HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Cowlitz River Fall Chinook
Species or Hatchery Stock	Fall Chinook (*Oncorhynchus tshawytscha*)/Cowlitz Hatchery
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz River/Lower Columbia
Date Submitted	
Date Last Updated	April 19, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

Cowlitz River Fall Chinook

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

Fall Chinook (*Oncorhynchus tshawytscha*)

ESA Status: Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha*) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.

1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson
	Cowlitz Complex Manager
Agency or Tribe:	Washington Department of Fish & Wildlife
Address:	1182 Spencer Road, Winlock, WA 98596
Telephone:	(360) 864-6135
Fax:	(360) 864-6122
Email:	johnsmjj@dfw.wa.gov

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 Facility Maintenance

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

Funding Sources
Tacoma Public Utilities

Operational Information	Number
Full time equivalent staff	14.5
Annual operating cost (dollars)	$1,700,000.00 (Specific costs to program cannot be broken out separately).

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Cowlitz Salmon Hatchery Fall Chinook Stock
Broodstock collection location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Adult holding location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Spawning location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Incubation location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Rearing location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz

1.6 Type of program.

Integrated Harvest Program

1.7 Purpose (Goal) of program.

Under the previous FERC license, the goal of this program had been to mitigate for the loss of fall Chinook that would have been produced naturally in the Cowlitz River system in the absence of the Cowlitz River Hydroelectric Project in the basin by achieving an adult goal back to the facility. Adult mitigation goals also provided significant harvest for ocean an freshwater fisheries but also by the mid-1990's started to contribute to conservation, recovery, research and education goals. Under the new license, the primary objective of the new Cowlitz River Hydroelectric Project Settlement Agreement is ecosystem integrity and the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (FERC No. 2016, August 2004). River objectives above Mayfield Dam will be achieved through the reintroduction of Chinook, coho, steelhead and cutthroat into the upper Cowlitz River above Lake Scanewa and Tilton River (Mayfield Lake) basins. In addition, habitat improvements are planned to increase fish passage/collection facilities at key locations in the Cowlitz River Basin to increase fish survival through the Project area.

This program will be providing adults for upriver recovery goals as outlined in the Final 2004 Cowlitz River Fisheries and Hatchery Management Plan (FHMP).

1.8 Justification for the program.

In 1948, the Washington Department of Fisheries (WDF) and the Washington Game Commission estimated that the Upper Cowlitz River produced 63,612 adult fall chinook salmon and 32,490 adult spring chinook salmon annually (Tacoma Power 2000). The construction of Mayfield and Mossyrock Dams and the Barrier Dam from 1963 to 1968 restricted or prevented movement into the Cispus, Tilton, and Upper Cowlitz Rivers. Historically, fall chinook salmon were observed spawning as far upstream as the lower reaches of the Tilton and Cispus Rivers (Bryant 1949 as cited in Myers et al. 2003). The WLCTRT has identified 2 historical populations of fall chinook salmon with the extirpated Upper Cowlitz fall run and Lower Cowlitz river fall run incorporated into the Cowlitz Hatchery stock (Myers et al. 2003 and WCSBRT 2003). Redd counts in 1961 through 1966 for the Cowlitz River indicated 37 percent were found above Mayfield. Based on that redd distribution, returns to the Cowlitz River would have been 23,067 fish. Distribution was from near the mouth to upper major tributaries such as the Ohanapecosh River, many miles above Mayfield and Mossyrock dams (Thompson and Rothfus 1969). The construction of Mayfield

and Mossyrock Dams blocked access to much of the historical spawning habitat (Myers et al. 2003). The original WDFW/Tacoma Power mitigation agreement goal was 8,300 adult fall Chinook back to the Cowlitz Salmon Hatchery. From 1967 through 2003, returns to the hatchery averaged 5,725 (68%) of the mitigation goal in the expired SA.

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 existing hatchery stocks will continue to 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. Along with habitat and fish passage improvements, current operational and after Cowlitz Hatchery Complex remodel and phase in plans (SA Article 7), are described in detail in the Cowlitz River Fisheries and Hatchery Management Plan (SA Article 6). The Cowlitz River Fisheries and Hatchery Management Plan (FHMP) proposal will be to operate hatchery programs rearing salmonids native to the Cowlitz River as Integrated, and all non-native species as Segregated. An unknown level of integration occurs due to the hatchery fish not being mass-marked. In the short term, naturally produced fall Chinook will not be incorporated into the hatchery population so long as the upper basin productivity experiment is being conducted for a period of 12 – 15 years. The Fisheries Technical Committee (FTC) will evaluate the concept of an integrated hatchery program at the Cowlitz Complex in the next iteration of the FHMP after Year 6.

This program provides fish for ocean and freshwater commercial and recreational fisheries. Based on future productivity and fish passage improvements in the upper basin, the Cowlitz spring Chinook program will be consistent with the Cowlitz River Fisheries and Hatchery Management Plan (FHMP) proposal to operate all hatchery programs rearing salmonids native to the Cowlitz River as Integrated, and all non-native species as Segregated (Final FHMP August 2004). The hatchery fall Chinook program will be managed in anticipation that an Integrated Type strategy designed to achieve conservation and harvest goals over the long term (>15 years) will be the preferred approach for the basin. In the Final FHMP Tacoma Power proposes to fund the beginning of mass marking all Cowlitz Complex fall Chinook released in 2006, the first brood year following the approval for implementation of the FHMP. It is unable at this point to determine the degree to which the fall chinook program could be integrated or at what levels per Hatchery Scientific Review Group (HSRG) recommendations. This will take longer than the spring chinook or coho programs as fall chinook productivity experiments in the upper Cowlitz will not start until after the spring chinook has been monitored and returns from mass marked programs start returning in 2010.

WDFW protects listed fish and provides harvest opportunity 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.

In order to minimize impact on listed fish by the Cowlitz River fall Chinook program, a number of risk aversions are included in this HGMP (**Table 1**).

Table 1. Summary of risk aversion measures for the Cowlitz fall Chinook 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, updates or needed remodel or fixes assessed.
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	• Broodstock collection procedures identify listed fish. • Safe handling protocols in place. • Listed fish placed back to stream.
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).
Competition & Predation	2.2.3, 10.11	• Ecological interactions risk aversions

1.9 List of program "Performance Standards".

See section 1.10 below.

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

1.10.1 Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
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 10-year average of 0.10 % smolt-to-adult survival that includes harvest plus escapement (8752 at current 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 2,000 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)
	Maintain effective population size.	
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 (50-80 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).

Up to 2,200 adults at a 1:1 male to female ratio is needed for the program. Additionally up to 2% (22) jacks can be used. Egg Take goal is 5,600,000 eggs (FBD 2004). Fecundity has ranged from 4,700 – 5,000 per female in past years.

