

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Cowlitz River Early Winter Steelhead
Species or Hatchery Stock	Early Winter Steelhead (<i>Oncorhynchus mykiss</i>) Cowlitz Trout Hatchery
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz/Lower Columbia
Date Submitted	
Date Last Updated	April 19, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

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

Steelhead (*Oncorhynchus mykiss*)/Early Winter Run/Cowlitz Trout Hatchery

ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson Cowlitz Complex Manager
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
Tacoma Public Utilities	Funding Source and Cowlitz Trout Hatchery Facilities Owner

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

Operational Information	Number
Full time equivalent staff	8.0
Annual operating cost (dollars)	\$985,000.00 (Specific costs to program cannot be broken out separately).

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1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Hatchery Early Steelhead (Cowlitz River- Hatchery Returns)
Broodstock collection location (stream, Rkm, subbasin)	Cowlitz Trout Hatchery/Cowlitz River/Rkm 66.0/Cowlitz Subbasin
Adult holding location (stream, Rkm, subbasin)	Cowlitz Trout Hatchery/Cowlitz River/Rkm 66.0/Cowlitz Subbasin
Spawning location (stream, Rkm, subbasin)	Cowlitz Trout Hatchery/Cowlitz River/Rkm 66.0/Cowlitz Subbasin
Incubation location (facility name, stream, Rkm, subbasin)	Cowlitz Trout Hatchery/Cowlitz River/Rkm 66.0/Cowlitz Subbasin
Rearing location (facility name, stream, Rkm, subbasin)	Cowlitz Trout Hatchery/Cowlitz River/Rkm 66.0/Cowlitz Subbasin

1.6 Type of program.

Isolated Harvest Program

1.7 Purpose (Goal) of program.

The goal is to provide hatchery produced steelhead for recreational fishing in the Cowlitz River.

1.8 Justification for the program.

The Cowlitz River Basin supported both winter and summer steelhead runs, although historically, winter steelhead were the dominant form. Prior to the completion of the Mayfield and Mossyrock Dams, the upper basin produced up to 22,000 winter steelhead annually. The construction of Mayfield and Mossyrock Dams blocked access to approximately 50% of historical spawning habitat (Myers et al. 2003). Adult steelhead enter the Cowlitz River from mid-November through June with the early winter (non-endemic) stock returning predominantly in late November through January as opposed to the late winter steelhead local stock returning from March through June and spawning from March to June (SaSI 2002). Since the hatchery opened, the early winter steelhead program has been a significant regional fishery annually from November to January.

By the late 1990's, most indigenous anadromous populations in the Lower Columbia ESU including the Cowlitz River system were either depressed, proposed for, candidate species or listed under the Endangered Species Act (ESA). The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, FERC No. 2016, August 2004). In order to achieve these goals, the endemic hatchery stocks will serve as gene banks for native Cowlitz basin stocks of fish and be used to rebuild and restore wild stocks and provide continued harvest opportunities. The non-endemic early winter steelhead program has been reduced to current levels of 300,000 smolts to reduce impact on the late winter stock. This has been more than a 300% reduction of levels from 1991-2000 (913,598).

The program will be consistent with the Cowlitz River Fisheries and Hatchery Management Plan (FHMP) proposal to operate hatchery programs rearing salmonids native to the Cowlitz River as

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Integrated, and all non-native species as Segregated (The Cowlitz River Project, FERC No. 2016, August 2004). WDFW will continue to run the program as a segregated stock. The program will be managed for early spawn timing, heavy harvest opportunity and preventing fish from accessing the upper basin. The program utilizes early winter stock derived from adults returning to the Cowlitz Barrier Dam and Blue Creek trap (Cowlitz Trout Hatchery) and the size of the program has been tailored to meet harvest objectives, based on the Cowlitz Hydroelectric re-licensing process and research/M&E activities (FERC 2016). Early winter steelhead used for the program are not native to the Cowlitz River with the broodstock origin Chambers Creek stock (Puget Sound).

Both, current and future lower and upper river steelhead production are described by the Fisheries and Hatchery Management Plan (FHMP) submitted by Tacoma Power for the Cowlitz River Hydroelectric Project (FERC No. 2016). WDFW has implemented restrictive regulations permitting the retention of marked adult hatchery steelhead only and requiring the release of naturally produced adult steelhead. All hatchery steelhead released in the action area are externally marked with an adipose fin-clip to allow for these selective fisheries. WDFW will manage the tributary harvest of summer and winter steelhead stocks in the action area not to exceed a maximum harvest rate of 10% of the natural spawning population, although the actual impacts are expected to be closer to 5%. The Cowlitz Hatchery barrier dam located below Mayfield Dam prevents early winter steelhead from accessing stream reaches above this point. The ability to discriminate hatchery/natural origin fish assures that the program/stock adheres to the proper isolated harvest stock criteria, and prevents introduction of winter steelhead in the upper Cowlitz River and tributaries.

The program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish. To reduce interactions between hatchery and ESA-listed fish, hatchery production for all species, production figures through out the 35 year re-licensing term in the remodeled facility will be established after rebuild (>2008) and negotiations with NOAA, WDFW and Tacoma Power (Cowlitz Hydroelectric Project FERC NO. 2016).

WDFW protects listed fish and provides harvest opportunity on the steelhead programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) approved by NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

To minimize impact on listed fish by the Cowlitz River early winter steelhead program, a number of risk aversions are included in this HGMP (Table 1).

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Table 1. Summary of risk aversion measures for the Cowlitz early winter steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	<ul style="list-style-type: none"> Water rights are formalized from the Department of Ecology. Monitoring and measurement of water usage is reported (monthly NPDES reports).
Intake Screening	4.2	<ul style="list-style-type: none"> Intake and screen criteria compliance with NOAA determined. Structures have been assessed; updates or needed remodel and capitol costs determined in the proposed hatchery rebuild (>2008).
Effluent Discharge	4.2	<ul style="list-style-type: none"> This facility operates under the “Upland Fin-Fish Hatching and Rearing” National Pollution Discharge Elimination System (NPDES) general permit. Conducts effluent monitoring and reporting and operates within the limitations established in its permit. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Discharges from the cleaning treatment system are monitored.
Broodstock Collection & Adult Passage	7.9	<ul style="list-style-type: none"> Safe handling protocols in place. Listed fish returned back to stream. Broodstock collection procedures can identify listed fish.
Disease Transmission	7.9, 10.11	<ul style="list-style-type: none"> <i>Fish Health Policy in the Columbia Basin.</i> <i>Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995).

1.9 List of program "Performance Standards".

See section 1.10 below.

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

Benefits 1.10.1

BENEFITS		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Provide hatchery early winter steelhead for recreational harvest.	Release up to 300,000 winter steelhead smolts annually or until after rebuild (>2008) production has been determined. Program fish provide a freshwater fishery.	All releases are properly documented. Estimate harvest rates and catch of program fish.
Assure that hatchery operations support the current recovery/mitigation agreement between Tacoma Power and WDFW.	Contribute to a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 7-year average of 1.55 % smolt-to-adult survival that includes harvest plus escapement (12,385 fish at current production levels).	Survival and contribution to fisheries will be estimated for each brood year released. Work to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of Washington Department of Fish & Wildlife (WDFW) hatchery programs	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments	Participate in annual coordination meetings between the co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity	A minimum of 200 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return Maintain effective population size.	Annual run timing, age and sex composition and return timing data are collected. Adhere to WDFW spawning guidelines. (WDFW 1983)
Program fish are identifiable	Use mass-mark (adipose-fin clip) for selective fisheries (wild steelhead release)	Verify that mark quality goals are being met by mark efficiency checks during marking and at release. Quantify the number of program fish released and observed in the fishery to evaluate survival, performance, contribution to the fishery, and return to the hatchery rack.
Release groups are in a smolted condition	Release groups meet State Steelhead Rearing Guidelines.	Document size, age, and indicators of smoltification including: coefficient of variation (CV), standard deviation (STD) and condition factor (K or C).

