HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Photo: Puget Sound Energy

Hatchery Program:	Baker River Sockeye Hatchery Program (Integrated)
Species or Hatchery Stock:	Sockeye *(Oncorhynchus nerka)*
Agency/Operator:	Puget Sound Energy Washington Department of Fish and Wildlife
Watershed and Region:	Skagit River/ North Puget Sound
Date Submitted:	
Date Last Updated:	November 14, 2014

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1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Baker River sockeye program at Baker River Hatchery.

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

Baker River (Skagit River) Sockeye (*Oncorhynchus nerka)* – Puget Sound sockeye are not ESA listed.

1.3 Responsible organization and individuals

Baker River sockeye program is co-managed with the **Sauk-Suiattle Tribe** and **Swinomish Indian Tribal Community** (represented by Skagit River System Cooperative - SRSC), and **Upper Skagit Indian Tribe.**

Puget Sound Energy (PSE) is the owner and operator of the hatchery facility, (with the exception of hatchery manager who is WDFW employee), and Baker River Upstream Fish Trap. PSE provides funding per the Baker License, for the program as directed by the Co-Managers, who conducts consultation, in regard of hatchery programs operations, and reports to the **Aquatics Resource Group** (ARG). The ARG annually evaluate and update fish release numbers, locations, times and size at release proposed by the Co-Managers. The ARG includes PSE, **Upper Skagit Indian Tribe**, SRSC, National Park Service (NPS), National Marine Fisheries Service (NMFS), local citizens, and all interested **Baker River Coordinating Committee** (BRCC) members. The BRCC includes WDFW, PSE, SRSC, USFWS, U.S. Forest Service (USFS), NPS, and all Signatories of the Settlement Agreement. The BRCC has overarching authority over the license implementation for the Baker River hydroelectric project and function of associated resource groups, including the ARG.

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

Funding Sources	Operational Information (for FY 2015)
Puget Sound Energy	Full time equivalent staff – 6.0 PSE, 1.0 WDFW Annual operating cost - $535,425

PSE funds implementation of the Fish Propagation Facilities Plan as specified by conditions in Settlement Agreement Article 101 for Baker River Project, FERC No. 2150.

1.5 Location(s) of hatchery and associated facilities.

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Baker River Upstream Fish Trap	Broodstock collection	Baker River (WRIA 04.0435) at RM 0.7, tributary to Skagit River (WRIA 03.0176) at RM 56.5.
Baker River Hatchery	Incubation, rearing,	Sulphur Creek (WRIA 04.0488), tributary to Lake Shannon (water reservoir behind Lower Baker Dam on Baker River (WRIA 04.0435) at RM 8.9. Baker River is a tributary to the Skagit River (WRIA 03.0176) at R.M. 56.5.
Lake Shannon	Release	Water reservoir behind Lower Baker Dam on Baker River (WRIA 04.0435) at RM 8.9.
Baker Lake		Water reservoir behind Upper Baker Dam on Baker River (WRIA 04.0435) at RM 9.2.

The facilities at Baker River Hatchery include Spawning Beach #4, located at the mouth of the Sulphur Creek.

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1.6 Type of program.

Integrated Conservation, with harvest benefits.

1.7 Purpose (Goal) of program.

Protection, Mitigation, Enhancement, (PME as per Article 101, FERC license).

1.8 Justification for the program.

The program exists in accordance with Baker Settlement Agreement Article 101 included in the Baker River Project FERC License. The goal of this program is to prevent the extirpation of this unique stock by providing suitable semi-natural spawning/incubation opportunity via man-made spawning beach and traditional cultural methods and to maintain an adult sockeye return level of a minimum of 3,000 fish. Because the natural lake-shore spawning beaches and several miles of river spawning access of this population were inundated and lost by the construction of Baker Dam, and current reservoir management precludes the natural spawners from "adapting" to the new lake levels due to the reservoir drafting during spawning season and incubation period, this population requires artificial enhancement to mitigate this loss and achieve Baker River and lake production potential. The stock has been successfully maintained, with little alteration of its natural history pattern, since the inception of the program in 1957 (HSRG, 2003). In addition to avoid stock extirpation, the new facilities can support production for meaningful harvest opportunities for both state and tribal goals.

To minimize impacts on listed fish by Baker River Hatchery operation and the Baker River sockeye salmon program, the following Risk Aversions are included in this HGMP:

Table 1.8.1: Summary of risk aversion measures for the Baker River sockeye program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1	Usage of spring water is regulated through WDOE water right permits for Sulphur Spring (S1-25440) and Domestic Spring (G1-28743)
Intake Screening	4.2	Water for hatchery operation is primarily withdrawn directly from and Sulphur Springs and domestic spring. Fish are not present at the natural springs and domestic spring.
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. Baker River Hatchery production falls in this category.
Broodstock Collection & Adult Passage	2.2.3, 7.9	Two Baker River dams are too high for conventional fish ladders and permanently block natural access to Baker River above Lower Baker Dam. All fish returning to Baker River are trapped, collected and sorted at the Baker River Upstream Fish Trap and transported to their release destination by truck according to the adult salmon species management protocol directed by the Fish Resource Agencies. Sockeye are distributed between the Sockeye Spawning Beach, the Hatchery and Baker Lake based upon the Fish Co-manager approved sockeye distribution schedule.
Disease Transmission	2.2.3, 7.7, 9.2.7	The culturing operation at the hatchery is conducted in accordance with *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) to prevent introduction and/or spread of any diseases. A part of this plan was designed specifically for sockeye program at Sulphur Creek hatchery to minimize and prevent outbreaks of IHNV disease. The

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		most current details are summarized in "Containment Plan and Sampling Protocol: Baker sockeye, Sulphur Creek facility, April 8, 2014"
Competition & Predation	2.2.3, 10.11	Life history, feeding habits, behavioral attributes, and size at releases of sockeye salmon are expected to result in limited competitive and predatory interactions with listed salmon and steelhead. The Species Interaction Workgroup (SIWG) (1984) identified sockeye as posing a low risk of competition and predation to naturally produced Chinook in freshwater.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Standards 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.

Table 1.10.1.1: "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 *U.S. v Washington.*	Contributes to co-manager harvest.	Fish contribution to fisheries will be estimated.
3.1.2- Program contributes to mitigation requirements.	This program provides mitigation benefits in accordance with Settlement Agreement Article 101 for the Baker River Project.	Survival and contribution to fisheries will be estimated.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to the cultural benefit that fishing provides. Recreational fishery angler days, length of season, number of licenses purchased. Fish available for tribal ceremonial use.	Fish contribution to fisheries will be estimated.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.1.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
3.1.3 Program addresses ESA responsibilities.	ESA consultation(s) under Section 7 have been completed, Section 10 permits have been issued, or HGMP has been determined sufficient under Section 4(d), as applicable.	First HGMP for this program was submitted to NOAA fisheries in March 2003. This HGMP has been updated to reflect changes in the program and resubmitted to NOAA fisheries
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from	Temporal distribution of broodstock collection, and of naturally produced population at point of collection.	Annual run timing, age and sex composition and spawning escapement timing data are collected.

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which broodstock is taken.		
3.4.3. Life history characteristics of the natural population do not change as a result of this artificial production program.	Specific life history characteristics to be measured in the artificially produced population.	Annual run timing, age and sex composition and spawning escapement timing data are collected.
3.4.4. Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and nearshore rearing.	Carrying capacity criteria for basin-wide and local habitat, including method of calculation.	Sockeye smolt production capacity was studied and summarized in Mazumder, 2004, and Sullivan and Hilgert Report, 2010. Capacity limit were modeled and did determined maximum capacity. Actual capacity is currently being explored through monitoring smolts sizes and fish condition.
3.5.1. Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Genetic composition of naturally-produced adults and co-occurring adults of this program, measured annually.	Currently not monitored
3.5.2. Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Collection of broodstock is done randomly throughout the entire return period.	Annual run timing, location, age and sex composition and return timing data are collected and recorded annually.
3.7.1. Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (PNFHPC, WDFW Fish Health Policy, INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, 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. Compliance with water right permit.	Flow and discharge are 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.	There is no fish habitat upstream of the water source.
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.	Certification of fish health during rearing and immediately prior to release, including pathogens presence and virulence.	Fish to be releases are examined 1 to 6 weeks prior to transfer or release, in accordance with the *Co-managers Fish Health Policy* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites	Lots of 60 adult broodstock are examined for pathogens at spawning.

