FINAL
HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Sandy River Coho Salmon Program**
Species or Hatchery Stock:	**Coho Salmon (Stock 11)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**North Willamette Watershed, NW Region**
Draft Submitted: **Submitted for ESA Consultation:**	**September 1, 2006** **August 1, 2013**
Date Last Updated:	**November 6, 2013**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery Program.

Sandy River Coho Salmon Program.

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

The population under propagation is hatchery-produced Sandy River coho salmon, *Oncorhynchus kisutch* (stock 11). The wild population of coho salmon in the Sandy River is part of the Lower Columbia River Evolutionarily Significant Unit (ESU), and is listed as endangered under the Oregon State Endangered Species Act, and was recently listed as threatened under the federal Endangered Species Act (ESA), effective July 2005. The hatchery-produced coho population is considered part of the ESU and is included in the recent listing decision (September 29, 2006) by NOAA Fisheries.

1.3) Responsible organization and individuals.

Lead Contacts:

Name and Title:	Scott Patterson, Fish Propagation Program Manager
Organization:	Oregon Department of Fish and Wildlife
Address:	3406 Cherry Drive NE, Salem, OR 97303
Telephone:	503-947-6218
Fax:	503-947-6202
Email:	Scott.D.Patterson@state.or.us

Name and Title	Todd Alsbury, District Fisheries Biologist
Organization:	Oregon Department of Fish and Wildlife
Address:	17330 SE Evelyn St., Clackamas, OR 97303
Telephone:	971-673-6011
Fax:	971-673-6071
Email:	todd.alsbury@state.or.us

Hatchery Contact:

Name and Title:	Tim Foulk, Hatchery Manger, Sandy Hatchery
Agency:	Oregon Department of Fish and Wildlife
Address:	39800 SE Fish Hatchery Rd. Sandy, OR 97055
Telephone:	(503) 668-4222
Fax:	(503) 668-4572
E-mail:	Sandy.Hatchery@state.or.us

Other agencies, Tribes, co-operators, or organizations involved:
The National Oceanic and Atmospheric Administration (NOAA Fisheries) currently provides funding for program production and operation through the Mitchell Act.

1.4) Funding sources, staffing level and annual hatchery program operational costs:

Sandy Hatchery:

Funding Sources:	Other Fund (License) = 100%
Staffing Level:	3 Full Time Employees
Annual Budget:	The annual total budget for the FY 2014 was $285,000.00 which was not separated by species reared at the facility

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

Sandy Hatchery: Sandy Hatchery is located at approximately RM 0.75 on Cedar Creek- a tributary to the Sandy River Basin, Clackamas County, Oregon. The hatchery is at an elevation of 500 feet above sea level, at latitude 45^{o} 24' 25" N (45.40694) and longitude 122^{o} 15' 11" W (122.2531). The regional mark processing code for Sandy Hatchery is 5F33226 H26 21.

Coho salmon program activities include:
Adult collection
Adult holding
Spawning
Incubation
Acclimation/Release

1.6) Type of program.

Segregated Harvest.

1.7) Purpose of program.

The Sandy River coho salmon program is in place for harvest augmentation and mitigation. The primary goal of the Sandy coho salmon program is to mitigate for the loss of coho salmon catch in sport and commercial fisheries due to habitat and passage loss or degradation as a result of hydropower development on the mainstem Columbia River. The intent is to produce coho that provide a fishery for sport and commercial fishers. This program aims to provide a high quality, hatchery reared, basin-origin coho salmon for harvest in the lower Columbia River commercial and recreational fisheries, the Sandy River recreational fishery, and the Pacific Ocean commercial and recreational fisheries. Although no numeric harvest goal for this program has been adopted the average smolt to adult survival rates of 1.75% (Table 1.12a) has provided with good opportunities for commercial and recreational fishing in the Pacific Ocean, the Lower Columbia River and the Sandy River sub-basin. The numeric goal for this coho program is to release 300,000 smolts in the Sandy Basin each year. The Sandy Hatchery coho program also provides 200,000 smolts to Clatsop County Fisheries for terminal gill-net fisheries. This portion of the program is expected to be transitioned to Bonneville or other Lower Columbia hatchery facility within the next 2-3 years.

The primary objectives of the Sandy Hatchery, as outlined in the Sandy Hatchery Operations Plan 2014, are:

Objective 1: Foster and sustain opportunities for sport, commercial, and tribal fishers consistent with the conservation of naturally-produced native fish.

Objective 2: Contribute toward the sustainability of naturally produced native fish populations through the responsible use of hatcheries and hatchery-produced fish.

Objective 3: Maintain genetic resources of native fish populations spawned or reared in captivity.

Objective 4: Restrict the introduction, amplification, or dissemination of disease agents in hatchery produced fish and in natural environments by controlling egg and fish movements and by prescribing a variety of preventative, therapeutic and disinfecting strategies to control the spread of disease agents in fish populations in the state.

Objective 5: Minimize adverse ecological impacts to watersheds caused by hatchery facilities and operations.

Objective 6: Communicate effectively with other fish producers, managers and the public.

1.8) Justification for the program.

The wild and hatchery populations of coho salmon in the Sandy River basin are listed as threatened under the federal ESA, and listed as endangered under the Oregon State Endangered Species Act, which prohibits commercial and recreational fishing of wild coho salmon in the basin. This program was started to enhance coho salmon fishing opportunities in the Sandy River and the lower Columbia River basins. The Sandy Hatchery coho program is managed to supplement regionally important coho fisheries while minimizing potential risks to wild Chinook, coho, and steelhead populations.

The Sandy River coho program is managed to supplement harvest in fisheries impacted by the construction and operation of hydropower dams in the Columbia River basin. Specifically, the program is managed to produce coho salmon to sustain selective Columbia River and Sandy River terminal sport and commercial fisheries. The Columbia and Sandy rivers are well regarded for recreational Chinook, coho, and steelhead angling. These fisheries receive a great deal of angler effort because of the close proximity to the Portland metropolitan area and generate substantial economic benefits to the region.

The major concern about holding this sport fishery is the impact on listed fish. The harvest of Sandy Hatchery coho is managed to comply with the Fisheries Management and Evaluation Plan (FMEP) that explains the management implications for holding a sport fishery where hooking mortality of listed fish may occur. Based on observed encounter and hooking mortality rates, we estimate a maximum fishery impact of 3% for these all fall tributary salmon fisheries. Current sport fishing regulations in the Lower Columbia River ESU require that all unmarked coho be released back to the water

unharmed. Only adult coho marked with an adipose fin clip may be retained in recreational fisheries. Sport fishing for coho in the Sandy and Clackamas rivers is open year-round with regulations requiring release of any unmarked fish in order to protect wild coho that tend to migrate into tributaries in November and December.

The Sandy River coho program is managed as a segregated hatchery program. The current program utilizes only hatchery-produced Sandy River coho returning to the Sandy Hatchery as broodstock. ODFW evaluations have identified that a majority (>70%) of natural spawning habitat for coho in the Sandy basin exists above the former Marmot Dam site, with the vast majority of habitat in the upper basin being found in the Salmon and Still Creek/Zigzag rivers. A small portion (<30%) exists in the lower mainstem and tributaries including the Bull Run River, Little Sandy River, Cedar Creek, Gordon Creek, Trout Creek, and Beaver Creek. The following is a summary of key hatchery practices and management features in place to minimize the risk of potential impacts to listed salmonids.

- Broodstock for the program is obtained from hatchery fish returning to the Sandy Hatchery. No fish are transferred from outside the Sandy Basin for inclusion in the broodstock.
- Wild coho are not currently incorporated into the hatchery broodstock, leaving all wild coho to spawn naturally. Wild coho may be integrated into the broodstock in the future if the naturally produced population in the Sandy is determined to be healthy enough to withstand removal of limited number of adults. We will seek approval through modification of this HGMP if integration is considered in the future.
- Randomly selected adults from all portions of the run and all age classes (except precocious males) are incorporated into the broodstock to maintain genetic diversity of the population.
- Smolts are released in a physical condition, and at times and locations that promote rapid out-migration to reduce potential interactions with wild salmonid populations.
- All hatchery fish are fin-marked (adipose clipped) to allow for harvest in selective fisheries and to facilitate sorting of returning adults.
- The natural spawning escapement in the Sandy Basin is managed to achieve at least 95% wild coho in this spawning population (i.e. no more than 5% may be hatchery stock). Data from the former Marmot Dam trap and ongoing spawning surveys indicate few hatchery coho migrate upstream of Cedar Creek and Sandy Hatchery (refer to Table 1.12b and 2.2.2d for stray rate information).
- This program complies with ODFW's Fish Health Management Policy and Integrated Hatchery Operations Team (IHOT) standards for prevention and treatment of fish diseases.
- This program complies with all other applicable IHOT standards.

1.9) List of program "Performance Standards".

See Section 1.10 below.

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

1.10.1) Performance Indicators addressing "BENEFITS":

Legal Mandates:

Performance Standard (1)*:* Contribute to mitigation agreements between NOAA Fisheries and the State of Oregon (Mitchell Act).

Indicator (1)(a): Achieve a smolt to adult survival rate adequate to collect sufficient adult broodstock to produce 300,000 coho smolts for release into the Sandy River basin and 200,000 coho smolts for release in CCF net pens.

Monitoring and Evaluation: Monitor adult returns, smolt production, and survival rates. These metrics are reported annually in the ODFW Annual Fish Propagation Report (www.dfw.state.or.us/fish/hatchery/).

Performance Standard (2): Program goals are aligned with authorized federal, state, regional, and local fisheries conservation and restoration initiatives.

Indicator (2)(a): Program complies with Oregon Native Fish Conservation Policy, the Sandy River Basin Plan, and the Lower Columbia Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead.

Monitoring and Evaluation: Conduct periodical program policy and goal reviews in relation to hatchery program management, practices, and facilities. Conduct annual spawning ground surveys to determine compliance with established policies.

Harvest and Socio-Economic Effectiveness:

Performance Standard (3): Contribution of Sandy Hatchery coho to the Sandy River sport fishery, the Lower Columbia River sport and commercial fisheries, and the ocean sport and commercial fisheries.

Indicator (3)(a): Number of adult hatchery coho caught in the Sandy River sport fishery, the Lower Columbia River sport and commercial fisheries, and the ocean sport and commercial fisheries.

Monitoring and Evaluation: Collect catch data from fish buyers, coded wire tag (CWT) recoveries from commercial and sport sampling programs, dock side creel samples, and punch cards.

Performance Standard (4): Hatchery release groups are sufficiently marked and tagged to facilitate identification and track survival. Goal is 100% marking of hatchery smolts.

Indicator (4)(a): Number of program fish adipose fin clipped and/or coded wire tagged. *Monitoring and Evaluation:* Sample all smolt release groups to verify that mark rate is within the range of 95% to 100%.

Life History Characteristics:

Performance Standard (5): Maintain life history characteristics of current hatchery broodstock.

Indicator (5)(a): Hatchery coho retained and spawned as broodstock have similar life history characteristics as overall hatchery coho run. No ongoing trend toward changes in regard to run timing, fish size, sex composition, fecundity, adult:jack ratio, and age.

Monitoring and Evaluation: Life history characteristics for broodstock, as well as all hatchery coho, are monitored at the Sandy Fish Hatchery.

Ecosystem function:

***Performance Standard (6)*:** Provide nutrient enrichment and food web benefits in natural salmon spawning streams of the Sandy River Basin.

Indicator (6)(a): Hatchery fish in excess of broodstock requirements may be placed (as carcasses) in streams for nutrient enrichment.

Monitoring and Evaluation: Track the number and location(s) of carcasses distributed for nutrient enrichment. Monitor ability to consistently respond to planned nutrient enhancement needs as appropriate for Oregon watersheds. Monitor effectiveness of nutrient supplementation.

Indicator (6)(b): Hatchery carcasses placed for nutrient enrichment will comply with ODFW and Oregon Department of Environmental Quality (DEQ) guidelines for disease control and water quality.

Monitoring and Evaluation: ODFW's Fish Pathology Section screens carcasses for possible disease and gives final approval for all nutrient enrichment projects prior to project initiation.

1.10.1) Performance Indicators addressing "RISKS":

Operation of Artificial Production Facilities:

Performance Standard (7): Sandy Hatchery is operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (i.e., IHOT, PNFHPC, and the Oregon Fish Health Management Policy).

Indicator (7)(a): Number and type of pathogens observed, in both broodstock and rearing juveniles, are within accepted guidelines.

Monitoring and Evaluation: ODFW fish pathologists, along with hatchery staff, regularly monitor fish health and conduct fish disease examinations. Monitoring efforts include sampling for viral infections, abnormal fish loss investigations, monthly fish health checks, and pre-transfer and pre-liberation fish health inspections.

Indicator (7)(b): Rearing survival rates (egg-to-fry and fry-to-smolt) are within guidelines.

Monitoring and Evaluation: Egg to fry and fry to smolt survival rates are estimated for each brood year.

Performance Standard (8): Effluent from Sandy Hatchery will not detrimentally affect natural in-river populations.

Indicator (8)(a): Hatchery effluent is managed to comply with conditions and water quality limits outlined in the existing NPDES permit.

Monitoring and Evaluation: Effluent water samples are analyzed for compliance. The NPDES permit is mandated by the EPA in accordance with the Clean Water Act, and regulated by the Oregon Department of Environmental Quality.

Performance Standard (9): Juvenile releases do not introduce new pathogens and do not significantly increase the level of existing pathogens in the Sandy River Basin.

Indicator (9)(a): Juvenile fish health will be certified prior to release.

Monitoring and Evaluation: Regular monitoring efforts by ODFW fish pathologists and hatchery staff include sampling for viral infections, abnormal fish loss investigations, and pre-transfer and pre-liberation fish health inspections.

Performance Standard (10): Minimize impacts to naturally produced adult coho.

Indicator (10)(a): Weir/trap operation at the Sandy Hatchery does not result in significant stress, injury, or mortality to naturally produced salmonid populations. Pass all naturally produced (unmarked) coho upstream of the hatchery in order to achieve full seeding of habitat in Cedar Creek. Preclude adult hatchery coho from passing upstream through selective trapping operations at Sandy Hatchery.

Monitoring and Evaluation: Monitor the number of fish handled, frequency of trap operation, and mortalities in the adult collection trap for both hatchery and naturally produced fish of each species. Record data and monitor unmarked coho passed upstream in order to assess success of reintroduction effort. Monitor the number of outmigrating smolts through smolt trap operations in order to assess natural production in Cedar Creek upstream of the hatchery.

***Performance Standard (11)*:** Minimize impacts to naturally produced juvenile coho.

Indicator (11)(a): Hatchery fish will be released in time and locations, and in a condition that minimizes the interaction with listed fish. NMFS compliant fish screens installed at Sandy Hatchery to protect outmigrating fish resulting from natural production upstream of the hatchery (Note: The water intake screen replacement at Sandy has been scheduled for summer 2012 to make it compliant with the NOAA Fisheries screening criteria).

Monitoring and Evaluation: Monitor smolt development using available indicators, e.g. age, size, and coloration of smolts at the hatchery to assure smolts are full-term at release. Utilize release locations downstream of the former Marmot Dam site. Evaluate effectiveness/compliance of fish screen device and provide routine maintenance.

Life History Characteristics:

Performance Standard (12): Manage the Sandy Basin with emphasis on natural production of wild fish

Indicator (12)(a): The number of hatchery coho spawning in the natural spawning habitat for coho salmon in the Sandy Basin shall not exceed 5% of the naturally spawning population.

Monitoring and Evaluation: Conduct annual spawning ground surveys to assess the number of hatchery fish spawning in the natural spawning habitat for coho salmon in the Sandy Basin. (Note: a limited number of hatchery coho were observed at Marmot Dam prior to removal and in ongoing surveys throughout the primary natural production areas for coho salmon in the Sandy; see below Table 1.12b).

Performance Standard (13): Minimize potential adverse impacts to naturally produced coho in natural spawning habitat if proportions of hatchery origin spawners (pHOS) exceed those adopted under the *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead*.

Indicator (12)(a): The number of hatchery coho spawning concurrently with wild coho in natural spawning areas shall not exceed 5% of the naturally spawning population.

Monitoring and Evaluation: Conduct annual spawning ground surveys to assess the number of hatchery fish spawning concurrently with wild fish in natural spawning areas of the Sandy Basin.

1.11) Expected size of program.

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

A maximum of 450 adults (270 females & 180 males), will be collected to meet the production goal of 300,000 smolts for on-station release and 200,000 smolts for CCF net pens.

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

Table 1.11.2. Proposed annual fish release levels for the Sandy River coho program.

Life Stage	Release Location	Annual Release Level
Yearling/smolts	Sandy Hatchery, Cedar Creek	300,000
Yearling/smolts	CCF Net Pens	200,000

NOTE: Currently, fish are released into Cedar Creek at the Sandy Hatchery, though in the past they have also periodically been released into the lower mainstem (in years when Cedar Creek experiences very low flow conditions). Additional acclimation sites may be developed in the future if monitoring determines hatchery origin fish are straying unintentionally into natural production areas. Total numbers released will remain constant unless it is determined reductions are necessary to comply with existing policy. All coho are reared full-term at Sandy Hatchery.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels.