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Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Smolt release groups will meet WDFW fish health standards. Releases will be volitional as much as possible dependent on existing facilities.	WDFW Fish Health Section inspects adult broodstock yearly and monitors juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy
	Inspection of adult broodstock	At spawning, lots of 60 adult broodstock are examined for pathogens
	Inspection of off-station fish/eggs prior to transfer to hatchery	Control of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy.

1.10.2 Risks:

RISKS		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Minimize impacts and/or interactions to ESA listed fish	Hatchery juveniles are raised to smolt-size (5.0 - 5.5 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Program fish are checked for signs of smolt fitness close to release time.	As identified in the HGMP: Monitor size, number, date of release and mass mark quality.
Production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and instream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures accessed with future plans and priority fixes evaluated to meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations	Temporal differences in run timing between hatchery steelhead and wild late winter steelhead. Mass mark release to enable state agencies to implement selective fisheries.	Use trap and collection facilities to document the run times of returning summer steelhead and late winter steelhead.

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

Up to 200 adults are needed for the program at 4,200 eggs fecundity (2003). Egg take goal is 420,000 (FBD 2004).

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

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (Rkm)	Major Water-shed	Eco-province
Yearling	300,000	4.5-5.0	April 15- May 20	Cowlitz River and Blue Creek (Rkm 0.8)	66.0	Cowlitz	Lower Columbia

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

For steelhead, the expired WDFW/Tacoma Power Settlement Agreement (SA) stated mitigation levels are to be an average of the last five years for anadromous production (including sea-run cutthroat) with a total adult return level of 38,600 fish. Based on the data presented in the Cowlitz Hatchery Program Evaluation Report for 2000, 1,100,000 hatchery smolts (early, late, and summer) would need to be released each year to achieve the benchmark. The total steelhead program would be comprised of 450,000 indigenous winter steelhead, 200,000 non-indigenous early winter steelhead, and 450,000 non-indigenous summer steelhead raised to a release size ranging from 5 to 8 fish per pound. The number of juveniles released to meet the adult benchmark is based on the assumption that the composite hatchery steelhead survival will average 1.9 percent.

In the previous Settlement Agreement (SA), production goals for steelhead were mitigated for a total adult return level combined with winter steelhead and sea-run cutthroat. This was part of the WDFW/TPU mitigation agreement level for an average of 38,600 adults (Tipping and Harmon Annual Reports through 2002). Current program performance is in **table 2**.

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Table 2. Cowlitz early winter Steelhead Program Performance.

Year	Releases	Sport Harvest ^a	Hatchery Escapement ^b	BY	Releases	SAR %
1995	621,471	2,931	3,751	1993	621,471	1.08
1996	602,432	2,269	9,210	1994	602,432	1.91
1997	740,816	1,981	7,438	1995	740,816	1.27
1998	768,192	1,947	1,705	1996	768,192	0.48
1999	542,286	4,393	2,994	1997	542,286	1.36
2000	926,739	4,431	3,375	1998	926,739	0.84
2001	510,138	17,993	1,867	1999	510,138	3.90
2002	292,545		3,146	Avg		1.55
2003	210,849		2,223			
2004	218,577		2,506			
Average	543,405	5,134	3,822			

a) Sport harvest totals from WDFW Annual Steelhead Harvest Summary.

b) Escapement back to the rack is reported from Cowlitz Salmon and Cowlitz Trout Hatcheries.

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

The early winter steelhead program began when the Cowlitz Trout Hatchery was completed in 1967 with release of non-endemic early winter (Chambers Stock) beginning in spring 1968.

1.14 Expected duration of program.

Winter steelhead production is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, now operated under the new license (effective date of July 18, 2003). The license is for a term of 35 years and expires July 18, 2038.

1.15 Watersheds targeted by program.

Cowlitz/Lower Columbia

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 key issues of the early winter steelhead program in regards to ESA listed fish are the impacts of hatchery smolts on lower river Chinook, coho and late winter steelhead. For hatchery winter steelhead, predation, disease and competition along with genetic introgression are impacts on the listed fish. Handling of listed fish occurs during adult collection at the Cowlitz Salmon hatchery separator unit with both hatchery and wild fish are collected, sorted, held and distributed to any number of programs scenarios including upper river adult reintroduction (FHMP). The program releases a yearling smolt at a time, size and condition factor per WDFW Steelhead Rearing Guidelines (July 31, 2001). The steelhead guidelines indicate the weight, length frequency and condition factors at release that results in rapid emigration behavior and minimizes residualism. All releases are made below the Cowlitz River barrier dam downstream of the Tilton River/Lake Mayfield system and the Upper Cowlitz system above Lake Scanewa. Significant reintroduction and recovery programs for fall and spring Chinook and coho salmon along with winter steelhead and sea run cutthroat have been ongoing in those areas since 1996. Natural production from upriver areas are collected at the CFFF and released as smolts from the salmon hatchery after acclimating in the stress relief ponds. Smolts of all wild fish range from 101.7 – 199.2 mm fl depending on species (Serl and Morrill 2004). By this time, the upriver production is at a size and condition indicating rapid emigration from the lower river. Releases occur almost exclusively at Blue Creek where intense bank pressure congregates at the main “clay bank hole” and below the junction of Blue Creek with the river. The Cowlitz Hatchery Boat ramp provides access to the river in the Blue Creek vicinity. The purpose of the release of the Chambers stock steelhead into the Cowlitz River is to continue an early steelhead sport fishery while eliminating a directed harvest on wild summer steelhead. Adults are trapped at Cowlitz Salmon Hatchery (CSH) and are spawned and incubated at Cowlitz Trout Hatchery (CTH). Returning hatchery steelhead that are trapped at the Barrier Dam are marked and returned to the river just above the confluence with Blue Creek (Rkm 66.1) for additional harvest opportunity or broodstock collection.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: Eliminate the program. This action would eliminate potential interaction with the natural population and eliminate impacts on other ESA listed species.

Pros: Eliminating the early winter steelhead program would eliminate any potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression. It is unknown if avian or mammal predation that occurs on hatchery smolts would then be shifted 100% to listed stocks in this scenario.

Cons: Currently, steelhead studies on the Kalama River Research Station indicate that early and late winter (wild stocks) can be managed in the same system especially where separation for upriver endemic stocks can occur. Eliminating the early winter steelhead portion is not considered acceptable at this time; currently this program supports a very popular sport fishery and significant economic benefits statewide and the Lower Columbia River region. The late winter steelhead program will need to recover at both a level to support upriver goals and shift some of the timing to an earlier timing to replace the loss of early Chambers stock otherwise little opportunity to harvest fish would exist and place increased harvest pressure on wild fish. If the program was eliminated, the goals of the Cowlitz Basin Fish Management Plan (WDFW), Cowlitz Fish Hatchery and Management Plan (FHMP) and Settlement Agreement (FERC 2016) would not be met. Thousands of hours of bank fishing would be eliminated from the early winter season November – January of the year as well as significant personal boating and guide trips through out

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the same period. Pressure would be shifted to other rivers less capable of sustaining the fishing effort.

Alternative 2: Reduce the program per FHMP proposals A reduction of 33% of the program steelhead production has been proposed after rebuild (>2008).

Pros: In the new SA, the Cowlitz Complex facilities will be remodeled by 2008 and the production for all indigenous and non-endemic stock programs are being proposed for reductions (FHMP). In large part, reductions for non-endemic summer and early stock winter steelhead are proposed in order to reduce the impacts to listed fish. Actual impacts to listed fish from non endemic stocks have not been evaluated in the Cowlitz system. Reducing production might reduce densities in rearing units and provide space for future hatchery programs. Reducing densities can help with some disease problems if rearing density were the problem.

Cons: Reductions are based on reducing indirect potential impacts on listed fish even though specific evaluations on those impacts have been conducted. Further reductions in the current program could reduce hatchery production below threshold levels that would effect the harvest benefit.

Alternative 3: Retain current production

Pros: Continue to manage the Lower Cowlitz River system as a significant segregated winter steelhead producer in Western Washington. The large size of the Cowlitz River is conducive to large boats for guide trips and significant access is still available to bank anglers at release points and other locations. The early winter timed harvest follows the coho run and provides a continuous harvest opportunity until the late winter run materializes in February and March..