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	Necropsies of fish to assess health, nutritional status, and culture conditions	Adult broodstock is annually inspected by Fish Health Section pathologist for pathogens. Juvenile fish are monitored monthly for health assessment. WDFW's Fish Health Section pathologist recommends preventative or remedial measures to prevent or treat disease, with administration of therapeutic or prophylactic treatments as deemed necessary. A fish health database is maintained to identify trends in fish health, diseases and treatments.
3.7.5 Any distribution of 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.	All applicable fish disease policies are followed.	Conduct controls of specific fish pathogens through eggs/fish movements in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006)
3.7.7 Weir/trap operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap.	Trap protocol has been developed to minimize handling and stress on captured adults. Mortalities are monitored for adult and juvenile trap and haul.
3.8.2 Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Artificial production was chosen as the preferred alternative for habitat and population recovery objective.	Annual operating costs reported.

1.11 Expected size of program.

1.11.1 <u>Proposed annual broodstock collection level (maximum number of adult fish).</u>

The current program capacity allows for placing up to 4,000 adults into the spawning beach and to collect enough broodstock for up to 7-million artificially-incubated fry. The annual goal has varied from year to year depending on research results and Co-managers agreement. The hatchery facilities are planned to be further developed to accommodate increasing production of up to 15,000,000 fry. Production objectives may be revised by Co-managers depending on sockeye smolt capacity assessments, future nutrient enrichment study results in Baker Lake and Lake Shannon and other adaptive management practices.

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

Production goal for 2014 is shown in **Table 1.11.2.1**.

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Table 1.11.2.1: Proposed number, size, date of release, and location of program releases in 2014.

Age Class	Max Number	Location
Unfed Fry (Spawning Beach)	Up to 2,000,000	Baker Lake
Fed Fry (Hatchery Reared)	Up to 3,500,000 Up to 2,500,000	Baker Lake Lake Shannon
Sub-yearling	Up to 330,000	Baker Lake
Yearling	Up to 5,000 Up to 5,000	Baker Lake Lake Shannon

Source: Co-Manager-agreed production, 2014.

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

For return years 2001-2012 the average escapement of Baker Lake sockeye to the terminal area was 14,935, and ranged from 3,588 to 48,229. Return to the Baker River Upstream Fish Trap averaged 11,391 sockeye, and ranged from 2,763 to 28,407 (**Figure 1.12.1**, see also **Table 3.3.1**).

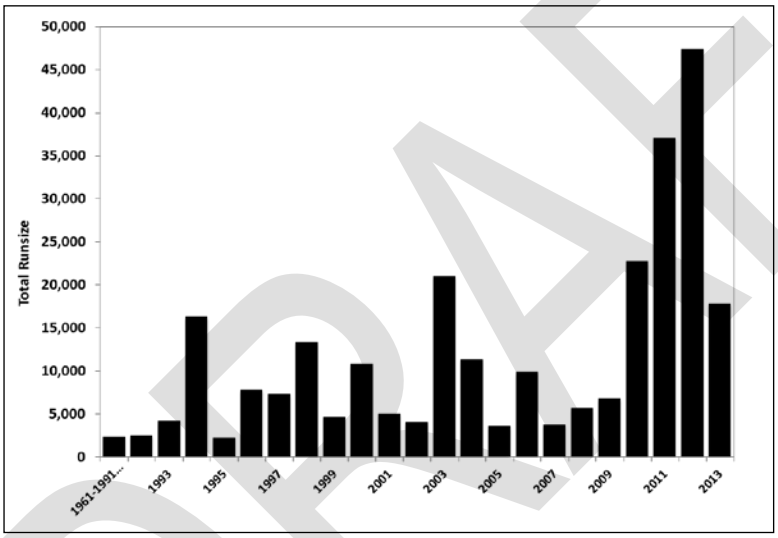

Figure 1.12.1 Baker Lake sockeye total terminal area return (Aaron Dufault, 2014).

The recent years higher return rates are attributed to more efficient migrating juvenile fish collection at Floating Surface Collectors (FSC). The passage efficiency of the migrating juveniles has improved with the installation of the FSCs (2008 in Baker Lake and 2013 in Lake Shannon) that can currently collect estimated 90% of the migrants in comparison to previously used gulpers that collected estimated 50%.

Average survival of out-migrant smolts to adults for years 2001-2012 was 7%, and ranged from 2% to 13% (Co-manager data, 2014).

The ratio of deposited eggs to out-migrating fry at artificial beach averaged 53% with a range of 32% to 85% (years 2001-2013, see also **Table 10.3.2**). The low survivals were caused by IHNV outbreaks.

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

This program was initiated in 1957, with operation of Spawning Beach #1. Beach #2 was completed in 1959, and Beach #3 in 1966. Beach #4 was built to replace beaches #1-3 threatened by flooding from the Baker River (the site also developed water flow limitations and structural problems at beaches #1, 2, and 3), was first used in 1990 and it is currently the only operating beach. Spawning Beaches #1, 2, and 3, were decommissioned in 2013.

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1.14 Expected duration of program.

This is an ongoing program expected to continue long-term.

1.15 Watersheds targeted by program.

The program targets the Skagit River watershed (WRIA 03 and 04).

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

In order for any alternative actions to be considered for attaining program goals, the affected parties (co-managers) must approve any changes. In the Skagit River watershed any changes in the production at the Baker River Hatchery have to be reviewed and approved by WDFW and Sauk-Suiattle Tribe, Swinomish Indian Tribal Community and Upper Skagit Indian Tribe.

Current production levels are annually reviewed by the co-managers and adaptively managed as to meet the strategy of testing and attaining maximum production of smolts in Baker and Shannon reservoirs.

Alternative 1: Modification or termination of program. The Co-managers did not pursue this alternative until Co-managers replace the sockeye program with other production as per the Baker Settlement Agreement Article 101, SA 101(e) "Licensee shall continue the existing programs described below, unless modified or terminated at the direction of the Sauk-Suiattle Indian Tribe, Swinomish Indian Tribal Community, Upper Skagit Tribe, and Washington Department of Fish and Wildlife ("Fish Co-managers"). Licensee shall fund and implement fish propagation and enhancement programs, when and if directed by the Fish Co-managers according to the following: 1) fisheries management objectives provided to license by the co-managers, 2) weight and production targets established by the co-managers, within the capacity and production limits (maximum 20,000 pounds for no more than three months annually) of the facilities required by this article, 3) species mix, life stages, and quantities, based on Co-managers' direction, within the capacity and production limits of the facilities required by this article, and 4) facility production is limited to the space available to the Sulphur Springs site" (Fish Propagation Facilities Plan, Baker Settlement Agreement Article 101, Baker River Project, FERC No. 2150).

2 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.

This HGMP was previously submitted to NOAA in March of 2003; however it was never acted on by NOAA. This 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.

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.

- 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 (Ford 2011), as well as twenty-seven artificial propagation programs (NMFS 2013 78FR38270). In the Skagit basin, the Technical Recovery Team (TRT) has identified demographically independent populations (DIPs) in the Lower Skagit River, Upper Skagit River, Upper Cascade River, Lower Sauk River, Upper Sauk River and Suiattle 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). 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 Skagit Basin, the TRT has preliminarily delineated one winter steelhead DIP in Nookachamps Creek and three DIPs of combined winter/summer steelhead (mainstem Skagit River, Baker River and Sauk River) (PSSTRT 2013).

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.

Skagit River spring Chinook in the Puget Sound Chinook ESU. Recent escapement levels (2001-2012) have averaged 660 for natural spawners in the Upper Sauk River DIP, 351 for the Suiattle River DIP and 371 for the Cascade River DIP. During this same period, the Upper Sauk DIP has shown and increasing population trend, while the Suiattle has decreased and the Cascade has remained relatively stable (SaSI, WDFW 2013).

Skagit Summer/ Fall Chinook in the Puget Sound Chinook ESU. Recent escapement levels (2001-2012) have averaged 10,695 for natural spawners in the Upper Skagit River DIP, 700 for the Lower Sauk River DIP and 2,403 for the Lower Skagit River DIP. All populations have shown declining population trends during this same period (SaSI, WDFW 2013).

Puget Sound Chinook salmon: Updated Risk Summary. All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. 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,

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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).

See Marblemount Chinook HGMPs for Chinook viability criteria.

