HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Cowlitz River Late Winter Steelhead
Species or Hatchery Stock	Late Winter Steelhead (*Oncorhynchus mykiss*) Cowlitz Trout Hatchery
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz/Lower Columbia
Date Submitted	
Date Last Updated	April 18, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

Cowlitz River Late Winter Steelhead

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

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

ESA Status: Threatened

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
Bonneville Power Administration	Cowlitz Falls Research /Fish Reintroduction Activities, including Stress Relief Pond/Acclimation

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

Funding Sources
Tacoma Public Utilities
Bonneville Power Administration

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).

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Hatchery Late Winter Steelhead
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.

Integrated Harvest*

1.7 Purpose (Goal) of program.

The purpose of this program is to contribute to harvest, conservation/recovery, research and/or education as mitigation for Hydro impacts and Habitat loss. This is an integrated program although currently, wild fish have not been used in the broodstock. The goals for the target stock are to maintain the current high biological significance and viability. The program also has goals of (1) providing harvest of late winter steelhead to fisheries of the lower Cowlitz River and Lower Columbia River/Estuary; (2) re-establishing and conserving naturally producing populations of late winter steelhead into the upper Cowlitz River and tributaries; and (3) contributing to research and education through mitigation for hydroelectric development and habitat loss. The strategy in place to accomplish these goals is through an integrated recovery program.

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. Adult winter steelhead enter the Cowlitz River from mid-November through June. 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). Over 249 miles of historical anadromous fish habitat, including steelhead habitat in the mainstem Cowlitz River, Muddy Fork, and Clear Fork, and in the Tilton and Lower Ohanapecosh Rivers, is blocked to volitional passage by the Project dams (Harza 1999a). Three historical populations in the upper Cowlitz River Basin including Cispus, Tilton and Upper Cowlitz winter run segments have been extirpated but are incorporated within the late winter steelhead stock (Myers et al. 2003 and WCSBRT 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 2001, the hatchery program has shifted from early non-endemic winter steelhead to the late winter stock historically occurring in the system.

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. By the next FHMP, a level of integration of wild fish into the existing broodstock will be implemented. Currently, only hatchery marked broodstock have been used since the start. 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 late winter steelhead program now makes up over 40% of the steelhead production in the system. Both, current and future lower and upper river production are described by the Fisheries and Hatchery Management Plan (FHMP) submitted by Tacoma Power for the Cowlitz River Hydroelectric Project (FERC No. 2016). Along with upriver reintroduction of adults and carcass nutrient enhancement, hatchery production has been proposed to achieve Phase 1 objectives in conjunction with habitat fish passage improvements and fishery management strategies (FERC No. 2016). Since 1996, natural origin (NOR) and hatchery adult steelhead spawners have been transported to the Upper Cowlitz and Cispus River systems. "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. This program will be used to restore natural spawning populations of winter steelhead in the upper Cowlitz River basin.

The Cowlitz River Fisheries and Hatchery Management Plan proposal is to operate hatchery programs rearing salmonids native to the Cowlitz River as Integrated, and all non-native species as Segregated (The Cowlitz River Project, FERC No. 2016, August 2004). The Cowlitz River late winter steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. Currently no wild winter steelhead are incorporated into the broodstock. Phase 2 of the Cowlitz River Fisheries and Hatchery Management Plan (FHMP 2004) indicates that natural origin broodstock will be integrated (based on HSRG guidelines) when the current late winter steelhead reintroduction effort is successful at providing a locally adapted stock from the current hatchery stock. 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.

WDFW has implemented restrictive regulations permitting the retention of marked adult hatchery steelhead only and requiring the release of naturally produced adult steelhead (WDFW 2003a). All hatchery steelhead released in the action area are externally marked with an adipose fin-clip to allow for these selective fisheries. WDFW (2003a) 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% (WDFW 2003a). The program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish. 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.

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 late winter steelhead program, a number of risk aversions are included in this HGMP (**Table 1**).

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

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	• Water rights are formalized from the Department of Ecology. • Monitoring and measurement of water usage is reported (monthly NPDES reports).
Intake Screening	4.2	• 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	• 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	• Safe handling protocols in place. • Listed fish placed back to stream. • Broodstock collection procedures can identify listed fish.
Disease Transmission	7.9, 10.11	• *Fish Health Policy in the Columbia Basin*. • *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

1.9 List of program "Performance Standards".

See section 1.10 below.

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

Note: Performance Standards below only pertain to the hatchery production at Cowlitz Trout Hatchery only and do not contain complete indicators for the upriver reintroduction program. For further information on upriver performance indicators and standards, refer to the Final Draft FHMP (August 2004).

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Support Upper Cowlitz basin restoration and recovery	Achieve Phase 1 late winter steelhead adult goals in the upper Cowlitz. Provide fry/fingerlings if needed for additional smolt production and/or for FCE testing at CFFF	Adult cohorts monitored and tracked yearly. Fry/fingerling releases consistent with FTC and FHMP goals.
Assure that hatchery operations support Columbia River fish Mgt. Plan *(US v Oregon)*, production and harvest objectives	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 with co-managers 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 360 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return	Annual run timing, age and sex composition and return timing data are collected. Adhere to WDFW spawning guidelines. (WDFW 1983)
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery origin fish	Use mass-mark (adipose-fin clip) for selective fisheries with additional groups Ad+CWT and CWT only for evaluation purposes	Returning fish are sampled throughout their return for length, sex, mark and
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).	Necropsies of fish to assess health, nutritional status, and culture conditions	WDFW Fish Health Section inspect adult broodstock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams	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.

