part of the Muckleshoot Indian Tribe's federally-recognized treaty fishing rights reserved by the Treaties of Medicine Creek and Point Elliott. The role of this and other hatchery programs associated with treaty-reserved fishing rights is to support four basic values recognized by the Federal courts: (1) resource conservation, (2) ceremonial, religious, and spiritual values, (3) subsistence values, and (4) commercial values.

The natural production of Chinook throughout the Green-Duwamish watershed has been diminished by extensive habitat loss and degradation (also see Section 3.4 below). So long as watersheds are unable to maintain abundant self-sustaining salmonid populations, hatchery programs will be needed to mitigate and replace lost natural production and provide meaningful harvest opportunity in fulfillment of the Tribe's treaty fishing rights as affirmed by U.S. v. Washington. Mitigation is required for lost natural production throughout the watershed.

Natural production of Chinook and other salmonids in the Green-Duwamish watershed is diminished by extensive habitat loss and degradation. In 1911, the City of Tacoma constructed a diversion dam on the Green River near RM 61 to divert water for municipal and industrial use. This dam blocked all migrating fish and diminished stream flows downstream. In 1962, the U.S. Army Corps of Engineers (USACE) completed the Howard Hanson Dam (HHD) near RM 64 for flood control, water supply, and flow augmentation. HHD is an impassable barrier to fish migration, blocking approximately 100 miles of historic anadromous fish habitat. Reservoir and water diversion operations alter the natural flow regime and aquatic habitat. An adult fish trap and haul facility was completed in 2005 at the Tacoma Water dam, however, upstream fish passage awaits construction of juvenile fish passage facilities at HHD. Reservoir storage was expanded in 2006 through the USACE-Tacoma Additional Water Storage Project.

The majority of the lower half of the Green-Duwamish basin is dominated by urban, commercial, residential, and industrial land uses. The prospects for restoring significant areas of properly functioning habitat and natural ecosystem processes in this landscape are limited. Ninety-eight percent of the historic estuary has been lost to development, and sediment and water quality in the current estuarine habitat is poor. Intertidal and marine shorelines are lined with artificial structures, while levees and revetments confine the lower 30 river miles and much of the middle river. Green River temperatures far exceed state water quality standards and at times exceed lethal levels for salmonids as a result of inadequate riparian vegetation and reduced groundwater inflows. These and many other factors continue to degrade habitat and limit natural processes needed to support the life history of salmonids, reducing the abundance and productivity of natural populations in the watershed.

This program will replace the former role of the Tribe's Keta Creek Hatchery with regard to Chinook production in the Green River. Chinook produced at the Keta Creek Hatchery were planted in the upper watershed above Howard Hanson Dam between 1987 and 2007 (see Section 10.3). Together with Green River minimum instream flow provisions, the Fish Restoration Facility is a central element of the 1995 settlement agreement between the Muckleshoot Indian Tribe and the City of Tacoma regarding the City's water supply operations in the Green/Duwamish River System.

1.9 List of program "Performance Standards".

See section 1.10 below.

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

1.10.1. "Performance Indicators" addressing benefits.

Table 1.10.1.1. Performance standards, indicators, and monitoring and evaluation addressing benefits.

Performance Standard	Performance Indicator	Monitoring & Evaluation
Hatchery operations support Puget Sound Salmon Management Plan (U.S. v. Washington) and sustain Muckleshoot tribal fisheries guaranteed through the Treaties of Point Elliot and Medicine Creek.	Contribute to a meaningful harvest for sport, tribal and commercial fisheries.	Survival and contribution to fisheries will be estimated for each brood year released. Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process, North of Falcon).
Program addresses ESA responsibilities	Program complies with Federal ESA-listed fish take authorizations for hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Externally-marked hatchery fish enable monitoring of hatchery and natural composition of harvest and escapement.	Harvests and hatchery returns are monitored by agencies to provide up-to-date information
Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT) production fish to differentiate from naturally-produced fish.	Annual estimates of mass-mark rate of all hatchery releases. Returning fish encountered are examined for fin-marks upon hatchery return and on spawning grounds. Estimates of hatchery (marked) and natural returns are recorded annually.
Broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Collection of broodstock occurs randomly throughout the entire return period.	Annual run timing, age and sex composition and return timing data are collected.
Program contributes to mitigation requirements for habitat loss and degradation in all areas of Green River Basin, including partial mitigation for fish passage impacts of H. Hanson Dam and municipal water diversion per the 1995 Green River Agreement between MIT and the City of Tacoma.	Fry releases utilize the rearing potential of the habitat above HHD; smolt releases have high survival benefit and low residualism rate. This program contributes to sport, tribal and commercial fisheries.	Outmigration survival and contribution to fisheries will be estimated for each brood year released.
The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation	Apply monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Annual run timing, age and sex composition and return timing data are collected.

1.10.2) "Performance Indicators" addressing risks.

Table 1.10.2.1. Performance standards, indicators, and monitoring and evaluation addressing risks.

Performance Standard	Performance Indicator	Monitoring & Evaluation
Minimize impacts and/or interactions to ESA listed fish.	Hatchery juveniles are released as fry to rear in the upper watershed streams prior to outmigration at a size and time similar to that of co-occurring natural origin Chinook. Subyearling smolts are released at a time that fosters rapid outmigration and at full smoltificaton, limiting duration of potential interaction with listed juveniles.	Monitor size, number, and date of release. Mass marking allows monitoring of migration timing, rate, and behavior of Chinook released through capture of downstream migrating fish at the WDFW juvenile outmigrant trap on the Green River near RM 33.
Artificial production facilities operate in compliance with all applicable fish health guidelines, facility operation standards and protocols including Co-managers Fish Health Policy.	Prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to facility goals.	Pathologists from NWIFC monitor programs monthly. Fish health is documented. Exams performed at each life stage may include tests for virus, bacteria, parasites, and/or pathological changes, as needed.
Releases are marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT) production fish to identify them and differentiate from naturally-produced fish.	Annual estimates of mass-mark rate of all hatchery releases. Returning fish encountered are examined for the fin-mark upon hatchery return and on the spawning ground. Numbers of estimated hatchery (marked) and natural (unmarked) are recorded annually.
Broodstock are collected throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Collection of broodstock occurs randomly throughout the entire return period.	Annual run timing, age and sex composition and return timing data are collected.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	Discharge water quality compared to applicable standards for NPDES permit compliance. State water rights permit compliance.	Flow and discharge monitored and reported in monthly NPDES reports.
Water withdrawals and in-stream diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake screen structures will meet federal guidelines.	Barrier and intake structure will be routinely inspected and maintained to insure compliance with guidelines.
Hatchery operations comply with ESA responsibilities.	MIT completed an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.

1.11) Expected size of program.

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

The program will require up to 300 males and 300 females.

