TACOMA POWER
TACOMA PUBLIC UTILITIES

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TACOMA PUBLIC UTILITIES

February 8, 2006

Electronic Filing and Via FedEx

Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Ms. Michelle Day
NOAA Fisheries
Hydropower Division
1201 NE Lloyd Blvd., Suite 1200
Portland, OR 97232

Re: City of Tacoma, Cowlitz River Project, FERC No. 2016
License Article 413 Trap and Haul Plan
License Article 415 Final Fish Passage Plan

Dear Agencies:

Enclosed for your review and approval are the Trap and Haul Plan and the annual Fish Passage Plan required under articles 413 and 415, respectively, of the license for the Cowlitz River Project No. 2016, as amended. As requested by Tacoma Power on July 7, 2007, the Federal Energy Regulatory Commission granted an extension for filing both of these plans until February 9, 2006. Both of the enclosed plans were prepared in consultation with the Fisheries Technical Committee and in particular NOAA Fisheries.

Substantive comments on the plans were received from NOAA Fisheries and American Rivers/Trout Unlimited. These comments are addressed in the response to comment section of both reports.

If you have any questions regarding this submittal, please do not hesitate to contact Debbie Young, Natural Resource Manager, at (253) 502-8340 or Mark LaRiviere, Senior Fisheries Biologist, at (253) 502-8767.

Sincerely,

Patrick D. McCarty
Generation Manager

Enclosures

cc: Federal Energy Regulatory Commission, Portland Regional Office (w/attachment)
Fisheries Technical Committee (w/attachment)
Debbie Young (w/attachment)
Mark LaRiviere (w/attachment)

bc: Tom Martin (w/attachment)
Sarah Hahn (w/attachment)
Pam Klatt (w/attachment)
Don Clarke, GKRSE (w/o attachment)
Binders (3) (w/attachment)

City of Tacoma,
Department of Public Utilities, Light Division
Cowlitz Hydroelectric Project
FERC 2016-071

License Article 413

Anadromous Fish Trap and Haul Plan

1. INTRODUCTION

This plan is prepared in compliance with the requirements of the amended license for the Cowlitz River Project No. 2016 and in response to the March 23, 2004 biological opinion filed by NOAA Fisheries for the continued operation and maintenance of the Cowlitz River Project. The Federal Energy Regulatory Commission (the Commission) issued an Order Amending New License for FERC Project No. 2016, effective July 9, 2004. The license article requires the City of Tacoma, Department of Public Utilities, Light Division (dba Tacoma Power) to develop and file a trap and haul plan for anadromous fish passage in the Cowlitz River basin within one (1) year of the amended order issuance. On July 7, 2005, Tacoma Powerrequested a seven-month extension of time for the trap and haul plan. The basis for this request was the numerous comments received on the initial FTC review draft, and the time required to work out passage issues. On August 21, 2005, the Commission granted an extension of the plan submittal until February 9, 2006.

PROJECT DESCRIPTION

The Cowlitz Project (FERC No. 2016) is Tacoma Power's largest electricity generating facility and is located on the Cowlitz River, Lewis County, Washington. The Project consists of two dams, the Mayfield Dam at river mile (RM) 52 and Mossyrock Dam, upstream at RM 65. In addition to the project generating electricity and providing flood control, Tacoma operates 3 major parks, manages approximately 14,000 acres of wildlife lands, and owns and funds operation of the Cowlitz Salmon Hatchery (RM 50) and the Cowlitz Trout Hatchery (RM 42). The Barrier Dam, associated with the Cowlitz Salmon Hatchery is located at RM 49.5. The original 50-year license for the Cowlitz Project was issued on December 28, 1951. A new thirty-five year license was issued and became effective on July 18, 2003.

The Mayfield development completed in 1963 includes a 250-foot-high, 850-foot-long, concrete arch and gravity dam that impounds Mayfield Lake, which has a maximum surface area of 2, 250 acres. In addition to the Cowlitz River, inflows from the Tilton River also contribute to Mayfield Lake, which supports public and private recreational facilities. An 854-foot-long power tunnel passes through the right abutment of the dam and terminates at a concrete fore bay structure. Four penstocks continue from the fore bay structure to the four generating units, which have an installed capacity of 162-megawatts (MW).

The Mossyrock development completed in 1968 includes a 606-foot-high double curvature concrete arch dam that creates Riffe Lake, a 23-mile long, 11,830-acre reservoir with 52 miles of shoreline. Riffe Lake supports several parks and other recreational facilities. Three penstocks, varying in length from 248 to 285 feet, extend down to the powerhouse, which is adjacent to the base of the dam. The powerhouse contains two generating units with room for a third, and has a total installed capacity of 300 MW. Transmission lines link the Mossyrock and Mayfield developments.

2. FERC License Article

Order Amending New License Article 413.

As required by condition 3 of the incidental take statement, the licensee shall, within one year of issuance of this order, develop a trap and haul plan, in consultation with the Fisheries Technical Committee, including NOAA Fisheries, and file the plan for NOAA Fisheries and Commission approval. The plan shall address and minimize harm to anadromous fish during any trap and haul operation. The plan shall adhere to the most updated criteria at the time of the plan regarding trapping and hauling of anadromous fish as outlined in the document "Draft Anadromous Salmonid Passage Facility Guidelines and Criteria" available at http://www.nwr.noaa.gov/1hydrop/hydropweb/docs/release_draft.pdf
Additionally, as the number of adult fish returning to the applicable traps increase, the licensee must increase the trap and haul capabilities before existing capabilities are exceeded.

3. Background

The impetus for the construction of the Barrier Dam (a velocity barrier to anadromous fish at RM 49.5 on the Cowlitz River) was the completion of Mossyrock Dam upstream of Mayfield Dam in 1968. Mossyrock Dam is 606 feet high from its bedrock base and retains a reservoir (Riffe Lake) that is 23 miles in length. The technical opinions in 1968 were that the low currents and thermal stratification in Riffe Lake would prevent natural upstream fish migration above the dam, thus volitional passage over Mossyrock Dam was not a viable option for migration. A trap and haul system was incorporated into the Cowlitz Salmon Hatchery and the Barrier Dam when constructed in 1968. These facilities have been in continuous operation since July 11, 1968, and replaced the upstream passage facilities provided at Mayfield Dam from 1961 to 1968.

Cowlitz Falls Dam at RM 88.0 has a surface bypass and collection system for downstream migrants. The Cowlitz Falls Fish Collection Facility (CFFF) is operated by the Washington Department of Fish and Wildlife (WDFW) on contract to the Bonneville Power Administration (BPA). Tacoma Power is contracted by the BPA to transport the collected smolts downstream to the lower Cowlitz River. A detailed description of BPA's CFFF system is available in Thompson, et. al. (1997).

4. Objectives

The objectives of this plan are as follows:

1. To provide a description of the anadromous fish trap and haul facilities owned by Tacoma Power in the Cowlitz River basin.

2. To provide a description of the operation of the trap and haul system operated by Tacoma Power in the Cowlitz River basin.

3. To describe the adherence of, or proposed changes to, Tacoma Power's facilities and the trap and haul operations to better meet the latest criteria for anadromous fish passage as determined by NOAA Fisheries.

Note: Plans for the downstream (juvenile) collection and hauling are described in License Article 415, Anadromous Fish Passage Plan.

5. PLAN

This plan is developed in conjunction withthe License Article 415 – Anadromous Fish Passage Plan. The Article 415 plan includes the maintenance schedules, emergency operation protocols and inspections and reporting protocols for all Tacoma Power anadromous fish passage facilities, including the trap and haul facilities detailed in this plan.

TRAP AND HAUL FACILITIES DESCRIPTION

Cowlitz Salmon Hatchery:

The upstream fish (adult) migration facilities at the Cowlitz Salmon Hatchery consist of a velocity barrier, an adult fish handling area and a truck transportation area. The downstream fish migration facilities at the Cowlitz Salmon Hatchery consist of stress relief ponds (raceways) constructed specifically for downstream migrants.

The Barrier Dam at RM 49.5 on the Cowlitz River is a velocity barrier, effectively preventing fish from migrating further upstream. This barrier directs the adult fish into a fish way entrance on the north side of the river. In addition to the ladder flow, auxiliary river water is introduced into the lower end of the north shore ladder to increase the ladder attraction flow to 200 cubic feet per second (cfs) which is 10% of the minimum flow established for the Cowlitz River below Mayfield Dam and 3% of the average annual flow of the Cowlitz River below Mayfield Dam. A minimal amount of additional hatchery raceway drain water is added to the ladder flow to entice the fish to climb the fish ladder.

The adult fish ladder has three segments: an entrance ladder, a fish way pipe, and a separator ladder to the holding pool above the level of the separator.

The upstream fish migration facilities at the Cowlitz Salmon Hatchery consist of:

1) **Attraction area**
2) **Separator area**
3) **Truck transport**

Downstream fish migration facilities at the Cowlitz Salmon Hatchery consist of:

4) **Stress relief ponds** for Downstream Migrants

1) The **Attraction area** consists of:

The **Barrier Dam**, an exclusion barrier, which prevents fish from migrating further upstream and directs them to the

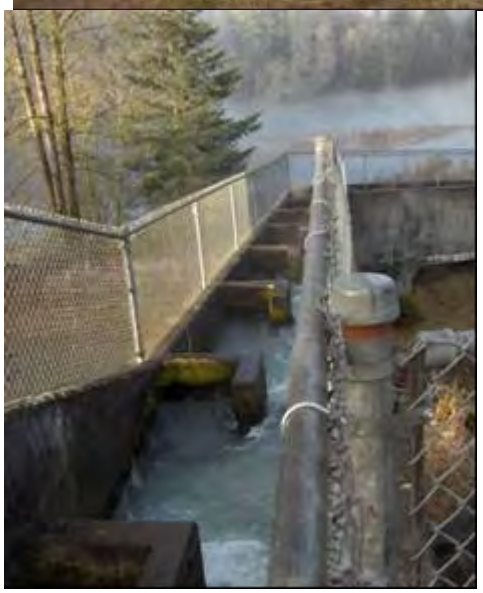
Ladder/fish way entrance located on the river's north side.

Auxiliary attraction water is added at the entrance to entice fish to enter the **Fish ladder**.

There are three segments to the Fish Ladder at the Cowlitz River Project Salmon Hatchery:

Entrance ladder,

Fish way pipe, and



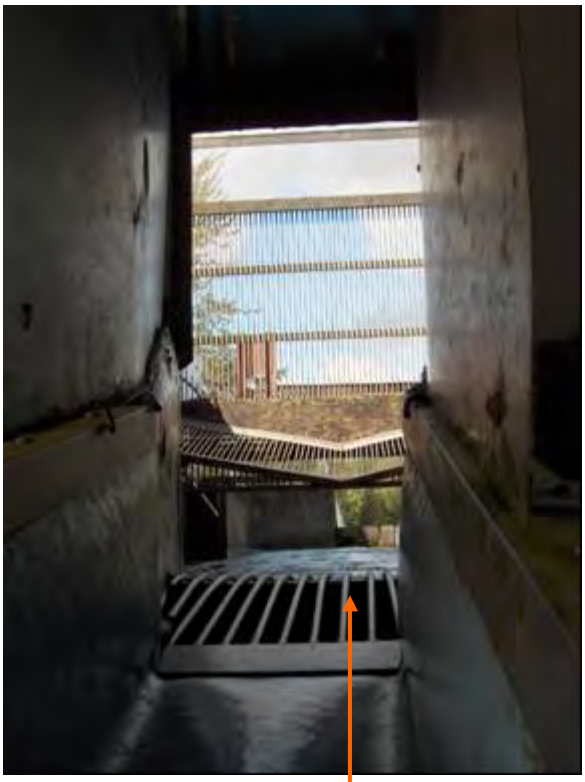
the **Separator ladder**, which raises fish to the height of the

Holding pool.

A **finger weir** at the holding pool assists in keeping fish contained until they are hand sorted.

2) The **Separator area** consists of the:

Crowder in the holding pool, which is lowered into the water, and by moving it forward and lifting it, reduces the available area to encourage fish to jump through the



Flume entrance when attraction water cascades through the gate.

Fish then slide down the **flume** to

Fiberglass sorting troughs,

where fish are sorted via fiberglass flumes.

An up-well water supply is added to the holding pool through grates at the head of the fish flume. This flow induces the fish to jump where they are temporarily stranded on an inclined flume and then slide down a wetted flume into one of two hand sorting tanks. The amount of water used for the up-well attraction can be regulated – a lower water flow will reduce the number of fish attempting to jump into a wetted flume, and a higher (or maximum) setting is used at times of low adult density in the holding pond to attract the maximum number of adult fish into the wetted flume.

The wetted flume has a series of swing gates that can be operated from the control booth or set in fixed positions. The choices of the settings are used to send the adult fish to hatchery brood stock holding ponds, directly into the adult transfer tanks holding tanks (very rarely) or into the hand sorting tanks. An aluminum pipe crowder can be used to force and guide the fish to the flow at the wetted flume entrance by reducing the area of the holding pond. This crowder has a "toe" that effectively crowds the entire fish content of the holding pool into a small area at the mouth of the wetted flume. This process empties the entire holding pool.

In the hand sorting tank, some fish (steelhead and coho) are anesthetized with carbon dioxide upwelling from stones on the bottom of the tanks. Other fish (spring Chinook, fall Chinook and sea-run cutthroat trout) may not be anesthetized. All fish are gently lifted from the hand sort tanks after they settle down. Fish are held by their caudal peduncle and supported under their ventral surface for examination.

Upon a determination of an external mark (or lack thereof) each fish is placed into one of seven wetted fiberglass tubes that transport the fish by gravity into one of the six holding tanks or into the flume to the hatchery ponds reserved for brood stock.

All adult fish are interrogated for wire tags with a hand wand or a fixed wire tag detection device. Currently (in 2005) there are 22 different tag and/or external mark combinations possible and 30 different dispositions possible for adult fish returning to the Cowlitz Salmon Hatcher separator.