Table 1.12(a). Summary of CWT recoveries for Sandy hatchery coho released in the Sandy basin. Brood year 2010 recoveries not yet complete.

Brood Year	# smolts released within basin	# of Ad+CWT tagged juveniles released	% of release Ad+CWT tagged (mark rate)	Estimated from Expansion of Actual Recoveries			SAR to Hatchery (= spawner escapement)
				SAR (all recoveries)	Estimated Total Contribution to all Fisheries (%)	Estimated Total Contribution to FW Fishery (%)	
1995	670,670	130,377	19.4	0.81	0.09	0.03	0.72
1996	255,602	59,021	23.1	0.46	0.18	0.02	0.28
1997	661,837	117,497	17.8	1.57	0.33	0.07	1.24
1998	808,295	126,494	15.6	3.39	1.72	0.36	1.66
1999	690,977	123,553	17.9	1.58	0.90	0.03	0.67
2000	834,734	54,522	6.5	2.58	1.79	0.22	0.78
2001	700,534	55,681	7.9	2.86	1.28	0.14	1.58
2002	677,614	54,236	8.0	1.24	0.21	0.02	1.02
2003	680,310	53,844	7.9	1.00	0.20	0.02	0.79
2004	666,334	52,285	7.8	1.95	0.93	0.14	1.02
2005	692,890	54,174	7.8	0.91	0.32	0.11	0.59
2006	665,744	53,215	8.0	4.11	1.68	0.16	2.39
2007	743,456	54,383	7.3	2.19	0.44	0.09	1.74
2008	488,654	55,231	11.3	1.48	0.43	0.11	1.04
2009	512,494	52,479	10.2	0.55	0.16	0.06	0.40
2010	462,950	53,446	11.5	tbd	tbd	tbd	tbd

Note: Data used is from release groups that had CWT's and did not include "double index" groups or release groups with and AD-CWT rate less than 1%. SARs to fisheries are based on expansion of actual recoveries and contains sources of error

Table 1.12(b). Adult hatchery coho salmon returns to the Sandy Hatchery and to Marmot Dam, 1990-2012.

Return Year	Sandy Hatchery	Marmot Dam
1990	6,131	--
1991	11,534	--
1992	13,277	--
1993	231	--
1994	7,947	--
1995	3,264	--
1996	328	--
1997	1,276	--
1998	5,476	--
1999	1,013	2
2000	12,506	1
2001	20,454	0
2002	6,890	0
2003	8,746	5
2004	15,920	21
2005	10,654	10
2006	10,225	7
2007	7,674	10
2008	8,688	n/a
2009	16,755	n/a
2010	18,039	n/a
2011	6,347	n/a
2012	2,508	n/a

Source: Sandy Hatchery data from Sandy Hatchery records. Marmot Dam data from Doug Cramer, PGE. Prior to 1999 not all hatchery and wild coho could be distinguished.

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

Sandy Fish Hatchery began operation in 1951 as a state funded facility. The first year of adult broodstock collection for the coho program was in 1952.

1.14) Expected duration of program.

This program is ongoing, with no planned end date.

1.15) Watersheds targeted by the program.

Targeted watersheds include:

- Lower Sandy River
- Lower Columbia River
- Pacific Ocean

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

1.16.1) Brief overview of key issues.

The Sandy coho program is a segregated program that was originally developed from locally adapted broodstock. Naturally produced fish are not regularly incorporated into the broodstock due to the relatively low numbers of naturally produced fish that return each year, and the impact to the natural population that would occur if naturally produced fish were diverted to the hatchery population. Naturally produced coho salmon in the Sandy basin are currently listed as endangered under the Oregon Endangered Species Act, and threatened under the Federal ESA. The purpose of the program is to provide harvest opportunities for commercial and recreational fisheries in the ocean, lower Columbia River, and lower Sandy River to mitigate for the loss of habitat resulting from hydroelectric development in the Columbia Basin. All hatchery fish are adipose fin-marked.

<u>Issue 1:</u> Future reductions in the number of coho smolts released in the Sandy basin may be required to control stray rates into the upper basin after Marmot Dam is removed in 2007.

Program changes were implemented at Sandy Hatchery in anticipation of the removal of Marmot Dam in 2007. These changes were intended to reduce straying of hatchery fish to the primary natural production areas throughout the basin. These changes are evaluated annually through spawning ground surveys (annual reports available through the ODFW Oregon Adult Salmonid Inventory and Sampling Project, OASIS). Stray rates are currently below 5% but if stray rates exceed the 5% target adopted for the basin in the Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (ODFW, 2010), other program changes will be required which would likely include a reduction in the number of coho smolts released in this basin. Despite the low stray rate, releases of hatchery coho are now reduced to 300,000 per year in response to operational changes at Sandy Hatchery and to bring the release number in line with reduction in out-of-basin harvest. See Table 2.2.2d information for on the proportion of hatchery coho found in the natural spawning habitat of the Sandy River.

<u>Issue 2:</u> The presence of non-fin marked coded-wire-tag ("double index") fish complicates the ability to easily recognize returning hatchery fish.

Non-fin marked coded wire tag ("Double index") fish are no longer released into the Sandy River. Prior to 2003, these releases were 50,000 smolts annually. Upon return to trapping and sorting facility as adults, these unmarked fish could potentially be passed erroneously as wild fish into natural production areas (failure of the CWT detection wands or human error). Concern for this is minimal due to the low number of hatchery fish that were encountered at Marmot Dam prior to removal and the low number of hatchery fish currently found in spawning surveys. All fish passed upstream of Sandy Hatchery will be checked for CWT prior to allowing the fish to volitionally move upstream.

1.16.2) Potential Alternatives to the Current Program.

The following draft alternatives were identified during public workshops and are not necessarily being endorsed by the managing agency or the author of this document.

Issue 1; Alternative 1: *If hatchery coho stray rates exceed ODFW adopted standards after Marmot Dam is removed, reduce the number of smolts released in the basin to an appropriate level.*

Pros & Cons: Interactions with hatchery strays would be controlled to minimize risks to naturally produced coho populations in the primary natural production areas throughout the basin. Low program costs to implement this alternative. However, recreational and commercial fisheries in the ocean and lower Columbia River would be impacted, and fish available for harvest by recreational anglers in the lower Sandy River would be reduced. Commercial fishermen, recreational anglers and sport fishing groups may oppose the alternative. The change is not consistent with the purpose of the program or existing mitigation agreements.

Despite there being a relatively low stray rate for coho salmon in the Sandy River, recent program changes reduced the in-basin release to 300,000 smolts, a 400,000 smolt reduction from past releases in the basin.

Issue 1; Alternative 2: *If hatchery coho stray rates exceed ODFW adopted standards after Marmot Dam is removed, reduce the number of smolts released in the basin by transferring smolts for acclimation and release in the Youngs Bay net pens operated by CCF for the SAFE Coho Program.*

Pros & Cons: If feasible, risks to naturally produced coho populations in the upper basin from interactions with hatchery strays could be reduced. The impact to ocean and lower Columbia River recreational and commercial fisheries would be minor since total smolt release numbers would not change. Coho harvest in Youngs Bay or other Select Area fisheries may increase. Fish available for harvest by recreational anglers in the lower Sandy River would be reduced, though, so Sandy River anglers and sport fishing groups may oppose this change. The alternative is consistent with the purpose of the program and existing mitigation agreements. Clatsop County Fisheries (CCF) may need to expand the net pen operation to accommodate additional smolts; if so, funding has not been identified to implement that action.

Issue 1; Alternative 3: *If hatchery coho stray rates exceed ODFW adopted standards after Marmot Dam is removed, investigate options for developing alternate release sites and adult trapping facilities in the lower Sandy, such as in the Bull Run River.*

Pros & Cons: ODFW conducted an evaluation of potential acclimation sites with a focus on spring Chinook since monitoring indicates straying does not appear to be an issue for coho and steelhead (See Table 2.2.2d information for on the proportion of hatchery coho found in the natural spawning habitat of the Sandy River). If future monitoring indicates that straying of coho is creating risk to wild fish, ODFW will investigate opportunities along with the risks of developing additional off-station acclimation ponds. If feasible

and successful, risks to naturally produced coho populations in the upper basin from interactions with hatchery strays could be reduced. Effects to recreational anglers in the lower Sandy River would be minor, and a fishery could be created in the vicinity of any new release/trapping site. It is expected that Sandy River anglers and sport fishing groups would support this alternative. There should also be no impact to ocean or lower Columbia River recreational and commercial fisheries. The alternative is consistent with the purpose of the program and existing mitigation agreements. Agreements with other parties may be needed for trap site development, and there would be increased program costs associated with transporting smolts to the alternate location and operating a remote trapping location; funds are currently not available for a large scale acclimation program but we are currently pursuing opportunities for sighting an acclimation pond in the Bull Run River.

Issue 2; Alternative 1: *Discontinue the release of "double-index" (non-fin marked coded-wire-tagged) coho in the Sandy basin.*

Pros & Cons: This change would allow hatchery and wild fish to be sorted with minimal risk of passing hatchery fish into the wild fish sanctuary. This action is the most cost effective alternative for eliminating the concern. The effects on the "double index" monitoring program should be minimal since all the required components of the monitoring effort are not in place in this basin. If necessary, this portion of the statewide "double index" monitoring program could be shifted to another basin.
***ODFW no longer releases "double-index" tagged coho in the Sandy Basin and we no longer consider the upper basin a "wild fish sanctuary" now that Marmot Dam is removed..*

Issue 2; Alternative 2: *Continue the current release of "double index" tags and accept that some hatchery fish may be passed into the wild fish spawning sanctuary in the upper basin.*

Pros & Cons: This alternative does not require any change in the current program nor are increased costs or financial investments required. The "double index" monitoring program would continue in the basin.
***ODFW no longer releases "double-index" tagged coho in the Sandy Basin and we no longer consider the upper basin a "wild fish sanctuary" now that Marmot Dam is removed..*

1.16.3) Potential Reforms and Investments.

The following draft potential reforms and investments were identified during public workshops, are for discussion purposes, and are not necessarily being endorsed by the managing agency or the author of this document.

Reform/Investment 1: If needed to reduce interactions between hatchery and wild coho populations after Marmot Dam is removed, conduct a feasibility study to identify alternate smolt release locations in the lower Sandy basin where adult trapping facilities could be constructed. Assess the costs of constructing, operating and maintaining a remote trapping facility. The cost of the study is currently undetermined. The cost of

constructing, operating and maintaining a remote trapping facility would be determined by the study. {Issue #1, Alternative 3}

Reform/Investment 2: If needed to reduce interactions between hatchery and wild coho populations after Marmot Dam is removed, determine if capacity exists to transfer smolts to lower Columbia River Select Area Fishery sites (SAFE Coho Program) such as the CCF program in Youngs Bay. If capacity does not exist, evaluate the costs of constructing, operating and maintaining additional SAFE sites (e.g. additional net pens at the CCF site). The cost of this evaluation is currently undetermined. The cost of constructing, operating and maintaining additional net pens (if needed) would be determined by the study. {Issue #1, Alternative 2}

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS

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

Fish propagation activities for the Sandy River coho program are covered by the following:

- Section 7 (Consultation) - 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999).
- An ESA Section 7 Biological Opinion and Incidental Take Statement for the Sandy Hatchery Coho program was issued on September 28, 2012.
- Section 4d - Lower Columbia River Coho FMEP.
- Submission of this HGMP to NOAA Fisheries shall serve as take authorization for ESA-listed fish; the HGMP for this program was submitted to NOAA on 09/01/2006, and this is an updated version of the previously submitted HGMP.

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

All Columbia River anadromous salmonids that successfully return to spawn must migrate through the lower Columbia River and estuary twice during their life cycle. Thus, hatchery programs in the lower Columbia have the potential to affect the 12 listed ESUs in the Columbia basin. However, ESA listed salmonid populations that occur in the subbasin where the program fish are collected and released are most likely to be affected by program activities. These populations include:

The Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*) ESU is federally listed as threatened under the Endangered Species Act, effective May 24, 1999.

The Lower Columbia River coho salmon (*Oncorhynchus kisutch*) ESU is federally listed as threatened under the ESA, effective July, 2005. This ESU is listed as endangered by the State of Oregon.

The Columbia River chum salmon (*Oncorhynchus keta*) ESU is federally listed as threatened, effective May 24, 1999.

The Lower Columbia River steelhead (*Oncorhynchus mykiss*) ESU is federally listed as threatened under the ESA.

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

- Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.

Lower Columbia River coho - Lower Columbia River coho are listed as endangered by the State of Oregon and threatened by NOAA Fisheries. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in

Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, Oregon.

Lower Columbia River coho salmon are present in numerous Oregon tributaries to the lower Columbia. However, coho observed in some of these subbasins are hatchery stocks and few wild fish are present. The exception being self-sustaining populations in the Sandy and Clackamas River and small, self-sustaining populations of naturally produced coho in Scappoose Creek, Clatskanie River, and above Willamette Falls. The population currently existing above Willamette Falls is of hatchery origin.

Lower Columbia River coho are categorized as either Type S or Type N, based on their general ocean distribution either south or north of the Columbia River. Managers also refer to Type S as early stock coho and Type N as late stock. Early stock coho salmon in the lower Columbia generally enter the Columbia River beginning in August, with peak spawn timing generally in late October- early November. Late stock coho salmon in the lower Columbia generally enter the Columbia River beginning in September, with peak spawn timing generally in late November and December. Depending on spawn timing and water temperature, coho fry begin emerging in the spring, rear for a year in freshwater, and emigrate the following spring (Groot and Margolis 1991). Direct take of listed wild coho shall not occur due to this program, as all brood fish shall be of marked hatchery origin fish.

- Identify the ESA-listed population(s) that will be <u>indirectly</u> affected by the program.

All listed species occupying habitats in the lower Sandy River and/or the lower Columbia River migration corridor(s) may be indirectly impacted by the presence of Sandy River (hatchery) coho salmon. While the potential exists for negative impacts, no direct effect has yet to be quantified regarding which, if any, of these populations are affected, and in what way. However, it is believed that any incidental impact to listed species will be minimal, based upon risk aversion measures of the hatchery program identified in this HGMP. These listed species include:

- Lower Columbia River Chinook - The Lower Columbia River Chinook salmon ESU was listed as threatened under the ESA effective May 24, 1999. This ESU includes all naturally spawned Chinook populations residing below impassable natural barriers (e.g., long-standing, natural waterfalls) from the mouth of the Columbia River to the crest of the Cascade Range just east of the Hood River in Oregon and the White Salmon River in Washington. This ESU excludes populations above Willamette Falls, as well as Clackamas River spring Chinook. Within this ESU, there are historic runs of three different Chinook salmon populations: spring-run, tule, and late-fall “bright” Chinook salmon.

- Columbia River Bull Trout - The Fish and Wildlife Service issued a final rule listing the Columbia River population of bull trout as a threatened species on June 10, 1998.

The Hood River Recovery Unit forms part of the range of the Columbia River population.

- Lower Columbia River Steelhead - The Lower Columbia River steelhead ESU was listed as threatened under the ESA on March 19, 1998. This ESU contains tributaries to the Columbia River between the Cowlitz and Wind Rivers in Washington, inclusive, and the Willamette and Hood Rivers in Oregon, inclusive. Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, and steelhead from the Little and Big White Salmon Rivers in Washington.

- Columbia River Chum - The Lower Columbia River chum salmon were listed as a threatened species on March 25, 1999. The ESU includes all naturally spawning populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.

Indirect take of or impact on above listed fish may occur due to competition for food and space during outmigration of the hatchery program fish.

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

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

The Willamette/Lower Columbia Technical Recovery Team (WLC-TRT) determined minimum abundance thresholds (MATs) for the Oregon Lower Columbia fall/spring Chinook, chum, and coho populations in the vicinity of the Sandy Hatchery coho program (McElhany et al. 2007). The WLC-TRT established MAT values for both "critical" (very high risk of extinction) and "viable" (low risk of extinction) status. Thresholds for chum salmon were identified, but there was insufficient data to assess the status of chum populations in the Columbia River ESU, so they are not presented here. The MAT values for "critical" status for the Sandy populations of Chinook, coho and steelhead were 400, 1,800, and 425 respectively. The "viable" abundance levels defined for Chinook, coho and steelhead are 800, 3,300 and 750 respectively.

The MAT values identified by the WLC-TRT were used in the status assessment conducted as part of developing the Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead. The status assessment found that the Sandy coho population was below the "critical" MAT at 1,600. The assessment found the Sandy late fall Chinook population was above the "viable" level at 1,764, whereas the fall Chinook and spring Chinook populations were below and above the "critical" level respectively at 144 and 714.

-Current population status and de-listing scenarios identified in existing/current recovery plans.

The recently completed *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (LCRCRP, ODFW 2010) adopts the

biological criteria for achieving delisting that were established by the WLC-TRT (McElhany et al. 2007). The WLC-TRT criteria use a scoring system that is based on each population's 100-year probability of extinction, as categorized into "extinction risk classes." The criteria do not require each population to be "viable" (i.e., having a low extinction risk), but do require a specific number of viable populations and an aggregate level of extinction risks for all populations within strata and across ESUs that are intended to assure the ESU exists into the future.