1.**11.2) Proposed annual fish release levels (maximum number) by life stage and location.**

Note: Proposed annual release levels life stage, and location for FRF Chinook. Note: Release levels, life stage, and location will ultimately depend on the status of planned juvenile fish passage facilities at the USACE Howard Hanson Dam and related assessments.

Table 1.11.2.1. Alternative A- With Effective Juvenile Passage at Howard Hanson Dam

Life Stage	Release Location	Annual Release Level
Fry	Upper Green River watershed upstream of Howard Hanson Dam in streams including Sunday, Snow, Smay, McCain, Friday, Intake, Tacoma, Canton, Gale, and Charley creeks, North Fork Green River, and the Green River mainstem (as accessible)	Up to 500,000
Smolt (sub-yearlings)	On site at the Fish Restoration Facility, Green River near RM 60	Up to 100,000

Table 1.11.2.2.Alternative B – Without Effective Juvenile Passage at Howard Hanson Dam

Life Stage	Release Location	Annual Release Level
Smolt (sub-yearlings)	On- site at the Fish Restoration Facility - Green River near RM 60	Up to 600,000

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

Note: The MIT Keta Creek Hatchery outplanted juvenile Chinook into the upper Green River watershed from 1986 through 2007, but this process was temporarily discontinued while work proceeded on a new fish passage facility at Howard Hanson Dam (HHD). Planting numbers from that era are described in Section 10.3. Some Chinook were tagged with half-length CWTs and survival was extremely poor (SAR 0.06%). Renewed plants in the upper Green River watershed would not begin until downstream passage at HHD is addressed. Completion of this project by the U.S. Army Corps of Engineers has been delayed.

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

Program and facilities are not yet constructed, target date for construction TBD. Related historical juvenile Chinook releases in the watershed above HHD occurred from 1986 – 2007.

1.14) Expected duration of program.

Indefinite

1.15) Watersheds targeted by program.

Green River – 09.0001

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

Expansion of the program at WDFW Soos Creek Hatchery was considered but this option was rejected due to capacity constraints, and an increased risk of loss within the hatchery when relying on a single facility for production. Watershed restoration sufficient to meet program goals including dam removal; restoration of near-pristine floodplain, stream channel, water quality, and forest landscape and estuary conditions; was considered infeasible. Expansion of the MIT Keta Creek Hatchery Complex was considered but rejected due to limited water supply and space.

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

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

This HGMP is being submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d). Past Chinook plants in the upper watershed were proposed for ESA review and authorization under the Keta Creek Hatchery Green River Fall Chinook HGMP, originally submitted to NMFS in May, 2003.

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

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

Puget Sound Chinook ESU, Duwamish/Green River Chinook (*O. tshawytscha)*: Listed as Threatened on March 24, 1999 (64FR14308); Threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed Threatened by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant currently. The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, as well as twenty-six artificial propagation programs (Ford 2011). In the Duwamish/ Green River basin, the Technical Recovery Team (TRT) has identified one demographically independent population (DIP) (Duwamish/Green River Chinook) (Ruckelshaus et al. 2006).

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

Puget Sound Steelhead DPS, Green River (*O. mykiss):* Listed as threatened under the ESA on May 11, 2007 (72FR26722); reaffirmed threatened by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. In the Duwamish/Green River basin, the TRT has preliminarily delineated one demographically independent population (DIP) of winter steelhead; (Green River), no summer run populations were identified in the basin (PSSTRT 2011).

2.2.2) Status of NMFS 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

Puget Sound Chinook ESU, Duwamish-Green River fall Chinook (*O. tshawytscha):* NMFS (1999) considered this stock to be in the ESU, but not essential for recovery. The stock was designated Category 2a, as the hatchery population is derived from a native, local population (SSHAG 2003). The NMFS subsequently listed hatchery production in the Green because these hatchery stocks are not significantly divergent from naturally-spawning fish in the watershed (70 FR 37160 June 28, 2005; NMFS SHIEER 2004, NMFS 2005). Recent escapement levels (2003-2011) have averaged 1,860 for natural spawners in the Green/Duwamish DIP. During this same time period, the population has shown declining trend (SaSI, WDFW 2012). The Puget Sound Chinook Harvest Plan (PSIT and WDFW 2010a) set natural-origin-recruit spawner low abundance threshold of 1,800 and an upper management threshold of 5,800 for the Green River fall Chinook. The NMFS refers to a critical threshold of 835 and a viable threshold of 5,523 for this population in their evaluation of the Harvest Plan (NMFS 2011). Between 2000 and 2011, Green River fall Chinook naturally spawning escapements have remained above critical threshold levels except in 2009 and 2011. The levels have been at or above viable thresholds in 7 of these last twelve years. *Updated risk summary*: All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Many of the actions identified in the Puget Sound Chinook recovery plan are expected to take years or decades to be implemented, and to potentially produce significant improvements in natural population attributes, and these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last BRT status review.

Green River steelhead, Puget Sound steelhead DPS (*O. mykiss):* Steelhead counts in the Green River have declined steadily since the 1980s and most sharply since 2005. The PSSTRT population viability analyses indicate the majority of steelhead populations in the Puget Sound DPS are at moderate to high levels of extinction risk. The extinction risk appears to be especially high for the Central and Southern Sound MPG. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 45 fish) is high—about 90% within 80 years. With an estimated mean population growth rate of -0.042 and process variance of 0.001, we can be highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 20 years, and that a 99% decline will not occur within the next 45 years. However, beyond the next 50 years we are highly uncertain about the precise level of risk (Ford 2011). The Comanagers developed critical and viable threshold values for annual spawning escapement in each management unit (MU) as part of the 'Puget Sound Steelhead Management Plan' (PSIT and WDFW 2010b). The PSSTRT may develop

thresholds for each DIP in the future. The Comanagers' critical and viable thresholds for the Green River population were set at 250 and 1000 (PSIT and WDFW 2010b).

- Provide the most recent 12 year (e.g. 2000-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.*

Duwamish-Green River/Summer-Fall Chinook:

Table 2.2.2.1. Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S).

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
Green/Duwamish	*4.69*	*1.18*	*1.34*	*0.23*	*3.1*	*0.53*	*3.58*	*0.73*	*3.12*	*0.29*	*-0.09*	*-0.13*
ESU	*9.57*	*2.19*	*5.05*	*0.96*	*3.01*	*1.24*	*2.70*	*1.19*	*1.67*	*0.67*	*-1.81*	*-0.28*

Source Data: Ford et al. 2010

Table 2.2.2.2. Short and long term population trend and growth rate estimates for the Puget Sound Chinook ESU populations.