The four concrete adult holding tanks date back to the original hatchery construction in 1968. Two adult holding tanks are fiberglass and date to when the adult fish handling and transport capacity was expanded. This expansion was done in 1996 in conjunction with the *Cowlitz Falls Project, Fisheries Management Plan: Anadromous Fish Reintroduction Plan*. The adult holding tanks have an up-well water supply, constant overhead water spray and fencing around the tanks. Each adult holding tank has a 1,500 gallon capacity and is operated with the same loading density criteria as the fish trucks, as each tank loads directly into a single fish truck load. The six circular cone shaped holding tanks at the separator are used to hold sorted adult fish prior to transport. The maximum time adult fish will be held in the holding tanks is 72 hours.

All of the separator and adult holding tanks are under a metal roof structure. Public access is restricted in the separator area to protect the fish, only hatchery and other appropriate personnel have access.

The separator system is taken out of service for maintenance in February, although not annually. To prepare for the shut down the attraction flow is turned off for several days. On the day of the shut down the holding pool crowder is run repeatedly to empty the pool, the holding pool water level is increased with bin boards to block the finger weir, the ladder water supply is then gradually reduced, and personnel chase or net and hand-transport all residual fish within the ladder within the ladder and the transportation channel downstream to the Cowlitz River water level below the Barrier Dam.

The adult fish are directed into **holding tanks** or

sent to hatchery broodstock ponds via **flumes**.

3) **Truck transport** consists of:

Tanker trucks that connect to

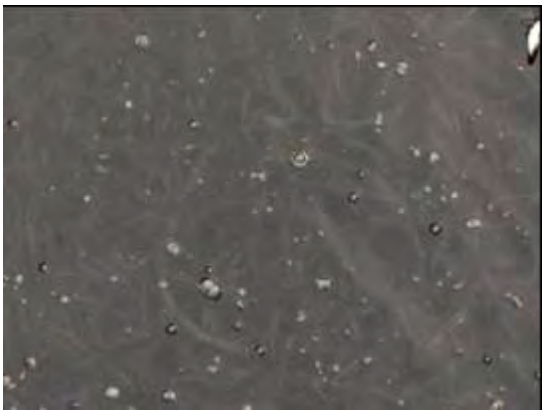
the bottom of the holding tanks by moveable **bellows**, where fish are transferred into the truck's tank

by draining the holding tank through the truck tank.

Fish are transported to designated releases sites.

4.) The **Stress relief ponds** consist of twelve (12) 8' x 50' raceways with a separate water supply and drain system. Each raceway is capable of holding a single truck load of downstream migrants (smolts) collected at the Cowlitz Falls fish collection facility:

Twelve concrete ponds each which are



capable of holding one truck delivery of downstream migrant fish from the Cowlitz Falls Fish Facility. Fish are allowed to volitionally migrate from these ponds and are released through a pipeline outfall located just downstream of the **Barrier Dam fish ladder entrance**.

Cowlitz Trout Hatchery:

The upstream fish (adult) migration facilities at the Cowlitz Trout Hatchery consist of a blockage on Blue Creek, a ladder and an adult fish holding/sorting area.

The upstream fish migration facilities at the Cowlitz Trout Hatchery are:

1) An **Attraction area**
2) Adult holding **Ponds**
3) **Truck transportation**

1) The **Attraction area** consists of:

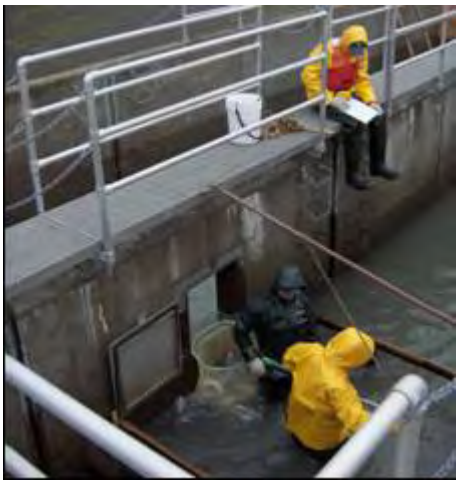
A **barrier** on Blue Creek at entrance of the fish ladder prevents fish from continuing upstream.

Attraction water flows into the creek from the **fish ladder**, whose purpose is

to route the fish to the level of the adult **holding pond**.

2) The **Holding ponds** consist of:

A **central pond** that is directly accessible to the fish ladder, and



two **auxiliary ponds**, one parallel to each side of the main pond, used to segregate and hold broodstock and fish for transport.

The blockage consists of an adult fish exclusion barrier on Blue Creek just upstream of the entrance to the fish ladder. Water flowing down the fish ladder is from the hatchery raceways and the adult holding areas within the hatchery. The fish ladder terminates in a holding pond where the adults are held and sorted by hand.

The holding pond consists of a central pond directly accessible to two side auxiliary ponds through ports in the pond walls. Each auxiliary pond is parallel to the central pond and is further subdivided to hold and segregate adult fish.

3.) The **Truck transport** consists of;

A **fish lift protocol** and

a 1,500 gallon **tanker truck** with a screened top entrance for ventilation and loading fish, an oxygen system, and

a rear gate designed to offload fish to locations designated by the Washington Department of Fish and Wildlife.

The truck transport at the Cowlitz Trout Hatchery consists of a driving surface up to the edge of the side auxiliary ponds where the fish can be directly loaded by boom on a fish truck, or handed up in a dip net and placed directly into the trucks.

Fish Hauling Trucks:

Tacoma Power operates three (3) 1,500 gallon fish hauling trucks, and the Washington Department of Fish and Wildlife operates one (1) 1,500 gallon fish hauling truck on the Project. Each truck is a single axle vehicle capable of live-hauling adult and juvenile salmonids throughout the Cowlitz River basin. The tanks have baffles, water circulation capability and air stones for oxygen delivery. The Tacoma Power trucks have a discharge gate on the end (back) of the tank is hydraulically controlled for a quick opening into a metal flume that can be extended up to 8 (eight) feet behind the discharge gate.

Truck Description:

The newest Tacoma Power truck is a 2002 Navistar cab and chassis with a 120-inch wheelbase, 34,000 lb. GVW, 12,000 lb. front and 22,000 lb. rear axle capacity. The tank is stainless steel, oval in shape with a capacity of 1,500 gallons.

The tank, together with bolsters, brackets, braces, clamps, anchor plates, pads, hatch walls, railings, chute construction shapes, tank ends, and bulkheads is made of non-corrosive stainless steel. All welds on the inside of the tank are rounded off, concave, or convex for best

construction, and smoothly finished to prevent damage to fish. All sharp edges are rounded and ground smooth.

All inside clamp screws and attachment screws are of stainless steel of 50 brinel hardness more than the tank material. The heads are countersunk, assembled tightly slightly below the surfaces into which they are seated. No screws enter or penetrate the tank shell or bulkheads, but instead bottom into a stainless steel pad or plate arc welded to tank shell or compartment bulkheads. Exposed bolt ends located inside the tank are capped to avoid injury to the fish.

The tank slope has a one (1) inch drop per each 19-inches of length from front-end bottom to rear-end bottom and a minimum of 3 degrees slope towards the center from the sides.

The interior of the tank has two (2) 12 gauge dished baffles. The baffles are mounted on pads that are attached to the top of the tanks, extend one-half of the distance to the bottom and have holes near the top for circulation.

Two (2) screened bottom outlets are provided in the tank. These outlets are designed to empty the tank completely when valves are opened on level ground. A passive automatic fill/shutoff/anti-siphon device is provided so that separate vents will allow the water to drain until the entire contents of the tank is empty.

There are 3/4-inch sight gauges installed on either side of the tank, one in front of the top loading port and one near the rear. These gauges are visible from the exterior of the tank. The sight marker gauges are calibrated by a contractor certified by the State of Washington, Department of Weights and Measurements to certify the volume accuracy of tank volume at each increment by averaging front and rear gauges.

A fish discharge trough is provided and fabricated out of 10 gauge stainless steel. It is “U” shaped and approximately 10-feet long by 4-feet diameter and 10-inches deep with a flattened or rounded bottom. The chute slides under the chassis. Deployment and storage of the chute is a one-person operation and powered by a drive chain along each side of the bottom driven by a 12VDC electric motor. All edges inside the trough are rounded and smooth to prevent injury to fish.

The rear discharge port is centered at the bottom of rear tank wall. The port is a 24-inch diameter and flared to the inner tank and smoothed to minimize injury to fish. An air operated knife or guillotine valve is provided for a watertight seal. The cover is designed to open quickly and fully for fish discharge. A 5-inch juvenile discharge port with a 5-inch male cam lock connection (with cover) is installed at the lower center of the main 24-inch valve disc.

Centered on the tank top is an opening of approximately 36.5-inch inner diameter and a 4-7/16-inch outer diameter flange designed to mate with the existing loading bellows at the Cowlitz Salmon Hatchery and the bellows at the Cowlitz Falls Fish Collection Facility. A perforated metal port cover that operates horizontally, either sliding forward or backward, or pivoting to the side, and which latches securely, is provided. The loading bellows can be raised slightly and the lid can be positioned over the loading port to prevent fish from jumping out of the tank.

The tank has three (3) vertical motor-driven and direct-connected, 12 volt aerators with an output of 75 GPM. Along the interior of the tank, between the baffles, there are eight (8) 48-inch long oxygen diffusers. These carbon diffusers, fabricated with fiberglass, are mounted to the

floor of the tank using a food grade silicone adhesive and have a 3/16-inch perforated, low-profile stainless steel cover (closed on both ends) to protect diffusers, fittings, and oxygen hoses from damage by fish. The diffusers are large enough to provide adequate oxygen supply to tanks when loaded with adult/juvenile fish. The diffusers are faired into the tank side wall to prevent trapping small fish.

The aerator system and compressed gas-oxygen system are provided with system failure indicators inside the truck cab.

TRAP AND HAUL FACILITIES OPERATION

Cowlitz Salmon Hatchery:

Barrier Dam

The Barrier Dam has a 13' ogee crest with a concrete apron and is specifically designed to prevent adult salmonids from migrating further up the Cowlitz River. To increase the effectiveness of the dam, a low-voltage D.C. electric barrier is incorporated into the ogee crest. Two strips of stainless steel are embedded one foot apart on the dam crest. The amount of charge delivered to the strips is dependent upon the flow of water in the Cowlitz River but does not exceed 0.5 volts per inch of water surface. Currently juvenile fish releases from the Cowlitz Salmon Hatchery enter the river above the Barrier Dam and during release times (spring and early summer) the current to the Barrier Dam electrical grid is turned off to prevent any incidental harm or additional stress.

The Barrier Dam electrical grid is turned off only on the morning of juvenile fish releases from the Cowlitz Salmon Hatchery. Both the adult ladder attraction flow (the auxiliary ladder water supply system) and the electric grid on the Barrier Dam ogee crest are turned off the morning of scheduled juvenile fish releases at the Cowlitz Salmon Hatchery. Both systems are turned back on or activated based on visual examination of the near shore waters upstream and downstream of the main hatchery drain pipe, and a determination that the hatchery juveniles are no longer present in large numbers. The voltage control system for the Barrier Dam electrical grid is set at a minimum setting (30 units) during low-flow conditions on the Cowlitz River, i.e., 2,000 – 4,000 cubic feet per second (cfs), and the system is set at a maximum setting (40 units) at flows above 4,000 cfs. The ladder flows at a constant rate of 22 cfs year round.

Ladder

The right bank (north) ladder entrance is a concrete structure containing two entrances. The primary entrance is a 5- foot 9-inch wide vertical slot positioned approximately 20 feet upstream from the ends of entrance walls. The entrance sill is at elevation 216.0', which is designed to provide a 4.0 feet minimum flow depth through the vertical slot. Attraction water provided through a set of wall diffusers maintains a 1.0 foot head upstream of the entrance pool. The second entrance is a 1.0 foot wide vertical slot entrance that provides access for fish that penetrate the falling water and are under the crest. This entrance is located adjacent to the area under the barrier dam.

Water is supplied to the primary entrance slots to maintain a velocity of 8.0 feet per second (fps) through the slots for tail water elevations between 220.0' and 229.0'. At higher tail water elevations, the velocity will decrease but the entrances will still operate. Diffusion water is added at a maximum velocity of 1.0 fps to the first and third lower ladder pools at the primary

entrance to make up for flooding due to tail water fluctuations. Auxiliary attraction water flows from the Barrier Dam headwater into the lower end of the ladder through the diffusers. The design intent was to introduce scented water from the main hatchery drain, which is upstream of the Barrier Dam and flows in higher concentration adjacent to the shoreline to the auxiliary entrance inlet. The auxiliary entrance inlet capacity at elevation 220.0', or minimum flow for the Cowlitz River, is 193.6 cfs. This added to the ladder flow of 22.4 cfs gives a total ladder attraction flow for the right bank ladder entrance of 216 cfs.

A review of the design of the south bank fish ladder entrance raised more questions than it did answers. The ladder appears to have gates intended to attract fish approaching along the south shore and then directing them behind and below the crest of the barrier dam. However, the area under the crest is open to tailwater and thus subject to a rolling turbulent flow. In fact water flows in the reverse direction entering the gates of the south bank entrance and flowing into the area behind the crest. If anything, fish that jump through the falling water may enter the gate into the structure behind the crest and then proceed back downstream to reenter the river. One can only speculate that originally there may have been some plan to have a channel behind the crest that was not open to tailwater and thus have a positive flow from the fish ladder across the river to this south bank structure. As constructed, the south bank structure has no functioning value.

The adult fish ladder is operated year-around. A total of 22.4 cubic feet per second (cfs) of water is up welled into the holding pool and flows down the ladder. The adults have access throughout the ladder up to the holding pool at the head of the ladder. An auxiliary attraction water source is used to increase the flow of water at entrance of the fish ladder and offer the fish an alternative to jumping at the water spilling over the Barrier Dam. Scented water from the raceways is added by pumping out of at vault on the hatchery drain line and into the ladder for additional attraction up the ladder. The amount of scented water added to the ladder for attraction is a negligible volume.