1.10.1 Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt-size (5.5-6.0 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups)	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial 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 meet state and federal guidelines where located in fish bearing streams.	All fish entering the hatchery are documented: Hatchery records. Visual observations recorded. 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	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvests are monitored by agencies and tribes to provide up to date information.

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

387 adults will be needed to for an egg take goal of 760,000 eggs (FBD 2004). An additional 1,000 adults are needed to meet upper Cowlitz and Tilton escapement.

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
Fingerling	200,000	100	September-October	Upper Cowlitz	Above RKm 140	Cowlitz	Lower Columbia
Yearling	315,000	5.5	May	Cowlitz River (RKm 78.9) and Upper Cowlitz	78.9 and Various Points in Upper Cowlitz Subbasin)	Cowlitz	Lower Columbia
Yearling	37,500	5.5	May	Cowlitz River	(RKm 78.9)	Cowlitz	Lower Columbia
Yearling	37,500*	5.5	May	Cowlitz Falls	(RKm 140)	Cowlitz	Lower Columbia

* Yearlings are released for additional productivity and for determining Fish Collection Efficiency (FCE) at CFFF.

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

Specific harvest rates for each group of hatchery steelhead are unknown, (because both groups are adipose fin clipped), however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest. Total winter catch of early and late steelhead are combined below. Releases from 2001 do not include the late winter steelhead releases (see also section 10.7).

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 for the new SA. The total steelhead program after hatchery rebuild (>2008) 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. For most years, the late winter stock catch and program performance has not been separated from the early portion. It is currently unknown what levels are contributed by the late stock and early stock. Future data could be collected based on time of harvest.

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**.

Table 2. Cowlitz winter Steelhead Program Performance – Note: Cannot be broken by stock at this time. .

Year	Releases	Sport Harvest[a]	Hatchery Escapement[b]
1995	621,471	2,931	3,751
1996	602,432	2,269	9,210
1997	740,816	1,981	7,438
1998	768,192	1,947	1,705
1999	542,286	4,393	2,994
2000	926,739	4,431	3,375
2001*	510,138	17,993	1,867
2002*	292,545	Na	3,146
2003*	210,849	Na	2,223
2004*	218,577	Na	2,506
Average	**543,405**	**5,134**	**3,822**

BY	Releases	SAR %
1993	621,471	1.08
1994	602,432	1.91
1995	740,816	1.27
1996	768,192	0.48
1997	542,286	1.36
1998	926,739	0.84
1999	510,138	3.90
Avg		**1.55**

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.
*Late winter plants are not included.

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

Fingerling plants were made in the early 1990's, with yearling plants starting in 1995.

1.14 Expected duration of program.

Late winter steelhead production from CTH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an 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

Over the short term, it is assumed that the number of juvenile steelhead of all races required to meet the 20,000 adult benchmark will be produced at the Cowlitz Hatchery Complex. 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. The key issues of the late 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 at Blue Creek where intense bank pressure congregates at the main "clay bank hole" and below the junction of Blue Creek with the river. Releases are also made at the Cowlitz Salmon Hatchery and in upriver areas. The Cowlitz Hatchery Boat ramp provides access to the river in the Blue Creek vicinity. The purpose of the release of the late stock steelhead into the Cowlitz River is to continue an later timed steelhead while eliminating a directed harvest on wild winter steelhead. Adults are trapped at Cowlitz Salmon Hatchery (CSH) and are spawned and incubated at Cowlitz Trout Hatchery (CTH). All wild winters are prioritized to the upper river system.

1.16.2 Potential Alternatives to the Current Program

Alternative : Reduce the program per FHMP proposals A reduction of 23% 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 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 2: Retain current production

Pros: Continue to manage the Lower Cowlitz River system as a significant winter steelhead producer. 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 continous 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
Chun	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.
Lower Columbia River Steelhead listed as threatened under the ESA on March 19, 1998.

Identify the ESA-listed population(s) that may be incidentally affected by the program.
Lower Columbia River fall chinook salmon are listed as "threatened" under the ESA on May 24, 1999.
Lower Columbia River spring chinook salmon listed as "threatened" under the ESA on May 24, 1999.
Lower Columbia River Coho 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.

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

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

In the lower river: 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).

In the upper system: The Settlement Agreement states that it is the responsibility of NOAA-Fisheries and USFWS to set the adult abundance values used to determine the sustainability of spring Chinook and late winter steelhead in the upper Cowlitz River and for all anadromous fish species in the Tilton River. These abundance values are used as one of the two criteria for determining when upstream adult fish passage facilities would be constructed at the Project. Minimum abundance (500 adults for all indigenous salmonids) targets for the Tilton River and upper Cowlitz River populations have been proposed by Tacoma Power in Section 3.5.1 of the Cowlitz River FHMP. These are not necessarily levels that constitute recovery, but a minimum population size that prevents unacceptable rate of risk for extinction in the near future. It should be emphasized that these proposed abundance targets are based on the interpretation of currently available data and determining the need for adult passage facilities and should be modified as more rigorous analysis of new data is completed (Cowlitz River FHMP).

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 **(Table 4)** although less than 40,000 - 45,000 smolts (19%) can be collected at the CFFF (**Appendix A).** 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 5).**

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

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

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

Table 4. Total smolt production* of the Upper Cowlitz since 1997.

