

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:

**Umpqua River Basin Coho Salmon
Program**

**Species or
Hatchery Stock:**

Coho Salmon (Stocks-18)

Agency/Operator:

Oregon Department of Fish & Wildlife

Watershed and Region:

Umpqua Watershed-Southwest Region

Draft Submitted:

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First Update Submitted:

November 28, 2011

Second Update Submitted:

December 5, 2014

Third Update Submitted:

June 7, 2017

Date Last Updated:

June 6, 2017

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Rock Creek Hatchery, Umpqua River Basin Coho Salmon Program (stock-18) in South Umpqua River and Cow Creek.

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

Umpqua basin wild Coho Salmon *Oncorhynchus kisutch* are part of the Oregon Coast Coho Evolutionary Significant Unit (ESU), which was listed as a threatened species under the federal ESA on August 10, 1998 (Federal Register Notice 1998). It was subsequently de-listed in 2005 and was relisted effective May 12, 2008 (Federal Register 73FR7816, Oregon Coastal Coho ESU, February 11, 2008). The listing includes all naturally produced Coho Salmon from Cape Blanco north to the Columbia River. Of particular interest for this HGMP is the listing of the Cow Creek stock. The stock is incorrectly identified in the Federal Register Final Species Determination as stock-37 (page 7824), but the text identifies the stock as the Cow Creek stock. Thus in the Umpqua basin, the Coho Salmon stock-18 is an ESA-listed. The listing was reviewed again in 2011 and the threatened listing was upheld. This listing was also upheld again in 2016. Coho Salmon are also a sensitive species under Oregon's Sensitive Species Rule (OAR 635-100-0040).

1.3) Responsible organization and individuals.

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

Under an agreement with the Federal Energy Regulatory Commission (FERC) in 1984 (Project No. 7161), Douglas County provides the broodstock collection site at Galesville Dam and funding to raise the stock-18 Coho Salmon at Rock Creek Hatchery for harvest mitigation. Local STEP volunteers assist the ODFW with brood collection, fish culture activities and releases. Through brood year 2005, a portion of the Coho Salmon eggs (stock-18) were used for a STEP unfed fry program at Glendale High School. This program was discontinued in 2006 due to flood damage at the site and the 2007 Oregon Coastal Coho Conservation Plan (OCCCP 2007). Per the 2001 FERC/PacifiCorp's settlement agreement, the ODFW also had a mitigation project to provide North Umpqua stock-55 eyed eggs to PacifiCorp as part of a Before-After-Control-Impact (BACI) study. The experimental eyed eggs release program of stock-55 ended in brood year 2011 (release year 2012).

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

Rock Creek Hatchery is funded 100% with fishing license revenues. Douglas County funds the South Umpqua Coho program through direct funding of approximately \$24,500 annually.

Rock Creek Hatchery's total annual budget is \$500,000 (09-11 biennium), and approximately \$35,000 is spent for the Coho Salmon program. Personnel include a Hatchery Manager 1, a Fish & Wildlife Senior Technician, and three Fish & Wildlife Technicians. The seasonal staff include, fin clippers, etc.

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

Current Facilities

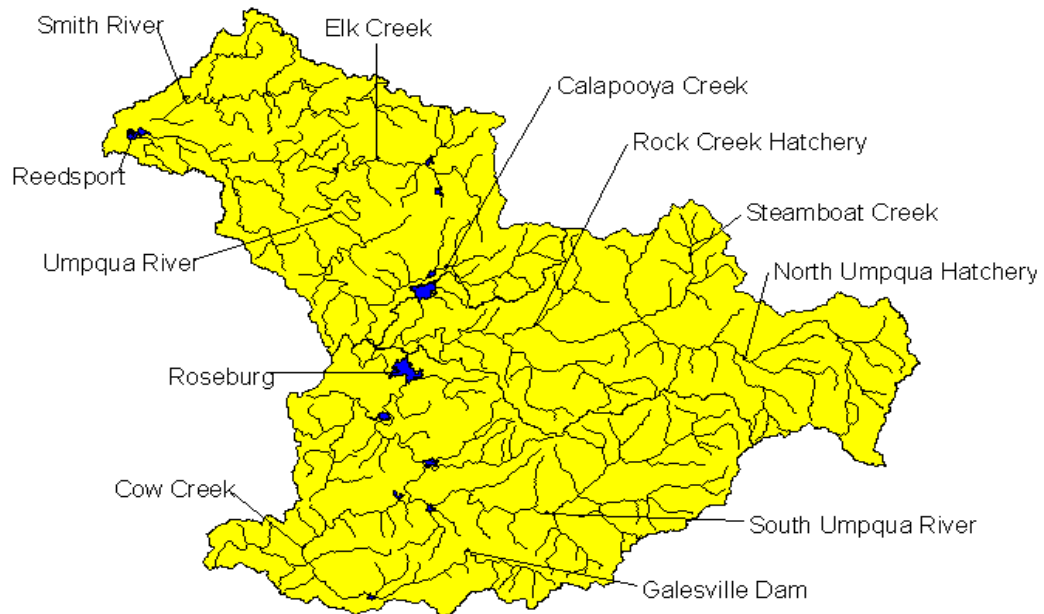
- *Rock Creek Fish Hatchery* – is located on Rock Creek, a tributary to the North Umpqua River at RM 36 of the Umpqua Basin. The hatchery is located on 26.5 acres of land, 23 miles East of Roseburg, Douglas County, Oregon. The hatchery site is at an elevation of approximately 820 feet above sea level, at latitude 43° 20' 07" and longitude 123° 00' 05". The watershed code for Rock Creek is 1600200000.

- *Rock Creek Diversion Dam and Ladder* - In 2012, the new diversion dam and fish ladder was completed. The diversion dam provides water to Rock Creek Hatchery while the fish ladder improves passage. Modifications of the fish counting and sorting systems of the ladder were still occurring in 2014. Downstream of the ladder and sorter, there is a channel entrance that allows returning hatchery fish to volitionally return to a hatchery raceway.
- *Galesville Dam* – is located at RM 60 on Cow Creek, a tributary to the lower South Umpqua River. Coho Salmon swim volitionally into the trap located at the base of the Dam, which is a complete barrier to anadromous fish migration. This site collects primarily returning South Umpqua/Cow Creek stock-18 hatchery Coho Salmon. The Watershed Code for the facility is 1600500000.
- *Happy Valley Trap Facility* – is located at RM 18 on the lower South Umpqua River. This trap is a temporary picket weir type trap located at a river pinch point and can only be operated during lower water levels. Once this HGMP is approved and based on current guidelines and policies, when appropriate criteria for the donor population are met, this site can be used to collect some wild Coho Salmon for integration into the hatchery broodstock. The Watershed Code for the Happy Valley trap facility is 1600300000.

Spawning, Egg Incubation, and Rearing:

The South Umpqua Coho Salmon (stock-18) are spawned, incubated and reared to smolt stage at Rock Creek Hatchery. There are currently two existing volunteer egg incubation sites located in the South Umpqua River basin (Barrett Creek and Deer Creek) that could be used, if necessary, to rear the Coho Salmon from the eyed egg stage to button-up. These sites were used previously for Coho rearing.

Umpqua River Basin



Release Sites:

South Umpqua stock-18 Coho Salmon smolts are raised at Rock Creek Hatchery. Approximately 30,000 are transported to net pens in the pool at the base of Galesville Dam and acclimated for three weeks. This pool is the terminal end of anadromous passage for fish in Cow Creek. The remaining smolts are released in the same pool below Galesville. These fish acclimate as they linger in the area prior to volitionally emigrating downstream.

In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time if and when this revision to Article 45 might occur. Currently, the FERC license

holder has no plans to seek this modification.

The North Umpqua stock-55 Coho Salmon egg injection and unfed fry release program ended in 2012.

1.6) Type of program.

The South Umpqua Coho Salmon program is a harvest/mitigation program and fits the NOAA definition of an isolated harvest program. Hatchery smolts are raised to produce fish for ocean and freshwater harvest as mitigation for natural production lost in Cow Creek above Galesville Dam, on the South Umpqua River.

1.7) Purpose (Goal) of program.

The 60,000 Coho Salmon smolts release program (stock-18) is required for harvest mitigation for ongoing habitat loss above Galesville Dam, on Cow Creek. These smolt releases are intended to mitigate for the loss of habitat and to provide adult fish for the ocean and inland fisheries. The goal is to provide a freshwater harvest of 1,000 to 3,000 adult Coho Salmon. Freshwater harvest on these hatchery fish during the last couple of years has averaged 1,160.

Per a mitigation agreement with the PacifiCorp an experimental study program of 90,000 wild Coho Salmon (stock-55) eyed eggs were used to seed habitat for a mitigation study on East Fork Rock Creek from 2009 to 2011 brood years, to determine the role of large woody debris structures in stream habitat for increased production of juvenile Coho Salmon. The eyed eggs were deployed in artificial redds or Whitlock-Vibert boxes. The project concluded in 2012. And presently there is no hatchery program of stock-55 Coho Salmon.

1.8) Justification for the program.

Galesville Dam was completed in 1986 and currently blocks approximately 28 miles of Coho Salmon habitat on the upper Cow Creek. Under a 50-year FERC License (license #7161) which expires in 2034, Douglas County is required to mitigate for the loss of this habitat by providing an adult capture facility at the dam site plus funds to the ODFW to annually raise 60,000 Coho Salmon smolts (stock-18). These smolts are reared to augment the fisheries impacted by the ongoing loss of wild Coho Salmon production caused by hydroelectric project operations. The smolts have been mass marked with adipose fin-clip since the mid-1990's. ODFW has subsequently adopted angling regulations that target inland fisheries on hatchery-origin fin clipped Coho Salmon. As a result, in the Umpqua Basin, only hatchery-produced fin clipped Coho could be harvested since the late 1990's. Harvest on the South Umpqua hatchery-produced fish averages about 1,160 Coho Salmon per year in the Umpqua's inland fishery. Other hatchery Coho Salmon programs in the basin have been discontinued (e.g., Stock-151 Coho: Gardiner-Reedsport-Winchester Bay STEP 2001; Stock-18 Coho: STEP unfed fry South

Umpqua/Windy Creek 2006; Stock-55 Coho: Rock Creek/North Umpqua 2005; Stock-55 Coho: PacifiCorp Experimental Egg injection study 2012). Thus the stock-18 Coho Salmon program meets the dual goal of meeting mitigation needs and is the only program providing fish for a popular recreational fishery. Current angling regulations do not allow angling in the South Umpqua basin from September 16 through November 30th to protect Chinook Salmon spawning in the South Umpqua and Cow Creek. Starting on December 1 each year, anglers can harvest fin-clipped Coho Salmon that they might hook in the South Umpqua while fishing for winter steelhead. Likewise fin-clipped Coho can be harvested throughout the fall during salmon/steelhead seasons on the Smith, Mainstem and North Umpqua. With the NOAA approval, ODFW implemented a fishery for wild Coho Salmon in the lower 27 river miles of the Mainstem Umpqua beginning in 2011.

1.9) List of program “Performance Standards” and 1.10) “Performance Indicators.”

Legal Mandates

Performance Standard (1): Program contributes to annual mitigation requirements.

Indicator 1(a): 60,000 juvenile Coho Salmon (stock-18) are released into the Cow Creek/South Umpqua basin.

Contribution to Fisheries

Performance Standard (2): Fish are produced in a manner enabling effective harvest while avoiding over-harvest of non-target fish by releasing all program fish (100%) with fin clipping.

Indicator 2(a): Estimated number of fin marked fish harvested by recreational anglers in the ocean and freshwater coho fisheries by run year.

Indicator 2(b): Estimated numbers and ratios of annual harvest of hatchery and wild Coho Salmon in the ocean and freshwater fisheries.

Indicator 2(c): Estimated annual escapement of wild Coho Salmon to the North and South Umpqua basins.

Performance Standard (3): Program smolts are marked to enable determination of impacts and benefits in fisheries.

Indicator 3(a): Number of fin-marked fish reported in each fishery produces accurate estimates of harvest.

Indicator 3(b): Confirm that hatchery smolts were marked with appropriate fin-mark prior to release.

Indicator 3(c): Pre-release mark quality checks indicate at least 95% of fish released have retained identifiable marks.

Performance Standard (4): Non-monetary societal benefits for which the program is designed are achieved.

Indicator 4(a): Estimated number of recreational fishery angler days.

Hatchery/Facility Performance

Performance Standard (5): Facility operation complies with applicable fish health and facility operation standards and protocols.

Indicator 5(a): Results of monthly fish health examinations and pre-release fish health certification.

Indicator 5(b): Annual reports indicating level of compliance with applicable fish health standards and criteria.

Performance Standard (6): Any distribution of carcasses or other products for nutrient enhancement meets appropriate disease control regulations and interagency agreements.

Indicator 6(a): Number and location of carcasses distributed for nutrient enrichment.

Indicator 6(b): Disease examination of all carcasses to be used for nutrient enrichment.

Indicator 6(c): Statement of compliance with applicable regulations and guidelines.

Indicator 6(d): Number of food quality fish donated to food banks to feed the needy.

Performance Standard (7): Effluent from artificial production facilities will not detrimentally affect the water quality of the habitat and its populations.

Indicator 7(a): Monitor effluent water quality per NPDES permit and verify that hatchery effluent is in compliance with the existing NPDES permit limits and water quality standards.

Performance Standard (8): Hatchery program is sustainable.

Indicator 8(a): Number of broodstock collected is sufficient to maintain the hatchery brood goals.

Indicator 8(b): Average number of juveniles released achieves production goals.

Performance Standard (9): Artificial production program maximizes survival rates at varying life stages within the hatchery.

Indicator 9(a): Enumerate survival rates from egg-fry, fry-fingerling, and fingerling to smolt to determine optimal rearing conditions and practices.

Performance Standard (10): Adult weir/trap operations do not result in significant stress, injury or mortality in natural populations.

Indicator 10(a): Average adult trapping mortality rate for wild fish does not exceed 1% due to Coho Salmon brood collection.

Indicator 10(b): If an exceedance occurs, measures will be implemented to prevent similar mortality problems in the future.

Indicator 10(b): Adult traps are checked regularly from October 1 to December 31.

Conservation Objectives - Conserve genetic and life history diversity of coho within the Umpqua basin.

Performance Standard (11): Meet the criteria for naturally spawning hatchery fish defined in the Oregon Coast Coho Conservation Plan.

Indicator 11(a): Conduct spawning ground surveys in the Umpqua Basin, and enumerate numbers of hatchery and wild fish observed.

Indicator 11(b): Monitor fishways and trapping facilities, and enumerate the number of hatchery and wild fish observed.

Performance Standard (12): Fish propagation activities do not threaten the persistence/rebuilding of the wild Coho Salmon population in the Umpqua Basin.

Indicator 12(a): Collection of wild South Umpqua Coho Salmon for hatchery broodstock will occur after this HGMP is approved, and only when the spawning population is forecast to be greater than 1,000 fish.

Indicator 12 (b): If wild Coho Salmon are collected, no more than 2% of the South Umpqua wild Coho population would be collected for hatchery broodstock annually. Use of wild brood would equal to 10% of the broodstock, or as guided by the best available science and policies which may result in use of 100% wild brood.

Indicator 12(c): Track post-season estimates of annual escapement of wild Coho Salmon in the Umpqua Basin, in relation to population's "viable" and "critical" threshold levels.