Skagit River summer and winter-run steelhead in the Puget Sound Steelhead DPS. The number of natural-origin winter steelhead has substantially increased in the last five years. From a low point in 2008-2009 of 2,502 spawners, the number of spawners increased to 3,981 in 2009-2010, 5462 in 2010-2011, to 6,182 in 2011-2012, and to 8,272 in 2012-2013. Ford (2011) used spawner data collected through 2008 and concluded the following: "Steelhead counts in the Skagit River have declined steadily since the 1980s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 504 fish) is high—about 80% within 75 years. With an estimated mean population growth rate of −0.037 ($\lambda = 0.964$) and process variance of 0.005, NOAA was confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 30 years, and that a 99% decline will not occur within the next 60 years. However, beyond the next 50 years NOAA was uncertain about the precise level of risk." Based on a habitat-based intrinsic potential (IP) estimate by the PSSTRT (2013), the capacity for summer and winter steelhead in Skagit system ranges from 6,478 to 129,551 for the mainstem Skagit DIP, 2,323 to 46,460 for the Sauk DIP, 503 to 10,056 for the Baker River DIP and between 123 and 2,462 for the Nookachamps Creek winter steelhead DIP (Table 2.2.2.1).

*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 to an average of 51% in 2009 to 141% in 2013.

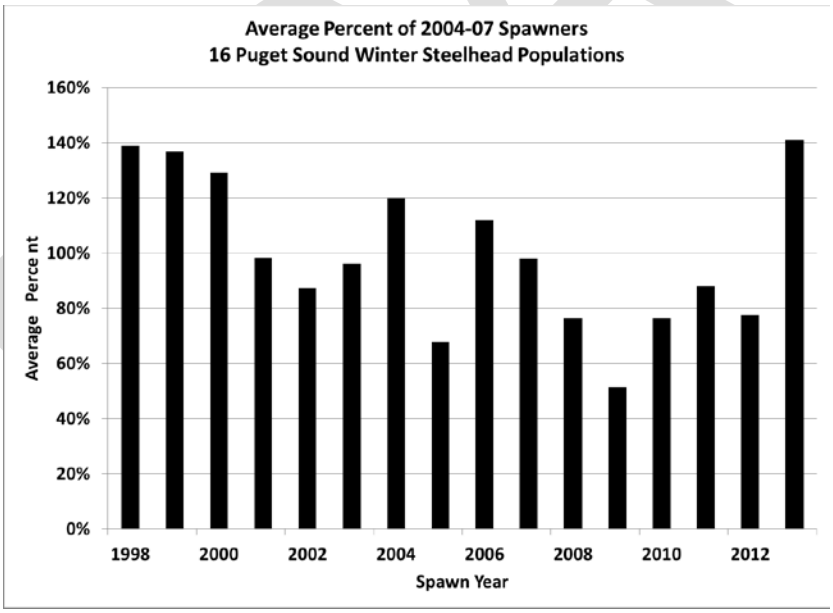

Figure 2.2.2.1. Average percent of 2004-2007 spawners for 16 Puget Sound winter steelhead populations.

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.

Table 2.2.2.1: Estimated DIP abundance thresholds of wild steelhead in the Skagit basin. Abundance goals for summer-run fish (*italics*) are still under review. QET, quasi extinction threshold; SAS, smolt to adult survival. Minimum abundance = 100 (Low Abundance), 250 (Viable).

Population Basin				Quasi Extinction Threshold	Low Abundance	Viable	Capacity
Population Name	Area km^2	Mean Elevation (m)	Total Stream Length (m)		1% SAS	5% SAS	20% SAS
Nookachamps Creek	183	252	159,503	27	123	616	2,462
Skagit River	5,543	1,098	2,815,113	157	6,478	32,388	129,551
Sauk River	1,897	1,132	1,079,263	103	2,323	11,615	46,460
Baker River	771	999	421,859	36	503	2,514	10,056
Puget DPS Total				**1,462**	**30,449**	**153,194**	**613,662**

Source: Hard et al. 2014

- 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 Marblemount Chinook HGMPs for Chinook productivity data.

Skagit System Steelhead (*Oncorhynchus mykiss*): Smolt monitoring traps utilized in larger river systems cannot successfully trap steelhead smolts. Smolt monitoring for Chinook and coho salmon in the Skagit River system indicates low numbers of wild steelhead smolts incidentally caught (Kinsel et al. 2008).

Table 2.2.2.2: Steelhead smolts and adults caught in Skagit River scoop and screw traps 1998-2007.

Species	1998		1999		2000		2001		2002	
	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr	Scp	Scr
Steelhead 1+										
Natural	389	1,100	99	334	95	597	32	317	118	437
Hatchery	446	2,325	122	511	75	736	23	465	75	534
Steelhead Adult	1	3	11	1	1	2	0	0	1	2
Species	**2003**		**2004**		**2005**		**2006**		**2007**	
	Scp	**Scr**	**Scp**	**Scr**	**Scp**	**Scr**	**Scp**	**Scr**	**Scp**	**Scr**
Steelhead 1+										
Natural	32	366	337	1,287	45	289	36	293	179	746
Hatchery	26	474	213	2,401	16	183	17	624	114	1,932
Steelhead Adult	0	0	0	0	2	0	0	0	0	3

Source: Kinsel et al. 2008

Table 2.2.2.3: Steelhead Exp Population. Trend ln(nat. spawners) (95% CI)

Population	1985-2009	1995-2009
Skagit River winter-run	0.969 (0.954 - 0.985)	0.978 (0.931 - 1.029)

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW, the Sauk-Suiattle Tribe, Swinomish Indian Tribal Community, and the Upper Skagit Indian Tribe.

- 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 Marblemount Chinook HGMPs for Chinook escapement data.

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Table 2.2.2.8: Wild Skagit River steelhead escapement 2000-2011.

Return Year	Winter Run*	Summer Run
2001/2002	5,394	NA
2002/2003	6,818	NA
2003/2004	7,332	NA
2004/2005	6,382	NA
2005/2006	6,757	NA
2006/2007	4,242	NA
2007/2008	4,887	NA
2008/2009	2,502	NA
2009/2010	3,981	NA
2010/2011	5,462	NA
2011/2012	6,185	NA
2012/2013	8,727	NA
Average	**5,722**	**NA**

Source: SaSI, WDFW 2013

* Total Escapement Data are total escapement estimates for all Skagit Basin winter steelhead and include winter steelhead in the Sauk, Suiattle, White Chuck and Cascade Rivers. Estimate is based on AUC redd counts from flights in the mainstem Skagit River from RM 22.5 to 94.1 and in the Sauk River from 0.0 to the forks, including up to RM 2.5 on the SF Sauk. Mainstem areas not surveyed are expanded for. Tributaries Alder, Diobsud, Rocky, O'Toole, Cumberland, Day, Sorenson, Hansen and Jones creeks, White, Dan's, Murphy, and Falls are surveyed and cumulative redd counts are tallied in order to calculate expansions for unsurveyed tributaries .

- 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 Marblemount Chinook HGMPs for Chinook hatchery- and natural-origin fish 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: Two Baker River dams are too high for conventional fish ladders and permanently block natural access to Baker River above Lower Baker Dam. Salmonids existence above the dams depends on human intervention. All fish returning to Baker River are trapped, collected and sorted at the Baker River Upstream Fish Trap for transportation above the dams and/or distribution in accordance with adult salmon species management protocol, updated as required by Co-managers. Sockeye broodstock is collected from volunteers returning to the Baker River Upstream Fish Trap during routine fish collection operation, which would be held out regardless of sockeye broodstock collection effort and as such does not affect listed fish passage in any additional way. No broodstock collection takes place at the Baker River Hatchery.

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include: water withdrawal, hatchery effluent, and intake compliance. Hatchery operation, monitoring and maintenance are conducted within and in accordance to permitted guidelines (see HGMP sections 4.1 and 4.2). Permit requirements are followed to minimize potential indirect 'Take" associated with the operations of hatchery facilities. No take of listed fish have been reported by staff during the normal operation of this hatchery.

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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). WDFW conducts fish disease examinations to ensure minimal disease transmission and to prevent the introduction and/or spread of any fish diseases. Fish health-monitoring efforts include fish health examinations and virus sampling, abnormal fish loss investigations, and pre-transfer and pre-release inspections. All activities are conducted in accordance with guidelines developed under the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). The IHN virus (IHNV) is the primary concern at the spawning beach. A part of the plan mentioned above was designed specifically for sockeye program at Baker River Hatchery to minimize and prevent outbreaks of IHNV disease. The most current details are summarized in "*Containment Plan and Sampling Protocol: Baker sockeye, Sulphur Creek facility, April 8, 2014.*"

Predation/Competition: Life history, feeding habits, behavioral attributes, and size at releases of sockeye salmon are expected to result in limited competitive and predatory interactions with listed salmon and steelhead. The Species Interaction Workgroup (SIWG) (1984) identified sockeye as posing a low risk of competition and predation to naturally produced Chinook in freshwater. Hatchery crew planting sockeye fry into Baker Lake observed Chinook feeding upon sockeye fry. Hook and line sampling of the fish in the vicinity of the release confirmed the presence of and predation by Chinook. The presence of sockeye fry in the Baker system may have a positive effect on Chinook, coho and Bull Trout, which are all found in the system.

