HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Whatcom Creek Hatchery Chum Program (Segregated)
Species or Hatchery Stock:	Nooksack River Chum (*Oncorhynchus keta*)
Agency/Operator:	Bellingham Technical College
Watershed and Region:	Whatcom Creek / North Puget Sound
Date Submitted:	October 6, 2014
Date Last Updated:	December 4, 2015

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SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Whatcom Creek Hatchery Chum Program

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

Nooksack River chum salmon (*Oncorhynchus keta*) - not ESA listed

1.3) Responsible organization and individuals

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

The Bellingham Technical College Whatcom Fish Hatchery/Educational facility works closely with WDFW's Kendall Creek Hatchery, often sharing both labor and equipment between the two facilities.

The Lummi Indian Nation is developing chum program in the Nooksack River Basin utilizing eggs collected at Whatcom Creek hatchery in addition to BTC educational program. The Lummi Bay Chum program will depend on Whatcom Creek as a source of eggs until it is established to support itself with fish returning to the Lummi Bay hatchery.

Co-manager policies are in effect for all Puget Sound hatchery programs.

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

Bellingham Technical College provides the hatchery facilities through a lease with the City of Bellingham Parks Department, which owns the property. The college also provides most operational costs and provides one full-time hatchery manager and student labor. Funding for fish feed is through Aquatic Lands Enhancement Account (ALEA) funding provided to WDFW for Co-op fish production. No exact figures of operational costs are available at this time as labor may heavily be school and or volunteer provided.

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

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Whatcom Creek Hatchery	Broodstock collection; adult holding, incubation, rearing, acclimation, release.	Maritime Heritage Park (1600 C Street, Bellingham WA), on Whatcom Creek (WRIA 01.0566) at RM 0.5. Whatcom Creek enters into Bellingham Bay.
Kendall Creek Hatchery	Early Incubation.	Mouth of Kendall Creek (01.0406), tributary to the NF Nooksack River (WRIA 01.0120) at RM 46,

1.6) Type of program.

Segregated harvest.

1.7) Purpose (Goal) of program.

Harvest Augmentation/Education.

1.8) Justification for the program.

Bellingham Technical College (BTC) provides training in "Fisheries and Aquaculture Sciences" to prepare for a career in aquaculture field and offers, among others, hatchery operations and aquaculture techniques courses. Whatcom Creek hatchery is BTC educational facility, providing students with hands-on experience through culture of chum, pink and Chinook salmon. These hatchery programs "provide educational benefit through the teaching of fish culture at BTC and through close ties with the Bellingham public schools" (HSRG 2003). Besides educational opportunities this program provides fish for harvest.

To minimize impacts on listed fish by facility operations and the Whatcom Creek chum program, the following Risk Aversions are included in this HGMP:

Table 1.8.1: Summary of risk aversion measures for the Whatcom Creek chum program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights are formalized through permit permit # S1-28591C, obtained from WDOE.
Intake Screening	4.2	The hatchery intake is "grandfathered in". Upgrades to bring the structure into compliance with NMFS fish passage criteria has been planned and included in 2017 budget.
Effluent Discharge	4.2	No NPDES permit is required for facilities with production of less than 20,000 pounds per year in accordance to criteria set by WDOE as the limit for concern in regard of hatchery effluent discharge effects. Whatcom Creek Hatchery production falls in this category.
Broodstock Collection & Adult Passage	2.2.3, 7.9	Broodstock for the program is collected from volunteers returning to the hatchery trap open from June through December. Fish passage is not obstructed at any time because there is no weir blocking the river and forcing fish to the trap. Personnel are instructed to release ESA listed species, if and when encountered.
Disease Transmission	9.2.7	The program is operated consistent with the Co-managers Fish Health Policy (WDFW and WWTIT 1998, updated 2006).
Competition & Predation	2.2.3, 10.11	Due to life history, feeding habits, and the size at release, fall chum are expected to result in limited competitive and predatory interactions with listed fish. Releases also occur into Whatcom Creek, that has not been identified as a watershed, where an ESA listed indigenous Chinook or summer chum populations were historically present (Ruckelshaus et al.

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		2006, Johnson et al. 1997).

1.9) List of program "Performance Standards".

See HGMP section 1.10. Standards and indicators are referenced from Northwest Power Planning Council (NPPC) Artificial Production Review (APR) (NPPC 2001).

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

1.10.1) "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.1 Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in US v WA.	Contribution to co-manager harvest.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (EBD and FBD processes, annual fisheries management plans).
3.1.2 Program contributes to mitigation requirements.	Number of fish released by program, returning, or caught, applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. This program provides mitigation for lost fish production due to development within the Nooksack River system and contributes to sport and tribal fisheries.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries. Hatchery fish are marked to allow differentiation of hatchery and natural-origin fish.	Agencies monitor and estimate survival and contribution to fisheries for each brood year released. Fish are released with a thermal (otolith) mark to differentiate from natural-origin stocks.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply basic monitoring standards in the hatchery: feed conversion rates, growth trajectories, mark/tag rates, weight distributions (CVs).	Annual run timing, age and sex composition data are collected upon adult return. Growth rates, mark rate and size at release and release dates are recorded annually.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to cultural and recreational benefits to the general population. Also contributes cultural, ceremonial and subsistence (C&S), and recreational benefits for PNW Native Americans. Surplus (food-grade quality) fish provide contributions to local charitable organizations. Recreational fishery angler days, length of season, number of licenses purchased.	Annual harvest of hatchery fish based on estimated from Co-manager data, Catch Record Card (CRC) estimates and creel surveys.