Regions and Populations	Years	Trend Natural Spawners w/Cl	Hatchery Fish Success = 0 Lambda w/Cl	p>1	Hatchery Fish Success = 1 Lambda w/Cl	p>1
Green River Fall Run	1995-2009	0.952 (0.851 - 1.065)	1.003 (0.274 - 3.67)	0.51	0.835 (0.3 - 2.324)	0.13
	1968-2009	1.01 (0.981 - 1.039)	0.994 (0.892 - 1.108)	0.45	0.799 (0.716 - 0.89)	0.00

Source Data: Ford et al. 2010

Table 2.2.2.3. Abundance of migrant Chinook sub-yearlings in the Green River above and below WDFW juvenile trap (Rkm 55), and above the Soos Creek Hatchery rack. Source: Topping et al. 2011.

Trap Year	Above Trap			Below Trap			Soos Creek			Total Abundance
	Redds	Deposition	Abundance	Redds	Deposition	Abundance	Females	Deposition	Abundance	
2000	1,625	7,312,500	475,207	826	3,717,000	241,551	1,616	7,272,000	275,125	991,883
2001	3,064	1,378,800	809,616	936	4,212,000	247,324	1,580	7,110,000	275,000	1,331,940
2002	2,711	12,199,500	584,151	480	2,160,000	103,428	995	4,477,500	275,000	962,579
2003	3,772	16,974,000	449,956	2,314	10,413,000	276,034	1,239	5,575,500	275,000	1,000,990
2004	3,124	14,058,000	236,650	1,038	4,671,000	78,631	720	3,240,000	54,542	369,823
2005	4,769	21,460,500	470,334	827	3,721,500	80,561	623	2,803,500	61,442	612,337
2006	1,553	6,988,500	99,796	82	369,000	5,269	598	2,691,000	38,428	143,493
2007	3,170	14,265,000	127,491	883	3,973,500	35,512	313	1,408,500	12,588	175,591
2008	2,435	10,957,500	400,763	438	1,971,000	72,088	676	304,200	111,259	584,110
2009	2,107	94,810,500	196,118	282	1,269,000	26,248	504	2,268,000	46,911	269,277
2010	218	981,000	55,547	57	256,500	14,524	759	3,415,500	193,395	263,466

Source: Topping et al. 2011

Note: Smolt monitoring activity occurs on this system.

Table 2.2.2.4. Abundance estimates, 95% confidence intervals, and coefficient of variation (CV) for natural-origin steelhead smolts rearing above the Green River juvenile trap (RKm 55), migration years 2000-2010.

Trap Year	Abundance	95% C.I.		CV
		Lower	Upper	
2000	14,529	-----	-----	-----
2001	53,077	-----	-----	-----
2002	12,612	-----	-----	-----
2003	n/a	-----	-----	-----
2004	n/a	-----	-----	-----
2005	n/a	-----	-----	-----
2006	16,748	-----	-----	-----
2007	2,285	-----	-----	-----
2008	n/a	-----	-----	-----
2009	26,174	10,151	42,198	19.4%
2010	71,710	49,317	94,103	15.9%

Source: (Topping and Zimmerman 2011).

Table 2.2.2.5. Exp. Steelhead Population Trend ln (nat. spawners) (95% CI)

Population	1985-2009	1995-2009
Green River winter-run	0.992 (0.969 - 1.016)	0.953 (0.892 - 1.019)

Source Data: Ford et al. 2010

- Provide the most recent 12 year (e.g. 2000-2011) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6. Green River and Soos Creek summer/fall Chinook total natural spawners, 2000-2012.

Year	Natural-Origin Spawners	Hatchery-Origin Spawners	Total Spawners*	Passed Above Soos Creek Weir***
2000	NA	NA	4,473**	2,419
2001	NA	NA	6,473**	3,623
2002	NA	NA	7,564**	3,401
2003	2,613	3,251	5,864	1,516
2004	2,922	5,025	7,947	1,134
2005	1,109	1,414	2,523	1,160
2006	2,516	3,274	5,790	1,564
2007	1,832	2,469	4,301	1,556
2008	3,825	2,146	5,971	1,053
2009	164	524	688	1,669
2010	839	1,253	2,092	1,504
2011	459	534	993	478
2012	1,629	1,462	3,091	1,217

Source: Aaron Bosworth, WDFW 2013 and SaSI 2013.

*Escapement estimates listed here include all HORs and NORs spawning naturally in the mainstem Green River and Newaukum Creek.
**Standardization of redd-based spawner survey methodology has revised the estimates for years prior to 2003. ***Not included in mainstem Green River spawner count.

Table 2.2.2.7. Green (Duwamish) River wild winter steelhead spawning escapement 2000-2011.

Return Year	Escapement
1999/2000	1,705
2000/2001	1,402
2001/2002	1,068
2002/2003	1,612
2003/2004	2,359
2004/2005	1,298
2005/2006	1,955
2006/2007	1,452
2007/2008	833
2008/2009	304
2009/2010	423
2010/2011	855
Average	**1,321**

Source: (Aaron Bosworth, District Biologist, 2012). Data are total escapement estimates based on cumulative redd counts in all mainstem spawning areas and in index reaches in Soos and Newaukum creeks totaling 12 miles. Does not include wild brood collected for hatchery program.

- Provide the most recent 12 year (e.g. 2000-2011) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Table 2.2.2.8. Puget Sound Chinook average natural (natural-origin and hatchery) and natural-origin only spawners and percent hatchery contributions for five year intervals. Spawning abundance averages are geometric means and hatchery contribution averages are arithmetic.

Return Years	1990-1994			1995-1999			2000-2004			2005-2009		
Populations	Nat	%	NOR	Nat	%	NOR	Nat	%	NOR	Nat	%	NOR
Green-Duwamish	5,239	56%	2,214	6,792	68%	2,007	6,335	37%	3,921	3,077	56%	1,288
ESU	23,938	75%	17,905	27,392	63%	17,245	43,192	72%	31,294	34,486	69%	23,938

Data Source: Ford et al. 2010

Green River (Duwamish) steelhead (*Oncorhynchus mykiss*): The level of hatchery winter run steelhead spawners in the Green River is unknown. Due to timing differences between early Chambers winter stock and Skamania summer stock steelhead and a majority of the existing wild winter stocks (being later February – June), interaction on the spawning grounds is unclear.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u> (see "Attachment 1" for definition of "take")**.**

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

Broodstock Collection, Handling, and Holding: The collection and handling of these fish may result in take of listed fish through migration delay, injury during holding or through handling and incidental mortality through trapping or handling. However, these risks are likely low. Most Soos Creek/Green River Chinook programs including incidental or non-targeted broodstock trapping ends by the time that wild winter steelhead enter the system making it highly unlikely for encounters or effects. Summer steelhead (hatchery and natural origin) may be encountered in the adult holding pond during Chinook broodstock collection. Natural origin summer steelhead may be encountered but are returned back to stream. Natural origin summer steelhead in the Green River system are believed to be of non-native origin (SaSI 2002).