Year	Steelhead Unmarked	Steelhead RV(& hatchery)	Coho	Chinook	Cuthroat	Total Emigration
2004	*23,249*	*44,355*	*308,079*	*225,164*	*1,487*	*602,334*
2003	21,565	25,480	400,762	254,368	1,880	704,055
2002	9,300	41,361	168,281	119,673	1,676	340,291
2001	30,861	66,629	796,948	156,545	1,867	1,052,850
2000	26,184	25,426	236,960	136,920	2,051	427,541
1999	25,368	28,235	88,788	36,717	1,349	180,457
1998	24,505	39,321	196,520	51,913	1,363	313,622
1997	7,714	29,253	17,490	134,206	722	189,385

* FCE for 2004 include: winter steelhead (48.5%), coho (41.6%), spring Chinook (19%), and cutthroat (48.5%). Source – Cowlitz Falls Annual Reports 1997-2004.

Table 5. Spring Chinook Adults transported to the Upper Cowlitz River Basin, 1996 – present.

Year	Not sexed	Female Ad Clip	Female Un Mark	Male Ad Clip	Male Un Mark	Jack	Total
2004		4,786	116	5,928	139	502	11,471
2003		4,482	264	4,089	284	18	8,589
2002	1,465	119	Unk	179	Unk	50	1,787
2001		68	Unk	60	Unk	0	128
2000		98	Unk	106	Unk	0	204
1999		53	Unk	38	Unk	177	268
1998		0	0	0	0	0	0
1997		0	0	25	0	26	51
1996		2	Unk	4	Unk	0	6

Source – Cowlitz Falls Annual Reports 1997-2004.

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a): 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 6**). 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. Fall Chinook production occurs in the Tilton River and Mayfield Lake tributaries as adults are hauled by Tacoma Power**.** Smolts are

collected at Mayfield Dam **(Table 7).**

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 6. 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.

Table 7 . Mayfield Dam downstream fish passage. Migrants captured with estimated FGE (fish guidance efficiency) and turbine survival applied to estimate passage survival (PS) and total passage. PS%= (FGE x bypass survival)+((1-FGE)x turbine survival). Fish Guidance Efficiency (FGE) at the collection site: 66.4% for coho, 81.4% for Chinook and 73.6% for Steelhead.

Year	Coho Salmon				Chinook Salmon				Steelhead			
	Captured	Est. Total Run	PS %	Est. Total Pass.	Captured	Est. Total Run	PS %	Est. Total Pass.	Captured	Est. Total Run	PS %	Est. Total Pass.
1995	374	563	95.3	537	317	389	96.5	376	2560	3478	95.9	3335
1996	1773	2670	95.3	2545	64	79	96.5	76	3318	4508	95.9	4323
1997	895	1348	95.3	1285	4456	5474	96.5	5283	329	447	95.9	429
1998	16747	25221	95.3	24039	2153	2645	96.5	2553	6476	8799	95.9	8437
1999	8006	12057	95.3	11492	86	106	96.5	102	2893	3931	95.9	3769
2000	23535	35444	95.3	33783	62	76	96.5	74	3528	4793	95.9	4596
2001	82215	123818	95.3	118013	618	759	96.5	733	7447	10118	95.9	9702
2002	11675	17583	95.3	16759	19282	23688	96.5	22862	2050	2785	95.9	2671
2003	38892	58572	95.3	55826	10825	13299	96.5	12835	4790	6508	95.9	6241
Mean	20457	28732	95.3	27385	4207	1361	96.5	1314	3710	5154	95.9	4942
*Assumes 90% turbine survival, 98% bypass survival, no spillway passage												

Source. NOAA Fisheries consultation No. 2001/02045- Biological Opinion for ESA Section 7 Consultation for the Cowlitz River Hydroelectric Project (FERC No.2016).

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 with the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002). Late winter steelhead including wild adults of wild and fry plants (RV) and of lower river hatchery releases have been transferred upstream since 1996 **(Table 8).** In 2004, 35,032 steelhead smolts were collected at the CFFF of which 11,276 (32%) were of wild origin **(Appendix A).** Fry plants identified by RV clip contribute to the escapement, while yearling plants of RV and adipose fin clips (37,500) provide some level of harvest on identified steelhead for the upper basin. As current FCE was 48.5% for steelhead, current production in the upper basin is approximately 65% of the 1994 GAIA estimates (100,000) carrying capacity of the upper Cowlitz River. Steelhead abundance estimates are made in a number of Lower Columbia tributaries including the S.F Toutle, Green, Coweeman, E.F Lewis and Washougal Rivers but not the Lower Cowlitz system (FMEP 2003).

Table 8 . 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 *(Oncorhynchus kisutch)*: In the lower Cowlitz, Mayfield Dam has blocked tributaries above river mile (RM) 52 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 River and upper Cowlitz system. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz since 1999 **(Table 9).** FCE of coho smolts in 2004 was 42% with 128,161 coho smolts collected at CFFF with a majority of them transported to the Cowlitz Salmon Hatchery Stress Relief ponds in 2004 **(Appendix A).** Total smolt production was 308,079. Based on a maximum potential egg deposition of 92 million eggs, egg-to-smolt survival was 0.33% (Serl and Morrill 2004).

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.

Table 9. 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. Broodstock collection activities will directly handle listed fish and will have take tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables will occur at the end of this HGMP.

Broodstock Program:

Broodstock Collection: Only identified hatchery fish are retained for spawning. Wild steelhead are returned to stream or transported to the upper basin. 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. The ability to discriminate hatchery/natural origin fish assures the program/stock adheres to the proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. The program utilizes natural winter steelhead stock derived from adults returning to the Cowlitz Barrier Dam.