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1.10.2) "Performance Indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries. Hatchery fish are marked to allow differentiation of hatchery and natural-origin fish.	Agencies monitor and estimate survival and contribution to fisheries for each brood year released. Fish are released with a thermal (otolith) mark to differentiate from natural-origin stocks.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish.	Annual harvest of hatchery fish assessed based on Co-manager data, CRC estimates and creel surveys.
3.5.3 Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	The ratio of observed and/or estimated total numbers of artificially-produced fish on natural spawning grounds, to total number of naturally-produced fish.	Not monitored.
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually monitor and report release information including location, method, and age class to hatchery data systems.
3.5.5 Juveniles are released at a stage that encourages rapid outmigration from the system.	Size, number and date of release.	Annually monitor size, number, and date of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for harvest goals. Numbers of surplus hatchery returns are calculated annually.	Numbers of adults returning to the hatchery, broodstock collected, and surplus returns are recorded annually.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Adhere to HSRG (2004) and WDFW spawning guidelines (Seidel 1983). Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Annual run timing, age and sex composition data are collected upon adult return. Growth rates, mark rate and size at release and release dates are recorded annually.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage

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and protocols (IHOT, PNFHPC, WDFW Fish Health Policy, INAD, MDFWP).	of compliance with applicable standards and criteria.	may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. WDOE water right permit compliance.	Flow and discharge reported in monthly NPDES reports.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow Co-managers Fish Health Disease Policy (WDFW and WWTIT 1998, updated 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the *Co-Manager's Fish Health Policy* (WDFW and WWTIT 1998, updated 2006)
	Inspection of adult broodstock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-Managers Fish Health Policy (WDFW and WWTIT 1998, updated in 2006).
3.7.5 Any distribution of	All applicable fish disease	Controls of specific fish

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carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	policies are followed. See HGMP sections 7.5 and 7.8.	pathogens through eggs/fish movements are conducted in accordance to Co-Managers Fish Health Policy (WDFW and WWTIT 1998, updated in 2006). Disposition of carcasses are recorded in the WDFW Hatchery Adult Data.
3.7.6 Adult brood stock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution.	Fish returns to the hatchery are monitored and personnel are instructed to record and safely release all unmarked listed fish back to the creek when and if encountered. Whatcom Creek has not been identified as a watershed where an ESA listed indigenous Chinook and summer chum were historically present (Ruckelshaus et al. 2006, Johnson et al. 1997).
3.8.1 Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	Total cost of operation.	Annual operational cost of program compared to calculated fishery contribution value.

1.11) Expected size of program.

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

Up to 2,700 adults (1,350 males, 1,350 females) are needed to meet the 2.6 million egg take goal for Whatcom Creek chum program and 100,000 eyed-eggs transfer to Nooksack/Samish Regional Enhancement Groups. Additional 1.5 million eggs are currently collected to support Lummi Indian Nation Chum program at Lummi Bay hatchery, (refer to Lummi Bay Chum HGMP) and up to 1,700 fish are needed to be collected to fulfill that goal.

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

Table 1.11.2.1: Proposed annual releases.

Life Stage	Release Location	Annual Release Level
Fry	Whatcom Creek (WRIA 01.0566)	2,000,000

Source: WDFW, Future Brood Document 2015

In the past this program has provided eyed eggs to support other chum programs: Glenwood Springs (200,000), False Bay (100,000), Lynden Christian High School (50,000) and Camp Orkilla (5,000). These programs were eliminated in 2004.

Currently, when available, up to 100,000 eyed eggs are scheduled to be provided to Nooksack/Samish Regional Enhancement Group. Up to date eggs were provided in years 2011-2014 and resulted in juvenile releases into Terrell Creek.

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

Due to a lack of coded-wire tag (CWT) studies and limitations in accounting fish as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) cannot be accurately estimated.

Table 1.12.1: Whatcom Creek Hatchery chum escapement.

Year	Escapement
2003	4,016
2004	7,959
2005	5,300
2006	1,444
2007	276
2008	953
2009	2,313
2010	5,208
2011	3,436
2012	3,051
2013	8,471
2014	11,214
Average	**4,470**

Source: Bellingham Technical College

Note: The broodstock source for this program has been changed from Samish River stock to Nooksack River stock as outlined in section 6.2.1.

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

1979.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Whatcom Creek (WRIA 01.0566).

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

Currently no alternatives have been considered for this program.

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.

The Whatcom Creek chum HGMP was previously submitted to NOAA Fisheries in March 2003 but was not acted on at the time. This updated HGMP is submitted to NOAA Fisheries for ESA consultation, and determination regarding compliance of the plan with ESA Limit 6 of the 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed species.

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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.

None directly.

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

Puget Sound Chinook (*Oncorhynchus tshawytscha*): Listed as *Threatened* on March 24, 1999 (64FR14308); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant currently. The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, as well as twenty-six artificial propagation programs (Ford 2011). In the Bellingham Bay area, the TRT has identified demographically independent populations (DIPs) in the North/Middle Fork Nooksack and South Fork Nooksack River. There is no evidence that an independent population of Chinook salmon existed in the Samish River (Ruckelshaus et al. 2006).

Puget Sound steelhead (*Oncorhynchus mykiss*): Listed as *Threatened* under the ESA on May 11, 2007 (72FR26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington. This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) (Ford 2011). It also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery (NMFS 2013 78FR38270). In the Nooksack Basin, the TRT has preliminarily delineated one DIP of winter steelhead in the Nooksack River and one DIP of summer steelhead in the South Fork Nooksack River (Myers 2015).

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

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

Puget Sound Chinook salmon: Updated Risk Summary. All Puget Sound Chinook populations are below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified by Good et al. (2005) are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Many of the habitat and hatchery actions identified in the Puget Sound Chinook recovery plan are expected to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

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See North/Middle Fork Nooksack River Chinook HGMP for Chinook *Viability Criteria.*

Puget Sound Steelhead: Updated Risk Summary. The number of winter steelhead spawners has increased for many populations in Puget Sound since 2009. The number of spawners for 16 Puget Sound winter steelhead populations, relative to the average number of spawners for each population in the four year period up to the listing in 2007, increased from an average of 51% in 2009 to 141% in 2013. These recent, short-term increases in spawners are a positive development, but do not negate the long-term risks facing Puget Sound steelhead DPS. Using spawner data collected through 2008 or 2009, Ford (2011) concluded that the status of the listed Puget Sound steelhead DPS has not changed substantially since the 2007 listing, and that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future but are not currently in danger of imminent extinction.