Much of the detail of this program will be determined once the decision is made to build the facility. Historically, fish that were planted in the upper watershed originated from the Soos Creek Hatchery, which is the default source of broodstock for the FRF program at least initially. The Tacoma Water trap facility approximately a mile usptream could also provide Chinook to the FRF. In addition, juvenile Chinook have been released at the Palmer facility (RM 56.4) since 2010, and returns from this facility may be sufficient to supplement the broodstock needs of the FRF (RM 60) in future years. It is currently too early to tell what the contribution of Palmer releases will be to the area of the FRF facility. Broodstock collection facilities at the FRF are expected to be capable of collecting 100% of the adult Chinook returning, however, these facilities have not yet been designed.

In the event of broodstock collection at the Soos Creek Hatchery, effects on listed species are described in that HGMP and aspects are repeated here. The Soos Creek Hatchery adult weir is capable of trapping 100% of the adult Chinook returning to Soos Creek at RM 0.8.

Entrainment effects: Upstream of the Soos Creek 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. The water source for the FRF has not yet been developed. If screens are needed, they will be constructed to meet applicable NMFS guidelines.

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 (40-45 mm), and a second peak in mid-May to June comprised of larger Chinook salmon;

Fry from the FRF that may rear above HHD will likely have a slightly later outmigration timing than their natural counterparts because of the cooler temperatures in the upper watershed. Ultimately, the outmigration survival rate of the upper watershed Chinook fry released depends on factors such as in-reservoir delay, predation, fish guidance efficiency, and survival during and after transport, as the current USACE fish passage design collects juveniles at the dam for truck transport downstream. Smolts released at the FRF will likely also lag behind the fish from the lower watershed for similar reasons. The release timing for smolts in this program will occur in mid-to late June (after statistical week 25). The later release timing will reduce the likelihood for interaction with the majority of natural origin juvenile Chinook rearing and emigrating each year. On average, over 80% of juvenile Chinook have migrated past the trap after statistical week 23 (usually the first week of June) (Seiler et al., 2002). The average size of the hatchery Chinook smolts released under this HGMP will be approximately 75 mm, similar in length to the average size of Chinook migrants captured in statistical week 25. Food resource competition risks to listed Chinook juveniles in the Green River are reduced by the delayed timing of these upper river fish.

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, and exposure to surface water sources from areas harboring natural-origin fish that may be disease vectors, 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, use of spring or well water for critical rearing stages, continuing well-developed monitoring, diagnostic, and treatment programs already in place (Co-manager's Fish Health Policy 1998, updated 2006).

Genetic Effects: A Chinook hatchery has been present in the Green River System since 1901. There appears to be a high level of exchange between the Soos Creek Hatchery stock and the Green River natural population (SSHAG 2003). The Chinook program at Soos Creek Hatchery is integrated, and incorporates natural-origin fish for use as broodstock (See Soos HGMP section 6.2.3). At Soos Creek Hatchery, the intent is to allow fish not needed for broodstock to spawn naturally in the Green River Basin up to

levels sufficient to meet the escapement goal (5,800). At present, we are unaware of studies that found reduced reproductive fitness caused by breeding between genetically similar natural and hatchery origin ocean type fall Chinook released as fry or fingerlings. The propagation of ocean type Chinook in this program involves release of fish after a brief period of rearing in the hatchery. Berejikian and Ford (2004), in their review of relative fitness of hatchery and natural salmon, suggested it was reasonable to assume that populations of these species are less likely to change phenotypically and genetically by hatchery propagation than are species with longer freshwater rearing times.

Natural-origin fish are trapped at Soos Creek, Icy Creek, and the TPU trap to incorporate into the broodstock at the WDFW Soos Creek Hatchery. It is expected that the same strategy will occur at the FRF.

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

During the period when Chinook fry were last outplanted above HHD, there was no direct take associated with that portion of the program (at that time - the Keta Creek Hatchery portion) because broodstock were collected at the Soos Creek Hatchery and all such takes were associated with operation of the WDFW facility.

- 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 sub-yearling program are presented in Table 1 at the back of this document. 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.

To be determined.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (Explain any proposed deviations from the plan or policies.

The program is intended to be consistent with hatchery program guidelines in the co-managers' Puget Sound hatchery resource management plan (WDFW and PSTT 2004), and is aligned with the WDFW Future Brood Document. The program is intended to be consistent with the Washington state co-managers Salmonid Disease Policy that identifies Fish Health Management Zones, eggs and fish transfer policies, and guidelines designed to limit the spread of fish pathogens between and in watersheds (NWIFC and WDFW 1998, 2006).

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 Puget Sound Salmon Management Plan
- Co-Managers Future Brood Document
- Co-Managers Fish Health Policy
- Watershed Access agreement with the City of Tacoma
- Agreement between the Muckleshoot Indian Tribe and the City of Tacoma Regarding the Green/Duwamish River System (1995)

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* and the *Puget Sound Salmon Management Plan* (1985) which 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).

Hatchery salmon and steelhead production levels are detailed in the annual *Future Brood Document*. The Future Brood Document (FBD) is a pre-season planning document for fish hatchery production in Washington State for upcoming brood stock collection and fish rearing seasons (July 1 – June 30). The FBD is coordinated between WDFW, the Northwest Indian Fisheries Commission (NWIFC) representing Puget Sound and coastal treaty tribes, eastern Washington treaty tribes, and Federal fish hatcheries.

3.3) Relationship to harvest objectives.

Adult Chinook salmon produced through the program will be 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 2010. 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 (2000-2011), if available.

N/A. The related prior release of Chinook in the upper watershed that occurred from 1986 – 2007 had low survival, with an SAR of 0.06%, presumably related to poor fish passage conditions at HHD. During the three years of CWT releases in the upper watershed from 1994 through 1996, approximately 1.1 million tagged fish were released. An estimated 198 of these fish contributed to harvest.

3.4) Relationship to habitat protection and recovery strategies.

The FRF Chinook program is intended to contribute to treaty and non-treaty harvest opportunity given historic and continuing habitat loss in the WRIA 9 streams and Puget Sound.

In 1911, the City of Tacoma constructed a diversion dam across the Green River at River Mile 61 to divert water for municipal and industrial needs. This dam blocked all up-stream returning adult salmon. In 1962, the U.S. Army Corps of Engineers (USACE) completed the Howard Hanson Dam (HHD) near RM 64 for flood control, water supply, and flow augmentation purposes. HHD, an impassable barrier to fish migration, prevents natural production of salmonids in approximately 100 miles of historically accessible upstream habitat. HHD lacks fish passage facilities. A four mile-long reservoir is refilled during the smolt outmigration period, altering the natural springtime hydrograph downstream and confounding habitat connectivity. An adult fish trap and haul facility was constructed in 2005 at the Tacoma Water Headworks, however, use of this facility is on hold pending construction of downstream fish passage facilities at HHD. Reservoir storage at HHD was expanded in 2006 for municipal water supply through the USACE-Tacoma Additional Water Storage Project, further exacerbating productivity losses through reservoir inundation, migration delay, and other effects. The Fish Restoration Facility (FRF) program will help to mitigate continued lost fish production as a result of these dams. Together with Green River instream flow provisions, the FRF was a key element of the 1995 settlement agreement between the Tribe and the City of Tacoma regarding the Green/Duwamish River System.