The lower fish ladder transitions to a transport pipe above the Barrier Dam. The pipe is 53' long, 48" in diameter, and is lined with black mastic for waterproofing. Screened openings (27" square) occur every 48" for light and ventilation. The gradient is essentially level (< 0.09%) and thus conducive for fish to transition from the pipe to the concrete fish ladder.

Holding pool

The upper fish ladder connects the pipe to the 1,400 cubic foot holding pool above the separator facility. This ladder incorporates a 90° turn and is configured to readily guide fish into the holding pool and the up well water source. In the holding pool a finger weir prevents fish from moving back downstream, but is not a blockage to their movements. The holding pool and adult ladder water supply is pumped directly from the hatchery intake on the Cowlitz River. Water quality at the adult holding facility is monitored by hatchery employees daily. The varying stages of the Cowlitz River flow do not impact the operation of the adult collection and handling facility.

A 22.4 cubic foot per second upwell water supply is added to the holding pool through a grate at the head of the fish flume. This flow induces the fish to jump into an inclined wetted flume that leads to one of two hand sorting tanks. The amount of water used for the up well attraction can be regulated – a lower water flow will reduce the number of fish attempting to jump into a wetted flume, and a higher (or maximum) setting is used at times of low adult density in the holding pond to attract the maximum number of adult fish into the wetted flume.

The holding capacity of the pool, based on NMFS criteria, is 5,600 pounds or approximately 350 adult Chinook salmon or approximately 700 coho salmon.

The wetted flume has a series of swing gates that can be operated from the control booth or set in fixed positions. The choices of the settings are used to send the adult fish to hatchery brood stock holding ponds, directly into the adult transfer tanks holding tanks (very rarely) or into the hand sorting tanks. An aluminum pipe crowder is available to guide the fish to the flow at the wetted flume entrance by reducing the area of the holding pond. This crowder has a "toe" and can effectively crowd the entire area of the holding pool into a small area at the mouth of the wetted flume. This process empties the entire holding pool.

Tacoma proposes that modifications to allow easier use of the crowder be made, and that it will be used every separator operational day to insure that all fish that have already entered the holding pool are processed.

Separator

In the hand sorting tank, some fish (steelhead and coho) are anesthetized with carbon dioxide upwelling in the hand sort tanks from stones on the bottom. Other fish (spring Chinook, fall Chinook and sea-run cutthroat trout) are not anesthetized and gently lifted from the hand sort tanks after they settle down. Upon either marking or a determination of the external mark (or lack thereof) each fish is placed into one of seven wetted fiberglass tubes that transport the fish by gravity into one of the six holding tanks or into the flume to the hatchery ponds reserved for brood stock.

All adult fish are interrogated for wire tags with a hand wand or a fixed wire tag detection device. Currently (in 2005) there are 22 different tag and/or external mark combinations possible and 30 different dispositions possible for adult fish returning to the Cowlitz Salmon Hatcher separator.

The minimum operation schedule for the CSH separator facility has been year-round, except for maintenance shut-downs. During the fall the operation frequency is commonly seven (7) days per week.

Tacoma proposes that future CSH facility operation schedule consist of: five (5) days per week minimum operation (except for scheduled maintenance shutdowns of up to one-week per year). Natural-origin adult salmonids, destined for upper Cowlitz River basins, will have the first priority for transportation, followed by fish held over from the previous day. Most all fish will be trucked the day they are processed. The last truck normally leaves the CSH separator facility at 2:00 PM. During peak runs fish sorting will not be completed until 3:30 PM. Tacoma does not believe holding fish up to one (1) day is excessive, and does not support night-time operations due to safety concerns. Adult fish will normally not be held more than 24 hours. If separator operations are not scheduled for a weekend or holiday period, and fish remain in the holding tanks on Friday evening, then trucking may still be required on Saturday. When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days the operation frequency shall be increased to include the weekend days starting the following week. Decreases in schedule are the reverse of increases.

The CSH separator operational criteria will be reviewed each year.

The holding pool and the holding tanks have an alarm system for monitoring the water levels. The alarm signal is incorporated into the audible hatchery alarm system and enunciator panel.

The separator system is taken out of service for maintenance in February, although not annually. To prepare for the shut down the attraction flow is turned off for several days. On the day of the shut down the holding pool crowder is run repeatedly to empty the pool, the holding pool water level is increased with bin boards to block the finger weir, the ladder water supply is then gradually reduced, and personnel chase or net and hand-transport all residual fish within the ladder within the ladder and the transportation channel downstream to the Cowlitz River water level below the Barrier Dam.

Holding tanks

Four of the adult holding tanks are concrete and date back to the original hatchery construction in 1968. Two of the adult holding tanks are fiberglass and date to when the adult fish handling and transport capacity was expanded at the separator. This expansion was done in 1996 in conjunction with the *Cowlitz Falls Project, Fisheries Management Plan: Anadromous Fish Reintroduction Plan*. The adult holding tanks have an up-well water supply, constant overhead water spray and fencing around the tanks. All of the separator and adult holding tanks are under a metal roof structure. The separator area is restricted to public access to protect the fish.

The six circular cone shaped adult holding tanks at the separator are used to hold sorted adult fish prior to transport. Generally, all fish held in the holding tanks are transported on the same day they are placed in the tank, or the next operating day.

Transportation

Tacoma Power has three 1,500 gallon tanker trucks used to transport adult and juvenile fish. Tacoma maintains the trucks and provides the drivers. The fish hauling trucks are filled with river water at the separator. Operators drive under a holding tank and attach the truck to the holding tank bellows. The bellows are filled with river water and the holding tanks water valve is closed. A pneumatically operated blade valve at the bottom of the holding tank is opened and the tank drains through the truck's two valves, leaving the fish in the truck. This "water to water" transfer does not expose the fish to the air. Oxygen is provided through stones in tank bottom during transport. See Appendix 1 for the Cowlitz Hatchery Complex loading guidelines for fish hauling trucks.

The disposition of the adult fish handled at the separator depends upon their origin and the management protocol in place at the time. All tagged fish originating from the Tilton River system, and tagged as juveniles at Mayfield Dam, are transported to Gus Backstrom Park on the Tilton River in Morton, Washington. Unmarked adults are hauled upstream to the upper Cowlitz River basin. Some hatchery-origin fish are recycled downriver for the sport fishery. The majority of adults returning to the Cowlitz Salmon Hatchery separator are taken to upriver sites once hatchery brood stock requirements are met.

Release

Fish are transported to the various locations in the Cowlitz River basin as directed by the adult handling protocol (AHP). See Appendix 3 for the most recent Adult Handling Protocol for the Cowlitz Complex.

Upstream releases:
At the adult releases sites the transport truck backs up to the water edge and extends a metal chute up to an additional eight (8) feet over the water. The water and fish are released through a 24" hydraulic gate valve and the truck drains quickly. Some water can be slowly drained from the tank to slow the release of the fish if the drop to the water is higher than usual. Truck transport maximum capacity is up to 130 adult coho salmon and up to 75 adult Chinook salmon per load and is dependent upon the size of the fish. See Appendix 5 for a listing and maps of the Cowlitz River basin adult salmonid release sites.

Downstream releases:
Tacoma Power personnel transfer smolts from the fish hauling trucks to one of the eight (8) stress relief ponds at the Cowlitz Salmon Hatchery via a flexible 6" hose. A fish mortality count is logged and the pond is tagged to notify hatchery personnel. After 24 hours, smolts are released into Cowlitz River through the stress relief pond drain outlet at the mouth of the fish ladder. The stress relief ponds are fenced and screened to prevent predation while the smolts recover.

Tacoma proposes to make minor modifications to the stress relief pond outlet structures to encourage volitional release of the transported juvenile migrants.

The protocols followed for the handling of smolts transported from the upper Cowlitz River basin at the CSH stress relief ponds are listed in Appendix 4, *Stress Relief Ponds Protocols*.

Notification

In the event of a fish kill the following procedures apply: Immediately notify the Project Lead, Ecology's Southwest Regional Spill Response Office at (360) 407-6300, the SWRO Federal Permit Coordinator, Washington Department of Fish and Wildlife, and NOAA Fisheries Law Enforcement Office at 800-853-1964. Also notify Michelle Day of NOAA Fisheries at 503-736-4734. If Ms. Day cannot be reached at that number, call her cell phone at 503-351-4393. If Ms. Day cannot be reached, leave a message for her, and then call Keith Kirkendall at 503-230-5431. Notification shall include a description of the nature and extent of the problem, any actions taken to correct the problem and any proposed changes in operations to prevent further problems.

See Appendix No. 2 for the emergency protocol model. Tacoma will include the reporting of emergency events occurring to the Cowlitz Project fish transportation program in the annual Upstream Passage Study Report (License Article 3).

Cowlitz Trout Hatchery

Note: The adult ladder and holding pools are planned to be abandoned, with a shifting of all adult handling to the Cowlitz Salmon Hatchery under the Cowlitz Complex Remodel and Phase-in Plan.

Ladder

The adult fish ladder at the Cowlitz Trout Hatchery is operated seasonally. Normal operating times are from October through early April. A total of 1,500 gallons per minute (gpm) of water is up welled into the head of the holding pond. An additional 1,500 gpm is added at the top of the

fish ladder and both sources drain down the ladder. The adults have access throughout the ladder up to the holding pond at the head of the ladder.

When fish congregate at the in stream barrier in Blue Creek, hatchery personnel open the fish ladder by filling the adult holding pond with a mix of water sources; hatchery reuse water, first pass river water or ozone-treated water, and well water. The blend of different water sources used is dependent upon availability of the source water and the time of the year. Hatchery reuse water is a supply that has passed through raceways and used for rearing of juveniles.

The Cowlitz Trout Hatchery (CTH) receives the majority of its brood stock from the Cowlitz Salmon Hatchery (CSH) separator via truck. After sorting at the CSH separator, these fish are transported to the CTH and released into the holding ponds.

Holding pools

Upon entering and holding in the central pond, hatchery personnel enter the central pond and hand sort the fish from the pond into one of two parallel auxiliary ponds via closeable port holes in the pond walls. Adults are held in the auxiliary ponds separated by vertical barriers and supplied with the same pond water via an up–well supply at the head of each pond.

Transportation

WDFW has a 1,500 gallon tanker truck used to transport adult and juvenile fish. WDFW maintains the trucks and provides the drivers. The fish hauling truck is filled with river water at a stand pipe on the CTH grounds.

Adults are hand sorted in the holding pools and directly loaded by boom on a fish truck, or handed up in a dip net and placed directly into the trucks. See Appendix 1 for the Cowlitz Hatchery Complex loading guidelines for fish hauling trucks.

The disposition of the adult fish handled at the CTH ponds depends upon their origin and the management protocol in place at the time. Surplus hatchery-origin fish are recycled downriver for the sport fishery. The majority of adults returning to the CTH separator are recycled downriver once hatchery brood stock requirements are met.

Release

Fish are transported to the various locations in the Cowlitz River basin as directed by the adult handling protocol (AHP). See Appendix 2 for the most recent Adult Handling Protocol for the Cowlitz Complex.

At the adult releases sites the transport truck backs up to the water edge and the water and fish are released through a 24" hydraulic gate valve and the truck drains quickly. Some water can be slowly drained from the tank to slow the release of the fish if the drop to the water is higher than usual. Truck transport maximum capacity is up to 130 adult coho salmon or 120 adult steelhead, or up to 75 adult Chinook salmon per load and is dependent upon the size of the fish.

Notification

In the event of a fish kill the following procedures apply: Immediately notify the Project Lead, Ecology's Southwest Regional Spill Response Office at (360) 407-6300, the SWRO Federal Permit Coordinator, Washington Department of Fish and Wildlife, and NOAA Fisheries Law Enforcement Office at 800-853-1964. Also notify Michelle Day of NOAA Fisheries at 503-736-4734. If Ms. Day cannot be reached at that number, call her cell phone at 503-351-4393. If Ms. Day cannot be reached, leave a message for her, and then call Keith Kirkendall at 503-230-5431. Notification shall include a description of the nature and extent of the problem, any actions taken to correct the problem and any proposed changes in operations to prevent further problems.

6. CONSULTATION AND COMMENTS

Date	Agencies/ Committees	Participants	Type of Communication	Topics
May 17, 2005	Cowlitz Fisheries Technical Committee (FTC)	Tacoma Power, WDFW, Yakama Nation, NMFS, WDOE, USFWS & AR/TU	Draft License Article 413 plan	• Distribution of draft Anadromous Fish Trap and Haul Plan for review.
June 15, 2005	Washington Department of Fish and Wildlife	WDFW	Draft letter	• WDFW comments on Tacoma Power License Articles 409, 413 and 415 drafts.
June 16, 2005	National Marine Fisheries Service	NMFS	Draft letter	• Preliminary comments on deficiencies in the City of Tacoma draft Anadromous Fish Trap and Haul Plan (license article 413) and Anadromous Fish Passage Plan (license article 415) dated

				5/23/2005.
June 20, 2005	Cowlitz FTC	Tacoma Power, NMFS, Yakama Nation, USFWS & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.
June 23, 2005	Washington Department of Fish and Wildlife	WDFW	Letter	• WDFW comments on Tacoma Power License Articles 409, 413 and 415 drafts.
June 23, 2005	National Marine Fisheries Service	NMFS	Letter	• Comments on Tacoma Power's draft plans for License Articles 409, 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).
August 19, 2005	Tacoma Power	Tacoma Power	Letter	• Response letter to NMFS regarding the June 23, 2005 comment letter.
August 23, 2005	Cowlitz FTC	Tacoma Power, Yakama Nation, USFWS, WDOE, WDFW & AR/TU	Meeting	• Review of Anadromous Fish Passage and Trap and Haul Plans.
September 14, 2005	Cowlitz FTC	Tacoma Power, Yakama Nation, NMFS USFWS, WDFW & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.
October 4, 2005	Cowlitz FTC	Tacoma Power, NMFS USFWS, WDOE, WDFW & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.
October 11, 2005	Cowlitz FTC	Tacoma Power, NMFS, USFWS & WDFW.	On-site meeting	• Viewing and discussion of downstream passage improvements at Mayfield Dam. Discussion of Cowlitz Salmon Hatchery adult fish ladder and holding pool.
November 18, 2005	National Marine Fisheries Service	Tacoma Power & NMFS	On-site meeting	• Viewing and discussion of Cowlitz Salmon Hatchery adult fish ladder and holding pool.
December 6, 2005	Cowlitz FTC	NMFS Tacoma Power, WDFW, Yakama Nation, NMFS, WDOE, USFWS & AR/TU	Draft License Article 413 plan	• Distribution of final draft Anadromous Fish Trap and Haul Plan for review.
December 6,	Cowlitz FTC	Tacoma Power,	Meeting	• Review of

2005		Yakama Nation, USFWS, WDOE, & AR/TU		Anadromous Fish Trap and Haul Plans.
January 3, 2006	Cowlitz FTC	Tacoma Power, NMFS, USFWS, & AR/TU	Meeting	• Review of Anadromous Fish Trap and Haul Plan.
January 9, 2006	National Marine Fisheries Service	NMFS	Letter	• Comments on Tacoma Power's final draft plans for License Articles 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).
January 9, 2006	American Rivers/Trout Unlimited	AR/TU	Email/letter	• Comments on Tacoma Power's final draft plans for License Articles 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).