See Kendall Creek Winter Steelhead HGMP for steelhead *Viability Criteria.*

Kendall Creek hatchery spring Chinook in Puget Sound Chinook ESU. NMFS (1999) considered this hatchery stock to be part of the ESU, and listed with natural-origin Chinook salmon that are part of the North Fork Nooksack population (70 FR 37160. June 28, 2005; NMFS SHIEER 2004). The population rebuilding program was started with natural-origin fish from the North Fork Nooksack River native population. Since that time, the program has relied totally on volunteer returns to the hatchery. In the past, hatchery and natural origin Chinook were not entirely differentiated with distinguishing marks, so it was possible that natural origin fish contributed to the broodstock prior to data collection on this. The proportion of natural-origin fish typically used in the broodstock is quite low, as population productivity due to existing habitat conditions limit abundances of natural origin Chinook.

Nooksack spring Chinook in Puget Sound Chinook ESU. Recent escapement levels (2005-2013) have averaged 1,427 natural spawners in the North Fork Nooksack River DIP and -70 (2000-2013) for the South Fork Nooksack River DIP.

Samish River hatchery fall Chinook in Puget Sound Chinook ESU. NMFS (1999) considered this stock to be in the ESU but not essential for recovery. This stock was designated Category 3b; although the stock originated from within the ESU, it is not native to the area in which it is released. Historically, it is believed that the Samish River did not support a self-sustaining population of Chinook salmon. Further, there appears to be limited interaction between Samish River fish and native populations in the Nooksack and Skagit Basins (SSHAG 2003).

Nooksack River steelhead in Puget Sound steelhead DPS. Suspended sediment due in part to the glacial hydrology makes it difficult to monitor steelhead spawners in this system. Adult spawner data has only been collected for Nooksack winter steelhead in recent years and when conditions allow. The limited recent years when populations escapement estimates were determined suggest population abundances are relatively stable. There are no abundance trend data for SF Nooksack summer steelhead; this stock is not monitored and it is difficult to monitor. The status remains unknown in 2012 (SaSI, WDFW 2012). Based on a habitat-based intrinsic potential (IP) analysis by the Myers (2015), the estimated historic capacity for winter steelhead in this system was between 22,045 to 44,091 fish and between 1,137 to 2,273 for summer steelhead in the South Fork Nooksack.

Samish River and Bellingham Bay Tributaries steelhead in Puget Sound steelhead DPS. Ford (2011) used spawner data collected through 2008 and concluded the following: **"**Steelhead counts in the Samish River have declined sharply in recent years. Assuming these counts are a reasonable reflection of spawner abundance, the estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 43 fish) is high—about 80% within 25 years. With an estimated mean population growth rate (u est) of −0.037 (λ = 0.964) and process variance (Q est) of 0.140, we can be highly confident ($P < 0.05$) that a 90%

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decline in this population will not occur within the next 5−10 years, and that a 99% decline will not occur within the next 15 years. However, beyond the next 25 years we are highly uncertain about the precise level of risk". Based on a IP estimate (Myers 2015), the capacity for winter steelhead in the Samish River DPS was 3,193 to 6,386 fish.

- 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.

See North/Middle Fork Nooksack River Chinook HGMP for Chinook Productivity Data.
See Kendall Creek Winter Steelhead HGMP for Steelhead Productivity Data.

- 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.

See North/Middle Fork Nooksack River Chinook HGMP for Chinook Escapement Data.
See Kendall Creek Winter Steelhead HGMP for Steelhead Escapement Data.

- 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.

See North/Middle Fork Nooksack River Chinook HGMP for Chinook pHOS and pNOS estimates.
See Kendall Creek Winter Steelhead HGMP for steelhead geneflow data estimates.

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.

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

Broodstock Collection:

Whatcom Creek hatchery currently collects broodstock for pink and chum programs. The steelhead program has been eliminated after 2013/2014 collection. Hatchery trap has been traditionally open from June through March, but with steelhead program eliminated will operate through December. Fish passage during trapping operations is not obstructed at any time because no weir is used to block the river and force fish to the trap. All fish enter hatchery voluntarily.
According to the run timing provided by the hatchery, chum broodstock overlaps with end of Chinook and beginning of steelhead runs. Regardless of the overlap in run timing, listed Chinook are less likely to be impacted by broodstock collcection activities, since Whatcom Creek has not been identified as a watershed where an ESA listed indigenous Chinook was historically present (Ruckelshaus et al. 2006), and neither was summer chum (Johnson et al. 1997). Steelhead has been historically present in Whatcom Creek, and is included in the Samish River DIP (Myers 2015). However its current status is unknown since steelhead surveys are not performed in the creek, unmarked steelhead have been reported to return to the hatchery. Personnel have been instructed to release all ESA listed species back to the creek if and when encountered.

Table 2.2.3.1. Salmon and steelhead return time to Whatcom Creek Hatchery.

Species	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Pink												
Chinook												
Coho												
Chum												
Steelhead												

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Cutthroat	

Source: Bellingham Technical College 2015.

Adult passage: Fish passage is not obstructed at any time because there is no weir blocking the river and forcing fish to the trap at any time during broodstocking season.

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include; water withdrawal, hatchery effluent, and intake compliance or barrier blockages. Permit requirements for water withdrawal and effluent at outfall areas are followed and within permitted guidelines (see HGMP sections 4.1 and 4.2). The hatchery intake is "grandfathered in". Upgrades to bring the structure into compliance with NMFS fish passage criteria has been planned and included in 2017 budget. Monitoring and maintenance are conducted in order to minimize the potential indirect 'Take" associated with the operations of this facility.

Disease Effects: Interactions between hatchery reared and naturally produced populations may be a source of pathogen and disease transmission although there is little evidence showing that diseases are transmitted from hatchery fish to wild fish (Steward and Bjornn 1990). Considering that no listed Chinook and chum have historically existed in Whatcom Creek (Ruckelshaus et al. 2006; Johnson 1997), the risk of disease transmission to natural populations is expected to be low.

Predation: Life history, feeding habits, behavioral attributes, and size at releases of chum salmon are expected to result in limited competitive and predatory interactions with listed salmon and steelhead.

Competition/Niche-Displacement: Freshwater carrying capacity may be compromised if hatchery chum fry planted or those produced naturally from hatchery spawners competitively displace or compete with wild fish in their natural rearing habitats. Studies specific to competition or niche displacement in the Whatcom Creek, Nooksack and Samish River systems and tributaries has not been conducted.

Monitoring Activities: There are no monitoring activities directly associated with listed Chinook, steelhead or summer chum within this hatchery program outside of incidental trapping at hatchery weirs (see HGMP section 11).

