HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Green River Wild Winter Steelhead Program
Species or Hatchery Stock:	Green River Wild Winter Steelhead (Soos Creek Hatchery) (*Oncorhynchus mykiss*)
Agency/Operator:	Washington Dept Fish & Wildlife
Watershed and Region:	Green River (Duwamish)/ Puget Sound
Date Submitted:	
Date Last Updated:	February 25, 2010

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SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Green River Wild Stock Winter Steelhead Program

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

State common and scientific names.

Green River (Duwamish) Winter Run Steelhead (*Oncorhynchus mykiss*).

Wild winter steelhead in the Green River (Duwamish) basin along with all populations that constitute the Puget Sound DPS (Distinct Population Segment) have been listed as "threatened" under the Endangered Species Act (71 FR 15666, March 29, 2006, 72 FR, No 91; Friday, May 11, 2007).

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.

Name (and title):	**Annette Hoffmann**, Region 4 Fish Program Manager **Doug Hatfield, Region 4 Hatchery Operations Manager**	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The Muckleshoot Indian Tribe (MIT), WDFW and participating organizations initiated this program in 2001 with rearing done mostly at Keta Creek Hatchery located at RM 1.0 on Crisp Creek (WRIA 09.0113), a right bank tributary of Green River (WRIA 09.0001) at RM 40.2. Since 2005, the program has been operated by WDFW totally from Soos Creek Hatchery. Other organizations involved with the startup plans and current participation in hook and line broodstock collection includes the South King County Chapter of Trout Unlimited, Puget Sound Anglers, and Green River Steelhead Trout Club

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

Soos Creek Hatchery activities are funded with General Fund, DJ, and PSRE funding sources, with a combined annual budget of approximately $548,104 (2007 budget). At full staffing levels, the Soos Creek Hatchery personnel consists of a Hatchery Specialist 4, a Hatchery Specialist 3, and two Fish Hatchery Specialist 2', and 9 months of temporary time. Total break out costs by species or program is not possible as all costs are generally rolled up as part of the overall operating budget. WDFW uses a figure of $3.50 to produce a pound of steelhead smolts (6.0 fish per lb.) applied to segregated steelhead programs in Puget Sound (J. Kerwin, WDFW pers. comm. 2007).

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The current release goal (2010) is 33,000 smolts (6.0 fish per pound (fpp)) which would equate to $19,250.00 per broodstock cycle (excluding marking and special ventral fin clips costs). The program is to be managed as a one year smolt (27,000) and a 2 year smolt (6,000) program at this time Also, additional costs such as hook and line effort to procure wild broodstock, usage of adult holding facilities such as new fiberglass circular tanks recently installed, and heating water (if needed) are not included at this time.

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

Broodstock Collection: Broodstock are captured by WDFW and Muckleshoot tribal staffs (hook and line) at several locations in the Middle Green River mostly from RMs 29.3 - 44.0. Depending on water flows, some broodstock capture may be possible at the Soos Creek Hatchery trap located on Big Soos Creek (09.0072). Returning hatchery adults from this program which can be identified by a combination fin clip (adipose + ventral fin) may be trapped at this location. Hatchery adults are not considered for broodstock and have been released upstream in 2006 & 2007. Under some scenarios, wild fish returning to this site may be considered for broodstock use by the Co-managers.

Spawning; Incubation; Rearing: All current activities are conducted at Soos Creek Hatchery, located on Big Soos Creek (09.0072) at RM 1.0, tributary to the Green River (09.0001) at RM 33.5.

Release: Fish are released from the Soos Creek Hatchery to Soos Creek.

1.6) Type of program.

Integrated conservation.

1.7) Purpose (Goal) of program.

This program started as an augmentation program to provide hatchery steelhead propagated from wild stock parents to augment tribal and sport harvest opportunities. With the recent listing of Puget Sound steelhead and the decline in the natural population of winter steelhead in the watershed, the program has become a conservation based recovery program.

1.8) Justification for the program.

With the recent listing of Puget Sound steelhead and the decline in the natural population of winter steelhead in the watershed, the program has become a conservation based recovery program.

This integrated steelhead program is one of the few ongoing in the Puget Sound DPS which consists mostly of segregated stock steelhead hatchery programs (HSRG Puget Sound Reviews 2002-2003). Continuing evaluation and monitoring of this program will be important given the long history of the Chambers “early” winter stock cultured in the Green River system. The program was initiated in response to poor survival trends in the Chambers stock which originated

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from South Tacoma Hatchery (now Lakewood Hatchery in WRIA 12) and continues being released from Soos Creek Hatchery and other locations in the Green River (See also Palmer Ponds/Green River Winter Steelhead HGMP). Chambers stock has experienced a precipitous decline in smolt survivals especially since the 1990's in this system as in several other systems in Puget Sound (WDFW Historical Database Files). Annual smolt-to-adult-returns of 3% - 7% during the 1970's and 1980's (See Table 1, Section 1.12) have declined to average contribution rates of < 1.0% with the Green River system averaging 0.72% for the past decade (1996-2006).

The Co-managers (Muckleshoot Indian Tribe and WDFW) initiated the wild broodstock program to initially evaluate the survival and harvest contribution in comparison with the Chambers stock program. The new program is being designed as a conservation and recovery program in response to the recent listing of Puget Sound steelhead.

Broodstock are collected by hook and line by staff from WDFW and the Muckleshoot Indian Tribe from the Green River with progeny reared to smolt stage and released from Soos Creek Hatchery. Smolts will be marked with a ventral fin clip (RV or LV) and adipose fin clip in order to be identified from the traditional Chambers stock program (adipose clip only). Releases will consist of a group of 27,000 one year smolts and a small 2 year smolt group (6,000) and they will be expected to meet WDFW Statewide Steelhead Interim Steelhead Rearing and Release Guidelines (2001). This will foster out-migration from the Green River system, minimizing residualism, competition and other effects on listed juveniles in the system. A majority of Soos Creek water used for the total rearing cycle is river water and with fish released from Soos Creek Hatchery, there may be high homing fidelity back to this location. Returning double clipped fish that may be trapped at the Soos Creek weir may be considered for broodstock as part of the new integrated conservation program.

1.9) List of program "Performance Standards".

(From NMFS *Artificial Propagation Performance Standards and Indicators*, October 24, 2000 Draft)

3.1 Legal mandates
3.2 Harvest
3.3 Conservation of natural spawning populations
3.4 Life History Characteristics
3.5 Genetic Characteristics
3.6 Research Activities
3.7 Operation of Artificial Production Facilities

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

1.10.1) "Performance Indicators" addressing benefits.

3.1.2 Program contributes to mitigation and treaty trust requirements.
- *Number of smolts released as applicable to juvenile supplementation goals.*
- *Number of adults returning as applicable to mitigation and treaty trust requirements.*
- *Number of adults returning to fulfill adult supplementation goals.*

3.1.3 Program addresses ESA responsibilities.
- *- HGMP has been submitted for current operations to be determined sufficient under Section 4(d), as applicable.*

3.2.1 Fish are produced and released in a manner enabling effective harvest.
- *Number of target fish caught by fishery.*
- *Number of non-target fish caught by fishery.*
- *Angler days by fishery.*
- *Escapement of target fish.*

3.2.2 Release groups sufficiently marked to assess impacts.
- *Marking rate by type in each group.*
- *Sampling rate by fishery.*
- *Sampling rate by collection of returning adults not harvested by selective fisheries.*
- *Number of marks by type documented by collection of returning adults not harvested by selective fisheries.*

3.3.1 Program contributes to an increasing number of spawners returning to natural spawning areas or does not impact the current number of spawners.
- *Sampling rate of number of spawners on spawning ground and at hatchery by age.*
- *Redd expansion or number of redds in production index areas (Carcass surveys)*
- *Spawner-recruit ratios*

3.3.2 Juvenile releases are sufficiently marked for evaluation.
- *Mark rates by type.*
- *Sampling of mark type and quality upon release.*
- *Mark recoveries for juveniles and adult returns.*
- *Mark rate.*

1.10.2) "Performance Indicators" addressing risks.

(e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases.").

3.4.1 Fish collected for broodstock are taken throughout the return in proportions to the run distribution.
- *Timing of broodstock collection is documented and compared to entire return.*
- *Age composition of broodstock is documented though scale collection of entire run at adult trap.*

3.4.2 Broodstock collection does not reduce potential juvenile production in natural areas.
- *Broodstock collection numbers are documented, and hatchery juvenile production will be documented on a yearly basis.*
- *Collection of broodstock methods will be adjusted (if needed) according to run size.*

3.4.3 Life history characteristics of artificially produced population do not diverge from natural population.
- *Life history characteristics of natural and endemic hatchery population are measured (age composition of smolts, smolt timing, size at smolting, smolt to adult return, adult sex*

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ratio, age of adult return, fecundity, length/weight at age of return, temporal and spatial spawning distribution of returning adults).

3.4.4 Annual release numbers do not exceed local, basin and migratory corridor capacities.

- *Annual release numbers of late winter endemic stock and their release locations and times documented.*
- *Annual release numbers of juveniles and release locations.*

3.5.1 Patterns of genetic variation with natural populations do not change appreciably.

- *Genetic composition of naturally and artificially propagated adults is monitored and compared to eliminate non-local stocks and compared each generation (endemic stock used only).*

3.5.2 Broodstock collection does not adversely affect the genetic diversity of the naturally spawning population.

- *Spawning escapement and composition documented.*
- *Timing of brood collection is documented.*

3.5.3 Artificially produced adults do not exceed appropriate proportion within the naturally spawning population.

- *Observed and estimated numbers of natural and endemic hatchery adults passing traps will be documented.*
- *Observed and estimated numbers endemic hatchery adults passed upstream for supplementation in Soos Creek or in other locations in the Green River system will be documented.*

3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

- - *Time, type and locations of hatchery releases are documented.*

3.5.5 Fully smolted juveniles are released from hatchery program.

- *Level of smoltification at release is documented.*
- *Size at release of fry plants is documented. (Prior HSRG indicated fingerling releases, is this still an option?)*

3.6.1 Artificial production program uses standard scientific procedures to evaluate aspects of the program.

- *Scientifically based experimental design, with measurable objectives and hypotheses.*

3.6.2 The program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving objectives.

- - *Monitoring and evaluation framework includes timelines.*
- - *Annual and final reports are produced.*

3.7.1 Artificial production facilities are operated in compliance with all applicable operational and fish health standards and protocols.

- - *Compliance with operational and fish health standards and protocols is documented in annual reports.*

3.7.2 Effluent from facilities will not detrimentally affect natural populations.

- *Discharge water complies with applicable water quality standards, and in this case is outside the basin where the natural population exists (except for acclimation time).*

3.7.3 Water withdrawals will not prevent access to spawning areas, affect spawning behavior of natural populations, or significantly impact juvenile rearing environment.

- *Water withdrawals are documented and for this program are out of target species basin, except for acclimation time at release*
- *NMFS Screening criteria is documented*
- *Adult passage at diversion point is documented.*

3.7.4 Releases do not result in introduction of pathogens into natural production areas.

- *Proposed releases will be Fish-Health-certified prior to release.*

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3.7.5 Carcass distribution for nutrient enhancement is in compliance with appropriate regulations.
- *Carcass and/or kelt distribution is documented for the target stream*
- *Compliance is documented*

3.7.6 Broodstock collection does not significantly impede passage or alter spatial/temporal distribution of natural population.
- *Temporal/spatial distribution of population during hook and line collection is documented.*

3.7.7 Weirs/traps do not result in significant stress/injury/mortality to natural population.
- *Mortality rates in traps are documented.*
- *Visual observations of fish delay periodically made.*
- *Hook and line procedures will not result in significant stress or injury to listed fish.*

3.7.8 Predation by artificially produced fish does not significantly reduce natural population.
- *Release information is documented and compared to natural population data.*
- *Majority of releases will occur downstream of juvenile rearing habitat.*

1.11) Expected size of program.