Genetic introgression: Late steelhead are a local stock. Future integration will incorporate wild fish per FHMP.

Rearing Program:

Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance. Effluent at outfall areas is rapidly diluted with main stem flows and operation is within non-permitted guidelines (NPDES guidelines).

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).

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. Over the short term, it is assumed that the number of juvenile steelhead of all races required to meet the 20,000 adult benchmark will be produced at the Cowlitz Hatchery Complex. 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. Since 2000, releases of early winter non-local steelhead have been reduced and late winter steelhead have been increased.

Competition: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). If they do not migrate though, they could compete with wild fish. Studies and monitoring programs on many systems throughout Washington indicate that salmon and steelhead smolts released from hatchery programs 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 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. 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 are planted in lakes for additional harvest.

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, 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).

Broodstock take is included at the end of this HGMP.

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.
- Mtigation 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 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.

Hatchery Escapement (FHMP)
It is estimated that 387 adults are needed to produce 450,000 juvenile late winter steelhead smolts. An additional 1,000 hatchery adults may be needed for the upper Cowlitz River and Tilton River productivity tests. Thus, the total hatchery adult escapement target is 1,387. The 1,000 adult escapement goal for natural production would be considered a minimum value.

The lower Cowlitz River steelhead fisheries would be managed to achieve this minimum escapement target. Surplus hatchery late winter steelhead may be recycled to the lower Cowlitz River to increase harvest rates so long as spawning impacts do not exceed the HSRG guideline for Segregated hatchery programs of 10 percent hatchery contribution to the natural spawning population. For the first six years of the FHMP, no limits would be placed on the number of HOR late winter steelhead released in the Tilton River. Because of this, a higher priority would be given to increasing adult releases in the Tilton River rather than recycling fish to the lower river. Commercial fisheries in the mainstem Columbia River may occur in February and March with incidental harvest of both natural and hatchery winter steelhead with an adipose fin clipped. Sport fisheries selective for Cowlitz River late winter steelhead stock that are adipose fin clipped occur in the mainstem Columbia and the lower Cowlitz River from January through May. Through the FMEP for the lower Columbia River, has estimated that naturally spawned late winter steelhead will have an estimated mortality of approximately 4% in winter steelhead fisheries and approximately 3% mortality in sport fisheries directed at resident trout.

The releases of adipose fin and right ventral fin clipped "late" winter steelhead provide sport harvest opportunity for anglers in the Cowlitz and Lower Columbia rivers. Selective harvest regulations allow only the harvest of adipose or ventral 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 with a right ventral fin clip are protected from harvest in the Lower Cowlitz River. 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 each group of hatchery steelhead are unknown, (because both groups are adipose fin clipped), however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

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 annadromous 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 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-liscensing 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.

(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 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 oligotrohic 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 can not 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.

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' *Anadrommous Salmonid Passage Facility Guidelines and Criteria (draft, January 31, 2004)* 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: *Total Suspended Solids (TSS)*C1 to 2 times per month on composite effluent, maximum effluent and influent samples. *Settleable Solids (SS)*C1 to 2 times per week on effluent and influent samples. *In-hatchery Water Temperature* - 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, to be transported from the Cowlitz Salmon Hatchery fish separation unit, are held in one of six 643 cubic ft. 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 fish are transferred often to reduce stress and disease transfer between these fish.

Juvenile fish being 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 holding 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' . Fish are sorted, and if mature and needed for spawning, they are sorted 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.

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)

The Cowlitz Trout Hatchery has 88 shallow trough incubators.

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
6	Fry Racways	4500	90	20	2.5	300	1.0	0.25
8	Concrete Raceways	5340	100	20	2.5	1000	1.0	0.25
1	2.0 Acre Lake	1113600	870	160	8.0	4000	1.0	0.25

The Cowlitz Trout Hatchery has 88 shallow trough incubators, 6 fry raceways each 10' X 90' X 2.5' , 24 raceways each 20' X 90' X 2.5' , 3 five acre lakes, one 2.5 acre lake and three adult holding ponds each 10' X 150' X 5' .

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
6	Fry Racways	4500	90	20	2.5	300	1.0	0.25
8	Concrete Raceways	5340	100	20	2.5	1000	1.0	0.25
1	2.0 Acre Lake	1113600	870	160	8.0	4000	1.0	0.25

"Late" winter steelhead reared to smolt stage in raceways at the Cowlitz Trout Hatchery 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, nearly all these steelhead are planted via truck at either the boat ramp at the Cowlitz Salmon Hatchery or the boat ramp at the Cowlitz Trout Hatchery. Some "late" winter steelhead are trucked to the Cowlitz Salmon Hatchery and released from the stress relief ponds when space is available.

Smolts collected at the Cowlitz Falls fish collection facility are trucked below the dams and released at RM 49 from twelve stress relief raceways located at the Cowlitz Salmon Hatchery. These raceways were constructed as part of the reintroduction and restoration effort and were designed to allow a time period for recovery, presently up to 48 hours, and volitional release. Smolts collected at the facility include fin clipped "late" winter hatchery smolts acclimated and/or released in the upper watershed, unmarked smolts from hatchery fingerling releases, and some naturally produced smolts from hatchery adults that spawned in the upper watershed.

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

Generally, no physical operational difficulties have been experienced. Pathogen outbreaks of *Ceratomyxa shasta* have chronically 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 un-interrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply two of the four river water intake pumps, the north well (not currently in use), 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. During the year 2000 (December), auxiliary power backup was provided to the south wells while the system is being upgraded.