Indicator 12(d): Juvenile production of wild Coho Salmon does not decline (within local subbasins) as a result of fish propagation activities, particularly due to broodstock collection and smolt releases.

Performance Standard (13): Juveniles are released with net pen and natural acclimation in the upper Cow Creek stilling pool to maximize homing to target subbasin.

Indicator 13(a): Monitor dates of smolt acclimation and release.

Indicator 13 (b): Monitor the proportion of hatchery coho returning to the ladder at the base of Galesville Dam.

Performance Standard (14): Broodstock collection, selection and mating conserve the genetic and life history diversity of Umpqua Basin coho by following the guidelines in the Hatchery Management Policy (HMP), other policies and best available science.

Indicator 14(a): Adults collected represent the spectrum of the run.

Indicator 14(b): Percentage of wild fish returning to the facility taken for broodstock will follow constraints noted in Performance Standard 12, Fish Conservation and Hatchery Management Policy guidelines and best available science.

Indicator 14(c): Timing of hatchery adult returns to Galesville Dam overlaps wild coho returns.

Indicator 14(d): Females and males are selected and paired randomly for spawning.

Indicator 14(e): Coho Salmon are spawned at a 1:1 male to female ratio.

Indicator 14(f): If funding and technology become available, sample returning natural and hatchery broodstock for genetic characteristics, and/or environmental factors such as chemical concentrations and/or toxicology issues. May also sample hatchery juveniles or eggs. Samples (tissue, scale, organ, etc.) would be determined by the best science available for the evaluation.

Ecological Impacts

Performance Standard (15): Juvenile Coho Salmon will be released to maximize program benefits and minimize risk to wild populations.

Indicator 15(a): Hatchery smolts will be released after natural or net pen acclimation in the upper Cow Creek stilling pool to maximize adult homing to target areas.

Performance Standard (16): Hatchery smolts will be reared to age one and released at a time period similar to wild coho populations' emigration. Release data will be reported in ODFW Hatchery Management System (HMS) database.

Indicator 16(a): Monitor run timing of Coho Salmon in the basin.

Indicator 16(b): Enter release data and other appropriate information into HMS database.

Performance Standard (17): Wild smolt life history characteristics will not significantly change as a result of the hatchery program.

Indicator 17: Monitor juvenile emigration timing, size at emigration, and productivity in Umpqua Basin.

Performance Standard (18): Fish releases do not introduce new pathogens into local populations, and do not increase the levels of existing pathogens.

Indicator 18(a): Results of monthly fish health examinations.

Indicator 18(b): Certification of juvenile fish health immediately prior to release.

Indicator 18(c): Juvenile rearing density.

Performance Standard (19): Water withdrawals and diversion structures used in operation of artificial production facilities will not prevent access to natural spawning areas, affect spawning behavior of listed natural populations, or impact juvenile rearing.

Indicator 19(a): Water withdrawals compared to applicable passage criteria.

Indicator 19(b): Water withdrawal compared to NMFS juvenile screening criteria.

Indicator 19(c): Proportion of diversion of total stream flow between hatchery facility

intake and out-fall.

Performance Standard (20): Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 20(a): Smolt size at, and time of release compared to size and timing of naturally-produced fish present within the habitat.

Indicator 20 (b): number of hatchery smolts released represents a small proportion of the estimated number of juveniles in the Umpqua basin.

Monitoring and Evaluation:

Performance Standard (21): Monitoring and evaluation occurs on an appropriate schedule and scale to assess progress toward achieving program objectives and evaluating the beneficial and adverse effects on natural populations.

Indicator 21(a): Meets Coho Conservation Plan objectives for ongoing monitoring and evaluation.

Indicator 21(b): Annual and final reports.

Indicator 21(c): Maintain database for all monitoring data.

1.11) Expected size of program.

South Umpqua

- 60,000 smolts (stock-18) reared at Rock Creek Hatchery and released into Cow Creek (South Umpqua) at the base of Galesville Reservoir.

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

A maximum of 92 adult (46 pairs) Coho Salmon (stock-18) will be collected for broodstock. Once this HGMP is approved, and as guided by policies and best available science, up to 100% of the broodstock would consist of native wild Coho Salmon. These fish would be incorporated into the broodstock to prevent inbreeding depression or genetic degradation in hatchery-produced fish. However, the number of wild brood should not exceed 2% of the wild population, and no wild fish be taken for brood if the return of wild fish is predicted to be less than 1,000 Coho in the South Umpqua. The proposed brood numbers shall be taken assuming the following mortalities: brood loss (10%), egg loss (12%), fry loss (7%), and rearing loss (5%). Predicted fecundity is approximately 2,400 eggs per female, based upon yearly fecundity measurements. No wild Coho salmon have been taken as broodstock for this program since 2012.

In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time if and when this revision to Article 45 might occur. Currently, the FERC license

holder has no plans to seek this modification.

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

Life Stage	Release Location	Stock	Annual Release Level
Green Eggs			None
Unfed Fry			None
Fry			None
Fingerling			None
Yearling	Cow Creek Galesville Reservoir	18 18H	60,000 ± 10% 20,000 ± 10% ^a

- a. In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time if and when this revision to Article 45 might occur. Currently, the FERC license holder has no plans to seek this modification.

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

Estimates of adult Coho Salmon production from the Umpqua River hatchery Coho Salmon program for 2005 to the present are presented in Table 1-2. These data only include the returning hatchery fish after the conclusion of other basin hatchery programs. The estimates reflect program performance in relation to smolt-to-adult survival rates, adult fish harvests in the ocean and freshwater fisheries, hatchery returns, and escapement to natural spawning areas etc. These estimated numbers of total adults of hatchery-produced Coho Salmon were derived from a variety of data sources.

The “Ocean Commercial” and “Ocean Sport” columns were estimated by expansion of coded-wire tag (CWT) recoveries to reflect total production as follows: {(Estimated CWT recoveries / number of CWT smolts released) * total fish released}. This calculation was made for each group of CWT smolts released, and then summed across all CWT groups released for each brood year. Only brood year 2006 had CWT data. This estimate represents landed catch and does not include an estimate of non-landed coho mortality in chinook only fisheries. Included in the “Ocean Sport” column are any recoveries in the “Buoy 10” or other estuary fisheries outside of the Umpqua River Basin. The “Freshwater Sport” column is the punch card estimate of catch in the Umpqua River Basin. From return year 2008 – 2010, only hatchery fish could be harvested in fresh water. Beginning in 2011, the Umpqua, per approval of NOAA, was open to a limited freshwater wild harvest below the Scottsburg Bridge. The harvest data for 2011 and 2012 only represent the freshwater hatchery portion of the harvest. The hatchery return is the

number of hatchery fish handled at the Galesville Reservoir fish ladder which represent the terminal end of anadromy for the South Umpqua. Years 2008 and 2010 may include a small number of wild Coho Salmon handled. The estimate for hatchery spawning was from ODFW's GRTS estimates for the Umpqua basin, available via the October 2014 ODFW website for the estimated abundance of hatchery adult Coho Salmon spawners. Smolt to adult survival is calculated as the sum of the prior 5 columns divided by the "Smolt Release" column.

Table 1-2. Estimated total adult hatchery Coho Salmon produced per brood year and related adult return year. Data derived from HMS database and from CWT expansions, SRS, hatchery, and punch card data.

Brood Year	Smolt Release	Adult Return Year	Estimated Total Adult Hatchery Coho Produced					
			Ocean Comm.	Ocean Sport	Freshwater Sport	Hatchery Return	Spawning Areas	Smolt to Adult Survival
2005	88,884	2008-09	na	na	1280	208	462	2.2
2006	120,652	2009-10	5	90	1460	608	2,444	3.8
2007	72,017	2010-11	na	na	1500	646	3,212	7.4
2008	73,542	2011-12	na	na	803	83	1,355	3.0
2009	66,000	2012-13	na	na	756	267	669	2.5
2010	61,045	2013-14	na	na	na	348	815	na
Goal 60,000	61,000-120,000				Goal 1000-3000		b	

a. South Umpqua smolt release goal is 60,000. This table reflects the hatchery program once only South Umpqua hatchery coho would be present.

b. 10% or less of naturally spawning coho population. Since this goal is a percent of the wild coho abundance, which changes annually, we do not have a goal for absolute number of hatchery coho strays.

The objective of Galesville Dam mitigation plan (FERC 1984 - 2034) is to release 60,000 Coho Salmon smolts annually to mitigate for the loss of habitat above Galesville Reservoir and provide adult Coho for harvest in the ocean and the Umpqua River. The agreement also recognizes that the reservoir will be stocked with Rainbow Trout for recreational fishing.

Current goals include a freshwater harvest of 1,000 to 3,000 fin clipped adults Coho Salmon based on punchcard results and meeting hatchery stray rate guidelines for the basin per the NFCP and Coho Conservation Plan. The most recent punch card data shows an estimated average fresh water harvest of 1,160 stock-18 hatchery Coho salmon.

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

The Cow Creek/South Umpqua stock-18 Coho salmon program began in 1986 and will continue through the life of FERC license for Galesville Hydroelectric Project 7161.001.

1.14) Expected duration of program.

Smolt releases into the South Umpqua (stock-18) are ongoing per the FERC mitigation agreement and will continue until 2034.

1.15) Watersheds targeted by program.

The Umpqua Coho Salmon program is targeted at the lower South Umpqua River (below and including Cow Creek) and the mainstem Umpqua River sub-basins.

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 Umpqua basin operates a hatchery Coho Salmon program as part of a mitigation program for the loss of habitat due to the creation of Galesville Reservoir. This program also provides harvest augmentation for ocean and inland fishing. The mitigation program has specific requirements, and alternative actions may require amendments to the FERC license.

The ongoing Coho Salmon (stock-18) hatchery program was created to mitigate for habitat losses caused by the creation of Galesville Reservoir. This is a 50 year FERC agreement that includes the release of 60,000 hatchery-produced Coho Salmon smolts annually to Cow Creek. With the smolts released into Cow Creek, the potential impacts to native wild Coho Salmon include competition with naturally produced Coho in rearing habitats and spawning grounds, possible negative genetic impacts, and accidental take of wild Coho Salmon during harvest, and potential disease transmission.

The district is guided by the Native Fish Conservation Policy (NFCP 2003), the Fish Hatchery Management Policy (2003), the Fish Health Management Policy (2003), the Oregon Coast Coho Conservation Plan (OCCCP 2007), the Oregon Coastal Multi-Species Conservation and Management Plan (CMP 2014) and subsequent recovery and management plans and best available science. Thus the management of hatchery- and naturally-produced Coho Salmon will follow the aforementioned guidelines to manage Coho on the spawning grounds, during brood stock collection, and throughout the rearing and release phases of hatchery production. To further reduce potential impacts, hatchery smolts are released at peak smoltification to encourage quick out-migration and reduce interaction with wild Coho in rearing habitats. Since the smolts are acclimated via net pens or volitional migration in the upper stilling basin of Cow Creek, their homing tendency to the release site is increased, thus decreasing the stray rates. As previously mentioned, the smolts are also 100% marked to allow identification of program fish for brood stock collection, legal angling harvest, and for tracking stray rates. Program fish provide ocean and freshwater recreational harvest opportunity during regulated periods that allow harvest of fin clipped coho. Until 2011, these program fish provided the only

freshwater Coho Salmon retention fishery in the Umpqua basin. Since the North Umpqua hatchery Coho Salmon program has been discontinued, the stock-18 fish have contributed to an average harvest of about 1,160 adult Coho Salmon (ODFW Catch Statistics) while maintaining an average stray rate of about 5% in the South Umpqua basin (Mark Lewis, ODFW, pers. Com). The overall stray rate for the entire Umpqua basin has been less than 5% since the North Umpqua hatchery program was discontinued. In 2011, NOAA approved a limited wild Coho Salmon harvest on the lower Umpqua below Scottsburg. This wild fishery provides additional harvest opportunity and is subject to annual approval by NOAA.

1.16.2) Potential alternatives to the current program.

The following draft alternatives are ideas only and are not necessarily being endorsed by the managing agency (ODFW) or the authors of this document.

Alternative 1: Eliminate the Coho Salmon Hatchery Program.

Pros: Eliminating the Coho Salmon hatchery program would eliminate any potential interaction between hatchery-produced and wild Coho in the Umpqua basin.

Cons: Eliminating the hatchery program would eliminate a popular angling opportunity in the basin. Previously, regulations only allowed the harvest of hatchery fish, consequently, elimination of this program would eliminate Coho Salmon harvest in the Umpqua basin. The wild Coho Salmon fisheries which were initiated in 2011 provides limited wild Coho harvest opportunity, in the lower 27 river miles of the Umpqua. Thus the program's hatchery Coho Salmon continue to provide a valuable harvest opportunity for the rest of the basin. The basin has already reduced hatchery influence and provided spawning refuges by eliminating the North Umpqua hatchery Coho Salmon program plus closing coho angling in the South Umpqua from September 15 to November 30th, the North Umpqua above Rock Creek and closing salmon angling in all other tributaries in the Umpqua basin. The fishery is popular enough that from 2008 - 2012, punchcard data showed sport harvest in the bay and inland Umpqua ranged from 2,400 to 9,000 adult Coho Salmon. Port data for Winchester Bay estimates 7,400 – nearly 20,000 angler trips to the area for Coho and Chinook Salmon fishing.

Eliminating a popular Coho Salmon fishery will also decrease economic activities and revenue to Douglas County communities that rely on angler dollars. Communities directly impacted would include: Winchester Bay, Reedsport, Scottsburg, Elkton and Roseburg. Loss of the recreational opportunity and economic benefit of the hatchery program would also result in the loss of community support for the ODFW.

Eliminating the program would also prevent Douglas County from meeting it's legal obligations and benefits from the Galesville Reservoir FERC mitigation agreement on the South Umpqua. The department would also lose funds that are currently provided by Douglas County for the Cow Creek/South Umpqua hatchery program.

Alternative 2: Acclimate Hatchery Coho in the Lower Basin

Pros: Acclimating the hatchery Coho Salmon smolts in the lower portion of the basin could potentially reduce the interaction between hatchery and wild fish in the basin if homing to the acclimation site were successful. The most viable location for a lower basin acclimation site would be Winchester Bay.

Cons: A new acclimation site, with associated construction or setup costs would have to be established. Methods for feeding and protecting the smolts would also have to be established. Returning hatchery fish might not home well to the lower Umpqua since the parent generation consists of Coho Salmon from the South Umpqua/upper Cow Creek basin. Genetically these fish may be predisposed to return to the South Umpqua/Cow Creek. If the difference between the acclimation site and location predisposition was too great, this could lead to an increase in straying. If the program fish did not return to the base of Galesville, then another method of capturing appropriate broodstock would have to be developed. This could increase the cost of personnel to oversee another collection site. Hauling brood fish from lower in the basin to Rock Creek Hatchery would increase hauling cost and stress to the fish. Current volunteers who assist this program would be unlikely to participate in a program that would require driving nearly 200 miles round trip to the coast several times per week for 4 to 8 weeks. Thus either more staff or new volunteers would be necessary to capture and haul brood. Any returning hatchery fish that were not captured and removed from the lower basin could potentially spawn with lower Umpqua Coho Salmon which are considered to be a different breeding population in the Umpqua Basin. Upstream angling opportunity would be reduced if the hatchery fish stayed in the lower portion of the Umpqua. Releasing the stock-18 Coho Salmon smolts in a basin other than Cow Creek would not meet the constraints of the FERC mitigation agreement. Current facilities meet the needs of this program and the adult Coho Salmon returning through this program presently meeting the ODFW's fish production goals while providing an inland fishery in larger portion of the basin than a lower acclimation site would provide.