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

Up to 25 pairs (2009-10). More males may be collected in order to ensure that milt is available on a given spawn day to ensure at least 1:1 fertilization. Based on the future evaluation and research results, numbers released from this program may change based on management goals for the Green River system in the future (See also Section 1.16). Program to be modified beginning with the 2009-10 BY where approximately 27,000 will be raised to 1 year smolts and approximately 6,000 reared to 2+ year smolts.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Soos Creek Hatchery	27,000 1+ 6,000 2+

* Current goal. Co-Managers may adjust program size based on evaluation and research needs in the future.

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

Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most

recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

The original estimate of program performance was a smolt-to-adult survival of approximately 1% with an upper most goal of 5%. Based on a release of 33,000 smolts, approximately 330 adults at a one percent survival would be available with an upper most amount of 1,650 (5%). These ranges though, far exceed current survivals observed in the system. The most recent 12 year (1995–2006) adult contribution (Chambers winter stock) in the Green River system ranges from a low of 0.33% during the 1997/1998 season to a high of 1.30% in 1991/1992 with an average of 0.72% (See Green River/Palmer Ponds and Soos Creek Hatchery Winter Steelhead Program HGMP).

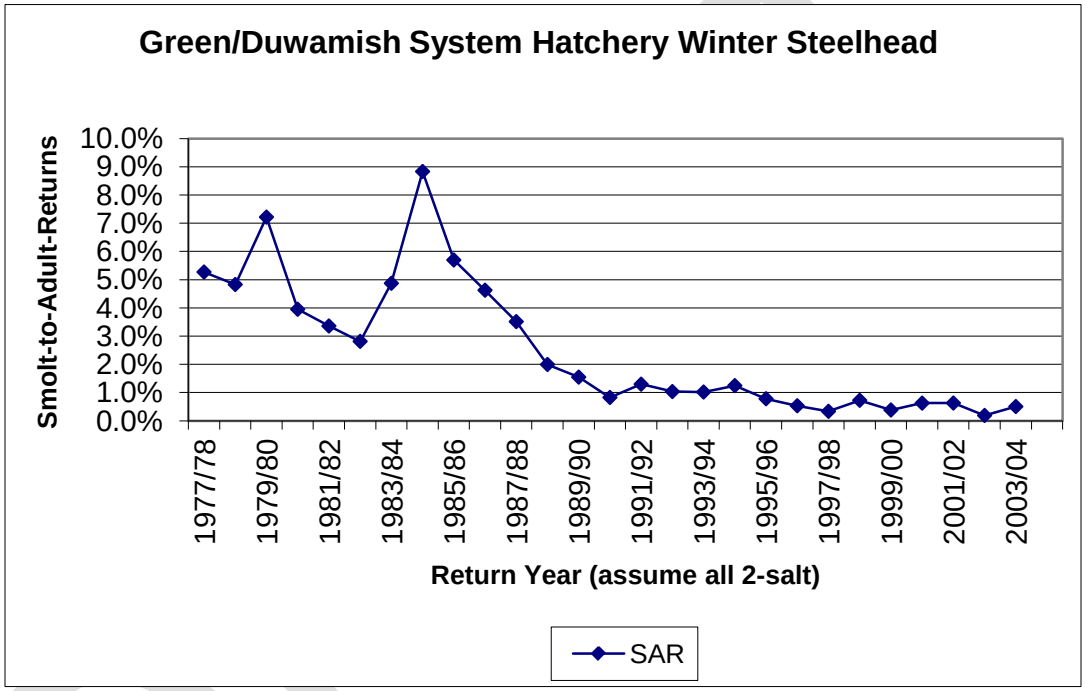

Figure 1. Trend of winter steelhead smolt (Chambers stock) contribution in the Green River system since the 1970's (WDFW Historical Database Files, Parrao, D.)

Using the most recent average (0.72%) may adult contribution rates closer to ~ 250 fish annually (minus harvest) with an upper most range of ~ 430 adults (1.3% high range). It is possible, that the double fin clip (AD + ventral) may also result in a reduced survival. Enough creel census studies have not been done at this time to differentiate later winter (February on) contributions between Chambers stock program (adipose fin clip only) and the new wild stock program with the ventral fin + adipose fin clip combinations (WDFW CRC Data). Current WDFW Sport Fishing Rules (2008/2009 edition) closes the selective fishery in the Green River from February 15th – 28th depending on river location which may preclude additional sport harvest opportunities. Tribal harvest numbers for these fish are not available at this time.

Recently, some hatchery fish have been trapped at the Soos Creek Hatchery weir (when flows allow) and are released upstream of the weir (**Table 2**). These may only represent partial hatchery contributions of this program. Returning adults in 2008 consisted of 2 year salt fish (2006 releases) and some 3 year salt fish (2005 releases). Based on 25 years of wild winter

steelhead data in the neighboring Green River System (WRIA 9), 2 salt (46.2%) and 3 salt (39.9%) components dominated age segments (Green River wild winter steelhead stock 1980–2005 data, T. Cropp 2006). Smaller age segments made up of jacks ~ 1 %, repeat spawners (~ 4%) and older age fish (4 salt ~ 4-5%) were monitored in that system. It is unknown how closely returning adults (released as one year hatchery smolts) will mirror or be different from those wild stock age profiles.

Table 1.12.1. Reported hatchery adults trapped at Soos Creek Hatchery Weir (WDFW Adult Escapement Reports).

Year	Number of Hatchery Adults Collected at Soos Creek Hatchery and Type Mark		
	AD + LV[1]	AD + RV[2]	AD[3]
2004	Na	Na	
2005	Na	Na	
2006	Na	Na	
2007*	6	6	
2008	11	33	9

* Partial counts only as the hatchery weir cannot be operated due to high water during some periods.
[1] ADLV mark indicates a 2005 (2004 BRD YR) smolt release.
[2] ADRV mark indicates a 2006 (2005 BRD YR) smolt release.
[3] 9 adults were adipose fin clipped only but returned during the February to May timeframe and are included in this data. This is because of a high level of AD fin clipped fish but missing ventral clips (~40%) were reported by staff for the 2006 year releases (BRD 2005).

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

The Muckleshoot Tribe and WDFW began this program co-operatively in 2001. Since 2005, the program has operated from Soos Creek Hatchery only.

1.14) Expected duration of program.

The Co-managers intent was for an evaluation of the program intended through at least 2011(with additional years, if needed), when 3-salt adults from the 2008 smolt release will have returned. A release of five years and results from those five years was needed by the Co-Managers in order to evaluate the program".

1.15) Watersheds targeted by program.

Include WRIA or similar stream identification number for desired watershed of return.

Duwamish/Green River (09.0001)

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

1.16.1) Brief Overview of Key Issues

Hatchery programs of both indigenous or non-local stock (Chambers or Skamania hatchery stocks) may negatively impact wild or listed salmonid in freshwater, nearshore estuary and marine environments by a number of issues including: hatchery abundance

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and densities, genetic impact (hybridization), competition, predation, hatchery diseases and hatchery facility impacts (i.e. water quality, traps, weirs and barriers). Endemic stock returning fish may have increased interaction with wild winter steelhead due to similar return timing potential. This program was started in order to monitor harvest contributions of a local stock program in comparison of the long used non-local stock (Chambers). The development of Chambers winter steelhead stock at South Tacoma Hatchery (WRIA 12) was used to augment the increasing consumptive sport recreational and tribal harvest demand in this system along with a majority of Puget Sound streams by the mid 1950's (et al. Crawford). All hatchery steelhead released in the basin are adipose clipped in order to provide a selective harvest in the Green River Basin including the endemic stock winter steelhead program (adipose fin clip plus ventral). The current selective fishery closes in this system Feb 15 – 28 (depending on river mile) and misses the opportunity to selectively harvest hatchery fish.

1.16.2) Potential Alternatives to the Current Program

The Statewide Steelhead Plan -Washington Department of Fish and Wildlife Statewide Steelhead Plan, Volume 1 – Statewide Policies, Strategies, and Actions, currently in Draft (Spring/Summer 2007), will address many of the issues and recommendations of the Puget Sound and WA Coast Hatchery Scientific Review Group (HSRG February 2002 and March 2003). Where current programs are found to be inconsistent with the Statewide or Sub-basin Watershed Plan goals, the Co-managers may choose to implement one or more of the following actions: 1) release steelhead juveniles from segregated programs only at locations where returning adults, in excess of harvest and broodstock needs, can be collected and removed from the system; 2) adjust the timing of broodstock collection and spawning, program size, release location, harvest rate in all fisheries, rearing practices affecting the rate of residualism or other factor to achieve an acceptable rate of gene flow; 3) eliminate the program; or 4) replace the segregated-stock program with an integrated program, which would require utilizing endemic fish for broodstock. The current program proposed in this HGMP is in the process of evaluating this option. Depending on the results, Co-Managers may be able to determine future hatchery stocks (local or non-local), to total numbers released and at what locations in the Green River Basin.

Alternative 1- Discontinue the wild broodstock program. This would eliminate removing wild listed steelhead from the Green River system from a program that has not been able to determine harvest or indirect adult supplementation benefits. This would eliminate potential hatchery smolts or returning adults from future usages in the system including future introductions above Howard Hansen Dam (RM-65).

Alternative 2- Switch to a conservation goal in response to any significant downward trend in the Green River wild steelhead status (currently "Healthy" 2002 WDFW **SaSI**). In 2008 and 2009, WDFW saw a precipitous decline in escapement.

1.16.3) Potential Reforms and Investments

Note: The reforms and investments have not been developed at this time. It is expected that individual hatchery programs in the basin will be consistent with recommendations and policies that are agreed upon by the Co-managers. Capital or facility upgrades and improvements to this program would be identified following these recommendations.

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

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

None. A Draft HGMP was developed in 2005 when the program was first intended to be reared entirely at Soos Creek Hatchery, but has not been submitted to NOAA Fisheries. This latest draft is an updated version of that original HGMP (K. Dimmitt, pers. comm. WDFW).

For USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.
WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions including hatchery operations. This agreement is for bull trout and pygmy rabbit but only would pertain to bull trout in Western Washington. These activities are on-going and yearly reports are compiled and submitted to USFWS. "The Department is authorized by USFWS for certain activities that may result in the take of bull trout including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities, and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys, presence/absence surveys, genetic tissue sampling, and habitat surveys for species other than bull trout." See also Bull Trout Addendum A (Section 15).

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

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

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

Green River (Duwamish) Winter Run Steelhead (*Oncorhynchus mykiss*).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

Green River Steelhead (*Oncorhynchus mykiss*):
A naturally producing summer run steelhead stock is recognized in this system by WDFW (**SaSI** 2002). This is believed to be natural production of non-native summer hatchery stock (Skamania origin) in the system.

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Duwamish/Green River/Summer-Fall Chinook (*Oncorhynchus tshawytscha*): The population is part of the Puget Sound ESU listed as threatened on March 24, 1999; threatened status reaffirmed on June 28, 2005 under the Endangered Species Act.

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 *(see definitions in "Attachment 1")*.

Green River Steelhead (*Oncorhynchus mykiss*):
Critical or viable population thresholds for Puget Sound steelhead have not been determined at this time. In the Green/Duwamish River Basin a native winter steelhead stock is part of the Puget Sound DPS listed as threatened under the ESA, 5/11/07 (72FR26722). A naturally producing summer run steelhead stock also is recognized in this system although considered to be of non-native origin (WDFW **SaSI** 2002). The Salmon and Steelhead Inventory (SaSI 2002), indicated the status of the winter steelhead population as "Healthy" because spawner escapements have generally varied within a range of 25% above or below the escapement goal of 2,000 wild spawners.