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

No direct mortality of listed fish is associated with this hatchery program. Broodstock is collected at the Baker River Upstream Fish Trap, where all retuning fish are collected for transportation around the dams, and only non-listed fish are raised at the hatchery.

- 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 at end of HGMP.

- 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.

There is no take of listed fish projected for this program.

3 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 is consistent with Co-managers Resource Management Plan for *Puget Sound Hatchery Strategies for Steelhead, Coho Salmon, Chum Salmon, Sockeye Salmon* and Pink Salmon (PSTT, WDFW, 2004). See also HGMP section 3.2.

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

This program operates in accordance to conditions specified in Settlement Agreement Article 101 for Baker River Project, FERC No. 2150.

PSE received a new 50-year operating license for the Baker River Hydroelectric Project in October 2008 from the Federal Energy Regulatory Commission (FERC). Four years earlier, PSE and 23 other parties including State and Federal Agencies, and Indian Tribes submitted a comprehensive settlement agreement to FERC for what later became the updated project license. The Settlement Agreement describe a comprehensive and long-term operating agreement that will provide significant and wide-ranging public benefits and provide for the protection, mitigation and enhancement of species affected by the Baker River Hydroelectric Project.

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound ESU, operates under *U.S. v Washington* (1974) and the *Puget Sound Salmon Management Plan* (PSSMP 1985) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights.

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

3.3 Relationship to harvest objectives.

Baker River sockeye harvest management is directed on hatchery produced fish through the Baker River hatchery program and wild component of the run. Baker Lake sockeye primarily contribute to Washington recreational sport fisheries in the Skagit River and Baker Lake and treaty commercial fisheries especially in the Skagit River and Skagit Bay. Baker sockeye are also intercepted by pre-terminal fisheries in Alaska and Canada, although the encounter rate in these fisheries is low based on data from test fisheries conducted in Strait of Juan de Fuca.

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

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.

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3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (2001-2012), if available.

Table 3.3.1.1: Baker Lake Sockeye fishery contributions.

Return Year	Total Terminal Area Return	Terminal Catch		Total Adults Return to the Trap	Test fishery	Lake Catch Sport (Non-treaty)	Tribal Trap Haul C&S
		8	78 (C-D-O)				
2001	5,160	0	177	4,942	41	0	0
2002	4,036	0	13	4,023	0	0	0
2003	20,977	4	713	20,236	24	0	3,617
2004	11,309	0	2,168	9,113	28	0	609
2005	3,588	0	381	3,192	15	0	0
2006	9,873	45	1,489	8,325	14	0	595
2007	3,719	0	938	2,763	18	0	0
2008	5,759	126	2,349	3,211	73	0	0
2009	6,724	0	205	6,486	33	0	0
2010	22,770	16	3,681	18,809	264	2,933	4,542
2011	37,072	2,387	7,207	27,187	291	8,341	4,493
2012	48,229	2,609	16,604	28,407	609	9,855	4,679
Average	**14,935**	**432**	**2,994**	**11,391**	**118**	**1,761**	**1,545**

Source: Co-managers' data, 2014.

3.4 Relationship to habitat protection and recovery strategies.

Habitat protection and restoration strategies are paramount to the stability 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.

Baker River Coordinating Committee: implements the terms of the Settlement Agreement and coordinates the work of the ARG and the Terrestrial Resource Implementation Group (TRIG) in regards of habitat protection and restoration.

Puget Sound Salmon Recovery Plan (2005): Describes habitat related challenges (http://www.govlink.org/watersheds/9/plan-implementation/HabitatPlan.aspx). Based on this recovery plan, a number of habitat actions have been implemented, with additional improvements identified to be considered in the future.

State of Our Watershed: Individual member Tribes have worked with the NWIFC and SSHIAP to create the State of Our Watersheds report. This document examines key indicators of habitat quality and quantity across more than 20 watersheds in western Washington that lie within tribal Usual and Accustomed fishing areas as defined by *U.S. vs. Washington* (1974 Boldt Decision).

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 - The Skagit Watershed Council is the Lead Entity for the Skagit basin that includes the lower and upper Skagit River (WRIAs 3 & 4). The Skagit Basin is the largest watershed in Puget Sound. The land use in the lower portion is 64% forestry, 22% agriculture, 5% urban, 4% range and 5% other. In the uplands, land use is 73% forestry, 12% range and 15% other (see also http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml).

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Regional Fisheries Enhancement Groups (RFEGs). **S**everal citizen based groups work in conjunction with local governments on habitat actions to benefit both listed and non-listed stock in the system. In the Skagit River system this includes the Skagit Fisheries Enhancement Group.

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 the Baker River Hatchery sockeye program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact sockeye survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile sockeye while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile sockeye 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
- Coho salmon
- Sculpin

Rearing and migrating adult Sockeye originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Skagit River to the detriment of population abundance and the program's success in monitoring and evaluating the wild stock and harvest augmentation. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Chinook
- Bull trout

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Fish species that could positively impact the program may include other salmonid species and trout present in the Skagit River watershed through natural and hatchery production. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating sockeye. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) stimulation of primary productivity through the release of nutrients from decaying carcasses (Wipfli et al. 1998); 2) enrichment of the aquatic invertebrate food base from decaying carcasses (Mathisen et al. 1988); and 3) direct consumption of carcasses by juvenile salmonids (Bilby et al. 1996).

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The sockeye program could positively impact freshwater and marine fish species

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that prey on juvenile fish. Nutrients provided by decaying sockeye carcasses may also benefit fish in freshwater. These species include:

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

4 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 Baker River Hatchery.

Water Source	Water Right		Available Water Flow	Water Temp. (F°)	Usage	Limitations
	Record/Cert. No.	Permit No.				
Big/Sulphur Springs	S1-25440C	----	40 cfs	47	Adult holding, Rearing	Unstable source due to sliding materials, sediment infusion.
Domestic spring	G1-28743	-----	1,150 gpm	47	Incubation	None
Depression Lake (Drainage tunnel)	G1-160818CL	----	Inactive	45-55	Emergency only, can be supplied to artificial beaches only	Overflow depends on Baker Lake water level

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.
[a] Water right permit held by WDFW.
[b] Water right permit held by Seattle Public Utilities.

Water for the fish production at Baker River Hatchery is gravity-fed. The hatchery and spawning beach is supplied primarily from groundwater springs that are source of good quality pathogen-free water available at constant temperature of 47ºF. Sulphur Springs, a natural water spring, is located at the higher elevation that the hatchery, about ¾ mile away. Water flow from the spring can be disrupted by naturally caused (extensive rain periods) hill slides above the collection site. Water supply disruption to the hatchery due to sliding materials occurred in 2003, 2005 and 2012 for up to two weeks at the time. The turbidity events are monitored by an alarm system and intake screens are installed to reduce entering of organic debris. Sliding material also elevates sediment content in the water that necessitates use of sand separators designed to provide sediment protection and removal capabilities, before water can reach hatchery ponds. Operation of sand separators and recent improvements at the springs' intake has helped reduce sediment content. In 2013, PSE employed a graded filter and geotextile filter fabric to control sediment infusion and prevent sliding material from moving into water supply.

Domestic Spring is the source of potable water supplied to the entire Baker Lake compound. Water collected in excess of need for domestic use, and before chlorine treatment, is directed to the hatchery and utilized during egg incubation.

When Baker Lake water level is above 705 feet, water seeps through the earthen dike and fills Depression Lake. The overflow water from Depression Lake can be used to supply spawning beaches during emergency situations but water availability from this source is dependent upon Baker Lake levels and is not always available.

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Water rights at Baker River Hatchery are formalized through the Washington Department of Ecology (WDOE) for fish propagation. Surface water rights were obtained by Puget Sound Power & Light Co. for S1-25440 in 1989; water rights for the domestic spring (G1-28743) were obtained by Puget Sound Energy in 2012.

NPDES permits:
Annual hatchery production does not exceed the WDOE standard of 20,000 pounds per year regarding hatchery effluent discharge effects and no NPDES permit is required.

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.

There are no immediate risks to the listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge. Fish are not present at the springs. The principle hatchery water intake structures are in compliance with NOAA Fisheries screening criteria (NMFS 1995, 1996).

5 SECTION 5. FACILITIES

Currently-operating Baker River Hatchery rebuilding and renovations (including modifications to Sockeye Spawning Beach #4) was completed in 2011, as part of the settlement agreement (FERC). The facility operation before renovation was described in a previously submitted HGMP.