REFERENCES

Thompson, D.P, D.E. Postlewait, A.J. Danskine, K. Malone, R. J. Moulton and M. Kohn. 1997. Cowlitz Falls Fish Passage Design and Construction. Waterpower '97. August 1997.

APPENDIX No. 1

Cowlitz Hatchery Complex loading guidelines for fish hauling trucks

TACOMA POWER
COWLITZ RIVER PROJECT

LOADING GUIDELINES FOR FISH HAULING TRUCKS

SPECIES	SIZE	Loading criteria - lbs. fish/gal. H_20	Maximum load in lbs. /1000 gal. H_20	11.4 lbs/mm tank displacement reading
Julveniles -				
Coho	Swim up to 101 fpp 100 fpp to> 51 fpp 50 fpp and larger	0.285 0.75 1.2	285 750 1200	25 66 105
Spring Chinook & fall Chinook	Swim up to 101 fpp 100 fpp to> 51 fpp 50 fpp to> 21 fpp 20 fpp and larger	0.285 0.75 1 1.2	285 750 1000 1200	25 66 88 105
Steelhead & cutthroat	Swim up to 101 fpp 100 fpp to> 21 fpp 20 fpp and larger	0.285 0.5 1	285 500 1000	25 44 88

Adults – All species should be hauled at no more than one pound of fish per gallon of water.

Note: The truck drivers are responsible for knowing the loading capacity of their truck before accepting any fish.

Oxygen – Initially set each flow meter at about 2 liters per minute. Oxygen should be adjusted to below saturation, (about 10-12 ppm at Cowlitz Project operating temperatures and altitudes). Oxygen should always be turned on to the air stones before water is loaded into the tank.

TRUCK DISINFECTION

Tanker Size	Amount of 12.5% chlorine bleach	PPM chlorine	Grams of sodium thiosulphate
1500 gal.	32 oz. (one quart) for 30 minutes	20	900 g for 15 minutes

Note: Always use a low range colorimetric chlorine test kit to ensure all chlorine is neutralized before water is discharged from the truck.

PROCEDURES FOR TACOMA POWER FISH HAULING TRUCKS

Temperature:
Upstream releases:
Fish transport will include alternate release sites to be used in case of high water temperatures (seven day average of maximum temperatures exceeds 18ºC or weekly mean temperature exceeds 16ºC; EPA 2001 or if the instantaneous temperature at the release site exceeds 18ºC) at the primary release site, or other factors that preclude use of the primary release site. During July to September water surface temperatures of Lake Scanewa will be collected to guide the adult salmomid release locations. Receiving water temperatures will be checked at other release sites as needed during the same time period.

Water temperature of the transport tank and the receiving water will be checked before releasing fish into Lake Scanewa from July 1 to September 30. If the above temperature criteria is not exceeded, but the temperature difference (*receiving water to tank water*) is greater than 7 degrees Fahrenheit (7° F), the water will be tempered in the tank to less than a 5° F difference at less than 1° F per six (6) minute rise.

Downstream releases:
At the Cowlitz Salmon Hatchery stress relief ponds if the temperature difference (*pond water to tank water*) is greater than 7 degrees Fahrenheit (7° F), the water will be tempered in the tank to less than a 5° F difference at less than 1° F per six (6) minute drop.

Oxygen:
Oxygen levels in the truck transport water are neither to exceed saturation nor to drop below 7 ppm.

Smolt release:
As juvenile fish are unloaded into the stress relief ponds, or other release sites, the discharge hose is held above the water surface at approximately a 45° angle so the fish cascade onto the water surface. Ramps are sometimes employed to facilitate a smooth exit from the tanker. Any remaining fish are flushed out with buckets of water or gently brushed out with a soft bristled broom.

Data:
Data to be collected by the truck transport drivers on the *Tacoma Power Fish Truck Worksheet will* include:

Date hauled, tank number hauled.
Driver name.
Time leaving hatchery.
Number of fish[1].
Tank water temperature and dissolved oxygen when leaving hatchery.
Location and time released.
Tank water temperature and dissolved oxygen at release site.
Receiving water temperature at release site (for difference in water temperatures).
Number of dead fish at release.
Comments on anything unusual noted during trip or upon release.

[1] Fishery technicians record the exact quantity, type and species of fish in each tank shipped.

Release sites:

Downstream

SRP	Stress relief pond, Cowlitz Salmon Hatchery
BD	Barrier Dam boat launch, River Mile (RM) 49.2
THP	Cowlitz Trout Hatchery pond
BLU	Blue Creek boat launch, RM 41.9
MB	Massey Bar boat launch, RM 36.0
I5	Interstate-5 boat launch, RM 29.8
OLE	Olequa boat launch, RM 24.5

Upstream

GB	Gust Backstrom Park, Morton. Tilton River
MLP	Mayfield Lake Park, Mayfield Lake
IKE	Ike Kinswa State Park, Mayfield Lake
MRP	Mossyrock Park, Riffe Lake
SCA	Day Use Park, Lake Scanewa
CIS	Cispus River site(s), various
FB	Franklin Bridge, Packwood.
1270	USFS Road #1270, above Packwood

TRUCK # ___________

TACOMA POWER FISH TRUCK WORKSHEET

DATE	DRIVER	TANK #	START LOCATION	# OF FISH	INITIAL WATER TEMP F	INITIAL D.O.	O_2 GAUGE SETTING	DEPART TIME	RELEASE LOCATION	ARRIVAL TIME	ARRIVAL WATER TEMP.	ARRIVAL D.O.	RECEIVING WATER TEMP. *3	RELEASE TIME	MORTS

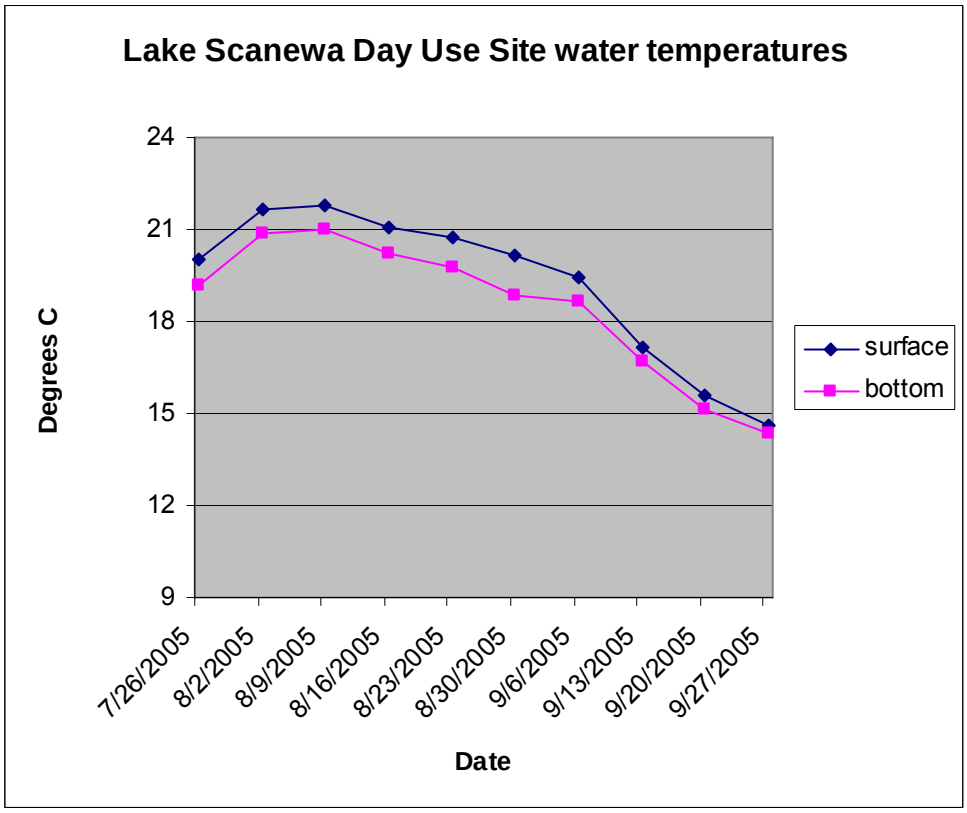
NOTES:

NOTES:

NOTES:

NOTES:

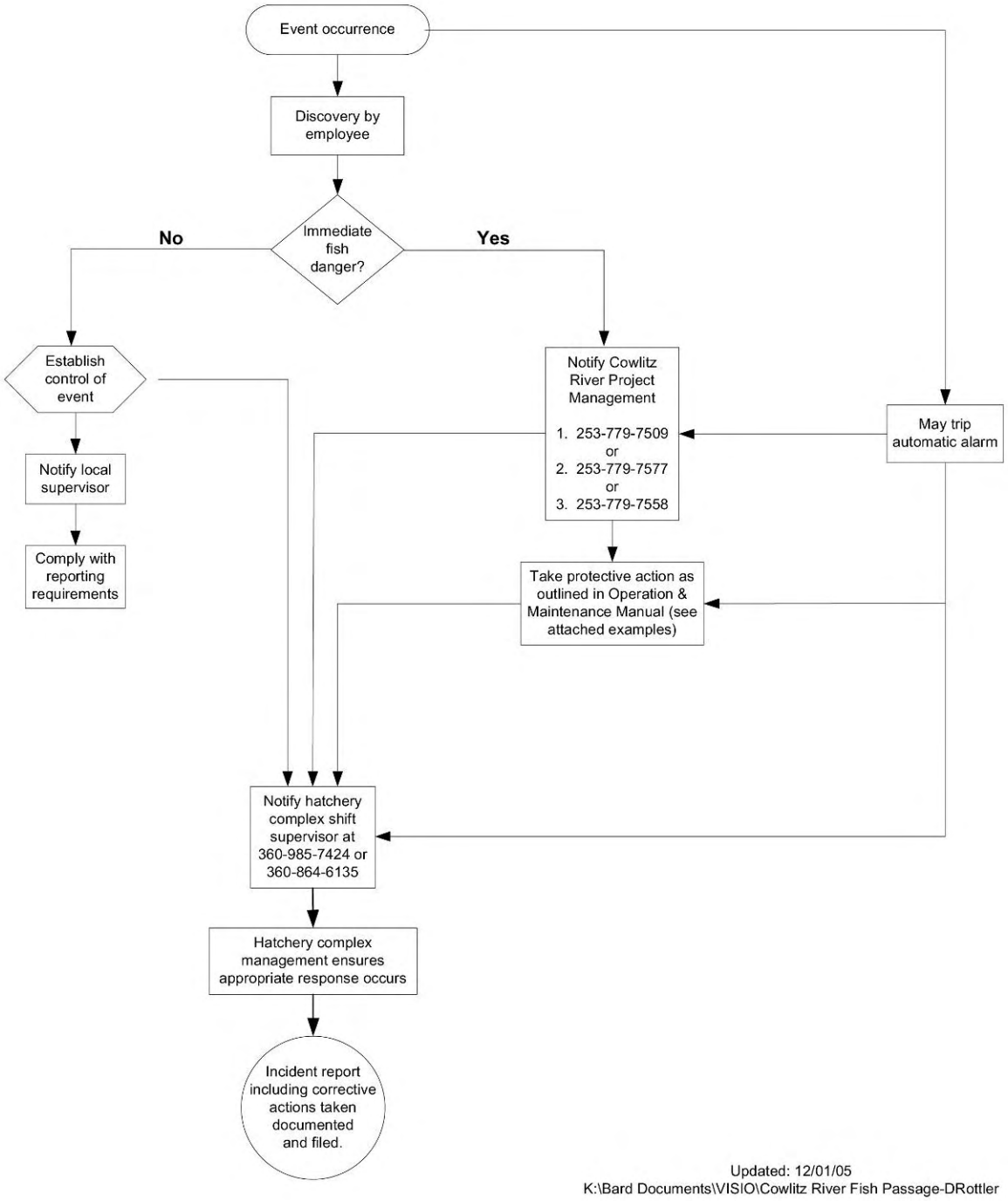
1. When the truck transport water is greater than 7° F than the receiving water, the transport water is to be tempered in 5° F increments, with a thirty minute acclimation period between increments. *Example:* The truck arrives as CSH with a water temperature of 69°F. The receiving water is 55°F. Add river water until the tank temperature is 65°F. Wait thirty minutes, add additional water until it is 60°F.
2. Oxygen levels in the truck transport water are neither to exceed saturation, **12 ppm**, not to drop below **7 ppm**.
3. Receiving water temperature recorded July through September only.