Population assessments were completed, using the best available data and scientific inference, to determine current status, in terms of extinction risk class, and improvements necessary to lower extinction risk (i.e., "gaps" to other risk classes). Consistent with NMFS guidance, this extinction risk assessment took into account a number of biological population parameters related to salmonid viability, including abundance, productivity, spatial structure, and diversity. A sophisticated quantitative model was used to assess population abundance and productivity parameters relative to extinction risk. Assessments were done for all Oregon LCR populations, excluding chum, which are considered functionally extirpated (i.e., locally extinct) from the Oregon portion of the ESU.

In light of the current status assessments and based on delisting criteria, the delisting desired status, (in terms of extinction risk class) of each population was determined in an iterative process with ODFW, the LCRCRP Stakeholder Team (Stakeholder Team), and State of Washington recovery planners, with input from NMFS and the LCRCRP Planning Team (Planning Team). Once the desired status for each population was determined, ODFW and the Stakeholder Team, with input from the Planning Team on feasibility, determined the threat reduction scenario for each population (excluding chum) utilizing the current status and gap results from the population assessments.

The threat reduction scenario shows how each population will get from its current status to the desired status through the reduction of anthropogenic impacts within a threat category. The scenario also shows the level and relative priority of actions necessary to address each threat in a population. The threat categories represent areas where current anthropogenic mortality rates were able to be estimated and actions can be applied to reduce impacts. These categories include: tributary habitat, estuary habitat, hydropower, harvest, hatchery fish, and predation. An Expert Panel approach, followed by refinement with the Planning Team and threat-specific managers, was used to determine the limiting factors and threats for each life stage and for different life cycle locations for each population. This was used to identify much more specific impacts within each threat category, as well as to guide and structure specific strategies and actions for each threat reduction. Actions specifically related to the coho program at Sandy Hatchery can be found in Table 9-3 of the Recovery Plan (ODFW 2010). In addition, Table 9-3 also includes other ESU-wide actions that can be applied to the hatchery program.

Sandy-Specific Recovery Plan actions addressing the coho hatchery program:

Action ID	Action	Status in the Sandy Basin
237-SY	Eliminate/reduce/shift program: Reduce hatchery coho releases (700k to 500k in 2010; shifted to Youngs Bay).	Completed

The current status of Sandy populations and the scenarios for de-listing those populations are found in Table 2.2.2(a) below. This table is from Table 6-36 of the LCRCRP.

Table 2.2.2(a) Summary of the current status and Delisting Scenario for Oregon Populations of Salmon and Steelhead in the Lower Columbia River (Source: *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead-Table 6-36, ODFW 2010).*

		Current		Delisting Scenario				
Species / Stratum (Run)	Population	Abundance	Overall Risk Class	Contribution to Delisting	Abundance	A&P Gap	Overall Risk Class	Confidence
COHO								
Coast								
	Youngs Bay	4	VH	Stabilizing	7	3	VH	Exceed
	Big Creek	8	VH	Stabilizing	12	4	VH	Exceed
	Clatskanie	1,363	H	Primary	3,201	1,838	VL	Achieve
	Scappoose	1,942	M	Primary	3,208	1,266	VL	Exceed
Cascade								
	Clackamas	6,548	M	Primary	11,232	4,684	VL	Exceed
	Sandy	**1,622**	**VH**	**Primary**	**5,685**	**4,063**	**L**	**Achieve**
Gorge								
	*Lower Gorge**	22	VH	*Support WA (L)*	962	940	H (L)	Achieve
	Upper Gorge/Hood	41	VH	Primary	5,203	5,162	L	Unlikely
CHINOOK								
Coast (Fall)								
	Youngs Bay	379	H	Stabilizing	505	126	H	Exceed
	Big Creek	216	VH	Contributing	577	361	H	Achieve
	Clatskanie	6	VH	Primary	1,277	1,271	L	Exceed
	Scappoose	356	H	Primary	1,222	866	L	Exceed
Cascade (Fall)								
	Clackamas	558	VH	Contributing	1,551	993	M	Exceed
	Sandy	**144**	**VH**	**Contributing**	**1,031**	**887**	**M**	**Achieve**
Gorge (Fall)								
	*Lower Gorge**	74	VH	*Support WA (M)*	387	313	H (M)	Achieve
	*Upper Gorge**	17	VH	*Support WA (M)*	87	70	VH (M)	Achieve
	Hood	33	VH	Primary	1,245	1,212	L	Unlikely
Cascade (Late Fall)								
	Sandy	**1,794**	**L**	**Primary**	**3,858**	**2,064**	VL	**Achieve**
Cascade (Spring)								
	Clackamas	1,371	M	*N / A*	8,377	7,006	*(VL)*	Achieve
	Sandy	**714**	**M**	**Primary**	**1,230**	**516**	**L**	**Exceed**
Gorge (Spring)								
	Hood	327	VH	Primary	1,493	1,166	VL	Exceed
STEELHEAD								
Coast (Winter)								
	Youngs Bay	2,486	VL	*N / A*	4,733	2,247	*(VL)*	Achieve
	Big Creek	1,143	L	*N / A*	3,182	2,039	*(VL)*	Achieve
	Clatskanie	2,451	VL	*N / A*	3,982	1,531	*(VL)*	Achieve
	Scappoose	3,245	VL	*N / A*	5,169	1,924	*(VL)*	Achieve
Cascade (Winter)								
	Clackamas	3,897	M	Primary	10,671	6,774	L	Unlikely
	Sandy	**674**	**H**	**Primary**	**1,519**	**845**	VL	**Exceed**
Gorge (Winter)								
	*Lower Gorge**	550	M (H)	*Support WA (L)*	881	331	M (L)	Achieve
	*Upper Gorge**	151	VH (H)	*Support WA (H)*	235	84	VH (H)	Achieve
	Hood	1,127	M	Primary	2,079	952	L	Exceed
Gorge (Summer)								
	Hood	35	VH	Primary	2,008	1,973	L	Unlikely
CHUM								
Coast								
	Youngs Bay	E	VH	Stabilizing	TBD	---	VH	---
	Big Creek	E	VH	Stabilizing	TBD	---	VH	---
	Clatskanie	E	VH	Primary	TBD	---	L	---
	Scappoose	E	VH	Primary	TBD	---	L	---
Cascade								
	Clackamas	E	VH	Contributing	TBD	---	M	---
	Sandy	**E**	**VH**	**Primary**	**TB**	---	**L**	---
Gorge								
	*Lower Gorge**	E	VH (L)	*Support WA (VL)*	TBD	---	VL	---
	*Upper Gorge**	E	VH	*Support WA (M)*	TBD	---	M	---

Table 2.2.2(b). Summary of the percent improvement required for each threat category in order to achieve the delisting desired status. Shared populations with Washington are indicated by an asterisk (Source: See title for Table 2.2.2a).

		% Improvement of Threats (Delisting Scenario)						
Species / Stratum (Run)	Population	Tributary Habitat	Estuary Habitat	Hydro	Harvest	Hatchery	Predation	Cumulative
COHO								
Coast								
	Youngs Bay	1.20%	22.33%	---	0.00%	0.00%	46.43%	0.02%
	Big	0.94%	22.33%	---	0.00%	0.00%	46.43%	0.04%
	Clatskanie	18.04%	22.33%	---	28.57%	23.08%	33.33%	11.93%
	Scappoose	7.42%	22.33%	---	28.57%	0.00%	33.33%	6.26%
Cascade								
	Clackamas	0.00%	22.33%	24.05%	28.57%	71.43%	37.50%	10.18%
	Sandy	**37.11%**	**22.33%**	**100.00%**	**28.57%**	**0.00%**	**37.50%**	**22.54%**
Gorge								
	Lower Gorge *	33.47%	22.33%	---	28.57%	87.50%	37.50%	21.37%
	Upper Gorge/Hood	91.50%	22.33%	14.50%	85.71%	100.00%	31.51%	58.63%
CHINOOK								
Coast (Fall)								
	Youngs Bay	0.00%	19.25%	---	6.67%	0.00%	28.57%	0.85%
	Big	27.54%	19.25%	---	7.69%	0.00%	28.57%	4.21%
	Clatskanie	20.26%	19.25%	---	41.67%	88.89%	23.08%	8.86%
	Scappoose	2.64%	19.25%	---	41.67%	88.89%	23.08%	7.12%
Cascade (Fall)								
	Clackamas	0.00%	19.25%	---	41.67%	66.67%	17.81%	4.51%
	Sandy	**31.15%**	**19.25%**	**100.00%**	**41.67%**	**66.67%**	**17.81%**	**14.55%**
Gorge (Fall)								
	Lower Gorge *	28.08%	19.25%	---	41.67%	33.33%	17.81%	10.76%
	Upper Gorge *	27.43%	19.25%	0.00%	38.46%	33.33%	23.08%	8.63%
	Hood	100.00%	100.00%	43.85%	100.00%	100.00%	100.00%	89.24%
Cascade (Late Fall)								
	Sandy	**27.86%**	**15.86%**	**100.00%**	**40.00%**	**80.00%**	**17.81%**	**25.15%**
Cascade (Spring)								
	Clackamas	34.73%	15.79%	76.47%	0.00%	84.62%	42.15%	26.64%
	Sandy	**0.94%**	**15.79%**	**100.00%**	**0.00%**	**81.48%**	**42.15%**	**1.97%**
Gorge (Spring)								
	Hood	8.84%	15.79%	65.62%	0.00%	88.89%	55.13%	7.92%
STEELHEAD								
Coast (Winter)								
	Youngs Bay	40.30%	15.79%	---	0.00%	50.00%	46.90%	28.42%
	Big	55.73%	15.79%	---	0.00%	75.00%	46.90%	41.50%
	Clatskanie	32.02%	15.79%	---	0.00%	0.00%	40.17%	22.08%
	Scappoose	30.30%	15.79%	---	0.00%	0.00%	40.17%	21.03%
Cascade (Winter)								
	Clackamas	63.73%	15.79%	3.85%	0.00%	56.52%	42.15%	39.18%
	Sandy	**1.54%**	**15.79%**	**100.00%**	**0.00%**	**80.77%**	**42.15%**	**7.67%**
Gorge (Winter)								
	Lower Gorge *	33.02%	15.79%	---	0.00%	0.00%	42.15%	21.11%
	Upper Gorge *	40.25%	18.60%	0.00%	0.00%	0.00%	39.39%	17.60%
	Hood	0.00%	18.60%	55.31%	0.00%	66.67%	39.39%	35.34%
Gorge (Summer)								
	Hood	85.33%	18.60%	55.31%	0.00%	100.00%	45.58%	52.10%
CHU								
Coast								
	Youngs Bay	---	---	---	---	---	---	---
	Big	---	---	---	---	---	---	---
	Clatskanie	---	---	---	---	---	---	---
	Scappoose	---	---	---	---	---	---	---
Cascade								
	Clackamas	---	---	---	---	---	---	---
	Sandy	---	---	---	---	---	---	---
Gorge								
	*Lower Gorge**	---	---	---	---	---	---	---
	*Upper Gorge**	---	---	---	---	---	---	---

- Provide the most recent 12 year progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Analyses conducted in developing the LCRCRP estimated intrinsic productivity for several of the Sandy listed populations. The intrinsic productivity estimates for coho, winter steelhead, late fall Chinook and spring Chinook were 4.825, 1.687, 10.437 and 2.577 recruits per spawner, respectively.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

All adult Sandy River Chinook, coho, and steelhead were counted at Marmot Dam prior to removal of the dam in 2007. Prior to 1999 wild and hatchery coho could not be distinguished and all unmarked fish (as well as many marked fish) were passed upstream. Since 1999, wild and hatchery fish could be distinguished and only wild fish have been passed upstream of Marmot Dam (with the exception of spring Chinook which were not 100% marked until 2002) until dam removal. Counts at Marmot Dam from 1992-2007 are provided below in Table 2.2.2(c).

2002-2012 Annual Coho Spawning Ground Survey data available at:
www.oregonstate.edu/dept/ODFW/spawn/pdf files/coho/AnnualEstLC2002-2012.pdf

Table 2.2.2(c). Total numbers of salmon and steelhead counted at Marmot Dam (Sandy River), 1992-2007, and estimated from spawning ground surveys (2008-2012).

Run	Spring Chinook[a/]		Coho [a/]		Winter Steelhead [a/]		Summer Steelhead [a/]	
Year	Total [c/]	Wild [b/]	Total [c/]	Wild [b/]	Total[c/]	Wild[b/]	Total [c/]	No Mark
1992	4,451	1,255	790	790	2,916	2,563	2,914	
1993	3,429	967	193	193	1,636	1,438	1,865	
1994	2,309	653	601	601	1,567	1,377	1,979	
1995	1,503	418	697	697	1,680	1,477	1,313	
1996	2,561	697	179	179	1,287	1,131	1,164	
1997	3,301	935	116	116	1,426	1,253	1,859	
1998	2,612	700	261	261	745	655	837	
1999	2,032	581	162	162	928	928	681	20
2000	1,986	564	742	730	784	741	173	110
2001	2,445	988	1,176	1,176	974	902	723	262
2002	1,262	1,035	367	367	1,529	1,031	544	473
2003	1,197	1,053	1,348	1,348	692	671	278	230
2004	2,698	2,294	1,209	1,209	877	869	403	343
2005	1,653	1,405	856	856	632	626	148	128
2006	1,349	1,209	923	923	651	643	126	107
2007	1,410	1,304	753	687	858	845	162	138
2008	4,965	2,721	1,277	1,277	n/a	n/a	n/a	n/a
2009	1,821	856	1,667	1,493	n/a	n/a	n/a	n/a
2010	6,076	1,391	1,029	901	2,096	1,498	n/a	n/a
2011	3,434	1,150	3,813	3,494	681	681	n/a	n/a
2012	4,024	3,070	1,198	1,165	508	508	n/a	n/a
2013	n/a	n/a	n/a	n/a	3,747	3,509	n/a	n/a

[a/] Spring Chinook were not 100% marked until the 1997 brood year (2002 -2005 adult return years). Coho were not mass marked until the 1996 brood year (1999-2000 adult returns). Summer and winter steelhead have been 100% marked since 1996.
[b/] 1992-1998 estimate of wild coho and steelhead and 1992-2002 estimate of spring Chinook from Appendix C of LCRCRP (ODFW 2010) (*indicated by dashed line). Number of coho and steelhead from 1999-2007 and number of spring Chinook from 2002-07 from actual counts at Marmot Dam. Wild fish count prior to 2008 does not include unmarked fish found below the former Marmot Dam.
[c/] Hatchery fish identified by adipose fin-clip were removed from the system beginning in 1998.
[d/] Partial count due to Marmot Dam removal on October 17, 2007.
Data from 1999-2007 are from ODFW-Marmot Dam counts.
Marmot Dam data prior to 1999 obtained from Doug Cramer-PGE

-Provide the most recent 12 year estimate of annual proportions of the direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The natural spawning grounds in the upper Sandy Basin (above Marmot Dam) were managed as a wild fish sanctuary from 1999 to 2007, when marked fish were not passed above Marmot Dam. However, ODFW has observed that relatively small numbers of

hatchery fish spawn naturally in the lower mainstem Sandy River (Table 2.2.2d). Spawning surveys indicate that hatchery fish are found in Cedar Creek below Sandy Hatchery and occasionally in Gordon, Trout, and Beaver Creek. Spawning surveyors rarely see hatchery coho in the mainstem or tributaries upstream of Cedar Creek

Prior to 1999, wild and hatchery coho in the Sandy River could not be distinguished and all unmarked fish were passed upstream of Marmot Dam. Most were assumed to be wild. Since 1999, wild and hatchery coho could be distinguished by an adipose fin clip and only wild fish were allowed to pass upstream of Marmot Dam. Between 1999 and 2010, an average of only 3.5% of coho arriving at Marmot Dam and spawning grounds have been identified as hatchery fish (see Table 2.2.2(d)).

Table 2.2.2(d). Proportion of hatchery coho at Marmot Dam (1999-2007) and at spawning grounds (2008-12) from basin-wide spawning surveys.

Year	Total Coho	Wild Coho	Hatchery Coho [a/]	% Hatchery
1999	162	162	0	0.0%
2000	730	730	0	0.0%
2001	1176	1176	0	0.0%
2002	367	367	0	0.0%
2003	1348	1348	0	0.0%
2004	1209	1209	0	0.0%
2005	856	856	0	0.0%
2006	923	923	0	0.0%
2007	753	687	66	8.8%
2008	1,277	1,277	0	0.0%
2009	1,667	1,493	174	10.4%
2010	1,029	901	128	12.4%
2011	3,813	3,494	319	8.4%
2012	1,198	1,165	33	2.8%

Source: ODFW Marmot Dam counts

[a/] Hatchery fish identified by adipose fin-clip were removed from the system beginning in 1998.

[b/] Partial count due to Marmot Dam removal on October 17, 2007.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

See Section 13, Attachment 2.

- 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.