Duwamish/Green River/Summer-Fall Chinook (*Oncorhynchus tshawytscha*): Preliminary critical and viable population thresholds under ESA have been determined by the Co-manager's (Puget Sound) Technical Review Team (PSTRT) to be at 1,800 and 5,800, respectively (PSTRT 2003). NOAA Fisheries thresholds are 835 and 5,523, respectively.

- 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.*

Green River (Duwamish) Steelhead *(Oncorhynchus mykiss):*
WDFW smolt monitoring activity occurs on this system. In 2006, 16,748 wild molts were estimated (WDFW 2006 Juvenile Salmonid Production Evaluation Report Green River, Dungeness River and Cedar Creek, 2006). Green River wild winter steelhead recruit per spawner (R/S) data for 1st year returning adult spawners, indicate a mean R/S of 1.42 (WDFW Regional Data, Cropp et al. 2006). The last ten years mean R/S is approximately 1.10. Data has been calculated from brood years 1977 up to 999 which was the last year with completed age 3 – age 6 recruits calculated. In years of lower escapements, (900 – 1,300) R/S values have been calculated at 2.336, while higher escapements (2,000 – 3,000) R/S values have ranged from 0.868 – 1.185 (WDFW Fish Management Region 4 Data, 2006).

Small numbers of wild summer steelhead are reported in WDFW harvest reports with recent summer steelhead regulations allowing retention of one wild summer fish annually on the Green/Duwamish System.

Duwamish/Green River/Summer-Fall Chinook *(Oncorhynchus tshawytscha):* On average (return years 1987-98), each Green River natural spawner (an aggregate of natural-origin and F1 hatchery-origin adults) produces 2.33 adults returning to Washington waters (WDFW Chinook Run-reconstruction Tables). Productivity for the natural-origin population only is unknown at this time. The high annual proportion of F1 hatchery-origin fish escaping to spawn naturally confounds the ability to determine the productivity of the natural proportion. R/S of the system for the five year period from 1994-1998 was at replacement or slightly above - 1.00 1.05 (Data

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from TRT A&P Tables 4/15/05, Shared Strategy). The most recent five year period (2000 –2004) has not been computed for the R/S values, but the geometric mean escapement has increased during that same time from 7,060 to a mean of 13,172 indicating a potential R/S approaching 2.0 for that time period.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available)***.**

Green River (Duwamish) Steelhead *(Oncorhynchus mykiss):*
Since the late 1970's, wild winter steelhead escapement has ranged from a low of 944 (1991) to a high of 2,633 (1996) with an average of approximately 1,800 fish for more than 25 years (WDFW Fish Management Region 4 Data, T. Cropp, 2006). More recently, escapements into the Green River have exceeded the goal of 2,000 in 5 of the last 12 years (1994 – 2005) with a range of 1,103 to 2,691. The 12-year average escapement is 1,961 (**SaSI** 2002). The PSBRT indicates a 25 year (1980-2004) geometric mean escapement of 1,802 (Puget Sound Steelhead Biological Review Team, 2005 Status Review Update for Puget Sound Steelhead, July 26, 2005). Summer steelhead harvest data indicates approximately 12 – 80 wild summer steelhead have been reported annually since 1990 (WDFW Historical Data base records).

Table 3. Green (Duwamish) River Wild Winter Escapement of First-time Returning Adults from 1980 to the present (WDFW Fish Management Region 4 Data, T. Cropp).

Return Year	Escapement*	Return YR	Escapement*	Return YR	Escapement*
1980/81	2,809	1991/92	1,942	2002/03	1,612
1981/82	3,577	1992/93	1,722	2003/04	2,359
1982/83	1,526	1993/94	1,821	2004/05	1,298
1983/84	2,118	1994/95	2,300	2005/06	1,976
1984/85	2,286	1995/96	2,633	2006/07	1,452
1985/86	2,778	1996/97	1,887	2007/08	833
1986/87	1,685	1997/98	2,362	2008/09	
1987/88	2,378	1998/99	2,574		
1988/89	1,916	1999/00	1,705		
1989/90	1,484	2000/01	1,402		
1990/91	944	2001/02	1,065		

*Data did not include ~ 20 - 40 fish used yearly as part of Keta Creek Hatchery program (2002 – 2004).

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Duwamish/Green River/Summer-Fall Chinook (*Oncorhynchus tshawytscha*): Escapement for more than twenty five years from **SaSI** Database 2007 (Table 4). Average escapement during the total period is 8,192, while the most recent twelve year escapement average is 11,122.

Table 4. Green (Duwamish) River Chinook Escapement from 1980 to the present.

Return Year	Escapement	Return YR	Escapement	Return YR	Escapement
1980	7,243	1991	10,548	2002	7,043*
1981	3,606	1992	5,267	2003	5,501
1982	1,890	1993	2,476	2004	7,317
1983	3,679	1994	4,078	2005	2,126
1984	3,353	1995	7,939	2006	5,520
1985	2,908	1996	6,026	2007	3,933
1986	4,792	1997	11,800	2008	5,735
1987	10,334	1998	9,115	2009	665
1988	7,994	1999	13,173		
1989	11,512	2000	10,526		
1990	8,035	2001	21,402		

* - Beginning in return year 2002 and continuing through 2009, these are the most recent co-manager agreed to escapement numbers for the Green River.

- 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.

Green River (Duwamish) Steelhead *(Oncorhynchus mykiss):*
Escapement is based on redd expansion surveys counted after March of the year (**SaSI** 2007). There is no breakdown of redds created prior to this time period. Preliminary conclusions by the TRT indicates that estimates of hatchery steelhead escaping to spawn naturally (in total streams) is less than 15% although some independent streams (Tahuya River and Morse Creek) up to 50% of the escapement is of hatchery fish (Puget Sound Steelhead Biological Review Team. 2005 Status Review Update for Puget Sound Steelhead, July 26, 2005). Due to timing differences between early Chambers Regional Pool eggs and a majority of the existing wild winter or summer stocks (being later February – June), interaction on the spawning grounds is unknown.

Duwamish/Green River/Summer-Fall Chinook (*Oncorhynchus tshawytscha*): Several documents are available for estimates of hatchery spawners in this system. For the most recent 5 year trend (Geometric Mean from 2000-2004), Green River total escapement has averaged 13,172 of which 34% of the escapement has been determine to be hatchery origin fish (Review conclusions by the Technical Recovery Team (TRT) and the Shared Strategy Interagency Work Group. May 2005).

A ratio of Soos Creek hatchery-origin adults to Newaukum Creek natural spawners averaged 23.3% in 9 years between 1989 and 1997 where sample rates averaged 30% per year (WDFW coded-wire tag data). From 1989 – 2004, pHOS was reported to average 52%. For 2004, specifically 66% with 2005 reported as 53% with Newaukum Creek being 70% (2005 Puget Sound Chinook Management Plan).

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2.2.3) 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 (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.

Hatchery Activities (Direct Takes)

Broodstock Collection:
The total annual goal (maximum of 50 (25 pair)) will be collected by hook and line. Wild fish arriving at Soos Creek Hatchery weir may be also be considered by the Co-managers. The broodstock portion represents ~3% of the average spawner escapement in this system (1,626 for the last 10 years (1999-2008)). In 2007/08, spawner escapement fell to 833, with the broodstock collection representing ~ 3.8% of total escapement. Mortality may occur during collection although fishing techniques, adult netting materials, holding protocols and transfer from boat to tanker trucks are under the area biologist supervision and implemented to maximize survival of listed fish.

Holding, Spawning, Rearing to Release:
Holding, spawning, incubation, rearing and eventual release of listed fish will take approximately 15 months (March through the following May) with 1+ smolts, but the new 2+ program will add approximately 12 months to rearing. New 16' fiberglass diameter circular ponds with bird and shade covers are available for use at Soos Creek Hatchery starting for the 2009 BRD. Prior to this time, intermediate deep concrete receptacles in the hatchery building were used to hold adults. Broodstock holding, spawning mortalities were reported as 6 in 2005, 1 in 2006, 6 in 2007, and 2 in 2008. Fish culture activities from handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding and any transport may result in some mortality as well as some diseases.

The egg take goal is 48,000 green eggs. Mortality is projected to be equally divided for egg/fry survival (~7,300) and total loss from fingerling through smolt rearing stages (7,300). Total annual survival from green egg to smolt release stage is projected to be ~ 70% (for 1+smolts) with a loss for the 2+ smolts being less than 7%.

Monitoring and Evaluation:
All smolts will be marked in order to distinguish the smolts upon return as adults. An adipose/ventral clipped fin combination will be used. Also, DNA samples of wild escapement, and some carcass surveys have been collected since 2002 by the Co-managers. These may be used to determine future pedigrees and evaluate some contributions of this supplementation program. Multi agency ongoing or proposed future research proposals may include or request usage of hatchery produced fish for several studies such as radio telemetry studies and DNA sampling. These may be for hatchery fish (fry, fingerlings and yearlings) from both integrated (wild stock) hatchery smolts and segregated (Chambers or Skamania) hatchery stocks. Fish from segregated stock hatchery programs are not included in current steelhead listings and therefore would only need to be agreed upon by the co-managers. Hatchery fish of integrated stock

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programs utilized in these studies are not lethal takes but may need to be communicated on a case by case basis with NOAA staff.

Kelt Re-conditioning: Some broodstock may be kelt reconditioned for a short time prior to release back to stream. Live-spawned females would be prioritized over males for kelt-reconditioning. This because several publications indicate females (10.2%) may repeat spawn in greater frequency than males in Kalama River studies (Howell et al. 1985), and re-capture studies indicating greater female survivals (88-91.3%) over males (Branstetter, Whiteaker, and Hatch, 2006). If this occurs, a pilot project may be implemented by the Co-managers and monitored with various tags or markings.

Fish Health Activities (Viral Sampling):
Current Co-manager disease policy guidelines indicate a minimum of 60 fish kidney/spleen samples for steelhead hatchery programs (Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State Policy, 1998 and Draft Version 2006). The total minimal lethal sampling goal of 60 exceeds the number of broodstock that would be used in one year (50). A combination of wild fish used as broodstock along with hatchery adults collected from the Soos Creek Hatchery weir may be used in order to fulfill virology sampling needs. A portion of swim-up fry (up to 10) may be used in lieu of any un-sampled (lethal) females. All mortalities will be sampled. Ovarian fluid samples are taken from all egg takes. Continuing update protocols and monitoring will be undertaken by the Area Fish Pathologist, if needed.

Operation of Hatchery Facilities:
All operations at Soos Creek Hatchery including water withdrawal, screening, trapping, pollution abatement, and disease control and fish culture practices will be operated within state policy guidelines. Environmental monitoring is conducted at WDFW hatcheries to ensure operation under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE) WAG - 1052. Monitoring parameters include total suspended solids, settable solids, in-hatchery water temperatures and in-hatchery dissolved oxygen. Effluent at outfall areas is rapidly diluted with main stem flows and operation is within permitted guidelines. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Water rights are formalized through DOE trust water right #S2-24939 and monitoring and measurement of water usage is reported in monthly NPDES reports. No loss to listed fish is known at this time from facility effects.

Releases of hatchery fish (Indirect Impacts):
Indirect takes from hatchery releases such as predation and competition is highly uncertain and is dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition). Although an HGMP may discuss our current understanding of these effects, it is not feasible to determine listed take from indirect impacts (genetic introgression, density effects, disease, competition, predation etc.).

Hatchery Production/Density-Dependent Effects:
Hatcheries may release numbers of fish that can exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. It is unknown if the 33,000 fish released would result in density problem in the system. Releases will be closely monitored to meet smolt condition guidelines per rearing and release parameters. The location of the release site is below significant portions of listed and fish productive habitat. Releases will be

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closely monitored for smolting behavior, in order to foster rapid emigration upon release. These parameters will be met as outlined in the Statewide Steelhead Interim Steelhead Rearing and Release Guidelines (2001). As this integrated program attempts to rear one year and two year smolts, releasing fish not meeting the release guidelines will be determined by the Co-managers.