1.16.3) Potential Reforms and investments.

Reform/Investment 1: Eliminating the stock-18 Coho Salmon harvest/mitigation program would violate the FERC agreement that extends until 2034. This would also eliminate a portion of Rock Creek Hatchery's budget that is provided by the FERC agreement for rearing the Coho juveniles. Eliminating the program would also reduce angling opportunity and have a negative economic impact on local communities. No investment cost for this reform has been identified, as this does not seem to be a viable option.

Reform/Investment 2: Moving this program to a lower acclimation site would increase operational costs of the program. It could also potentially increase stray rates into another subbasin, and would reduce the number of river miles available for inland recreational harvest of program fish. The change could alienate the volunteer organization that has

assisted this program for over 20 years and would be in violation of the FERC mitigation agreement. No investment cost for this reform has been identified, as this does not seem to be a viable option.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

Rock Creek Hatchery has been operating under an incidental take permit (number 1017) for Umpqua Cutthroat Trout, which were classified as endangered under the Federal Endangered Species Act in 1995. Cutthroat Trout were removed from the federal ESA list in April 2000 and subsequently the Oregon Department of Fish and Wildlife withdrew its application for the incidental take permit.

This program also operates under FERC license 7161 issued to Douglas County for operation of the Galesville Dam project (1984 – 2034). Rock Creek Hatchery also has permit NWP-2002-132/5; NMFS No. 2011/03901 for the operation and annual June cleaning of their intake pipe. This permit allows the excavation of 100 cubic yards of gravel and sand to clear the fish hatchery intake. The project is located at North Umpqua River Mile 35.7 approximately 150 feet upstream of the confluence with Rock Creek. Work is performed from the adjacent shoreline bar with an excavator. As per National Marine Fisheries Service requirements, aggregate is returned to the river system by spreading materials over the adjacent gravel bar. For additional requirements, see permit NWP-2002-132/5.

The HGMP for the Umpqua River Coho Salmon program was submitted to NMFS on 03/26/2003 for approval and ESA coverage. Because of some changes to the program the HGMP was updated and resubmitted to NMFS on 11/28/2011. And due to termination of the Coho Salmon program in the North Umpqua River soon after egg injection in 2012 this HGMP is being updated once again to accurately reflect the Coho propagation program within the Umpqua Basin.

Water right permits for the hatchery include: S 5890, S 8896, S 12003 and S 17680 for water from Rock Creek, and S 41447 for North Umpqua water.

The hatchery is operated under the NPDES general permit 300-J to comply with the federal Clean Water Act.

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

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

The ESA listed Oregon Coast Coho Salmon population may be affected by this hatchery program, particularly the Coho populations of the Umpqua Basin. The following are a brief description of the habitat and the affected population(s):

Umpqua Population Stratum

The OCCCP (2007) uses the population delineations identified by the Oregon Coast Workgroup of NOAA's Oregon-Northern California Technical Recovery Team (TRT). The TRT identified a geographic stratum of coho populations in the Umpqua that includes the following populations: Lower Umpqua, Middle Umpqua, North Umpqua and South Umpqua. There are estimated 1,489 miles of spawning habitat available to Coho Salmon inhabiting this population complex.

Coho Salmon Life History

Adult Coho Salmon migrate into fresh water in the fall to spawn. Spawning of wild Coho Salmon usually occurs from mid-November through February. Adult spawning Coho Salmon are typically three years old and 2-year-old jacks (precocious males) often accompany them from the next brood. Spawning occurs primarily in small tributaries located throughout coastal basins. The parents normally exhibit strong homing to their natal stream. The female digs a nest (redd) in the gravel and lays her eggs, which are immediately fertilized by accompanying adult males or jacks. Digging and displacing gravel from the upstream edge of the nest covers the eggs. The adults die soon after spawning. Each female lays about 2,500 eggs. Sex ratios of spawning adults tend to average around 50:50 at most locations (Table 2.2.1). However, Moring and Lantz (1975) observed 77% males in three small Alsea River tributaries over a period of 14 years. They concluded that males tend to move around and visit multiple streams.

The eggs hatch in about 35-50 days, depending upon water temperature. Warm temperature speeds hatching. The alevins remain in the gravel two or three weeks until the yolks are absorbed and emerge as fry to actively feed in the spring. Most juvenile coho salmon spend one summer and one winter in fresh water. The following spring, approximately one year after emergence, they undergo smoltification - physiological changes that allow them to survive in seawater. They then migrate to the ocean as smolts about 10-12 cm in length.

Table 2.2.1. Observations of coho salmon sex ratios at adult traps.

Population	Percent	Percent			
Complex	Males	Females	Location	Run years	Data Source
Nehalem	52%	48%	North Fork trap	1998-1999	Life Cycle Monitoring
Siletz	50%	50%	Mill Cr. Trap	1997-1999	Life Cycle Monitoring
Yaquina	51%	49%	Mill Cr. Trap	1997-1999	Life Cycle Monitoring
Alsea	77%	23%	Drift Cr. tributaries	1959-1972	Moring & Lantz (1975)
	50%	50%	Cascade Cr. Trap	1997-1999	Life Cycle Monitoring
Umpqua	55%	45%	Smith River trap	1999	Life Cycle Monitoring
Coos	63%	37%	S. Coos R.,	1999	Oregon Plan Monitoring
			Winchester Cr., & Fall Cr.		

The smolts undergo rapid growth in the ocean, reaching about 40-50 cm by fall. Little is known of the ocean migrations of Coho Salmon from Oregon coastal streams; however, it appears migrations are mostly limited to coastal waters. Initial ocean migration appears to be to the north of their natal stream (Fisher and Pearcy 1985; Hartt and Dell 1986). After the first summer in the ocean, a small proportion of males attain sexual maturity and returns to spawn as jacks. Migration patterns during the fall and winter are unknown. Those fish remaining at sea grow little during winter but feed voraciously during the next spring and summer, growing to about 60-80 cm in length. During this second summer in the ocean, certain percentage of maturing adults are caught in ocean troll and sport fisheries, usually to the south of their natal stream (Lewis 2000). The survivors return to their home streams or neighboring streams where they spawn and die to complete the life cycle.

Habitat Use and Freshwater Distribution

Spawning and rearing of juvenile Coho Salmon generally take place in small, low gradient (generally <3%) tributary streams, although rearing may also take place in lakes where available. Coho Salmon require clean gravel for spawning and cool water temperatures for rearing. Fifty-three to 58°F is preferred, with 68°F being the maximum (Reiser and Bjornn 1979). Fry emerge from February to early June (Moring and Lantz 1975) and occupy backwater pools and the stream margins (Mundie 1969; Lister and Genoe 1970; Nickelson et al. 1992a). In summer, Coho Salmon fry prefer pools in small streams, whereas during winter, they prefer off-channel alcoves, beaver ponds, and dam pools with complex cover (Nickelson et al. 1992a, 1992b). Complexity, primarily in the form of large and small wood, is an important element of productive Coho Salmon streams (Nickelson et al. 1992b; Rodgers et al. 1993). Little is known about residence time or habitat use of estuaries during seaward migration. It is usually assumed that Coho Salmon spend only a short time in the estuary before entering the ocean. However, recent research is finding that rearing in the upper ends of tidal reaches can be extensive.

The distribution of Coho Salmon within a basin is primarily determined by two factors: marine survival, and the distribution of freshwater habitat of different levels of quality. When marine survival has been very poor, Coho will be found in only the highest quality habitats. Coast-wide, high quality environments comprise about 22% of available habitat (Nickelson 1998). When marine survival increases, as could occur with a changing climate regime, Coho will redistribute into freshwater habitats of lower quality. Thus

Coho Salmon population dynamics function with a classic “source-sink” relationship among stream reaches.

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

Currently, this program has no intent to directly take any listed natural Coho Salmon. However, it has been proposed in this HGMP that up to 100% of the broodstock consists of listed natural origin Coho Salmon after the plan is approved by NMFS, which may cause direct take of listed natural Coho Salmon (up to 92 wild fish per year). The details of wild fish incorporation into broodstock have been described in Sections 2.2.3 and 6.2.3.

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

Indirect or incidental take of listed Coho Salmon may occur due to competitive interactions for food and space between hatchery-origin Coho Salmon and listed natural-origin Coho Salmon. Minimal indirect impact to listed Coho Salmon may also occur due to water withdrawal for hatchery operations, and a few incidental take (catch and release) of listed Coho may occur during Coho Salmon brood collection. Oregon coast steelhead populations are considered a “species of concern”, and may also be indirectly affected by this program. There are no other ESA listed populations in the basin affected by this program.

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

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

According to the OCCCCP (2007) the overall Umpqua stratum passed the viability analysis. The North Umpqua as an individual Coho Salmon population failed due to the hatchery influence. The North Umpqua program has subsequently been discontinued and coho numbers have increased. Gray et al. (2011) noted that to reach current full seeding in the Umpqua basin, 29,400 spawners would be necessary. As illustrated in Figure 2.2.2a, the Umpqua has generally met or surpassed the number of spawners necessary for fully seeding the basin and has averaged 42,656 returning adults during the last 12 years.

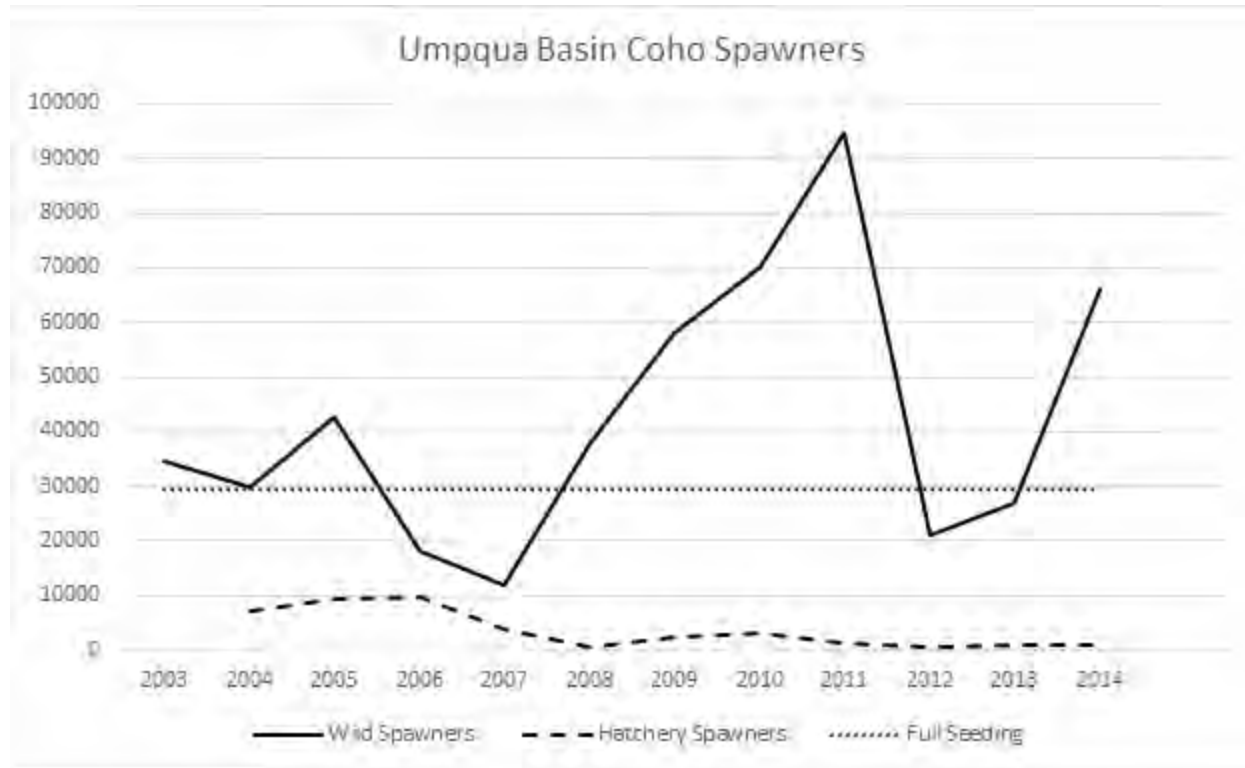


Figure 2.2.2a. Coho Salmon spawner abundance needed to reach full seeding levels in the Umpqua Basin.

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

Figure 2.2.2b illustrates the number of recruits per spawner in the South Umpqua basin. This data is available from the Salmon and Steelhead Recovery Tracker link on the ODFW website. The South Umpqua is presently averaging about 2.1 recruits per spawner. Data for the North Umpqua is not presented since the newest data does not include 2008 to the present. Data from 2008 onward reflects the current status of the North Umpqua basin since the hatchery program was discontinued.

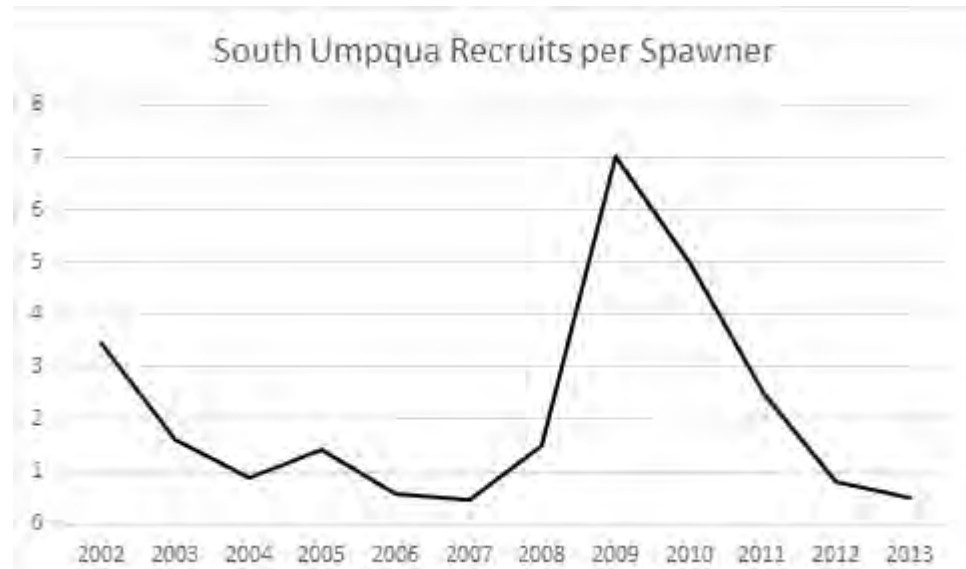


Figure 2.2.2b. Coho Salmon recruits per spawner by year for the South Umpqua basin, 2002-2013.

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

The Umpqua River has generally met or surpassed the number of spawners necessary for fully seeding the basin and has averaged 42,656 returning adult Coho Salmon during the last 12 years (see Figure 2.2.2a).