Trapping, sorting, passing of unmarked fish, and broodstock collection are the only hatchery activity that may lead to the take of listed fish. Coho broodstock are collected

via volitional return of adults to the fish trap at the Sandy Hatchery. Unmarked fish may enter the trap while the trap is open to receiving fish. The hatchery trap is open and checked daily, and fish are sorted a minimum of one time per week and up to 4 times per week during peak migration. Only adipose fin clipped coho are currently retained for broodstock. The wild or listed fish entering the trap are sorted from hatchery adults and placed into a post-sort holding pen. Unmarked adults are then volitionally passed through a concrete lined chute back into Cedar Creek upstream of the adult diversion weir. Any incidental take at the Sandy Hatchery is expected to be minimal as a result of the trapping, sorting, and broodstock collection methods described in Sections 6 and 7.

Incidental take of listed juvenile salmonids is not expected to occur through activities associated with adult collection, acclimation, and release of hatchery coho at the Sandy Hatchery. There may be competition between hatchery reared smolts and naturally-produced smolts in the lower mainstem Sandy River, however these effects have not been quantified. Interactions between hatchery coho smolts and wild juveniles are minimized by release strategies which promote rapid emigration. ODFW will be implementing a monitoring program to assess outmigration of smolts released from Sandy Hatchery and the Bull Run acclimation pond. The monitoring plan is detailed in Section 11.1.1 of this HGMP.

See Section13, Attachment 2 for estimated annual take levels of listed salmonids from hatchery activities.

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

The number of wild adult coho salmon trapped at Marmot Dam, and associated mortality as a result of handling and sorting is provided in Table 2.3.

Table 2.3. Wild (unmarked) adult fish passed at Marmot Dam, 1999 – 2007.

Year	Winter Steelhead	Coho	Spring Chinook[a/]	Observed Mortalities
1999	928	162	581	0
2000	741	730	564	0
2001	902	1176	988	0
2002	1,031	367	1,035	0
2003	671	1348	1,053	0
2004	869	1209	2,294	0
2005	626	856	1,542	0
2006	643	923	1,239	0
2007	845	687	1,505	0

[a/] Wild and hatchery Spring Chinook could not be completely distinguished until 2002 return year.
Source: PGE and Marmot Dam records.

- 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).

Annual take levels are not expected to exceed those outlined in the Take Authorization for broodstock collection and sorting activities associated with passage of unmarked fish upstream of the hatchery. The take estimate below is for activities specifically associated with trapping, sorting, and collection of coho broodstock at Sandy Fish Hatchery where unmarked coho, steelhead and Chinook may be encountered during trapping activities.

Take Authorizations for Operations of Sandy Fish Hatchery Adult Trap and Smolt Out-migrant Monitoring Trap

Species	Life Stage	Expected Encounter*	Indirect Mortality	Direct Mortality
Steelhead	Adult	250	5	0
Steelhead	Juvenile	2000	20	0
Chum Salmon	Adult	5	1	0
Bull Trout	Adult	5	1	0
Coho Salmon	Adult	600	12	0
Coho Salmon	Juvenile	5000	50	0
Fall Chinook	Adult	50	2	0
Spring Chinook (broodstock)	Adult	500	10	0

*The expected encounter is associated with fish encountered during sorting and broodstock collection activities at Sandy Fish Hatchery. The estimate does not include fish that may be encountered at the potential future adult weir/trap installed on the Bull Run River since ODFW does not anticipate a need to operate this proposed facility to sort coho salmon.

See Section13, Attachment 2 for estimated annual take levels of listed salmonids from hatchery activities.

- 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.

ODFW will consult with NOAA Fisheries if projected take levels may be exceeded. If wild fish show up at the Sandy Hatchery, they are sorted and passed above the hatchery adult diversion weir.

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.

- *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (ODFW 2010)

The Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (LCRCRP) contains an assessment of the status of each native stock, and a description of the desired biological status relative to measurable biological attributes, a description of short and long term management strategies to address the primary limiting factors, short and long term monitoring and research needs, and a description of measurable "trigger" criteria which would indicate a change in status or a need to modify or expand recovery efforts.

- *Native Fish Conservation Policy* (OAR 635-007-0502 through -0509), and
- *Fish Hatchery Management Policy* (OAR 635-007-0542 through 0548)

The policies outlined in these documents further refine the objectives of conservation of native fish stocks and limiting the impacts of hatchery produced fish on those native stocks. The Native Fish Conservation Policy (NFCP) defines ODFW's principle obligation for fish management as the conservation of naturally produced native fish in the geographic areas to which they are indigenous. The policy is based on the concept that locally adapted populations provide the best foundation for maintaining and restoring sustainable naturally-produced fish. The NFCP requires a conservation plan for each native stock (i.e. the LCRCRP). These conservation plans are to contain an assessment of the status of each native stock, and a description of the desired biological status relative to measurable biological attributes, a description of short and long term management strategies to address the primary limiting factors, short and long term monitoring and research needs, and a description of measurable "trigger" criteria which would indicate a change in status or a need to modify or expand recovery efforts.

The Fish Hatchery Management Policy (FHMP) compliments the NFCP in providing direction for the application of hatcheries as a fisheries management tool. The FHMP promotes the use of best management practices to ensure conservation of both naturally-produced native fish and hatchery-produced fish in Oregon. The policy requires a hatchery management plan for each program, and requires effective coordination planning be done cooperatively with other state, federal, and tribal management partners, as well as with university programs and the public. The policy provides general fish culture and facility guidelines and measures to maintain the genetic resources of native fish populations spawned or reared in captivity.

- *Fish Health Management Policy* (OAR 635-007-0960 to 635-007-1000)

This was developed to "minimize the impact of fish diseases on the state's fish resources." The policy applies to all forms of fish hatchery operations, including Salmon and Trout Enhancement (STEP) projects, and to all importation, transportation, release, and rearing of non-aquaria species within the state of Oregon. The goal is to inspect and detect disease agents in order to contain and treat them, and thus curtail potential impacts on existing fish populations.

Sandy River Basin Fish Management Plan (ODFW, 1997) and *Sandy River Fish Management Plan Amendment* (ODFW, 2001).

The Sandy Basin Plan and Amendment provided direction for the management of fish populations to protect and enhance naturally spawning populations in the Sandy River Basin by identifying and addressing factors that impact those populations. The plans also restricted fisheries and changed management direction of spring Chinook in ways consistent with rebuilding wild populations. The measures outlined in the plans are designed to maintain viable populations in the Sandy River. These plans are now superseded by adoption of new Oregon Administrative Rules that were recently incorporated through completion of the LCRCRP

- *Fisheries Management and Evaluation Plan- Lower Columbia River Steelhead in Oregon Freshwater Fisheries of the Lower Columbia River Tributaries Between the Pacific Ocean and Hood River* (ODFW, 2003).

This document outlines the plans for selective fisheries for hatchery produced steelhead in tributaries of the lower Columbia River, and plans for evaluation of the effectiveness of the fishery regulations in protecting natural spawning populations. The Fishery Management and Evaluation Plan (FMEP) calls for a comprehensive monitoring and evaluation program assessing the catch of wild fish, the abundance of wild and hatchery fish, and angler compliance throughout the basin. The results of the monitoring program are to be assessed annually.

- *US vs. Oregon*

This program aids in fulfillment of annual management agreements between the States of Oregon and Washington, the Federal Government, and the Columbia River Treaty Tribes under the jurisdiction of the US District Court.

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

- Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead
- Fisheries Management and Evaluation Plan- Lower Columbia River Chinook in Oregon Freshwater Fisheries of the Lower Columbia River Tributaries Between the Pacific Ocean and Hood River
- Section 7 Biological Opinion and Incidental Take Statement for Sandy Hatchery Coho issued September 28, 2012
- US vs. Oregon
- US vs. Canada Treaty
- Native Fish Conservation Policy
- Fish Hatchery Management Policy
- Fish Health Management Policy
- Biological Opinion on Artificial Propagation in the Columbia River Basin, 1999. Incidental Take of Listed Salmon and Steelhead from Federal and Non-Federal Hatchery Programs that Collect, Rear and Release Unlisted Fish Species, Portland, Oregon.
- The Mitchell Act
- NPDES permit for hatchery operations.
- MOA between ODFW and DEQ for fish carcass placement and nutrient enrichment program.

This HGMP is consistent with the above policies, plans, agreements and permits.

3.3) Relationship to harvest objectives.

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

This program is managed to provide coho salmon production to supplement harvest in ocean, Columbia River, and Sandy River commercial and sport fisheries to mitigate for lost salmon production related to habitat loss and degradation in the Sandy River Basin. Sandy Hatchery coho are an important contributor to west coast ocean fisheries, to lower Columbia River sport and commercial fisheries, and to the Sandy River sport fishery. Recovery of CWT fish indicates that the contribution to fisheries of Sandy Hatchery coho salmon is highest in the Oregon and Washington ocean commercial fisheries and Oregon freshwater sport fisheries (Lewis et al. 2002).

Total fishery harvest estimates for Sandy Hatchery coho salmon are listed in Table 3.3.1a. and Table 3.3.1b.

Table 3.3.1(a). Sandy River recreational angling harvest estimates by return year from 1995-2011.

Return Year	Number Caught
1995	209
1996	12
1997	112
1998	0
1999	116
2000	648
2001	3,552
2002	3,810
2003	5,629
2004	3,532
2005	1,729
2006	2,604
2007	2,627
2008	8,374
2009	6,218
2010	4,079
2011	1,591

Source: ODFW Sport Catch Harvest Records (Expanded). Harvest data from 2012 not available at time of current update.

Table 3.3.1(b). Ocean, Columbia River, and Sandy River sport and commercial harvest of Sandy hatchery coho by brood year (1995-2006).

Brood Year	Total Release[a/]	Estimated Harvest		
		Ocean[b/]	Columbia[c/]	Terminal[c/]
1995	699533	339	232	12
1996	345213	358	267	92
1997	688459	1450	316	5
1998	833735	10734	4151	83
1999	718155	3892	3364	560
2000	862729	12244	3428	2822
2001	772939	9021	770	2903
2002	705152	905	632	5160
2003	760299	1641	391	3990
2004	753327	6488	780	1753
2005	720606	1236	478	2302
2006	748079	10383	165	2976

Source: Corvallis Research

[a/]Total release numbers derived from HMIS.

[b/]Estimate of ocean harvest based on CWT returns of non-DIT tagged fish.

[c/]Estimate of freshwater harvest based on CWT returns of non-DIT fish and harvest card estimates of catch in the Sandy River (apportioned to brood year based on % of 2 and 3 year fish in the fishery estimated using CWTs.

3.4) Relationship to habitat protection and recovery strategies.

The Sandy River basin is a diverse system, containing important fish habitat that requires appropriate protection and recovery strategies to help improve native salmonid populations in the basin. The Bull Run River drainage is the water source for the City of Portland, which demands effective protection of water quality. This basin holds urban areas, agricultural areas, National Forest, a Wilderness Area, and its corridor in the lower basin is classified as a Scenic River. The Sandy River Basin Fish Management Plan (ODFW 1997) offers a thorough description of what the basin is, the uses that take place in it, and the habitat protective measures that are being employed by ODFW. The goal for habitat management is: "Protect, restore, and improve fish habitat throughout the basin to improve healthy native fish populations that provide ecological function and diversity to the Sandy watershed, and greatly benefit people in the region." This goal is supported by five Objectives:

Objective 1. Maintain and improve upstream and downstream passage for fish in the Sandy River basin at dams, water diversions, existing fishways, culverts, and where needed, at in-channel debris barriers.

Objective 2. Protect, enhance, and restore fish habitat in the Sandy River Basin.

Objective 3. Inventory stream and watershed conditions using current methods to assess factors limiting fish production in the Sandy basin.

Objective 4. Reduce artificial introductions of sediment into the Sandy River and basin tributaries.

Objective 5. Restore stream flows where possible, and protect existing stream flows and water quality from degradation associated with operation of dams, diversions, effluents, mining, recreation and other in-stream activities.

For the most part, the Sandy Hatchery coho program is consistent with these habitat protection and recovery strategies and with what is outlined in the Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (ODFW 2010). Specific habitat-related actions for the Sandy Basin in the Recovery Plan can be found in Table 9-3.

3.5) Ecological interactions.

(1) Species that could negatively impact the program include:

- Avian predators, such as great blue herons, Caspian terns, cormorants, and gulls.
- Mammalian predators such as river otters, harbor seals, or sea lions.
- Introduced fish species (American shad, walleye, smallmouth bass, and channel catfish).
- Native salmonids
- Northern pikeminnow.
- Out-of-basin hatchery salmonid releases.
- Known or unknown aquatic non-indigenous animals and plants.

The majority of the preceding species can be characterized as predators of juvenile salmonids, or competitors, which may negatively affect the survival of juvenile Sandy Hatchery coho after release. Recent estimates of annual Caspian tern predation on salmonid smolts in the Columbia River estuary have been as high as about 25 million (Roby et al. 1998). Caspian tern predation is highest on large smolts, such as steelhead or coho that spend 1-2 years rearing in freshwater. Predation is lower on ocean-type salmonids such as fall Chinook and chum salmon that emigrate as sub-yearlings. Northern pikeminnow (*Ptychocheilus oregonensis*) have been estimated to annually consume millions of juvenile salmonids in the lower Columbia River. Pikeminnow abundance in the lower Columbia River mainstem is likely high; therefore pikeminnow effects may be significant. Walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomeiui*) have been estimated to consume substantial numbers of emigrating juvenile salmonids in some areas. However, in general their predation on salmonids in the lower Columbia River and the estuary is considered relatively low. River otters (*Lutra canadensis*), Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are present in the lower Columbia region and may represent a substantial natural predation source on juvenile and adult salmonids. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed.

American shad (*Alosa sapidissima*), as well as large native and out-of-basin hatchery salmonid releases represent potential sources of competition to juvenile Sandy Hatchery coho. Some studies have found overlap in habitat use and diet items in juvenile American shad and both sub-yearling and yearling salmonids (McCabe et al. 1983). Similarly, the potential exists for large-scale hatchery releases of fry and fingerling Chinook salmon to affect the production capacity of estuaries (Lichatowich and McIntyre 1987). Thus, food availability may be negatively affected by the temporal and spatial overlap of juvenile salmonids from different locations (Bisbal and McConnaha 1998).

Aquatic non-indigenous species introductions in the lower Columbia River represent permanent alterations of the biological integrity of the ecosystem and increased food competition. Several nonnative invertebrate species have expanded their populations dramatically since introduction, particularly the Asian bivalve, *Corbicula fluminea*, and the New Zealand mud snail, *Potamopyrgus antipodarum*.

(2) Species that could be negatively impacted by the program include:

- Lower Columbia River Chinook
- Lower Columbia River steelhead
- Lower Columbia River coho
- Lower Columbia River chum
- Out-of-basin wild salmonids using the Columbia River estuary

Wild juvenile salmonids using the Columbia River may be affected by releases of Sandy Hatchery coho. However, the coho are released as full-term yearling smolts so they are expected to promptly out-migrate through the Sandy River and the lower Columbia River with a minimum of ecological interaction with other species.

Management efforts are taken to reduce the negative ecological interaction of hatchery fish on wild fish. Potential negative interactions that may occur are (a) genetic introgression, (b) competition, (c) disease transmission, and (d) predation. Although risks associated with this fish propagation program are not completely known, a brief summary of the potential risks, and the activities taken to avoid, minimize, or monitor such risk is described below.

(a) *Genetic Introgression* - Genetic introgression may occur if hatchery adults spawn in the wild. This impact is minimized through the following actions:

- All hatchery fish are externally marked and if spawning ground survey indicate the number of hatchery fish in natural spawning ground is above the level suggested in the recovery plan, appropriate measures will be taken including reduction in smolts release numbers and/or alternate acclimation/release locations.

- Hatchery brood originate from local Sandy River coho and are currently taken across the adult return period in proportion to returns in order to limit selection for specific run timing, to maintain genetic diversity within the population. These measures should help limit the impacts of any hatchery fish that do happen to spawn in the wild.

- Coho smolts spend their entire rearing life history at Sandy Hatchery on Cedar Creek water which allows them to fully imprint to the hatchery stream. This leads to very good homing fidelity back to the hatchery which in turn results in few hatchery adults to spawn in the wild.

(b) *Competition* - Freshwater carrying capacity may be compromised if hatchery coho competitively displace wild fish in their natural rearing habitats. Although there are little data to substantiate whether competitive interactions are occurring in the Sandy basin, there is a chance that it may occur in lower river reaches, below the areas of the former Marmot Dam site. The following are several strategies ODFW uses to avoid (or minimize) risks associated with hatchery and wild coho competitive interactions and carrying capacity concerns:

- Coho smolts are released in the lower river at a size that encourages swift emigration and little residualization. This should minimize spatial and temporal overlap, thereby reducing competition with wild juveniles for food and cover.

- The number of hatchery coho released from this program is considered “low” in magnitude relative to other Columbia River production programs and is not expected to cause serious density dependent effects in the Sandy Basin or lower Columbia River reaches" (NMFS 1999).

(c) *Disease Transmission* – Because hatchery coho are released into and return to the Sandy River, they are potentially a source of pathogen and disease transmission to wild fish populations. ODFW recognizes the importance and magnitude of fish disease and health, and hatchery coho are managed to minimize disease transmission to wild populations.