5.1 Broodstock collection facilities (or methods).

Adult sockeye for broodstock are collected at the Baker River Upstream Fish Trap, located on the Baker River at RM 0.7, half a mile downstream from Lower Baker Dam. The state-of-the-art facility is owned and operated by Puget Sound Energy. It was built to collect all fish returning to the Baker River for transportation above two Baker River dams (see video of Baker River Upstream Fish Trap). A weir blocks the river and directs all fish into the trap where they can be enumerated, identified, segregated by species, and transported and distributed according to the Baker River Upstream Fish Trap operations protocol.

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

Table 5.2.1: Trucks available for transportation at Baker River Hatchery.

Facility	Type	Capacity (gallons)	Fish Transported
Baker River Upstream Fish Trap and Baker River Hatchery	Truck-mounted tanks	2,000	Adults and juveniles
		1,400	
		500	

All transport trucks are equipped with aerators and oxygen tanks.

5.3 Broodstock holding and spawning facilities.

Artificial propagation of sockeye at Baker River Hatchery is conducted by utilizing spawning beach and traditional ponds. There is currently one operating spawning beach at Baker River Hatchery, known as Beach #4. Spawning Beaches #1, 2, and 3, located on spring-fed Channel Creek at the upper end of Baker Lake at RM 19.2 were decommissioned. Spawning Beach #4 is located at the mouth of the Sulphur Creek. It was modified in 2011, and divided into four equal 150' x 50' x 72" sections, separated by concrete walls. Each are equipped with a separate, direct spring water supply to reduce and contain IHNV outbreaks. Spawning beach capacity is 4,000 adults (up to 1,000 in each section). The spawning beach represents the least invasive type of artificial propagation used to supplement wild population (HSRG, 2003). Fish destined for spawning at the beach are transferred there directly and distributed equally into each section.

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The portion of the broodstock destined for the traditional artificial incubation and rearing, is held and spawned at adult holding ponds, supplied with spring water. Total capacity of adult holding ponds is 6,000 sockeye.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Baker River Hatchery.

Type	Number	Size
Vertical stack incubators	840	15" W x 2.5"D x 18"L
Shallow troughs	4	1’W x 1’ D x 24’L

Incubation area is divided into 5 separated rooms, each with separated water supply system for disease transmission prevention. Four rooms are used for sockeye, and one for coho incubation. The hatchery and spawning beach egg incubation capacity is 7,000,000 and 4,000,000, respectively.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Baker River Hatchery.

Type	Number	Dimensions
Swim up troughs	22	2’W x 2’D x 12’L
Intermediate troughs	6	3’W x 3’D x 24’L
Circular ponds	8	16’ Diameter x 4’D
Rearing raceways	4	8’W x 4’D x 80’L
14 'glass circulars ponds	8	4’W x 4’D x 15’L
Adult holding ponds	4	20’W x 5’to 6’D x 65’L
Adult raceways	2	8’W x 5’D x 80’L
Artificial Spawning Beach	1(divided into 4 sections)	150' x 50' x 72" (each section)
Trout pond*	1	22,791 cubic feet

*Trout pond is the only pond from the old hatchery considered for possible future utilization.

Table 5.5.2: “Stress Relief Ponds: available at the Baker River Upstream Fish Trap

Type	Number	Dimensions
Stress relief ponds	4	12’W x 72’’D x 40’L

5.6 Acclimation/release facilities.

Artificial beach. The artificial beach is supplied with water from Sulphur Springs. Fry leaving artificial beach are captured as they exit, and are trucked and released directly to Baker Lake at the Blue Tarp site to rear naturally.

Fry and yearlings raised in the incubators and ponds are trucked and planted directly into Baker Lake and Lake Shannon; sub-yearlings are planted into Baker Lake.

See HGMP section 10.4 for more information about release sites.

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

In 2011, an estimated number of 258,662 fry were lost due to IHNV outbreak.

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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.

The facility is equipped with low water alarms, turbidity alarm system, a back-up generator in case of power loss, and gas powered pumps. The Baker Dam operator receives alarm calls and contacts appropriate personnel in case of emergency.

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). Adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of fish disease pathogen transfers.

6 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 sockeye salmon returning to Baker River upstream fish trap. Puget Sound sockeye are not ESA listed.

6.2 Supporting information.

6.2.1 History.

Artificial enhancement began in 1896, when the state built a hatchery on Silver Creek, along the south shore of Baker Lake with purpose of sockeye propagation and supply to Puget Sound. Baker Lake was recognized as "the only natural spawning grounds of sockeye salmon in Puget Sound" (Kemmerich, 1945). The natural run at that time was estimated to be approximately 20,000 fish. During early 20th-century hatchery production, the annual sockeye run ranged between 3,500 and 14,000 fish. In 1925, Lower Baker Dam was constructed, and Lake Shannon was created, which blocked access to the Baker Lake. A ladder and "elevating contrivance" was constructed to provide passage. From that time through the early-1960s, sockeye adult returns averaged 3,000. In 1933, Baker River Hatchery was closed due to low sockeye returns. The hatchery program was reinstituted in 1957, with artificial spawning beds constructed at the upper end of the new Baker Lake to mitigate for loss of natural spawning beaches. In 1959, the construction of the Upper Baker Dam was completed and the valley, including the natural Baker Lake was inundated. In the mid-1960s, the sockeye returns dropped further and continued to decline through the 1980s. In 1985, only 99 sockeye adults returned to the Baker River system, the lowest total on record. This decrease coincided with a similar decline in other stocks throughout the region, alarming fisheries managers and operators of hydroelectric projects. Puget Power took a number of steps to address the problem. In 1976, the company funded a study of Artificial Spawning Beaches #s 2 and 3, and the following year established a program to assess juvenile outmigration. To investigate the causes of decline in salmon stocks, Puget Power initiated a study of the Baker Basin ecology in 1981, examining water quality, zooplankton, and lake sedimentation. During this period, the company joined fisheries agencies in convening a voluntary, ad hoc committee of fisheries biologists to develop recovery plans for Baker River stocks. Called the *Baker River Committee*, this group continues operating through the present (Salmon on the Baker River, PSE).

The utilization of the spawning beaches was the innovation. There have been four spawning beaches sequentially built, utilized, and abandoned for the program. Spawning beaches #1, 2 and 3, located at the upper end of the Lake, could no longer sustain water flow for hatchery needs and

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channel shifting, and were permanently discontinued in 2004, and decommissioned in 2013. The site formerly known as Beach #4 was modified in 2011, and is the only beach currently used for the program. All returning adults are now trapped below Lower Baker Dam and transported above the dams. Some adults are placed in the artificial spawning beaches, some are used for hatchery production, and some are released into Baker Lake to spawn naturally. Natural spawning takes place for the most part in seeps and springs at the head end of the lake and in the lower Baker River. Sockeye may also enter lake tributaries and spawn on the lake shoreline. Fry from the artificial spawning beaches and from hatchery production are released into Baker Lake and Lake Shannon, where they rear naturally. At the smolt stage, sockeye are captured at both dams and released downstream below lower Baker dam to complete their seaward journey.

The 1913 survey identified sockeye as spawning primarily in the Baker River, above the historic Baker Lake; surveys in 1954 and 1955 identified 99% of the Baker River sockeye spawning on the shores of Baker Lake. Whether the original population had two distinct genotypes, lake-spawning and river-spawning, is not clearly known.

Baker River sockeye are native to Baker Lake and the Baker River, tributary to the Skagit River. The hatchery stock was originally derived from wild Baker River sockeye. The current program is maintained entirely from progenies from artificial production at the hatchery- and wild- origin recruits (excess adults spawning naturally above Baker Lake) returning to the Baker River Trap.

Baker sockeye have been exported to other waters of the state. Lake Washington sockeye originated, in part, from Baker Lake. There were intermittent plants of Lake Whatcom Kokanee into Lake Shannon for the sport fishery.

6.2.2 Annual size.

The current program capacity allows for placing up to 4,000 adults into the spawning beach and to collect enough broodstock for up to 7-million artificially-incubated fry. The annual goal has varied from year to year depending on research results and Co-manager agreement. The hatchery facilities are planned to be further developed to accommodate increasing production of up to 15,000,000 fry. Production objectives may be revised by Co-managers depending on sockeye smolt capacity assessments, future nutrient enrichment study results in Baker Lake and Lake Shannon and other adaptive management practices.

6.2.3 Past and proposed level of natural fish in broodstock.

The majority of sockeye are released unmarked and their origin can't be identified. With no tool for origin identification level of natural and hatchery components in the broodstock is unknown.