Cons: Potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression would remain at current levels or increased. Depending on hatchery remodel, pond design configurations for increasing smolt quality could be offset by current levels of production or any increases. Funding for production would take away from other priorities in the area.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: There would be a negative impact region wide to elimination of the program. Angling restrictions would likely become more restrictive to protect any wild summer run fish in the Cowlitz system or in other neighboring systems due to the increase in pressure. Evaluating the impact would require funding.

Reform/Investment 2: Reducing the program per FHMP proposals would size the program to the new remodel design in order to benefit fish culture rearing parameters to produce high quality smolts.

Reform/Investment 3: Funding for maintaining the current production or increases would be needed. Potential lower river release and retention sites would need to be developed to concentrate releases below significant stretches of the lower river productivity of listed fish.

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

None, although NOAA Fisheries has consulted on the operations of all the fish production activities at these facilities as part of a Columbia River basin wide hatchery biological opinion in 1999 for listings prior to 1998. On March 23, 2004, NOAA Fisheries (Consultation No. 2001/02045) issued a Biological Opinion for the ESA Section 7 permit for the Cowlitz River Hydroelectric Project (FERC No. 2016).

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Spring Chinook	M	L
Cowlitz Fall Chinook	L	L
Coweeman Fall Chinook-Natural	H	M
Toutle Fall Chinook	M	L
Late Winter Steelhead	H	L
Coho- (Proposed)	Na	Na
Chum-	Na	Na

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

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

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

None.

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

Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*) are listed as “threatened” under the ESA on May 24, 1999.

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) listed as “threatened” under the ESA on May 24, 1999.

Lower Columbia River Steelhead (*Oncorhynchus mykiss*) listed as “threatened” under the ESA on March 19, 1998.

Lower Columbia River Coho salmon (*Oncorhynchus kisutch*) within the Lower Columbia River/Southwest Washington Evolutionary Significant Unit (ESU) were proposed as threatened under the federal Endangered Species Act in 2004 (NOAA 69 FR 33101; 6/14/2004).

Columbia River Chum salmon (*Oncorhynchus keta*) listed as “threatened” under the ESA on March 25, 1999.

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2..2.3 Describe the status of the listed natural population (s) relative to “critical” and “viable” population thresholds.

Critical habitat designations for LCR chinook salmon, LCR steelhead, and CR chum salmon are no longer in effect (68 Federal Register (FR) 55900 (Sept 29, 2002). Recovery planning interim viability criteria for the Willamette/Lower Columbia domain were developed by the WLCTRT (McElhany et al. 2003). Current and future recovery goals and population targets have been established for Chinook, coho, chum and steelhead populations in the LCR ESU by the Lower Columbia Fish Recovery Board (LCFRB Basin Plans 2004).

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*): Cowlitz Hatchery Spring Chinook are integrated with the Upper Historic population under NOAA’s proposed listing determination (69 FR 33102; 6/14/2004). The current spring Chinook hatchery stock is listed as a core genetic legacy population in the Cowlitz system (Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Natural escapement levels in the lower river below the barrier dam (which include hatchery-origin fish) are typically only 200 to 400 fish (SaSI 2002), although escapement in 2003 and 2004 have increased significantly (**Table 3**). Estimates of adults above Mayfield Dam in the 1960’s indicated approximately 9,900 spring Chinook (Serl and Morrill 2004). Currently, significant numbers of adults have been transported the past few years approaching these numbers. Current carrying capacity for spring Chinook smolts in the upper Cowlitz basin is 311,000 smolts (Serl and Morrill 2004). Current productivity in the upper system is approximately 225,000 smolts although less than 40,000 - 45,000 smolts (19%) can be collected at the CFFF (Serl and Morrill 2004). Spring Chinook short and long term objectives for the programs are covered in Section 5.1 (FHMP). Tacoma Power continues to truck adults above the Cowlitz Falls Dam as part of the anadromous reintroduction program.

Table 3. Spring Chinook Abundance Estimates in the Lower Cowlitz River

Year	Lower Cowlitz River	Year	Lower Cowlitz River
1990	320	1998	356
1991	284	1999	285
1992	279	2000	266
1993	236	2001	347
1994	167	2002	419
1995	347	2003	1,937
1996	36	2004	1,793
1997	455	2005	

Source – Lower Columbia Region FMEP 2003 and WDFW Spawning Surveys (2004).

Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*): In 1951, the fall chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951). Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001 the goal had not been met since 1989 (SaSI 2002). In 2002, escapement was 1,427 while 2003 had 10,329 and 4,466 were reported for 2004 (**Table 4**).

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Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing but adults are taken to the Tilton River.

Coweeman River: Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). SaSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; status today is depressed (SaSI 2002).

Toutle River Fall Chinook. Natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited in WDW 1990). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990). From 1990–2001, escapement in the South Fork Toutle system averaged 57 fish although significant increases in fall Chinook escapement for 2002 and 2003 reflect the Lower Columbia River trend for those past 2 years.

Table 4. Fall chinook salmon abundance estimates in the Cowlitz System.

Year	Coweeman River	Cowlitz River	Green River	SF Toutle River
1990	241	2,698	123	0
1991	174	2,567	123	33
1992	424	2,489	150	0
1993	327	2,218	281	3
1994	525	2,512	516	0
1995	774	2,231	375	30
1996	2,148	1,602	667	351
1997	1,328	2,710	560	0
1998	144	2,108	1,287	66
1999	93	997	678	42
2000	126	2,700	852	27
2001	646	5,013	4,951	132
2002	891	14,427	7,452	444
2003	1,082	10,329	13,806	137
2004	1,550	4,466	4,108	603

Source – LCR FMEP (2003) up to 2001. 2002 – 2004 data from WDFW database.

Lower Columbia River Steelhead (*Oncorhynchus mykiss*): In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The Cowlitz system had six historical populations including three core (Cispus, Upper Cowlitz, and N.F. Toutle) populations. All are winter steelhead stocks and the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Late winter steelhead have been reintroduced into the upper system (**Table 5**).

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Table 5. Late Winter Steelhead Adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked STHD			RV – Right Ventral Clip			AD – Adipose Clip			Totals
	UM- Female	UM- Male	UM- Jack	RV - Female	RV - Male	RV – Jack	AD- Male	AD – Female	AD - Jack	
1996-7	22	12	0	5	14	0	0	1	0	54
1997-8	6	5	0	5	1	0	26	23	0	66
1998-9	15	24	13	10	29	3	6	49	8	157
1999- 2000	108	107	0	28	73	0	19	77	0	412
2000- 01	133	125	37	71	122	20	70	124	27	729
2001- 02	346	419	1	174	492	1	453	898	3	2,787
2002- 03	316	205	2	335	241	0	933	497	3	2,532
2003-4	146	146	4	100	167	0	214	619	1	1,397
2004-5										
Totals										

Source - *DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT*

Lower Columbia River Coho: Cowlitz Hatchery coho stock are integrated with the Upper and Lower Cowlitz historic population under NOAA's proposed listing determination (69 FR 33102; 6/14/2004). Presently, most Cowlitz River coho are of hatchery origin. Mayfield Dam has blocked tributaries above river kilometer (rkm) 83.2 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton and upper Cowlitz and Cispus rivers. The Washington Department of Fisheries estimated coho escapement at about 32,500 fish in 1951. Coho counts past Mayfield from 1961-66 averaged 24,579. Hatchery-produced returns averaged 24,997 adults and 9,723 jacks in 1980-94 with a peak of 54,685 adults in 1986 and 19,178 jacks in 1987. The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz (**Table 6**) and the Tilton River system since 1996.