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

The number of spawning adults in the South Umpqua has increased in recent years and from 2003 to 2014 averaged 15,295 wild Coho Salmon and 662 hatchery-origin Coho Salmon (Figure 2.2.2c). According to OASIS spawning ground data (M. Lewis pers.com and <http://odfw.forestry.oregonstate.edu/spawn/reports.htm>) hatchery influence has ranged from 0% to 13% of the population and has averaged 4.6% since 2004. This is well within the goals of the NFCP (2003), OCCCP (2007) and HMP (2003) plans. Since the hatchery program for this basin fulfills a specific mitigation goal of releasing 60,000 smolts, this stray rate should continue to remain low and meet the department's program goals for stray rates. Per NEQ seeding levels noted by Gray et al. (2011), the South Umpqua population has also met or exceeded reaching 75% of the seeding needs of the basin in most years (Figure 2.2.2c). Persistence estimates in 2007 (ODFW Salmon and Steelhead Recovery Tracker) show a high probability of all of the Umpqua's populations persisting into the future. The Lower Umpqua had an average probability of 0.993, Mid Umpqua 0.992, North Umpqua 0.976, and South Umpqua 0.997. Again, these data for the North reflect the time period prior to the hatchery program being discontinued.

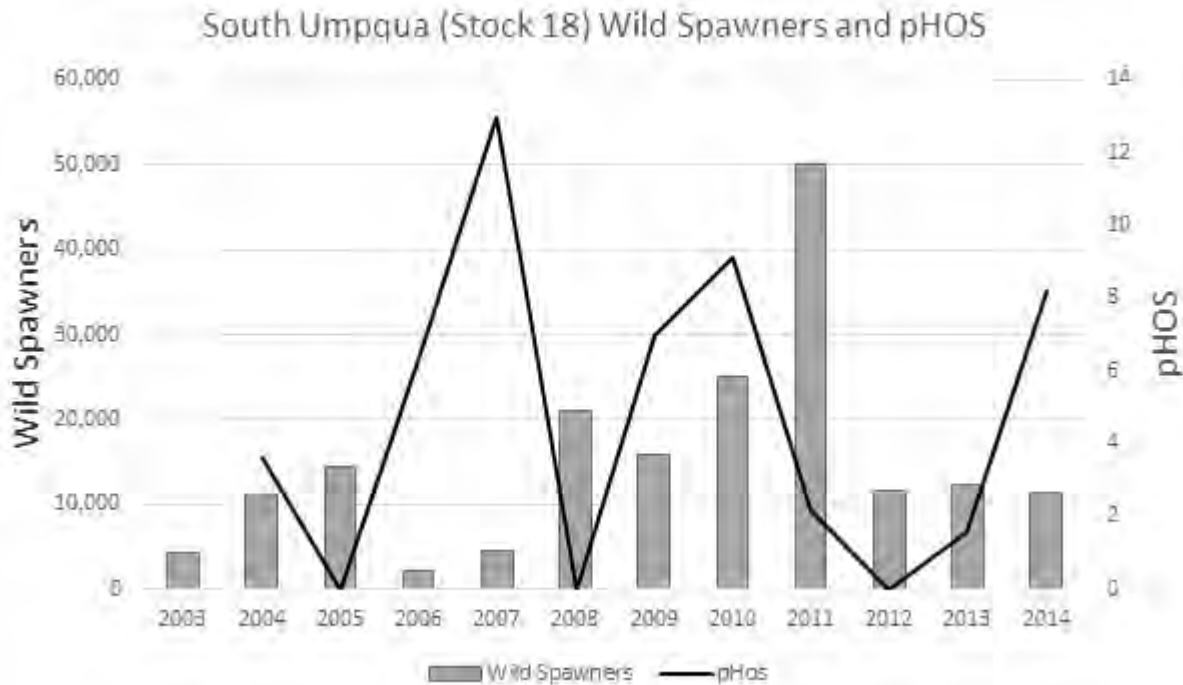


Figure 2.2.2c. The number of wild-origin and hatchery-origin Coho Salmon (pHOS) in the South Umpqua Basin, 2004-2014.

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.

- 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.

(1) Number of Wild Fish for Broodstock.

Wild fish have not been taken for broodstock since 2012. Once this HGMP is approved, the goal of this stock-18 Coho Salmon program is to take brood fish from both hatchery-origin and wild-origin Coho Salmon. To prevent domestication effects in hatchery-produced fish, per approval of this HGMP, current policies and best available science, up to 100% wild fish shall be collected and incorporated into brood stock each year. Therefore the number of wild fish collected for broodstock may be up to 92 wild fish each year, depending on the predicted number of wild fish returning to the South Umpqua River. Wild fish will only be taken for hatchery broodstock when the expected return of wild spawners is above 1,000 fish, so the impact to the wild population would be less than 2% removal of the wild population for this program.

(2) Broodstock Collection at Upper Cow Creek - Galesville Dam.

Both hatchery- and wild-origin Coho for stock-18 broodstock may be collected at a terminal trap at the base of Galesville Dam. Most wild Coho Salmon returning to this facility will be allowed to spawn naturally at the terminal end of Cow Creek or may be transported and released into lower Cow Creek subbasin. Brood fish of both wild- (after HGMP approval) and hatchery-origin will be transported to Rock Creek Hatchery. Total numbers of adult fish collected for brood at Galesville Dam since 1988 are shown in Section 7.4.2. At the trapping facility a power outage caused the mortality of 48 wild Coho Salmon in 2005, and in 2010 crowding in the area behind the crowder caused the mortality of ~7 wild Coho Salmon. In both of these cases ODFW met with Douglas County Water Resources and together the agencies developed improvements to avoid any similar losses in the future. In the past, wild Coho Salmon transported to the Rock Creek Hatchery facility for holding, and mortality from holding to spawning averaged less than 10% over a period of 11 years.

Since the Galesville trap site is a terminal facility, there are no other effects on the listed species such as migration delays, etc. Galesville Dam trap is operated periodically from October 1 through approximately January 31 to collect brood. Per the mitigation agreement, hatchery Coho not used for brood could be trucked to other streams where spawners are needed. However, ODFW does not currently think spawners, especially hatchery spawners, are needed anywhere in the South Umpqua. Currently, instead of placing hatchery Coho in other parts of the basin, hatchery Coho not used for brood are used for the food bank, recycled into Galesville Reservoir, or are allowed to spawn in upper Cow Creek where it terminates at the base of the dam as long as the OCCCCP goal for hatchery spawners is achieved. Since this is the terminal end of anadromous distribution, this area is considered a “dead end” for the population. Most of the Coho Salmon at the base of the dam are fin clipped hatchery fish. Most of the returning “wild” fish to this area are likely the unmarked returning progeny from hatchery by hatchery crosses. Since the South Umpqua and overall Umpqua basin have been well below prescribed hatchery stray rates, spawning in this terminal dead end area is considered to have a minimal impact on the population.

(3) Downstream migrant rotary traps.

Depending on monitoring/inventory needs for smolt survival/migration and available funding, the ODFW periodically operates rotary traps on lower Cow Creek, Smith River, Brush Creek, Big Tom Folley Creek, Hinkle Creek, Calapooya, Wolf Creek, Copeland Creek, Calf Creek, the Soda Springs by-pass or other sites in the basin as deemed necessary for monitoring. See below Table 2.2.3b for a list of the number of Coho Salmon smolts observed at some of the traps. Other agencies and partners have operated downstream migrant traps on Myrtle Creek, Ollala Creek, Calapooya Creek, Little River, Rock Creek, Canton Creek, Calf Creek, Jackson Creek, upper South Umpqua River, Dumont Creek, Elk Creek, Quartz Creek, Wolf Creek, Little Wolf Creek, and Boulder Creek. Incidental mortality associated with these activities is generally within the scientific take permit guidelines. Any variance is reported by the agency responsible.

(5) Spawner Escapement Monitoring.

ODFW conducts random spawning ground surveys throughout the basin to document the presence of hatchery fish on spawning grounds. Hatchery-origin Coho Salmon are identified based on fin mark and/or coded-wire tag. More intensive spawner escapement activities have been periodically conducted in Smith River, West Fork Smith River, Brush Creek, Big Tom Folley Creek, Weatherly Creek, Paradise Creek, Cow Creek, French Creek, Rock Creek, Hinkle Creek, Wolf Creek, Little Wolf and the Calapooya.

(6) Rock Creek Hatchery Intake Clean out, North Umpqua River.

Rock Creek Hatchery also has permit NWP-2002-132/5 for the operation and annual June cleaning of their intake pipe. This permit allows the excavation of 100 cubic yards of gravel and sand to clear the fish hatchery intake. Project is located at North Umpqua River Mile 35.7 approximately 150 feet upstream of the confluence with Rock Creek. Work is performed from the adjacent shoreline bar with an excavator. As per National Marine Fisheries Service requirements, aggregate is returned to the river system by spreading materials over the adjacent gravel bar. For additional requirements, see permit NWP-2002-132/5.

- 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 data in Table 2.2.3a show the number of wild-origin and hatchery-origin adult Coho Salmon handled and/or counted at Winchester Dam trap sites from 2008 to 2014 when the North Umpqua program was concluded. Galesville data represents total Coho Salmon handled at the dam and does not distinguish between hatchery- and wild-origin due to the need to quickly remove Coho Salmon from the trap during years with high returns. Table 2.2.3b shows the number of Coho Salmon smolts captured at ODFW monitoring sites in the most recent years that smolt traps were operated to determine an estimated yearly Coho smolt production (based on counted outmigrants). These facility operations are covered under an ESA research permit administered by the ODFW and authorized by the July 2000 4(d) Rule (65 FR 42422). Permits are renewed annually to cover district activities. Annual reports are submitted to NOAA and are posted on their website.

Table 2.2.3a. Adult wild- and hatchery-origin Coho Salmon handled/counted at Umpqua Trap facilities, 2008-2014.

	# of stock 18 wild coho for brood	# of stock 18 wild coho handled *	# of stock 18 hatchery coho for brood	# of stock 18 hatchery coho handled **	# of stock 55 wild coho retained for brood at Winchester Dam
2008	30	57	35	92	0
2009	16	27	51	557	97
2010	n/a	n/a	n/a	n/a	82
2011	42	48	28	55	77
2012	19	11	45	222	0
2013	0	40	77	268	0
2014	0	67	20	646	0

*Fish passed back into the South Umpqua at Galesville or Happy Valley traps

** Fish used for food bank, placed into Galesville Reservoir, or passed back into the South Umpqua

Table 2.2.3b. Coho smolt observations at ODFW trap sites since 1988.

Trap Site	Year	Coho smolts observed	Smolt population estimate
Cow Creek	1988	290	N/A
	1991	712	N/A
	1992	N/A	N/A
	1993	1355	N/A
	1994	2964	N/A
	1995	3883	N/A
	1996	3396	N/A
	1997	902	N/A
	1998	N/A	N/A
	1999	547	N/A
	2000	1370	N/A
Trap Site	Year	Coho smolts observed	Smolt population estimate
Brush Creek	1995	1,959	6,236
	1996	902	2,344
	1997	239	3,220
	1998	803	15,512
	1999	296	816
	2000	1,324	4,980
	2001	1,451	2,760
	2002	1,818	3,495
	2003	1,171	3,236
	2004	NA	NA
	2005	5,515	9,508
	2006	1,306	4,937
	2007	1,732	2,086
	2008	1,948	3,641
2009	530	2,905	
2010	1,448	7,177	
2011	4,197	8,640	
Trap Site	Year	Coho smolts observed	Smolt population estimate
Big Tom Folley	1997	778	2,826
	1998	338	1,016
	1999	118	407
	2000	494	2,637
	2001	1,926	6,636
	2002	399	2,207

	2003	NA	NA
	2004	NA	NA
	2005	5,223	13,803
	2006	1,336	5,163
	2007	1,428	11,864
	2008	1,232	13,585
	2009	1,620	7,261
	2010	1,512	23,289
	2011	3,539	8,820

Source: Brush and Big Tom Folley data described further in Truemper et al. 2011.

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

Brood year 2011 was the last year for collecting 92 wild adult Coho Salmon (stock-55) for the PacifiCorp’s research mitigation program, and that program of stock-55 has ended. Thus for the South Umpqua stock-18 Coho program, per approval of this HGMP, or as guided by policies and the best available science, up to 100% of the 92 brood fish needed for this program will be wild-origin as long as that would not exceed 2% of the wild population. No wild fish would be collected if the return of wild fish is predicted to be less than 1,000 Coho Salmon in the South Umpqua basin. Unintentional take includes average and range of losses at the hatchery, or trap.

Table 2.2.3c. Estimated ESA listed natural- and hatchery-origin salmonid take levels by hatchery activity.

Listed species affected: <u>Coho Salmon (<i>Oncorhynchus kisutch</i>)</u> ESU/Population: Oregon <u>Coast Coho</u>				
Activity: Broodstock Collection – Direct Take and Incidental Take				
Location of hatchery activity: Galesville Dam (Cow Creek, South Umpqua River), Happy Valley (South Umpqua)				
Dates of activity: Galesville Dam: November through January, Happy Valley: Sept – Oct.				
Hatchery program operator: Rock Creek Hatchery				
Type of Take	Annual Take of Listed Fish By Life Stage <i>(Number of Fish)</i>			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	5,000H/W	1,000
Collect for transport b)	0	0	500H	0
Capture, handle, and release c)	0	0	3,000H/W	
Capture, handle, tag/mark/tissue sample, & release d)	0	0	1,000H/W	0
Removal (e.g. broodstock) e)	0	0	92 H/W	0
Intentional lethal take f)	0	0	1,000 H other uses	0
Unintentional lethal take g)	5,000H (2000-13000)	2500H (2000-10000)	2H/W (30-200)H/W	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through stream surveys, carcass, or mark recovery, or migration delay at weirs. Spawning Ground surveys have a categorical exclusion under the research 4d permit.

- b. Take associated with weir or trapping operations where listed fish are captured and transported for release. Note: includes potential recycling of hatchery stock 18 which are listed.
- c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream. Hatchery fish may be placed in the reservoir.
- 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 is removal of some hatchery fish for food bank program or nutrient enrichment.
- 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. Numbers provided represent a total loss at the hatchery for the eggs or smolts. Numbers represent the average, and (range).
- h. Other takes not identified above as a category. This would include legal harvest of coho stock-8 hatchery fish and wild coho harvest per NOAA approval. This would have to be adjusted with changes in approved wild harvest rates or quota.

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). If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

For the Galesville fish trap, the ODFW and Douglas County Public Works Department have developed a notification tree and an emergency aeration program for the Galesville fish ladder in the event that power or water flow to the site is interrupted. Emergency measures include direct aeration to the raceway, and ODFW personnel to evacuate the fish from the raceway if necessary. The ODFW and County also worked together make coho evacuation faster and safer. This included widening walls and installing handrails adjacent to the ladder steps to allow easier access for removal of fish. Fish losses at other capture facilities are evaluated on an individual basis and are addressed according to standardized fish handling protocols and procedures and according to best management practices and IHOT (1995) guidelines.