The Biological Opinion prepared by NMFS (200) for the Tacoma Water Habitat Conservation Plan (HCP) identified the possible planting of hatchery juveniles in the upper river as a covered activity in the City's Incidental Take Permit, if found to be beneficial to restoration. The 2001 Tacoma Water Habitat Conservation Plan (HCP) includes a commitment to fund a fish restoration facility to rear salmonids and to provide transport and release of juvenile Chinook, coho and steelhead into the upper watershed

from the facility (HCP Measure HCM 2-05). Chinook from the FRF would be used to restore and enhance this population in the Green River and serve as the source of juvenile outplants to the upper watershed for (1) monitoring and evaluation; (2) to accelerate the natural rebuilding of Chinook above the dam; and/or (3) to supplement adult returns in the Green River to address short term declines in adult escapement. Juvenile releases above HHD will be made only after a period of testing to verify safe passage through the dam and reservoir. As stated in the Biological Opinion, the Muckleshoot Fish Restoration Facility, which is supported by Tacoma, will proceed through the necessary Tribal, federal and state regulatory process separate from any Incidental Take Permit issued to Tacoma Water.

The majority of the lower half of the accessible river basin is highly developed, channelized, and/or industrialized. These factors have degraded or eliminated habitat areas and natural processes important for Chinook and other salmon, adversely affecting the abundance and productivity of the natural population in the watershed. The following lists some of the ongoing efforts in the Green River basin (WRIA 9) by the Tribe and state, local, and federal governments to protect and improve instream flows, water quality, fish passage, riparian and floodplain habitats, and where possible, the natural ecosystem processes that create and maintain salmon habitat.

Green River Chinook, coho, and steelhead fry reared at the Keta Creek Hatchery were outplanted above the HHD reservoir from 1987 through 2007 in an effort to utilize the rearing capacity of the upper watershed streams blocked by the dams. Upper watershed plants were discontinued while the USACE worked to plan and construct a juvenile fish passage facility at HHD. Fish passage construction was abandoned several years ago by the USACE due to funding concerns. USACE plans and schedule to complete downstream passage are uncertain.

The Biological Opinion for the combined HHD and Additional Water Storage Project noted that, even with a new fish passage facility, downstream passage of juvenile Chinook was predicted to be imperfect with a 64% fish guidance efficiency (FGE), resulting in an estimated 36% loss of upper basin Chinook smolts (NMFS, 2000). The BO anticipated a gradual improvement in habitat conditions for Chinook salmon in the upper basin as a result of landowner Habitat Conservation Plans and Forest Practices Act measures, however, it expected that the "outcome downstream of HHD is the continued gradual degradation of Chinook habitat and direct loss of fish". While the BO predated completion of the WRIA9 salmon habitat plan, despite the plan the lower portion of the Green River basin continues to be degraded by population growth and land use activities limiting habitat for Chinook and other salmon and adversely affecting their abundance and productivity.

Chinook from the facility would be used to restore and enhance the Green River population and serve as the source of juvenile outplants to the upper watershed for (1) monitoring and evaluation; (2) to accelerate the natural rebuilding of Chinook; and/or (3) to supplement adult returns to address short term declines in adult escapement.

King County is the lead entity for the WRIA 9 salmon recovery planning group, a coalition of local governments and stakeholders. The WRIA 9 Salmon Habitat Plan (August 2005) outlined projects and programs focusing on habitat limitations identified in the basin: transition habitat in the Duwamish estuary; rearing habitat in the estuary, middle and lower river, and nearshore marine areas, and spawning habitat in the middle and lower river.

The Salmon Recovery Funding Board (SRFB) is composed of citizens appointed by the Governor and five state agency directors that provides grant funds to protect or restore salmon habitat and assist related activities in the basin. The US Army Corps of Engineers' Ecosystem Restoration Program has also funded projects in the basin intended to improve habitat conditions for salmon. The non-governmental Mid Puget Sound Regional Enhancement Group works to implement habitat restoration projects in cooperation with other entities to benefit salmonids in the system. A number of habitat restoration activities were initiated under the 2001 Tacoma Water Green River Habitat Conservation Plan in the upper river, and a Superfund cleanup plan is being developed to address toxic contamination of Duwamish River sediments. The net cumulative effect of these activities is uncertain, and salmon habitat was reported to be in continued decline since the adoption of the Puget Sound Chinook Recovery Plan (M. Judge, 2011).

Member Tribes have worked with the NWIFC and SSHIAP to create the State of Our Watersheds report. This document examines key indicators of habitat quality and quantity across more than 20 watersheds in western Washington that lie within tribal Usual and Accustomed fishing areas as defined by *U.S. vs. Washington* (Boldt decision). The Green River habitat section can be found under the Muckleshoot chapter at http://maps.nwifc.org:8080/sow2012/.

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 FRF 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
- Puget Sound steelhead
- Bull trout

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Fish species that could positively impact the program may include 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. These species include:

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

Nutrients provided by decaying Chinook carcasses might also benefit fish in freshwater.

This program could contribute to available food resources for the Threatened southern resident killer whale/orca population in Puget Sound. Chinook salmon are a key prey species for this population (e.g., Ford and Ellis 2006, 2011), and low Chinook abundance is one critical limiting factor for that population.

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.

Incubation and rearing water will be from wells and/or surface water in the amount of 2 cfs with a potential for expansion to 35 cfs in the future. The water quality is expected to be excellent.

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.

Water intake facilities will meet current NOAA Fisheries screening criteria.

SECTION 5. FACILITIES

Note: Because the Fish Restoration Facility has not yet been constructed, the details needed in this section will be developed at a later date.

5.1) Broodstock collection facilities (or methods).

The initial default source of broodstock will be the Soos Creek Hatchery, however, it is anticipated that some adult Chinook will be available at the Tacoma Water Headworks trap located one mile upstream of the Fish Restoration Facility and at the WDFW Palmer ponds facility. If warranted, fish will be collected at the FRF adult handling facility.

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

Adult fish will transported via tanker truck.

5.3) Broodstock holding and spawning facilities.

Broodstock facilities for Chinook at the Fish Restoration Facility will be sized to handle up to 600 fish.

5.4) Incubation facilities.

Facility details to be determined

5.5) Rearing facilities.

Facility details to be determined

5.6) Acclimation/release facilities.

N/A

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

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 the Fish Restoration Facility, alarm systems will be in place 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, updated 2006). 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.