To prevent introduction, spread, or amplification of fish pathogens, all hatchery activities are conducted in accordance with guidelines developed under the ODFW 2003 Fish Health Management Policy, the Pacific Northwest Fish Health Protection Committee (PNFHPC), and according to protocols outlined by the Integrated Hatchery Operations Team (IHOT 1996). ODFW fish pathologists, along with hatchery staff, regularly monitor fish health and conduct fish disease examinations. Monitoring efforts include sampling for viral infections, abnormal fish loss investigations, and pre-transfer and pre-liberation fish health inspections.

(d) *Predation* - Hatchery coho released into nursery habitats may residualize within the subbasin and directly prey on naturally produced salmon and steelhead fry. Due to their location, size, and time of emergence, newly emerged Chinook and coho salmon fry and fingerlings are likely to be the most vulnerable to predation by hatchery released fish (NMFS 1999). However, direct predation by hatchery fish on naturally produced fish in migration corridors is believed to be low (NMFS 1999). In addition to direct predation, large groups of hatchery fish may attract alternate predators in rearing habitats and migration corridors, such as pinnepeds, birds, and other fish species.

(3) Species that could positively impact the program include: Any hatchery or wild fish that dies or is deposited within the subbasin may enrich the nutrient levels in the basin. Collected broodstock in excess of production needs may be distributed throughout the Sandy River in order to increase the nutrient supply. Decaying carcasses of salmonid species may contribute nutrients that increase productivity in the subbasin.

(4) Species that may be positively impacted through the program include: Any freshwater or marine species that depend on salmonids for food or nutrients may benefit from this program. Pacific salmon carcasses are important for nutrient input back to freshwater streams (Cederholm et al. 1999). Many species are known to utilize juvenile and adult salmon as a nutrient food base (Groot and Margolis 1991; McNeil and Himsworth 1980). Declines in wild salmonid populations during the last few decades could reduce overall ecosystem productivity. Hatchery production has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climatic cycles.

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.

Sandy Hatchery - The water source for the Sandy Hatchery is Cedar Creek, a tributary to the Sandy River. Water rights total 12,577 gallons per minute (gpm). Water is supplied to the hatchery by gravity flow. Cedar Creek's average water temperature is 45°F during the acclimation period. The hatchery intake on Cedar Creek is 100% screened throughout the year and the screens are compliant with NMFS current screening criteria. River water withdrawal is covered under Oregon water permit # 23300 (12/3/1954).

Table 4.1. Summary of Sandy Hatchery water temperature and water usage (averages).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GPM	11,200	9,910	11,200	11,200	7,500	7,200	6,400	2,780	2,900	7,240	7,240	8,800
Temp (F)	43.4	43.5	45	47.1	50.8	54.8	60.7	60.7	57.2	40.6	46.1	42.9

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 the hatchery water withdrawal, screening, or effluent discharge.

Sandy Hatchery - The intake system in Cedar Creek is 100% screened and is considered compliant to NOAA Fisheries fish screening criteria. Over 250 coho were passed for the first time in over 50 years during the fall of 2010 and all unmarked coho and winter steelhead will be transported upstream of the hatchery for release until trap modifications can allow for volitional release after sorting of marked and unmarked fish. Hatchery effluent is managed to comply with conditions and water quality limits outlined in the existing NPDES permit.

A minimum flow of 2.3 cfs will be maintained in channel at all times during summer months (June 1 – September 30) in order to ensure effective upstream migration of juvenile and resident fish that may be present in the vicinity of the hatchery. A minimum flow of 5 cfs will be maintained in channel during the normal adult migration period in order to ensure effective upstream adult migration through the reach between the hatchery intake and adult diversion weir. If stream flow drops below 5 cfs instream during the adult migration period, hatchery staff will physically transport any fish collected in the trap upstream of the intake. Flows less than 5 cfs will naturally limit upstream movement of both adult and juvenile fish due to instream conditions that limit passage.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock for this program are collected by volitional return to an adult trap at the Sandy Hatchery on Cedar Creek. At the hatchery fish are handled individually with soft mesh dipnets, identified, sorted to gender, counted, and either held at Sandy Hatchery or in the case of wild fish, are transported and released into Cedar Creek upstream of the hatchery. Unmarked coho will be allowed volitional passage into upper Cedar Creek after initial sorting operations. In the future, adult fish may be collected by hook and line in order to ensure representation of the entire return timing of coho salmon in the Sandy Basin.

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

Adult Transportation -
Broodstock is collected at Sandy Hatchery and enter the facility volitionally, therefore no additional transportation is necessary.

Unmarked coho and winter steelhead that enter the trap at Sandy Hatchery are currently passed upstream of Sandy Fish Hatchery as soon as practical after initial sorting operations are completed. Fish are allowed to volitionally enter a channel that flows back into the main channel of Cedar Creek adjacent to the adult holding pond. If stream flow is excessively low during the normal adult migration period (October – May) fish may be transported in a fish liberation truck utilizing a small, portable tank (~300 gallon) equipped with supplemental oxygen. Normal handling and transit time is < 1 hours.

5.3) Broodstock spawning and holding facilities.

Adult coho used for broodstock are held in an adult holding pond at the Sandy Fish Hatchery. The holding pond is approximately 35’ x 75’ with an average depth of 3 feet (~7,875 ft^3). All adults are spawned under a covered platform at the Sandy Fish Hatchery.

5.4) Incubation facilities.

Sandy Hatchery
Incubation through the eyed stage takes place at Sandy Hatchery in two flow-through concrete troughs (Table 5.5.1). Eggs are bulk incubated in sixteen individual trough sections with approximately 75,000 eggs per section. Water flows through the incubators at 12 gpm. The temperature of the water during early incubation is ~52°F. Average initial egg size is approximately 115 green eggs/ounce.

5.5) Rearing facilities.

Sandy Hatchery -

Table 5.5.1. Incubation and rearing facilities at Sandy Hatchery.

Unit Type	Unit Length (ft)	Unit Width (ft)	Unit Depth (ft)	Unit Volume (ft3)	Number Units	Total Volume (ft3)	Construction Material
Adult Holding Pond	78	35	3	8,190	1	8,190	concrete
Incubation Troughs	14	1.4	1.17	223	24	552	concrete
Raceways	80	20	3.5	5,600	20	112,000	concrete

5.6) Acclimation/release facilities.

All hatchery coho salmon are acclimated entirely on water from Cedar Creek. Release of smolts takes place directly into Cedar Creek at the Sandy Hatchery.

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

There have not been any significant fish losses resulting from hatchery operations at Sandy Fish Hatchery.

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 acclimation pond is alarmed to notify hatchery staff if water supply is interrupted.
- Cedar Creek is the sole water source during rearing/acclimation and is gravity fed.
- Coho salmon adults held at Sandy Fish Hatchery are monitored for loss and necropsies conducted to determine cause of death. Treatments may be applied to prevent further loss.
- Fish health monitoring and disease prevention standards at Sandy Hatchery is consistent with ODFW Fish Health Management Policy and IHOT protocols for fish health.
- Hatchery staff at all three facilities are on-call 24 hrs/day to address emergency (or unexpected) events.
- All incubation trays, rearing ponds and head tanks at all three facilities are alarmed to notify hatchery staff if an equipment failure occurs.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source.

The broodstock for the Sandy River coho program are obtained from adult coho salmon returns to the Sandy Hatchery, on Cedar Creek.

6.2) Supporting information.

6.2.1) History.

The Sandy Fish Hatchery was built in 1952 and trapping of broodstock for the coho program was initiated in 1952-53. During its inception, the vast majority broodstock for the Sandy River coho program came from wild, adult Sandy River coho captured in Cedar Creek. Unmarked coho that could be of natural or hatchery origin returning to the facility were utilized for brood until marked adults began to return in 1999 and 2000. Only returning hatchery-origin coho from this program are currently being used as broodstock.

6.2.2) Annual size.

The annual broodstock maximum is ~450 adults, ~270 females and ~180 males.

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

The broodstock originated from 100% natural fish in 1952-53. Naturally produced fish that entered the Sandy Hatchery may have been incorporated in the broodstock through the 1998 brood year. Since then, all hatchery coho are mass marked, and naturally produced coho are no longer incorporated into the broodstock. See Section 7.4.2 for details regarding past levels of broodstock collection. ODFW may request authorization in the future to incorporate limited numbers of wild adult coho into the broodstock in order to reduce the loss of genetic heterozygosity in addition to other domestication effects in the hatchery population. This action will only be taken if it can be demonstrated through monitoring and assessment of wild adult coho that the population is healthy and abundant enough to withstand removal of limited numbers and not impact viability of the population.

6.2.4) Genetic or ecological differences.

The broodstock originated entirely from wild, adult Sandy River coho captured in Cedar Creek. However, the broodstock is fairly old (started in 1952) and may have developed genetic differences from the wild population due to domestication and artificial selection. Currently there are no known genetic differences between the hatchery broodstock and the natural (i.e., wild) population, but there has not been a comprehensive genetic analysis of the two populations.

Despite descending from wild Sandy River coho, the hatchery population may exhibit substantial ecological differences (e.g. homing ability, general behavior, run timing, etc.)

from the wild population. These differences will likely be due to the process of rearing in a hatchery environment. Despite this potential, available information indicates that a high percentage of Sandy Hatchery coho return back to their point of release in Cedar Creek. Coho survey annual reports indicated that there are limited instances where a high proportion of hatchery fish were found straying from Cedar Creek and into other lower basin tributaries (i.e. Gordan Creek). These instances of higher than normal stray are related to low flows through fall when coho are returning and are challenged moving into smaller tributaries in addition to release numbers exceeding the target release. See Table 2.2.2(d) for data on coho stray rates over the past 12 years.

6.2.5) Reasons for choosing.

Initially wild Sandy River coho salmon were chosen as the broodstock source for the Sandy Hatchery coho program because it was the goal of the program to utilize only the locally-adapted, wild fish for propagation. This broodstock is believed to be genotypically and phenotypically similar to the natural Sandy River stock, and therefore, Sandy origin local coho broodstock was chosen for artificial propagation for better adaptation into the Sandy River basin and to maintain genetic similarity between wild and hatchery produced populations within the basin.

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.

All broodstock for the Sandy River coho program have come from local Sandy River coho salmon collected in Cedar Creek. Thus, genetic and ecological effects to listed fish due to broodstock selection are assumed to be minimal. However, while the vast majority of hatchery coho return to the Sandy Hatchery, Marmot Dam counts and ongoing spawning surveys indicate that a small percentage of hatchery coho may spawn naturally in tributaries to the lower mainstem Sandy River below the former Marmot Dam; There is also the potential that some of these hatchery fish could migrate past Cedar Creek and into the upper Sandy Basin where they could successfully spawn with wild fish (Tables 2.2.2c and 2.2.2d). It is expected that utilizing a broodstock derived entirely from the locally-adapted wild stock will minimize any adverse genetic or ecological effects to listed natural fish. All Sandy Hatchery coho are marked with an adipose fin-clip prior to release. Only hatchery fish are currently used as broodstock.

In the future, wild coho may be integrated into the broodstock if it is determined through monitoring that the naturally produced population is healthy and abundant enough to withstand removal of limited number of adults. This action will be taken in order to reduce the potential for domestication of the hatchery stock.

SECTION 7. BROODSTOCK COLLECTION

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

Only returning hatchery adults are collected and used for broodstock.

7.2) Collection or sampling design.

All marked adults volitionally entering the trap at the Sandy Hatchery are collected. Adults for broodstock are randomly selected from the entire run, without bias for size, run timing, or any other characteristics.

7.3) Identity.

Native wild fish are identified by the presence of an adipose fin. Fish with an adipose fin are tested for CWTs. If no CWT is present then the fish are assumed to be wild and are passed upstream into Cedar Creek. However, due to marking error, up to 3% of un-marked fish may be hatchery-origin fish that were either not marked or poorly marked allowing for the adipose fin to regenerate. Only marked fish are used for broodstock.

7.4) Proposed number to be collected.

7.4.1) Program goal.

The annual broodstock collection goal is 450 adults (~270 females and ~180 males). However, all marked coho entering the trap are collected to increase recovery of CWT information. Numbers collected are substantially larger than the number taken for broodstock to compensate for adult mortality that may occur prior to spawning.

7.4.2) Broodstock collection levels for the last twelve years, or for the most recent years available.

Table 7.4.2. Number of hatchery coho taken for broodstock, 1993-2012.

Year	Males	Females	Jacks[a/]
1993	27	80	6
1994	732	2,196	
1995	452	1,355	
1996	48	143	29
1997	199	595	
1998	244	732	
1999	152	456	
2000	200	600	
2001	210	630	
2002	210	552	
2003	176	527	
2004	255	510	
2005	255	510	
2006	170	510	
2007	260	510	
2008	245	489	
2009	240	489	
2010	304	450	
2011	299	450	
2012	180	270	

Source: Sandy Hatchery records.

[a/] The exact number of jacks used for broodstock is unknown for most years, however the Sandy Hatchery tries to incorporate jacks into the broodstock at a rate of ~ 10%.

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

All hatchery fish that enter the hatchery trap are collected and are either selected for broodstock or utilized in nutrient enrichment programs in local streams. All hatchery coho carcasses used for enrichment of spawning streams are marked to prevent confusion with monitoring of naturally spawned fish. Fish that may be in excess of broodstock and nutrient enrichment needs are provided to the Oregon Food Bank or local food banks.

7.6) Fish transportation and holding methods.

All broodstock are collected at the Sandy Hatchery where holding, and spawning,, take place. Therefore, there is no additional transportation of broodstock. Adult coho used for broodstock are held in an adult holding pond at the Sandy Hatchery (See Section 5.5 for details regarding the adult holding facilities). Wild coho and winter steelhead that enter the trap at the Sandy Hatchery are sorted and allowed to pass upstream of the hatchery into Cedar Creek. All unmarked Chinook and summer steelhead will be transported via aerated live tank to the Sandy River at or upstream of the former Marmot Dam site.

7.7) Describe fish health maintenance and sanitation procedures applied.

See Section 9.1.6 for details regarding fish health monitoring, maintenance, and sanitation.

7.8) Disposition of carcasses.

Adult hatchery coho salmon in excess of broodstock needs will be killed, sold or given to the Oregon Food Bank (if in suitable condition), used for stream nutrient enrichment, or disposed of in a local landfill per IHOT and ODFW guidelines.

Table 7.8. Number of fish used for nutrient enrichment projects in the Sandy River Basin.

Year	Stream	# of Carcass/Species	Miles Treated
1997	Still Creek	400 Coho	1.5
1998	Still Creek	400 Coho	1.5
1999	Still Creek	400 Coho	1.5
2000	Still Creek	396 Coho	1.5
2001	Salmon River	75 Chinook	13
	Sandy River	19 Chinook	2
	Camp Creek	1,213 Coho	5
	Clear Fork	1,212 Coho	5
	Clear Creek	1,212 Coho	5
2002	Salmon River	161 Chinook	13
	Sandy River	244 Coho	2
	Camp Creek	216 Chinook	5
		1,056 Coho	
	Clear Fork	1,300 Coho	5
	Clear Creek	1,381 Coho	5
	Lost Creek	244 Coho	2
2003	Camp Creek	815 Coho	3
	Clear Fork	1,400 Coho	4.5
	Clear Creek	470 Coho	1.5
2004	Lost Creek	250	1
	Clear Fork	2,914	3.75
	Camp Creek	1,949	3.5
2005	Lost Creek	750	2
	Clear Fork	3,250	3.75
	Camp Creek	2400	3
2006	Sandy River	6,269 coho	
2007	Sandy River	2,952 coho + 304 Chinook	
2008	Sandy River	4,657 coho + 212 Chinook	
2009	Sandy River	3,657 coho	
2010	Sandy River	6,512 coho + 379 Chinook	
	Cedar Creek	39 coho	
2011	Sandy River	3,095 coho	26
2012	Sandy River	2,217 coho	20

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.

All broodstock are collected from hatchery fish returning to the trap at the Sandy Hatchery. Listed wild fish are not used as broodstock for this program. Broodstock are selected at random from throughout the entire run to avoid any timing and/or size bias and to maintain genetic diversity within the population. Listed coho and steelhead entering the trap at Sandy Hatchery are sorted and allowed to volitionally move upstream into Cedar Creek above the hatchery.

SECTION 8. MATING

8.1) Selection Method.

Coho of all sizes are collected from throughout the temporal distribution of the run to avoid any timing and size bias. Ripe fish are randomly selected for mating.

8.2) Males.

Ripe males will be randomly selected and spawned at a 2:3 (male-to-female) ratio with females.

8.3) Fertilization.

Coho will be selected and paired at random from the pooled brood population for spawning. Fish are spawned at a 2:3 (male-to-female) spawning ratio. The IHOT, PNFHPC, and state guidelines are followed during spawning (such as fish handling, disinfection, and sanitation procedures that prevent pathogen transmission between stocks of fish).

8.4) Cryopreserved gametes.

No cryopreserved gametes are used in this program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed fish resulting from the mating scheme.