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.**

North Umpqua River Fish Management Plan: This Coho Salmon program had been operated under the guidelines of the North Umpqua River Fish Management Plan which

was approved on March 21, 1986 by the ODFW Commission. The fish management plan was revised in March of 2007 to be consistent with the Oregon Coast Coho Conservation Plan. Until May 2000, the Umpqua River Coho Salmon program was operated under ESA Section 10 incidental take permit application for hatchery programs in the Umpqua Basin for take of Umpqua River Cutthroat Trout. The ODFW requested that the permit be withdrawn as a result of the delisting of the Umpqua River Cutthroat in May 2000. On 11/28/2011, ODFW submitted HGMP for this program to NOAA Fisheries for ESA coverage. This is an update version of the previously submitted HGMP as it became necessary as a result of the relisting of Coastal Coho and changes to the Coho Salmon propagation program.

Native Fish Conservation Policy: The Oregon Fish and Wildlife Commission approved the Native Fish Conservation Policy in 2003. The NFCP requires the development of a conservation plan for each native stock within the species management unit (SMU).

Oregon Coast Coho Conservation Plan (Coast Coho Plan): This plan was approved in 2007 fulfilling the NFCP requirement for Coho Salmon along the Oregon Coast. The Coast Coho Plan provides the management direction for Coho Salmon populations along the coast from Sixes River in the south to the Necanicum River in the north, including the North, South, Middle and Lower Umpqua populations. The plan also provides guidance on the use of Coho hatchery programs. Per recommendations of this plan, the North Umpqua hatchery Coho program was discontinued in 2005.

Oregon Coastal Multi-Species Conservation Management Plan (CMP): was approved in 2014. This plan supersedes many of the older basin plans such as the North Umpqua River Fish Management Plan and is the basis for updating various conservation goals, OAR's and harvest regulations.

Fishery Management & Evaluation Plan (FMEP): pursuant to limit 4 of the ESA 4(d) rule, this is an agreement with NMFS to establish guidelines for in river wild Coho Salmon harvest (Gray et al. 2014). The wild harvest quota for the Umpqua has ranged from 1,300 to 3,000 from 2011 – 2014. In the future a non-quota season may be established. The wild harvest has averaged approximately 1,500 wild coho during 2011-2014.

Fish Hatchery Management Policy: This policy provides guidance for the responsible use of hatchery-produced fish. It outlines the best management practices for hatchery programs to ensure conservation and management of both naturally produced native fish and hatchery produced fish in Oregon.

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

- 1) Section 10 incidental permit number 1017(withdrawn May 2000)
- 2) FERC permit number 7161 (1984 – 2034)
- 3) US Army COE permit number 2000-00552

- 4) ESA Section 7 consultation, biological opinion in cooperation with Roseburg and Coos BLM districts, Umpqua National Forest, Interagency fish population monitoring program, approved by NMFS 10 April, 1997
- 5) US Army Corps of Engineers- General Authorization permit number for improving fish habitat in Western Oregon
- 6) DEQ Memorandum of Agreement regarding fish carcass distribution in Oregon streams.
- 7) Oregon Plan for Salmon and Watersheds.
- 8) Memorandum of Understanding for Waiver of Fish Passage Requirements between the Oregon Fish and Wildlife Commission and PacifiCorp, dated March 2001 and incorporated into the North Umpqua Settlement Agreement (Section 4.2, Appendix E) filed with FERC on 13 June, 2001.
- 9) ODFW's Native Fish Conservation Policy, adopted 2003.
- 10) ODFW Fish Hatchery Management Policy, adopted 2003.
- 11) Oregon Coast Coho Conservation Plan, adopted 2007.
- 12) NWP-2002-132/5 also listed by NMFS as No. 2011/03901 permit for maintenance and annual cleaning of hatchery facility intake.
- 13) Water Right Permits: S 5890, S 8896, S 12003, S 17680 for Rock Creek.
- 14) Water Right Permits: S 41447 for North Umpqua.
- 15) DEQ National Pollutant Discharge Permit (0300J) for Effluent Discharge.
- 16) ODFW Fish Health Management Policy
- 17) Oregon Coastal Multi-Species Conservation and Management Plan, adopted 2014
- 18) Fishery Management & Evaluation Plan, annual NMFS approval of in-river wild coho harvest.

The operation of this hatchery program is consistent with the above plans, policies, permits and agreements.

3.3) Relationship to harvest objectives.

Harvest objectives for Oregon Coast Natural (OCN) Coho Salmon have been approved by NMFS under the section 7 consultation for the PFMC's salmon management plan. Coho smolts raised in the hatchery for the stock-18 program are 100 percent marked (ad-clip) for identification and selective harvest in targeted fin-marked coho fisheries in the ocean and the Umpqua basin.

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

The data of past releases of Coho Salmon smolts from the South Umpqua River Coho program (stock-18) are presented in Table 3.3.1a; and the estimated numbers of adult

Coho Salmon harvests during the past 13 years in the Umpqua River Basin are presented in Table 3.3.1b. Selective harvest of hatchery-origin Coho Salmon in Umpqua Basin freshwater fisheries began in 1996. Until 2008, harvest of fin clipped Coho would have included hatchery fish from both the North and South Umpqua hatchery programs. The mainstem Umpqua River is the primary area for this fishery. However, regulations allow for the harvest of hatchery coho where steelhead or Chinook Salmon seasons are open. Thus harvest is also allowed in the North Umpqua which now has a hatchery stray rate of less than 6% and in the South Umpqua which opens for steelhead on December 1. Due to the December opener there is little harvest effort on Coho Salmon in the South Umpqua. Table 3.3.1b shows estimated harvest of the previous North Umpqua and South Umpqua program fish from 2001 – 2012. Note that years from 2008 and beyond reflect harvest of only South Umpqua hatchery fish since the North Umpqua was discontinued.

Table 3.3.1a. South Umpqua stock-18 Coho Salmon smolt releases, 2001-2013.

Brood Year	Smolts Released
2001	61,555
2002	61,143
2003	65,113
2004	121,005
2005	88,884
2006	120,652
2007	72,017
2008	73,542
2009	66,000
2010	61,045
2011	60,037
2012	60,056
2013	n/a

Table 3.3.1b. Fin marked (hatchery) Coho Salmon harvest data for inland sport fisheries in the Umpqua River Basin, 2001 – 2013.

Year	Harvest
2001	14,006
2002	2,321
2003	3,463
2004	2,181
2005	1,488
2006	2,466
2007	1,105
2008*	1,280
2009*	1,460
2010*	1500
2011*	803
2012*	756
2013*	

Note: Estimates based on a combination of Punch Card data for Umpqua River & Bay, Smith, South Umpqua and N. Umpqua rivers.

** Indicates when harvest would be only on returning South Umpqua hatchery coho.*

3.4) Relationship to habitat protection and recovery strategies.

Coho Salmon in the Umpqua Basin have declined previously for a number of reasons, including: 1) poor ocean conditions; 2) predation; 3) lack of proper screening at irrigation diversions and pumps; 4) degradation of sufficient suitable habitat (spawning gravel and large woody debris); 5) unfavorable natural conditions; 6) inadequate fish passage at culverts; and 7) excess harvests.

Overall habitat conditions appear to be improving, which is benefiting survival of Coho Salmon. Wild Coho are being protected by ESA to enhance recovery, while alternate Coho Salmon fishing opportunities have been created through the hatchery program to satisfy public demand. Also, local watershed councils, in conjunction with federal and state agencies, are implementing numerous freshwater habitat improvement projects throughout the basin, including fencing riparian habitats, placing large woody debris in the streams and improving fish passages. In the past 12 years, coho in the Umpqua Basin have reached full seeding goals 8 years. Gray et al. (2011) note that the technical review team goal for full seeding in the Umpqua is 29,400 spawners. The North Umpqua hatchery Coho Salmon program was discontinued per the OCCCP (2007) to reduce risk to listed natural Coho Salmon in the basin. The number of hatchery-origin Coho Salmon in the basin is now averaging less than 5%.

3.5) Ecological and genetic 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 (largemouth bass and smallmouth bass).
- Known or unknown aquatic non-indigenous animals and plants.

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

- Umpqua River naturally-produced Coho Salmon
- Umpqua River steelhead
- Umpqua River Chinook Salmon

Wild juvenile salmonids using the Cow Creek, South and Main Umpqua River may be affected by releases of hatchery produced Coho Salmon program. However, the Coho juveniles are released as full-term smolts so they are expected to promptly out-migrate through the South Umpqua and the main Umpqua River with a minimum of ecological interaction with other native species.

Potential negative impacts that may occur are direct take of wild broodstock and incidental take of listed fish by recreational fishery. Indirect take (in quantitative terms) which may occur from *(a) genetic introgression; (b) broodstock collection period and selection; (c) competition; (d) disease transmission; and (e) predation* has not been empirically measured. Although risks associated with this fish propagation program are

not completely known, a brief summary of the potential genetic and ecological risks, and the activities taken to avoid, minimize or monitor such risk is described.

(a) Genetic introgression → Hatchery adults spawning in the wild

ODFW recognizes four primary breeding populations of Coho Salmon within the Umpqua Basin Complex: Lower Umpqua, Mid Umpqua, North Umpqua and South Umpqua. Within these reaches, there is an estimated 1,489 miles of available Coho spawning habitat. The entire Smith River subbasin, mainstem Umpqua tributaries, upper South Umpqua subbasin above Cow Creek, and upper North Umpqua River above Steamboat Creek are designated wild fish sanctuaries.

Hatchery-origin Coho Salmon previously spawned in lower river reaches of the North Umpqua River through 2007 primarily below Rock Creek Hatchery. This hatchery program was discontinued. Hatchery Coho from the harvest/mitigation can spawn in upper Cow Creek (below Galesville Dam). Viable habitat exists below Galesville Dam. Therefore hatchery-origin Coho Salmon could breed with other hatchery fish or with residing wild fish, resulting in genetic introgression. However, since this is the very upper dead end of anadromy in Cow Creek, and overall hatchery stray rates have averaged only 5% in the South Umpqua basin, this hatchery influence to the overall Coho population is minimal. Potential risks to wild Umpqua Basin Coho Salmon due to interbreeding with hatchery Coho include loss of genetic integrity within and between populations, and gene drift. To address this potential risk, Department personnel conduct the following risk avoidance measures:

- Random spawning surveys are conducted annually throughout the Umpqua population complex.
- Because the Smith River, lower mainstem Umpqua tributaries, upper South Umpqua, and upper North Umpqua are designated wild fish sanctuaries, hatchery smolts are not released in these areas. Coho Salmon juveniles are acclimated and released below Galesville Dam to promote adult homing to this area to provide a Mainstem fishery and return to adult collection sites.
- The current hatchery brood was founded and maintained with wild and hatchery adults returning to Galesville Dam on Cow Creek and South Umpqua River (Stock-18). This strategy was used to avoid or prevent common effects of using non-local breeding stocks and/or long-term domesticated stocks, such as changes in juvenile and adult run timing, foraging patterns, spawning behavior, and natal homing when compared to the wild population. To avoid these types of deleterious impacts, ODFW maintains a localized stock-18 brood and incorporates a limited number wild Coho into the hatchery brood annually.
- To track meeting the objectives of the OCCCP, hatchery stray rates will be monitored to see that they average less than 10% of the naturally spawning coho in any Umpqua population.

- All hatchery-reared smolts are adipose fin-clipped. Additionally, when funding is available, a subset of these fish are internally tagged with a coded-wire tag (CWT). The combination of external fin clips and internal tags allow hatchery-reared smolts to be readily identified and sorted from naturally produced fish during fisheries, broodstock collection, spawning surveys, etc.

(b) Broodstock Collection and Selection

Although hatchery protocols generally avoid intentional selection for particular traits (i.e. body composition, age, or size), some level of artificial selection is unavoidable. Just as natural selection imposes certain environmental strains on in-river species, and culls certain segments of a population, hatcheries will impose certain strains (and survival advantages) to fish rearing within the hatchery. Further, some management protocols may polarize (or further diverge) the wild population from the hatchery population. For example, hatchery Coho are released as one-year age smolts at a targeted size of 10 fish per pound. Hatchery smolts generally reach this size in April, are released soon after, and presumably emigrate within 2-3 weeks to begin their ocean phase life history. With this planned release strategy, hatchery Coho differ from their wild counterparts in that they display less size variation and a narrower migration period during smoltification. The benefit of swift emigration versus managing releases to more closely match the wild population is a planned management decision to optimize smolt emigration, ocean survival, and adult return.

However, to avoid or minimize long-term domestication, or selection, in the hatchery brood population, wild Coho will be infused into the South Umpqua (Stock-18) hatchery broodstock annually after the HGMP is approved by the NMFS. This is not without some risk, as collection of wild coho for broodstock will reduce the demographic size of the wild population and may drive the natural population below its effective population size: the minimum population size needed to maintain genetic diversity. Risk aversion measures employed to address these potential risks and maintain a wild-type hatchery brood across multiple generations, while minimizing impacts to the natural Coho Salmon population, include:

- Coho Salmon collected represent the spectrum of the run. During spawn time, the ripe fish are selected randomly from the pooled brood population and are spawned at a one-to-one, male-to-female spawning ratio.
- The proportion of wild fish collected to maintain the wild-type broodstock program will not exceed 2% of the natural run of the local breeding population in the South Umpqua. Per approval of this plan, or as guided by other policies or best available science up to 100% of the broodstock would be native natural Coho.
- Wild Coho Salmon adults will only be collected for broodstock if the expected return of wild Coho is greater than 1,000 fish. If wild returns to the South Umpqua are expected to be less than 1,000 adults, only returning hatchery fish will be used for broodstock.

Operating Winchester and Galesville dams may indirectly impact wild adult coho by

blocking or delaying natural migrations. As a result, adults may reject the collection trap, fall back, and spawn downstream in less suitable spawning grounds. In addition, handling coho at these adult collection/fish passage facilities may induce stress, which may inadvertently affect natural spawning behaviors. The combined result of these actions may displace adult spawning, both temporally and spatially. To avoid these risks, the Department does the following:

- ODFW staff use special care when handling adult fish to ensure that fish are released unharmed.
- ODFW and Winchester Water Control District regularly evaluate adult fish passage efficiency at Winchester Dam. Several improvements to the Fishway were completed in 1999, 2000 and 2006. Safety improvements for staff were made in 2010 and 2011. A lamprey ramp was installed in 2013, and the face of Winchester Dam was most recently repaired in 2013. Repairs to the dam are generally done in late August – mid September to minimize impacts to salmonids.
- ODFW staff regularly check the adult fish trap at Winchester Dam and count fish passing via a camera and recording device. Wild Coho may be detained and released during broodstock collection activities for other species such as spring Chinook Salmon, summer and winter steelhead. These hatchery programs are described in more detail in their respective HGMP's.
- The Galesville Dam collection site is located below the dam where Cow Creek anadromy subsequently terminates. There is no upstream passage built into this dam, so the fish linger in the area and can spawn near the terminal end of Cow Creek. Coho Salmon start arriving at the base of the dam in early November and collect in the pool area near the ladder through the end of the spawning season. Thus fish in the stilling pool represent the full spectrum of the run. When Coho Salmon are noted in the area by ODFW or Douglas County staff, the trap is turned on to start the attraction flow to bring fish into the ladder. If less than 50 fish were observed in the area the trap may operate for 48 hours without a visual check since the trap's raceway is capable of holding 4,600 pounds of fish. If more fish are in the vicinity the trap is checked daily. Depending on the number of fish present and whether additional fish are seeking entrance into the trap, Coho Salmon may be allowed to remain in the trap for 3 – 5 days prior transport or removal from the trap. As of 2006, the electric system of the raceway is triggered to an alarm system that notifies a phone tree if electricity is interrupted, impacting flow. Additionally an aeration system has been built into the trap for emergency purposes and access to the steps of the ladder has been improved to allow faster removal of the fish from the trap. Wild adults that enter the trap are either transported to the hatchery for broodstock or released back into the terminal pool below the dam. If deemed necessary, they could be moved to other locations in the Cow Creek sub-basin to naturally spawn. Hatchery Coho at this site are used for brood, recycled to the reservoir fishery, used for the food bank, or released back into the terminal pool below the dam.