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Table 6. Hatchery Coho adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked Coho			AD – Adipose Clipped Coho			Totals
	UM-Female	UM-Male	UM-Jack	AD - Female	AD - Male	AD – Jack	
1996-7	0	0	0	932	594	629	2,155
1997-8	0	0	0	2,774	1,262	464	4,500
1998-9	0	0	0	4,128	4,140	3,154	11,422
1999-2000	2,398	2,383	120	10,594	11,635	7,197	34,327
2000-01	514	778	284	14,653	16,674	9,566	42,469
2001-02	1,150	1,644	96	15,504	21,564	1,497	41,455
2002-03	3,661	4,688	416	23,698	30,490	6,300	69,253
2003-04	3,477	4,511	484	9,526	11,169	6,143	35,310
2004-05							
Totals	11,200	14,004	1,400	81,809	97,528	34,891	240,891

Source - *DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT*

Columbia River Chum salmon (*Oncorhynchus keta*) listed as “threatened” under the ESA on March 25, 1999. Chum were reported to historically utilize the lower Cowlitz River and tributaries downstream of the Mayfield Dam site. Typically less than 20 adults are collected annually at the Cowlitz Salmon Hatchery with adults hauled downstream to suitable spawning habitat areas. In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries.

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: The following hatchery activities are identified in the ESA Section 7 Consultation “Biological Opinion on Artificial Propagation in the Columbia River Basin” (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Listed fish are not taken in the broodstock operation for this program. Approximately 20-100 wild early-winter steelhead are identified and taken to the upper Cowlitz basin.

Broodstock Program:

Broodstock Collection: The Cowlitz Barrier Dam adult collection facility enables the program to discriminate all returning adult fish according to hatchery and natural origin fish, since the program fish releases are 100% marked. A certain number of summer fish can be trapped at the Cowlitz Trout Hatchery. The ability to discriminate hatchery/natural origin fish assures that the program/stock adheres to proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. All wild salmonids collected are transported to the upper Cowlitz basin and tributaries for natural spawning.

Genetic introgression: Spawn timing has shifted to early in the season. Spawning will occur from December (50%) through January (50%) and will be completed by January 31 although it has proven difficult to get 50% of the eggs taken during January as most females ripen in

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December. Spawning ground data indicate a few wild steelhead redds begin to appear in early to late March, abundance peaks in late April to early May, and last redds are constructed in late May to early June (Lower Columbia Steelhead Conservation Initiative (LCSCI). Decreasing production is likely to further reduce the number of early winter adults potentially straying into late winter steelhead spawning areas in the lower river.

Rearing Program:

Operation of Hatchery Facilities: See HGMP section 4.2.

Disease: Although Cowlitz Salmon or Cowlitz Trout Hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000). *C. Shasta* is not believed to be transmitted egg to egg or fish to fish (WDFW).

Release:

Hatchery Production/Density-Dependent Effects: Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW. Since 2000, releases of early winter non-local steelhead have been reduced to current levels of 300,000 smolts which is more than a 300% reduction of levels from 1991-2000 (913,598).

Competition: Studies and monitoring programs on many systems throughout Washington indicate that salmon and steelhead smolts released from hatchery programs especially in larger river systems migrate rapidly downstream with migration rates of approximately 20 river miles per day observed by steelhead smolts in the Cowlitz River (Harza 1998). Once in the lower Columbia River mainstem of tidal influence, in a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 Rkm daily respectively.

Predation: Hawkins and Tipping (1999) reported that in 1998, nearly half of the hatchery steelhead smolts sampled on the Lewis River, Washington contained Chinook salmon fry and the smolts had consumed a mean of 1.13 fry each. The variable predation rates cited above were associated with extremes in Chinook salmon fry abundance; low predation rates had low spawner densities and high predation rates had high spawner densities. In the absence of site-specific empirical information, the identification of risk factors can be a helpful tool for reviewing hatchery programs.

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Cowlitz River though is a large river system averaging 6,664 and 7,490 cfs during April and May (Real Time average 1934- present). Below I-5, the Toutle River, a large tributary of the Cowlitz River adds another 2,000 – 2,600 cfs to the system.

Dates of Releases: Steelhead are released mid-April to May 1st. Listed Chinook from the Lower Columbia ESU believed to be present in many systems over a wide rearing and migration window from March thru August. 90% of listed chum in the lower Columbia ESU have typically migrated by May 1st (Rawding 2004). Listed winter steelhead can be emerging during the release period with 50% swim up occurring by mid-June (LCSI Draft 1998).

Relative Body Size: Salmonid predators were thought to be able to prey on fish up to

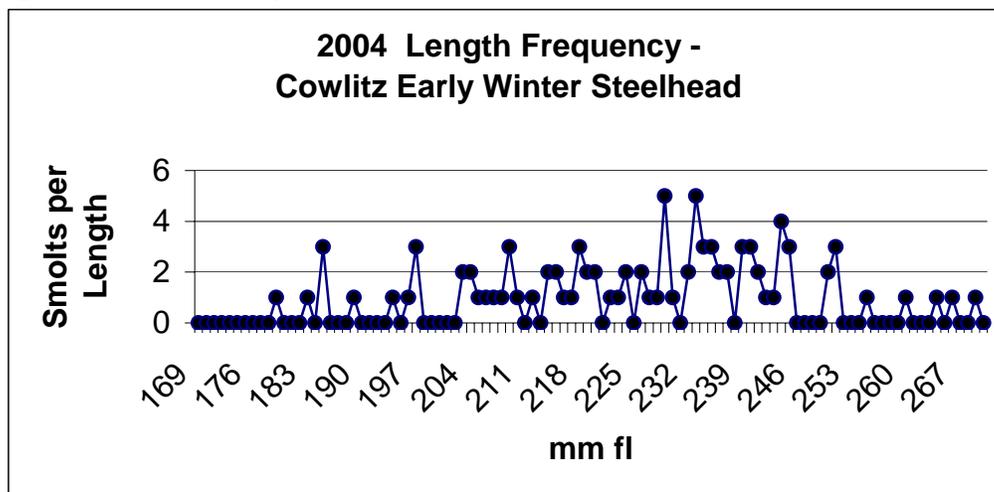
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approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length or larger in aquarium environments (Pearsons et al. 1998). The “33% of body length” criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the “33% of body length criterion” until further data for individual rivers can be collected.

Release Location and Release Type: The release from the Cowlitz Salmon Hatchery is directly to the lower river at Rkm 78.8. This is below the upper river productivity. It is likely that a significant portion of migration and dispersal of the hatchery program occurs before peak emergence of listed winter steelhead. Although the release is not totally volitional, most fish quickly vacate the pond as soon as screens are removed.

Residualism: To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, active pond management, size, and release guidelines (Steelhead Guidelines, July 2001). Condition factors including a lean .90-.99 K factor and co-efficient of variation (CVs) of less than 10% are steelhead rearing guidelines. Ideally, 95% of released fish would be over 180 mm fl. with most smolts 190-210 mm fl. From length frequency data (**Figure 1**), 1 fish out of the 100 lengths sampled upon release in spring 2004 were found to be less than 180 mm fl (179 mm fl). Non-growing fish that could potentially residualize are removed throughout the rearing cycle during mass marking or size grading by winter and not released to anadromous waters but can be planted in lakes for additional harvest.

Figure 1. Cowlitz Early Winter Steelhead Plants



Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once reaching the Columbia River, fish appear to travel quickly. Median Travel Time of subyearling chinook, on the mainstem Columbia River, from McNary to Bonneville Dam was estimated to average 8.0 days (29.2 Rkm/d) during the years 1997 to 2003 (Memo- Michele DeHart to Bill Tweit (WDFW), 2003). In a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17,

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and 35 RKm/d respectively. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring Activities: In the new SA, interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

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

Listed fish are not used in the broodstock for this program.

In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities.

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

Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, who along with the Complex Manager would determine an appropriate plan and consult with NOAA if needed.

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.

The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and Chinook in the ESU.

For ESU-wide hatchery plans, the steelhead production from Cowlitz Salmon Hatchery was described in the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin and the 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Current production numbers can vary from past productivity levels and reflect reductions in programs due to ESA concerns.

Hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. The following is a list of guidelines, policies and permit requirements that guide WDFW Columbia hatchery operations:

- *WDFW Steelhead Rearing Guidelines*. Details rearing guidelines and rearing parameters statewide (July 31, 2001).
- *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
- *Spawning Guidelines for Washington Department of Fisheries Hatcheries*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).
- *Stock Transfer Guidelines*.
- *Fish Health Policy in the Columbia Basin*.
- *National Pollutant Discharge Elimination System Permit Requirements*

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

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003). The new thirty-five year license was issued March 13, 2003, and became effective on July

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18, 2003. Tacoma Power has contracted with the Washington Department of Fish and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.