Genetic Introgression:
The programs proportionate natural influence (PNI) will meet or exceed gene flow (hatchery to wild) guidelines established for integrated stock programs (Hatchery Scientific Review Group – HSRG Technical Discussion Paper #1: Integrated Hatchery Programs June 21, 2004). This includes the 100% usage of wild fish for broodstock (pNOB) resulting in PNIs of > .70 (pHOS would be calculated from the performance of the current Green River winter steelhead contribution levels). The acclimated release site from Soos Creek Hatchery may congregate hatchery fish in the Soos Creek confluence area with the Green River (RM 33.5) rather than distributing fish up to Tacoma Power's Water Diversion Dam (~RM 61.5).

Competition in the watershed, nearshore estuary and ocean:
Juvenile salmon and steelhead, of both natural and hatchery origin, rear for varying lengths of time in the estuaries and pre-estuaries transitional zones before moving out to sea. The intensity and magnitude of competition in the area depends on location and duration of estuarine residence for the various species of fish (Simenstad et al. 1992). Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles per day. Steelhead smolts released on-station may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). In the transitional riverine to lower river nearshore estuary environments it was found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead were 22, 18, 17, and 35 RKm/d, respectively in the Lower Columbia estuary (Dawley et al. 1984). More recent radio acoustical telemetry studies in the Green River indicate steelhead smolt travel times of 10 - 12 days from the Middle Green to the estuary, a distance of 32 - 64 river miles (Puget Sound Telemetry Study Draft Report – Green River 2006 Results). Once in the ocean, rearing conditions are characterized as to dynamic to access impact although fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in near shore areas affected by upwelling (Chapman and Witty 1993). However, very little information is available on either subject. To date, research has not demonstrated that hatchery and naturally spawning salmonids compete in the ocean (Williams, 1997).

Predation:
Steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released).

Several studies have been done on this subject for listed Chinook. No studies specific to listed steelhead are available. The "33% of body length" criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994). Accumulated studies from the Upper Columbia and Puget Sound listed below (Table 5) may indicate a level of risk to listed Chinook. In a recently published report by WDFW, extremely small numbers of predation by hatchery steelhead on listed Chinook were observed from several rivers including the Green

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River (WRIA 9), Deschutes River (WRIA 13), Coweeman River and the Kalama River in WRIA 27 (Sharpe et al. 2008).

Table 6. Review of hatchery steelhead predation studies on wild Chinook fry.

Location	Year	HSH Examined		Chinook in Guts		Predation Rate		Est. Chinook Eaten by HSH Population		Proportion of prey population consumed		Methods
		Before June 1	After June 1	Before June 1	After June 1	Before June 1	After June 1	Before June 1	After June 1	Before June 1	After June 1	
Lower Snake	1992-1993	65	611	0	0	0.0000	0.0000					Screw/Electro
(Imaha & Grand Ronde)	1993-1994		358		0		0.0000					Electrofishing
	1994		175		1		0.0057					Electrofishing
Upper Salmon River	1992	6762		7		0.0010		7				Hook & Line/ Electro
Lower Snake (Tucannon)	1992	1067	671	1	2	0.0009	0.0030	216	240	0.39	0.43	Hook & Line
Yakima												
NF Teanaway /Jack Creek	1992		55	0	0		0.0000					Electrofishing
NF Teanaway	1993	31	28	0	0	0.0000	0.0000					Hook & Line
Lewis	1995-1996	74		1		0.0135						Seining
	1997	100	10	2	1	0.0200	0.1000					Seining
	1998	3	45	0	54	0.0000	1.2000					Seining
Elochoman	1999		221		1		0.0045					Hook & Line
	2000		45		1		0.0222					Hook & Line
Kalama River	2002	266		0		0.0000						Screw
Deschutes	2002	29		0		0.0000						Screw
Green River	2002	398		0		0.0000						Screw
Chehalis River	2002	35		0		0.0000						Screw
Skagit River	2002	4	2	0	0	0.0000	0.0000					Screw
Cedar River	1983-1985	18		0		0.0000						Electrofishing

Monitoring: Annual smolt monitoring and escapement methodology including redd expansion surveys, live and dead spawner counts are conducted by WDFW in the Green River system. These activities are indirect to the HGMP and not covered as "take" in this document. If, in the future, the Co-managers implement a kelt reconditioning and release study, some visual tag or markings may be employed. This "take" may be included in future HGMP versions for this program. As part of ongoing Puget Sound acoustic telemetry studies, the Green River Hatchery (Chambers stock) wild parental hatchery smolts and wild smolts were added to the acoustical studies in 2006. Wild smolts are captured in downstream smolt trapping activities or by hook and line so therefore is not in direct association with this hatchery program. Hatchery fish of Chambers origin and some from the Green River wild winter program may be used as part of the on-going telemetry studies Results from the research above and below Howard Hansen Dam (HHD), along with distribution patterns downriver, through nearshore and marine stations will be of value to current and future programs (Puget Sound Telemetry Study Draft Report – Green River 2006 Results).

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

Since inception in 2002, Muckleshoot Tribe and WDFW broodstock collection and lethal takes for this program (Table 6). See also Take Table 1 for loss of eggs and juvenile fish.

Take 6. Disposition of fish collected for broodstock since 2004.

Brood Year	Total Collected	Lethal Spawn/Kidney Spleen Virology		Pond Mortality	
		♀	♂	♀	♂
2002	Na	Na	Na		
2003	Na	Na	Na		
2004	40	12	13	3	2
2005	24	9	Na		
2006	43	10	11	1	
2007	39	15	18	6	
2008	29	5	6		2
2009	6	2	1		3

Na – Information source not available or recorded WDFW Databases.
NOTE – Total disposition of fish numbers may or may not add up to number collected. Number collected may be estimates and fish spawned may include live spawned and those returned back to stream.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).
Complete the appended "take table" (Table 1) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.

See Appendix Table 1. See "take" table at the end of the document. Up to 50 adults will be taken with a goal of 25 females and 25 males.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
(e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish.")

Methods to collect broodstock (hook and line) have had capture, handling and holding protocols in place since the inception of the initial program in 2002. These protocols and all other takes described in this HGMP will be reviewed annually by the Co-Managers in consultation with NOAA Fisheries in order to minimize "take" of listed fish.

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SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies. *(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").*

Shared Strategy Regional Salmon Recovery Plan
The Puget Sound Salmon Board coordinates recovery planning in Puget Sound with funding from the Washington State Governor's Salmon Recovery Office. Shared Strategy leads the development of the Puget Sound Chinook Salmon, Hood Canal Summer Chum and Bull Trout Recovery Plan (Shared Strategy, January 19, 2007). Several action and restoration efforts will be of multi-species benefit including listed steelhead in the Puget Sound DPS (Distinct Population Segment) listed as "threatened" under the Endangered Species Act (71 FR 15666, March 29, 2006, 72 FR, No 91; Friday, May 11, 2007). A web site link to the NMFS webpage describing the plan is located at http://www.sharedsalmonstrategy.org/plan/toc.htm

Washington State Hatchery Programs
WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements in order to operate. The following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations: *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington*. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

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

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

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

WDFW Steelhead Rearing Guidelines. Details rearing and release guidelines and parameters statewide (July 31, 2001). *Fish Health Policy of the Co-managers of Washington State*. This policy designates zones limiting the spread of fish pathogens between watersheds, thereby further limiting the transfer of eggs and fish in Puget Sound that are not indigenous to the regions

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(WDFW, NWIFC 1998 and Updated for 2006). *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.

Washington State Steelhead Management Plan (SSMP)
The purpose of this document is to provide a framework of policies, strategies, and actions that will lead to achievement of the following goal for the steelhead stocks and fisheries of Washington (Washington Department of Fish and Wildlife Statewide Steelhead Management Plan: Statewide Policies, Strategies, and Actions February 29, 2008). Artificial production program will be implemented as a component of a comprehensive habitat, hydro, harvest, and hatchery strategy, and by assuring artificial production programs meet the following characteristics:

Conservation Programs. Artificial programs implemented with a conservation objective (Green River wild winter steelhead) shall have a net aggregate benefit to the diversity, spatial structure, productivity, and abundance of the target wild stock.

Harvest Programs. Artificial production programs implemented to enhance harvest opportunities shall provide fishery benefits while allowing watershed specific goals for the diversity, spatial structure, productivity, and abundance of wild stocks to be met.

Regional Steelhead Management Plans (RMPs)
To minimize potential conflict, and to promote effective and efficient management of fisheries resources that are subject to both state and tribal management, the Department and tribes have developed a cooperative management approach to exercise their respective authorities and to achieve our shared conservation objectives. This cooperative management will be reflected in the individual regional management and watershed level plans (RMPs) with the respective tribes. Regional Steelhead Management Plans in development for all state steelhead ESUs (including the Puget Sound DPS) will be consistent with the SSMP. The local plan generally seeks to recover to VSP criteria, de-list PS steelhead, and provide consistent future harvest opportunity. A DRAFT Snohomish/Stillaguamish System RMP (2008 versions) has been provided as a template for other watersheds making up current Puget Sound steelhead listed populations. At this time, however, all specific populations and technical recovery goals have not been identified by the PSTRT.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

The Muckleshoot Indian Tribe (MIT) and WDFW initiated this program cooperatively in 2001-02 with segments of rearing at Keta Creek Hatchery and Soos Creek Hatchery. Since 2005, the program has been housed entirely at Soos Creek Hatchery.

Green River integrated winter steelhead production level is 33,000 smolts per year as detailed in the WDFW Future Brood Document (2008). The Future Brood Document (FBD) is a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30). The FBD is coordinated between WDFW, the Northwest Indian Fisheries Commission (NWIFC) representing Puget Sound and

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coastal treaty tribes, eastern Washington treaty tribes, and Federal fish hatcheries. Hatchery production by volunteers, schools, and Regional Fisheries Enhancement Groups are represented by WDFW.

WDFW hatcheries operates under *U.S. v Washington* that provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs.

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

Current Puget Sound selective-fishing rules requiring the release of all wild, unmarked steelhead began in the 1990s allowing retention of only hatchery produced adipose-fin clipped fish. This has reduced wild steelhead harvest statewide to approximately 1% of the catch. Tribal harvest figures which cannot distinguish between wild or hatchery steelhead have been much reduced on most rivers since 1995. The winter steelhead selective sport season ends by the end of February minimizing interaction with most of the wild winter stock. This selective fishery regulation (adipose-fin clip only) is in effect for the winter run steelhead in the Green River. Prior to June of 2010 one wild summer steelhead was allowed annually under special retention rules (WDFW Fishing in Washington Regulations 2008/2009). This was due to the non-native origin (Skamania summer stock) of any naturally occurring summer steelhead in the system (**SaSI** 2002).

Past practices focused on producing harvestable hatchery stocks, whose run timing is sufficiently earlier than wild stocks to allow for harvest with minimal impact to wild stocks. Returns from this integrated program will closely mirror the later timing of the wild winter-run.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.

The Co-managers (Muckleshoot Indian Tribe and WDFW) initiated the wild broodstock program to initially evaluate the survival and harvest contribution in comparison with the Chambers stock program. The new program is being designed as a conservation and recovery program in response to the recent listing of Puget Sound steelhead.

3.4) Relationship to habitat protection and recovery strategies.