6.2.4 Genetic or ecological differences.

The Biological Review Team (BRT) characterized Baker River Sockeye as separate ESU based on genetic, life history and environmental characters. Allozyme analysis has shown Baker River sockeye to be genetically distinct from salmon populations that spawn in lower Frazer River and all other native populations of Washington state sockeye salmon (WCSSBRT 1998; Gustafson and Winans 1999).

6.2.5 Reasons for choosing.

The stock was chosen based on its indigenous 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 broodstock through this program and no adverse genetic or ecological effects to listed natural-origin fish occur as a result of broodstock selection practices.

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7 SECTION 7. BROODSTOCK COLLECTION

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

Adults are selected for broodstock for this hatchery program.

7.2 Collection or sampling design.

Adult sockeye are trapped volitionally from approximately the middle of June through the end of August at the Baker River Upstream Fish Trap, located at the Baker River at the outlet of Lake Shannon. A new upstream fish passage facility was constructed in 2010. Fish enter water-filled 7-ft diameter by 60-ft tall tower that operates like an aquatic elevator for raising the captured fish from river level to the trap's elevated facility. A programmable control system and operators booth sorts fish by species and separates them into six holding pools. There is an adjacent sampling area for collecting biological information. Fish are transferred from holding pools to transport trucks via an automated system that minimizes handling. Adults are hauled into either the new fish culture facility, Beach #4 (RM 9), or into Baker Lake to spawn naturally and support a sport fishery. Broodstock is collected throughout the entire return timing.

7.3 Identity.

The majority of hatchery sockeye production, 6,000,000 fry, are released unmarked and cannot be differentiated from natural production. Fingerlings (330,000) are released mass-marked (adipose fin-clipped), and yearlings (10,000) are released mass-marked and PIT tagged (see also **Table 10.7.1**).

7.4 Proposed number to be collected:

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

The current program capacity allows for placing up to 4,000 adults into the spawning beach and to collect enough broodstock for up to 7-million artificially-incubated fry. The annual goal has varied from year to year depending on research results and Co-manager agreement. The hatchery facilities are planned to be further developed to accommodate increasing production of up to 15,000,000 fry. Production objectives may be revised by Co-managers depending on sockeye smolt capacity assessments, future nutrient enrichment study results in Baker Lake and Lake Shannon and other adaptive management practices.

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: Broodstock origin and sex composition at Baker River Hatchery, sockeye program, artificial incubation (AI) only

Brood Year	Marked		Unknown		Unmarked	
	Male	Female	Male	Female	Male	Female
2002			249	228		
2003			334	348		
2004			637	438		
2005	24	37			337	379
2006	38	46			482	383
2007	16	18			299	262
2008	6	17			263	296
2009	19	15			705	435
2010	169	156			1,219	1,325
2011	76	127			1,362	1,410
2012	21	34			1,292	1,198
2013	106	150			1,729	1,824
Average	**53**	**67**	**407**	**338**	**854**	**835**

Source: PSE fish rearing records 2014.

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

Sockeye not retained for broodstock are released into Baker Lake to spawn naturally in the lake and its tributaries, and distributed to Upper Skagit Indian Tribe, Swinomish Indian Tribe and Sauk-Suiattle Indian Tribe for ceremonial and subsistence purposes. A minimum of 1,500 adults are required to be placed directly into Baker Lake for natural spawning and nutrient enhancement. The number of adults intended for natural production is not currently agreed to, and will be annually reviewed and updated by the Co-managers.

7.6 Fish transportation and holding methods.

Sockeye collected at the Baker River Upstream Fish Trap can be transported by any of the trucks available at the facility. Tank size is chosen based on number of transported fish. Fish destined to the Baker River Hatchery and for lake releases are transported separately. Transport time to the hatchery is around 35minutes. Transferred fish are placed either into spawning beach or into adult holding ponds, both supplied with Sulphur Spring water.

Adults destined for Baker Lake are released directly into the lake at designated locations (see HGMP section 10.4 for more information about release sites). Transport time to the lake is about 45 minutes.

7.7 Describe fish health maintenance and sanitation procedures applied.

WDFW follows standard fish health protocols, as defined in the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). A part of this plan was designed specifically for sockeye program at Baker River Hatchery to minimize and prevent outbreaks of IHNV disease. The most current details are summarized in "Containment Plan and Sampling Protocol: Baker sockeye, Sulphur Creek facility, April 8, 2014."

7.8 Disposition of carcasses.

Spawned sockeye carcasses and adult mortalities from holding ponds and the spawning beaches are distributed into Baker Lake tributaries for nutrient enhancement if presence of IHNV is not detected. Infected carcasses are disposed of through the contracted fish buyer for dispersion at upland sites in the forest.

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

The two Baker River dams are too high for conventional fish ladders and permanently block natural access to Baker River above Lower Baker Dam. Salmonids existence above the dams depends on human intervention. All fish returning to Baker River are trapped, collected and sorted at the Baker River Upstream Fish Trap for transportation above the dams and/or distribution in accordance with adult salmon species management protocol, updated as required by the Co-managers. Sockeye broodstock is collected from volunteers returning to the Baker River Upstream Fish Trap during routine fish collection operation, which would be held out regardless of sockeye broodstock collection effort and as such does not affect listed fish passage in any additional way.

8 SECTION 8. MATING

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

Sockeye placed at the spawning beach spawn naturally, without human intervention.

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Information in this section refers to procedures applied during artificial spawning process at the hatchery facility.

8.1 Selection method.

Broodstock is selected randomly from ripe fish across the entire maturation time frame.

8.2 Males.

All males collected, including jacks, are considered for spawning and are selected randomly on spawn days. Males may be live-spawned to assure enough are available for fertilization. As a general rule, if live-spawning takes place, used males are marked with an operculum punch, separated for easy identification and, when possible, used no more than twice.

8.3 Fertilization.

Eggs pooled from five females are equally spread into five buckets, and eggs in each bucket are fertilized with milt from one male (matrix spawning). After 60 seconds of fertilization time, milt from secondary male is added to ensure successful fertilization. The secondary male becomes a primary male for fertilizing eggs in the following bucket. After fertilization all eggs are combined into one bucket and moved to the incubation room.

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.

Listed fish are not included in mating scheme through this program.

9 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: Survival rates from egg-take to ponding, Baker River Hatchery sockeye program, artificial incubation (AI) only

Brood Year	Eggs Collected	Survival Rates (%)	
		Green-to-Eyed Up	Eyed-Up-to-Ponding
2002	693,305	97	98
2003	794,262	95	98
2004	1,226,400	96	98
2005	1,244,000	94	98
2006	1,367,901	95	98
2007	970,901	95	98
2008	770,210	96	98
2009	1,771,686	95	98
2010	522,316	91	98
2011	5,283,605	96	94
2012	3,755,298	90	93
2013	5,160,586	91	97
Average	**1,963,373**	**94**	**97**

Source: PSE fish rearing records, 2014.

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9.1.2 Cause for, and disposition of surplus egg takes.

No surplus eggs are collected through this program.

9.1.3 Loading densities applied during incubation.

Artificial beach. A maximum of 1,000 fish are placed per each section that measures 150'x50'x72".

Vertical incubators. An estimated amount of 13,500 eggs (3.5-lbs) are placed per tray.

9.1.4 Incubation conditions.

Artificial beach. Incubation of naturally-deposited eggs in spawning beach occurs without human intervention. The beach substrate is filled with washed and graded rocks. Beach is supplied with good quality spring water upwelling through the rock substrate.

Vertical incubators. Eggs are incubated in trays supplied with water from domestic spring at the rate of 3 gpm per ½ stack. The water has constant temperature of 47ºF. Dissolved oxygen levels are checked when needed. The saturation levels average over 10 ppm. Vexar® layers are placed in the trays to provide substrate. Water supplied from domestic spring does not contain silt.

9.1.5 Ponding.

Artificial beach. Fish incubated in spawning beach emerge naturally.

Vertical incubators. When approximately 100% buttoned up (March) and ready for initial feeding, fish are moved from trays into swim up troughs supplied with spring water.

9.1.6 Fish health maintenance and monitoring.

There are five separate incubation rooms in the hatchery building, each with a separate water supply system to prevent disease transmission. Four rooms are used for sockeye, and one for coho incubation. Eggs placed into trays in incubation rooms are water-hardened in an Iodophor solution. Fungus in incubators is controlled by formalin drip, (15-minute injection 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 are removed. Fry loss is picked at the time of ponding and then daily.