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

Listed fish are not targeted for broodstock collection at Whatcom Creek hatchery. The trap is operated without weir blocking the river and forcing fish to the trap. Chinook or summer chum have not been reported collected during chum broodstock trapping. Unmarked steelhead has been inadvertently trapped, handled and released. Operational protocols are in place and call for return of all encountered listed fish back to the stream as quickly as possible if and when they occur. The mortality of encountered listed fish is estimated to be 0-1 fish annually, with staff reporting no encounters in most years. In 2014, the record number of 24 unmarked steelhead were recorded being trapped, handled and released without mortalities.

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

See "take" table.

- 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.

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Any projected take that will exceed the estimates given in this HGMP from this operation on a yearly basis would be communicated to WDFW Fish Program and NOAA staff for additional guidance.

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.

This hatchery program, and all other WDFW anadromous salmon hatchery programs, operates under *U.S. v Washington* and the *Puget Sound Salmon Management Plan* (PSSMP 1985). These provide the legal framework for coordinating hatchery programs, defining artificial production objectives, and maintaining treaty-fishing rights.

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

Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document. The 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 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.

This program is operated in accordance with a Cooperative Fish Production Agreement between Earl Steele, representing the Bellingham Technical College, and WDFW. That agreement is consistent with the Future Brood Document (FBD) and with this HGMP.

See also HGMP section 3.1.

3.3) Relationship to harvest objectives.

Each year state and tribal Co-managers plan and agree to a package of recreational and commercial salmon fisheries in consultation with Federal and Canadian fishery managers. These pre-season planning processes, known as the Pacific Fishery Management Council (PFMC), North of Falcon (NOF), and Pacific Salmon Commission planning processes, involve a series of public meetings between domestic and international federal, state, tribal and industry representatives and other concerned citizens.

Tribal and non-Tribal commercial and recreational fisheries directed at salmon and steelhead produced through hatchery releases are managed to minimize incidental effects to listed species and allows fisheries on hatchery-origin stocks that are not likely to adversely affect listed Chinook, steelhead or listed summer chum.

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.

Table 3.3.1.1: Whatcom Creek Hatchery fall chum fishery contributions.

Year	Area		
	4B-6C	7-7a	7B

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2002	13	256	6,190
2003	0	54	1,278
2004	17	137	3,692
2005	10	118	1,364
2006	12	66	4,407
2007	5	6	365
2008	8	32	445
2009	3	33	426
2010	10	48	3,875
2011	5	42	1,052
2012	1	28	506
2013	3	65	798
2014	Not	yet	available
Average	**7**	**74**	**2,033**

Source: Aaron Dufault, WDFW 2015

Whatcom Creek recreational chum fishery and Area 7B non-tribal and tribal commercial chum fisheries.

3.4) Relationship to habitat protection and recovery strategies.

Habitat protection and restoration strategies are paramount to the stability of self-sustaining, natural populations. Habitat protection and recovery strategies are addressed in documents developed for the Puget Sound area and individual watersheds. Different groups are involved in planning, funding and realizing restoration projects through the region as listed below.

Hatchery Action Implementation Plans (HAIPs): Are watershed-level documents developed by the western Washington Treaty Tribes (Tribes) and WDFW, which consolidate descriptions of hatchery programs from each watershed into a single document. This document addresses co-manager priorities, legal requirements of the Puget Sound Salmon Management Plan (PSSMP) and Endangered Species Act (ESA), and recommendations of the Hatchery Scientific Review Group (HSRG). It describes the adaptation of general principles for hatchery management to the unique genetic and ecological setting of each watershed. The HAIPs also describe how hatchery programs will operate in conjunction with harvest management, habitat restoration, and habitat protection to achieve near- and long-term goals for natural and hatchery production of salmon in each watershed, as well as listing funded and unfunded capital and operating/monitoring needs for all state and tribal hatchery programs and facilities. Each HAIP will also outline the monitoring and evaluation needs and describe the co-manager's adaptive management approach.

Salmon Recovery Funding Board (SRFB): Created by the Legislature in 1999, the SRFB is composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). The Board supports salmon recovery by funding habitat protection and restoration projects, and related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities: Whatcom County, with the passage of resolutions by the Nooksack Tribe, Lummi Nation, Cities of Ferndale, Everson, Lynden, Sumas, Nooksack, Blaine and Bellingham; and Skagit and Whatcom counties, was selected to be the Lead Entity in the Nooksack River basin. The Lead Entity was changed to the WRIA 1 Salmon Recovery Board in 2004 with the passage of an Interlocal Agreement that established the WRIA 1 Salmon Recovery Board, which is comprised of Nooksack Tribe, Lummi Nation, WDFW, Whatcom County, and Cities of

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Bellingham, Ferndale, Everson, Lynden, Sumas, Nooksack, and Blaine. Under the Interlocal Agreement, as the Lead Entity the WRIA 1 Salmon Recovery Board is the lead "for salmon recovery efforts and programs in WRIA 1 when cooperative and joint actions described within various federal, state, and local statutes and administrative programs are required." See also http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml

Regional Fisheries Enhancement Groups (*RFEGs*): 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 Nooksack Salmon Enhancement Association.

Puget Sound Partnership Action Plan: An ESU-wide recovery planning effort is being undertaken by the Puget Sound Partnership, a collaborative group dedicated to restoring salmon and steelhead throughout Puget Sound (available online at http://www.pugetsoundpartnership.org).

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fishes and other species on Whatcom Creek fall chum program could occur directly through predation on program fish, or indirectly through food resource competition or other ecological interactions. Chum survival rates could be negatively impacted through predation on newly released, emigrating juvenile fish in freshwater, estuarine and marine areas. Certain avian and mammalian species may also prey on juvenile listed salmon while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could potentially negatively impact juvenile Chinook chum through predation include the following:

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons
- Mammalian predators, including mink, river otters, harbor seals, and sea lions
- Cutthroat trout

Rearing and migrating juvenile and adult chum originating through the program may also serve as prey for large, mammalian predators in nearshore marine areas, the estuary and in freshwater areas downstream of the hatchery in the watershed to the detriment of population abundance and the program's success in augmenting harvest. Large mammalian species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals

(2) *Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program).*

- Puget Sound Chinook
-Puget Sound steelhead
-Puget Sound bull trout

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* The hatchery program protocols are designed to minimize the interaction between the program fish and other salmon and non-salmonid fishes. Therefore there are not expected to be significant positive impacts from salmon and non-salmon fishes to the program.