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

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Steelhead programs are included as one of approximately 40 WDFW-managed plans under the Co-manager's Non-Chinook Resource Management Plan (RMP) for the Puget Sound region. In response to the listing of the Puget Sound Steelhead DPS by NOAA Fisheries Service (National Marine Fisheries Service, May 2007), WDFW's Statewide Steelhead Management Plan (Statewide Steelhead Management Plan: Statewide Policies, Strategies, and Actions February 29, 2008) and specific watershed basin Resource Management Plans (RMPs) will be developed with the Co-Managers. The Washington Department of Fish and Wildlife *Statewide Steelhead Management Plan*: *Statewide Policies, Strategies, and Actions* (February 29, 2008) was adopted by the Washington Fish and Wildlife Commission on March 8, 2008.

Several citizen based groups in conjunction with local governments work on habitat actions to benefit both listed and non-listed stock in the system including the Mid Puget Sound Regional Enhancement Group (RFEG) and the Lead Entity for the Green River/Duwamish River watershed in King County (WRIA 9). Funding for several key identified actions has been bolstered by the Salmon Recovery Funding Board (SRFB), which was created by the Legislature in 1999. Along with Shared Strategy for Salmon Recovery, all are collaborative efforts to protect and restore salmon runs across Puget Sound.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

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

Hatchery steelhead smolts can be preyed upon through the entire migration corridor in the freshwater watershed and throughout the main Green River/Duwamish River, estuary and in marine waters. Other salmonids or introduced spiny rays – smallmouth (*Micropterus dolomieu*) and largemouth *(Micropterus salmoides)* may prey on steelhead smolts as well as avian predators, including terns (*genus Sterna and several sub-species*) , gulls (*genus Larus and several sub-species*), mergansers (*Mergus merganser*), double crested cormorants *(Phalacrocorax auritus)*, belted kingfishers *(Ceryle alcyon)*, great blue herons *(Ardea herodias)* and night herons *(Nycticorax violaceus)*. Mammals that can take a heavy toll on migrating smolts and returning adults include: mink (*Mustela vison)*, river otters (*Lutra canadensis*), harbor seals (*Phoca vitulina*), Stellar sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*)and Orcas *(Orcinas orca)*

(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
- Steelhead
- Bull trout

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

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

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

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

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SECTION 4. WATER SOURCE

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

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

Soos Creek Hatchery is supplied by surface water from Soos Creek. Water is withdrawn via 4 pumps at the hatchery site. Pumps produce 13,500 gallons per minute (gpm). In addition, a small spring water supply (50 gpm) can be utilized in the incubation building.

Although surface water is used throughout the entire hatchery program and provides a strong homing advantage, utilizing the only domestic spring water source may improve adult holding (fish heath) conditions. With the installation of two 16' circular ponds with access to this spring water, the adult holding conditions have been improved.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

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

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

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

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SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

Hook and line collection of steelhead broodstock will take place between late February and mid-April. They will also be trapped at Soos Creek in a 10' X 12' box style trap with a "v" entrance. The trap is checked daily and fish are sorted and passed upstream. Many years high water causes the trap to be inoperable.

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

Tribal, WDFW and, if needed, a local sports group will be fishing with hook-and-line from boats on the Green River. Captured fish will/have be/been placed in 6-8" PVC holding tubes suspended under water from the side of the boats until they reach a specified take-out point, where a 1000 gallon tanker or smaller (300 gallon) truck from the hatchery meets them. Fish are moved from the tubes into the tank, which contains a 0.5% salt solution for mild sedation during transport to the Soos Creek hatchery.

5.3) Broodstock holding and spawning facilities.

All adult steelhead are held in a series of 3' X 3' X 16' fiberglass rearing troughs fed with either Soos Creek or a domestic spring water source. Fish are crowded and sorted manually. Adults are spawned inside the hatchery building. In 2008, 2 new 16' circular fiberglass tanks were installed on the grounds. It has been determined that these will be utilized for the steelhead (broodstock adults or juvenile rearing receptacles) program.

5.4) Incubation facilities.

Eggs, after fertilization, are placed into shallow trough baskets at 25,000 eggs per basket. There is the capability to add heated water in addition to the Soos Creek surface water. After the eyed stage and dead eggs removed, they are placed back into the shallow trough baskets at 15,000 eggs per basket.

5.5) Rearing facilities.

After fry have buttoned up, they are transferred to fiberglass troughs for initial feeding at 25,000 per trough. For final rearing, the fish are moved outside to concrete raceways that are 10' X 80' X 4' or to the 16' circular tanks.

5.6) Acclimation/release facilities.

The steelhead are reared/acclimated on surface water (Soos Creek) or spring water, if warranted, and released.

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

High water can destroy the fish collection rack and lead to an inability to trap and sort adults at return. This has not led to mortality.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.
(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

At Soos Creek, alarm systems are in place and personnel are on 24-hour standby to reduce the risk of catastrophic loss of the propagated population. Fish rearing is conducted in compliance with the Co-managers Fish Health Policy (1998, Updated for 2006). Adherence to artificial propagation, sanitation and disease control practices defined in the policy reduced the risk of fish disease pathogen transfer to listed salmonids.

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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.

Broodstock are obtained by hook-and-line from the Green River between river miles 29.3 and 44. Only unmarked, wild steelhead representing timing and spatial distribution of true wild stock would be considered by the technical team for broodstock, if needed.

6.2) Supporting information.

6.2.1) History.

Past and existing segregated hatchery programs:
The non-local winter stock (Chambers) has been used to supply consumptive uses in this system as in several Puget Sound systems for decades. Development of the Chambers Creek winter stock at South Tacoma Hatchery in the 1940s and 1950's led to the establishment of the early winter run derivatives used at many Puget Sound stations including Green River Hatchery in the mid-1950's (Crawford 1979). Chambers stock was developed as an early timed stock that predominantly provided harvest of returning adults during the early winter months from November – January (Crawford 1979).

Integrated Project in the Green River:
The wild stock winter steelhead program has been a relatively new program.

6.2.2) Annual size.

The proposed collection of 50 adult steelhead for broodstock represents a small portion of the average amount of wild spawners in the Green River although critical or viable thresholds have not been determined for any steelhead populations in the DPS. The run size for the Green River natural-origin winter steelhead has averaged 1,626 for the last 10 years (1999-2008). Stock status was rated as **Healthy** in 2002 because spawner escapements have generally varied within a range of 25% above or below the escapement goal of 2,000 wild spawners (**SaSI** 2002). Average spawner escapement has met this level from 2002 to the most recent year (2006) of escapement data (WDFW **SaSI** DataBase 2007). For 2007 and 2008, the escapements have been 1,452 and 833, respectively.

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

The Green River wild winter steelhead program will use 100% wild broodstock. Returning hatchery fish will not be considered for broodstock use.

6.2.4) Genetic or ecological differences.

Broodstock will be wild natural-origin adults representative of the historical genetic structure of the natural population. Genetic samples (fin clips or punches) have been collected from hatchery and natural-origin winter steelhead in the Green River basin and other populations in the Puget Sound DPS. Broodstock DNA sampling began with fish taken to Keta Creek Hatchery (Muckleshoot Tribe) in 2002.

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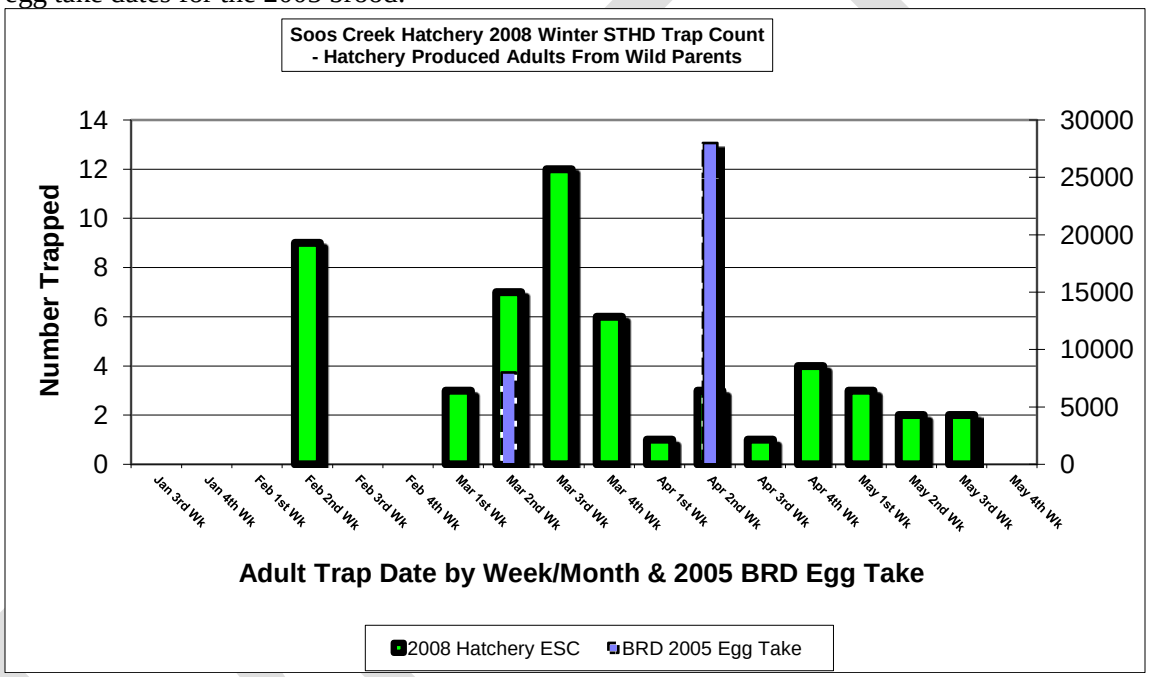
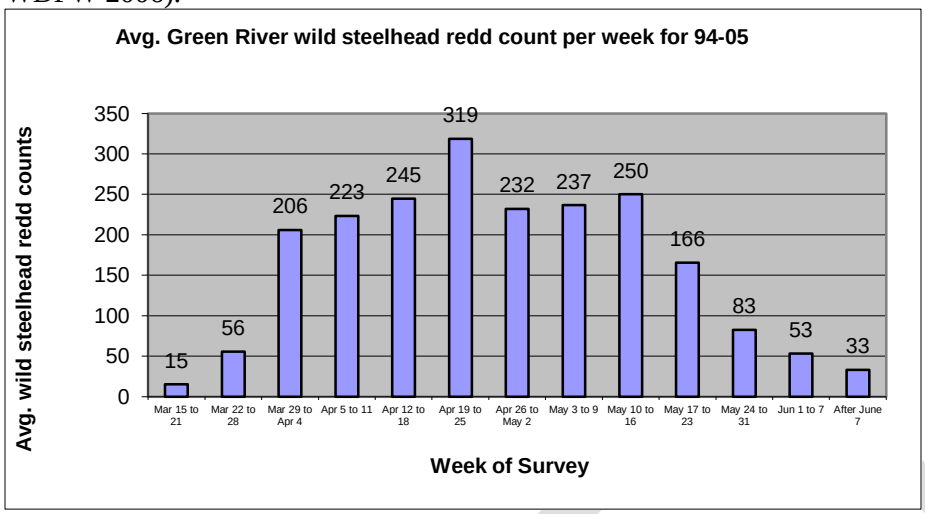
Adults returning later in the winter (March on) should be representative of the integrated hatchery program and will be monitored in regards to the original brood egg take dates (Table 7). In 2007, 6 LV fish returned to the Soos Creek Hatchery weir indicating a 2 salt return from 2005 plants with 6 RV fish counted from 2006 indicating a one year salt return. In 2008 when the trap was operable through the year, 33 hatchery fish (age 1.2) and 11 (age 1.3) returned. An additional 9 fish with an adipose only fin clip were trapped and based upon the timeframe and a significant missed ventral clip rate (2006 brood), were identified also as returning fish. In comparison, Green River wild winter steelhead age profiles based on 25 years of data from that system are repeat spawners: ~ 4.6%, 3 yr (2.1); ~ 6.1%, 4 yr age (2.2); ~ 46.2%, 5 yr age (2.3) and 3.2% 6 yr age (2.4). In 2007, all fish were trapped from February 15th to March 24th while in 2008 when the trap was operable throughout the entire time period fish were trapped from February 9th to May 14.