Lake Scanewa Day Use Site water temperatures
Degrees C
24
21
18
15
12
9
7/26/2005
8/2/2005
8/9/2005
8/16/2005
8/23/2005
8/30/2005
9/6/2005
9/13/2005
9/20/2005
9/27/2005
Date
surface
bottom

APPENDIX No. 2

Emergency Protocol

COWLITZ RIVER PROJECT FISH PASSAGE
Emergency Response Logic Chart



Updated: 12/01/05
K:\Bard Documents\VISIO\Cowlitz River Fish Passage-DRottler

APPENDIX No. 3

Adult Handling Protocol for the Cowlitz Complex

COWLITZ COMPLEX ADULT HANDLING - CSH

DISPOSITION OF ADULTS THAT ARRIVE AT COWLITZ SALMON HATCHERY

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	U. COWLITZ	SCANEWA	Retain at Hatchery
BY 2005			Electronic					
SPRING	H	Table	1 / 2			50% AHN	50% AHN	A
CHINOOK	W		N/A	0	0	0	ALL	

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
BY 2005								
FALL	H	Table	1 / 6	0	100% AHN			1
CHINOOK								
	W		12 / C	0	All			

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
BY 2005			Electronic					
	H	Table	1 / 2	0	25% - AHN		75%-AHN***	1
Late Coho								
	W	N/A	6 / 12		12 / All		6 / All	

1/3 Scanewa.

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
	H	N/A	2	All				
Sea Run								
Cutthroat	W	N/A	6 / 12		All			0
	W	N/A	8 / 5				All	0

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
WINTER	H	Table	2	AHN				
STEELHEAD								
	W	E	6 / 12		All			
EARLY	W	E	6				All	

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
WINTER	H	Table	2		25% AHN		75% AHN	
STEELHEAD	H	L	4 / 3				All	
	W	L	6				All	
LATE	W	L	5 / 12		All			

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
SUMMER	H	Table	2/14/15/16/17	AHN				
STEELHEAD	W	N/A	6	All				

COWLITZ COMPLEX ADULT HANDLING - CTH

DISPOSITION OF ADULTS THAT ARRIVE AT COWLITZ TROUT HATCHERY

BY 2003	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ (boat ramp)	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
			Electronic					
SPRING CHINOOK	H	N/A	N/A	All	0	0	0	0
	W		N/A	All	0	0		0

BY 2003	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ (boat ramp)	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
FALL CHINOOK	H		1 / 6	ALL				
	W		6 / 12	ALL				

BY 2003	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ (boat ramp)	TILTON R	CISPUS R. / U. COWLITZ	BLUE CRK ABOVE RACK	Retain at Hatchery
			Electronic					
Late Coho	H	N/A	1/2	All				
	W	N/A	6				6 All	

	ORIGIN	RUN TIME	MARKS IN FISH	RIFFE LAKE	SLCPP	SWOFFORD	LOWER COWLITZ (boat ramp)	
Sea Run Cutts	H	N/A	2	80% AHN	20% AHN	100 FISH		
	W	N/A	6 / 12				All	
	W	N/A	8 / 5				All	

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	LOWER COWLITZ (boat ramp)	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
WINTER STEELHEAD EARLY	H	E	2	AHN				
	W	E	5/6/12		ALL			

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ (boat ramp)	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
WINTER	H	L	2	AHN				
STEELHEAD	H	L	4 / 3	All				
LATE	W	L	5 / 6 / 9 / 12	All				

	ORIGIN	RUN TIME	MARKS IN FISH	LOWER COWLITZ	TILTON R	CISPUS R. / U. COWLITZ	SCANEWA	Retain at Hatchery
SUMMER	H	Table	2/14/15/16/17	AHN				
STEELHEAD	W	N/A	6	All				

COWLITZ COMPLEX ADULT HANDLING - NOTES

MARKS
1 - AD + CWT = ADIPOSE CLIPPED + CODED WIRE TAG
2 - AD = ADIPOSE CLIPPED ONLY
3 - AD + LEFT VENTRAL CLIPPED OR RIGHT VENTRAL CLIPPED
4 - RVC = RIGHT VENTRAL CLIPPED ONLY
5 - OTHER MARK
6 - NON-MARKED
8 - ELASTOMER CHEEK TAG / EYE TAG
10 - BEFORE MARCH 15 OR BEFORE FIRST MARK # 4 ARRIVES
11 - PIT TAGS
12 - BLANK WIRE NOSE TAG
13 - ELASTOMER ANAL FIN
14- AD+LV+BWT LEFT CHEEK
15- AD+LV+BWT RIGHT CHEEK
16 - AD+RED ELASTOMER - LEFT EYE
17 - AD+GREEN ELASTOMER - LEFT EYE

H = HATCHERY
W = WILD
AHN = ABOVE HATCHERY NEED

	SH-WI		CO %
E	**NOV - FEB (MID DEC - LATE FEB)	AUG 1 - OCT 15	45
		OCT 16 - NOV 30	45
L	APR 1 - MAY 31	DEC 1 - FEB 28	10

Jacks

NOTE: JACK SALMON WILL BE COLLECTED FOR SPAWNING AT 2% OF THE ADULTS COLLECTED FOR SPAWNING USE.

* ALL ADULT OR JACK SALMON WITH CODED WIRE TAGS AND / OR PIT TAGS WILL BE RETAINED AT THE HATCHERY UNLESS OTHERWISE NOTED.
Return all adult *Oncorhynchus* , whitefish, suckers and any other adult fish not identified on this document to the lower river.

Do not use summer steelhead that are in spawning condition prior to December for brood stock, this is normally 40% of adults collected. Double the number of adults needed for spawning need to be held to avoid utilizing adults in spawning condition prior to Dec. 1st.

All non-adipose clipped juvenile steelhead, cutthroat and salmon that enter the adult collection facility at either hatchery will be released into the lower river at the Olequa Boat Ram or other acceptable location.

All adipose clipped (hatchery origin) juvenile fish that enter the adult collection facility at either hatchery will be released into Riffe Lake.

MALES / FEMALES COLLECTED @ 1:1 RATIO FOR SPAWNING

APPENDIX No. 4

Cowlitz Salmon Hatchery stress relief pond protocols

TACOMA POWER
COWLITZ RIVER PROJECT

STRESS RELIEF POND (SRP) PROTOCOLS

Releases of smolts into the stress relief ponds will occur by the discharge hose secured above the water surface at approximately a 45° angle so the fish cascade onto the pond water surface. The driver will record all the pertinent data and leave the data sheet in the building at the SRP site. The driver will place an orange flag on the chain at the outlet of the ponds for quick identification in case of water loss.

When the truck transport water is greater than 7° F than the receiving water the truck transport water is to be tempered to less than 5° F by adding water, or by in-tank heaters at a less than 1° F per six (6) minute rise.

The CSH staff will keep two ponds ready for smolts from the upper Cowlitz basin. If more ponds are required the CFFF personnel will contact the hatchery staff to make arrangements. A pond, ready to receive a load of smolts, should be set up with 8 stop logs and an outlet screen.

At the end of the same day that the fish are transported to the SRP, between 3 PM and 4 PM, CSH staff are to pick any mortality and bag them, using the “Morts-1” tag from the data sheet. The volitional release period begins by removing the screen and allowing the fish to migrate through the future volitional structure. The data sheet is to be filled out with personnel, date, time and number of “Morts-1” picked.

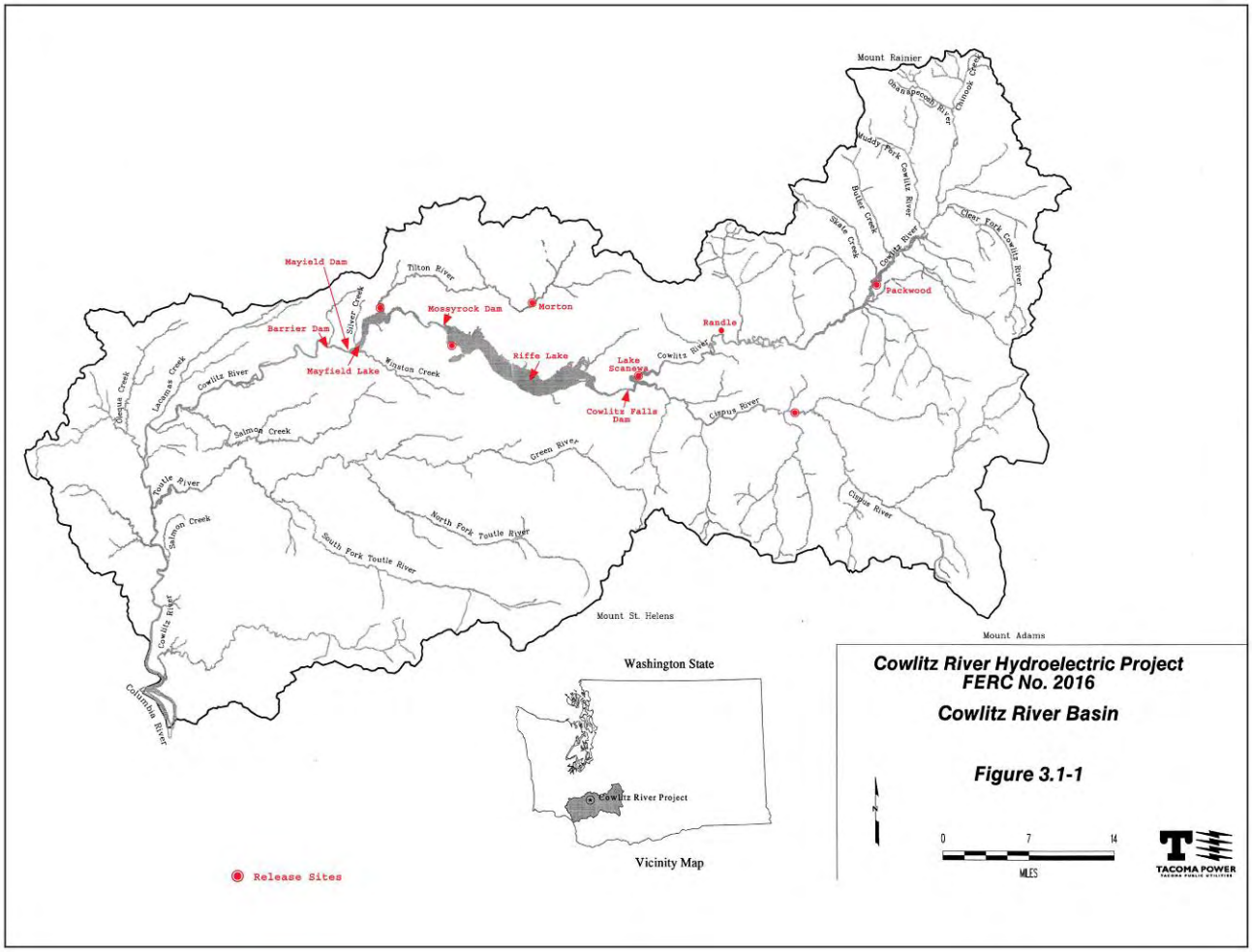
Between 3 PM and 4 PM on the day following transportation any mortality is to be picked and bagged, using the “Morts-2” tag from the data sheet. The remaining smolts are to be released by removing the volitional structure and stop logs effectively draining the pond and forcing all of the remaining fish to leave. The data sheet is to be filled out with personnel, date, time and number of “Morts-2” picked.

The SRP pond is to be cleaned if needed and set up for the next load of fish with 8 stop logs, a screen and refilled with water.

Contact the CFFF personnel if the mortality rate is >1% for any load before July 1st and >3% for any load after July 1st.

APPENDIX No. 5

Upper Cowlitz River basin adult salmonid release sites


Mount Rainier
Mayfield Dam
Tilton River
Silver Creek
Barrier Dam
Mossyrock Dam
Morton
Mayfield Lake
Riffe Lake
Lake Scanewa
Cowlitz River
Randle
Packwood
Muddy Fork Cowlitz River
Clear Fork Cowlitz River
Butter Creek
Skate Creek
Olequa Creek
Lacamas Creek
Salmon Creek
Winston Creek
Cowlitz Falls Dam
Cispus River
Green River
Toutle River
North Fork Toutle River
South Fork Toutle River
Mount St. Helens
Mount Adams
Columbia River
Washington State
Cowlitz River Project
Vicinity Map
Release Sites
Cowlitz River Hydroelectric Project
FERC No. 2016
Cowlitz River Basin
Figure 3.1-1
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MILES
TACOMA POWER

APPENDIX No. 6

Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities

November 2005

TACOMA POWER REVIEW AND COMPARISON OF ANADROMOUS SALMONID PASSAGE FACILITY GUIDELINES AND CRITERIA

Developed by
Tacoma Power and National Marine Fisheries Service

FOREWORD

Tacoma Power's review responses of NMFS fish passage guidelines applicable to Cowlitz Hydroelectric Project Fish Passage Facilities are included below in italics and underlined.

Since these criteria are general in nature, there may be cases where site constraints or extenuating biological circumstances dictate that certain criteria be waived or modified without delaying or otherwise adversely impacting anadromous fishes. It is the responsibility of the applicant to provide compelling evidence in support of any proposed waiver. Conversely, where NOAA Fisheries deems there is a need to provide additional protection for fish, more restrictive site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis. In addition, there may be instances where NOAA Fisheries provides written approval for use of alternative passage criteria, if NOAA Fisheries determines that the alternative criteria provides equal or superior protection as compared to the criteria listed herein, for a particular site or for a set of passage projects within the Northwest Region.

Criteria are design, maintenance or operational standards that can not be changed without a written waiver from NOAA Fisheries. For the purposes of this document, a criterion is described by the word "shall". A guideline is a recommended design, maintenance or operational feature that will generally result in safe and efficient fish way facility design, and for the purposes of this document are described by the word "should". A waiver from NOAA Fisheries is not required to deviate from a guideline. However, if the designer is unable to follow a guideline, the designer shall describe for the NOAA Fisheries administrative record the site specific circumstances that led to the chosen alternative. Where new or updated information suggests a different standard (criterion or guideline) provides better fish way passage, operation or maintenance this document will be periodically updated.