This is an isolated harvest program of hatchery stock, with no listed natural fish used as broodstock. Therefore it is unlikely that the mating scheme will have any adverse genetic or ecological impacts on listed natural fish. However, to maintain within hatchery-population genetic diversity (regarding run timing, size, etc.), broodstock are collected from the entire run and spawned randomly (while maintaining a 2:3 male to female spawning ratio) from the pooled broodstock population. All fish are sampled for BKD and IHN during spawning. Eggs and sperm from fish that test positive for BKD and/or IHN are destroyed.

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1. Number of eggs taken and survival rate to ponding of Sandy Hatchery coho, 1992-2012.

Brood Year	Egg Take	Green-egg to Eyed-egg Survival	Sandy H. Eyed-egg to Fry Survival	Cascade H. Eyed-egg to Fry Survival	Oxbow H. Eyed-egg to Fry Survival
1992	8,062,514	92.4%	98.8%	--	--
1993	151,871	89.1%	95.8%	--	--
1994	4,988,535	90.3%	96.6%	--	--
1995	3,171,614	91.0%	96.9%	--	--
1996	361,917	94.8%	97.4%	--	--
1997	1,538,168	94.0%	96.6%	--	--
1998	1,728,404	93.4%	96.0%	--	--
1999	1,115,291	96.2%	98.0%	--	--
2000	1,375,648	93.8%	94.9%	--	--
2001	1,912,800	93.1%	96.9%	--	--
2002	1,551,230	93.9%	91.1%	--	--
2003	1,325,272	95.9%	95.0%	--	--
2004	1,585,222	91.6%	95.3%	--	--
2005	1,350,383	89.2%	92.0%	--	--
2006	1,405,983	90.0%	92.5%	--	--
2007	1,270,930	93.6%	96.7%	--	--
2008	1,391,500	95.2%	--	98.3%	97.2%
2009	1,430,482	93.0%	--	95.2%	95.8%
2010	1,610,941	92.1%	--	97.2%	98.5%
2011	1,296,000	94.0%	--	97.6%	94.2%
2012	693,000	91.6%	94.3%	--	--

Source: Hatchery Management Information System (HMIS).

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

Measures are taken to only collect the number of eggs necessary to meet annual production goals. However, to compensate for possible mortality at the hatchery, enough eggs are taken and fertilized to allow for up to 10% excess of the target smolt release goal of 500,000 smolts (up to 330,000 for release into the Sandy River). Eggs may be tested and culled for BKD and/or IHN throughout the incubation and rearing process. If additional eggs are not needed they may be frozen and used for nutrient enrichment. If eggs are diseased, eggs are destroyed by freezing and disposed of in a landfill according to IHOT guidelines.

9.1.3) Loading densities applied during incubation.

Fertilized eggs are placed in bulk incubators until eye-up. Approximately 75,000 green eggs are placed in a single stack. Each stack is placed in a section of trough that measures 1' long x 1.5' wide x 1' deep. Once eggs are eyed, they are cleaned, dead eggs removed and good eggs counted into open baskets at 8,000 eggs/basket. There are 9 baskets /trough, and 8 troughs are used to hatch 375,000 fry, which will be used for the Sandy Hatchery coho program.

9.1.4) Incubation conditions.

Incubation through the eyed stage takes place in two flow-through concrete troughs. Sixteen individual squares are used for early incubation, with approximately 75,000 eggs per square. Flow through the incubators is 12 gpm. The temperature of the water used for early incubation is ~52°F. Average initial egg size is approximately 115 green eggs/ounce.

Incubation through hatching takes place in 8 flow-through concrete troughs. Nine individual baskets are used per trough, with approximately 8,000 eggs per basket. Flow through the incubators is 15 gpm. The temperature of the water used for late incubation ranges from 32-51°F. Average egg size at this stage is approximately 75 eyed eggs/ounce.

The IHOT species-specific incubation recommendations are followed for water quality, flows, and temperatures. Eggs are monitored when needed to determine fertilization efficiency and embryonic development. Eggs are incubated under conditions that allow equal survival of all segments of the population to ponding. Families are not incubated individually, but rather may be mixed with other families from the same spawn group. Families among spawning groups are mixed randomly at ponding so that unintentional rearing differences affect all families equally.

9.1.5) Ponding.

Coho fry are ponded in late February at approximately 1,200 fish/lb. Fry are distributed evenly between 4-6 concrete raceways. Each raceway is 80' long x 20' wide x 3.5' deep (or 5,600 ft^3). The fry are reared in these raceways until additional space becomes available, which usually occurs in May. At this time, the fish average approx. 200 fish/lb, and are stocked at a density of ~1,500 lbs of fish/pond. Flow rates in the ponds are 400 gpm of Cedar Creek water.

9.1.6) Fish health maintenance and monitoring.

ODFW has implemented both disease control and disease prevention programs at all of its facilities to achieve these objectives. These programs include the following standard elements:

<u>Disease Control (Reactive)</u>
• Perform necropsies of diseased and dead fish to diagnose the cause of loss.

• Prescribe appropriate treatments and remedies to disease. This includes recommending modifications in fish culture practices, when appropriate, to alleviate disease-contributing factors.
• Apply disease control policy as stated in the Oregon Administrative Rules (2003) which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
• Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)
• Routinely remove dead fish from each rearing container and notify ODFW Fish Pathology if losses are increasing. Monthly mortality records are submitted to Fish Pathology from each hatchery.
• Routinely perform examinations of live fish to assess health status and detect problems before they progress to clinical disease or mortality.
• Implement disease preventative strategies in all aspects of fish culture to produce a quality fish.
• Use a disease prevention policy that restricts the introduction of stocks into a facility.
• Use sanitation procedures that prevent introduction of pathogens into and/or within a facility.
• Conduct applied research on new and existing disease prevention techniques.
• Utilize pond management strategies to help optimize the quality of the aquatic environment and minimize fish stress that can be conducive to infectious and noninfectious diseases.

Health Monitoring
• Monthly health monitoring examinations of healthy and clinically diseased fish are conducted on each fish lot at the hatchery.
• All fish are given a health inspection no longer than 6 weeks before fish are released or transferred.
• Examinations for *Myxobolus cerebralis*, agent of whirling disease, are conducted annually.
• At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleen/pyloric caeca are examined for viral pathogens from each brood lot. If prespawning mortality is above normal, necropsies are conducted on dead adult fish for bacteria, parasites and other causes of death.
• Whenever abnormal behavior is reported or observed, or mortality exceeds 0.1% per day over five consecutive days in any rearing container, the fish pathologist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.
• Reporting and control of specific fish pathogens are conducted in accordance with the Fish Health Management Policy.

Fish and Egg Movements
• Movements of fish and eggs are conducted in accordance with the Fish Health Management Policy.

Therapeutic and Prophylactic Treatments
• Adult fish are injected with antibiotics for the control of bacterial diseases.
• At spawning, eggs are water-hardened in iodophor for disinfection.
• Juvenile fish are administered antibiotics orally as needed for the control of bacterial infections and for prevention of diseases.
• Only approved or permitted therapeutic agents are used for treatments.

Sanitation
• All eggs brought to the facility are surface-disinfected with iodophor.
• All equipment is disinfected with iodophor between uses with different fish/egg lots.
• Different lots of fish/eggs are physically segregated from each other by separate ponds, incubator units, and water supplies.
• Fish transport trucks are disinfected between the hauling of different fish lots.

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.

Disinfection, sanitation, and disease treatment procedures are implemented at all three facilities to ensure prevention of disease transfer between stocks, and between stocks and the receiving watershed (See Section 9.1.6). No ESA listed fish are involved in the incubation process of this program. Disinfection, sanitation, and disease treatment procedures are implemented to ensure prevention of disease transfer between stocks, and between stocks and the receiving watershed (See Section 9.1.6). Eggs are incubated on spring water to the eyed-up stage and then creek water to ponding. This is done to reduce disease transmission and minimize risks associated with siltation during the tender egg stage. Hatchery staff are available 24 hr/day, 7 days a week.

9.2) Rearing.

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

Table 9.2.1. Fry to fingerling and fingerling to smolt survival rates of coho reared at Sandy, Cascade and Bonneville hatcheries, brood years 1992-2012.

Brood Year	Egg Take	Sandy Hatchery Fry to Fingerling Survival	Sandy Hatchery Fingerling to Smolt Survival	Cascade Hatchery Fry to Fingerling Survival	Bonneville H. Fingerling to Smolt Survival	Oxbow H. Fry to Fingerling Survival
1992	8,062,514	95%	87%	--	--	--
1993	151,871	96%	90%	--	--	--
1994	4,988,535	92%	98%	--	--	--
1995	3,171,614	89%	96%	--	--	--
1996	361,917	94%	91%	--	--	--
1997	1,538,168	99%	99%	--	--	--
1998	1,728,404	99%	98%	--	--	--
1999	1,115,291	99%	98%	--	--	--
2000	1,375,648	99%	97%	--	--	--
2001	1,912,800	99%	96%	--	--	--
2002	1,551,230	99%	96%	--	--	--
2003	1,325,272	99%	96%	--	--	--
2004	1,585,222	99%	97%	--	--	--
2005	1,350,383	99%	94%	--	--	--
2006	1,405,983	99%	98%	--	--	--
2007	1,270,930	99%	98%	--	--	--
2008	1,391,500	--	--	99%	89%	99.6%
2009	1,430,482	--	--	99%	98%	90%
2010	1,610,941	--	--	98%	90%	89%
2011	1,296,000	--	N/A	--	N/A	97%
2012	767,515	N/A	N/A	--	N/A	--

Source: HMIS records.

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

The juvenile rearing density and loading guidelines used at all facilities are based on: standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria. The IHOT standards are followed for: water quality, alarm systems, predator control measures, and loading density.

Fish loading and density levels are as follows:

At Ponding:	0.907 pounds/gpm and 0.068 pounds/ft3
May split:	2.750 pounds/gpm and 0.417 pounds/ft3
Fall (prior to transfer):	9.000 pounds/gpm and 1.333 pounds/ft3

9.2.3) Fish rearing conditions.

At the Sandy Hatchery, IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. Settleable solids, unused feed, and waste are removed periodically to ensure proper cleanliness of rearing containers. The juvenile rearing density and loading guidelines used at the facilities are based on standardized agency guidelines, life stage specific survival studies conducted at other facilities, staff experience, and other criteria (See Section 9.2.2).

The water temperature range during the full rearing period varies from month to month. Extremes have been below 32°F in the winter (where ponds freeze over to a 1 foot depth) and approximately 77°F in late July/August. A 10 year average is approximately 42°F in winter and 60°F in summer. Water temperatures are recorded three times/day using a digital thermograph. Ponds are cleaned weekly and mortalities removed daily. Low dissolved oxygen levels have not been a concern. See Section 5.5 for details regarding fish rearing facilities.

9.2.4) Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4. Average monthly growth (biomass) data for coho reared at the Sandy Hatchery.

Hatchery	Month	Size (fish/lb.)
Sandy	March	785
Sandy	April	264
Sandy	May	183
Sandy	June	131
Sandy	July	88
Sandy	August	49
Sandy	September	37
Sandy	October	27
Sandy	November	25
Sandy	December	21
Sandy	January	19
Sandy	February	18
Sandy	March	18
Sandy	April	16

Source: HMIS records.

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

Fish growth rates (biomass) are measured each month for ponded fish. These data are reported monthly in ODFW standard Monthly Ponded Fish Reports. Energy reserve information is not available. See Section 9.2.4 for growth/weight data.

9.2.6) Indicate food type used, daily application schedule, feeding rate range, and estimates of total food conversion efficiency during rearing (average program performance).

Table 9.2.6. Feeding protocols for coho at the Sandy Hatchery.

Type of Feed	Fish Size Range (fish/lb.)	Application
# 0 Nutra Starter	1100 – 500	6-8 times/day
# 1 Nutra Starter	500 – 250	6-8 times/day
# 2 Nutra Starter	250 – 125	6-8 times/day
1.0 Bio Vita	125 – 100	3-4 times/day
1.3 Bio Vita	100 – 70	3-4 times/day
1.5 Bio Dry 3000	70 – 35	2 times/day
2.0 Bio Dry 3000	35 – 19	2 times/day
2.5 Bio Dry 3000	19 – 15	2 times/day

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

Fish health is monitored daily by hatchery staff and monthly by an ODFW fish health specialist. If any problems arise appropriate actions, including drug or chemical treatments, are applied. ODFW's Fish Health Management Policy and IHOT fish health guidelines are followed to prevent disease transmission between lots of fish on site or transmission or amplification to or within the watershed. See Section 9.1.6 for details regarding fish health monitoring, sanitation, and treatment protocols.

9.2.8) Smolt development indices (gill ATPase activity, growth factor, etc.).

The migratory state of the release population is determined by age, size, behavior, and physical appearance. Data of fish size and growth are recorded on monthly basis to ensure proper growth rate; and fish behavior, appearance, and coloration are observed which may indicate the smoltification and release time. See Section 9.2.4 for growth data. No ATPase activity studies are conducted.

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

This program uses conventional hatchery rearing techniques, and does not use any of the new "natural" type hatchery rearing strategies. However, fish are acclimated on Cedar Creek water under natural thermal conditions. Basin-specific environmental cues, along with pre-migration imprinting are believed to encourage adult homing to release areas. Fish are provided time for volitional release from the rearing pond at the end of the rearing period.

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.

To minimize any possible adverse impacts on listed fish, ODFW rears coho fry up to the full smoltification stage and releases full-term smolts that exhibit swift emigration, thus minimizing potential temporal and spatial overlap for food or other vital resources. Also,

fish health is routinely monitored and maintained to minimize any ecological effects to listed fish in the watershed (See Section 9.1.6).

SECTION 10. RELEASE

10.1) Proposed fish release levels.

Table 10.1. Proposed release levels of Sandy Hatchery coho salmon into Cedar Creek.

Age Class	Number Released *	Fish/lb.	Release Date	Release Location
Yearling	300,000	15.0	April/May	Cedar Creek (Sandy Fish Hatchery)
Yearling	200,000	15.0	April	CCF Net Pens

* The maximum number released is 330,000 into Cedar Creek. This is based on the IHOT criteria of plus or minus 10% of target release number.

10.2) Specific location(s) of proposed releases.

River Name: Cedar Creek (waterbody code = 0300304000)
Release Point: Cedar Creek, RM 0.25 (Sandy Hatchery)
Major Watershed: Sandy River
Basin or Region: Lower Columbia River Basin

Additional acclimation sites may be developed in the future to increase harvest opportunities or reduce unintended straying if it is found that hatchery origin coho overlap in time and space with natural origin coho.

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

Table 10.3. Annual release numbers and average size of Sandy Hatchery coho smolts released into Cedar Creek, brood years 1988-2011.

Brood Year	Number of Smolts Released	Average Size at Release
1988	955,532	14.8 fish/lb
1989	1,050,929	14.9 fish/lb
1990	1,037,280	15.0 fish/lb
1991	1,022,851	14.8 fish/lb
1992	917,334	16.0 fish/lb
1993	112,610	14.4 fish/lb
1994	794,554	14.6 fish/lb
1995	699,533	15.3 fish/lb
1996	284,583	14.9 fish/lb
1997	688,459	14.8 fish/lb
1998	833,735	14.8 fish/lb
1999	495,623	14.5 fish/lb
2000	862,729	14.4 fish/lb
2001	772,939	14.7 fish/lb
2002	705,152	14.6 fish/lb
2003	760,299	14.8 fish/lb
2004	753,327	14.7 fish/lb
2005	720,606	14.6 fish/lb
2006	748,079	14.9 fish/lb
2007	826,083	14.9 fish/lb
2008	516,555	15.9 fish/lb
2009	512,494	16.1 fish/lb
2010	462,950	15.1 fish/lb
2011	300,174	15.3 fish/lb

Source: Sandy Hatchery records.

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

Table 10.4. Release dates of Sandy Hatchery coho smolts into Cedar Creek, brood years 1988-2011.

Brood Year	Release Dates	Brood Year	Release Dates	Brood Year	Release Dates
1988	5/7/1990	1995	4/7/1997	2003	4/11/2005
	5/31/1990		5/5/1997		5/11/2005
1989	5/5/1991	1996	4/15/1998	2004	4/17/2006
	6/6/1991		5/14/1998		5/15/2006
1990	5/1/1992	1997	4/15/1999	2005	4/18/2007
	6/2/1992		5/14/1999		5/15/2007
1991	5/2/1993	1998	4/18/2000	2006	4/16/2008
	5/20/1993		5/15/2000		5/14/2008
	6/2/1993	1999	4/19/2001	2007	4/21/2009
1992	4/4/1994		5/16/2001		5/12/2009
	5/3/1994	2000	4/18/2002	2008	4/19/2010
	6/1/1994		5/16/2002		5/12/2010
1993	4/9/1995	2001	4/17/2003	2009	4/13/2010
	5/3/1995		5/14/2003		5/10/2010
1994	3/27/1996	2002	4/19/2004	2010	4/17/2011
	4/19/1996		5/13/2004		5/26/2011
	5/6/1996			2011	4/18/2013

Source: Sandy Hatchery records.

10.5) Fish Transportation.