Green River native origin stock. Initially, fish may be transferred from Soos Creek Hatchery. Adult Chinook salmon will be collected primarily from the Tacoma Water Headworks trap, and potentially Icy Creek, Palmer and the FRF traps, representing the extant, Duwamish/Green River native population delineated by the Puget Sound TRT (Ruckelshaus et al. 2006).

6.2) Supporting information.

6.2.1) History. Soos Creek Hatchery Chinook originated from broodstock collected from the mainstem Green River from 1901 through 1924 (Becker 1967). After 1924, sufficient adult returns to the hatchery release site had been established to create a self-sustaining program (SSHAG 2003). Some additional stocks were occasionally imported in the early days of the hatchery operation (e.g., Columbia river-origin Chinook in the 1920s), but genetic analyses (Marshall et al. 1995) indicate that the contribution of these transferred, out-of-basin stocks was not significant. The FRF will continue to use Green River stock.

6.2.2) Annual size.

Initially –up to 600 adults

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

Please refer to WDFW Soos Creek Fall Chinook HGMP.

6.2.4) Genetic or ecological differences.

Soos Creek Hatchery fall-run Chinook salmon are genetically similar to naturally spawning Chinook salmon in Newaukum Creek, a tributary to the Green River (Marshall et al. 1995). There appears to be a high level of exchange between the Soos Creek Hatchery stock and the Green River natural population (SSHAG 2003).

6.2.5) Reasons for choosing.

Native Green River 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.

Broodstock will be selected randomly from adult returns to the trapping sites over the full extent of the return timing. Over time, natural-origin adults will be included in the broodstock to keep the hatchery and naturally-produced fish genetically similar, reducing the risk of divergence of the populations.

SECTION 7. BROODSTOCK COLLECTION

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

7.2) Collection or sampling design.

Broodstock will be selected randomly from adult returns to the trapping sites over the full extent of the return timing.

7.3) Identity.
TBD

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults): 600

7.4.2) Broodstock collection levels for the last twelve years (e.g. 2000-2011), or for most recent years available:
N/A

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

Adult fish surplus to hatchery program needs will be released back in the river

7.6) Fish transportation and holding methods.

Fish transferred from the Tacoma trap and haul will be transported by tanker truck and held in 15" circulars or facilities TBD until ready to spawn.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols, as defined in the Co-manager Fish Health Policy (1998, updated 2006) are adhered to.

7.8) Disposition of carcasses.

Carcasses will be used for nutrient enrichment or sold.

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.

TBD

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 will be 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 will be selected randomly. Matings will be 1:1. About 1% of males used will be "jacks". If female numbers exceed hatchery need, eggs will be taken randomly from later spawning females, to represent that portion of the run, and the remaining females will be "surplused", i.e., removed from the breeding pool. As prescribed, adult Chinook exceeding hatchery need adults will be released to spawn naturally in the Green River

8.2) Males.

See 8.1

8.3) Fertilization.

Matings will be 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 one 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.

N/A

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.

Adults will be selected randomly from the entire run and will continue to include both hatchery and natural-origin adult fish. At the Fish Restoration Facility, 1:1 mating will be used 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.

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.

N/A

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

N/A

9.1.3) Loading densities applied during incubation.

Chinook eggs will be incubated in trays loaded at a maximum of 7,000 eggs per tray, or TBD.

9.1.4) Incubation conditions.

The eggs will receive ground water and/or surface water from the Green River. The eggs and subsequent alevins will be checked weekly or more often as needed for silt and or other problems.

9.1.5) Ponding.

Fry will be brought out at buttoned stage. This occurs typically mid-January depending on water temperature and other environmental factors. Fry will be about 900 per pound and 38 mm in length. The length ranges between 36 to 40 mm. The range for fry weights is 875 fish /lb to 925 fish/lb.

9.1.6) Fish health maintenance and monitoring.

Fish health services are provided by the Northwest Indian Fisheries Commission's Olympia Fish Health Center pathologists. In addition, MIT hatchery staff have taken the U.S. Fish and Wildlife Service's short course on Fish Health Management. Prior to loading the incubators, the eggs will be final picked. Dead eggs will be removed from each lot in the trays during weekly checks.

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.

N/A

9.2) <u>Rearing</u>:

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

N/A

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

Density in rearing tanks will not exceed 0.8 pounds fish/cubic feet.

9.2.3) Fish rearing conditions

Because the Fish Restoration Facility has not yet been constructed, the details for this section will be developed at a later date.

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.

N/A

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

N/A

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*).

N/A

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

Preventative care will promoted through routine health monitoring. NWIFC pathologists will conduct fish health exams at the Fish Restoration Facility on a monthly or more frequent basis from the time fish "swim-up" until they are released. Monthly exams include an evaluation of rearing conditions, as well as, lethal sampling of small numbers of juvenile fish to assess fish health status of the population and to detect pathogens of concern. The results are reported to hatchery managers along with any recommendations for improving or maintaining fish health. A vaccine produced by the Fish Commission may be used when appropriate to prevent the onset of enteric red-mouth disease. The entire health history for this stock is maintained in a relational database called AquaDoc.

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

N/A

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

TBD

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 Chinook produced at the Fish Restoration Facility will be larger and released later than wild fish to minimize interaction in the river.

SECTION 10. RELEASE

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

The Fish Restoration Facility fish will be volitionally released.

10.1) Proposed fish release levels

Table 10.1.1. Alternative A: With Effective Juvenile Passage at Howard Hanson Dam 10.2)

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fry	500,000	150	Late March to early May	Various tributaries in Green River watershed above Howard Hanson Dam (*see Table 1.11.2.1.*)
Smolt (subyearing)	100,000	65	mid to late June	Fish Restoration Facility site Green River near RM 60

Alternative B – Without Effective Juvenile Passage at Howard Hanson Dam

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Smolt (subyearing)	600,000	65	mid to late June	Fish Restoration Facility site Green River near RM 60

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

River: Green River 9.0001
Release point:

Alternative A- Fish Restoration Facility, Green River at RM 60 and various streams in the Upper Green River Watershed upstream of Howard Hanson Dam (RM 64). These streams will include Sunday, Snow, Smay, McCain, Friday, Intake, Tacoma, Canton, Gale, and Charley creeks, North Fork Green River, and the Green River mainstem as accessible

Alternative B - Fish Restoration Facility site Green River near RM 60

Major watershed: Green-Duwamish River
Basin or Region: Puget Sound

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

Note: Fall Chinook juveniles were released above Howard Hanson Dam each year from 1987 – 2007. The annual numbers released ranged from 263,950 - 1,141,127 with average sizes ranging from 147 to 612 fish per pound (data source: RMIS).

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

N/A

10.5) Fish transportation procedures, if applicable.

N/A

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

N/A

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

Releases will be marked to allow for statistically significant evaluation of program contribution, and to evaluate effects of the program on the local natural population.