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	5,000,000	50- 80	May-June	Cowlitz River	78.8	Cowlitz	Lower Columbia

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

The original WDFW/TPU mitigation agreement goal was 8,300 adult fall Chinook back to the Cowlitz Salmon Hatchery. From 1967 through 1997, the returns have averaged 69.7% of the mitigation goal excluding harvest (Cowlitz Annual Report for 1997).

Smolt-to-adult survival rates – Overall survival averaged 0.1025% from brood years 1988-1999 with a range from 0.2% in brood year 1994 to a high of .18% in brood year 1998. Brood years 1994,

1996 and 1997 brood years were low (0.2, 0.5 and 0.6% respectively), whereas recent brood years 1998 and 1999 have indicated an increase of .18 and .14 % respectively.

Adult production levels - Total catch averaged 1,558 from return years 1992-2001. Catch in return year 1994, 1995 and 1998 were lower (741, 868 and 577 total respectively). Returns since 2000 have averaged 2,005 fish with 2004 showing a significant increase of 4,756 fish.

From 1967 through 1997, escapement levels averaged 8,530 adults (102%) of the previous SA mitigation goal. From 1998 through 2004, escapement averaged 4,371 adults (25.2%) of mitigation goal although the recent trend from 2001 – 2004 has averaged 7,397 compared to 4,001 average escapement in the 1990's (**Table 2**). Since 1997, fall Chinook adults have been transported to the Tilton River basin (See also HGMP section 2.2).

Table 2. Cowlitz Salmon Hatchery Fall Chinook Adult Returns, SAR through BRD 1999 and Lower Cowlitz Escapement.

Year	Hatchery Return	Lower Cowlitz R. Escape-ment	BRD YR SAR	Year	Hatchery Return	Lower Cowlitz R. Escape-ment	BRD YR SAR
1980	1,968	2,418	NA	1993	2,907	2,218	0.12
1981	4,697	3,991	NA	1994	5,777	2,512	0.02
1982	4,284	3,024	NA	1995	3,689	2,231	0.08
1983	5,969	3,654	NA	1996	6,680	1,602	0.05
1984	5,117	2,577	NA	1997	2,752	2,710	0.06
1985	6,434	4,300	NA	1998	2,824	2,108	0.18
1986	10,757	3,711	NA	1999	3,119	997	0.14
1987	11,699	6,390	NA	2000	3,029	2,700	NA
1988	13,793	7,990	0.11	2001*	7,030	5,013	NA
1989	11,376	7,375	0.09	2002*	9,269	1,427	NA
1990	6,357	2,698	0.18	2003*	6,836	10,329	NA
1991	3,549	2,567	0.08	2004*	6,453	4,466	NA
1992	2,356	2,489	0.12	2005			

Sources - Stock assessment reports (BPA), annual reports, StreamNet Annual Coded-Wire Tag Program, Washington Missing Production Groups, Cowlitz Annual Reports from 1994-2000.

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

Fall chinook salmon have been reared at the Cowlitz Salmon Hatchery since 1967, but were also reared at a hatchery operated out of the Clear Fork in the upper basin until 1950.

1.14 Expected duration of program.

Fall Chinook production from CSH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, which operates 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 River/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

Note: Issues stated below have been addressed in the new FERC Settlement Agreement (The Cowlitz River Project, FERC No. 2016, August 2004).

Issue 1: Since 1967, fall Chinook have been released to the Cowlitz River in order to satisfy the mitigation adult goal and also contributed significant harvest benefits to freshwater and limited ocean fisheries. Ocean survival through the 1990's dramatically affected contribution and survival. With increased survival in the late 1990's, fall Chinook adults were used for upriver reintroduction starting in 1997 mostly to the Tilton River system. Adult transfers to the upper system were discontinued after 2002 in order to determine spring Chinook productivity. The new SA has been agreed upon by the parties to prioritize the continued operation of the hatcheries for the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels. In the recent FHMP, reductions of hatchery production have been proposed but should be based on whether fish passage (Issue 2) is successful and whether upper basin productivity has been proven. Overall plans for future restoration and recovery of the spring Chinook program exists in the FHMP (Section 5.2).

Issue 2: In the new SA, significant upper river reintroduction and natural production is occurring. Since the mid-1990's, significant restoration activities in the upper basin have taken place including adult re-introduction, fry and fingerling releases and subsequent natural smolt productivity. The greatest obstacle to restoration of upper basin anadromous fish runs is downstream passage of juvenile salmonids (smolts). They must be captured or collected to ensure that they do not residualize in a reservoir or run through a turbine. The Cowlitz Falls Dam (operated by the Lewis County Public Utility District) is the center of efforts to collect downstream migrant salmonids and transport them safely around hazards of reservoirs and dams to the lower river. Juvenile salmonids produced in the Tilton River pass downstream through a fishway at Mayfield Dam.

1.16.2) Potential Alternatives to the Current Program

Note: Although instructions in the Potential Alternatives HGMP section indicate draft plans not necessarily endorsed by management, the following alternatives have been agreed upon and supported by parties to the SA.

Alternative 1: Significant remodel plans within the Cowlitz Complex facilities are described in Article 7 that will be of significant benefit to producing coho for continued support of upper river efforts. Both the Cowlitz Salmon Hatchery and Cowlitz Trout Hatchery will be rebuilt within five years of license issuance with emphasis on innovative rearing practices. Planning, developing and reviewing alternatives for Cowlitz River Fisheries Management is currently underway through the Cowlitz Fisheries Technical Committee. The committee is comprised of representatives from Washington Department of Fish and Wildlife, NOAA fisheries, Tacoma Power, Trout Unlimited, Washington Department of Ecology, US Fish and Wildlife Service, and The Yakima Indian Nation. These include: a) hatchery design drawings that include decreased rearing densities and innovative practices to replicate historic out-migration size and timing; b) plans for construction scheduling; c) provision for hatchery water supply that maximizes water from existing groundwater wells and, if necessary, provides for treatment of up to 10 cfs additional river water; and d) a plan for gradual transition to innovative rearing practices. Both, current and future lower and upper river production are proposed by the FHMP. The FHMP indicates that as natural production increases, hatchery production would decrease based on credit mechanisms (see section 3.7 FHMP) after the hatchery re-build (>2008). The Project though has inundated miles of river and tributaries that natural production may not totally be able return to pre-project levels. WDFW is committed to improving hatchery production and making it consistent with wild fish restoration in the Cowlitz basin, but modification

of hatchery practices or reductions in lower river production must be evaluated.

Alternative 2: Significant habitat improvements for upstream and downstream have been agreed to in the SA including: Article 1. Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage, Article 2. Downstream Fish Passage: Mayfield and Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock. In the meantime, existing hauling of adults and trucking of smolts will continue. A number of issues hinge on the success of fish passage improvements including the full potential of the upper basin production.