Figure 6.2.4.1. Weekly collection (ESC) of winter steelhead to Soos Creek Hatchery in 2008 and egg take dates for the 2005 brood.



Indigenous wild steelhead are genetically and behaviorally distinct from the hatchery winter steelhead traditionally stocked as judged by allozyme methods, run timing and spawn timing in this system (Phelps 1994). Early hatchery winter steelhead are Chambers (via several regional egg pools) stock successfully returning back to the hatchery. Broodstock will be wild adults from the population in the Green River and reflect as much wild timing as possible (Table 8).

Figure 6.2.4.2. Wild Steelhead Redd Construction (Data provided by T. Cropp and S. Foley, WDFW 2006).



6.2.5) Reasons for choosing.

Describe any special traits or characteristics for which broodstock was selected.

Current winter steelhead stocks were developed from early timed Chambers Creek derivatives and do not represent the historical wild stock (Crawford 1979). Although the early non-local stock is perpetuated in the system, significant wild winter steelhead return in this system (**SaSI** 2002). Wild fish escapement is monitored from redd expansion and spawner surveys mostly from March – June. Endemic fish are the obvious first choice to develop a local hatchery broodstock in the system with the progeny optimally adapted for survival in the Green River/ Duwamish River system and will be most capable of surviving, returning to and effectively supplementing the Green River system. The later returning run timing would provide a harvest component after the early Chambers January-February timeframe.

The normal range of spawn timing for Green River wild winter steelhead is from mid- March through early June. Since the goal for this program is to release smolts in May to meet Statewide Rearing and Release Guidelines, brood fish must be spawned prior to mid-April in order to rear fish to this size in the eleven-month rearing period. For this reason, brood fish will be selected and eggs collected to match the peak of spawning in the wild but at the same time allow the hatchery to meet the release guidelines.

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.

(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous Chinook salmon population for use as broodstock in the supplementation program.*").

See Section 1.10

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Captured broodstock would be bathed with PolyAqua at a dose of 5ml/10 gallons of water (KPD-32) and held in individually safe PVC containers while transferred in tanker trucks with a 3-5% salt solution to reduce stress.

Use of wild natural-origin adult steelhead for broodstock will provide the greatest protection of the populations' overall genetic structure (minimize loss of genetic diversity). Only adults representing endemic stock through genetic analysis or return and maturity timing characteristics will be considered.

First generational hatchery returns (F1) from this program may be used as broodstock in a wild by hatchery cross (WxH), although preference will be given to WxW crosses. Factorial mating crosses will be employed to maximize genetic possibilities for effective population concerns as well as ensuring viable milt is used when needed.

All hatchery activities including holding and viral sampling will be consistent with the Co-Managers Fish Health Policies (2006), and consultation with NOAA Fisheries to reduce risk or harm to listed fish and preserving genetic material.

Baseline DNA microsatellite data collection has been ongoing at several Puget Sound tributaries including samples taken from Green River local and non-local hatchery stocks and some samples collected from wild escapement. Sampling all hatchery broodstock spawners in subsequent years will be vital to confirm indigenous stock usage, but will also be able to determine potential repeat spawner success of live spawned adults released back to stream, determine successful kelt re-condiitoning percentage if collected in subsequent years and determine parentage of succeeding F1 generational smolts or adults.

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SECTION 7. BROODSTOCK COLLECTION

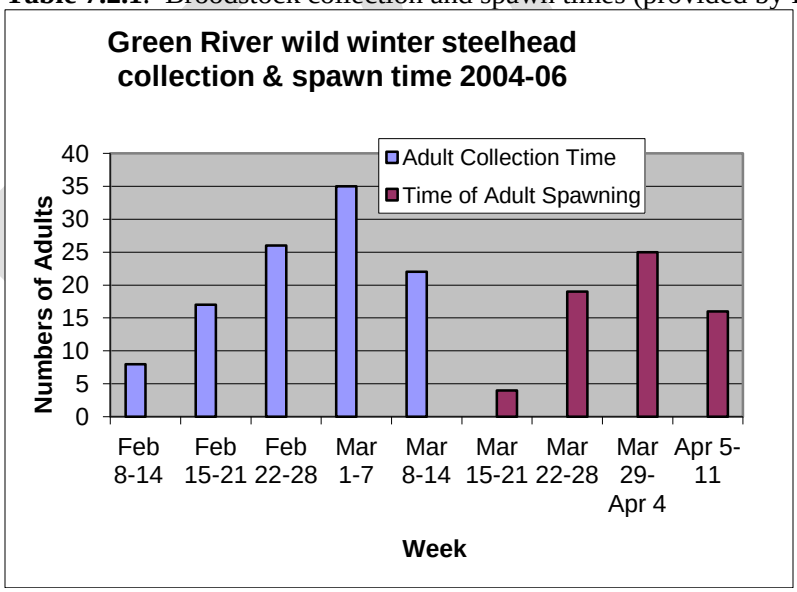
7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult steelhead.

7.2) Collection or sampling design.

Originally, total broodstcok collection (maximum of 50) would be ~ 3 % of the Green River natural-origin winter average escapement in this system (1,626 for the last 10 years (1999-2008)). This level is still well within the 30% operational guidelines for wild populations having 150 fish or more total escapement (HSRG Technical Discussion Paper #3, March, 2005). Wild adults are collected by hook and line on the Green River between river miles (RM) 29.3 and 44 with some limited contributions being trapped at the Soos Creek Hatchery weir. Other locations in the basin may be identified in the future. Most wild winter steelhead in the Green River begin to spawn in the system in early March and continues through June with the peak during the 3rd week of April (T. Cropp WDFW, pers. comm. 2006). Although earlier (December – February) and later (May – June) broodstock components may be available, the hatchery program will need to target most adults that may ripen in mid March through now the end of May to incorporate those fish into the two year smolt program (Table 7.2.1). This will facilitate successfully rearing the entire program to meet rearing and release guidelines by the following May. Studies conducted on Kalama River wild steelhead programs (Lower Columbia ESU) have indicated that broodstock taken from the peak periods of the spawn time is the best way to preserve equal opportunity of genetic expression for earlier and later returning population segments (Kalama River Research Studies, 1998 – present).

Table 7.2.1. Broodstock collection and spawn times (provided by K. Dimmitt WDFW 2006).



7.3) Identity.

Wild winter steelhead are native to the Green River (Duwamish) Basin and spawn starting in early March through June with the peak during the 3rd week of April. Non-local Chambers stock

are identified by a missing adipose fin, partial dorsal fin erosion and prevalence during the early winter months from late November through late January. Attempts will be made to utilize up to 50% double clipped returns into the program, but would try to utilize as few as possible.

7.4) Proposed number to be collected:

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

Up to 50 (2009-10) fish for adult broodstock. Fish collected in excess of broodstock needs (i.e. those that do not ripen prior to mid April) will be released back to stream.

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

Brood Year	Total Collected	Spawned	Pond Mortality
2002	Na	Na	Na
2003	Na	Na	Na
2004	40	12	13
2005	24	9	Na
2006	43	10	11
2007	39	15	18
2008	29	5	6
2009	6	3	3

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

The current protocol indicates a maximum of up to 50 wild fish and any fish not used will be released to spawn naturally as quickly as possible in order to preserve as much genetic material as possible. No fish would be considered for culling. F(1) generational returnees (hatchery fish) may be trapped at Soos Creek weir when flows permit.

7.6) Fish transportation and holding methods.

Tribal, WDFW and local sports club (if needed) will fish with hook-and-line from boats on the Green River to catch wild fish. Captured fish are placed in 6-8" PVC holding tubes suspended under water from the side of the boats until they reach a specified take-out point where a tank truck from the hatchery meets them. Fish are moved from the tubes into the tank, which contains a 0.5% salt solution for mild sedation during transport to the Soos Creek Hatchery. At the hatchery the fish are placed into covered, spring-fed intermediate tanks where they are held and checked weekly for spawning condition.

7.7) Describe fish health maintenance and sanitation procedures applied.

Broodstock will receive routine formalin treatments to minimize fungal infections although the holding time and cooler water temperatures during the time period may minimize fungus problems. Additional treatments as per the Co-managers Fish Health Policy (2006) may be required. Fish health specialists make monthly visits and consult with staff on the procedures

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needed to maintain fish health. All females used for spawning will be ovarian fluid sampled. Any pond mortalities will be quickly collected for the fish pathology examination.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (chlorine) procedures upon entering or exiting the area. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution and spawning area and implements are disinfected with iodophor solution at the day's end of spawning.

7.8) Disposition of carcasses.

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

Fish collected in excess of broodstock needs (i.e. those that do not ripen prior to mid April will be released alive into Soos Creek upstream of the hatchery site. Adults used for broodstock kidney/spleen viral sampling may be used for stream nutrient enhancement if cleared by the Area Fish Pathologist.

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.

(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

Only adults with the highest probability of being endemic late stock through time and distribution pattern will be considered. WDFW will attempt to collect broodstock at the peak spawn time of wild steelhead to prevent divergence from the natural population.

This program will use only hook and line techniques that minimize hooking and release mortalities. Specific fishing techniques, adult netting materials and holding protocols would be reviewed in consultation with NOAA Fisheries to minimize impact on listed fish.

Fish collected in excess of broodstock needs (i.e. those that do not ripen prior to mid April) will be released back into the Green River system in order to preserve as much genetic material as possible.

Continuing to sample all broodstock spawners in subsequent years will be vital to identifying only historical stock but will also be able to determine potential repeat spawner success of live spawned adults released back to stream, determine potential successful kelt re-conditioning if collected in subsequent years and determine parentage of succeeding F1 generational smolts or adults.

All hatchery releases to minimize any health risks to the listed populations will be consistent with the Co-Managers Fish Health Policies (2006)

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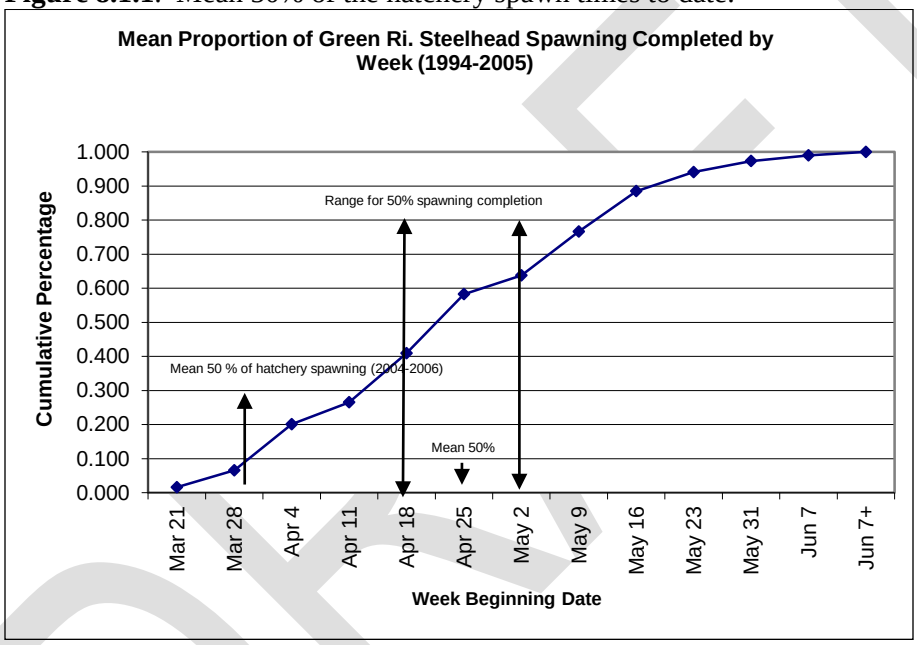
SECTION 8. MATING

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

8.1) Selection method.