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

N/A

10.9) Fish health certification procedures applied pre-release.

As stated for egg incubation, the NWIFC fish health lab provides pathologists who certify all fish healthy before release.

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

Fish will be released directly into the Green River or its tributaries.

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

Chinook subyearling smolts will be released from the Fish Restoration Facility in June (e.g. after statistical week 25) after the majority of natural origin Chinook have typically emigrated from the river to minimize the potential for ecological interactions in the river and in the Duwamish estuary with natural origin Chinook and steelhead. On average, over 80% of juvenile Chinook have migrated past the trap after statistical week 23 (usually the first week of June) (Seiler et al., 2002).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

Monitoring and Evaluation of Performance Indicators are briefly described in Section 1.10.

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

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

This information is described in Section 1.9 and 1.10.

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

Program funding is subject to annual evaluation and support from Northwest Indian Fisheries Commission, and other sources.

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.

SECTION 12. RESEARCH

The Tribe is not currently engaged in formal research involving this program; however, we coordinate with WDFW who is currently engaged in juvenile salmon studies on the Green River, and will coordinate as appropriate with USACE and/or Tacoma Water in future research and monitoring activities regarding future fish passage at HHD.

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

Citations

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. Seattle, Washington.

Berejikian, B. and Ford, M.J. 2004. Review of Relative Fitness of Hatchery and Natural Salmon. NOAA Tech. Memorandum NMFS-NWFSC-61.

Ford, J.K.B., and Ellis, G.M. 2006. Selective foraging by fish-eating killer whales *Orcinus orca* in British Columbia. Marine Ecology Progress Series **316**: 185–199.

Ford, J.K.B., and Ellis, G.M. 2011. Overview of foraging behaviour and diet of Resident killer whales. *In* Evaluating the Effects of Salmon Fisheries on Southern Resident Killer Whales: Workshop 1, September 21-23, 2011. NOAA Fisheries and DFO (Fisheries and Oceans Canada), Seattle, WA.

Ford, M.J. (ed.). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-113, 281 p.

Judge, M.M 2011. 2011 Implementation Status Assessment. Final Report. A qualitative assessment of implementation of the Puget Sound Chinook Recovery Plan. Prepared for the National Marine Fisheries Service. Task Order 2002

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. (pp 111-173). IN Busack, C. and J. Shaklee (editors.), Genetic diversity units and major ancestral lineages of salmonid fishes in Washington. Washington Department of Fish and Wildlife. Technical Report # RAD 95-02. Olympia, Washington.

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

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

NMFS (National Marine Fisheries Service). 1999. Endangered and threatened species: Threatened status for three Chinook salmon Evolutionarily Significant Units in Washington and

Oregon, and Endangered status for one Chinook salmon ESU in Washington; final rule. Partial 6-month extension on final listing determinations for four Evolutionarily Significant Units of West Coast Chinook salmon; proposed rule. Federal Register 64:14308-14328.

NMFS, 2000. Biological Opinion for Howard Hanson Dam and the Additional Water Storage Project. WSB-00-198. NMFS Northwest Region, Washington State Habitat Branch.

NMFS, 2001. Biological Opinion for for Proposed Issuance of a Section 10 Incidental Take Permit for the Tacoma Water Habitat Conservation Plan, Green River Water Supply Operations and Watershed Protection, King County, Washington. WSB 00- 22. NMFS Northwest Region, Washington State Habitat Branch, July 9, 2001.

NMFS (National Marine Fisheries Service). 2011. Evaluation of and recommended determination on a Resource Management Plan (RMP), pursuant to the salmon and steelhead 4(d) rule: Comprehensive management plan for Puget Sound Chinook: harvest management component. U.S. Department of Commerce, NOAA. FINWRl2010/06051.

Piper, Robert, et al., 1982, Fish Hatchery Management; United States Dept of Interior, Fish and Wildlife Service, Washington, DC.

PSSMP (Puget Sound Salmon Management Plan). 1985. United States vs. Washington (1606 F.Supp. 1405).

PSSTRT (Puget Sound Steelhead Technical Recovery Team). 2011. (Review Draft) Identifying historical populations of steelhead within the Puget Sound distinct population segment. U.S Department of Commerce National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center. Seattle, Washington. 112 pp.

PSTRT (Puget Sound Technical Recovery Team). 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.

RMIS (Regional Mark Information System). 2012. Retrieved February 6th 2012. Available from: http://www.rmpc.org/

Ruckelshaus, M.H., K.P. Currens, W.H. Graeber, R.R. Fuerstenberg, K. Rawson, N.J. Sands, and J.B. Scott. 2006. Independent populations of Chinook salmon in Puget Sound. United States Department of Commerce, NOAA. Technical Memo. NMFS-NWFSC-78, Seattle, Washington. 125 pp.

Seiler, D., G. Volkhardt, L. Kishimoto, and P. Topping. 2002. 2000 Green River juvenile salmonid production evaluation. Report FPT 02-03. Washington Department of Fish and Wildlife, Olympia, Washington.

SSHAG (Salmon and Steelhead Hatchery Assessment Group). 2003. Hatchery broodstock summaries and assessments for chum, coho, and Chinook salmon and steelhead stocks within evolutionarily significant units listed under the Endangered Species Act. NOAA Fisheries, Northwest Fisheries Science Center, Seattle, Washington and Southwest Fisheries Science Center, La Jolla, California. 326pp.

Topping, P., and M. Zimmerman. 2011. Green River Juvenile Salmonid Production Evaluation: 2009 and 2010 Annual Report. Washington Department of Fish and Wildlife. Annual Report: FPA 11-01. Olympia (WA). 96 pp.

WDFW (Washington Department of Fish and Wildlife) and WWTT (Western Washington Treaty Tribes). 1997. Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes concerning wild salmonids. Olympia, Washington. 46 pp.

WDFW (Washington Department of Fish and Wildlife) and WWTIT (Western Washington Treaty Indian Tribes). 1998 (Updated 2006). Salmonid disease control policy of the fisheries Co-Managers of Washington State. Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes, Olympia Washington.

Wipfli, M.S., J. Hudson, and J. Caouette. 1998. Influence of salmon carcasses on stream productivity: Response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences. 55(6): 1503-1511.