Potential Reforms and Investments:

Although costly, the development of restoration programs for the Cowlitz River watershed upstream of the barrier Dam represents a balancing act between competing needs for harvest and stock restoration, the evolving improvement of fish collection and passage for downstream migrants, the restoration of ecological function in the watershed, and host of other inputs currently unknown. The plan used to guide the process will need to be flexible enough to adapt to new information, aggressive enough to achieve success, and well-enough evaluated to guide this and future projects of this type.

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 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
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 fall chinook salmon are listed as "threatened" under the ESA on May 24, 1999.

Identify the ESA-listed population(s) that may be incidentally affected by the program.
Lower Columbia River spring chinook salmon listed as "threatened" under the ESA on May 24, 1999. Of the 14 hatchery stocks included in the LCR ESU, only the Cowlitz River spring chinook salmon was considered essential for recovery, but was not listed (64 FR 14308, March 24, 1999).
Lower Columbia River Steelhead listed as threatened under the ESA on March 19, 1998.
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.

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). 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 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 (Table 1.). It should be emphasized that these proposed abundance targets are based on the interpretation of currently available data and literature and should be modified as more rigorous analysis of new data is completed (Cowlitz River FHMP). With an increase habitat improvements, increased future recovery goals and potential population targets will be established in future FHMPs.

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 3**). 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 **(Table 4).** Smolts are collected at Mayfield Dam **(Table 5).**

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 3. 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 4. Annual numbers of adult fall Chinook (FCK), coho salmon, winter steelhead (WSH), late Winter Steelhead (LWS), and sea-run cutthroat trout adults transported into the Tilton River system from Cowlitz Salmon Hatchery (CSH) by origin, species, and sex.

Year	Hatchery						Wild				
	Species	Females	Males	Jacks	Non sexed	**Total Hatchery**	Females	Males	Jacks	Non sexed	**Total Wild**
1997	FCK	3	24	84		**111**					**0***
	Coho	867	2,766	2,056		**5,689**					
	WSH	293	289		286	**868**	8	11			**19**
	SRCT									79	**79**
1998	FCK	2	98	141		**241**					**0***
	Coho	903	1,106	1944		**3,953**	535	647	460		**1,642**
	WSH	92	158	83		**333**					
1999	FCK		1	72		**73**					
	Coho	2,469	3,058	2,471		**7,998**	573	673	29		**1,275**
	WSH				339	**339**		104			**104**
	SRCT							62			**62**
2000	FCK		1	636		**637**					**0***
	Coho	4,933	6,138	4,006		**15,077**	159	252	85		**496**
	WSH	324	323		7	**654**	72	47			**119**
	LWSH						2	6			**8**
	SRCT										
2001	FCK	588	1582	1,065		**3,235**					**0***
	Coho	12,569	14,770	1,808		**29,147**	660	1063	156		**1,879**
	WSH	214	320	8		**542**	88	84			**172**
	LWSH						1				**1**
	SRCT									92	**92**
2002	FCK	1,774	3,765	16		**5,555**					**0***
	Coho*	6,165	7,989	1,673		**15,827**	525	661	69		**1,255**
	WSH	477	601	3	451	**1,532**	152	153	1	300	**606**
	LWSH									12	**12**
	SRCT									7	**7**
2003**	FCK	1,968	2,317			**4,285**					**0***
	Coho	3,465	3,341			**6,806**					**617**
	WSH					**0**					**84**
	LWSH					**377**					**74**
	SRCT					**0**					**617**
2004**	FCK	945	1,269			**2,214**					**0***
	Coho					**12,030**					**381**
	WSH					**0**					**319**
	LWSH					**503**					**26**
	SRCT										**69**

*Coho adult numbers for return-year 2002 are incomplete; totals are through Dec. of 2002.
0* Fall Chinook wild/hatchery cannot be determined without mass mark to this point.
** Data for 2003 and 2004 male/female breakdowns are not available.
Source – Cowlitz Hatchery annual reports and D. Harmon (2002-2003).

Table 5. 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 Passage	Captured	Est. Total Run	PS %	Est. Total Passage	Captured	Est. Total Run	PS %	Est. Total Passage
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 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 6).** 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 7)** 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 8).**

Table 6. 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 7. 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 8. 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 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 9).** 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 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 9. 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 10).** FCE of coho smolts in 2004 was 42% with 128,161 coho smolts collected a CFFF with a majority of them transported to the Cowlitz Salmon Hatchery Stress Relief ponds in 2004. Total smolt production was 308,079. Based on a maiximum potential egg deposition of 92 million eggs, egg-to-smolt survival was 0.33%.

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 10. 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: 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 that the program/stock adheres to proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. All wild salmonids collected are transported to the upper Cowlitz basin and tributaries for natural spawning. Mortality during transport is reported at the end of this document.

Genetic introgression: Mass marking will begin with 2006 releases. Currently, an unknown level of integration has occurred since program inception. Eventually, a known level of integration of the hatchery and natural components of the run will be possible once a self-sustaining run is established in the basin.

Rearing Program:

Operation of Hatchery Facilities: See HGMP section 4.2 for water withdrawal, intake screening compliance and hatchery effluent discharges.

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of programs. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995) chapter 5 have been instrumental in reducing disease outbreaks. Although the hatchery has 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 are described in the Final FHMP including after the remodeling and phase-in plan, and the Disease Management Plan (>2008). Lower river production is also dependent on agreement of future upriver credit mechanisms between WDFW and Tacoma Power (Section 3.7). 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. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted. At which time, NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species.

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 they could compete with wild fish. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids. 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: At 75 – 80 mm fl at release, based on predator prey length relationships and behavioral characteristics, predation is probably low, Predation studies have not been conducted on the Cowlitz River system but several risk factors have been associated with predation:

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 is a very 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: Listed Chinook from the Lower Columbia ESU are believed to be present in many systems over a wide rearing and migration window from March thru August. Listed winter steelhead can be emerging during the release period with 50% swim up occurring by mid-June (LCSI Draft 1998). Some overlap could be occurring, but actual habitat, spatial or behavioral characteristics during the overlap are unknown.