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 re-used (3rd use) between numerous ponds the possibility for the spread of infection is there. 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.

"Late" winter adult steelhead returning to the Cowlitz Salmon and Trout hatcheries as identified based on historical run timing and the presence of external fin clips. The Cowlitz River late winter steelhead stock was developed from naturally produced Cowlitz winter steelhead from 1967 – 1970.

6.2.1 History.

The Cowlitz River late winter steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. The broodstock specifically targeted April and May spawners to avoid incorporation of Chambers Creek stock winter steelhead (see description below). Since 1971, adults have been from hatchery identified fish only. Many of the adult winter steelhead which would have returned to the Cispus, Tilton, and Upper Cowlitz Rivers were collected to establish the Cowlitz Trout Hatchery late winter stock. The late winter steelhead are reared at the Cowlitz Trout Hatchery and released into Blue Creek, directly below the hatchery.

The construction of Mayfield Dam in 1963 and Mossyrock Dam in 1968 eliminated about 50% of the historical spawning habitat for winter steelhead in the Cowlitz River. Historically, late winter steelhead populations occurred in the Tilton, Cispus, Upper Cowlitz, Lower Cowlitz, North Fork Toutle, South Fork Toutle, and Coweeman Rivers.

6.2.2 Annual size.

Cumulative adult returns/broodstock to the Cowlitz Trout Hatchery and Barrier Dam have annually average over 1000 fish/generation in recent years (Table 10).

Table 10. Adult escapement of late winter steelhead since 1998

YEAR	Hatchery Late Winter	Wild Late Winter
2004	NA	NA
2003	1,435	265
2002	3,071	305
2001	803	196
2000	1090	218
1999	444	149
1998	264	94
AVG.	1,184	204

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

The Cowlitz River late winter steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. Currently, no wild winter steelhead are used in the broodstock program. Phase 2 of the FHMP indicates that natural origin broodstock will be integrated when the current late winter steelhead reintroduction effort is successful at providing a locally adapted stock from hatchery stock.

6.2.4 Genetic or ecological differences.

There is little information available to indicate that lower-Columbia winter steelhead stocks are genetically distinct from one another. The stocks are treated separately by WDFW due to geographical isolation of spawning populations (WDF et. al.1993). Winter Steelhead are indigenous to the Cowlitz Basin where they were historically abundant and probably present

throughout the watershed (WDW 1990). Between 1961 and 1966, WDF collected an annual average of 11,081 adult steelhead at the Mayfield fish passage facility (Meekin and Birtchet 1963; Thompson and Rothfus 1969). After the construction of Mossyrock Dam in 1968, wild steelhead returns plummeted due to lack of juvenile outmigration and adult upstream passage (LCSCI 1998). It is estimated that wild steelhead production in the mainstem Cowlitz is minimal, but key wild production areas still exist in lower river tributaries such as Olequa Creek (LCSCI 1998).

The vast majority of steelhead production in the Cowlitz River is from hatchery fish and only approximately 8 accessible miles of spawning habitat remain in Cowlitz River. Many of the adult winter steelhead which would have returned to the Cispus, Tilton, and Upper Cowlitz Rivers were collected to establish the Cowlitz Trout Hatchery late winter stock. Two out-of-basin stocks are also reared at the hatchery, and some hybridization may have occurred between those stocks, although genetic studies indicate that Cowlitz Hatchery late winter stock are representative of winter steelhead historically found in the Cowlitz River Basin (C. Steward, Steward and Associates, pers. comm. to M. Day, NOAA Fisheries, November 12, 2003). Thus, as with Upper Cowlitz River Basin spring chinook salmon, the biological resources of the 3 extirpated Upper Cowlitz stocks are present, albeit in a homogenized form, in the Cowlitz River Trout Hatchery late winter broodstock. However, it is not known to what extent genetic variability has been lost, adaptive genetic complexes disrupted, or how domestication has altered the population (C. Steward, Steward and Associates, pers. comm. to M. Day, NOAA Fisheries, November 12, 2003).

6.2.5 Reasons for choosing.

Local stock with wild fish adapted to the Cowlitz system.

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 adipose fin-clipped hatchery-origin broodstock collected at the hatchery complex after April 1 will be selected.

Section 7. Broodstock Collection

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

Adults

7.2 Collection or sampling design

Most fish are captured upstream of the Cowlitz Trout Hatchery at the Cowlitz Salmon Hatchery. Even though the smolts are raised at the Cowlitz Trout Hatchery a large percent of the "late" winter steelhead by-pass the hatchery outlet at Blue Creek and migrate upstream to the Cowlitz Salmon Hatchery and are captured there. From here, they are transported to the holding ponds at the Cowlitz Trout Hatchery (this recruitment is unlike the early winter steelhead which volunteer into Blue Creek and enter the Cowlitz Trout Hatchery via its fish ladder).

Broodstock will be comprised of adipose-fin clipped adult "late" winter steelhead collected and spawned from April 1 through May 20 or later. Adults that enter the trap prior to April 1 will be marked with an opercle punch and returned to the river. These adults will not be used for broodstock needs. There will be no selection for size. Right ventral clipped or unmarked adults collected will be transported and released in upper watershed to spawn.