- The Cowlitz Fish Hatchery and Management Plan (FHMP) is part of the new Settlement Agreement (Article 6).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

3.3 Relationship to harvest objectives.

General harvest objectives are to provide fishing opportunities consistent with the mandates of WDFW, US v. Oregon, and other state and federal legal obligations. This management strategy is to maximize harvest opportunity of hatchery origin early winter steelhead in the lower Cowlitz River, while providing protection of natural origin fish.

The releases of adipose-fin clipped "early" winter steelhead provide sport harvest opportunity for anglers in the Cowlitz and lower Columbia rivers. Selective harvest regulations allow only the harvest of adipose-fin clipped steelhead in the lower Columbia River. Below the barrier dam, at the Cowlitz Salmon Hatchery, anglers may harvest only adipose-fin clipped steelhead. "Late" winter steelhead adults with a right ventral fin clip that return to either facility are transported and released in the upper Cowlitz watershed to provide a harvest opportunity for anglers and provide additional spawners for the restoration program. Specific harvest rates for hatchery steelhead are unknown, however punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest (**table 7**).

Table 7. Cowlitz Early Winter Steelhead Sport Harvest.

Year	Releases	Sport Harvest
1995	621,471	2,931
1996	602,432	2,269
1997	740,816	1,981
1998	768,192	1,947
1999	542,286	4,393
2000	926,739	4,431
2001	510,138	17,993
2002	292,545	
2003	210,849	
2004	218,577	
Average	543,405	5,134

3.4 Relationship to habitat protection and recovery strategies.

The re-licensing impact associated with Tacoma Power and Lewis PUD continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts are to fish and wildlife but the following pertains to fish only and include:

- (1) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration;
- (2) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish;
- (3) impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level;
- (4) impacts to resident and anadromous fishes downstream of the dams caused by project-related

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flow-dependent habitat changes;

(5) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations;

(6) impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport;

(7) changes in dynamics of fish-predator interactions resulting from change in fish escape options;

(8) changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife);

(9) interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish;

(10) inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several FERC Settlement Agreement articles are addressing passage way problems in the system including: 1 (Downstream Fish Passage for Riffe Lake and Cowlitz Falls), 2 (Downstream passage for Mayfield Lake) and 3 (Upstream Fish Passage for the barrier Dam, Mossyrock and Mayfield) deal with future proposals and improvement needed for restoring processes upstream and down. Additionally a fish habitat fund of up to 3.0 million dollars for identified projects has been created (Article 11).

Additional Processes:

The following processes have included habitat identification problems, priority fixes and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004).

Sub-Basin Planning

Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. *The Lower Columbia fish Recovery Board (LCFRB)* has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection

Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA)

A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven subbasins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

3.5 Ecological interactions.

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Below are discussions on both negative and positive impacts relative to the steelhead program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Steelhead smolts can be preyed upon through the entire migration corridor from release to the mainstem Columbia River estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can predate on chinook smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Based on PIT tags recovered at a large Caspian Tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids from the Columbia reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1998). River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, other hatchery fish may be a source of competition for Cowlitz steelhead smolts.

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run chinook salmon ESU (threatened); Snake River spring/summer-run chinook salmon ESU (threatened); Lower Columbia River chinook salmon ESU (threatened); Upper Columbia River spring-run chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be “overgrazed” when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system. There are no species that are known to directly positively impact the program. Multiple hatchery programs salmonids releases into the Columbia river system along with listed species (section 2), benefit the program by providing additional predation opportunity in the Columbia mainstem and estuary. Numerous non-salmonid fishes sculpins, lampreys and sucker etc. also would provide the same indirect benefits.

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and

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Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrophic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996).

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.

The Cowlitz Trout Hatchery has three sources of water:

- 1- 9 shallow wells on both sides of the river supply up to 5 cubic feet per second (cfs). This water is used for initial rearing and to alter water temperature. Water from the North Well has some bacteria and gas problems. Due to this problem, Tacoma Public Utilities (TPU) has installed power to the South Wells until a system upgrade is completed. In the fall of 2000, the North Well was not utilized and may be abandoned.
- 2- Ozonated river water: A ozone plant is used to disinfect up to 20 cfs of river water. This water is used from May to late November/ early December to avoid pathogens (primarily *Ceratomyxa shasta*) in the river water. The ozone plant has a auxiliary electrical generator. The plant cannot supply the volume of water needed from early December to mid-May. Plant is operational from mid-May to early December. Although a longer operation period would be desirable, capacity of this facility will not allow it.
- 3- The river intake is able to supply 50 cfs of river water or 20 cfs while the ozone plant is operating. The ozone plant is the first one designed specifically for hatchery use. This plant is capable of producing 200 pounds of ozone daily.

The temperature of the river supply ranges from 4° to 16°C, and only rarely exceeds 15°C, while water supplied from the wells has a more stable thermal regime that ranges from 8° to 12°C (Harza 1997a in FERC 2001). Water discharged from the hatchery into Blue Creek is a little warmer than the Cowlitz River during spring and summer. The DO levels of the Cowlitz Trout Hatchery effluent, which flows into Blue Creek, are typically 1-2 mg/L lower than the Cowlitz River (Harza 2000 in FERC 2001). River water is strictly a backup water source in case of well water system failure. Re used well water from incubation units is redirected to early rearing units.

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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.

Potential Hazard	Risk Aversion Measure
Hatchery water withdrawal	At Cowlitz Trout Hatchery, fish propagation water rights total almost 87 cfs including incubation water (wells) and surface water and are formalized thru trust water right S2W19839C and others* from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below).
Intake/Screening Compliance	The Cowlitz Trout Hatchery River intake structure complies with NOAA Fisheries' <i>Anadromous Salmonid Passage Facility Guidelines and Criteria (draft, January 31, 2004)</i> for juvenile fish life stages. The approach velocity and screen types are compliant, but concern remains with wild fry in the vicinity of the Trout Hatchery. This is in part due to the greater numbers of fry that could exist downstream of the barrier dam. In the current plans for the Cowlitz River Hatchery rebuild though 2008, no major modification of the intakes at Cowlitz Salmon or Cowlitz Trout Hatcheries are proposed by TPU. TPU is awaiting NOAA's Anadromous Salmonid Passage Facility Guidelines and Criteria policy to determine if the intakes will require upgrading of the intakes and exploring the possibility of new screen materials and end seals meeting draft NOAA criteria. Some type of electrical barrier in the structure might also be considered to improve the existing situation (WPU comments on the Draft Hatchery Complex Remodel and Phase-in Plan).
Hatchery effluent discharges. (Clean Water Act)	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). WAG 13-1034. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Adherence with the NPDES permit will likely lead to no adverse effects on water quality from the program on listed fish. Discharges from the cleaning treatment system are monitored as follows: <i>Total Suspended Solids (TSS)</i> C1 to 2 times per month on composite effluent, maximum effluent and influent samples. <i>Settleable Solids (SS)</i> C1 to 2 times per week on effluent and influent samples. <i>In-hatchery Water Temperature</i> - daily maximum and minimum readings are monitored.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

The Cowlitz Trout Hatchery has an adult trapping and holding facility that includes a weir and fish ladder in Blue Creek. Adult hold facility consists of three adult ponds @ 10' X 150' X 5'. Fish are hand sorted and handled according to the Cowlitz Complex Adult Fish Handling Protocol. Fish are returned to the river via truck from this facility.