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The chum program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying chum carcasses may also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Cutthroat trout
- Bull trout

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- Steelhead
- Coho salmon
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

SECTION 4. WATER SOURCE

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

Table 4.1.1: Water sources available at Whatcom Creek and Kendall Creek Hatcheries

Facility	Water Source	Water Right		Available Water Flow	Water Temp (F)	Usage	Limitations
		Record No Certificate	Permit No.				
Whatcom Creek Hatchery	Whatcom Creek (surface)	S1-28591C	-----	5.8 cfs	34-74	Broodstock holding, incubation, rearing release	High summer temperatures, silt
Kendall Creek Hatchery	Wells 1-2 (Infiltration trench)	G1-*10562C WRIS/ 06970	09733	4950 gpm	47	All	No limitations
	Wells (3,4,5)	G1-23273	----	11000 gpm			
	Kendall Creek (surface)	S1-00317C WRIS	-----	22.36 cfs	30-50	Broodstock holding, incubation	Limited summer usage.

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.

Whatcom Creek Hatchery: Is located on Whatcom Creek at RM 0.5, in the close proximity to Bellingham Bay, and as such creek water levels are tidally influenced and can be mixed with salt water. The hatchery is supplied with creek surface water, gravity-fed to the ponds and pumped to the incubation room. Hatchery operations are limited by high water temperatures during summer and early fall months, and an excessive silt load during high flows. Due to the heavy silt loads incubation of eggs to the eyed stage for all Whatcom Creek programs takes place at Kendall Creek Hatchery to prevent egg suffocation.

The water right permit for Whatcom Creek Hatchery surface water is formalized through the Washington Department of Ecology (WDOE) (see **Table 4.1.1**), and was obtained by Bellingham Technical College in 2008.

Kendall Creek Hatchery - Refer to Kendall Creek Hatchery HGMPs for water source information.

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.

Whatcom Creek Hatchery water intake structure is "grandfathered in". Upgrades to bring it into compliance with current NMFS fish passage criteria (NMFS 2011), has been planned and included in 2017 budget.

Annual hatchery production does not exceed the WDOE standard of 20,000 pounds per year regarding hatchery effluent discharge effects and as such no NPDES permit is required. Regardless, the hatchery has a settling pond that can be separated from the creek. The pond can hold up to 1,000,000 gallons of water, which can be recycled within the hatchery and used in emergency situations if the creek is contaminated.

Kendall Creek Hatchery – refer to Kendall Creek Hatchery HGMPs for information.

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SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock for programs at Whatcom Creek Hatchery is recruited from volunteers returning to the hatchery trap open from June through December. There is no weir blocking the river and forcing fish to the trap. Returning adults enter concrete pond through a 12-step fish ladder, rising ten vertical feet, and a "V" trap.

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

A WDFW owned 100-gallon tanker truck, equipped with aerators and oxygen tanks is used if needed for fish transportation. Fish moved above the falls on Whatcom Creek are placed in a barrel filled with water and transported with a pickup truck. Chum are not transported.

5.3) Broodstock holding and spawning facilities.

Collected broodstock is held in a 40' x 30' x 4' concrete pond supplied with creek water. Spawning takes place at the side of the pond.

5.4) Incubation facilities.

Table 5.4.1: Incubation vessels available at Whatcom Creek Hatchery.

Type	Number	Size
Vertical stack incubators	576	24" x 25" x 3"
Wooden shallow troughs	6	10' x 6' x 16'
Moist-air incubators	4	6' x 4' x 2'
	165	Tray size: 9" x 5" x 3"

Due to the heavy silt loads incubation of eggs to the eyed stage for all Whatcom Creek programs takes place at Kendall Creek Hatchery to prevent egg suffocation.

Refer to Kendall Creek HGMPs for hatchery specific information.

5.5) Rearing facilities.

Table 5.5.1: Rearing ponds available at Whatcom Creek Hatchery.

Type	Number	Size
Fiberglass circular ponds	4	48' diameter x 4'deep
Concrete circular ponds	2	60' diameter x 4'deep
Concrete ponds	2	40' x 30' x 4'

The circular concrete ponds are covered with bird netting and surrounded by electrical fence to prevent predation.

5.6) Acclimation/release facilities.

Fish are incubated and reared on Whatcom Creek water the entire time at the hatchery and released on-station directly from the rearing pond into the creek.

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

Columnaris outbreaks, causing elevated mortalities, were observed in rearing fish soon after broodstock source was changed from Samish River stock to Nooksack River stock. Outbreaks intensities subsided with time.

Columnaris outbreaks can also cause elevated adult mortalities..

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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.

All of the hatchery ponds are supplied with gravity-fed water and are not dependent on electricity. Water to the incubation room is pumped. The facility is equipped with low-water alarms, connected to the hatchery manager's cell phone, a back-up generator (in case of power loss), and a back-up pump. The hatchery water system also allows for recycling water within the system in case of surface water quality deterioration (oil spills, etc.). One-million gallons of water held in the settling pond may be used during emergency situations.

Fish rearing is conducted in compliance with the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW and WWTIT 1998, updated 2006) to minimize the likelihood of the take of listed natural fish that may result from disease transmission. Adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of pathogen transfers.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Adult chum salmon returning to Whatcom Creek hatchery trap. Whatcom Creek chum are not ESA-listed.

6.2) Supporting information.

6.2.1) History.

The chum program at Whatcom Creek Hatchery was initiated in 1979 with eggs collected at Samish Hatchery. Broodstock were descendants of mix of the local stock and transplants from Hood Canal stock. This source was used until 1984, when program fish begun to return in numbers sufficient to maintain broodstock needs. To eliminate utilization of out-of-basin fish, the hatchery began transition to utilizing local, Nooksack River chum stock and eggs for the program begun to be collected at Kendall Creek Hatchery. The transition lasted through years 1999-2001. In 2004, enough fish returned to Whatcom Creek hatchery to support the program and it has been mainly maintained with fish returning to the hatchery since. In 2007 and 2008, low adult returns prompted supplementation with eggs collected at Kendall Creek Hatchery. Currently enough fish return to support the program and provide additional eggs to support Lummi Bay chum program.