Sandy Hatchery coho salmon are not transported for release. All hatchery coho are currently released on site at the Sandy Fish Hatchery following an acclimation period.

10.6) Acclimation procedures.

Smolts are transferred from the raceways to the adult holding pond and allowed to recover for approximately 24 hours prior to release. The fish are then released from the adult holding pond by removing screens and partially lowering the water level in the pond to facilitate a gradual release and dispersed downstream migration of smolts. Fish are allowed to volitionally migrate from the pond for a 24 hour period. After 24 hours water levels in the pond are gradually dropped further to promote migration. After approximately 48 hours, water levels are dropped fully and any remaining fish are transported into Cedar Creek. Based on long-term observations, almost all coho smolts outmigrate volitionally during the first 24 hour period after screen removal.

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

All (100%) of Sandy Hatchery coho salmon smolts are fin marked and/or tagged with a CWT to differentiate between natural and hatchery fish. Sandy Hatchery coho are fin marked with an adipose fin clip (AD).

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

Fish numbers are reduced to program levels well before release. If necessary, at the time of release, excess fish are humanely euthanized and disposed of in a local landfill per IHOT and ODFW guidelines. Broodstock collection and egg-take protocols will be reviewed each year to evaluate consistency with proposed smolt release numbers.

10.9) Fish health certification procedures applied pre-release.

ODFW Fish Pathology staff performs pre-release fish health inspections. Results are reported on ODFW fish health forms. All fish are examined to detect the presence of any "reportable pathogens" as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release. Only certified fish are released into Cedar Creek. Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines. Fish health is also inspected prior to each transfer from one facility to the next.

See Section 9.1.6 for details regarding fish health monitoring, sanitation, and treatment.

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

In the event of an emergency, hatchery staff is instructed to call the District Fisheries Biologist in Clackamas and Fish Propagation at ODFW headquarters in Salem, Oregon. After consultation, it is likely that Sandy Hatchery coho smolts would be directly released into Cedar Creek.

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.

- All Sandy Hatchery coho smolts are released into Cedar Creek, where it is believed that there is minimal overlap with wild juvenile coho salmon outmigration.
- All Sandy Hatchery coho smolts are reared to and released at a size that is optimal for rapid emigration from Cedar Creek and the Sandy River.
- All Sandy Hatchery coho smolts are acclimated on Cedar Creek water to promote adult homing to Cedar Creek and the Sandy Hatchery.
- All Sandy Hatchery coho smolts are released downstream of the primary natural production areas (above the former Marmot Dam).
- All (100%) of Sandy Hatchery coho smolts are fin-marked to differentiate between natural and hatchery fish. Sandy Hatchery coho are fin marked with an adipose fin clip (AD).
- Mark quality checks (to identify the percentage of unmarked fish) are performed on Sandy Hatchery coho smolts prior to release.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE STANDARDS AND INDICATORS

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

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

Many policies within the hatchery program are already in place to minimize and avoid risks to ESA listed species. Thus, much of the monitoring and evaluation of the Sandy River coho program are incorporated into routine ODFW operations within the hatchery, Fish Pathology, and Fish Management programs. See Section 1.10 for a listing of monitoring and evaluation efforts associated with each of the performance indicators for the Sandy River coho program.

ODFW hatchery staff collect and record data concerning all aspects of the fish propagation program, including water quality, hatchery returns, spawners, eggs, rearing, and release. Data pertaining to fish numbers will be entered into ODFW's HMIS database. Water quality information will be reported to DEQ and kept on hand. Information about hatchery practices will also be collected and kept on hand. ODFW hatchery staff and Pathology Section staff will test, treat, and record information related to fish disease.

ODFW North Willamette Fish District (NWFD) and ODFW Fish Division staff will ensure that the program details and direction are consistent with pertinent policies and native fish objectives.

ODFW NWFD staff will collect juvenile outmigrant information from Cedar Creek using a rotary screw trap. To assess the success of the Cedar Creek wild fish restoration activities, a protocol with the objective of estimating the production of juvenile coho, steelhead, and trout that emigrate from Cedar Creek was developed. This protocol will use Rotary screw traps (RST) to monitor the production of juvenile salmonids. For our purposes, the word "production" refers to the total number of juveniles that swam past the RST.

Smolt Trap Protocol

Beginning in March 2013, a 5-foot diameter RST was placed in Cedar Creek a short distance above the adult diversion weir to monitor the production of wild fish. The Cedar Creek RST will be integrated into the existing Sandy Basin monitoring plan(Strobel 2012). Forms, figures, and tables will be standardized to make it easier to compare temporal data and provide an ability to understand the quality and limitations of the data that are collected.

The RST will be checked frequently and fish will be anesthetized to determine species, fork length, fin mark, and life stage. Trap efficiency studies will be conducted throughout the trapping season to determine the proportion of the outmigration that is being captured in the trap. Following a modified mark-

recapture protocol, up to 25 juveniles of each species each day are given a fin mark specific to the day of the week. Fins are marked with small clips. Marked fish are released upstream of the trap near the hatchery intake. Captured fish are then sorted daily looking for fin marks from previous days' releases. Smolt population estimation will be estimated using Darroch Analysis with Rank Reduction for R (DARR 2.0.2, Bjorkstedt 2010), a program provided by the National Marine Fisheries Service (NMFS: http://swfsc.noaa.gov/textblock.aspx?Division= FED&id=3346).

Operation and monitoring activities of the Cedar Creek RST from March 1 through June 30 will collect the bulk of the wild juvenile outmigration and provide biologists with production values that generate high quality data for the success of the wild fish reintroduction.

ODFW North Willamette Fish District, ODFW Fish Division, and/or ODFW Columbia River Program staff will analyze catch information and conduct wild fish supplementation work. No specific creel studies for coho currently exist for the Sandy River, although they do for the Columbia River sport and commercial fisheries (overseen by the Columbia River Program). The Columbia River Program also analyzes CWT returns. The North Willamette Fish District also coordinates and reports on carcass placement in the Sandy Basin, with the USFS and STEP volunteers performing most of the work.

Corvallis Research Lab staff will continue coho spawning surveys in the Sandy and Clackamas River basins. This monitoring will focus on wild coho abundance and distribution as well as hatchery/wild interactions. Information collected through spawning surveys will be compared with research related to hatchery/wild fish relationships to gain insight into potential interactions that may be occurring between hatchery-origin and wild coho. A monitoring plan providing detail on coho spawner survey protocol will be submitted to NMFS on an annual basis by June 1st of the year.

Goals (Both Coho and Steelhead)

1. Provide annual estimates of abundance for natural and hatchery origin spawners within the Sandy River population.
2. Provide annual estimates of the proportion of hatchery origin spawners (pHOS) in the naturally spawning Sandy River population.
3. Provide information on the spatial distribution of spawning activity within the Sandy River, including information on both natural and hatchery-origin spawning.
4. Provide information on temporal patterns of spawning activity within the Sandy River, including information on natural and hatchery-origin spawning.

Coho Spawner Surveys

Surveys will be conducted at least once every eleven days from October through January. To obtain abundance, the Area-Under-the-Curve (AUC) technique will

be used to estimate the number of coho salmon adults spawning in a given stream segment throughout the spawning season (Ganio et al. 1986). Spawning coho salmon are assumed to have an average spawning life of 11.3 days across the season (Perrin and Irvine 1990). The pHOS for the population will be estimated from the proportion of carcasses recovered in random surveys observed to have a clipped adipose fin. Scale samples will be taken from every fourth coho carcasses to provide information on life history. Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2012).

Finally, other on-going monitoring of fish populations occurs through ODFW's Corvallis Research Lab (habitat surveys), the USFS (juvenile surveys, smolt trapping), the City of Portland (Bull Run juvenile and adult surveys), and other entities. These monitoring efforts do not address any specific indicator, but information from them will be used by ODFW to evaluate and guide the overall hatchery program.

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

Current funding and staffing are adequately provided to allow implementation of the monitoring and evaluation activities identified in Section 1.10.

Monitoring needs were identified in Chapter 8 of the LCRCRP, and the implementation team will help prioritize.

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.

There are no additional risk aversion measures, beyond those identified earlier in this document (Sections 4.2, 5.8, 6.3, 7.9, 8.5, 9.1.7, 9.2.10, 10.11), applied specifically for monitoring and evaluation activities.

SECTION 12. RESEARCH

No research is being conducted in direct association with the Sandy Hatchery coho salmon program.

12.1) Objective or purpose. N/A

12.2) Cooperating and funding agencies. N/A

12.3) Principle investigator or project supervisor and staff. N/A

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

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

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

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

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

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). N/A

12.10) Alternative methods to achieve project objectives. N/A

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

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. N/A

SECTION 13. ATTACHMENTS

Attachment 1 - Citations

Bisbal, G.A. and W.E. McConnaha. 1998. Consideration of ocean conditions in the management of salmon. Canadian Journal of Fisheries and Aquatic Sciences, 55 (9): 2178-2186.

Cederholm CJ, Kunze MD, Murota T, Sibatani A. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24: 6-15.

Federal Register Notice. 2004. Endangered and Threatened Species: Proposed Listing Determinations for 27 ESUs of West Coast Salmonids; Proposed Rule. Vol. 69, No 113, pp 33102-33179.

Groot, C. and L. Margolis. 1991. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, British Columbia.

IHOT (Integrated Hatchery Operations Team). 1996. Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin (Volume II). Annual Report 1995. Project Number 92-043, Contract Number DE-BJ79-91BP60629. Portland, Or.

Lewis, M., C. Mallette, W. M. Murray, and K. Taylor. 2001. Annual Stock Assessment. Coded Wire Tag Program, 2001 Annual Report. Oregon Department of Fish and Wildlife, Salem, OR.

Lichatowich, J. A. and J.D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmon. Pages 131-136 in M.J. Dadswell, R.J. Klauda, C.M. Moffitt, R.L. Saunders, R..A. Rulifson, and J.E. Cooper (Eds.), *Common Strategies of Anadromous and Catadromous Fishes*. American Fisheries Society, Symposium I, Boston, MA, March 9-13, 1986.

McCabe, G. T., Jr., W. D. Muir, R. L. Emmett, and J. T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River Estuary. Fishery Bull. 81:815-826.

McElhany, P., T. Backman, C. Busack, S. Kolmes, J. Myers, D. Rawding, A. Steel, C. Steward, T. Whitesel, and C. Willis. 2004. Status evaluation of salmon and steelhead populations in the Willamette and lower Columbia River basins. Willamette/Lower Columbia Technical Recovery Team. NOAA Fisheries, Northwest Fisheries Science Center, Seattle, WA.

McElhany, P., M. Chilcote, J. Myers, R. Beamesderfer. 2007. Viability status of Oregon salmon and steelhead populations in the Willamette and lower Columbia basins, review draft. National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, Washington

McNeil, W.J. and D.C. Himsworth (editors). 1980. Salmonid Ecosystems of the North Pacific. Oregon State Univ. Press, Corvallis.

NMFS. 1999. Biological Opinion on Artificial Propagation in the Columbia River Basin. Incidental Take of Listed Salmon and Steelhead from Federal and Non-Federal Hatchery Programs that Collect, Rear and Release Unlisted Fish Species, Portland, Oregon.

ODFW. 1997. Sandy River Subbasin Fish Management Plan. Portland, OR.

ODFW. 2001. Sandy River Fish Management Plan Amendment 2001. Portland, OR.

ODFW. 2010. Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead. Oregon Department of Fish and Wildlife, Salem, OR.

Oregon Administrative Rules (OAR 635-007-0542 through -0548). 2003. Fish Hatchery Management Policy. Oregon Department of Fish and Wildlife, Salem, OR.

Oregon Administrative Rules (OAR 635-007-0960 through -1000). 2003. Fish Health Management Policy. Oregon Department of Fish and Wildlife, Salem, OR.

Oregon Administrative Rules (OAR 635-007-0502 through -0509). 2002. Native Fish Conservation Policy. Oregon Department of Fish and Wildlife, Salem, OR.

Roby, D. D., D. P. Craig, K. Collis, and S. L. Adamany. 1998. Avian predation on juvenile salmonids in the lower Columbia River. Unpublished 1997 annual report to the Bonneville Power Administration and US Army Corp of Engineers, Portland, Oregon.

Attachment 2 - Estimated listed salmonid take levels by hatchery activity

Listed species affected: Coho Salmon **ESU/Population: Lower Columbia** **Activity: Hatchery Trap**				
Location of hatchery activity: Cedar Creek mile 0.75 **Dates of activity: Annual** **Hatchery program operator: ODFW**				
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			600	
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

Listed species affected: Coho Salmon **ESU/Population: Lower Columbia** **Activity: Outmigrant/Smolt Trap**				
Location of hatchery activity: Cedar Creek RM 0.75 **Dates of activity: January-June** **Hatchery program operator: ODFW**				
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)		5000		
Capture, handle, tag/mark/tissue sample, and release d)		200		
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

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

Instructions:

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

Attachment 3 - Definition of terms referenced in the HGMP template.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Stock - (see “Population”).

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

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

Attachment 4 - Age class designations by fish size and species for salmonids released from hatchery facilities. (Source: Washington Department of Fish and Wildlife, November, 1999).

	SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
☐	Chinook Yearling	<=20	>=23
☐	Chinook (Zero) Fingerling	>20 to 150	3 to <23
☐	Chinook Fry	>150 to 900	0.5 to <3
☐	Chinook Unfed Fry	>900	<0.5
☐	Coho Yearling 1/	<20	>=23
☐	Coho Fingerling	>20 to 200	2.3 to <23
☐	Coho Fry	>200 to 900	0.5 to <2.3
☐	Coho Unfed Fry	>900	<0.5
☐	Chum Fed Fry	<=1000	>=0.45
☐	Chum Unfed Fry	>1000	<0.45
☐	Sockeye Yearling 2/	<=20	>=23
☐	Sockeye Fingerling	>20 to 800	0.6 to <23
☐	Sockeye Fall Releases	<150	>2.9
☐	Sockeye Fry	> 800 to 1500	0.3 to <0.6
☐	Sockeye Unfed Fry	>1500	<0.3
☐	Pink Fed Fry	<=1000	>=0.45
☐	Pink Unfed Fry	>1000	<0.45
☐	Steelhead Smolt	<=10	>=45
☐	Steelhead Yearling	<=20	>=23
☐	Steelhead Fingerling	>20 to 150	3 to <23
☐	Steelhead Fry	>150	<3
☐	Cutthroat Trout Yearling	<=20	>=23
☐	Cutthroat Trout Fingerling	>20 to 150	3 to <23
☐	Cutthroat Trout Fry	>150	<3
☐	Trout Legals	<=10	>=45
☐	Trout Fry	>10	<45

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

Attachment – 5 Program effects on other (aquatic or terrestrial) ESA-listed populations.

ADDENDUM A.

(Anadromous salmonid effects are addressed in Section 2)

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

Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

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

General species description and habitat requirements.
Local population status and habitat use.
Site-specific inventories, surveys, etc.

Fisher (*Martes pennanti*, Candidate Species)

Status: The west coast population of the fisher was accorded federal candidate status on April 8, 2004. Fishers, found only in North America, occur in the northern coniferous and the mixed forests of Canada and the northern United States. Their range extends from the mountainous areas in the southern Yukon and Labrador Provinces southward to central California and Wyoming, the Great Lakes and Appalachian regions, and New England.

In Oregon, fishers occurred historically throughout the Coastal and Cascade mountains. Currently, the range of the fisher is severely reduced. Despite extensive surveys conducted in forested regions of Oregon, records dating from 1954 to 2001 show that the remaining populations of fishers are restricted to two separate and genetically isolated populations in southwestern Oregon; one in the northern Siskiyou Mountains and one in the southern Cascade Range. The population in the southern Cascades descended from reintroduced fishers that were translocated to Oregon from British Columbia and Minnesota.

The west coast population of the fisher is endangered mainly due to the loss and fragmentation of habitat due to timber harvest, roads, urban development, recreation, and wildfires. Other threats include small population sizes and isolation, predation, and human-caused mortality from vehicle collisions, poaching, and incidental capture and injury.

Habitat: Fishers select forests with high canopy closure, large trees, and a high percentage of conifers. The physical structure of this type of forest provides the fisher with reduced vulnerability to predation and an abundance of prey. The distribution of the fisher is likely limited by elevation and snow depth.

Conservation Measures: In December 2000, the Fish and Wildlife Service (Service) received a petition to list the west coast population of the fisher as an endangered species in Washington,

Oregon, and California. The Service concluded that the west coast fisher population was a distinct population segment and was warranted for listing, but precluded by other higher priority listing action, and subsequently placed the species on the federal list of candidates. Now the Service will begin conducting an annual review of the species status and may propose to list the species at a later date. The Service encourages state and federal agencies proposing activities within the historic range of the fisher to give consideration to the fisher during the environmental planning process, especially activities which alter or destroy mature and old growth forests.

Bald Eagle (*Haliaeetus leucocephalus*, Threatened Species)

Status: Bald Eagles have been delisted from the federal endangered species list; but it is still a Threatened species under the Oregon rule. Bald eagle populations have rebounded considerably within the last few years, with nearly all recovery goals met for Oregon, Washington, and other regions of the country. Bald eagles and golden eagles are, and will continue to, be protected under the Bald Eagle and Golden Eagle Protection Act of 1940 (as amended) and the Migratory Bird Treaty.