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam across the Cowlitz River with an associated fish ladder with significant attraction features. The effective length of the barrier weir crest is 318 feet. The fish ladder supplies fish to the sorting, transfer and holding facilities. Adult fish to be transported are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

The main attraction feature of the Cowlitz Salmon Hatchery fish ladder is located above the barrier dam adjacent to the fish ladder. It diverts a significant amount of attraction water into the mouth of the fish ladder. This diversion has a bar screen with 7/8 in. clear rack bar spacing. Gravity intake control is achieved by use of a vertical slot weir equipped with a motor operated closure gate. This unit has no screening. An auxiliary vertically-slot entrance is provided at the left bank end of the barrier dam for the purpose of attracting fish from the left bank area to the transport area under the barrier and subsequent movement to the ladder facilities.

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

Adult fish, and occasionally juveniles, that are to be transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

Juvenile fish being released or transferred between facilities utilize the above trucks and the 1,500 gallon fish tanker assigned to the Cowlitz Trout Hatchery. All vehicles have juvenile and adult handling capability. They all have oxygen and recirculating systems. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon fiberglass tank and several 250 gallon tanks) are utilized for moving fish around and between the facilities. The 1,500 gallon tanker assigned to the trout hatchery has a hydraulic loading boom for loading adults from the trout hatchery adult ponds.

5.3 Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Raceway	1472.2	34.0	10.0	4.33	1300

The Cowlitz Trout Hatchery has three adult holding ponds @ 10' X 150' X 5' .

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Fish collected at the Cowlitz Salmon Hatchery for broodstock are held in ponds that are 20' X 100' X 5.5'. From the fish ladder separation facility fish can be sorted to two of these ponds. Broodstock can be transferred to a number of other ponds via direct pond to pond transfer or by handling, after anesthesia, in the spawning room and returning to a chosen pond via a return tube.

At the Cowlitz Trout Hatchery fish are sorted, if mature and needed for spawning, to a holding area in one of the adult ponds. From this holding area the females are killed and placed on a drying rack out of the pond. After the eggs are taken, males are netted up and placed into a small holding container into which carbon dioxide is diffused. Once the males are anesthetized, they are live spawned and then returned to the pond.

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Shallow Trough (2 tier) with incubation baskets	50	3.5-5.0	7.165/trough	20000 (5 baskets per trough)	21000 (1 basket per trough)

5.5 Rearing facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
50	Shallow Troughs	7.165	14.33	1.0	0.5	5.0	1.0	0.25
3	Fry Racways	4500	90	20	2.5	300	1.0	0.25
4	Concrete Raceways	5340	90	20	2.67	1000	1.0	0.25
1	5.0 Acre Lake	1856000	1450	160	8.0	4000	1.0	0.25

5.6 Acclimation/release facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
50	Shallow Troughs	7.165	14.33	1.0	0.5	5.0	1.0	0.25
3	Fry Racways	4500	90	20	2.5	300	1.0	0.25
4	Concrete Raceways	5340	90	20	2.67	1000	1.0	0.25
1	5.0 Acre Lake	1856000	1450	160	8.0	4000	1.0	0.25

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

The de-nitro towers deteriorated and caused significant gas bubble disease problems during the 1999-2000 incubation phase. Outbreaks of *Ceratomyxa shasta* have caused some significant fish mortality in the past. Installation of an ozone treatment facility in 1994 has decreased mortality significantly.

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.

Safeguards to insure an uninterrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply two of the four river water intake pumps, the north well and the ozone plant. All water sources and head boxes of all raceways are equipped with low water alarms. The water intake structure also has an alarm for the river water, south well water and the north well water. All wells and river pumps are also alarmed. The river water is a source of numerous pathogens. This water is disinfected by the ozone plant during the warmer rearing months. Since water is reused between numerous ponds the possibility for the spread of infection is inherent at the facility. Normal fish culture hygiene is practiced. Flooding and muddy water occasionally occurs even though the river level is controlled by three dams.

Section 6. Broodstock Origin and Identity

6.1 Source.

The program utilizes locally adapted non-endemic early winter stock derived from adults returning to the Cowlitz Barrier Dam and Blue Creek trap (Cowlitz Trout Hatchery).

6.2.1 History.

The early winter steelhead program at the Cowlitz Trout Hatchery started in 1967, when the hatchery was completed. The early winter steelhead program that was started in 1945 at the Chambers Creek Hatchery (located in the Puget Sound near Tacoma, Washington) used Chambers Creek stock winter steelhead. This early-timed winter steelhead stock was combined with Cowlitz River winter steelhead at a 1:1 mix of Chambers Creek and native Cowlitz River fish (Crawford 1979). Elochoman River early steelhead stock (Chambers Creek derivative) was also used in the past.

The current program continues to use early winter steelhead returning to the Cowlitz Trout Hatchery for broodstock. To minimize impacts to listed late winter steelhead, production has been reduced and releases only occur at the hatchery. Recent studies have shown that Chambers Creek stock steelhead exhibit relatively low reproductive success in the wild. The early winter steelhead have been found to be genetically distinct from the late winter steelhead, but concern remains because there is still some spawn timing overlap between the two groups.

6.2.2 Annual size.

Up to 200 adults are collected for the broodstock program. Since 1995, total returns to the both the Cowlitz Trout and Cowlitz Salmon Hatcheries range from approximately 1700 – 9,200 steelhead.

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

The early steelhead stock is not native to the Cowlitz River with broodstock for the winter steelhead was originally from the Chambers Creek (South Puget Sound) Skamania Hatchery (a mixture of Washougal and Klickitat River summer steelhead). Currently, the early steelhead releases use adults returning to the hatchery and no natural fish have been incorporated in the broodstock.

6.2.4 Genetic or ecological differences.

Early winter steelhead are non-endemic stock. A local stock of late winter steelhead are used for the integrated winter steelhead program also existing in the system (see Cowlitz river Late Winter Steelhead HGMP). The difference in spawn timing (3 months earlier for early hatchery fish), poor reproductive success for these fish in the wild (Hulett et al. 1998) and spatial separation at spawning have helped to maintain genetic differences between hatchery and wild fish. Fish are released as age-1+ smolts whereas wild steelhead are predominantly age-2+ smolts. Out-migration timing for both life history types is similar but is slightly earlier for the hatchery component (Fuss et. al. 1998).

6.2.5 Reasons for choosing.

This stock chosen just to provide harvest opportunity.

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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.

- Only hatchery stock is used.
- Timing is separated from natural steelhead.
- Holding pond procedures follow IHOT guidelines. .
- Other listed fish, if identified, will be released immediately if encountered during the broodstock collection process.

Section 7. Broodstock Collection

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

Adult steelhead arriving at Cowlitz Salmon Hatchery or Cowlitz Trout Hatchery.

7.2 Collection or sampling design

Fish are collected at the Cowlitz Salmon Hatchery separator. Fish are either re-cycled or taken to the the Cowlitz Trout Hatchery. Spawn timing has shifted to early in the season. Spawning will occur from December (50%) through January (50%) and will be completed by January 31 although it has proven difficult to get 50% of the eggs taken during January as most females ripen in December.

7.3 Identity.

Early winter steelhead are identified by run timing and hatchery-origin fish are adipose-fin clipped. Natural early winter timed fish are very rare but if found, are returned to the river with most seasons none are found. A larger portion occurs in the late winter steelhead program.

7.4 Proposed number to be collected:

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

Up to 200 adults at a female to male 1:1 ratio. Fecundity is approximately 5,000 eggs.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Adults		
	Females	Males	Jacks
1995	413	413	--
1996	398	278	--
1997	385	208	--
1998	207	194	--
1999	223	223	--
2000	240	229	--
2001	204	202	--
2002	115	115	--
2003	100	100	--
2004	104	104	--

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

Steelhead adults that are above hatchery needs are right operculum punched and returned to stream to enhance the sport fishery.

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7.6 Fish transportation and holding methods.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Trucks (2)	1500	Y	N	60	Sodium Chloride	0.5
Tanker Truck (Fiberglass Tank)	1000	Y	N	60	Sodium Chloride	0.5

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Raceway	1472.2	34.0	10.0	4.33	1300

7.7 Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), WDFW's Fish Health Manual November 1966, updated March 30, 1998 or Co-manager guidelines are followed. The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection including chlorine or iodophore procedures upon entering or exiting the area. Formalin treatments are administered if needed.