6.2.2) Annual size.

Up to 2,700 adults are estimated to be needed to support collection of 2,600,000 eggs to meet Whatcom Creek Hatchery program release goal of 2,000,000 fry and 100,000 eyed-eggs transfer to Nooksack/Samish Regional Enhancement Groups. Estimated additional 1,700 adults should suffice for support of Lummi Bay Chum program to collect 1,500,000 eggs.

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

This chum production is managed as a segregated program, with the intent to keep hatchery stock reproductively separate from naturally-spawning populations. As no listed chum is known to have existed in Whatcom Creek (Ruckelshaus et al. 2006), there should be no inclusion of natural-origin fish into the broodstock. All chum released through this hatchery program have been consistently 100% otolith-marked since 2001 releases (brood year 2000), and their origin can be identified by an otolith mark.

6.2.4) Genetic or ecological differences.

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Program utilizes locally adapted Nooksack River stock; no genetic or ecological differences are known.

6.2.5) Reasons for choosing.

The preference was given to use local stock for hatchery propagation and Nooksack River chum was chosen for its local origin.

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.

No listed fish are selected for this hatchery chum program.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Chum broodstock is recruited from volunteers returning to the hatchery trap and collected through the entire run. The trap is open from June through December for chum and pink broodstock collection. Chum typically return from late October through early December, with the peak return in late-November.

7.3) Identity.

All fish released through this hatchery program have been consistently 100% otolith-marked since the 2001 release year (brood year 2000).

7.4) Proposed number to be collected:

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

Up to 2,700 adults are collected annually for Whatcom hatchery chum program and RFEG transfer. Since 2013 up to 1,700 adults are additionally collected to support Lummi Bay Chum program.

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

Table 7.4.2.1: Fish origin, sex composition and egg take of broodstock spawned at Whatcom Creek hatchery for the chum program.

Brood Year	Females	Males
2003	275	280
2004	1,600	1,221
2005	1,195	1,134
2006	71	71
2007*	112	110
2008*	376	577
2009	947	1,366
2010	1478	1191
2011	841	731
2012	819	658
2013	2,659	1,262

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2014	2,002	1,953
Average	**1,031**	**880**

Data source: Bellingham Technical College

* Due to low adult return to the Whatcom Creek hatchery, broodstock was supplemented with egg collected at Kendall Creek Hatchery.

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

Chum in surplus of broodstock needs are donated to SeaShare food bank, or disposed of by a contracted fish buyer.

7.6) Fish transportation and holding methods.

Not applicable; adults are not transported.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult broodstock are sampled for virus in accordance with the Co-Managers Fish Health Policy (WDFW and WWTIT 1998, updated in 2006) and spawning procedures follow the guidelines set forth in WDFW's Spawning Guidelines (Seidel 1983, HSRG 2004). Standard fish culture techniques and sanitation procedures are applied during spawning procedures.

7.8) Disposition of carcasses.

Food-grade carcasses may be donated to SeaShare food bank or disposed of by a contracted fish buyer. Both food-grade and non food-grade carcasses may also be used for nutrient enhancement in Whatcom Creek.

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.

Impacts from chum broodstock collection are expected to be low. Whatcom Creek hatchery currently collects broodstock for pink and chum programs. The steelhead program has been eliminated after 2013/2014 collection and listed species are not targeted at this facility. Hatchery trap has been traditionally open from June through March, but with steelhead program elimination, it will operate only through December. Fish passage during trapping operations is not obstructed at any time because no weir is used to block the river and force fish to the trap. All fish enter hatchery voluntarily. Also Whatcom Creek has not been identified as a watershed where an ESA listed indigenous Chinook and summer chum were historically present (Ruckelshaus et al. 2006, Johnson et al. 1997). Regardless, operational protocols that require return of all encountered listed fish back to the creek as quickly as possible, if and when they occur, are in place.

SECTION 8. MATING

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

8.1) Selection method.

Broodstock is selected randomly from ripe fish across the entire maturation time frame. Spawning takes place one to three times per week.

8.2) Males.

All males collected, are considered for spawning and chosen randomly on any spawning day.

8.3) Fertilization.

The protocol for this educational program is to utilize matrix spawning.

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8.4) Cryopreserved gametes.

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.

No listed fish are included as part of the mating scheme.

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.

Table 9.1.1.1.: Eggs collected for Whatcom Creek Hatchery chum program.

Brood Year	Eggs Collected
2003	2,110,000
2004	2,000,900
2005	2,016,000
2006	195,000
2007	214,500*
2008	550,000*
2009	1,550,000
2010	2,224,000
2011	1,600,000
2012	1,740,000
2013	4,000,000
2014	4,250,000
Average	**1,870,867**

Source: Earl Steele, Bellingham Technical College

* Due to low adult returns egg take was supplemented with eggs collected at Kendall Creek Hatchery.

Annual survival rates data are not available. The average survival rate from green-to-eyed egg is estimated as 85%, and eyed-to-ponding as 99% (Earl Steele, personal communication, 2012).

Since 2013 additional eggs are collected at the facility to support Lummi Bay Chum program.

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

No excess eggs are collected beyond the needs of the program. Current management approaches do not allow for the take of eggs in surplus of program goals. If losses are too high, then goals are not met.

9.1.3) Loading densities applied during incubation.

All eggs are fertilized and incubated to eyed stage at Kendall Creek Hatchery in. Fertilized eggs are placed in troughs at approximately 500,000 eggs per trough.

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9.1.4) Incubation conditions.

Kendall Creek Hatchery: Fertilized eggs are incubated in 24"x 1"x 17" troughs supplied with well water at constant temperature of 47ºF, and at a flow rate of 18gpm. Once eyed (December, January), eggs are shocked, otolith-marked (chillers are used to lower water temperature to create marks), and transferred back to Whatcom Creek Hatchery. Eyed-eggs are placed on burlap and ice, and transported in 5-gallon buckets. The transportation time to from Kendall Creek to Whatcom Creek Hatchery is about 40 minutes.