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. Yearling spring Chinook releases at 5 - 16 fpp (approximately 200 - 136 mm fl) pose a risk to listed fish in the lower river as most upper river produced smolts are of yearling size **(Table 12).**

Table 12. Average fork length (fl mm), weight (gms), and condition factor (K), of upper Cowlitz smolts released to the lower river

Um Steelhead	FL	Wt	K	n
2004	*175*	*51.3*	*0.910*	*801*
2003	183	55.8	0.880	1,170
2002	176	53.0	0.900	908
2001	187	61.0	0.900	1,565
2000	186	60.0	0.910	2,000
1999	181	57.0	0.940	1,765
1998	194	74.0	1.000	1,491
1997	187	63.0	0.930	430

Coho	FL	Wt	K	n
2004	*119*	*19.2*	*1.015*	*1723*
2003	121	18.2	1.001	1,695
2002	120	19.0	1.010	1,050
2001	126	21.0	1.010	1,658
2000	125	21.0	1.020	2,035
1999	128	23.0	1.050	1,254
1998	137	26.0	1.020	1,813
1997	129	24.0	1.080	509

RV Steelhead	FL	Wt	K	n
2004	*199*	*73.7*	*0.914*	*80*
2003	170	44.3	0.894	400
2002	193	73.0	0.920	199
2001	195	98.0	0.910	227
2000	199	71.0	0.890	522
1999	196	75.0	0.860	689
1998	194	58.0	0.800	1,136
1997	182	58.0	0.950	455

Spring chinook	FL	Wt	K	n
2004	*111*	*15.4*	*1.076*	*801*
2003	112	15.1	1.059	1,492
2002	113	16.0	1.070	2,314
2001	119	20.0	1.090	2,911
2000	123	20.0	1.080	2,991
1999	130	26.0	1.140	2,352
1998	131	24.0	1.070	1,056
1997	113	16.0	1.110	327

Cutthroat	FL	Wt	K	n
2004	*189*	*59.9*	*0.839*	*715*
2003	191	59.9	0.824	1,273
2002	190	62.0	0.840	972
2001	194	66.0	0.860	1,051
2000	195	64.0	0.830	1,235
1999	191	63.0	0.860	529
1998	199	66.0	0.880	877
1997	204	78.0	0.870	193

NP chinook	FL	Wt	K	n
2004	*102*	*12.8*	*1.090*	*1105*
2003	85	7.3	1.157	607
2002	72	4.7	1.200	153

Source - Draft Annual Report for the Cowlitz Falls from 1997- 2004.

Release Location and Release Type: The release from the Cowlitz Salmon Hatchery is directly to the lower river at RKm 78.8 well below the upper river productivity although in the lower river natural productivity area. Although the release is not totally volitional, most fish

quickly vacate the pond as soon as screens are removed. Based on past history, time and size release parameters, fish are in a smolted condition and could be migrating quickly upon release.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, size, and time guidelines. Limited evidence of residualism from programs following the following guidelines and fish culture practices has been indicated from snorkeling studies on the Elochoman River (Fuss 2000).

- Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and used for determining release time.
- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.

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: 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. Carcass surveys on Cowlitz spring and fall Chinook are conducted annually. 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. See also HGMP section 11.0 (Monitoring).

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).

Direct takes or from loss of fish from broodstock collection and release are located in tables at the back of this document. 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.

Production numbers in this HGMP can vary from past productivity levels and reflect reductions in programs due to ESA concerns, but for ESU-wide hatchery plans, the fall Chinook production from Cowlitz Salmon Hatchery was consistent with 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

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 govern WDFW Columbia hatchery operations:

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

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

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003). The new thirty-five year license was issued March 13, 2003, and became effective on July 18, 2003. Tacoma Power has contracted with the Washington Department of Fish and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.
- Cowlitz Fisheries and Hatchery Management Plan (Final August 2004).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

3.3 Relationship to harvest objectives.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Pacific Fisheries Management Council, *US v. Oregon*, and other state, federal, and international legal obligations. Besides ocean fisheries, specific harvest objectives will vary depending on the phase of the reintroduction and recovery program but fishery exploitation rates are expected to increase as the status of natural populations of fall Chinook improves (FHMP).

Marine fisheries in Southeast Alaska, British Columbia, and Washington that harvest Cowlitz River fall Chinook are expected to operate through 2008 under the provisions of the 1999 annexes of the PST. These provisions include a schedule of allowable harvest rates that vary with aggregate stock abundance for fisheries in Southeast Alaska (troll, net, and sport gear), Northern British Columbia (troll and Queen Charlotte sport), and West Coast Vancouver Island (troll and outside sport). Provisions in the PST also require Canada and the United States to reduce by 36.5 percent and 40 percent respectively, the total adult equivalent mortality rates (relative to the 1979-82 base period) in other fisheries that affect a prescribed list of stocks. Although Cowlitz River fall Chinook are not included in that list, reductions in exploitation rates of this magnitude remain likely due to the co-mingled status of Cowlitz and other prescribed stocks.

Current commercial non-selective fisheries in the mainstem Columbia River may occur in August and September to harvest fall Chinook.

Sport fisheries selective for adipose fin-clipped fall Chinook may be implemented in the future in the mainstem Columbia River and the lower Cowlitz River from August through October. Assuming a 10 percent mortality rate for the release of unclipped fish, a six percent encounter rate in the mainstem Columbia, and a 44 percent encounter rate in the lower Cowlitz, the WDFW objective for the total freshwater harvest rate in these sport fisheries would be 5 percent.

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

Fisheries benefiting from this program will include:

1. Ocean recreational and commercial fisheries from the mouth of the Columbia River north to S.E.Alaska.
2. Columbia River Zone 1-3 commercial fishery
3. Columbia River Zone 1-3 recreational fishery
4. Lower Cowlitz River recreational fisheries

Fall Chinook from the Cowlitz River are harvested in a variety of sport and commercial fisheries in Southeast Alaska, British Columbia, Oregon and Washington. Total adult equivalent exploitation rates in all fisheries since the 1977 brood have ranged from 13 percent (1991 brood) to 78 percent (1977 brood), with an average exploitation rate of 55 percent in all years. Based on coded wire tag analysis of HOR fish, most exploitation historically occurred in ocean fisheries, primarily in Washington and off the west coast of Vancouver Island, with an average total adult equivalent exploitation rate in all ocean fisheries of 42 percent for the 1977 through 1996 broods. Reductions of exploitation rates in these fisheries in recent years, particularly in response to the poor survival rates of many stocks in the early 1990s, resulted in ocean exploitation rates as low as 11 percent (1991 brood).

Table 13. Percent of Cowlitz Fall Chinook Contribution to Largest Fisheries.

Brood Year	Alaska Troll	Cana-dian Troll	WA Troll	OR Troll	Treaty Troll	Col. River Gillnet	Cana-dian Ocean Sport	WA Ocean Sport	Columbia Sport
Avg. (1994-99)	7.8	12.0	11.2	19.4	4.0	9.3	7.4	21.0	4.1

3.4 Relationship to habitat protection and recovery strategies.

The impact associated with Tacoma Power's and Lewis PUD's 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 to fish incldue:

(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 Settlement Agreement articles are addressing passage way problems in the system including: Article 1 (Downstream Fish Passage for Riffe Lake and Cowlitz Falls), Article 2 (Downstream passage for Mayfield Lake) and Article 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 Article 11 has created a fish habitat fund of up to 3.0 million dollars for identified projects (FERC 2016).

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.