(c) Competition and Carrying Capacity → Niche-Displacement

Carrying capacity is a function of both the population and its environment, and can be

defined as the upper limit of the population size that the environment can support. Hence, freshwater carrying capacity may be compromised if: 1) returning hatchery-reared adults out-compete wild adults for spawning beds, and 2) if hatchery Coho displace wild fish in their natural rearing habitats. Research documenting adverse effects of hatchery fish on the freshwater carrying capacity of salmonid streams is generally lacking.

Although the impacts that hatchery-origin Coho may have on naturally-produced Coho Salmon in the Umpqua Basin are not known, the Department manages the hatchery population to avoid negative impacts that may occur. For example, wild adults may unsuccessfully compete for spawning grounds; hence, their reproductive success may be compromised as a result of hatchery adults. Wild juveniles can be displaced as a result of residing hatchery juveniles and experience premature emigration, increased vulnerability to predators from being in more exposed areas, and competition for food and space. There is little evidence to suggest whether competitive interactions such as these exist, or not, within the South Umpqua River Coho population complex. However, the Department uses the following strategies to avoid or minimize risks associated with hatchery and wild coho competitive interactions and carrying capacity concerns.

- To minimize the impacts of niche-displacement or density-dependent effects, ODFW releases Coho smolts at times and sizes that are believed to promote emigration and prevent residualization, and subsequently minimize potential temporal and spatial overlap for food and cover.
- At least half of the South Umpqua Basin coho smolts are acclimated for 2-3 weeks in the pool below Galesville prior to release. The remaining smolts are released in the same pool and acclimate naturally prior to voluntarily emigrating. Acclimated release, versus direct release of large groups of fish, may reduce the impacts of density-dependent effects. Coho leave voluntarily, while experiencing on-site environmental cues and conditions such as flow, temperature, light, and weather conditions. These basin specific environmental cues, along with pre-migration imprinting, are believed to encourage adult homing and reduce straying.

The aggregate number of hatchery-origin Coho released from this program is 60,000 smolts into Cow Creek.

- Hatchery Coho smolts are released into the mainstem of Cow Creek (below Galesville Dam). Since most wild Coho fry/juvenile rear in the tributaries, this reach is not known to significantly overlap with naturally rearing wild coho populations in the Umpqua population complex; hence, hatchery coho smolts are spatially segregated from primary wild rearing areas.

In the past, most studies documenting ocean carrying capacity have targeted coho salmon productivity (e.g., Oregon Production Index) and density dependent associated mortality. Results have been mixed thus the extent and magnitude of ocean carrying capacity impacts resulting from hatchery coho releases are unresolved.

(g) Disease Transmission

Since disease transmission and its effects on fish populations result from multiple environmental factors and interacting causes, establishing definitive relationships is difficult. However, because hatchery coho are reared in a closed environment, and acclimated/released into Umpqua Basin, they may be a source of pathogen and disease transmission to wild populations. The Department recognizes the importance and magnitude of fish disease and health, and hatchery coho are managed to minimize disease transmission to wild populations. The fish health goal for Rock Creek Hatchery is to maximize survival at all life stages using disease control and disease prevention techniques. Refer to Appendix 1 regarding disease protocols and procedures to prevent the introduction of diseases, and prevent the spread or amplification of fish pathogens within the hatchery. All fish health management activities are conducted in accordance with ODFW Fish Health Management Policy and guidelines developed by the Pacific Northwest Fish Health Protection Committee and according to protocols outlined by the Integrated Hatchery Operations Team (IHOT 1995). The Department Fish Pathologists, along with hatchery staff, regularly monitor fish health status.

(h) Predation

Hatchery-origin Coho Salmon smolts that are volitionally released into the Upper Cow Creek are released into the pool directly below the dam, thus competitive interactions with wild fry and smolts and potential predation are reduced.

(3) Species that could positively impact the program:

Any hatchery- or wild-origin fish that die within the sub-basin enrich the stream environment, and thus positively impact the program fish. Placement of salmonid carcasses within the basin can also be used for nutrient enrichment may increase the productivity of the habitat and increase survival of program fish.

(4) Species that may be positively impacted through the program:

Any freshwater or marine species that depend on salmonids as a nutrient or food base may get benefits from feeding on hatchery-produced fish. Pacific salmon carcasses are an important source for nutrient input back to freshwater streams (Cederholm et al. 1999). Declines in wild salmonid populations may reduce overall ecosystem productivity, and thus alternate production of hatchery-reared salmon has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low natural 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.**

Water from Rock Creek is diverted into Rock Creek Hatchery at 30 cfs from October through June and from the North Umpqua at 25 cfs from July through September. Rock Creek experiences elevated stream temperatures and low flows in the summer months, and hence water is withdrawn from the North Umpqua River during these periods. This water usage is covered by the Water Rights (S 5890, S 8896, S 12003, S 17680 for Rock Creek; S 41447 North Umpqua) which are also listed in section 3.2. This also includes the water intake and associated annual maintenance and cleaning. The facility complies with the water rights, water withdrawals, and annual water uses reporting to Oregon Department of Water Resource.

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

The water intakes structures meet the NMFS' specified mesh screening criteria. The Rock Creek intake is equipped with 0.0689-inch polymer rotating screens and the North Umpqua intake is screened with 5/64 inch perforated aluminum panels. One hundred percent of the cleaning waste discharged from the facility raceways is abated into a large 100' x 80' pond before discharge to Rock Creek. Effluent discharge from Rock Creek Hatchery is monitored and data are reported quarterly to the Oregon Department of Environmental Quality as per requirements of the National Pollutant Discharge Elimination System general permit 300-J, to comply with the federal Clean Water Act). Rock Creek Hatchery also has USACOE permit NWP-2002-132/5; NMFS No. 2011/03901 for the operation and annual June cleaning of their North Umpqua intake. This permit allows the excavation of up to 100 cubic yards of gravel and sand to clear the fish hatchery intake. The project is located at North Umpqua River at RM 35.7, which is approximately 150 feet upstream of the confluence with Rock Creek. Work is performed from the adjacent shoreline bar with an excavator. As per National Marine Fisheries Service requirements, aggregate is returned to the river system by spreading materials over the adjacent gravel bar. For additional requirements, see permit NWP-2002-132/5. Discharge from cleaning normally occurs in June. The fish ladder at Rock Creek Hatchery was replaced, with construction concluding in 2012. The new ladder improved fish passage and includes a fish counting window and sorter. Software for fish counting is still being tested at the fish counting window and the sorter is not yet fully functional. Since there is no longer a hatchery program for North Umpqua coho, neither of these attributes would be used for coho.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adult fish for broodstock are collected at the following three locations:

- (1) Galesville collection raceway at the base of Galesville Dam on Cow Creek, a tributary of the S. Umpqua River in Azalea. The concrete collection raceway (60' X 15') is equipped with a false weir ladder and a power crowder. This facility is used to collect stock-18 Coho Salmon broodstock by turning on the water, which then fills the raceway and spills down a short ladder to the terminal stilling pool below the dam. The water provides attraction flow for the fish to move into the raceway. There is no fish passage above the dam.
- (2) Rock Creek Hatchery Raceway Entrance. This consists of a finger weir in the upper end of a passage channel ascending from Rock Creek. It guides fish into a 20'x 30' concrete and wood collection pen. The channel entrance is below the Rock Creek ladder and allows fish to swim directly into raceways at the hatchery before they reach the fish ladder. This site is no longer used to collect coho brood, but coho could inadvertently swim into this ladder when the channel is kept open for other species.
- (3) Happy Valley Trap on the lower South Umpqua River. This trap consists of a picket weir and fyke with a temporary holding area for adult salmon. The primary target at this trap is to collect fall Chinook Salmon, however the site may also be used to collect some wild Coho Salmon for stock-18 Cow Creek/South Umpqua Coho Salmon program.

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

- Transportation trucks are of three sizes: a 3,000 gal stainless steel tractor-trailer with liquid oxygen and agitators; a 2,300 gal stainless steel tanker with liquid oxygen; and a 1,000 gal steel tanker with refrigeration and oxygenation facilities.
- Insulated portable tank with diffused oxygen and spray aeration that has a holding capacity of 280 gallons of water.
- Insulated push-in aluminum tanks with diffused oxygen and spray aeration that hold 300 gallons of water.
- Non-insulated push-in aluminum tanks with spray aeration that hold 200 gallons of water.

5.3) Broodstock holding and spawning facilities.

Rock Creek Hatchery is the only facility used to hold and spawn coho. Holding facilities are concrete pens that measure 12' x 30'. The water depth is adjustable from 1.5' to 4' deep, but is normally kept at a depth of 4'. Water is supplied from Rock Creek from October through June and from the North Umpqua from July through September. Flow is

adjustable, but is normally set at 1.5 cfs. All adult salmon are held in this collection/holding pond until spawning. Spawning occurs in an adjacent hatch house building inside the shop area. The hatch house area is converted for this use during spawning periods only.

5.4) Incubation facilities.

At Rock Creek Hatchery, eggs are incubated in 20 Mari-source stack incubators. Supply water is filtered to 20 microns mesh and passed through a UV sterilization unit. The water supply is the same as the rest of the hatchery. Discharge water from incubation is returned to Rock Creek after passage to the pollution abatement pond.

STEP hatchboxes have had low mortality rates and average (less than 10%) for eyed eggs to unfed fry. The hatchboxes in the district operate on gravity flow systems. Each hatchbox site is inspected and approved by ODFW prior to any allocation. Hatchboxes were used prior to 2006 for Coho Salmon unfed fry releases, and as part of the Umpqua Coho Genetic Pedigree Project to compare survival from fry releases to that of smolt releases (Theriault et al. 2011). No Coho Salmon eggs are currently being reared in hatchboxes.

5.5) Rearing facilities.

Rock Creek Hatchery has 21 rearing containers of different sizes: two – 30' x 80' concrete raceways; six – 20' x 80' concrete raceways; six – 145' x 20' concrete raceways; one – 20' x 80' concrete raceway with a center wall; and six – 16' Canadian troughs. All these rearing containers are arranged with a single pass water flow system, and flows are adjustable in all containers. The raceways have a maximum depth of 5'.

5.6) Acclimation/release facilities.

Coho Salmon smolts are acclimated at:

- 1) Cow Creek/South Umpqua - Galesville net pens – one or two 20' x 30' x 12' net pens with 3/8 inch mesh suspended by PVC pontoons. Net pens are located in the Galesville stilling pool located below the dam.
- 2) Cow Creek/South Umpqua – Galesville pool – this is the terminal end of Cow Creek located below Galesville Dam and is near the net pens. Smolts acclimate naturally in the stilling pool prior to volitionally emigrating.

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

Fish Disease -

At Rock Creek Hatchery, disease outbreaks pose the greatest operational difficulty. Coho suffer from Cold Water Disease and Gill Amoeba. Cold Water Disease has been

controlled substantially by insertion of vexar substrate in incubator trays. Gill amoeba is successfully treated with Formalin. Coho have a very high resistance to *Ichthyophthirius multifiliis*, although the parasite is lethal to steelhead.

Storm Events -

A large November storm occurred in 1996, resulting in the collapse of the Rock Creek intake and the emergency release of 1,200 Coho Salmon broodstock into Rock Creek during the peak of the torrent. Consequently, 35% of that year's broodstock were retained during the next week. The new water intake system at the 2012 ladder includes self-cleaning screens. However, during high flow events, hatchery staff do have to also manually clean the screens. There is a chance that a flood event could plug the screens despite mechanical and manual efforts to clean the screens.

In 2005 a storm event led to a power outage in the middle of the night that interrupted water flow and aeration to the adult collection ladder at Galesville. Although the county was aware of the outage, the power could not be turned on for several hours due to the down wires. Due to 9 hours of captivity without electricity to operate the aeration system approximately 48 wild and 82 hatchery Coho died from oxygen deficiency. Since then the Douglas County Public Works Department has installed a non-electric source of back up water that can be sprayed into the raceway to continue aeration. In addition, since all outages are noted on the computer, any outage that cannot be re-booted within a few minutes from the Roseburg office will trigger a phone tree to county and ODFW personnel so that appropriate actions can be taken. Actions will include starting the backup aeration and evacuating the fish if necessary. In 2010 a large number of Coho Salmon entered the Galesville trap within 24 hours. While handling fish on the front side of the crowder, additional Coho entered the area behind the crowder and in the steps of the ladder. These fish had insufficient oxygen, and consequently about 7 wild Coho died. In cooperation with Douglas County measures were taken in 2011 to improve the aeration system behind the crowder and to improve access to the steps of the ladder so fish can be evacuated faster. The entrance of the ladder now also has a gate that can be used to prevent more fish from entering the ladder.

- 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.**

Rock Creek Hatchery

- Rock Creek Hatchery is equipped with a state-of-the-art 245 kw emergency generator which has the capacity to run the North Umpqua pump station and hatchery facility concurrently.
- The facility is staffed 24 hours per day, 365 days a year. All rearing and incubation containers are secured with low level water alarms connected to five personnel residences via Motorola radio and facility grounds audio siren in case of water emergencies.

- The hatch house is equipped with an intruder security system connected to same radio and siren.
- Both intakes are equipped according to NMFS fish screening criteria.
- The supply water entering the hatchhouse water is filtered to 20 micron mesh and UV sterilized before introduction to eggs and fry.
- Fish health is examined each month and appropriate measures are taken to prevent outbreak of diseases. Fish health is also inspected prior to transfer or release and only certified fish are released to prevent transmission of diseases.

ODFW Fish Health Management Policy (2003) and IHOT (1995) protocols are followed to prevent fish disease outbreaks and transmission of diseases. All propagation equipment is disinfected with chlorine or iodophore as it is received or dismissed from each station. Outbreaks of disease are responded to immediately and prudently with guidance from certified pathologists. If necessary, brood fish are prescribed a weekly treatment to prevent fungal growth/infection. Fertilized eggs are disinfected in iodophore for an hour, and then as prescribed to prevent fungal infections in incubating eggs.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

The North Umpqua research program ended 2011, thus South Umpqua Coho Salmon (stock-18) of both wild- and hatchery-origin will be used to sustain the mitigation/harvest program for the South Umpqua. Umpqua basin Coho Salmon are part of the Oregon Coast Coho ESU which was listed as threatened in 1998, delisted in 2005, relisted in 2008 and retained its threatened status upon review in 2011.

6.2) Supporting information.

6.2.1) History.