WDFW is evaluating a pilot effort to live spawn females, hold, feed and enable these females to recover and spawn again the next year based on pilot work done by Yakama Indian Nation Fisheries staff (pers. comm. Joe Blodgett, YIN Fisheries Production Biologist)

7.3 Identity.

Only hatchery-origin adipose-fin clipped "late" winter adult steelhead are used as broodstock. Fish collected prior to April 1 are not used in order to avoid potential crosses with early winter steelhead. To help supplement the reintroduction and restoration effort in the upper watershed, WDFW may transport and release one out of every four adipose- fin clipped adults collected after April 15 to the upper watershed. This option depends upon the expectation of meeting basic program needs first.

7.4 Proposed number to be collected:

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

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
Planned	180	180	0
1995	238	238	0
1996	305	305	0
1997	207	208	0
1998	127	136	0
1999	105	105	0
2000	161	158	0
2001	244	244	0
2002	160	160	0
2003	129	129	0
2004	165	167	0

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

Adult late winter steelhead that returned to the Cowlitz Salmon Hatchery separator were sorted and those fish designated for the upper watershed were placed in holding tanks. These were later transported and released by Tacoma Power at the boat launch to Lake Scanewa at the LCPUD Day Use Park. The FHMP places no limits on the number of HOR late winter steelhead released into the Tilton River. Because of this, a higher priority is given to increasing adult releases in the upper river rather than re-cycling surplus adults back to the lower river for harvest. More than 8,000 adult late winter fish have been hauled upstream since 1997 (Table 11).

Table 11. 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										

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

7.6 Fish transportation and holding methods.

Fish that arrive at the Cowlitz Trout Hatchery are held in a trap (100' x 10') until sorted weekly. Then desired fish are placed into separate sections of a holding raceway. Sections are divided by picket racks. "Late" winter steelhead that are trapped at the Cowlitz Salmon Hatchery are sorted as they arrive to the adult holding ponds or to one of the six circular transfer ponds. They are trucked (transfer is described under section 10.5) to the Cowlitz Trout Hatchery and dumped into the appropriate section where they are sorted by sex, ripe or unripe. Fish are then sorted weekly to determine ripeness.

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 iodiphore procedures upon entering or exiting the area. Formalin treatments are administered if needed.

7.8 Disposition of carcasses.

Effective December of 2000, spawned carcasses of female "late" winter steelhead are buried. Also, no carcasses are provided for nutrient enhancement due to (IHNV) disease 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.

Fish of non-hatchery origin (right ventral marked and unmarked) will be returned quickly upriver in a manner which will not harm them.

Section 8. Mating

8.1 Selection method.

Broodstock will be comprised of adipose-fin clipped adult "late" winter steelhead collected and spawned from April 1 through the end of the season (May 20 or later). Multiple takes of up to seven takes can be spawned. New fish will be recruited into the spawning population throughout this time period. As the restoration effort continues, it may be necessary to incorporate naturally produced fish into the broodstock to maintain genetic integrity. This will be decided through consultation with NMFS at some point in the future.

8.2 Males.

Males will be used once unless a shortage exists, double opercle punched and returned to river.

8.3 Fertilization.

The sperm from one male is combined with the eggs from one female. After five minutes, the fertilized eggs (from one female) are disinfected and water hardened in an iodine solution for one hour. After one hour, the eggs are combined into five fish pools then placed into shallow trough baskets 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.

- All "late" winter steelhead adults mated are of hatchery origin (marked with an adipose fin clip) and are collected only after April 1.
- There will be no selection for size.
- Right ventral clip or unmarked adults collected will be transported and released in the upper watershed to spawn.

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 (%)
1995	952,000	NA	NA
1996	1,229,200	NA	NA
1997	936,100	91.2	NA
1998	550,500	87.1	NA
1999	418,500	94.4	NA
2000	636,000	75.4	NA
2001	1,028,800	87.0	NA
2002	1,110,069	NA	NA
2003	867,694	NA	NA
2004	725,548	NA	NA

Source: WDFW Hatchery Records. NA- Data not available at this time and will be included in submittal to NOAA.

9.1.2 Cause for, and disposition of surplus egg takes.

The program has protocols and procedures to prevent surpluses. But, in case of a surplus, eggs would be incubated and reared full-term to fry or smolt, and surplus/overage of fish would be dispersed in the subbasin based on consultation with regional manager.

9.1.3 Loading densities applied during incubation.

Egg are eyed and hatched in baskets in shallow troughs. Eggs from five females are eyed in each basket. Then 20,000-21,000 eyed eggs per trough for hatching. Egg size varies from 3,144 to 3,798 per pound. (Three year average)

9.1.4 Incubation conditions.

The Cowlitz Trout Hatchery has 88 shallow trough incubators, 6 fry raceways @ 10’ X 90’ X 2.5'. Temporary modifications to the gas diffusers are being worked on to reduce the supersaturated gas levels from the North well (primary incubation supply) and the low oxygen level (8.1 parts per million (ppm)) currently obtained from this water supply. Well water is normally 48 - 50°F. This well has recently been plagued with bacteria growths causing plugging problems in the incubation baskets. A new water supply with an auxiliary backup system is being requested from Tacoma Public Utilities.

Heated water is used in incubating later egg takes in order to manipulate growth rate of the latest egg takes. Growth of fish from the latest takes do not completely catch up to earlier takes, but the rate is significantly in advance of non-heated water.

9.1.5 Ponding.

Fish hatching, swim up, and initial rearing is in shallow troughs. Feeding is initiated 10 days after swim-up when the fish are about 2,000 fish per pound (fpp). Ponding, which is forced, occurs when fish are from 1,500 fpp to 600 fpp depending on pond space. Lengths are not measured. Ponding is in July and August.