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

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program*: Cowlitz Chinook 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). Salmon returning to the upper and lower Cowlitz River system will be important to the ecosystem and provide a rich, seasonal food

resource that directly affects the ecology of both aquatic and terrestrial consumers, and indirectly affects the entire food-web that knits the water and land together (Pacific Salmon and wildlife-Ecological Contexts, Relationships, and Implications for Management, 2000). Nutrient Enhancement and biomass Needs for the upper Cowlitz system are discussed in sections 3.6.1(FHMP).

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 Salmon Hatchery is supplied from three sources. The majority of water is supplied from the Cowlitz River with an average 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and April, normally for egg incubation and early fry rearing. Tacoma Public Utilities has a 211 cubic feet per second (cfs) water right at the Cowlitz Salmon Hatchery. An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project. Stress relief ponds have an alarm at the head box.

Runoff is predominantly generated by rainfall, with a portion of spring flows coming from snowmelt in the upper elevations and occasional winter peaks from rain-on-snow events. Flow in the mainstem is regulated in large part by the hydropower system. Mayfield Dam (RM 52) is operated by Tacoma Power and has a relatively small (133,764 acre-foot) capacity. Behind Mayfield Dam, Mayfield Lake provides little flood storage capacity and flows from Mayfield Dam are largely in response to the regulation of flows through Mossyrock Dam upstream. Flood flows in the lower mainstem have been substantially reduced due to flow regulation at the dams. Low summer flows have increased due to flow releases designed to protect the fishery resource in the lower river. In general, average summer, fall, and winter flows have increased and average spring flows have decreased since Mayfield Dam came online in 1956. This altered streamflow regime is believed to have improved conditions for some anadromous fish that spawn in the lower river but it is also believed to improve conditions for the intermediate host of the salmonid parasite, Ceratomyxa Shasta (Mobrand Biometrics 1999).

Two separate well systems provide 1,000 and 700 gpm, respectively, between August and April and generally are used for egg incubation and early fry rearing. Excessive gas in the incubation effluent is variable and may be associated with periodic increases in yolk coagulation in eggs and fry. Supersaturated Nitrogen gas conditions during high water necessitate the use of the dinitrofication tower system. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with an iodine solution after each use. LCFRB

The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). The water is coolest during January through March and warmest during June through October. Water temperatures of the effluent from the hatchery are about the same as in the river (Harza 2000 in FERC 2001). The river and wells supply water to the Cowlitz Salmon Hatchery incubation and rearing facilities with DO levels of between 7 and 14 mg/L (Harza 1997a in FERC 2001). DO concentrations of water discharged from the Cowlitz Salmon Hatchery closely mimic those of the river (Harza 2000 in FERC 2001). In contrast, the Cowlitz Trout Hatchery gets much of its water from wells that have low DO concentrations that are increased to between about 8.5 and 11 mg/L by aerators before being supplied to incubation and rearing vessels (Harza 1997a in FERC 2001). Water in these facilities generally remains at or above 8 mg/L.

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 Salmon Hatchery, fish propagation water rights total almost 250 cfs including incubation water (wells) and surface water and are formalized thru trust water right S2W19889C 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 Salmon Hatchery River intake structure is not compliant with NOAA Fisheries' *Anadrommous Salmonid Passage Facility Guidelines and Criteria (draft, January 31, 2004) or WDFW's Fish Protection Screen Guidelines for Washington State (WDFW, draft, June 2001).* This assessment is based on structural components and the hydraulics of the intake by WDFW(November 16, 2004 Intake Assessment, Cowlitz Salmon hatchery, Ray Berg, Lead Project Engineer). Velocity through intake screens, sweep velocity, mesh openings and juvenile bypass from screens do not meet criteria. In the current plans for hatchery rebuild though (>2008), no major modification of the intakes at Cowlitz Salmon or Cowlitz Trout Hatcheries are proposed by TPU because of the uncertainty over the potential breaching of the barrier dam. Also, TPU is awaiting NOAA's Anadromous Salmonid Passage Facility Guidelines and Criteria policy to determine if the intakes will require upgrading of the intakes. The water diversion and pump intakes at the salmon hatchery do not have adequate screens and may also pose a potential risk to naturally produced chinook. Currently, the diversion and water intake structure for the Cowlitz Salmon Hatchery is located adjacent to and immediately upstream of the barrier dam and is not completely screened. There is some potential risk that some naturally produced fall chinook juveniles could be taken should they enter this structure. TPU is investigating the intake to see if reasonable measures could result in improvements.
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 13-1021. 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 Temperatures* are monitored daily for maximum and minimum readings.

* Several additional water rights exist for groundwater well and for additional water used by BPA for the new stress relief ponds (Harza - Preliminary Draft Environmental Assessment 2001).

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam (constructed in 1969) across the river (length of 318') and an associated fish ladder. The Barrier Dam, directs migrating adult fish to the fish ladder which leads to the salmon hatchery sorting facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction, neither the transport channel nor the left bank entrance are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including two concrete ponds 100’ x 20’ x 5’ with 2,000 gpm per pond via transfer tube.

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 feet circular tanks at the adult trap and separator. Tanker trucks are 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. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon, one 1500 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities. Adult upriver hauls can take up to one hour

5.3 Broodstock holding and spawning facilities.

Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	-	-	-	-
5	Concrete Ponds	10000	100	20	5.0	2000

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Techna Vertical Stack Units (16 trays/Stack Unit)	216 (3456 Trays)	3-5	-	7000	7000

There are 272 stacks of vertical incubators (Heath Techna). TPU proposal calls for replacing these with 140 stacks of new vertical stack incubators. Each stack consists of 16 trays which are divided into two 1/2 stacks of 8 trays with separate water supplies. Each half-stack has a separate water supply at 3 gpm (to hatch).. Fry are incubated at 5 gpm (to ponding) and confined in ConWed substrate to discourage excessive swimming.

5.5 Rearing facilities.

The Cowlitz Salmon Hatchery has 36 modified Burrows ponds and 17 ponds (kettles). In addition, 12 BPA Stress Relief Ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program. See also below:

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	Modified Burrow Ponds	16000	100	20	8.0	2000	1.61	0.3
17	Concrete Kettle Ponds	4000	100	5	8.0	330	1.61	0.3
1	Concrete Raceway	2000	100	5	4	330	1.61	0.3

5.6 Acclimation/release facilities.

From CSH: Releases are from rearing ponds (see section 5.5) discharging into the Cowlitz River upstream of the fish barrier dam.

For upper river fingerling releases: Cowlitz Falls Dam presents a barrier which impedes or prevents downstream migration of smolts from the Upper Cowlitz. However, the dam includes a juvenile bypass system. The Cowlitz Falls fish facility attracts and collects downstream migrating juveniles at an estimated efficiency of 58%-65% for steelhead and 23%-24% for chinook salmon (Dammers et al. 2002).