7.8 Disposition of carcasses.

Spawmed carcasses of steelhead are considered inedible. Carcasses are buried. Presently carcasses are not used in nutrient enhancement, primarily for disease (IHNV) concerns.

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

The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

Section 8. Mating

8.1 Selection method.

Males and females available on a given day are mated randomly. Spawning begin in early December and conclude in early January. Approximately three egg take are planned. .

8.2 Males.

When spawning activities occur, females are lethal spawned while the males are anesthetized with carbon dioxide and live spawned in anticipation of future spawning purposes and/or enhance the sport fishery.

8.3 Fertilization.

Beginning with the 2000 brood spawning (December 1999), all spawning is one male to one female. Sperm is added to eggs from one female and after five minutes, the fertilized eggs are disinfected and water hardened in an iodine solution for one hour. After the one-hour period, the eggs are combined into 5 fish pools and placed in shallow troughs to incubate.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

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

Males and females available on a given day are mated randomly. Natural, unmarked fish, will not be used for spawning.

Section 9. Incubation and Rearing.

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

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1991	2,100,000	NA	NA
1992	1,717,500	NA	NA
1993	1,560,400	NA	NA
1994	1,691,800	NA	NA
1995	1,761,090	NA	NA
1996	1,714,700	NA	NA
1997	1,641,400	91.7	NA
1998	900,000	85.4	NA
1999	936,600	89.4	NA
2000	941,800	86.7	NA
2001	836,000	86.4	NA
2002	577,833	94.5	NA
2003	521,154	NA	NA
2004	554,548	NA	NA

NA- Data not available at this time. It will be completed at time of submission to NOAA

9.1.2 Cause for, and disposition of surplus egg takes.

A surplus of eggs have been held in past years to accomplish two goals: 1) to provide a larger gene pool and 2) to provide insurance against losses due to disease (C. shasta and IHN) and predation. If surplus still occurs over and above program needs, eggs are destroyed. Eggs are combined into 5 fish pools and placed in shallow troughs to incubate.

A fish grader is used for grading and selecting out fish that do not meet program standards. Five families are grouped per incubation unit. Program does not manage family size variation to maintain effective population size. Eggs in excess/surplus to program needs are culled to maintain egg take/juvenile numbers within plus/minus 10% of program goal.

9.1.3 Loading densities applied during incubation.

Eggs from five fish are incubated per basket (in shallow trough) until eyed then 20,000 - 21,000 eggs per trough for hatching. Egg size varies from 3,250 to 3,500 per pound

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9.1.4 Incubation conditions.

Flow, temperature and D.O.s are monitored. Oxygen level in troughs normally 8.1 parts per million (ppm).

9.1.5 Ponding.

At 10 days after swim up (volitional), in trough, fish are fed at about 2,000 fish per pound (fpp). Ponding occurs when fish are from 1,500 fpp to 600 fpp depending on pond space. Lengths are not measured. Ponding begins in mid-February continuing into May. The procedures used for determining when fry are based on visual inspection of the amount of yolk remaining

9.1.6 Fish health maintenance and monitoring.

Diseases occurring in fry are: Bacterial Cold Water disease and Trichodina. Standard fish health protocols are followed as defined in the Fish Health Manual (WDFW 1996).

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.

Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.

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 (1990-2001), or for years dependable data are available.

See section 9.1.1

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

Rearing containers are concrete raceways of either 10' X 90' or 20' X 90'. The 10" wide raceways are started with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with a 400,000 fish maximum at 700 fpp. Normal loadings are 75% of above. As fish increase in size, the numbers are reduced to a final holding number of 35,000-40,000 fish per 20-foot wide raceway. Ten foot wide raceways are not used at final grow out.

9.2.3 Fish rearing conditions.

Ponds are cleaned on average every other day throughout their rearing. Effluent from cleaning goes into a pollution abatement pond. Oxygen levels are normally greater than 10 ppm with incoming river water. Due to dependence on limited ozonated and well water during a significant period of the rearing cycle (mid-May through November) multiple reuse of water is necessary to achieve production goals. Late winter steelhead are programmed to be supplied with only "first" use when available. This is to optimize growth and to avoid pathogen transfer between ponds of late winter steelhead whenever possible. Recent problems associated with the North Well (incubation & rearing trough) water supply due to iron bacteria and excess gas have caused some additional loss to fry. Temperatures range between 40-54 degrees F at both hatcheries.

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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.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
February at Swimup		2000		
March		1300		0.350
April		650		0.500
May	54.6	275	3.950 E-04	0.577
June	67.6	150	4.041 E-04	0.455
July	82.2	75	4.034 E-04	0.500
August	92.3	50	4.085 E-04	0.333
September	104.2	30	4.022 E-04	0.400
October	127.4	20	4.399 E-04	0.333
November	140.4	15	4.026 E-04	0.250
December	150	10	4.488 E-04	0.333
January	165.2	8	4.039 E-04	0.200
February	178.1	7.0	4.536 E-04	0.250
March	184.7	6.0	4.199 E-04	0.143
April	189.0	5.0	3.913 E-04	0.167

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

See section 9.2.4 above.

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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*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Swimup-Fry	Mash/#0	7	3.0-4.0	nya	0.5
Fry	#1 and #2 crumble	7	3.0-4.0	nya	0.7
Fingerling	1.2 mm and 1.5 mm	7	1.5-2.5	nya	0.9
Yearling	2.0 mm	5	1.0-1.5	nya	1.3
Smolt	2.5 mm	57	1.0-1.5	nya	1.5

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

Fish Health Monitoring	Health and disease monitoring is done by pathologists currently budgeted for the Cowlitz Complex. Policy guidance includes: <i>Fish Health Policy in the Columbia Basin</i> and <i>Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	Standard fish health protocols, as defined in the Co-Managers Fish Health Manual (WDFW 1996), are adhered to. In the standard ponds, fry and fingerlings have been treated with Florinicol for Bacterial Cold Water disease and Paracide-f for external parasites, fungus and <i>trichodina</i> control on holding adults. Infectious Hematopoietic Necrosis Virus (IHNV) can cause either low level chronic mortalities during the rearing period and or significant mortality on smaller subyearling fish before October of the year. The life cycle of <i>Ceratomyxa shasta</i> , the cause of ceratomyxosis, involves an intermediate host, which is a polychaete worm. Wherever this worm exits, <i>C. shasta</i> may become established by the introduction of infected fish or infective water into the area. The lower Cowlitz River appears to harbor <i>C. shasta</i> . Wild and hatchery fish may contract this disease as they migrate through the lower river. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file.
Sanitation	Mortality is collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

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

The migratory state of the release population is determined by behavior, physical appearance and other criteria.

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

None currently. Previous efforts in the past (see section 11).

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.

When juveniles are culled, it is NOT done randomly over all segments of the population.

Section 10. Release

10.1 Proposed fish release levels.

Age Class	Max. No.	Size (fpp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	300000	4.5-5.0	April 15- May 20	Cowlitz River and Blue Creek (RKm 0.8)	66.0	Cowlitz	Lower Columbia

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

300,000 smolts (@ 4.5-5.0 fpp) are released into the Cowlitz River @ RKm 66.0 (Cowlitz Trout Hatchery Boat Ramp and Blue Creek).

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

Release Year	Yearling Release		
	No.	Date (MM/DD)	Avg Size (fpp)
1995	683,247	April 15-30	7.6
1996	602,432	April 15-30	7.8
1997	764,616	April 15-30	7.4
1998	768,192	April 15-30	7.3
1999	542,286	April 15-30	6.8
2000	926,739	April 15-30	7.4
2001	360,000	April 15-30	5.5
2002	292,545	April 15-30	6.1
2003	210,849	April 15-30	4.4
2004	218,577	April 15-30	4.5

10.4 Actual dates of release and description of release protocols.

Winter steelhead are reared in raceways at the Cowlitz Trout Hatchery and the smolts must be trucked out of these ponds to be released. The raceways at the trout hatchery have no outlet to the river for fish release. Water discharged from the raceways can be routed to the adult ponds, the rearing lakes or the pollution abatement ponds, but not directly to the river. Therefore, fish are planted via truck at the boat ramp at the Cowlitz Trout Hatchery.