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.

Only hatchery-origin fish are incubated. Backup generator systems are on-site to provide power for hatchery pumps in the event of power loss at both the Cowlitz Salmon and Cowlitz Trout Hatcheries.

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.

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
June- At Swimup		2000		
July		1200		0.400
August	43.7	590	3.712 E-04	0.508
September	62.7	160	4.129 E-04	0.729
October	78.4	80	4.406 E-04	0.500
November	88.7	50	4.435 E-04	0.375
December	127.4	20	4.025 E-04	0.600
January	136.5	15	4.294 E-04	0.250
February	153.4	10	4.125 E-04	0.333
March	175.8	7.0	3.919 E-04	0.300
April	207.0	5.0	3.930 E-04	0.286

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

See section 9.2.4 above.

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 #1	7	4.0		0.5
Fry	#1 and #2 crumble	7	4.0		0.7
Fingerling	1.2 mm and 1.5 mm	7	3.0		0.9
Yearling	2.0 mm	7	1.0-3.0		1.3
Smolt	2.5 mm	7	1.0-3.0		1.5

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: *Fish Health Policy in the Columbia Basin* and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (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	*Renibacterium salmoninarum*, the pathogen that causes BKD in salmonids, is passed from the adult via the egg stage to the juvenile fish. *R salmoninarum* is also transmitted by the water borne route, among fish in the rearing ponds as well as from the hatchery water supply. Fry and fingerling undergo ELISA segregation during rearing, as well as oral prophylactic treatments with Erythromycin. In the standard ponds, fry and fingerlings have been treated with Florinicol for Bacterial Cold Water Disease (BCWD) and Paracide-f for external parasites, fungus and *trichodina* control on holding adults. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low level chronic mortalities during the rearing period. Erythrocytic inclusion body syndrome has occurred in many years and predisposes fish to other diseases, such as bacterial kidney disease (BKD), fungal infections and BCWD. Frequently it occurs concomitantly with these diseases. Formalin baths were also given after marking to prevent cold-water disease and fungus from infecting the clipped area. 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 iodiphor 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.

An ozone water sterilization plant is available for use during portions of the year. The plant has a 20 cfs maximum design capacity. The purpose of this plant is to reduce the mortality and poor growth of fish associated with *Ceratomyxa shasta* (*C. shasta*) infection.

Section 10. Release

10.1 Proposed fish release levels.

See section 10.2.

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

Age Class	Max. No.	Size (fpp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Fingerling	200,000	100	September-October	Upper Cowlitz	Above RKm 140	Cowlitz	Lower Columbia
Yearling	315,000	5.5	May	Cowlitz River (RKm 78.9) and Upper Cowlitz	78.9 and Various Points in Upper Cowlitz Subbasin)	Cowlitz	Lower Columbia
Yearling	37,500	5.5	May	Cowlitz River	(RKm 78.9)	Cowlitz	Lower Columbia
Yearling	37,500	5.5	May	Cowlitz Falls	(RKm 140)	Cowlitz	Lower Columbia

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

Release Year	Fry Release			Fingerling Release			Yearling Release		
	No.	Date (MM/DD)	Avg size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1992				73230					
1993									
1994				246129					
1995				394129			100192		7.4
1996				417100			118297		8.5
1997				636375	September	128	178143	May	7.4
1998				314678	October	100	176930	May	7.3
1999							128236	May	8.1
1999	Upper River Releases			187830	October	89.2	67637	May	10.4
2000							217154	May	7.6
2000	Upper River Releases			23360	October	53	2924	May	7.5
2000	5002		307	Tilton Releases					
2001							435487	May	6.8
2001	Upper River Releases						90065	May	9.6
2002				504930	October	80	408650	May	8.9
2002	Upper River Releases			418597	October	85.5	37359	May	9.3
2002	Tilton Releases			79768	October	72.6		May	
2003							335334	May	10.2
2003	Upper River Releases			231614	October	51.0	31768	May	11.6
2003	Tilton Releases			68119		61.0			
2004				199704	Oct 5-7	85.5	228229	May	6.7
2004	Upper River Releases						24864	May	7.0

Source - WDFW planting records.

10.4 Actual dates of release and description of release protocols.

See section 10.3 table above for actual dates.

Late winter steelhead are reared in raceways at the Cowlitz Trout Hatchery. 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, the smolts must be trucked out of these ponds to be released. Fish are released via truck at either the boat ramp at the Cowlitz Salmon Hatchery or the boat ramp at the Cowlitz Trout Hatchery in May.

October fingerling releases include right ventral clipped and unmarked fish with multi elastomer tags on late winter steelhead for the Upper Cowlitz Restoration Project (UCR). This is done by trucks and buckets to areas that were accessible (Serl and Morrill, 2000).

10.5 Fish transportation procedures, if applicable.

Juvenile fish being released, as well as being transferred between facilities, utilize the two1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through the displacement of water and the 1,500 gallon fish tanker assigned to the Cowlitz Trout Hatchery. They all have oxygen and recirculation 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.

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

At CTH, fish have been reared in the facilities their entire yearling cycle and directly released adjacent to the rearing ponds at the CSH boat launch and the CSH boat launch site. River water has been used the entire cycle with ozone treated water used from May to December.