As broodstock are collected in various stages of unripe condition, they will be checked weekly for appropriate ripeness. Spawners will be selected from ripe fish on a given spawn day trying to get appropriate number of males and females for factorial crosses. No selection criteria based on size or shape would be used but to maximize the fertilization success of available spawners. A comparison of timing for 2004 and 2005 hatchery spawning with the overall system spawning is below (Figure 8.1.1).

Figure 8.1.1. Mean 50% of the hatchery spawn times to date.



8.2) Males.

All males are prioritized based on ripeness and factorial cross needed. In some cases, male collections may exceed female broodstock collection in order to provide viable milt for a given spawn day. When primary males are not available to meet factorial scenarios on a given spawn day, secondary males may be used more than once. In those cases, males will be limited to no more than four times as primary spawners. If they are used more than once, they will be tagged for identification purposes to track the number of times a particular male has been used.

8.3) Fertilization.

As there is only 25 pair to spawn with maturation potentially spread over a month, the small number of fish ripe on individual days could potentially limit spawning options. Up to 25 males may be captured to prevent not having a fertilized male on hand for a fertilized female on a given day. Fertilization will occur in factorial crosses (2 x 2 or even 3 x 3) as much as possible if

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multiple spawners are ripe on a given day. In order to ensure a high likelihood of genetic expression and fertilization potential, if equal factorial crosses are not present on a given spawn date, other matings could be used to increase the number of overall crosses. Sperm motility may be checked prior to mixing with eggs. For factorial matings, water will be introduced after mixing milt. After 30 seconds, staff will combine eggs to one container in order to provide a minimal male back-up role.

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

8.4) Cryopreserved gametes.

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

Cryopreserved gametes are 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.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

A factorial-mating scheme (as described in section 8.3) is used to reduce the risk of loss of within population genetic diversity. Other fertilization schemes, while maintaining a 1:1 male to female spawning ratio as much as possible, will be applied as needed. The total pool size is small and potentially could be spread out over a significant spawn timeframe.

Females will be air spawned to prevent mucus loss associated with stripping of the body cavity. Staff will only attempt to spawn fish when they are totally ripe. Once spawned, they will attempt to re-condition the kelts for a short time prior to release.

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

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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.

Approximately 48,000 eggs will be taken for a release of 33,000 smolts. Data below provided by Soos Creek hatchery staff (M. Wilson, 2007).

Year	Num. Green Eggs Taken	Survival from Green to Fry	Survival from Fry to Smolt	Total Survival to smolt
2004	64,400			
2005	36,000	76.2%	90.5%	68.8%
2006	46,000	66.3%	95.5%	65.5%
2007	40,000	59.0%	Na	Na
2008	29,000	95.1%	73.9%	70.3%

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

Extra eggs may be taken as a safeguard against potential incubation and rearing losses. Survival data for 2004-05 (65-70%) indicate that an approximate 48,000 egg take will get the desired release goal of 33,000 smolts (27,000 1+ and 6,000 2+ smolts).

9.1.3) Loading densities applied during incubation.

Fertilized eggs are put into shallow trough baskets at up to 25,000 eggs per basket with flows of 6-8 gallons per minute (gpm). After eye-up and dead egg removal, they are put back into shallow trough baskets at 15,000 eggs per basket with similar flows.

9.1.4) Incubation conditions.

Once put down in the troughs after fertilization, they are put on unheated Soos Creek surface water.

9.1.5) Ponding.

After fry have buttoned up, they are transferred (forced) to a fiberglass trough for initial feeding at 25,000 per raceway with a flow of 50 gpm.

9.1.6) Fish health maintenance and monitoring.

Eggs will be monitored daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus can be prescribed by WDFW fish health specialists and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed.

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9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

The hatchery incubation room is protected by a low water alarm system. The main water supply and power supply system are alarmed to notify hatchery personnel if a failure occurs. A generator, in case of a power failure, backs up the power supply.

9.2) Rearing

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

For the limited data for green egg to smolt from 2004-05, the survival to smolt release was 70.5%. This data is only for the program at Soos Creek in its entirety. Prior to this time, program components were spread out between several Co-Manager facilities in the system.

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

The fish are reared using the loading densities recommended by Piper et al. (1982). In all facilities within the Green River system, densities are kept at or below 3.3 lbs /gpm and 0.5 lbs /cu ft. before the last loading reduction in the fall of the year. Trough maximum loading is 40 lbs at 12 gpm (3.33 lbs/gpm). Tank and raceway maximum loading for early rearing is 132 lbs for the tanks at 40 gpm (3.3 lbs/gpm) and 800 lbs per raceway at 300 gpm (2.66 lbs/gpm). The final maximum loading per raceway is approximately 3200 lbs. at 300 gpm (10.6 lbs/gpm). Once density levels in the fiberglass troughs reach 0.20 lbs fish/gpm, the steelhead will be moved to outside 10' X 80' X 4' concrete raceways. Flow index (FLI) is monitored monthly for all programs at Soos Creek Hatchery and would not exceeds 80% of the allowable loading (1982 Piper). Loadings could be lighter than these, but feeding the population to achieve size consistency is a priority.

9.2.3) Fish rearing conditions

Ambient oxygen levels range between 10-12 ppm entering to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly for all programs at Soos Creek Hatchery and would not exceeds 80% of the allowable loading (Piper 1982). Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding will be predominately by hand presentation.

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.

Monthly growth data provided by Soos Creek hatchery staff for rearing to yearling smolt size in one year.

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Month	Size (fish/lb) by Brood Year		
	2005	2006	2007
May	1,437	1,500	1,557
June	600	650	651
July	200	233	143
August	91	123	90
September	42	43	32
October	23	28	27
November	18	20	20
December	15	14	18
January	13	13	14
February	10	10	11
March	7	7	9
April	5	6	8
May	release	release	release

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

See above.

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).

Fish are started with various brands of starter feed, typically Biodiet or Rangen. Fish are fed frequently after swim-up and ponding, up to 10 times a day at body weight percentages up to 5%. Fish are gradually increased on feed size from starter, to crumble, to pellet, and feeding frequency decreases as fish increase in size. Fish are converted over to a high protein EWOS feed as soon as possible. Conversions typically are in the .7-.8 range.

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

A WDFW fish health specialist monitors fish health at least once a month. Prior to this examination, whenever abnormal fish behavior or mortality is observed, the hatchery staff will contact the fish health specialist. Based on pathological or visual signs by the hatchery staff, the pathologist determines the appropriate course of action. External signs such as lesions, discolorations, and fungal growths will lead to examinations of skin, gills and organs. Mortality (disposed of) can lead to kidney and spleen checks for Bacterial Kidney disease (BKD). Blood is checked for signs of anemia or other pathogens.

Sanitation may consist of raceway cleaning more frequently and disinfecting equipment between raceways and/or between species on site. Reporting and control of selected fish pathogens are done in accordance with the Co-Managers Fish Health Policy (1998 and revised 2006).

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

The goal will be to release fish based on time, size and condition factor parameters as per Statewide Steelhead Rearing and Release Guidelines (2001). Pre-liberation samples will note smolt development visually based on degree of silvering, presence/absence of parr marks, fin clarity and banding of the caudal fin. No gill ATPase activity or blood chemistry samples to determine degree of smoltification or to guide fish release timing is anticipated.

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

Several methods to make the rearing receptacles represent some semi-natural features may be planned by staff including; camouflage covers over the outside rearing units, paint so that the walls and bottoms are of nearly natural coloration and texture which will promote natural looking fish. Demand or pneumatic feeders may also be used where possible to limit human interaction is determined by Co-managers**.**

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation. *(e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

Fish will be reared to achieve a size and quality that represents the best chance for survival in order to achieve the goals of the program. Facilities provide a safe and secure rearing environment through the use of alarm systems, pumping systems, and backup generators to prevent catastrophic fish losses.

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SECTION 10. RELEASE

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

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

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	27,000 1+ 6,000 2+	5.0 - 6.0 5.0 – 6.0	May May	Soos Creek Soos Creek

Note: 10 fpp ~ 155 mm fork length

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

Stream, river, or watercourse: Soos Creek 09.0072

Release point: Soos Creek (RM 1, tributary to the Green River at RM 33.5)

Major watershed: Green River

Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.
*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Release Year	Release Date	Release Location	Stage of release			Fish/ Lb	Mark	
			Fry	Fingerling	Yearling		Ad Clip	AD/ Vent
2001	May 1 - 15	Green River RM 56.0.			19,958	5.6	Yes	
2002	Jul 19	Big Soos Creek RM 4.8.	1,665			450	Yes	
2002	Jul 19	Green River RM 48.4.	7,515			450	Yes	
2002	Unknown	Unknown		43,395		257	Unknown	
2003	Unknown	Unknown			34,400	Unk	Unknown	
2004	Unknown	Unknown		11,412		400	Unknown	
2004	Unknown	Unknown			27,500	Unk	Unknown	

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2005	May 1	Soos Creek Hatchery			46,000	6.5		Yes Ad/LV
2006	May 1	Soos Creek Hatchery			24,800	5		Yes Ad/RV
2007	May 1	Soos Creek Hatchery			29,000	6	Yes Ad+	LV
2008	May 1	Soos Creek Hatchery			20,400	8	Yes Ad+	RV

Source: WDFW Fish Plant Database 2008.
NOTE: Information in shaded boxes do not occur in the WDFW Fish Plant database but were provided in an earlier HGMP version.

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

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

See specific release dates Section 10.3.

10.5) Fish transportation procedures, if applicable.

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

Early releases involved some transported fry releases. Off station releases at this time are not planned for this program. If this occurs in the future stringent transportation procedures would be developed by Co-Managers including low loading densities (< 0.1 lbs. /gal), oxygen infused via carbon stone etc.

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

The water source is predominately surface water from Soos Creek. After leaving intermediate feeding tanks in the hatchery building, fish are moved to outside to raceways and reared entirely on Soos Creek surface water until release.

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

All fish (accept for fry/fingerlings) released as yearling smolts are marked with a combination adipose fin and ventral fin clip. Ad/LV clips were to be applied to fish released in odd-numbered years while Ad/RV clips were to be applied to even-year releases. Releases in 2005 (Ad/LV) and 2006 (Ad/RV) were accomplished although a high rate of 40% missing ventral clips (RV) were reported in 2006 year releases.

The survival rate of smolts may be impacted by the double mark combination with a reduced survival rate from ventral fin clips reported in several sources for yearling fish (M. Kimbel WDFW, pers. comm. 2008). Other marks such as blank CWTs may be applied in the future based on an updated review of the program by the Co-managers.

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

No surplus fish at the time of release are expected. Survivals (~70%) from egg-to-smolt release for 2004-05 indicate that the programmed release goal of 33,000 will be achieved. Monitoring of fish numbers, growth and mortality at the hatchery will provide reasonably accurate estimates of live fish throughout their rearing life. Only if extremely high survival (unexpected) of progeny from the green egg stage occurred would surplus fish be identified during the rearing cycle. Depending on success of higher survival or lower survival, egg takes would be adjusted in order to reach needed goals. Future supplementation strategies may also be developed for using these fish in other parts of the Green River system.

10.9) Fish health certification procedures applied pre-release.

All fish health monitoring will be conducted by a qualified WDFW fish health specialist. They will be conducting examinations of juvenile fish at least monthly and more often, if needed. As the release period approaches, the population will be checked 1-3 weeks pre-release by the Fish Health Specialist. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist. They will investigate abnormal levels of fish loss when they occur. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release. Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible. Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database. Fish culture practices will be reviewed as necessary with facility personnel. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures, and treatments will be discussed.