Existing facilities may not adhere to the criteria and guidelines listed in this document. However, that does not mean these facilities must be modified specifically for compliance with this document. The intention of these criteria and guidelines is to assure future compliance in the context of fish passage facilities major upgrades and new designs.

This is a preliminary review of existing, salmonid passage facilities at the Cowlitz River Project against the applicable, draft NOAA criteria and guidelines. The facilities reviewed include the Mayfield downstream migrant facility and the Cowlitz Salmon Hatchery fish ladder, exclusion barrier, and adult fish trap. The review is preliminary as measurements or further analyses may be required to confirm information gathered from drawings and operation manuals.

No major upgrade or new design is planned for these passage facilities and Tacoma Power's objective with this document is to identify parameters that may not be up to current standards so that reasonable improvements may be considered.

I. Review of Guidelines Applicable to Cowlitz Salmon Hatchery Fish Ladder

Section 4. Design Flow Range

4.1 **Description, purpose and rationale:** The design stream flow range constitutes the operational bounds of the fish passage facility. Each fish passage facility shall be designed to pass migrants throughout a design stream flow range, bracketed by a designated high and low design passage flow. Within this range of stream flow, migrants should be able to pass safely and quickly. Outside of this flow range, fish shall either not be present or not be actively migrating, or shall be able to pass safely without need of a fish passage facility. Site-specific information is critical to determine the design time period and river flows for the passage facility - local hydrology may require that these design stream flows be modified for a particular site. In addition, the fish passage facility should be of sufficient structural integrity to withstand the maximum expected flow. It is beyond the scope of this document to specify structural criteria for this purpose.

Consistent with the terminology used throughout this document, criteria are specified by the word "shall" and guidelines are specified by the word "should". Criteria are required design features, unless site specific conditions preclude their use and a site-specific written waiver is provided by NOAA Fisheries (also see Foreword). Guidelines are not required, but deviation from a guideline requires a written explanation by the project designer. It is suggested that deviation from a guideline be discussed with NOAA Fisheries prior to final design. Since these guidelines and criteria are general in nature, there may be cases in which site constraints or extenuating circumstances dictate that certain criteria be waived or modified. Conversely, where there is a need to provide additional protection for fish, including species of fish not directly under NOAA Fisheries jurisdiction, site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis.

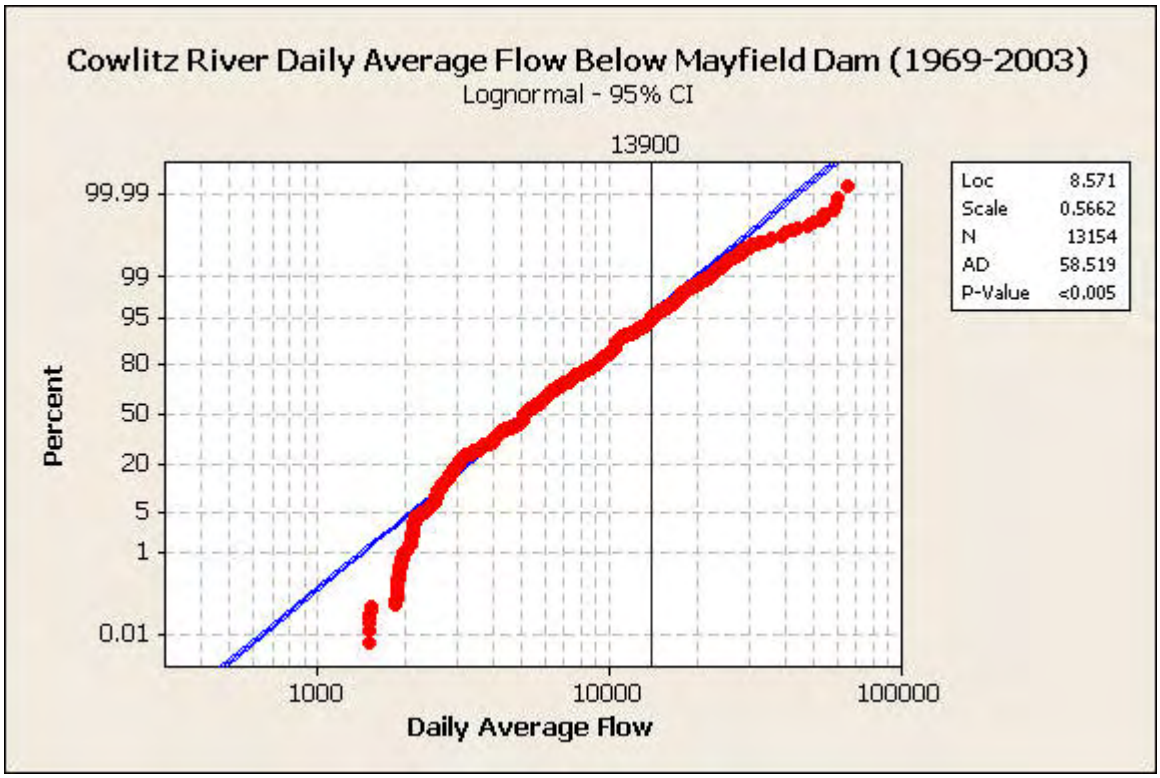
4.2 **Low Fish Passage Design Flow** is the mean daily average stream discharge that is exceeded 95% of the time during periods when migrating fish are normally (i.e. historically) present at the site, as determined by a flow-duration curve summarizing at least the previous 25 years of daily discharges, or by an appropriate artificial stream flow duration methodology if discharge records are not available. The low passage design flow is the lowest stream discharge for which migrants are expected to be present, migrating, and dependent on the proposed facility for safe passage. This could also be the minimum in stream flow, as determined by state regulatory agencies, by ESA consultations with NOAA Fisheries, or by an article in a FERC license.

The minimum in stream flow below Mayfield is 2,500 cfs in the summer (tail water El. 221.75), 3,500 cfs in the fall (tail water El. 222.5), and 5,000 cfs in the spring (tail water El. 223.1). The tail water elevations listed are from original Barrier Dam rating curve. Note: tail water conditions

appear to have increased by 2-3 feet since construction of dam as a result of stream bed aggredation.

4.3 **High Fish Passage Design Flow** is the mean daily average stream discharge that is exceeded 5% of the time during periods when migrating fish are normally (historically) present at the site, as determined by a flow-duration curve summarizing at least the previous 25 years of daily discharges, or by an appropriate artificial stream flow duration methodology if discharge records are not available. This is the highest stream discharge for which migrants are expected to be present, migrating, and dependent on the proposed facility for safe passage.

Assuming that migrating fish are always present, the high fish passage design flow based on 1969 to 2003 river flow data was calculated to be 13,900 cfs (see graph below).

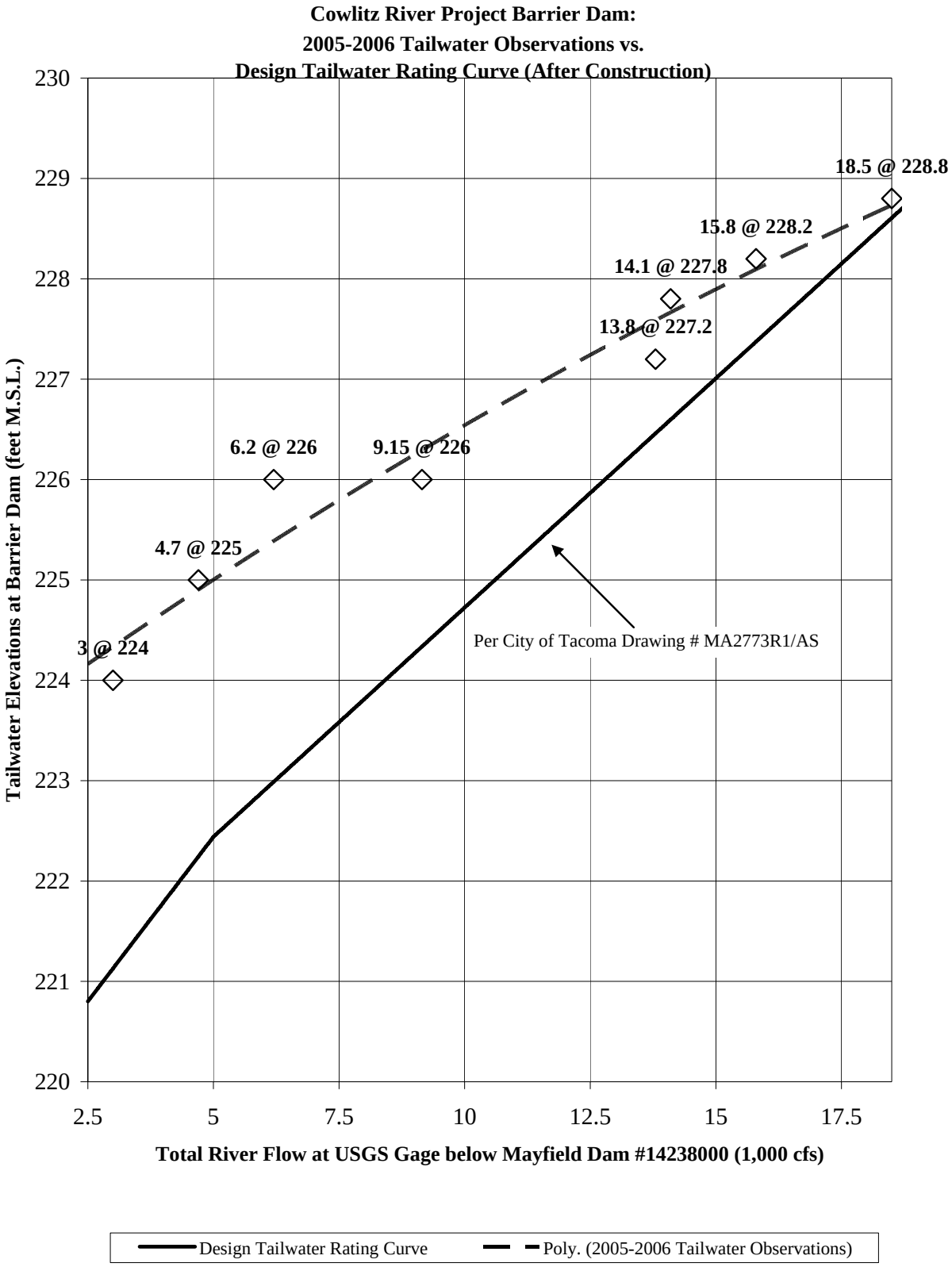


4.4 The fish way design should have sufficient river freeboard to minimize overtopping by 50 year flood flows. Fish way operations may include shutdown of the facility at very high flow or flood flow, in order to allow the facility to quickly return to proper operation when the river drops to within the range of passage design flows. Other mechanisms to protect fish way operations after floods will be considered on a case by case basis. In no case shall a fish way be inoperable for a period greater than 7 days during the migration period for any anadromous salmonid species.

There is sufficient river freeboard for flood flows.

4.4 The fish way design shall allow for safe, timely and efficient fish passage throughout the

entire range of operations of the diversion structure causing the passage impediment. If the fish way can not be operated, the diversion structure should be shut down.



Section 5. Upstream Passage System Criteria

5.1 Types of fish ladders

5.1.1 **Description, purpose and rationale**: The intent of this section is to identify potential pitfalls of a particular ladder type given specific site conditions, and to provide additional criteria for use with a specific type of fish ladder.

Consistent with the terminology used throughout this document, criteria are specified by the word “shall” and guidelines are specified by the word “should”. Criteria are required design features, unless site specific conditions preclude their use and a site-specific written waiver is provided by NOAA Fisheries (also see Foreword). Guidelines are not required, but deviation from a guideline requires a written explanation by the project designer. It is suggested that deviation from a guideline be discussed with NOAA Fisheries prior to final design. Since these guidelines and criteria are general in nature, there may be cases in which site constraints or extenuating circumstances dictate that certain criteria be waived or modified. Conversely, where there is a need to provide additional protection for fish, including species of fish not directly under NOAA Fisheries jurisdiction, site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis.

There are three basic categories of types of fish ladder. The most widely used is the pool-type ladder, characterized by a series of pools separated by fish way weirs that break the total project head into passable increments. Nearly all of the energy from upstream pools is dissipated in the downstream pool volume, resulting in a series of relatively quiescent pools that migrating fish can use to rest, stage and ascend upstream. Four examples of a pool-type ladder are a vertical slot (section 5.1.2), a pool and weir ladder (section 5.1.3), a weir and orifice ladder (section 5.1.4), and full width stream weirs (section 5.1.5). A second category of fish ladder is the roughened chute ladder, which consists of a hydraulically roughened channel with continuous energy dissipation throughout its length. Four examples of a roughened chute style of ladder are a steep pass, denil, a roughened stream channel and a pool-chute fish ladder (section 5.1.5).

In addition to describing the configuration and application of the particular styles of fish ladders, this section identifies general criteria and guidelines for use in completing the remainder of the upstream passage facility design.

5.1.4 **Weir and orifice fish ladder** - The weir and orifice fish ladder passes the fish way flow from fore bay through successive fish way pools connected by overflow weirs and orifices, that divide the total project head into passable increments. The Ice Harbor ladder is an example of a weir and orifice fish ladder. This ladder design was initially developed for use at Ice Harbor Dam (Lower Snake River) in the mid-1960s. The weir consists of two orifices, centered and directly below two weirs - one on each side of the longitudinal centerline of the ladder. Between the two weirs is a slightly higher non-overflow wall, with an upstream projecting flow baffle at each end. Half- Ice Harbor ladder designs consist of one weir, one orifice and a non-overflow wall between fish way pools. This type of ladder cannot accommodate much, if any, water surface

elevation fluctuation in the fore bay pool, since fish ladder flow and pool turbulence would fluctuate excessively. If fore bay or tail water fluctuates, this type of fish ladder is often designed with an auxiliary water supply and flow regulating section, as described in 5.4 and 5.8.