The Umpqua coho brood was originally founded in 1980 using adults returning to Smith River. Beginning in 1987, the brood was re-founded with adults returning primarily to Winchester Dam on the North Umpqua River (stock-55) and Galesville Dam on Cow Creek, a tributary to the South Umpqua River (stock-18). Through brood year 2005, a portion of the stock-18 brood were used to produce eggs for an unfed fry program at Glendale High School. The program released unfed fry in the South Umpqua basin on Windy Creek through 2006. This program was discontinued per a flood at the site and the OCCCP program. To provide harvest augmentation, the ODFW did have a North Umpqua hatchery Coho stock-55 program. Per the OCCCP, the program was

discontinued in 2005, with the last adults returning in 2007. The North Umpqua stock-55 was also used for an Umpqua Coho Genetic Pedigree research project (1999 -2005) and a PacifiCorps egg release research program (2009-2011). These stock-55 programs have concluded, thus the Coho Salmon stock-18 hatchery program is the only active Coho Salmon program in the basin.

Wild or hatchery Coho Salmon adults may still swim into a collection area at Rock Creek Hatchery on the North Umpqua River during collection for other species. All Coho will be sorted and released back into Rock Creek. Happy Valley Trap on the South Umpqua River can be used as broodstock collection site for the South Umpqua stock-18 program to provide some wild coho for integration into the broodstock. The main collection site for the stock-18 harvest/mitigation program is at the base of Galesville Dam. This collection facility was created below the dam to collect broodstock per the FERC mitigation plan. The facility has been in operation since 1986.

6.2.2) Annual size.

South Umpqua Stock 18 Brood: A total of 92 adults (46 pairs) will be collected annually to produce 60,000 smolts for harvest mitigation.

In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time, if and when this revision to Article 45 might occur. Currently, the FERC license holder has no plans to seek this modification.

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

From 1987 through 1998, less than 675 wild Coho Salmon were incorporated into the hatchery broodstock annually. From 1999 to 2005, a maximum of 458 wild Coho were annually spawned for broodstock. During this time period ODFW was using approximately 30% wild brood for its stock-18 and stock-55 hatchery programs and 100 pairs of wild Coho for the Umpqua Coho Genetic Pedigree Project. After the conclusion of the coho-55 hatchery program, up to 97 native Coho of stock-55 were annually collected during 2009 – 2011 for a PacifiCorp research program. This program has ended.

Since 2012, no wild Coho have been taken for broodstock. Once this HGMP is approved, and as guided by policies and best available science, up to 100% of the Coho stock-18 broodstock would be native natural Coho. No wild fish shall be taken as brood if the predicted number of wild fish return to the South Umpqua River is less than 1,000 fish and the number of wild brood shall not exceed 2% of the wild fish return. In addition to adult fish, some jacks may be taken in a similar proportion to the jack numbers observed in the wild run.

6.2.4) Genetic or ecological differences.

Although little is known about genetic or ecological differences between hatchery and wild coho, the Umpqua Coho Genetic Pedigree Project did document that reproductive success (RS) of second generation (F2) hatchery fish was lower than that of wild coho (Theriault et al. 2011). This was true of F2 progeny from unfed fry releases as well as smolt releases. Hatchery jacks had a RS more equal to wild coho. It is suspected that some aspect of hatchery mating or hatchery rearing of the early life-stages likely had some impact on the later reproductive success (Theriault et al. 2011).

6.2.5) Reasons for choosing.

Smith River coho stock was originally chosen as the founding stock for the North Umpqua program since it was an in-basin stock that was accessible for collection given specific criteria. For example, trap operations could be conducted throughout the coho run. There were also healthy numbers of wild coho in this breeding population and a relatively small percent of the wild fish (less than 25%) were used for hatchery broodstock. Once hatchery adults started returning to Winchester Dam and Rock Creek Hatchery, the Smith River broodstock collection was discontinued. Since then, wild and hatchery adults have been collected from the North Umpqua River (primarily from Winchester Dam, for stock-55 program) and South Umpqua River (from Galesville Dam, for stock-18 program), as both stocks are recognized by the TRT and OCCCP as populations of different geographic strata in the Umpqua 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.

Refer to section 3.5 for details. At present, the wild Coho Salmon population in the South Umpqua is considered sustainable. As mentioned previously, once this HGMP is approved the goal for the stock-18 program is to incorporate 10% native natural Coho into the broodstock. No wild fish would be taken as brood if the predicted number of wild fish return to the South Umpqua River is less than 1,000 fish. The number of wild brood shall not exceed 2% of the wild fish return. Incorporation of wild fish into hatchery program every year will help reduce genetic drift in the hatchery population to help minimize adverse genetic effects to wild fish if they interbreed. The average number of wild fish returning to the South Umpqua River in the past 10 years was >16,000 fish. So, even if all 92 brood fish were wild fish the impact would be <1.0%, and would have a minimum adverse impact to the wild population. Currently, no wild Coho are taken for broodstock.

Brood fish for Coho Salmon stock-18 program are collected throughout the entire run period, to minimize pressure on a particular section of the run as well as to preserve the genetic diversity of the populations. Brood fish are collected randomly to avoid bias for age and size. Jacks are incorporated into the broodstock at approximately the same ratio

as the in-season wild return. This brood selection method helps maintain genetic diversity and characteristics similar to natural run.

SECTION 7. BROODSTOCK COLLECTION

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

Adults will be captured for broodstock. In addition to adult collection, some jacks shall be collected and be incorporated into the broodstock at approximately the same ratio as the in-season wild return.

7.2) Collection or sampling design.

1) Rock Creek: (Native stock 55, Straying stock-18)

- The current raceway passage channel at Rock Creek Hatchery is opened when needed to augment brood collections if the number of adults captured at Winchester Dam is not sufficient to fulfill broodstock goals for North Umpqua hatchery programs. Fish returning via this channel swim directly into a raceway holding pen at the hatchery. This channel is operated for summer steelhead and spring Chinook Salmon hatchery programs. The only overlap in run timing would be if this channel were open September – November to collect additional summer steelhead. Any wild coho entering the facility would be returned to Rock Creek. Straying hatchery coho would be used for the ODFW stream enrichment (carcass placement) project in Rock Creek.
- The new 2012 sorter upstream of the hatchery will likely not be used during the time frame that coho would be present in Rock Creek. However, if it were used and coho were captured, the same strategies discussed above will be used for the accidental coho capture. In addition, hatchery fish might also be donated to local food banks. However since the North Umpqua Hatchery program has been discontinued it is expected that there will be few straying hatchery coho. The ladder provides upstream passage.

2) South Umpqua - Galesville Dam & Happy Valley (stock 18)

- ODFW and Douglas County personnel periodically operate the Galesville Dam trap from November through January. The goal is to capture the wild and hatchery Coho Salmon brood necessary (stock-18) to maintain the South Umpqua mitigation/harvest program. Coho gathering in the pool below the ladder represent the spectrum of the run. Coho for broodstock are randomly selected from the coho present in the fish trap. Hatchery fish not used for brood stock may be used for local food bank programs, used for nutrient enrichment, or left in the terminal pool of Cow Creek to spawn naturally (if consistent with achieving the stray rate goal in

the OCCCP). Wild coho are also left in the terminal end of Cow Creek but could be recycled lower in the system to enhance spawning if deemed necessary.

- Happy Valley trap may be used to collect wild brood for the stock-18 Coho Salmon program. Although the fish collected at this site would be representative of the South Umpqua basin, they would also be primarily representative of the early portion of the run since the trap is in the lower river system and cannot be operated during high flows.
- Jacks are incorporated into the broodstock at the approximate same ratio as the in-season wild return.

7.3) Identity.

All hatchery smolts are externally marked with an adipose fin clip so that all returning adults can be distinguished from naturally-produced (non-fin clipped) fish. As a result, returning hatchery adults can be identified by the lack of an adipose fin (fin clipped), and wild fish identified by the presence of an adipose fin (non-fin clipped).

7.4) Proposed number to be collected:

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

The goal is to collect 92 adults (46 pairs). A few jacks may be collected, reflecting the jack ratios in the run year (approximately 10%).

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

Table 7.4.2. Number of South Umpqua stock-18 Coho Salmon captured at Galesville Dam and Happy Valley Trap (both hatchery and wild), and wild only North Umpqua stock-55 Coho Salmon captured at Winchester Dam. Through BY 2005, there was an unfed fry program on Windy Creek.

Brood Year	Adult Females	Adult Males	Jacks	Eggs	Juveniles
2001	57	68	1	136,690	54,195
2002	59	55	5	163,346	99,480
2003	49	51	1	110,980	100,125
2004	102	85	3	232,465	178,523
2005	75	71	8	182,124	137,287
2006	46	55	6	123,937	116,802
2007	36	34	4	83,888	75,290
2008	43	37	3	82,762	75,061
2009	44	33	2	101,712	91,018
2010	34	30	0	100,616	95,793
2011	25	27	0	93,941	84,936
2012	50	35	3	103,292	92,799
2013	38	37	2		
	Winchester Dam (program ended in 2011)				

2009	50	47			
2010	40	40			
2011	31	36			

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

At Galesville, hatchery fish not used for brood stock may be used for food bank programs, used for nutrient enhancement or left in the terminal pool of Cow Creek if consistent with achieving the stray rate goals of the OCCCP.

7.6) Fish transportation and holding methods.

Fish transport time from Galesville Dam (stock-18) to Rock Creek Hatchery is approximately two hours, while transport from Happy Valley is approximately 1 hour. Adult Coho Salmon are transported in a fish liberation tank of 2,300-gallon capacity, with a maximum of 100 fish per trip, or are transported in portable tanks (200 – 300 gallon capacity) with loading rates of one pound of fish per gallon of water. Oxygen levels in transportation tanks are maintained at 9-11 ppm, and water temperature ranges from 45 to 50°F. No fish anesthetic is used during transportation, although PolyAqua or an equivalent product may be added to the tank to reduce potential handling abrasions.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish are treated with 167 ppm formalin for 1.5 hours upon receipt at facility and are further treated three times per week until spawning, to prevent fungal infections. Outbreaks of furunculosis are monitored regularly and antibiotic (oxytetracycline) injections can be used to treat, if necessary. Spawned adults are sampled and tested for viral and bacterial infection by ODFW’s centralized pathology unit. Tanks are disinfected with chlorine. All equipment is disinfected with iodophor.

7.8) Disposition of carcasses.

Carcasses are placed for nutrient recycling according to ODFW’s stream enrichment program, as per DEQ permits and current MOU guidelines.

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.

At present, the wild Coho Salmon population in the South Umpqua is considered sustainable. As mentioned previously, the goal for the stock-18 program, pending approval of this plan, additional policies and the best available science, is to incorporate up to 100% wild fish into broodstock each year. This number shall not exceed 2% of the wild run of the South Umpqua and no wild Coho Salmon will be used for brood if the run

forecast is less than 1,000 fish for the South Umpqua. Incorporation of wild fish into hatchery program every year will help prevent the genetic drift in the hatchery population and will help minimum adverse genetic effects to wild fish if they interbreed. The average number of wild fish returning to the South Umpqua River in the past 10 years is >16,000 fish. So, even if all 96 brood fish are wild origin the impact would be <1.0%, and thus would have a minimum adverse impact to wild population. See section 3.5 for further information.

SECTION 8. MATING

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

8.1) Selection method.

Ripe fish will be randomly selected for spawning, without any bias for particular traits (e.g. age, size, color etc.). Jacks may be selected for mating in a proportion, reflecting their proportion in the natural run. Fish are sorted (and randomly paired) weekly from October-December with selectivity towards ripe females. This ensures egg representation from the entire span of the spawning period.

8.2) Males.

Males are spawned once. A 1:1, male: female spawning ratio is maintained. Jacks are incorporated at random and are proportional to the population.

8.3) Fertilization.

Eggs are fertilized on a 10 male x 10 female matrix, to avoid selection bias, artificially increase the number in the spawning family and to help ensure genetic diversity in the offspring. Ovarian and tissue samples are drawn on 60 fish to monitor viral presence. Fish are examined by a fish pathologist to monitor overall health and condition. Fertilized eggs are water hardened in 100-ppm iodine for one hour.

8.4) Cryopreserved gametes.

Cryopreservation of gametes does not take place 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 natural fish resulting from the mating scheme.

- A randomly picked mating scheme representing the entire adult migration time is used to increase heterozygosity in offspring genotype. The entire window of spawn

timing is incorporated into the hatchery progeny to represent the full diversity of that brood year.

- A matrix mating process is performed to further randomize the mating process and to have increased genetic diversity in offspring.
- Once this HGMP is approved, broodstock will be comprised of at least 10% wild adults unless the donor population does not meet population level criteria described elsewhere or due to ODFW policies.
- Coho are selected and spawned randomly, while maintaining a 1:1, male-to-female spawning ratio.

SECTION 9. INCUBATION AND REARING

Specify any management *goals* (e.g. “egg to smolt survival”) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

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

Table 9.1.1. Data showing number of eggs taken and mortality rates of South Umpqua Coho Salmon (stock-18) program, 2001 - 2013.

Brood Year	# eggs taken	Egg Loss %	Fry Loss %	Juvenile Loss %	Smolts released	Smolt goal
2001	136,690	57.3%	NA	NA	61,555	60,000
2002	163,346	29%	NA	NA	61,143	60,000
2003	110,980	4.2%	NA	NA	65,113	60,000
2004	232,465	10.4%	7.4%	5.6%	121,005	60,000
2005	182,124	12.2%	1.1%	3%	88,884	60,000
2006	123,937	4.2%	1.7%	5.3%	120,652	60,000
2007	83,888	7.4%	3.1%	7.4%	72,017	60,000
2008	82,763	5.0%	4.5%	2.5%	73,542	60,000
2009	101,712	8.3%	2.4%	10.7%	66,000	60,000
2010	100,616	4.2%	0.6%	2.7%	61,045	60,000
2011	93,311	3.6%	5.7%	8.7%	60,037	60,000
2012	103,292	7.7%	6.8%	8.8%	60,056	60,000
2013	73,866	2.9%	2.9%	NA	NA	60,000

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

We do not anticipate having a surplus of eggs unless fecundity is significantly higher than average. In this case surplus eggs (more than what is needed to produce +/-10% of 60,000 smolts on average) will be destroyed as per the ODFW Hatchery Management Policy.

9.1.3) Loading densities applied during incubation.

Rock Creek

Trays are Mari-source replica to Heath

Green egg size @ 125 per ounce.

Eyed egg size @ 75 per ounce.

Density for green in trays is 200 ounces per tray.

Egg density in tray for hatching eggs @ 80 ounces per tray.

Water flows in incubator is set @ 5 gallons per minute for egg and fry incubation.

9.1.4) Incubation conditions.

At Rock Creek Hatchery, incubation temperatures are monitored and recorded @ 8 am and 4 pm daily. Hatch house water is filtered through 20 micron mesh and then UV sterilized. Oxygen is randomly monitored and is generally at 100% saturation. When required, water temperature may be increased or decreased to unify rates of development between fish of different spawning dates. This method may also be used to otolith marking when necessary.

9.1.5) Ponding.

Rock Creek – Coho Salmon fry at Rock Creek Hatchery are forced ponded @ 99% button-up, while length of fry is 36 mm and the weight is 1,200 fish/lb.

9.1.6) Fish health maintenance and monitoring.

Rock Creek Hatchery -

At Rock Creek Hatchery, green eggs are water-hardened in iodophor for 1 hour.

Pathology samples of fish tissues and ovarian fluid to check for viral infection are taken from each brood. To prevent eggs from fungal infections, incubating eggs are treated with formalin at 1,250 ppm for 15 minutes, four times per week. Hatch house water is disinfected with ultra violet filtration. There is no incidence of yolk-sac malformation at this facility.