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

Due to leaking end walls and kettle gates on the south side, a shortage of – 424,292 coho fry occurred between kettle inventories and mass marking to ponds. During the fourth quarter, 3 ponds of coho were treated for Bacterial Coldwater disease. These ponds had lower flows due to plugged 1 inch jets and hatchery staff had to clean the jets out on a regular basis to keep water flow in these ponds. The coho have gone over the contracted allowable flow indexes since the third quarter of 2003. This is due to the number of available ponds and constricted flows to the coho ponds. Sand and debris still accumulate in these small inlet jets and reduce water flow from the optimum of 2,300 gpm in the rearing ponds. This flow constraint contributes to causing the flow indexes to exceed the allowable contract value of 1.0 in the coho and fall chinook ponds. End walls on the south side of the hatchery still leak profusely, even after gaskets were replaced by T.P. employees. These leaking end walls allow juvenile salmon to escape from the ponds into the center channel and then out to the river via the waste way making inventory control impossible. These end walls also leak water from the center channel into the juvenile rearing ponds. This allows infectious organisms from the returning adults to infect the juvenile fish being reared on that side of the hatchery. Kettle gates have also allowed fry to escape during planting of our yearling smolts. This problem was addressed by T.P. employees by cementing some of the kettle gates closed.

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.

- Tacoma Public Utilities upgraded its electrical service at the Cowlitz Salmon Hatchery in the summer of 1999 including a new electrical service line from the Lewis County Power Supply Line. A new 1.5 KBW generator with upgraded switching equipment was also installed in 1999. The new generator is capable of suppling the power previously supplied by the three previous generators combined. Tacoma Public Utilities has retained the 600 KW generator and switching equipment in case the new generator should ever fail. Tacoma Public Utilities staff maintains the facility. Tacoma Public Utility staff and Washington Department of Fish and Wildlife Staff test the emergency systems weekly.
- Fish are not reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.
- The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.
- Staff is notified of emergency situations at the facility.
- The facility is continuously staffed to assure the security of fish stocks on-site.

Section 6. Broodstock Origin and Identity

6.1 Source.

The hatchery program was developed using the local stock of fall chinook salmon returning to the Cowlitz Salmon Hatchery.

6.2.1 History.

Historically, fall chinook salmon were observed spawning as far upstream as the lower reaches of the Tilton and Cispus Rivers (Bryant 1949 as cited in Myers et al. 2003). They were also present in the Toutle and Coweeman Rivers in large numbers. After the construction of the Mayfield and Mossyrock Dams and the Barrier Dam, upstream movement of fall chinook salmon was restricted. The hatchery program was developed using the local stock of fall chinook salmon, and was operated to meet a mitigation goal of 8,300 adults. The hatchery has maintained production using locally returning fish and there have only been four introductions of non-local egg transfers since 1951. Natural spawning habitat conditions in the Lower Cowlitz River may limit the successful reproduction of naturally spawning fall Chinook salmon, but in recent years an estimated 80% of the naturally spawning fall chinook salmon were of unknown, presumably natural, origin fish. Because only a small percentage of the hatchery fall chinook salmon releases are marked, naturally produced fall chinook salmon can be incorporated into the broodstock. The hatchery population is considered part of the demographically independent population of fall chinook salmon in the Lower Cowlitz River.

6.2.2 Annual size.

Program takes approximately 1100 females and males for the egg take goal of 5,600,000 (FBD 2004).

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

Because only a small percentage of the hatchery fall chinook salmon releases are marked, naturally produced fall chinook salmon can be incorporated into the broodstock. For the future, the hatchery fall Chinook program will be managed in anticipation that an Integrated Type strategy designed to achieve conservation and harvest goals over the long term (>15 years) will be the preferred approach for the basin. The level of proposed natural fish in the broodstock will be dependent on upriver productivity and the ability to identify all future Chinook origin in the system (mass marking for hatchery release).

6.2.4 Genetic or ecological differences.

Program broodstock is a derivative of native/naturally adapted Cowlitz River stock. That hatchery has maintained production using locally returning fish and there have only been four introductions of non-local egg transfers since 1951.. Adults are randomly selected throughout the run.

6.2.5 Reasons for choosing.

The broodstock chosen displays morphological and life history traits similar to the natural population and to meet harvest goals.

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.

The following procedures are in place that maintain broodstock collection within programmed levels:

- The collection plan for natural origin adults is in place that prevents collection of surplus fish
- Excess adults are used for seeding available habitat in accordance with genetic guidelines
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Section 7. Broodstock Collection

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

Year	Adults		
	Females	Males	Jacks
1990	3360	2529	67
1991	1915	1472	62
1992	1211	998	71
1993	1301	1401	89
1994	2183	1840	89
1995	1794	1848	99
1996	2527	2914	33
1997	1686	1010	26
1998	1063	1196	41
1999	1493	1589	34
2000	1467	1419	110
2001	1451	1601	48
2002	1207	1208	15
2003	1142	1071	29
2004	1264	1227	31

7.2 Collection or sampling design

Fish are collected fish throughout the entire run to meet specific fish management objectives and maintain the genetic integrity of this stock. Presently, adults for broodstock are collected from August through November, (sometimes December). At the base of the barrier dam (designed to stop/reduce all adult fish migration upstream) is a fish ladder leading to a trap and a fish separator. Adults can be sorted/separated into appropriate ponds for holding until spawned.

All adults not needed for broodstock were transported to the Tilton River and downstream. Before transport, they were sorted by hand at the separator. Any fish AHN that were detected as having an ad clip & coded wire tag were donated to food banks after the snouts were taken. All broodstock were inoculated with antibiotics for furunculosis and treated with formalin for fungus.

7.3 Identity.

All adult fish are hand sorted at the Cowlitz Salmon Hatchery and only hatchery fish of the appropriate time and number are retained for spawning use. Since 1997 and the introduction of mass marking, natural populations of spring chinook have not been integrated within the current. For years prior to mass marking no estimates can be made on the proportion of natural fish used for broodstock. Natural escapement levels (which include hatchery-origin fish) back to 1990 have been typically only 200 to 400 fish (SaSI 2002).

7.4 Proposed number to be collected:

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

Egg take goal for 2004 and 2005 is 5,600,000. Egg fecundity ranges from 4700 – 5,000. In 2003, egg fecundity was 4,795.

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
1990	3360	2529	67
1991	1915	1472	62
1992	1211	998	71
1993	1301	1401	89
1994	2183	1840	89
1995	1794	1848	99
1996	2527	2914	33
1997	1686	1010	26
1998	1063	1196	41
1999	1493	1589	34
2000	1467	1419	110
2001	1451	1601	48
2002	1207	1208	15
2003	1142	1071	29
2004	1264	1227	31
2005	-	-	-

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

Significant numbers of adult fall chinook salmon to the Tilton Basin began in 2001 **(Table 4).** Both unmarked and adipose fin clipped adults are transported. Prior to that there had been only a small number of jacks passed upstream since 1980 due to hatchery spawning needs.