The northern bald eagle is closely associated with freshwater, estuarine, and marine ecosystems that provide abundant prey and suitable habitat for nesting and communal roosting (Watson et al. 1991). Breeding territories are typically located within one mile of permanent water in predominantly coniferous, uneven-aged stands with old-growth structural components (Anthony et al. 1982, Stalmaster 1987, Anthony and Isaac 1989). Bald eagles winter along ice-free lakes, streams, and rivers where food and perch sites are abundant and the level of human disturbance is low (USFS 1977, Steenhof 1978, Stalmaster 1980). Communal nights roosts are used by bald eagles primarily during the winter months. In the Pacific Northwest, communal roosts generally occur in multi-layered mature or old-growth conifer stands that provide protection from weather and human disturbance (Stalmaster and Newman 1978).

Home range size varies greatly according to food abundance and the availability of suitable nest and perch trees (Stalmaster 1987). Favored nest trees are usually the largest tree or snag in a stand that provides an unobstructed view of the surrounding area and a clear flight to and from the nest (Stalmaster 1987). Nest are usually built on limbs just below the crown, with the canopy above providing cover (USFS 1977). Nesting behaviors typically begin in January, followed by egg laying and incubation in February and March (Isaac et al. 2001). Young are reared throughout April, May, and June. Fledging occurs in July and August. Bald eagles are primarily predators but also opportunistic scavengers that feed on a variety of prey including salmon, other fish, small mammals, waterfowl, seabirds, and carrion (Snow 1981). Bald eagles usually forage in large open areas with a wide visual field and suitable perch trees near the food source (USFS 1985).

The bald eagle occurs throughout the United States and Canada. It winters primarily along rivers south of the Canadian border. The historic decline of the bald eagle has been attributed to the loss of feeding and nesting habitat, organochloride pesticide residues, shooting, poisoning, and electrocution (Snow 1981). Human interference has been shown to adversely affect the distribution and behavior of wintering bald eagles (Stalmaster and Newman 1978). Critical Habitat: Critical habitat for bald eagles has not been formally designated by USFWS.

Northern Spotted Owl (*Strix occidentalis caurina*, Threatened Species)

Status: The northern spotted owl was listed as a threatened species throughout its entire range in June 1990 (55 FR 26114). It ranges from southern British Columbia south to Marion County, California and east to the shrub steppe of the Great Basin in Oregon and California. In the Western Cascades, the northern spotted owl can be found from approximately sea level to 4000 feet in elevation (USFWS 1992). Most observations of spotted owl habitat use have been made in forests with a component of old-growth and mature forests consisting of western hemlock, Douglas-fir and western red cedar. However, the northern spotted owl has been observed to use a wide variety of habitat types and forest stand conditions, including managed stands, for nesting, feeding or roosting (USFWS 1992). In general, northern spotted owls preferentially use forests with greater complexity and structure. In the Western cascades, the home range of northern spotted owl pairs ranges in size from approximately 1,450 acres to 9,750 acres with a median home range size of 2,950 acres (USFWS 1992). Spotted owls do not build their own nests. They depend on suitable naturally occurring nest sites such as broken-top trees and cavities in older-age forests, abandoned raptor nests, squirrels nests and debris accumulations. Most northern spotted owl nest sites observed on public lands have been located in old-growth or mature forests (USFWS 1992). However, spotted owls are known to nest in managed stands, especially if residual old-growth characteristics are present. Owlets remain in the nest for three to five weeks and generally leave the nest before they can fly. They usually remain near the nest in nearby branches or on the ground where they are fed and tendered by both adults before dispersing in early fall (late September to early October) (USFWS 1992). Roosting habitat are typically areas of relatively dense vegetation (high canopy closure dominated by large-diameter trees). Spotted owls respond to variations in temperature and move within the canopy to find favorable microclimate conditions which are facilitated by multistoried stand structure of roost sites (USFWS 1992). Spotted owl foraging habitat is more varied but is generally characterized by high canopy closure and complex structure. Spotted owls are primarily nocturnal and eat small mammals, birds and insects. Both the woodrat (Neotoma fuscipes and N. cinerea) and the northern flying squirrel (Glaucomys sabrinus) compose the majority of the prey base of the spotted owl (USFWS 1992).

Habitat: Critical habitat is designated for the northern spotted owl solely on 6.9 million acres of federal lands (57 FR 1796). Areas managed by the U.S. Forest Service (USFS) in upper Eagle Creek watershed are part of the critical habitat designation for northern spotted owl. Northern spotted owls live in forests characterized by dense canopy closure of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops. Although they are known to nest, roost, and feed in a wide variety of habitat types, these owls prefer older forest stands with variety: multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Typically, forests do not attain these characteristics until they are at least 150 to 200 years old.

Conservation Measures: The listing of the northern spotted owl as threatened and the designation of critical habitat are helping to reduce habitat loss on federal lands. Although the need for timber necessitates continued harvesting, new forest management practices now stress restricted harvesting in old-growth forests and suggest alternate areas for harvest which are less preferred by spotted owls. Careful planning of timber sales and wise use of forest resources is necessary to halt the decline of the northern spotted owl and other old growth-associated species.

The Northwest Forest Plan, created in 1994, creates a system of late-successional reserves (LSR) across the range of the species that are designed to provide suitable nesting habitat over the long term. The federal forest lands outside these reserves are managed to allow dispersal between the LSRs through riparian reserves and other land allocations.

Western Yellow Billed Cuckoo (*Coccyzus americanus occidentalis*, Candidate Species)
The yellow-billed cuckoo in the western United States was accorded candidate status in July 2001. The western yellow-billed cuckoo includes all members of the species found in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas and Washington.

Status: Historically, the yellow-billed cuckoo bred throughout much of North America. Available data suggests that within the last 50 years the species' distribution west of the Rocky Mountains has declined substantially. Loss of streamside habitat is regarded as the primary reason for the population decline. The species was probably never common in Oregon. Historical records for the state show that breeding cuckoos were most often sighted in willow bottoms along the Willamette and Columbia Rivers; there are few records of cuckoo sightings in eastern Oregon. The last confirmed breeding records in Oregon were in the 1940's. Most of the recent records of cuckoos are from eastern Oregon at Malheur National Wildlife Refuge in Harney County, and from Malheur and Deschutes Counties.

Habitat: Western yellow-billed cuckoos breed in dense willow and cottonwood stands in river floodplains.

Water Howellia (*Howellia aquatilis*, Threatened Species)
Water howellia was federally listed as threatened without critical habitat in 1994 (USFWS 1994). A recovery plan has not yet been published for this species.

Status: Water howellia is known to occur sporadically in Washington, Idaho, Montana, and California. There are no known extant occurrences in Oregon. However, the species has historically been collected (voucher specimens in herbariums) from at least four different places in the state. It was first collected in 1879 from Sauvies Island, Multnomah County. It was collected from Sauvies Island again in 1886, but not since then. It was also collected from Lake Oswego in Clackamas County in 1892. It was collected from two places in the Salem area, most recently in 1977. Numerous attempts to relocate these sites have been unsuccessful. The historic Oregon sites were all located within the Columbia River floodplain or the broad valley of the Willamette River.

Habitat: Information on herbarium labels or Oregon collections describe the habitat as "ponds in woods", "pond in shaded woods", and "stagnant ponds in the timber". Information from other locales indicate that this species is restricted to small, vernal, freshwater wetlands, glacial pothole ponds, or former river oxbows that have an annual cycle of filling with water over the fall, winter and early spring, followed by drying during the summer months. These habitats are generally small (<1 ha [2.5 ac]) and shallow (<1 m [3 ft] deep). Bottom surfaces are reported as firm, consolidated clay, and organic sediments. Most locations were surrounded by deciduous trees and howellia was found in shallow water or around the edges of deep ponds. Associated

species include duckweed (*Lemna* spp.), water starworts (*Callitriche* spp.), water buttercup (*Ranununculus aquaticus*), yellow water-lily (*Nuphar polysepalum*), bladderwort (*Utricularia vulgaris),* and pondweeds (*Potamogeton* spp.).

Bradshaws Lomatium (*Lomatium bradshawii*, Endangered Species)
Bradshaw's lomatium was federally listed as endangered in 1988 (USFWS 1988). A recovery plan was published in 1993 (USFWS 1993). Bradshaw's lomatium currently extends from Clark county, Washington, to the southern end of the Willamette Valley, Oregon. The greatest concentrations of remaining sites where plants occur is in and adjacent to the Eugene, Oregon metropolitan area.

Habitat: The majority of Bradshaw's lomatium populations occur on seasonally saturated or flooded prairies, adjacent to creeks and small rivers in the southern Willamette Valley. Soils at these sites are dense, heavy clays, with a slowly permeable clay layer located 15-30 cm (6-12 in) below the surface. This clay layer results in a perched water table during winter and spring, and is critical to the wetland character of these grasslands, known as tufted hair-grass (*Deschampsia cespitosa*) prairies. Bradshaw's lomatium occurs on alluvial (deposited by flowing water) soils. The species occurs on soils in the Wapto, Bashaw and Mcalpin Series (NRCS mapped soil unit STATSGO 81).

Conservation: Endemic to and once widespread in the wet, open areas of the Willamette Valley of western Oregon, Bradshaw's lomatium is limited now to a few sites in Lane, Marion, and Benton Counties. Most of its habitat has been destroyed by land development for agriculture, industry, and housing. In addition, water diversions and flood control structures have changed historic flooding patterns, which may be critical to seedling establishment. Reductions in natural flooding and fire cycles also permit invasion of trees and shrubs, and eventual conversion of wet prairies to woodlands.

Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*, Threatened Species)
The Oregon silverspot is a medium-sized, orange and brown butterfly with black veins and spots on the dorsal (upper) wing surface, and a yellowish submarginal band and bright metallic silver spots on the ventral (under-side) wing surface. This subspecies is distinguished from other subspecies of silverspot butterflies be a somewhat smaller size and darker coloration at the base of the wings. These are morphological adaptations for survival in a persistently wind and foggy environment.

Status: The historical range of this subspecies extends from the Long Beach Peninsula, Pacific County, Washington, south to Del Norte County, California. All of these populations were restricted to the immediate coast, centered around salt-spray meadows, or within a few miles of the coastline in similar meadow-type habitat. At the time of listing the only viable population known was on the Siuslaw National Forest in Tillamook County, Oregon. Additional populations have since been discovered at Cascade Head, Bray Point and Clatsop Plains in Oregon, on the Long Beach Peninsula in Washington and in Del Norte County in California.

Habitat: The Oregon silverspot occupies three types of grassland habitat. One type consists of marine terrace and coastal headland salt-spray meadows (e.g., Cascade Head, Bray Point Rock

Creek-Big Creek and portions of Del Norte sites). The second consists of stabilized dunes as found at the Long Beach Peninsula, Clatsop Plains, and the remainder of Del Norte. Both these habitats are strongly influenced by proximity to the ocean, mild temperatures, high rainfall, and persistent fog. The third habitat type consists on montane grasslands found on Mount Hebo and Fairview Mountains. Conditions at these sites include colder temperatures, significant snow accumulations, less coastal fog, and no salt spray.

The most important feature of the habitat of the Oregon silverspot is the presence of the early blue violet. This plant is normally the only species on which the Oregon silverspot can successfully feed and develop as larva. This plant is apart of the sal-spray meadow vegetation and is an obligatory component of the butterfly's habitat. Other features of optimum habitat include moderate grass cover, and a mixture of herbaceous plants used for nectaring by adults. Adults generally move out of the meadows into the fringe of conifers or brush for shelter, courtship and mating.

Analyze effects.

No take of USFWS trust species is expected to occur or be adversely affected by operation of the Sandy Fish Hatchery.

Adult hatchery fish in Cedar Creek could potentially serve as a forage base for bald eagles. Adult hatchery carcasses distributed in tributary streams can also enhance nutrients and ecosystem productivity of the stream (Cederholm et al. 1999).

Actions taken to minimize potential effects.

No actions are necessary to address effects for USFWS ESA trust species.

References:

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. N. Amer. Wildl. Nat. Res. Conf. 47:332-342.

Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. J. Wildl. Manag. 53:148-159.

Cederholm, C.J., M.D. Kunze, T. Murota, and A. Sibatani. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Eastman, D.C. 1990. Rare and endangered plants of Oregon. Beautiful America Publishing Company. Wilsonville, Oregon, 194 pp.

Guard, B.J. 1995. Wetland plants of Oregon and Washington. Lone Pine Publishing. Vancouver, B.C., Canada, 239 pp.

Issacs, F.B., R.G. Anthony and D.P. Anderson. 2001. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River recovery zone, 1972 through 2001. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, OR, 34pp.

Lower Columbia Fish Recovery Board. Draft 2004. Lower Columbia Salmon and Steelhead Recover and Subbasin Plan, Technical Foundation Vol III Other Species. Lower Columbia Fish Recovery Board, Longview, Washington.

National Marine Fisheries Service (NMFS) 1999. Biological Opinion on Artificial Propagation in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

National Marine Fisheries Service (NMFS). 2000. Biological Opinion on operation of the Federal Columbia River Power System. December 21, 2000.

Oregon Department of Fish and Wildlife (ODFW) 1992. Clackamas River Subbasin Fish Management Plan, Portland, Oregon.

Oregon Department of Fish and Wildlife (ODFW). 1997. Status of Oregon's bull trout. Distribution, life history, limiting factors, management considerations, and status. Portland, Oregon.

Oregon Department of Fish and Wildlife. 2003. Endangered Species Fact Sheet; Columbian White-tailed deer. Oregon Department of Fish and Wildlife http://oregonfwo.fws.gov/EndSpp/FactSheets/Mammals/deer.dwt.

Lower Columbia Fish Recovery Board. Draft 2004. Lower Columbia Salmon and Steelhead Recover and Subbasin Plan, Technical Foundation Vol III Other Species. Lower Columbia Fish Recovery Board

Snow, C. 1981. Southern bald eagle and northern bald eagle, habitat management services for Endangered Species. Bureau of Land Management Report No. 5.

Stalmaster, M.V. 1980. Management strategies for wintering bald eagles in the Pacific Northwest. In Knight, R.L. et al. editors, Proceedings of the Washington Bald Eagle Symposium, June 1980, Seattle, Washington.

Stalmaster, M.V. 1987. The bald eagle. Universe Books, New York, NY. 227pp.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 42:506-513.

Steenhof, K. 1978. Management of wintering bald eagles. Eastern Energy and Land Use Team, Office of Biological Service, U.S.D.I. Fish and Wildlife Service, FWS/OBS/78/79. 59 pp.

U.S.D.A. Forest Service (USFS). 1977. Bald eagle habitat management guidelines. Pacific Southwest Region, San Francisco, CA. 60 pp.

U.S.D.A. Forest Service (USFS). 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. Chapter 13 – Bald eagles. R6-F&WL-192-1985. U.S.D.A. Forest Service Pacific Northwest Region, Portland, Oregon. 332pp.

U.S.D.A. Forest Service (USFS). 1995. Eagle Creek watershed analysis. Pacific Northwest Region, Mt. Hood National Forest. 109pp.

U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Northern Spotted Owls (draft), 662pp.

U.S. Fish and Wildlife Service (USFWS). 1993. Final Rule: Determination of Threatened status for the plant "*Sidalcea nelsoniana*" (Nelson's Checker-mallow). February 12, 1993, Federal Register 58:8242.

U.S. Fish and Wildlife Service (USFWS). 1994. Final Rule: The plant, water howellia ("*Howellia aquatilis*"), determined to be a Threatened Species. July 14, 1994 Federal Register.

U.S. Fish and Wildlife Service (USFWS). 2000. Final Rule: Endangered status for "*Erigeron decumbens*" var. "decumbens" (Willamette Daisy and Fender's Blue Butterfly ("*Icaricicia icarioides fenderi*") and Threatened status for "*Lupinus sulphureus*" spp. "kincaidii" (*Kincaid's lupine*). January 25, 2000 Federal Register 65 (16): 3875-3890.

U.S. Fish and Wildlife Service (USFWS). 2000. Biological Opinion on operation of the Federal Columbia River Power System. December 21, 2000.

U.S. Fish and Wildlife Service (USFWS). 2002. Biological Assessment for Eagle Creek barrier replacement project, Eagle Creek National Fish Hatchery. Prepared by Ellis Ecological Services, Estacada, Oregon for Smith-Root, Inc on behalf of Eagle Creek National Fish Hatchery, May 15, 2002.

Washington National Heritage Program (WNHP). 1997. Field guide to selected rare vascular plants of Washington. Washington National Heritage Program and U.S.D.I. Bureau of Land Management.

Watson, J.W., M.G. Garrett and R.G. Anthony. 1991. Foraging ecology of bald eagles in the Columbia River estuary. J. Wildl. Manage. 55:492-499.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name and Title of Applicant: Jeff Boechler, North Willamette Watershed District Manager

Signature: _____Date: _____

Certified by: Scott Patterson, Fish Propagation Program Manager

Signature: _____ Date: _____