Whatcom Creek Hatchery: Eyed-eggs transferred from Kendall Creek Hatchery are placed in vertical trays at around 9,000 eggs per tray, and supplied with creek surface water at a rate of 4 gpm. Temperature is monitored daily and dissolved oxygen added when needed. Vexar™ layers are placed in trays as a substrate substitute. The use of surface water causes silt problems and silt loads are monitored and removed as needed.

When available, 100,000 eggs are transported to Nooksack/Samish Regional Enhancement Group facility up to two days after arrival from Kendall Creek Hatchery.

9.1.5) Ponding.

When fish are buttoned-up (March), based on visual observation and measured KD factor (1.7-1.8) at the size of ~1,200-1,300 fpp, fish are moved to a concrete pond supplied with creek surface water, where they are reared until April (400 fpp).

9.1.6) Fish health maintenance and monitoring.

All fertilized eggs are water-hardened in an iodophor solution. Fungal growth on dead eggs in the incubators is controlled by formalin drip treatments (15-minutes per day at a target dose of 1,667-ppm formalin) throughout incubation to just prior to hatching. Once eyed, eggs are shocked and dead eggs removed. Eyed egg-to-ponding fry loss is picked at the time of ponding and fry mortalities are removed daily.

There are no fungus problems in moist-air incubators, and chemicals are not used.

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.

Listed fish are not incubated through this program.

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.

Annual survival rates data are not available. The average survival rate from ponding-to-release is estimated as 99%, (Earl Steele, personal communication, 2012).

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

Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in Fish Hatchery Management (Piper et. al. 1982) and Co-managers Fish Health Policy (WDFW and WWTIT 1998, updated 2006). Fish rearing densities are maintained at maximum less than 3 lbs of fish /gpm at release and under 0.35 lbs/ft^3.

9.2.3) Fish rearing conditions

Fish are reared, in concrete pond supplied with creek surface water, for one month, since March ponding till April release.

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Table 9.2.3.1: Average surface water temperature (°F), by month, Whatcom Creek

Month	Average Water Temperature (ºF)
January	42
February	44
March	45
April	46
May	48
June	51
July	57
August	59
September	55
October	52
November	45
December	43

Source: Earl Steele, Bellingham Technical College, 2012

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.

Table 9.2.4.1: Average size (fpp), by month, juvenile chum reared at Whatcom Creek Hatchery.

Month	Average Size (fpp)
March/April	1,250
April/May	496

Source: Earl Steele, Bellingham Technical College, 2012

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

See Table 9.2.4.1 for growth information. No energy reserve data is available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (*e.g. % B.W./day and lbs/gpm inflow*), and estimates of total food conversion efficiency during rearing (*average program performance*).

Chum are given a starter feed formulation of *Bio-Oregon* brand. Feeding frequencies usually begin at eight feedings/day, 7-days a week and end at four feedings/day, 7-days a week. Feed rates vary from 1% to 6.0% B.W./day. The overall season food conversion rate is approximately 0.7:1.

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

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist (FHS). Hatchery personnel carry out treatments prescribed by the FHS. Procedures are consistent with the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW and WWTIT 1998, (Revised July 2006).

A drip of 0.5 ppm of potassium permanganate is applied every other day for 60 minutes as a precaution for bacterial gill disease.

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

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Chum show migration behavior right after emergence. In the hatchery environment, they are kept for around 30-days after ponding to be released as a fed fry to assure better survival. ATPase activity is not measured.

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

No "NATURES" type rearing methods are applied through the program.

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.

No listed fish are propagated through this program. Nooksack River chum are not ESA-listed.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Table 10.1.1. Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fed Fry	2,000,000	400	May	Whatcom Creek

Source: WDFW, Future Brood Document 2015

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

Stream, river, or watercourse: Whatcom Creek (01.0566)
Release point: Whatcom Creek, RM 0.5
Major watershed: Whatcom Creek (Bellingham Bay)
Basin or Region: Puget Sound

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

Table 10.3.1. Chum released by stage, size and date, Whatcom Creek Hatchery.

Release Year	Fry	Avg. size (fpp)	CV	Date(s)
2004	100,000[a]	263	11.5	5/18-30
2005	1,862,000	650	NA	4/11, 12
2006	1,680,000	454	4.7	4/21, 25
2007	1,120,000	390	5.9	4/21-27
2008	600,000[b]	325	NA	5/8
2009	395,000[b]	357	6.9	4/30
2010	1,263,000	577	NA	4/19, 30, 5/13
2011	2,000,000	761	8.2	4/21
2012	1,360,000	665	6.0	4/30
2013	1,547,900	427	NA	4/2, 11
2014	2,100,000	388	NA	4/29
2015	2,283,000	700	NA	4/10, 18, 30
Average	**1,359,242**	**496**	**7.2**	**----**

Source: WDFW fish plant database, 2015

[a] Lower number released due to a Columnaris outbreak.

[b] In 2007 and 2008 fewer fish returned to the hatchery resulting in lower juvenile releases in 2008 and 2009. Egg take was supplemented with eggs collected at Kendall Creek Hatchery and the portion of 399,500 in 2007 and 65,000 in 2008 were progeny of supplemented eggs.

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

Chum are forced released by the draining ponds. Fish are released at night, during high tide and exit the pond through 12-inch drain pipe.

10.5) Fish transportation procedures, if applicable.

Not applicable; fish are released on station.

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

Fish are incubated and reared on Whatcom Creek water the entire time at the hatchery and are released on-station, directly from the rearing pond into the creek.

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

Table 10.7.1: Marks applied

Brood Year	Mark Type	Population Marked
2000-current	Otolith	Entire release

Source: WDFW, Future Brood Document 2015

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

There is no surplus fish associated with this program.

10.9) Fish health certification procedures applied pre-release.

Prior to release, fish health is monitored and the fish health status of the population is certified by a WDFW Fish Health Specialist.

Standard Fish Health Procedures performed at the facility:

- All fish health monitoring are conducted by a qualified WDFW fish health specialist.
- Juvenile fish examinations are conducted at least monthly and more often if necessary. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.
- Abnormal levels of fish loss are investigated when occur.
- Fish health status is determined prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release or transfer.
- Appropriate actions, including drug or chemical treatments are recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile is be generated when possible.
- Findings and results of fish health monitoring are recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices are reviewed as necessary with facility personnel. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures and treatments are discussed.