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.

At Rock Creek Hatchery, eggs are incubated in filtered water to minimize loss due to silts. Early rearing of fry is also conducted in filtered and UV sterilized water to minimize losses due to diseases. Chemical treatment of eggs during incubation is applied to protect eggs of listed as well as hatchery fish from infectious diseases. All chemically-treated wastewaters are diverted to pollution abatement pond for sufficient dilution before discharge.

9.2) Rearing:

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

See Section 9.1.1 regarding mortality data by life stage at Rock Creek from 2001 – 2013.

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

The rearing density and loading criteria relative to flow and space at Rock Creek Hatchery (for temperatures below 58 degrees F) are:

Fish density and water flow = 8 lbs fish/gal/min.

Fish poundage and rearing space = 1.0 lb/ft³.

9.2.3) Fish rearing conditions.

Rock Creek Hatchery- Water temperature is monitored three times per day. Dissolved oxygen is monitored when there are potential adverse conditions, such as low flows and/or high temperatures (mid 60's or above, degrees Fahrenheit). Rearing containers are flushed or cleaned one to two times per week, as needed. Flow and rearing densities are monitored on a monthly basis.

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. Monthly fish growth (number of fish/lb) for Rock Creek Hatchery Coho Salmon program.

Month	Weight (fpp)
April	804
May	268
June	129
July	73.2
August	46.7
September	28.6
October	21.9
November	19.5
December	16.5
January	14.8
February	12.4
March	11.3

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

See Table 9.2.4 for monthly fish growth information at Rock Creek Hatchery. No energy reserve data are available.

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

Food Type	Range for Use (fpp)	Feeding Rate (% BWD)	Food Conversion (avg)
BioVita Starter #0	1000 - 570	2.8	0.74
BioVita Starter #1	570 - 300	2.6	0.80
BioVita Starter #2	300 - 150	2.5	0.88
BioClark's Fry 1.2mm	150 - 90	2.1	0.90
BioVita Fry 1.2mm	150 - 90	2.1	1.03
BioClark's Fry 1.5mm	90 - 60	1.5	0.95
BioVita Fry 1.5mm	90 - 60	1.5	0.97
BioClark's Fry 2.0mm	60 - 25	1.2	1.36
BioClark's Fry 2.5mm	25 - 9	0.6 – 1.0	1.29

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

Fish health and behavior monitoring occurs daily. Mortalities are collected and analyzed daily. Pathology examinations scheduled as needed for prophylactic and therapeutic treatments. Parasitic and bacterial infections are treated as per prescriptions by Department fish pathologists. Viral infections are monitored by Department fish pathologists. Disinfecting is the primary prevention of lateral transfer of viral infection. See Appendix 1, for Fish Health Protection Procedures at Rock Creek Hatchery.

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

Usually fish age, size, behavior, and coloration are used as indication for smoltification. No ATPase enzyme activity data has been collected to-date.

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

Natural stream/river water is diverted to hatchery for stock-18 Coho Salmon fry rearing. Smolts are allowed to acclimate via net pens or the stilling pool and emigrate volitionally after release.

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.

At Rock Creek Hatchery the stock-18 Coho Salmon fry are reared to smolts stage and returned to upper Cow Creek for net pen or natural acclimation in the stilling pool to decrease stray rates to other places in the basin. The smolts are 100% adipose fin clipped for identification for targeted harvest, broodstock collection and monitoring. The raceways at Rock Creek are appropriately screened so that while these fish are being reared they cannot escape into the North Umpqua.

SECTION 10 RELEASE

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

10.1) Proposed fish release levels.

Table 10-1. Proposed release numbers.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	60,000 ± 10% 20,000 ± 10%	10/lb 10/ lb	April-May April-May	Cow Creek (stock 18) Galesville Reservoir ^a

- a. In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time, if and when this revision to Article 45 might occur. Currently, the FERC license holder has no plans to seek this modification.

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

Table 10-2. Smolt and unfed fry release locations.

Stream	Watershed Code	Fish Age	Release Point	Watershed	Basin
Cow Creek	1600500000	Smolt	RM 60	South Umpqua	Umpqua
Galesville Reservoir	1673000000	Smolt	~RM 65	South Umpqua	Umpqua ^a

- a. In addition to Cow Creek releases, the ODFW reserves the right to stock coho smolts into Galesville Reservoir as an additional fishery. In order for this stocking to occur however, the Reservoir Fishery Management Plan (Article 45) for the FERC license (Project No. 7161) should be modified to include the stocking of coho salmon. It is unknown at this time, if and when this revision to Article 45 might occur. Currently, the FERC license holder has no plans to seek this modification.

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

Table 10-3. Data of stock-18 coho eggs and unfed fry released into Windy Creek and smolts released in Cow Creek, South Umpqua.

Release Year	Eggs/Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size	Release Date
2003	35,000	1,200/lb	N/A		N/A		61,555	9.9/lb	
2004	45,000	1,200/lb	N/A		N/A		61,143	10.4/lb	
2005	74,837	1,200/lb	N/A		N/A		65,113	9.6/lb	
2006	63,801	1,200/lb	N/A		N/A		121,005	12.6/lb	4/18 - 5/12
2007			N/A		N/A		88,884	11.5/lb	4/16 - 5/8
2008			N/A		N/A		120,652	9.8/lb	4/7 - 4/28
2009			N/A		N/A		72,017	10.5/lb	4/13 - 5/1
2010			N/A		N/A		73,542	10.4/lb	4/19 - 5/4
2011			N/A		N/A		66,000	11.4/lb	4/25 - 5/19
2012			N/A		N/A		61,045	11.7/lb	4/12 - 5/3
2013			N/A		N/A		60,037	10.1/lb	4/10 - 5/7
2014			N/A		N/A		60,056	9.8/lb	4/1 - 5/1
2015			N/A		N/A		62,999	9.5/lb	4/6 - 4/29

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

Smolts released into the South Umpqua basin are placed directly into net pens in Cow Creek at the base of Galesville Dam or released into the terminal pool below the dam. Smolts in the net pens are acclimated for three weeks and released volitionally by dropping one side of the net to allow escape. Releases are in April or May during peak smoltification (Table 10-3). Release dates range from April 1 to May 19th with the peak of releases occurring during the last 2 weeks of April and first week of May. Release dates vary due to annual differences in water temperature which impacts the speed at which the fish grow. The program generally net pens about 50% of the smolts. Smolts not placed in the net pens are released in the terminal stilling pool at an earlier date to acclimate naturally and emigrate volitionally.

10.5) Fish transportation procedures, if applicable.

Juvenile fish from Rock Creek Hatchery are transported to the acclimation site (Cow Creek) in insulated tanker trucks, and the transportation time is approximately 2 hours. Liberation trucks are equipped with oxygen tanks, and oxygen monitoring devices. Fish densities do not exceed one lb per gallon of total tank volume.

10.6) Acclimation procedures.

Generally, 50 – 100% of the Coho Salmon smolts are acclimated in net pens (for a three

week period) prior to release into Cow Creek. If <100% smolts are acclimated in net pens, the remaining smolts are released in the terminal pool near the acclimation site and allowed to acclimate naturally and emigrate volitionally.

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

All smolts (100%) are adipose fin clipped. Coded-wire-tags may be used on a certain percentage of the fish if funding is available.

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

We do not anticipate having significant surpluses of smolts, however there will be years where the release number is above or below the goal due to normal fluctuations in survival. We anticipate that the number of smolts released will average 60,000.

10.9) Fish health certification procedures applied pre-release.

Fish are examined for parasites, viral and bacterial infection 30 days prior to release by a certified ODFW pathologist and only certified fish are released per ODFW's Fish Health Management Policy, and only certified fish are released. See Appendix 1, for Fish Health Protection Procedures at Rock Creek Hatchery.

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

Rock Creek Hatchery – ODFW staff will contact the District Biologist to initiate pre-established contingency plan, which may entail releasing or transferring broodstock to alternate hatcheries; releasing indigenous juveniles (in priority) to prescribed release date; and holding remaining species on life support until transport is available.

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.

Fish are reared to one-year smolt size and released volitionally at peak smoltification and migration time to ensure increased survival and minimized competition with native species in natal areas. Total smolt release numbers have declined since 1998 to lessen competition with natural-origin smolts. Unfed fry programs were also discontinued in the South Umpqua basin. Additionally, the entire Smith River subbasin, mainstem Umpqua tributaries, upper South Umpqua subbasin above Cow Creek, and upper North Umpqua River above Steamboat Creek are designated wild fish sanctuaries.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

A description of monitoring and evaluation for each Performance Standard is provided in sections 1.9 and 1.10 of this document. The evaluation measurements for each Performance Standard are written in italics with individual indicators enumerated.

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

As with all state programs, budgets are approved by the Legislature for a two-year period. No commitment of funds can be made past the approved budget period. Funds for various projects associated with this hatchery program come from a variety of sources including license dollars, state general funds and federal sport fish restoration funds as well as a variety of other federal funds (BLM, USFS, etc.). Funds are committed for portions of the program monitoring, but can change with relatively short notice.

The South Umpqua stock-18 Coho Salmon program is conducted under a FERC Mitigation agreement with Douglas County. Consequently Douglas County provides funds for this program.

The State of Oregon has demonstrated a long-term commitment to the evaluation of natural Coho Salmon abundance coast wide. For Coho Salmon management purposes the Umpqua Basin is identified as one of the five gene conservation areas (GCA). Statistically rigorous Coho Salmon spawning abundance estimates have been made annually in each GCA since 1990. Part of this commitment is to evaluate the presence of hatchery origin adults in natural spawning habitats.

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.

NMFS has evaluated the fishery research program under consideration of the ESA research limit of the July 2000 4(d) Rule (July 10, 2000; 65 FR 42422). ODFW concurs with this determination and will conduct research activities in accordance with the conditions and requirements of the approved program.

SECTION 12. RESEARCH

12.1) Objective or purpose.

The Umpqua Coho Genetic Pedigree Project was conducted by Oregon State University and the ODFW. This project concluded in 2010. Findings from this research project to evaluate relative reproductive success, plus smolt and unfed fry survival were published in the following peer reviewed journal publications:

Theriault, V., Moyer, G.R., Jackson, L.S., Blouin, M.S., and Banks, M.A. 2011. Reduced reproductive success of hatchery Coho Salmon in the wild: insights into most likely mechanisms. *Molecular Ecology*

Theriault, V., Moyer, G.R., and Banks, M.A. 2010. Survival and life-history characteristics among wild and hatchery Coho Salmon returns: how do unfed fry differ from smolt releases? *Canadian Journal of Fisheries and Aquatic Sciences*. 67:486-497.

Moyer, G.R., Blouin, M.S., and Banks, M.A. 2007. The influence of family-correlated survival on Nb/N for progeny from integrated multi- and single-generation hatchery stocks of Coho Salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences*. 64:1258-1265.

Additional Genetic/Environmental Research: May be conducted if funding and technology becomes available to sample returning natural and hatchery broodstock for genetic characteristics, and/or environmental factors such as chemical concentrations and/or toxicology issues. Such studies may also require to sample hatchery juveniles or eggs. Samples (tissue, scale, organ, etc.) would be determined by the best science available used for the evaluation.

North Umpqua Stock-55 Research Project: It was a BACI design to evaluate the effects of large woody debris density to increase the carrying capacity of streams for juvenile coho production. This project was conducted by PacifiCorp. To date there are no published results, however the ODFW completed its brood obligations to this program in 2011.

Winchester Dam Fallback rate: During 2010 and 2011 as broodstock were being collected for the PacifiCorp program, additional coho were floy tagged at Winchester Dam. The purpose of the tagging was to determine how many coho drop back over the dam after initial passage and to compare Winchester Dam counts with spawning ground counts. To date there are no published results, however less than 1% of the coho dropped back over the dam after initial passage.

Other research includes monitoring coho numbers via the Winchester Dam counting station camera, OASIS spawning ground surveys and data analysis, and periodic creels. These projects are part of the NFCP, HMP, OCCCCP and other ODFW policy and

guidelines for monitoring the population.

12.2) Cooperating and funding agencies.

Douglas County has a FERC agreement (7161) for the mitigation of Galesville Reservoir, thus provides funding for the South Umpqua, stock-18 hatchery Coho Salmon program.

The Umpqua Fishermen's Association cooperatively helps the ODFW via assisting with brood stock collection of stock-18 Coho and the acclimation and release of the smolts. If surplus hatchery fish are captured, they may be donated to local food bank programs.

The PacifiCorp settlement agreement included a research program using wild stock-55 coho eggs. This program was concluded after egg placement in 2012.

The Umpqua Fish District also has multiple partnerships with other agencies and conservation groups. Depending on need and potential internal and external funding, these partnerships can be utilized to assist research efforts.

12.3) Principal investigator or project supervisor and staff.

Greg Huchko, District Fish Biologist, Umpqua Watershed. Principle Investigators:
Umpqua ODFW Fish District, Roseburg, OR

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

Not applicable (NA).

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

- OASIS spawning ground surveys follow protocols established by ODFW 2007.
- Statistical creels are periodically conducted to evaluate harvest or to ensure meeting of quota goals. These creels are established using ODFW protocol.
- Use of tissue from brood fish for genetic or environmental analysis, following ODFW or cooperating lab protocol.
- At Winchester Dam there is a camera system in the count room which records all fish which pass upstream using the ladder. During the coho run, this counting is used to determine the stray rate of the coho-18 hatchery fish in the North Umpqua. The camera counting of fish is also used instead of OASIS spawning ground surveys for estimating the North Umpqua coho population.

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

September through January.

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

NA

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

NA

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).

NA

12.10) Alternative methods to achieve project objectives.

The use of non-ODFW protocol for spawning ground surveys or creel would generate results that may not be statistically accurate. The methods may produce some insight and generalities, but could not be used to estimate actual harvest or population levels.

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

NA

12.11) 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.

Staff conducting any research project will be properly trained in fish identification and handling and proper walking in streams with redds present.

SECTION 13. ATTACHMENTS AND CITATIONS

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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: Timothy Walters, Umpqua Watershed District Manager, West Region, ODFW

Signature of Applicant: _____ Date: _____

Certified by: Scott Patterson, Fish Propagation Program Manager, ODFW, Salem

Signature: _____ Date: _____

Appendix 1

Fish Health Protection Procedures at Rock Creek Hatchery

The fish health monitoring plan is per ODFW Fish Health Management Policy, as well as the plan developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin Anadromous Salmonid Hatcheries, Annual Report 1994, Bonneville Power Administration).

- Each month fish health monitoring will be conducted by a qualified fish health specialist.
 - Annually examine brood stock for the presence of viral reportable pathogens. Number of individuals examined, usually 60 fish, will be great enough to assure a 95% chance of detection of a pathogen present in the population at the 5% level. American Fisheries Society “Fish Health Blue Book” procedures will be followed. With wild adult steelhead stocks generally all fish are sampled for viruses at spawning.
 - Annually screen each salmon brood stock for the presence of *R. salmoninarum*. Methodology and effort will be at the discretion of the fish health specialist.
 - Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
 - Investigate abnormal levels of fish loss when they occur.
 - Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
 - Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
 - Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
 - Fish culture practices will be reviewed as necessary with facility personnel. Where and when pertinent, nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures, and treatments will be discussed.
-