IHNV outbreaks are of primary concern at the beach and in the incubators. To reduce and contain IHNV outbreaks, the beach is divided into four sections separated by concrete walls and each are equipped with a separate, direct water supply. When adult spawners begin to die, they are removed from the beach to eliminate potential IHNV concentrating in spots. When fry begin to emerge from the gravel, 60 fish samples (12-five fish pools) are collected from each beach sub-section weekly for IHNV testing. If the samples show four or more positive pools per 60 fish sample, the entire beach section is destroyed and effluent is diverted to a clarifier. As a precaution, the section of the spawning beach is completely sanitized with chlorine between uses.

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 or at this hatchery.

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.

Survival rates for fish reared at the hatchery through standard rearing methods are provided in **Table 9.2.1.1**. Spawning beach survival rates are provided in **Table1.12.1**.

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Table 9.2.1.1: Survival rates from fry to smolt, Baker River Hatchery sockeye program, artificial incubation (AI) only

Brood Year	Survival Rates (%)	
	Fry-to-Sub-yearling	Sub-yearling-to-Smolt
2002	46.3	NA
2003	85.4	NA
2004	99.4	95.0
2005	99.5	99.8
2006	98.8	99.5
2007	99.2	99.1
2008	98.1	99.3
2009	97.3	99.2
2010	98.0	97.3
2011	94.8	97.6
2012	88.9	98.4
2013	NA	NA
Average	**91.4**	**98.4**

Source: PSE fish rearing records, 2014.

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 3lbs of fish /gpm at release and under 0.35lbs/ft^3.

9.2.3 Fish rearing conditions

Artificial beach: Fry emerge from the gravel and exit beach between February and May.

Rearing ponds: Sockeye are reared initially in swim up troughs for up to two weeks and then moved into rearing raceways supplied with Sulphur Springs water. Fry are released unmarked between March and May, at the size ranging between 700 and 2,000 fpp. Remaining fish are mass-marked (adipose fin-clipped only) in summer (July/August) at 100-185 fpp. A group of fish destined for release as sub-yearlings is released in November at less than 50 fpp. Fish destined for release as yearling smolts are PIT tagged in December and released the following April at around 10 fpp.

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.

Artificial beach: Natural rearing and feeding takes place in the spawning beach. Out-migrant fry range in size between 3,400 and 3,000 fpp.

Table 9.2.4.1: Average size (fpp), by month, of juvenile sockeye reared at Baker River Hatchery

Month	Average Size (fpp)	
	Sub-yearlings	Yearlings
March	3,054	3,054
April	2,400	2,400
May	2,250	2,250
June	1,500	1,500
July	600	600
August	185	185

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September	100	100
October	75	75
November	45-50	45-50
December	Released	40-45
January		30-45
February		25-30
March		20-25
April		15-20

Source: PSE fish rearing records, 2014.

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).

Artificial beach: Hatchery personnel observed sockeye feeding naturally before exiting the beach. Sockeye in the artificial beach are not fed by hatchery employees.

Rearing ponds: Sockeye are fed a variety of diet formulations including: starter feed, crumbles and pellets; the food brand used may vary, depending on cost and vendor contracts. Feeding frequencies usually begin at 12 feedings/7-days a week and end at 1 feedings/5-days a week. Feed rates varies from 1.5% to 5.0% B.W./day. An overall season food conversion rate is approximately 0.6:1. Fry are fed a minimum of one week before release.

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 WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Part of this plan was designed specifically for sockeye program at Baker Lake Hatchery to minimize and prevent outbreaks of IHNV disease. The most current details are summarized in "Containment Plan and Sampling Protocol: Baker sockeye, Sulphur Creek facility, April 8, 2014."

See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

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

ATPase activity is not measured. Sockeye are not released as smolts.

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

The man-made spawning beach is utilized to produce portion of the sockeye production through this hatchery program. The beach represents the least invasive type of artificial propagation used to supplement wild population (HSRG, 2003). Fish transported and placed into the beach spawn, incubate, emerge and exit the beach naturally.

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; however, all reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of high-quality spring water for incubation, high-quality feeds for rearing, rearing densities and loadings that conform to best management practices, frequent fish health inspections and the presence of professionally trained personnel to operate the facility. Hatcheries are designed to provide safe

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and secure rearing environment through the use of alarm systems, backup generators, availability of emergency water supply and emergency plan to prevent catastrophic fish losses.

10 SECTION 10. RELEASE

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

10.1 Proposed fish release levels.

The new hatchery and refurbished sockeye spawning beach are capable of producing 11-million salmon fry annually with potential future expansion increasing production to 15-million fry.

Production goal for 2014 is shown in **Table10.1.2**. Production goals for future years will be within the maximum, but at the levels agreed to annually by Co-managers.

Table 10.1.2: Proposed number, size, date of release, and location of program releases in 2014.

Brood Year	Age Class	Max Number	Size (fpp)	Release Date	Location
2014	Unfed Fry (Spawning Beach)	Up to 2,000,000	3,000-3,400	February - May	Baker Lake
	Fed Fry (Hatchery Reared)	Up to 3,500,000 Up to 2,500,000	700-2,000	March - May	Baker Lake Lake Shannon
	Sub-yearling	Up to 330,000	20-50	November	Baker Lake
	Yearling	Up to 5,000 Up to 5,000	10	April	Baker Lake Lake Shannon

Source: Co-Manager-agreed production, 2014.

Approximately 330,000 fry are allocated for the extended rearing program. Sockeye released in fall as sub-yearlings survive at the higher rate and benefit production. An additional 10,000 fish are allocated to release as yearlings for use in SFC efficiency study.

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

Stream, river, or watercourse: 1. Baker Lake
2. Lake Shannon

Release point: 1. Blue Tarp. Other sites as developed
2. Tailrace below hatchery. Other sites as developed

Major watershed: Skagit River Basin (WRIA 03 and 04)

Basin or Region: Puget Sound

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

Table 10.3.1: Releases by number, size and dates of release by year, sockeye program, artificial incubation (AI) only

Release Year	Fry	Avg. size	Date(s)	Sub-yearling	Avg. size	Date(s)	Yearling	Avg. size	Date(s)
2003	663,950	2,679	2/14-5/27	68,023	56	5/21	5,203	20	4/13
2004	758,994	2,665	3/2-5/21	50,716	49	10/28	23,432	16	4/13
2005	1,188,524	2,774	2/9-5/23	54,485	43	10/19	4,907	20	4/6
2006	1,134,724	2,999	2/3-5/11	50,920	50	12/14	5,028	18	4/12
2007	1,224,356	2,495	2/9-5/24	50,956	33	12/12			
2008	935,849	2,521	2/22-5/19	55,730	32	11/20	7,005	19	3/12
2009	726,064	2,471	2/17-5/21	64,547[a] 59,450	654 60	6/10 11/18	6,856	13	4/7

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2010	4,595,414	2,547	2/5-5/20	100,080[a] 56,700	365 46	6/23 11/17	4,835	17	4/19
2011	5,095,860	2,395	3/7-5/16	115,023	39	11/10	8,229	14	4/27
2012	4,770,140	2,838	2/22-5/24	-----	-----	-----	10,993	15	3/9-5/24
2013	3,467,317	2,483	3/6-5/19	147,653	51	11/15	8,700	19	4/1-5/1
2014	4,761,302	2,804	2/12-5/22	117,083	45	11/12	7,200	18	3/20-4/30
Average	**2,443,541**	**2,639**		**75,1586**	**47**		**8,399**	**17**	

Source: PSE fish rearing records, WDFW Hatcheries Headquarters Database 2014.
Note: CV values were not calculated for the program at this hatchery.
[a] Not included in calculated average

Table 10.3.2: Baker River hatchery sockeye production at the spawning beach only

Brood Year	Beach Number	Females Spawned	Egg Production	Percent Survival	Fry Production
2001	3&4	1,017	2,949,300	45%	1,316,042
2002	3&4	1,677	4,863,300	32%	1,537,065
2003	3&4	1,854	5,376,600	39%	2,089,175
2004	3&4	1,662	4,819,800	34%	1,638,138
2005	4	971	2,815,900	59%	1,656,858
2006	4	1,807	5,240,300	38%	1,990,183
2007	4	850	2,465,000	77%	1,892,677
2008	4	1,161	3,366,900	39%	1,326,437
2009	4	1,713	4,967,700	71%	3,511,564
2010	4	Not in operation			
2011	4	469	1,360,120	85%	1,160,105
2012	4	1,192	3,456,800	61%	2,095,632
2013	4	1,013	2,937,700	62%	1,827,986
Average	**w/o 2010**	**1,282**	**3,718,285**	**53%**	**1,836,822**

Source: PSE fish rearing records, 2014
Note: The estimated fecundity is 2,900 eggs/female.