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

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

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

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

The release of smolts fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with naturally produced steelhead juveniles and other listed fish. Since the standard release strategy will consist of releasing smolts only, most will orient to the river for a short time (1-10 days) and then emigrate. The program is not planning to release undersized fish (fingerling stages as had occurred in the past) and is planning to review the program based on an evaluation of the releases through the proposed timeframe.

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Time, smolt size and condition factors at release will be consistent with 2001 Interim Steelhead Rearing and Release Guidelines.

The release area from Soos Creek Hatchery is downstream from significant portions of productive habitat. This may reduce and limit ecological competition and impacts with listed juveniles.

As the program is reared and released from Soos Creek Hatchery, acclimation to the Soos Creek surface water should result in a strong homing to the immediate area.

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SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

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

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

Most if not all data required for the indicators are collected concurrently by the Co-Managers. Tribal net and subsistence hook-and-line fisheries are monitored and mark-sampled by the Muckleshoot Tribal fisheries staff. Sport fishery is mark-sampled by WDFW staff. By gathering mark data from these fisheries, biologists can estimate the proportion of each fishery's catch that is composed of project fish. Post-season hook-and-line sampling occurs from mid-March through mid-May on the main stem Green River. In addition to obtaining scale samples for aging wild fish, samplers' record marks from all hatchery fish caught, enabling biologists to estimate the proportion of the annual natural escapement that is composed of project fish. All aspects of the hatchery program will be documented per this submitted HGMP.

3.1.3 Standard: The HGMP will be submittal to NOAA Fisheries.

3.1.2, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.7.6, 3.7.7 Standards: Indicators will be provided by USACE Buckley Trap monitoring and data collected from that monitoring. Smolt monitoring for Upper White River production has not been identified at this stage. Funding to run past, present and future DNA samples will need to be identified.

3.5.4, 3.5.5, 3.6.1, 3.7.1, 3.7.2, 3.7.3 3.7.4 Standards: Spawning, hatching, rearing data provided from Voights Creek, Puyallup Tribal Hatchery and Muckleshoot Hatcheries. Diseases are controlled by Co-Managers Fish Health Policy (2006).

3.7.5 Standard: Carcass or nutrient enhancement monitored by Co-Managers and Fish Health Specialists.

3.7.8 Standard: Fish released as smolts with monitoring by the Lower White River Mainstem Trap by the PIT.

3.8.2, 3.8.3 Standards: Economics including tribal ceremonial use are not a goal at this stage, although long range goals may be determined by the Co-Managers.

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

Current tribal and WDFW staffing is committed to monitoring and evaluation of this project through the 2010 season (MOU, WDFW & MIT 2002). The co-managers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health

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testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group. Preliminary results by Duffy et al. (2005, HSRG Research Workshop) indicated that the dominant predator of salmonids in the nearshore and estuary environments is cutthroat trout. Chinook were found to prey largely on herring and sandlance. The biggest prey item for coho was marine plankton and pink and chum salmon.

2) A three-year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:
   a. Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;
   b. Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;
   c. Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;
   d. Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions that this project will address include:
   a. How do trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?
   b. How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?
   c. What is the rate of residualism of steelhead in Puget Sound rivers? Funding needs have not yet been quantified, but would likely be met through a combination of federal and state sources.

4) Steelhead Monitoring: Besides monitoring specific to HGMP Section 1.10, monitoring proposals to reduce impacts are identified in the current DRAFT version of the Washington Department of Fish and Wildlife Statewide Steelhead Plan Volume 1. Statewide Policies, Strategies, and Actions (April 6, 2007 Version).

Stock Structure, Diversity, and Abundance

- Evaluate the stock structure of steelhead in the Puget Sound, Olympic Peninsula, and Southwest Washington regions. Evaluate assumptions of the 1992 co-manager analysis and, building on the tools developed by the Puget Sound, Willamette/Lower Columbia, and Interior Columbia technical recovery teams, define and implement a consistent procedure for evaluating stock structure. Collect samples for analysis with methods that assure run timing and life history type are known.
- Increase the percentage of wild stocks with escapement assessed on a regular basis through prioritization of monitoring, soliciting funding, developing alternative estimation methods and sample designs, and enlisting the assistance of other organizations and the public.
- Periodically evaluate genetic conservation guidelines to ensure steelhead genetic diversity is

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conserved.

- Include British Columbia, Oregon and Idaho hatcheries within a broad scale monitoring and evaluation plan that assesses the productivity of wild stocks relative to the presence or absence of integrated or segregated hatchery programs.
- Monitor and evaluate juvenile and adult abundance and productivity for all stocks with a priority towards SaSI critical - and federally-listed steelhead.
- Design and implement a program to monitor the genetic and life history characteristics of steelhead stocks and a management structure for analysis and reporting. Prioritize the collection of samples from control stocks and from watersheds with both a hatchery program and a significant wild stock.
- Assess the gene flow rate between the non-local segregated hatchery stocks and wild stocks in conjunction with the stock assessment work.
- Establish a web-accessible database with age-specific estimates of the abundance, escapement, harvest, fishery and other related mortality of wild and hatchery steelhead stocks.
- Seek funding to support the additional monitoring and evaluation components that will address unknown mortality factors.

Stock Status

Reassess the status of all populations in Washington on a 4 to 8 year cycle to assure that opportunities for early action are not missed. Use population viability analysis (PVA) to evaluate spawner abundance and, for populations identified to have a potential conservation concern, broaden the analysis to evaluate the contribution of rainbow trout to population viability, the previous performance of the population, and factors affecting population status.

Annually monitor and review the status of populations at risk, identify limiting factors, and assess the effectiveness of management actions. Recommend new programs to address limiting factors, and potentially initiate "rescue programs" like kelt reconditioning, natural stream channel rearing, or hatchery supplementation to conserve wild populations until limiting factors are resolved.

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

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

All monitoring or evaluation activities may impact listed fish through capture and release. Listed fish would be predominately chinook and steelhead stocks. All protocols would be determined by consultation with NOAA Fisheries in order to reduce any impact to listed fish.

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SECTION 12. RESEARCH

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

12.1) Objective or purpose.

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

As part of ongoing Puget Sound acoustic telemetry studies, steelhead smolts from Green River hatchery (Chambers stock), wild parental hatchery smolts and wild smolts were added to the acoustical studies in 2006. Wild smolts are captured in downstream smolt trapping or hook and line activities so therefore is not in direct association with this hatchery program. Hatchery smolts from both Chambers stock and the endemic wildstock program may be used as part of the ongoing research (USACE Puget Sound Telemetry Study Draft Report – Green River 2006 Results).

12.2) Cooperating and funding agencies.

Not applicable

12.3) Principle investigator or project supervisor and staff.

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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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).

Up to 150 steelhead may be used on a year by year basis. Only wild smolts hook and lined or collected by wild smolt monitoring operations would be authorized by a take permit. Approximately 50 Chambers and another 50 hatchery smolts (from wild parents) have been used in some years for this on-going study.

12.10) Alternative methods to achieve project objectives.

Not applicable

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

Not applicable

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").

Not applicable

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SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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

This section will be the cornerstone for any required consultation with the U.S. Fish and Wildlife Service under section 7 of the ESA. Accordingly hatcheries that may affect any federally listed/ proposed ***aquatic or terrestrial*** *species under USFWS jurisdiction need to complete this section. By fully addressing the topics of this section, the HGMP will provide the information necessary to initiate formal or informal consultation under the ESA for species under USFWS jurisdiction.*

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.

WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions including hatchery operations. This agreement is for bull trout and pygmy rabbit but only would pertain to bull trout in Western Washington. These activities are on-going and yearly reports are compiled and submitted to USFWS. "The Department is authorized by USFWS for certain activites that may result in the take of bull trout including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities, and conservation activites such as adult traps, juvenile monitoring, spawning ground surveys, presence/absence surveys, genetic tissue sampling, and habitat surveys for species other than bull trout."

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

Dungeness Bull Trout *(Salvelinus confluentus):* The bull trout was listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). The status of the Dungeness/Gray Wolf is Unknown while the Dungeness population is tentatively considered Healthy (WDFW Bull Trout **SaSI**, 2004). Critical or viable population thresholds have not been developed for bull trout. Some fishing/capture numbers indicated high densities in 1996 surveys in the Upper Dungeness River stock. Only anecdotal angler reports and results of electrofishing sampling are available. Anglers report that historically bull trout/Dolly Varden were very common and widespread from the lower to the upper watershed. They report that they are still widespread, but greatly reduced in numbers (Mongillo 1992). Six bull trout/Dolly Varden were captured incidental to electrofishing for steelhead in June, 1994 by WDFW biologists. Two were taken at RM 16 in the Dungeness River, and four were taken at RM 1 in the Gray Wolf River. Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were made on all fish by three biologists. The two fish from RM 16 were calculated to be bull trout by one biologist and as one bull trout and one Dolly Varden by the other two biologists. All biologists agreed that the four fish from the Gray Wolf were three bull trout and one Dolly Varden. In 1996 five char collected from the

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lower Dungeness River were identified as bull trout. The char ranged in length from 28 to 62 centimeters. They were collected by WDFW personnel at Dungeness Hatchery while spawning hatchery coho salmon in the fall of 1996 (Bull Trout **SaSI,** 1998, updated to 2004).

Habitat-- The Dungeness River has been affected by human activities including removal of riparian vegetation for urban and agricultural development, logging in the upper watershed, flood control, water withdrawals for irrigation and pollution of the river and estuary by urban and agricultural run-off. Impacts from irrigation withdrawals occur between river miles 6.8 and 11.0 during the critical low-flow period between August and October. Erosion resulting from agriculture, urban development and forest practices has caused extensive gravel aggradation and channel braiding in the river. These factors reduce the water depth, increase water temperature and velocity, and destabilize the river bedload. Fine sediments smother eggs in spawning habitat, and low water flows create barriers to migrating adult fish. Flood control dikes confine the river during high water events, exacerbating bedload instability and subjecting rearing fish to extreme conditions.

15.3) Analyze effects.

There are not activities associated with this hatchery program that would directly impact bull trout/Dolly Varden other than encountering them in other hatchery programs during broodstock collection activities. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species. Any unintended take, observed or unobserved encounters of bull trout/Dolly Varden are reported by WDFW to USFWS.

15.4 Actions taken to minimize potential effects.

There are not activities associated with this hatchery program other than encountering them in other hatchery programs during broodstock collection activities (steelhead or coho) that would directly impact or create potential effects on bull trout/Dolly Varden in this system based on the current understanding of the status of these fish.

15.5 References

WASHINGTON STATE SALMONID STOCK INVENTORY BULL TROUT/DOLLY VARDEN, Washington State Department of Fish and Wildlife - October 2004.

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Green River/ Puget Sound Steelhead	**Activity:** Green River Wildstock Winter Steelhead Program
Location of hatchery activity: Soos Creek Hatchery	**Dates of activity:**	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			50	
Intentional lethal take f)				
Unintentional lethal take g)			Up to 5[2]	
Other Take (specify) h)				

[1] Approximate loss of reared components from the adults taken only. These are not wild segments additive to the adult totals.
[2] Pond mortality may be variable annually and part of the 32 adults captured.
Note: Unintentional take may include a combined 15,000 eggs, fry, fingerling smolt stages in the normal course of rearing these fish. These would not be cumulative with the adult removal.

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.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Stock - (see “Population”).

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

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

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

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

	SPECIES/AGE CLASS	Number of fish/pound	SIZE/CRITERIA Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Yearling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 8000	0.6 to <23
X	Sockeye Fall Releases	>150	>2.9
X	Sockeye Fry	>800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=0.45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fry	>20 to 150	3 to <23
X	Steelhead Unfed Fry	>150	<3
X	Cutthroat Yearling	<=20	>=23
X	Cutthroat Fingerling	>20 to 150	3 to <23
X	Cutthroat Fry	>150	<3
X	Trout Legals	<=10	>=0.45
X	Trout Fry	>10	<0.45

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

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