The Cowlitz Salmon Hatchery fish ladder is a weir and orifice type.

5.2 Fish way entrance design criteria

5.2.1 Description, purpose and rationale: The fish way entrance is composed of an entrance gate or slot, through which fish way attraction flow is discharged, and through which fish enter the upstream passage facility; it is possibly the most critical component in the design of an upstream passage system. Placing a fish way entrance in the correct location(s) will allow a passage facility to provide a good route of passage throughout the design range of passage flows; optimal fish way entrance hydraulic characteristics and geometry are key design parameters. The most important aspects of a fish way entrance design are the 1) location of the entrance, 2) shape and amount of flow emanating from the entrance, 3) approach channel immediately downstream of the entrance, and 4) flexibility in operating the entrance flow to accommodate variations in tailrace elevation, stream flow conditions, and project operations.

5.2.2 The fish way entrance gate configuration and operation will vary based on site specific project operations and stream flow characteristics. Entrance gates are usually operated in either a fully open or fully closed position, with the operating entrance dependent on tailrace flow characteristics. Sites with limited tail water fluctuation may not require an entrance gate to regulate the entrance head. Adjustable weir gates that rise and fall with tail water elevation may also be used to regulate the fish way entrance head. Other sites may accommodate maintaining proper entrance head by regulating auxiliary water flow through a fixed geometry entrance gate.

Due to an increased tail water elevation, it appears that a submerged weir is required at the ladder entrance to provide the appropriate fish way entrance head. This is planned for installation in 2006.

5.2.3 Fish way entrances shall be located at points where fish can easily locate the attraction flow and enter the fish way. When choosing an entrance location, high velocity and turbulent zones in a powerhouse or spillway tailrace should be avoided, in favor of relatively tranquil zones adjacent to theses areas. At locations where the tailrace is wide, shallow and turbulent, excavation to create a deeper, less turbulent holding zone adjacent to the fish way entrance(s) may be required.

5.2.4 Attraction flow from the fish way entrance should be between 5% and 10% of high design passage flows for streams with mean annual discharges exceeding 1000 cfs. For smaller streams, where feasible use larger percentages (up to 100%) of stream flow. Generally speaking, the higher percentage of total river flow used for attraction into the fish way, the more effective the facility will be in providing upstream

passage.

The mean annual discharge for the Cowlitz River is around 6,015 cfs and the high fish passage design flow is approx. 13,900 cfs. 5% to 10% of high design passage flow would be 695 cfs to 1,390 cfs. Based on the O&M Manual, the design AWS flow for the fish ladder appears to vary from 208 cfs to 694 cfs (5% of high fish passage design flow) for tail water elevations between 220 M.S.L and 229 M.S.L. Therefore, this attraction flow guideline may not be satisfied under all operating conditions.

5.2.5 The fish way entrance head (hydraulic drop) shall be maintained between 1 to 1.5 feet, and designed to operate from 0.5 to 2.0 feet of hydraulic drop.

The design was for one (1) foot differential +/- 3" per the Operation and Maintenance (O&M) Manual. In addition, this manual stated the following: "Water is supplied to the right bank entrances to maintain a velocity of 8 fps through entrance slots for tail water varying from El. 220 to El. 229. The right bank entrances will continue to operate when tail water is higher than El. 229 (20,000 cfs), but velocity criteria will not be maintained."

However, at a river flow of approx. 3,000 cfs in September 2005, the 1 foot differential did not exist. Based on a review of Barrier Dam rating curve at this flow condition, it appears that tail water conditions have risen by 2-3 feet from conditions present at design. The tail water elevation was 224 M.S.L. during inspection rather than 221 M.S.L. as expected. Note: The O&M manual discusses the excavation of a tailrace channel downstream of barrier dam as follows: "This channel is 250 feet wide and approximately 1,200 feet long, and lowered the water level in the river at the barrier approx. 4.0 feet from the pre-barrier conditions at the flow of 12,000 cfs". It appears that post-construction floods may have filled in this excavated tailrace channel.

5.2.6 The minimum fish way entrance width should be four feet, and the entrance depth should be at least six feet, although the shape of the entrance is dependent on attraction flow requirements. Also, see requirements for mainstem Columbia and Snake rivers in section 10.

The right bank fish entrance is 5'-9" wide and had a depth of 6 feet for total river flows of approx. 3,000 cfs (tail water elevation of 222 M.S.L. and entrance sill elevation of 216 M.S.L.). Based on the September 2005 inspection, it appears that the entrance depth has increased for this river flow.

5.2.7 If the site has multiple zones where fish accumulate, each tailrace accumulation location will require a minimum of one entrance. For long powerhouses, additional entrances are required. Since tailrace hydraulic conditions usually change with project operations and hydrologic events, it is often necessary to provide two or more fish way entrances.

Adult fish enter the fish ladder through two entrances on the right bank. As the Barrier Dam passage channel is defined by a downstream wall with a top elevation of 219 (lower than predominant tail water elevations), the original design appears to have never provided attraction flow to left bank entrance or dam's passage channel. As very few fish are expected to enter ladder through smaller 1' wide slot at Barrier Dam, it may be

beneficial to close this gate to increase the attraction flow at the primary 5'-9" wide entrance.

5.2.8 Closure gates shall be provided to provide flow to the appropriate entrance gate, and shall not conflict with any potential path of fish migration. Fish way entrances shall be closed by downward-closing slide gates, unless otherwise approved by NOAA Fisheries.

Downward-closing slide gates were used for both fish way entrances.

5.2.9 Fish way entrances can be either adjustable submerged weirs, vertical slots, orifices, or other shapes provided that the hydraulic requirements specified in 5.2.3, 5.2.4 and
5.2.5 are achieved. It is noted that some non-salmonid species will avoid using orifices.

Both entrances are vertical slot. The 2006 installation of a submerged weir at main fish way entrance is planned to correct for higher tail water conditions previously discussed.

5.2.10 The desired entrance weir and/or slot discharge jet hydraulic condition is streaming, not plunging, for submerged weir discharges. Plunging flow induces jumping and can cause injuries, and it presents hydraulic condition some species may not pass.

The first submerged weir encountered has a top elevation of 219.88. Therefore, for the minimum daily average river flow of 1,800 cfs (tail water elevation = 221 ft. M.S.L.), there would be streaming flow rather than plunging flow at this location.

5.2.11 In general, low flow entrances should be oriented more or less perpendicular to stream flow, and high flow entrances should be oriented more or less parallel to stream flow. Site-specific assessments are required.

The right bank high flow entrance is oriented more or less parallel to river flow.

5.2.12 The fish way entrance design shall include staff gages to allow for a simple determination of whether entrance head criterion (see 5.2.4) is being met. Staff gages shall be located in the entrance pool and in the tail water just outside of the fish way entrance, in an area visible from an easy point of access. Care should be taken in the design when placing staff gages, being sure to avoid turbulent areas and areas where velocity is increasing in front of the fish way entrance. Gages should be readily accessible to facilitate in-season cleaning.

There are adequate staff gages at site which will be cleaned and/or repaired during 2006 inspection of AWS structure and fish ladder entrance.

5.3 Fish way entrance pool criteria

5.3.1 Description, purpose and rationale: The fish way entrance pool is at the lowest elevation of the upstream passage system. It discharges flow into the tailrace through the entrance gates for the purpose of attracting upstream migrants. In many fish ladder

systems, the entrance pool is the largest and most important pool, in terms of providing proper guidance of fish to the ladder section of the upstream passage facility. It combines ladder flow with auxiliary water system flow through diffuser gratings to form entrance attraction flow (see 5.4). The entrance pool shall be configured to readily guide fish toward ladder weirs or slots.

5.3.2 The minimum transport velocity (between entrance and first fish way weir, and over submerged fish way weirs) is 1.5 ft/s.

Design fish way entrance velocities were 8 fps per the Operation and Maintenance Manual. The velocity between fish way entrances and last stage of diffuser grating ranges from 2 to 2.5 fps [Example: 316 cfs / (18.8'x8') = 2.1 fps] and then decreases to a range of 1.5 to 1.7 fps [Example: 174 cfs / (14.1'x8') = 1.5 fps] after 1st stage of diffuser grating. With these assumptions, the transport velocity criteria appear to not be satisfied for approx. 15 feet downstream of first weir. This would need to be confirmed with field measurements but I suspect that the velocity immediately below first weir is no more than 1 fps for the majority of conditions.

5.3.3 The fish way entrance pool shall be designed to optimize attraction to the lower fish way weirs. This can be accomplished by angling vertical AWS diffusers toward and terminating near the lowest ladder weir.

There are two down-wells within AWS structure which, depending on tail water elevation, provide additional water to first fish way weirs through vertical diffusers.

5.4 Auxiliary Water System (AWS) Criteria

5.4.1 Description, purpose and rationale: AWS flow is usually routed from the fore bay through a trash rack or intake screen, a back set flow control gate, an energy dissipation zone, energy baffles, and diffusers, and into the fish way. An AWS provides flow to the entrance pool and/or area upstream of weirs that on occasion become back-watered, and usually provides the bulk of the attraction flow through fish way entrances. In addition, the AWS is used to provide make-up flows to various transition pools in the ladder such as bifurcation or trifurcation pools, trap pools, exit control sections, or counting station pools.

5.4.2 Vertical diffusers should consist of non-corrosive, vertically-oriented flat-bar grates, and shall have a maximum one-inch clear horizontal spacing.

Existing diffusers are vertically oriented with 1" clear spacing.

5.4.3 The maximum AWS diffuser velocity shall be less than 1.0 ft/s for vertical diffusers and 0.5 ft/s for horizontal diffusers, based on total diffuser panel area.

The design maximum velocity through vertical diffusers was 1 fps.

5.4.4 The design shall provide access for debris removal from each diffuser.

5.4.5 All diffuser edges and surfaces exposed to fish shall be rounded during fabrication to reduce the potential for contact injury.

5.4.6 Vertical AWS diffusers shall have a top elevation at or below the low design entrance pool water surface elevation.

The top and bottom elevation of diffusers is 230 ft. M.S.L. and 214 M.S.L., respectively. The entrance sill is at 216 ft. M.S.L. and the crest of the barrier dam spillway is at 229 ft. M.S.L.

5.4.7 A trash rack shall be provided at the AWS intake with clear space between the vertical flat bars of less than one inch, and maximum velocity of less than 1 ft/s. The support structure for the trash rack shall not interfere with cleaning requirements, and shall consider access, debris raking and debris removal. Where possible, the trash rack should be installed at a 1:5 (horizontal: vertical) slope (or flatter) for ease of cleaning. The trash rack design shall allow for easy maintenance, considering access for personnel, travel clearances for manual or automated raking, and removal of debris

The trash rack has 7/8 inch clear spacing and appears to have less than half the area of the diffusion grating so the velocity at this location is expected to be above 1 fps.

5.4.8 In instances where the majority of the in stream flow passes through the AWS during periods of juvenile out-migration, the AWS intake should be screened to NOAA Fisheries Juvenile Fish Screen Criteria (see Section 12). Trip gates or alternate intakes can be included in the design to ensure that AWS flow targets are achieved if the screen reliability is uncertain at higher flows. Debris and sediment issues may preclude the use of juvenile fish screen criteria for AWS intakes at certain sites.

*The majority of river flow never passes through AWS (approx. maximum % = 262/2000 * 100 = 13%).*

5.4.9 AWS flow control can consist of a control gate, turbine intake flow control, or other flow control systems, located sufficiently far away from the AWS intake to ensure uniform flow distribution at the AWS trash rack at all AWS flows. AWS flow control is required to ensure that the correct quantity of AWS flow is discharged at the appropriate location during a full range of fore bay water surface elevations.

There is a slide gate downstream of AWS trash rack but it was not intended for flow control. The slide gate is temporarily closed to assist with daily cleaning of trash rack and when juveniles are released from the hatchery. Otherwise, it is kept 100% open.

5.4.10 Excess energy shall be dissipated from AWS flow prior to passage through add-in diffusers (5.4.3). This is necessary to minimize surging and to induce relatively

uniform velocity distribution (± 10%) at the diffusers. Surging and non-uniform velocities may cause adult fish jumping and associated injuries or excess migration delay. Examples of methods to dissipate excess AWS flow energy include: 1) routing flow into the pool with adequate volume (see 5.4.11), then through a baffle system (porosity less than 40%) to reduce surging through entrance pool diffusers, 2) passing AWS flow through a turbine, 3) passing AWS flow through a pipeline with concentric rings or other hydraulic transitions designed to induce head loss.

There is an energy dissipation pool between trash rack and diffusion grating.

5.4.11 An energy dissipation pool in an AWS should be a minimum volume established by the following formula:

$$V \geq \frac{\text{٢ Q H .}}{(16 \text{ ft-lb/s})/\text{ft}^3}$$

where: V = pool volume, in ft3, ٢= unit weight of water, 62.4 pounds (lb) per ft3
Q = AWS flow, in ft3/s, H = *Velocity Head* of AWS flow, in feet

5.4.12 Staff gages shall be installed to indicate head differential across the AWS intake trash rack, and shall be located to facilitate observation and cleaning. Head differential across the AWS intake shall not exceed 0.3 feet.

There is a headwater staff gage at intake but there may not be a gage inside of trash rack.

5.4.13 AWS intake trash racks shall be of sufficient structural integrity to avoid the permanent deformation associated with maximum occlusion.

5.4.14 To facilitate cleaning, the AWS shall be valved or gated to provide for easy shutoff during maintenance activities, and subsequent easy re-set to proper operation.

he fish ladder AWS is easily shut off for maintenance activities (e.g. cleaning trash rack) via motor-operated, slide gate.

5.4.15 At locations where bed load can cause accumulations at the AWS intake, sluice gates or other simple bed load removal devices are required.

5.5 Transport Channels

5.5.1 Description, purpose and rationale: A transport channel conveys flows between different sectors of the upstream passage facility, providing a route for fish to pass.