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."
By submitting this material the Muckleshoot Indian Tribe is not conceding the application of the ESA to its hatchery operations. This information is primarily submitted to facilitate the ability of the NMFS to carry out it's duties under ESA consistent with the government to government relationship between the Muckleshoot Indian Tribe and the United States.
Name, Title, and Signature of Applicant:

Dennis Moore – Fish Enhancement Manager

Certified by_____ Date:_____

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

Listed species affected: Chinook Salmon (*O. tshawytscha*) **ESU/Population:** Puget Sound/Green Duwamish Fall Chinook
Activity: Fish Restoration Facility Chinook Program

Location of hatchery activity: Green River near RM 60 **Dates of activity:** August- July

Hatchery program operator: Muckleshoot Indian Tribe

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	-	-	Up to 440	-
Collect for transport b)	-	-	Up to 440	-
Capture, handle, and release c)	-	-	Up to 100	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	Up to 440	-
Intentional lethal take f)	-	-	Up to 330	-
Unintentional lethal take g)	52,000	16,800	Up to 110	-
Other Take (specify) h)	-	-		-

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

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

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

Listed species affected: Steelhead (*O. mykiss*) **ESU/Population:** Puget Sound DIP/Green Duwamish winter steelhead
Activity: Fish Restoration Facility Steelhead Program

Location of hatchery activity: Green River RM 60 **Dates of activity:** Year round

Hatchery program operator: Muckleshoot Indian Tribe

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	-	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

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

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2)

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

This HGMP is being submitted for ESA consultation and take prohibition exemption under ESA section 4(d).

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Green (Duwamish) Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a *threatened* species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). The Green River is considered critical habitat for bull trout and is thought to serve rearing, migration and overwintering purposes (USFWS 2004). Bull trout have been documented in the Green River as far upstream as RM 41 in recent years and are consistently reported in the lower Duwamish River. However, the USFWS does not consider the watershed to be a core area for bull trout in Puget Sound (USFWS 2004), and no distinct population has been delineated for the Green River. It is unclear whether the bull trout observed represent local-origin fish or transients from other systems as there is no information on timing or distribution of spawning in the basin if any occurs (SaSI 2004). The Tacoma Water Headworks adult fish trap at RM 61 has been operated by Tacoma Water on a limited basis for various purposes since 2007 and bull trout have not been encountered during trap operations (Greg Volkhardt, Tacoma Water, pers. comm.).

Habitat--The Green River watershed has been heavily impacted by human activities, which include logging, road construction, flood control and municipal water supply diversion dams, agricultural development, river channelization, intensive industrial and residential development, and estuarine dredging and filling. Historically the contribution of the White and Black Rivers which accounted for two-thirds of the flow of the Duwamish would have greatly increased the amount of favorable bull trout habitat in the system. It is unknown if the current habitat can support bull trout, but suitable habitat may still be available in the upper watershed above Howard Hanson Dam. Water temperatures and habitat conditions in the lower basin are often unsuitable for this species. It is not known if bull trout occupied the upper watershed in the past; they do not appear to be present now (Watson and Toth 1994). More recently, no bull trout were found during extensive gill net sampling in Howard Hanson reservoir conducted in winter and spring of 2008 by the US Army Corps (Fred Goetz, USACE, *pers. comm.).*

Several listed and candidate species are found in King County.

Listed or candidate species:
"No effect" for the following species:

Marbled murrelet (*Brachyramphus marmoratus*) –Threatened [critical habitat designated]
Canada Lynx (*Lynx canadensis*) –Threatened [critical habitat designated]
Gray Wolf (*Canis lupus*) –Threatened
Grizzly bear (*Ursus arctos horribilis*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened [critical habitat designated]

Candidate Species
Fisher *(Martes pennanti)* – West Coast DPS
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Oregon spotted frog *(Rana pretiosa)* [historic]
Yellow-billed cuckoo *(Coccyzus americanus)*
Whitebark pine *(Pinus albicaulis*)

15.3) Analyze effects.

Hatchery activities, including broodstock collection, hatchery trap, water discharges, and water intake structures may pose a risk to bull trout populations or individuals. However, risk to bull trout populations from the FRF program is expected to be low as no records of bull trout observations have been reported in the Green River in the vicinity of the FRF.

Hatchery activities associated with the FRF program will include broodstock collection at the FRF facility in a fishway ladder or other adult collection facility, and at the Tacoma Headworks adult fish trap in the Green River. Bull trout have not been encountered at the Tacoma Headworks fish trap or observed near the trap (Greg Volkhardt, Tacoma Water, pers. comm.).

FRF hatchery surface water intake structures may pose a risk to any bull trout that might be encountered at these facilities, however the risk will be low as they will be screened in compliance with appropriate NMFS and USFWS protection criteria.

Water discharges from the hatchery may affect water quality in the Green River, however, the risk of water quality degradation affecting the health of bull trout would be low given that discharges will comply with NPDES permit and monitoring if required, employ discharge water treatment facilities and water quality best management practices to avoid or minimize adverse effects on water quality.

The FRF will operate on surface water from the Green River and/or groundwater sources. Water withdrawals will be non-consumptive, and will not exceed the rates authorized by the state. The

risk to bull trout from water withdrawals is low as the water supplied to the hatchery will be non-consumptive and will also be returned to the river at the point where it is withdrawn during low flow periods to minimize impacts to instream flows.

Hatchery operations may introduce or spread fish pathogens that might pose a risk to the health of any bull trout that may occur in the creek. However, this risk would be low as hatchery facilities and fish culture practices are operated in compliance with all applicable fish health guidelines, facility operation standards, and protocols, including routine monitoring and testing for pathogens.

Juvenile fish releases from the hatchery could provide prey for any bull trout occurring in the Green River downstream of the hatchery.

15.4) Actions taken to minimize potential effects.

Broodstock collection facilities would be checked at least daily when operating. Any bull trout encountered at the trap would immediately be returned safely to the stream. Any bull trout encounters would be recorded and reported to USFWS.

Water intake structures will be screened in compliance with current NMFS and USFWS fish protection criteria. Water intake screening and structures will be inspected several times each week to insure they are operating correctly. Any bull trout encountered at the water intake facilities would be returned immediately to the Green River, and reported to USFWS.

Water withdrawals will be non-consumptive and limited to the rates authorized by existing state water rights certificates. During low flows, water will be pumped back to the point of withdrawal to maintain adequate flows in any bypass reach.

Program facilities will be operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including the Co-managers Fish Health Policy (NWIFC and WDFW, 2006) to prevent the introduction or spreading of fish pathogens including routine monitoring and testing for pathogens.

15.5) References

USFWS (U.S. Fish and Wildlife Service). 2004. Draft recovery plan for the coastal-Puget Sound distinct population segment of bull trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound management unit. Portland, Oregon. 389 + xvii pp.

USFWS (U.S. Fish and Wildlife Service). 2008. Bull trout (*Salvelinus confluentus*) 5-year review: Summary and evaluation. U.S. Fish and Wildlife Service. Portland, Oregon. 55 pp.

WDFW (Washington State Department of Fish and Wildlife). 2004. Washington State salmonid stock inventory bull trout/ Dolly Varden. Washington State Department of Fish and Wildlife. Olympia, Washington.

Watson, G. and Toth, S. 1994. Limiting factors analysis for salmonid fish stocks in the Plum Creek habitat conservation plan (HCP) area. December 14, 1994 draft of fish limiting factors analysis.