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

In the case of a catastrophic event, conditions critical to the fish's health would be monitored and if necessary, fish could be released prematurely or moved to other facilities, if space available, to prevent loss.

Flooding has not been a problem since Whatcom Creek Hatchery started operations in 1979.

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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.

Preliminary results (2005, HSRG Research Workshop) from ongoing research being conducted by Duffy et al. (2002) in assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon and potential predators and competitors, in northern and southern Puget Sound indicate that the dominant predator of salmonids in the nearshore and estuary environments is cutthroat trout. Chinook were found to prey largely on herring, sandlance, chum, and when present, pink salmon. Released at the size of 400fpp, chum does not pose risk to any listed species at the time of releases; it may rather serve as the source of food.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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.

The purpose of monitoring is to identify and evaluate the benefits and risks from this hatchery program, elements of which are identified in HGMP section 1.10. The Co-managers conduct numerous ongoing monitoring programs, including catch, escapement, marking, tagging, smolt trapping and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species.

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

See HGMP section 11.1.1

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.

Risk aversion measures will be developed, if funding is available, in conjunction with the monitoring and evaluation plans.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Not applicable

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

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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

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).

Not applicable

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.

Not applicable

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SECTION 13. ATTACHMENTS AND CITATIONS

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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)

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.

The 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.

> *"The department is authorized by the 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..."*

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

Nooksack Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). Ten local populations have been identified in the Nooksack Core Area, based the distribution of suitable spawning and rearing habitat: Lower, Middle and Upper North Fork, Lower and Upper Middle Fork, Lower and Upper South Fork, Glacier Creek, Lower Canyon Creek and Wanlick Creek. The anadromous form is known to be present and it is possible that the fluvial and resident life history forms are also present in the core area. Anadromous outmigrants have caught in the lower mainstem from early April through mid-July (USFWS 2004). Bull trout spawning is known to occur throughout much of the upper watershed and is mainly confined to non-glacier tributary streams. Little, if any, comprehensive information exists concerning escapement levels, population size, or past harvest levels and as such the current status of the Nooksack bull trout is unknown (WDFW Bull Trout SaSI 2004). In Bellingham Bay, bull trout were observed in Squalicum Creek in the late 1970's and in lower Whatcom Creek more recently. In 2002, three sub-adult bull trout approximately 203 to 229 millimeters (8 to 9 inches) in length entered the Whatcom Creek Hatchery pond. These were reported to be the first bull trout observed at the facility in more than a decade, although formerly one to two a year were said to be observed at the facility. The recovered abundance level for bull trout in the Nooksack Core Area has been set at 2000 adult spawners, based on current habitat capacity (USFWS 2004).

Table 15.2.1: Summary table of core area rankings for population abundance, distribution, trend, threat, and final rank.

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Nooksack River	Unknown	620-3000	Unknown	Moderate, imminent	Potential Risk

Source Data: USFWS 2008

Habitat— Forest practices in the past, and related road networks and mass wasting, have had some of the most significant impacts to bull trout habitat within this core area. These have resulted in the loss or degradation of a number of spawning and rearing areas within local populations, as well as foraging, migration, and overwintering habitats. Bellingham Diversion has significantly reduced if not precluded connectivity of the Upper Middle Fork Nooksack local population with the rest of the core area. Bellingham Diversion currently prevents most anadromous and fluvial bull trout returning to the Middle Fork Nooksack River from reaching spawning and rearing habitats in the upper watershed. Agriculture practices, residential

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development, the transportation network and related stream channel and bank modifications have resulted in the loss and degradation of foraging, migration, and overwintering habitats in mainstem reaches of the major forks, as well as in a number of tributaries. Marine foraging habitats for this core area have and continue to be greatly impacted by urbanization along nearshore habitats in Bellingham Bay and Strait of Georgia. The presence of brook trout in many parts of the Nooksack core area and their potential to further increase in distribution is of significant concern given the level of habitat degradation that has occurred within the core area. The detection of brook trout/Dolly Varden hybrids further emphasizes this threat to bull trout. The absence of established spawner index areas or other repeatable means of monitoring bull trout population abundance and distribution within the core area, continues to hinder the identification, conservation, and restoration of remaining spawning and rearing reaches within the core area (USFWS 2004).

Several other listed and candidate species are found in Whatcom County; however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

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

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

PROPOSED
Dolly Varden (*Salvelinus malma*) due to similarity of appearance

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

15.3) Analyze effects.

There are no activities associated with this hatchery program that would directly impact the bull trout population. There is the possibility for indirect "take" associated with hatchery program operations—up to and including unintentional lethal take. Any observations of bull trout encountered during any hatchery activity, up to and including lethal take associated with hatchery activities, are reported annually by WDFW to USFWS under the ESA section 6 operating agreement. See section HGMP 15.1 above.

15.4) Actions taken to minimize potential effects.

All adult trapping facilities are regularly checked at consistent short intervals while actively trapping. All efforts are made to minimize any holding time listed fish remain in any traps.

All off-station collection activities attempt to minimize interaction with and effects to listed bull trout.

15.5) References.

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

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*		**ESU/Population:** Puget Sound/ Nooksack Chinook	**Activity:** Whatcom Creek Fall Chum Program
Location of hatchery activity: Whatcom Creek Hatchery, RM 0.5 of Whatcom Creek (WRIA 01.0566)		**Dates of activity:** June - May	**Hatchery program operator:** BTC
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)	-	-	0	
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

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

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

Table 2. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound/ Nooksack Steelhead	**Activity:** Whatcom Creek Fall Chum Program
Location of hatchery activity: Whatcom Creek Hatchery, RM 0.5 of Whatcom Creek (WRIA 01.0566)	**Dates of activity:** November-December	**Hatchery program operator:** BTC

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Listed species affected: Steelhead *(Oncorhynchus mykiss)*	ESU/Population: Puget Sound/ Nooksack Steelhead	Activity: Whatcom Creek Fall Chum Program
Location of hatchery activity: Whatcom Creek Hatchery, RM 0.5 of Whatcom Creek (WRIA 01.0566)	**Dates of activity:** November-December	**Hatchery program operator:** BTC

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)	-	-	24	
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migration 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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