10.4 Actual dates of release and description of release protocols.

Artificial beach: Out migrating fry leave spawning beach volitionally when ready and exit directly into the channel where they are collected for transportation to release sites at either Baker Lake or Lake Shannon. Screens from the beach sections are pulled starting in February. Fish are enumerated while leaving beach using Smith-Root fish counter. Fish are transported whenever 30,000 fry are accumulated or every three days, whatever comes first.

Rearing ponds: Fish reared in the ponds are destined for releases in March-May (fry, Lake Shannon and Baker Lake), November (sub-yearlings, Baker Lake) and April (yearlings, Baker Lake and Lake Shannon). All fish are trucked and released directly into their release destinations at either Baker Lake or Lake Shannon. Released fish numbers are calculated by subtracting mortalities.

See **Table 10.3.1** for release dates.

In accordance with Settlement Agreement Article 101 the Baker River Co-Managers have developed the sockeye fry release plan outlined in Baker River Co-Managers Fish Distribution Plan:

"Puget Sound Energy (PSE) will outplant sockeye fry at the direction of the Baker River Hatchery Manager rotating daily amongst no less than three out-planting sites, approved by the Co-Managers, in each reservoir. Three functional sites are necessary to avoid conditioning predators, to provide time for fry dispersal in the littoral zone before the next plant, and to ensure viable planting sites when environmental and logistical demands may at times pose a human

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safety concern that temporarily limits site use. An increased number of sites may be desired at higher reservoir levels when more planting sites become available. Site criteria include locations in the upper half of each reservoir to avoid attraction to the FSCs, to better mimic what would be natural fry emigration into the reservoir from both riverine and lake spawning sockeye, quiescent water so that fry can recover from trap and haul distress to orientate after planting prior to entering current, a maximum drop from the truck to in-water transfer of three feet, and a minimum depth of three feet using the fry planting nozzle. Sockeye fry from Artificial Incubation will mostly be planted after two weeks feeding in swim-up troughs. Spawning Beach #4 fry will mostly be planted directly upon emigration from the beach segments. The number of sockeye fry to be produced annually in artificial incubation and Spawning Beach #4, the number to be planted in each reservoir, and number for extended rearing and fall release will be determined by the Co-Managers and finalized at the Pacific Fisheries Management Council North of Falcon process that takes place annually in March. These decisions will be documented in an addendum to the *Baker River Co-Managers Fish Production Plan* annually in late-March or early-April.

Planting Sites. As of June 2014, only one year-round functional site exist in Baker Lake, the Blue Tarp site. A second site at Channel Creek is no longer functional due to the loss of a beaver dam and elimination of quiescent water with sufficient depth for planting fry. To meet Co-Manager objectives for effective fry planting at least two additional sites will need to be developed or repaired. In Lake Shannon only one functional site exists (the Baker River site adjacent to the hatchery facility), and it requires a generation outage for planting. The site could be greatly improved with the addition of an off-channel ponding facility, similar to the stress relief ponds, that allows for volitional releases without a generation outage. Given the lack of road access in Lake Shannon, planting from a boat may be the only viable option to meet Co-manager objectives for effective fry release. All planting sites shall be maintained in a safe, functional condition so that they are available for use across the operating pool throughout the planting season (February 1 through May 31). Not all sites need to function across the full pool as long as three approved sites are available at any given pool level.

10.5 Fish transportation procedures, if applicable.

All fish released through this program are trucked to their release destinations. Tanks sizes are chosen based on the size of the fish load. Transport time varies between 5 and 35 minutes, depending on the destination (see video).

10.6 Acclimation procedures.

All fish are reared on the Sulphur Springs water.

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

Table 10.7.1: Number released, by mark type, Baker Lake Sockeye program.

Brood Year	Stage	Number	Marking
2014	Fry	All Released	Unmarked
	Sub-yearlings	All Released	AD Only
	Yearlings	All Released	AD+PIT Tag

Source: Future Brood Document 2014

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

There is no excess fish associated with this program, all available fish are released. Release goals are evaluated and set annually (see **Table 10.1.1**), and limited by Settlement Agreement. Actual production depends on facility capacity, fish escapement, spawning success and IHNV outbreak levels.

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10.9 Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is 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 if they 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 (drought or flooding) critical to the fish's survival, fish may be released early to prevent losses or moved to another facility if feasible.

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.

Life history, feeding habits, behavioral attributes, and size at releases of sockeye salmon are expected to result in limited competitive and predatory interactions with listed salmon and steelhead. The Species Interaction Workgroup (SIWG) (1984) identified sockeye as posing a low risk of competition and predation to naturally produced Chinook in freshwater.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

The program exists in accordance with Baker Settlement Agreement Article 101 included in the Baker River Project FERC License.

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

See HGMP section 11.1.

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.

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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.

No listed species are present above the project. Below the project, the life history, feeding habits, behavioral attributes, and size at releases of sockeye salmon are expected to result in limited competitive and predatory interactions with listed salmon and steelhead.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

No research is currently conducted for this program. See section 11 - Monitoring.

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.

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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13 SECTION 13. ATTACHMENTS AND CITATIONS

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14 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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15 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.

Skagit Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). The USFSW identified the Lower Skagit River below Diablo Dam as a core area with 19 local populations and two potential local populations (USFWS 2004). This core area supports all four life forms of bull trout: resident, fluvial, adfluvial, and anadromous. The adfluvial form is only found in the Baker River system in both Lake Shannon and Baker Lake. While spawning has been documented in the Baker River and its tributaries above Baker Lake, it is believed that bull trout in Lake Shannon originate from fish spilling over the upper Baker dam and that any natural spawning is extremely limited. Anadromous bull trout are found throughout the system and also make extensive use of the estuarine and nearshore waters foraging on juvenile salmon, smelt, sandlance and herring. Resident and fluvial forms are also found throughout the anadromous zones of the Lower Skagit core area. Primary spawning areas are found in the upper portions of the watershed at an elevation of 1,000 to 3,000 feet. The Lower Skagit core area is thought to represent the largest population of bull trout in Washington State and the status of this stock is considered to be healthy (WDFW 2004). The recovered population level for the Lower Skagit core area has been set at 3,800 adults.

Table 15.1.1: Summary table of core area rankings for population abundance, distribution and trend

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Lower Skagit River	2,500-10,000	620-3,000	Increasing	Slightly	Low Risk

Source: USFWS 2008

Table 15.1.2: Bull trout redd counts in the South Fork Sauk River spawning index area, and bull trout smolt counts at the lower Skagit River trap (representing entire core area), 1998 to 2009.

Year	Number of Redds	Smolts Captured
1998	62	358
1999	---	199
2000	---	246
2001	163	142
2002	318	189

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2003	287	149
2004	433	186
2005	104	31
2006	143	90
2007	110	228
2008	208	146
2009	77	72
Average	**191**	**170**

Source: Zimmerman and Kinsel 2010.

Habitat - Large portions of this core area fall within areas under National Park and Wilderness designation, so these areas have generally avoided many of the impacts from more intensive land management. Gorge Dam currently restricts connectivity between the Stetattle Creek local population and the majority of the core area. This has put the Stetattle Creek local population at increased risk, however this break in connectivity may be less significant to the core area as a whole due to the large number of connected local populations that exist below this barrier. The Baker Dams also restrict connectivity between the Baker Lake local population and Sulphur Creek potential local population and the rest of the core area. Operations of the Lower Baker Dam have at times significantly impacted water quantity in the lower Baker and Skagit Rivers. Agriculture practices, residential 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. Nearshore foraging habitats have and continue to be impacted by agricultural practices and development activities. Bull trout within this system were overharvested in the past, but the implementation of more restrictive regulations in the early 1990's have helped allow the population to increase in abundance from the low levels of the late 1980's. Recent spawning index area counts strongly indicate that this population is rebounding near or to recovered levels. (USFWS 2004).

Several listed and candidate species are found in Whatcom and Skagit Counties; 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 Skagit bull trout population. There is the possibility for indirect "take" associated with hatchery

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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 HGMP section 15.1.

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

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"Take" Tables

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound Chinook		**Activity:** Baker Lake Sockeye Program	
Location of hatchery activity: Baker Lake Traps	**Dates of activity:** April - November		**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)	-	-	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)	-	-	-	

* No broodstock collection takes place at the Baker River Hatchery. Broodstock for the program is collected at the Baker River Upstream Trap by PSE employees.

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound Steelhead		**Activity:** Baker Lake Sockeye Program	
Location of hatchery activity: Baker Lake Traps	**Dates of activity:** April - November		**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)	-	-	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)	-	-	-	

* No broodstock collection takes place at the Baker River Hatchery. Broodstock for the program is collected at the Baker River Upstream Trap by PSE employees.

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.

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