In the past, "late" winter steelhead were acclimated in net pens above Cowlitz Falls dam. Since 1996, fry and fingerlings releases have been made to the upriver areas. As part of the reintroduction program in the upper Cowlitz River, 12 stress relief ponds (resting raceways) were constructed at the Cowlitz Salmon Hatchery. Collection of smolts from the upper basin was made possible by the inclusion of the fish collection facility with the construction of the Cowlitz Falls Dam. Prior to this, fish would drop into Riffe Lake and would reside there. Few smolts find their way out of Riffe Lake. Fish transported from the Cowlitz Falls fish collection facility are transferred to the stress relief ponds and given 24-48 hours to settle down before commencing their journey downstream. "Late" winter steelhead trucked from the trout hatchery may utilize these ponds when the ponds are not needed by fish being transported downstream from the Cowlitz Falls fish collection facility.

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

All "late" winter steelhead smolts released from the Cowlitz Complex are adipose fin clipped prior to release. Late winter fingerlings for upper river plants are RV and RV + AD marked.

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

This situation should not occur since there is opportunity to deal with any surplus as eggs and when fish are inventoried during early rearing. However, should this situation arise for some unforeseen reason, NMFS would be immediately consulted. (Use additional smolts to provide for more harvest opportunity and adults for restoration/recovery, Charles Morrill, personal communication).

10.9 Fish health certification procedures applied pre-release.

Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. Prior to this examine, whenever abnormal behavior or mortality is observed, staff also contacts the Cowlitz Facility Fish Health Specialist. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

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

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.

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 winter steelhead smolts prior to release, Smolt-to-Adult survival rates of hatchery winter steelhead 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.

A fisheries and hatchery management plan is in development as a component of the Cowlitz Hydroelectric Project Settlement Agreement. A draft plan is scheduled to be available to the Cowlitz Fisheries Technical Committee by February 1, 2002. In the interim, fish population 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 Cowlitz 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.

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 funds the staffing and support logistics for the program monitoring and evaluation. Staffing is comprised of and derived from a pool of personnel used in fish cultural and pathology related tasks.

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.

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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Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

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.

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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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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:_____

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

Steelhead

ESU/Population	Lower Columbia River Steelhead
Activity	Cowlitz Late Winter Steelhead Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	December-May
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)			0-5**	
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)	Up to 76,000*	Up to 68,400*	Up to 380	
Intentional lethal take (f)				
Unintentional lethal take (g)				
Other take (unintentional, indirect) (h)				

*A 10% mortality is calculated for each life phase above.

** Wild adult returns to hatchery are transported to the upper Cowlitz basin.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category

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

Spring Chinook

ESU/Population	Lower Columbia River Spring Chinook
Activity	Cowlitz Late Winter Steelhead Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	December-May
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0-5	
Other take (specify) (h)				

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

Take Table 3. Estimated listed salmonid take levels by hatchery activity.

Fall Chinook

ESU/Population	Lower Columbia River Fall Chinook
Activity	Cowlitz Late Winter Steelhead Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	December-May
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0*	
Other take (indirect, unintentional) (h)				

* Fall chinook are not present during broodstock take for this program.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

Take Table 4. Estimated listed salmonid take levels by hatchery activity.

Coho

ESU/Population	Lower Columbia River Coho
Activity	Cowlitz Late Winter Steelhead Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	December-May
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0-5	
Other take (unintentional, indirect) (h)				

a.Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category

Appendix A. Number of salmonids collected at the Cowlitz Falls Fish Facility and smolts transported to the Stress Relief Ponds in 2004 and total collection by season from 1997-2004. {*error in transport under review*}

2004	Spring Chinook				Steelhead						Coho		Cutthroat		Total	Total
Season	fry	NP[1]	Hatchery[2]	1+	parr	hum	AD	RV+ad	RV smolt	Um smolt	fry	smolts	parr	smolts	Fish	Smolt
Totals:																
Spring-Summer season: Continious operation April 17-August 30, 2004.																
Collected	409	8,383	21,198	20	936	0	2,685	16,029	5,042	11,276	11,489	128,161	110	721	206,464	193,515
Transported	399	8,188	20,500	20			*2,180*	*16,470*	4,972	11,192		127,419		720		192,060
Extended Operation: Twice Weekly Operation Sept 17- October 15, 2004.																
Collected	0	330	4	0	12	0	0	0	3	33	511	14	3	1	911	385
Transported		325	3						2	32		13		1		376
Total season collection by year, 1997-2004																
2004	*409*	*8,383*	*21,198*	*20*	*936*	*0*	*2,685*	*16,029*	*5,042*	*11,276*	*11,489*	*128,161*	*110*	*721*	*206,464*	*193,515*
2003	3,320	7,741	26,982	18	756	0	29	16,434	170	14,740	5,177	173,540	282	1,280	250,479	240,944
2002	1,615	5,595	20,733	0	428	1	590		23,162	5,247	5,423	55,029	126	990	118,939	111,343
2001	762		36,450	25	295	4,659	242		33,491	17,807	4,405	334,718	166	1,077	434,097	428,469
2000	815		32,704		55		89		16,404	17,023	3,174	106,880	140	1,343	178,627	174,409
1999	421		8,878		4,832		31		10,783	10,001	2,269	15,120	78	545	52,892	50,159
1998	31		14,917		0		22		25,921	15,691	656	109,974	42	888	168,193	167,391
1997	18		22,815		0		37		15,621	2,777	558	3,673	103	260	46,016	45,149

1] Unmarked fish in 2004 were assumed to be naturally produced. 2003 and 2002 numbers based on fry marking a portion of fry plant with VIE marks.

2] 2004 numbers based on RV clipped fish captured.