Release begins April 15 and is completed by May 20. Hatchery reared releases start out as volitional (screen is removed and fish allowed to migrate out on own). Fish that do not leave volitionally are forced out when lake is lowered and drained in May. All raceway reared fish are trucked out to RM 41. Release directly from the raceways is not possible.

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10.5 Fish transportation procedures, if applicable.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Trucks (2)	1500	Y	N	60	Sodium Chloride	0.5
Tanker Truck (Fiberglass Tank)	1000	Y	N	60	Sodium Chloride	0.5

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

Winter steelhead are reared in raceways at the Cowlitz Trout Hatchery and the smolts must be trucked out of these ponds to be released. The raceways at the trout hatchery have no outlet to the river for fish release. Water discharged from the raceways can be routed to the adult ponds, the rearing lakes or the pollution abatement ponds, but not directly to the river. Therefore, fish are planted via truck at the boat ramp at the Cowlitz Trout Hatchery.

Release begins April 15 and is completed by May 20. Hatchery reared releases start out as volitional (screen is removed and fish allowed to migrate out on own). Fish that do not leave volitionally are forced out when lake is lowered and drained in May. All raceway reared fish are trucked out to RM 41. Release directly from the raceways is not possible.

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

All fish are mass marked with adipose fin clip.

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

Fish identified as surplus or fish not in smolted condition parameters, if identified and segregated would be taken to landlocked lakes for additional sport opportunities.

10.9 Fish health certification procedures applied pre-release.

All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release.

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

Contact complex manager who consults with regional manager in Olympia for decision. Fish would not be purposely released during flooding unless the water system failed. At the Cowlitz Trout Hatchery, fish in the lakes can be released directly to the river, but fish in the raceways would need to be pumped to trucks or to the river. Due to the large number of ponds time would be limited at both facilities.

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.

- Continue to mass mark fish of hatchery origin to provide fishing opportunities while limiting exploitation rates on natural stocks.
- Segregate the hatchery program to provide fishing opportunities in the lower Cowlitz River while limiting impacts on naturally produced salmonids to acceptable levels.
- Eliminate early winter steelhead adult stocking in the Tilton River.
- Eliminate the early winter steelhead adult recycling program unless results of the genetic analysis shows no impact to the native late winter population.
- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations
- Fish are acclimated for several weeks at the site before release.
- Also, innovative rearing techniques proposed in the settlement hatchery remodel will incorporate semi natural aspects of fish culture including protective pond coloration along with overhead and in-water cover on an experimental basis.
- Because early winter steelhead are highly susceptible to *ceratomyxosis* these fish are reared for a portion of their time in the hatchery on pathogen free water (ozone treated).

Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW. Artificial propagation activities in this license that will be proposed as part of the FHMP, the Remodeling and Phase-In Plan, and the Disease Management Plan,¹⁹ will undergo a separate ESA consultation as these plans are not developed enough to give a clear understanding of the proposed action on which to consult. Any future hatchery consultation will be in the overall context or to meet the goal of reestablishing self-sustaining population levels consistent with a viable ESU scenario. In other words, viable populations of spring chinook salmon and a contributing population of steelhead will need to be established above the Project. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted, pursuant to which NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species. This section generally considers the direct and indirect effects to listed species that may result from hatchery mitigation actions.

Section 11. Monitoring and Evaluation of Performance Indicators

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

In addition to the regional monitoring activities associated with this program, see section 2.2.3-Monitoring, the Cowlitz Hatchery evaluation Biologist monitors and evaluates the following factors associated with this hatchery program: Condition Factor of hatchery spring chinook smolts prior to release, Smolt-to-Adult survival rates of hatchery spring chinook releases, Freshwater harvest levels for hatchery program releases. In association with upper Cowlitz watershed recovery efforts, the Cowlitz Hatchery evaluation Biologist also operates the smolt trap at Mayfield Dam. This trap receives emigrating juveniles generated from plants and natural production in the Tilton River watershed.

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia). Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall Chinook juveniles to estimate survival has also begun on the lower river.

The completion of the Surface Collection System and Fish Facilities at the Cowlitz Falls Dam in 1996 marked the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 linear miles of historically productive habitat in the upper Cowlitz and Cispus watersheds. Since then, WDFW funded by Tacoma Power, has monitored productivity of spring Chinook, late winter steelhead, coho and cutthroat trout. Fish Collection Efficiency (FCE) is monitored by mark-recapture of steelhead, coho and age-zero spring chinook smolts that are marked with visible implant elastomer tags.

The Cowlitz River Fisheries and Hatchery Management Plan is a component of the Cowlitz Hydroelectric Project Settlement Agreement with a large component of monitoring and evaluation for the upper basin recovery. Currently monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile out-migration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.

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

Tacoma Public Utilities has made long-term commitment to provide funding that supports staff and logistics to undertake program monitoring and evaluation.

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.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

Section 12. Research

12.1 Objective or purpose.

There is no current research associated with this program. Below is a list of past research conducted in association with this program:

Survival of Steelhead Smolts Released at different Sites on the Tilton River. 1995. Cowlitz Fish Biologist Annual Report for 1995 H95-02.

Tipping, J. M. 1994. *Effects of Raceway Cleaning Frequency on Growth and Freshwater Survival of Hatchery Steelhead.* The Progressive Fish Culturist 56:293-295.

Tipping J.M., and Gilhuly G. J. 1996. *Survival of Electranesthetized Adult Steelhead and Fall Chinook eggs.* North American Journal of Fisheries Management 16:469-472

Initial vs. Repeat Entry into Hatchery Traps. 1998. Cowlitz Fish Biologist Annual Report for 1997 H98-2. WDFW Olympia.

Rearing Pond Structure Experiment on Smolt to Adult Survival. 1998. Cowlitz Fish Biologist Annual Report for 1997 H98-2. WDFW Olympia.

Survival of Dye Marked and Ventral Clipped Steelhead. 2000. Cowlitz Fish Biologist Annual Report for 1999 FP00-09. WDFW Olympia.

Tipping, J.M. 1991. *Heritability of Age at Maturity in Steelhead.* North American Journal of Fisheries Management 11:105-108.

Tipping J.M. 1997. *Effects of Smolt Lengths at Release on Adult Returns.* The Progressive Fish Culturist 59:310-311.

Tipping J.M. 1988. *Ozone Control of Ceratomyxosis: Survival and Growth Benefits to Steelhead and Cutthroat Trout.* The Progressive Fish Culturist 50:202-210.

12.2 Cooperating and funding agencies.

Research conducted by WDFW and Funded through Tacoma Power.

12.3 Principle investigator or project supervisor and staff.

Cowlitz Hatchery Evaluation Biologist

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

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

No current research. See above studies for information.

12.6 Dates or time periods in which research activity occurs.

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

No current research. See above studies for information.

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

No current research. See above studies for information.

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12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).

No current research. See above studies for information.

12.10 Alternative methods to achieve project objects.

No current research. See above studies for information.

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

No current research. See above studies for information.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities.

No current research. See above studies for information.

Section 13. Attachments and Citations

13.1 Attachments and Citations

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- Dawley, E. M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics And Survival Of Juvenile Salmonids entering the Columbia River estuary During 1983. Annual Report to the Bonneville Power Administration, Portland, OR.
- Easterbrooks, J. 1980. Salmon production potential evaluation for the Cowlitz River system upstream of the Cowlitz Falls Dam site. Washington Department of Fisheries.
- Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Migratory Behavior and Incidence of Post-Release Residualism of Hatchery Reared Coho and Chinook Salmon Released into the Elochoman River, WDFW Annual Report FPA99-08.
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- Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), Pacific salmon life histories. Vancouver, BC: University of British Columbia Press. Groot and Margolis 1991
- IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish Production facilities in the Columbia River basin. Volume III - Washington. Annual Report 1995. Bonneville Power Administration, Portland, OR. Project Number 92-043. 536 pp.
- Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. American Fisheries Society Symposium 1: 131-136.
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Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

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

Name, Title, and Signature of Applicant:

Certified by _____ Date: _____