7.6 Fish transportation and holding methods.

Fish used for broodstock are held in ponds that are 20' X 100' X 5.5' or in the circular separator tanks if needed. From here they can be transferred from the ponds to the spawning room where they can be checked for ripeness, anesthetized and spawned or returned to a holding pond via a return tube (if not ripe). For hauling adults to the upper basin, 1500, 1000 and 750 gallon tanker trucks are used. Normal transit time is 30-60 minutes.

7.7 Describe fish health maintenance and sanitation procedures applied.

All fish held for spawning are treated with formalin at 1:6000 for fungus and parasite control. IHN is tested from 60 fish pool ovarian fluid samples and BKD is tested from 60 fish kidney/spleen samples.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (chlorine) procedures upon entering or exiting the area. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the days end of spawning.

7.8 Disposition of carcasses.

Presently, all spawned carcasses and mortalities are buried at a Tacoma Public Utilities upland site. Spawned carcasses are not, at this time, utilized for nutrient enhancement.

Section 8. Mating

8.1 Selection method.

Fish are collected throughout the entire run to meet specific fish management objectives and maintain the genetic integrity of this stock of fish. Fish are selected randomly and spawned from September through early December.

8.2 Males.

Males are normally used once except when the following occurs; when too few males per ripe females exist then they are live spawned and returned to pond (occasionally occurs at the first and last spawnings).

8.3 Fertilization.

Equal sex ratios and 1:1 matings with pooled gametes from 2 females and 2 males (refer to previous section for additional information when 1:1 ratio does not exist). After water (pathogen free) is added to enhance fertilization, the fertilized eggs from each female are disinfected and water hardened in an iodine solution for one hour. After the one hour period, the eggs are placed in the incubators. Every season, 60 ovarian fluid samples are taken to check for IHNV. ELISAs are done on all females and, during picking, eggs are isolated according to ELISA values. "Below-low" ELISA designations are ponded and reared separately. Various combinations of spring chinook with low, moderate and high ELISA values are reared from year to year in one or two rearing units, segregated from all fish with "below-low" ELISAs.

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.

- Only Cowlitz local broodstock will be used. .
- Spring chinook will be collected through out the run time from adults arriving at the hatchery rack.
- Mating cohorts are randomly selected
- Protocols for population size, fish health disinfection and genetic guidelines followed.

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 (%)	Fry-fingerling Survival (%)
1990	13,040,000	NA	NA
1991	6,911,000	94.0	98.6
1992	5,324,000	95.3	97.1
1993	5,179,000	94.3	91.0
1994	8,271,000	92.7	92.0
1995	7,664,000	90.6	95.2
1996	7,506,890	89.5	84.4
1997	6,743,000	90.2	95.8
1998	4,239,800	94.6	88.1
1999	6,313,600	95.6	94.4
2000	6,168,258	95.4	88.5
2001	6,427,271	94.9	96.9
2002	6,476,300	NA	NA
2003	5,461,200	NA	NA
2004	5,719,700	NA	NA

9.1.2 Cause for, and disposition of surplus egg takes.

None since strict broodstock plans are in place which set annual broodstock aquisition and eggtake goals. In cases where egg survival exceeds criteria and/or surplus eggs are taken, fish would be outplanted as unfed fry into the Upper Cowlitz subbasin/tributaries or provided to cooperative programs.

9.1.3 Loading densities applied during incubation.

Fall chinook eggs are typically 1,630 eggs/pound (lb.). Standard loading per Heath tray at eyeing is 7,000 eggs/tray. Heath vertical incubators consist of 16 trays divided into two 1/2 stacks of 8 trays. Each half-stack has a separate water supply at 3 gpm. Fry are incubated at 5 gpm and confined in ConWed substrate to discourage excessive swimming. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators.

9.1.4 Incubation conditions.

All eggs were water hardened in a 100-ppm iodophor solution for 1 hour and hatched in vertical incubators with flows set at 5 gallons per minute. Typically, in an 2 stack (8 trays) incubation unit with eggs, influent water to top tray has a dissolved oxygen (DO) content of 11 parts per million (ppm) while the effluent water at bottom tray has ~9 ppm at < 50 degrees Fahrenheit. Influent total gas continues to be variable and sometimes unacceptably high depending upon well and other water sources. Total gas in influent water in the header trough has exceeded 113% and influent water is typically above 100% saturation as measured by HARZA N.W. and the Cowlitz crew.

9.1.5 Ponding.

Fall chinook fry are ponded when less than 1 millimeter (mm) of yolk is showing. They typically have accumulated ~1780 Temperature Units (TU's), are ~990 fish per pound (fpp) and are ~37 mm long. At the Cowlitz Salmon Hatchery these fish are usually ponded between mid-December and mid-April. This range is due to a wide range of egg take dates. Ponding is forced, as Heath incubators do not lend themselves to volitional ponding of swim-up fry.

9.1.6 Fish health maintenance and monitoring.

Eggs laid down to eye start receiving a 1:600 formalin drip treatment for fifteen minutes daily, 48 hours after water hardening until they are shocked and picked. Incubation guidelines for proper hatching and early rearing conditions are to not exceed a population of 20,000 eggs/fish or 25lbs of fish per shallow trough. When these limits are met, fry from the incubation room are ponded directly into F-series raceways or if space is available, they are evenly split into adjacent shallow troughs. There is not enough south well flow to supply both the F-series raceways and the incubation and still stay within rearing parameters. The relief comes when F-series and A-series are supplied with ozonated treated water.

Salmon Saprolegniasis (fungus) is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

- Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.
- Incubation takes place in home stream water.
- The program does NOT use water sources that result in hatching/emergence timing similar to that of the naturally produced population.
- Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality , flows , temperature , substrate and incubator capacities.
- Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on site.
- Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

Year	1990	1991	1992	1993	1994	1995	1996	1997
Fry-fingerling Survival (%)ear	-	98.6	97.1	91.0	92.0	95.2	84.4	95.8
Fingerling - smolt	Same	Same	Same	Same	Same	Same	Same	Same
Year	1998	1999	2000	2001	2002	2003	2004	2005
Fry- Fngerling Survival (%)ear	88.1	94.4	88.5	96.9	NA	NA	NA	NA
Fingerling - smolt	Same	Same	Same	Same	Same	Same	Same	Same

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

In recent years, there has been an increased emphasis on controlling numbers of fish reared to enhance quality. Densities are < 0.5 lbs/ft³ and at release the density index is ~0.1. The goal is to not exceed a Density Index of 0.1 and maintain a Flow Index of around 0.3 to 0.6.

9.2.3 Fish rearing conditions.

Rearing units are cleaned at least one time per week. Total gas and corresponding DO's have been extensively monitored by HARZA N.W., contractors with TPU. Due to the re-circulating nature of the Cowlitz Salmon Hatchery ponds, DO's of influent and effluent water are often nearly the same. For example, with water temperatures at 46E Fahrenheit, a pond of fish had 8.4 ppm DO influent and 9.0 ppm DO in effluent water.

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

Rearing Period	**Length (mm)**	**Weight (fpp)**	**Condition Factor**	**Growth Rate**
February (Fry Ponding)	35	1050	0.00035	
March	46	400	0.00035	0.619
April	58	200	0.00035	0.500
May	68	120	0.00035	0.400
June	78	80	0.00035	0.333

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*).

Although Cowlitz fall chinook have been fed dry feeds with reasonable success, they are typically started on BioDiet Starter #3 and then BioMoist Grower feed. The 1991, 1992, 1993 and 1994 broodyears had conversion rates of 1.32:1, 1.5:1, 1.3:1 and 1.36:1, respectively. Fall chinook are typically fed between 2.5% and 3.5% B.W./day, depending upon water temperature and weather conditions. They are pushed to grow as quickly as possible despite cool spring water temperatures (partly due to reservoirs upstream). Attempts are made to keep fall chinook that are under 100 fpp. below 3 lbs/gpm flow. In recent years, fall chinook are typically planted in late May or June at approximately 60 - 80 fpp. and at 5 lbs/gpm.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
1150-302	Ewos #1 Micro	6-8	2.5-3.0	0.068	0.9
302-150	Ewos #2 Micro	1-4	1.75-2.5	0.111	0.9
150-90	Ewos 1.2mm	1	1.75	0.046	0.9
90-Release	Ewos 1.5 mm (Short-Cuts)	1	1.5	0.044	1.0

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 time and size criteria that is prescribed in the program. None used at this time. Although, organosomatic indexes were conducted by personnel from the WDF fish health section during late 1980s and early 1990s under BPA funding. ATPase work was conducted by Wally Zaugg, NMFS, in the early 1980s and reported in the Proceedings of the Northwest Fish Culture Conference for the fish released in the Cowlitz River.

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

None. Mimicking the natural environment in rearing ponds will be a goal for the future CSH remodel (Article 7, FERC 2016).

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.

See HGMP sections 5.8, 6.3, 7.9 and 9.1.7 for risk aversion measures taken under this propagation program.

Section 10. Release

10.1 Proposed fish release levels.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Fingerling	5,000,000	80	May-June	Cowlitz River	78.8	Cowlitz	Lower Columbia

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

Main fingerling program is released from CSH to the Cowlitz River at RKm 78.8. Major watershed is the Cowlitz River located in the Lower Columbia Eco-province.

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

Release Year	Eggs/Unfed Fry Release			Fry Release			Fingerling Release		
	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1991							7058200	June	68
1992							6270300	June	65
1993							4302500	June	80
1994							4419900	June	65
1995							7294900	May-June	77
1996							6334100	May-June	83
1997				14648	June	105	7174543	July-August	80
1998							5945600	May-June	71
1999							4002900	May-July	66
2000							5585066	June	62
2001							5975811	May-June	70
2002	522699	February	1120				5303961	June	71
2003							5,215,538	June	68
2004							5,016,455	June	61

10.4 Actual dates of release and description of release protocols.

Normally, Cowlitz fall chinook are released from mid May through late June, usually at 60 to 80 fpp as 0+ age fish. The 1999 release took place in May, June and July. Size ranged between 63 and 68 fpp. The 1998 group was planted in May and June averaging 71 fpp. The 1997 releases took place in June and July at ~ 80 fpp. Due to low water temperatures during rearing growth rates are suppressed and late ponded fish do not attain release size until June/July. All releases are forced.

10.5 Fish transportation procedures, if applicable.

None needed. Fish are released in the same subbasin as the final rearing facility.

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

Fish are reared for on-station and upper Cowlitz River releases their entire life on Cowlitz River water.

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

In past years and up to release of spring 2005 (brood 2003), 200,000 fish (4%) have been adipose-fin clipped/coded-wire tagged. In the Final FHMP, Tacoma Power proposes to fund the beginning of mass marking all Cowlitz Complex fall Chinook released in 2006, the first brood year following the approval for implementation of the FHMP.

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

TPU agreement allows for a plus/minus 10% of approved program fish release goal. At eyed-egg stage or unfed fry stage surplus are adjusted accordingly to meet release target as specified in the the TPU agreement. Future Brood Document (FBD) sets annual broodstock aquisition and egg take goals. In cases where egg survival exceeds criteria and/or surplus eggs are taken, fish would be outplanted as unfed fry into the Upper Cowlitz subbasin/tributaries or provided to cooperative programs.

10.9 Fish health certification procedures applied pre-release.

- All fish are examined for the presence of "reportable pathogens" as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release.
- Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines.

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

Hatchery management would contact regional manager to inform him/her of situation. Regional manager would follow the protocols set forth in the TPU agreement and Section 7/10 permit. If emergency release is authorized, screen would be lifted and sumps dropped to allow a force release of fish into the Cowlitz River.

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.

- Weekly transport flows will assist migration (SA License Article 13).
- Volitional release during natural out-migration timing is proposed with the post remodel (SA License Article 7).
- Fish are not released in a manner that simulates natural seasonal migration patterns.
- Fish are released at a time and size specified in an established juvenile production goal.
- The percent of hatchery fish spawning in the wild is estimated by:
    - Annual stream surveys (e.g. carcasses)
    - Escapement data from a weir or dam
    - Harvest records, creel surveys
- Fish are released within the historic range for that stock.
- The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Section 11. Monitoring and Evaluation of Performance Indicators

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

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

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

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

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

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:

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

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.

No current research. See above studies for information

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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Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), Pacific salmon life histories. Vancouver, BC: University of British Columbia Press. Groot and Margolis 1991

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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.

Spring Chinook

ESU/Population	Lower Columbia River Spring Chinook
Activity	Cowlitz Fall Chinook Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-December
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 2. Estimated listed salmonid take levels by hatchery activity.

Fall Chinook

ESU/Population	Lower Columbia River Fall Chinook
Activity	Cowlitz Fall Chinook Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-December
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)	Up to 560,000*	Up to 504,000*	Up to 2,200**	
Intentional lethal take (f)				
Unintentional lethal take (g)			10-50	
Other take (indirect, unintentional) (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.

Steelhead

ESU/Population	Lower Columbia River/ Cowlitz Late Winter Steelhead
Activity	Cowlitz Fall Chinook Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-December
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 (unintentional, indirect) (h)				

* Not encountered during program operation.

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 Fall Chinook Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-December
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)				

* Hatchery coho are proposed for listing.

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.