5.5.2 The range of transport channel velocities shall be between 1.5 and 4 ft/s, including flows over or between weirs inundated by high tail water.

The design velocity was 1.3 fps in the transport channel for design ladder flow of 22.4 cfs. Per Harza's 5/8/96 flow measurements, the existing ladder flow is 16.2 cfs which would provide a velocity closer to 1 fps.

5.5.3 The transport channels should be a minimum of 5 feet deep.

Depth of flow is 4 feet in 5 foot diameter pipe.

5.5.4 The transport channels should be a minimum of 4 feet wide.

Transport channel is a 5 foot diameter pipe.

5.5.5 The transport channels shall be of open channel design.

The intent of this criteria appears to be satisfied with 1 foot of freeboard in pipe.

5.5.6 Ambient natural lighting should be provided in all transport channels, if possible. Otherwise acceptable artificial lighting is to be used, as described in 5.10.2.

Ambient natural lighting is provided periodically along entire length of transportation channel.

5.5.7 Care shall be taken in design to avoid hydraulic transitions or lighting transitions, in order to reduce the possibility of excess migration delay.

This was done.

5.6 Fish ladder design criteria

5.6.1 Description, Purpose and Rationale: A fish ladder converts the total project head at the passage impediment into passable increments, by providing suitable conditions for fish to hold, rest, and ultimately pass upstream. The criteria provided in this section have been developed to provide conditions to pass all anadromous salmonid species upstream with minimal delay and injury.

5.6.2 The maximum hydraulic drop per pool shall be 12 inches.

The original design condition was a hydraulic drop of 1 foot from pool to pool.

5.6.3 Ladder overflow weirs shall be designed to provide at least 12 inches of flow depth over the weir crest. The depth shall be indicated by locating a single staff gage (with the zero reading at the overflow weir crest elevation) in an observable, hydraulically stable location.

The design depth over weirs is 12 inches.

5.6.4 The pool dimensions should be a minimum of 8 feet long (upstream to downstream), 6 feet wide, and 5 feet deep. However, specific ladder designs will require specific pool dimensions that are greater than the minimums specified here.

The existing pool dimensions are 10 feet long, 5 feet wide, and 7 feet deep for a total pool volume of 350 cubic feet.

5.6.5 Turning pools (i.e. where the fish way bends more than 90°) should be at least double the length of a standard fish way pool, as measured along the centerline of the fish way flow path. Special consideration shall be given for the direction of the flow path from the upstream weir to assure that passage through the downstream weir is not compromised.

5.6.6 Additional guidance and criteria for application of specific ladder types is located in Section 5.1.

5.6.7 The fish way pool volume shall be a minimum of:

$$V \geq \frac{\gamma Q H}{(4 \text{ ft-lb/s})/\text{ft}^3}$$

Where: V = pool volume, in ft^3
γ = unit weight of water, 62.4 pounds (lb) per ft^3
Q = *fish ladder* flow, in ft /s
H = energy head of pool-to-pool flow, in feet

under every expected design flow condition.

V = 350 cubic feet > [62.4 (22.4 cfs) (1 foot) / 4] = 349 cubic feet at design ladder flow. Per Harza's 5/8/96 flow measurements, the existing fish ladder flow is 16.2 cfs which would no longer be in full compliance with this criteria.

5.6.8 The dimensions of orifices should be at least 15 inches high by 12 inches wide, with the top and sides champhered 0.75 inches on the upstream side, and champhered 1.5 inches on the downstream side of the orifice.

Orifices are 18" by 18" for a total orifice area of 2.25 sq. ft..

5.6.9 The freeboard of the ladder pools shall be at least 3 feet at high design flow.

Including 4 foot high chain link fence, freeboard is at least 5 feet throughout ladder at high design flow of 13,341 cfs.

5.6.10 Ambient lighting is preferred throughout the fish way, and in all cases abrupt lighting changes shall be avoided.

Ambient lighting is provided throughout fish way.

5.6.11 At locations where the flow changes direction more than 60 degrees,

45 degree vertical miters or 2-foot vertical radius of curvature shall be included at the outside corners of fish way pools.

5.7 Counting Window Stations – *not applicable*

5.8 Fish way Exit Section – *not applicable*

5.9 Fish way Exit Trash Rack and Debris Management – *not applicable*

5.10 Miscellaneous considerations

5.10.1 Fishways should be secured to discourage vandalism and poaching and to provide public safety.

The AWS structure and concrete sections of the fish ladder are secured by fencing. The transportation channel does not have fencing around it but is an enclosed pipe and further from access roads.

5.10.2 Ambient lighting shall be provided throughout the fish way. Where this is not possible (such as in tunnels), artificial lighting should be provided in the blue-green spectral range. Lighting shall be designed to operate under all environmental conditions at the installation.

Ambient lighting is provided throughout fish way.

5.10.3 Personnel access shall be provided to all areas of the fish way, to facilitate operational and maintenance requirements. Walkway grating should allow as much ambient lighting into the fish way as possible.

Most areas of fish way are easily accessed.

5.10.4 All metal edges in the flow path used for fish migration shall be ground smooth to minimize risk of lacerations. Concrete surfaces shall be finished to ensure smooth surfaces, with one-inch wide 45° corner chamfers.

5.10.5 Protrusions (such as valve stems, bolts, and gate operators) shall not extend into the flow path of the fish way.

5.10.6 All control gates exposed to fish (such as at entrances in the fully-open position) shall have a shroud or be recessed to minimize or eliminate fish.

II. Review of Guidelines Applicable to Cowlitz Salmon Hatchery Barrier Dam

Section 6. Exclusion Barriers

6.1 **Description, purpose and rationale:** Exclusion barriers are designed to minimize the attraction and stop the migration of upstream migrating fish into an area where there is no upstream egress or suitable spawning area, and to guide fish to an area where upstream migration can continue. Exclusion Barriers can also be used to restrict movement of undesirable species into habitat. Exclusion barriers are designed to minimize the potential for injury of fish that are attracted to impassable routes. Some examples of the use of exclusion barriers include:

preventing fish from entering return flow from an irrigation ditch
preventing fish from entering the tailrace of a power plant
guiding fish to a trap facility for upstream transport, research or broodstock collection
guiding fish to a counting facility
preventing fish from entering a channel subject to sudden flow changes
preventing fish from entering turbine draft tubes
preventing fish from entering channels with poor spawning gravels, poor water quality or insufficient water quantity.

The two primary categories of exclusion barriers are picket barriers and velocity barriers. Another type of exclusion barrier is a vertical drop structure, which provides a jump height that exceeds the vertical leaping ability of fish. Other types of barriers, such as electric and acoustic fields, have very limited application because of inconsistent results most often attributed to varying water quality (turbidity, specific conductance).

Consistent with the terminology used throughout this document, criteria are specified by the word “shall” and guidelines are specified by the word “should”. Criteria are required design features, unless site specific conditions preclude their use and a site-specific written waiver is provided by NOAA Fisheries (also see Foreword). Guidelines are not required, but deviation from a guideline require a written explanation by the project designer. It is suggested that deviation from a guideline be discussed with NOAA Fisheries prior to final design. Since these guidelines and criteria are general in nature, there may be cases in which site constraints or extenuating circumstances dictate that certain criteria be waived or modified. Conversely, where there is a need to provide additional protection for fish, including species of fish not directly under NOAA Fisheries jurisdiction, site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis.

6.4 Vertical Drop Structures - Description: A vertical drop structure can function as an exclusion barrier by providing total project head in excess of the leaping ability of the target fish species. These can be a concrete monolith, rubber dam, or approved alternative.

Vertical drop structure criteria include the following:

6.4.1 The minimum height for vertical drop structure shall be 10 feet relative to the tailrace high design flow elevation.

The tailrace elevation at high design flow of 13,900 cfs was approx. 227 feet according to May, 1967 rating curve (MA2773R1) for after construction and excavation of tail channel. The Barrier headwater during the high design flow is approx. 235 feet providing a differential of 8 feet for this condition. The maximum apron elevation is El. 217 and the crest of Barrier Dam weir is at El. 229.

To prevent fish migration past Barrier Dam, facilities for an electrified field were provided at the barrier weir crest consisting of two electrified plates 1 foot wide and spaced 10 feet apart and extending the full length of the barrier.

6.4.2 To minimize the potential for leaping injuries, a minimum of two feet of cantilevered ledge shall be provided.

6.4.3 Provision shall be made to ensure that fish jumping at the drop structure flow will land in a minimum five foot deep pool, without contacting any solid surface.

III. Review of Guidelines Applicable to Cowlitz Salmon Hatchery Adult Fish Trap

Section 7. Adult Fish Trapping Systems

7.1 Description, purpose and rationale: In general, NOAA Fisheries requires volitional passage, as opposed to trap and haul, for upstream passage facilities. This is primarily due to the risks associated with the handling and transport of adult upstream migrants, in combination with the long term uncertainty of funding, maintenance and operation of the trap and haul program. However, there are instances where trap and haul may be the only viable option for a particular site. In particular, at high head dams where thermal stratification occurs in the reservoir, temperature differentials in the fish way (as opposed to water temperatures below the dam) may dissuade fish from utilizing volitional passage facilities.

This section addresses design aspects of adult fish trapping systems. The operations and design criteria and guidelines are dependent on each other, since the management objectives for trap operation define the facility functional design and must be stipulated before the trap design development can be proceed.

In many cases, NOAA Fisheries will not require retrofit of existing facilities to comply with criteria listed herein. It is emphasized that these criteria and guidelines are viewed as a starting point for design development of new, or upgraded, trapping facilities. This section does not directly apply to existing trapping programs/facilities, unless specifically required by NOAA Fisheries.

Consistent with the terminology used throughout this document, criteria are specified by the word “shall” and guidelines are specified by the word “should”. Criteria are required design features, unless site specific conditions preclude their use and a site-specific written waiver is provided by NOAA Fisheries (also see Foreword). Guidelines are not required, but deviation from a guideline require a written explanation by the project designer. It is suggested that

deviation from a guideline be discussed with NOAA Fisheries prior to final design. Since these guidelines and criteria are general in nature, there may be cases in which site constraints or extenuating circumstances dictate that certain criteria be waived or modified. Conversely, where there is a need to provide additional protection for fish, including species of fish not directly under NOAA Fisheries jurisdiction, site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis.

Adult fish trapping systems can either be included in the initial design of a proposed upstream passage facility, or in some cases can be retro-fitted to an existing fish way. Traps should be designed to utilize known or observed fish behavior to benignly route fish into a trap holding pool that precludes volitional exit. From the trap holding pool, fish can be loaded for transport and/or examined for research and management purposes. Traps can be used as the terminus of volitional upstream fish passage followed by transport to specific sites, or as a parallel component of a fish ladder where fish can either be routed into an adjacent trapping loop or if the trap is closed allow to fish pass unimpeded through the fish way.

7.2 Trap Design Scoping

Trap new-construction or major upgrade proposals shall address and describe the consideration of (at least) the following issues:

Objective of trapping - count, handle, collect, interrogate for tags, etc.
Number of fish targeted and total number potentially present
Target species
Other species likely to be present at the trap
Environmental conditions during trap operation such as water and air temperature, flow conditions (lows and peaks), debris load, etc.
Operation location, duration and scale
Fish routing and ultimate destination
Maximum duration of delay or holding within the trapping system for target and non - target fish.
Security mechanisms

Note: It is also permissible to attach a Hatchery and Genetic Management Plan (HGMP), 4(d) Limit 7 Scientific Research and Take Authorization application, or Section 10 (a) (1) (A) permit application if it contains some of this information.

7.3 Fish Handling Guidelines

7.3.1 The following general fish handling guidelines should be utilized for design of new or updated facilities.

7.3.2 Use of nets to capture or move fish shall be minimized or eliminated. If nets are used they shall be sanctuary type nets, with solid bottoms to allow minimal dewatering of fish. Fish shall be handled with extreme care.

No nets are used or planned.

7.3.3 Fish should be anesthetized before being handled.

All fish are anesthetized with existing and future plans. Electro anesthesia is planned for future operations to increase processing speed, minimize stress to fish, and improve ergonomics for workers.

7.3.4 New or upgraded trapping facilities shall be designed to enable non-target fish to bypass the anesthetic tank.

In order to meet the processing speed necessary to minimize fish delay, this will not be feasible.

7.3.5 Fish shall be removed from traps at least daily - more often when either environmental (e.g. water temperature extremes or high debris load) or biological conditions (e.g. migration peaks) warrant.

Further analyses of this parameter will be needed to determine whether there is any delay issue and the appropriate response.

7.3.6 Individuals handling fish shall be experienced or trained to assure fish are handled safely.

7.3.7 Fish ladders shall not be completely dewatered during trapping operations, and should not experience any reduction in fish way flow.

Fish are not dewatered during trapping operations and there is a redundant water supply available.

7.4 General Trap Design System Criteria

7.4.1 Primary trapping system components usually include: in-ladder removable diffusers or gates to block passage within the ladder and guide fish into the trap, an off-ladder holding pool including a transition channel or port and trapping mechanism (through which attraction flow is discharged via one of the devices described in 7.6)

a gate to prevent fish from entering the trap area during crowding operations
a holding pool fish crowder (for encouraging adult egress from the off-ladder holding pool to sorting/loading facilities)
separate holding pool inflow and outflow facilities
distribution flume (used with false weir or steep pass to enable fish entry to and/or egress from the holding pool)
and a lock or lift for truck-loading fish.

General trap design system criteria include:

7.4.2 Fish ladders are the preferred means of upstream passage at impediments, unless site conditions preclude their use. This is due to the preference that fish be allowed to pass at their inclination, rather than that of a human operator. Factors to be considered include the adverse effects of holding trapped fish in a potentially high-density holding pool for an excessive period, the long-term uncertainty of maintaining funding and trained personnel, exposure to poaching or predation in the trap, injuries from jumping, facility failures (e.g., loss of water supply), and cumulative handling and holding stresses.

7.4.3 In general, fish ladders should not be designed or retrofitted with either in-ladder traps or

loading facilities. Rather, trap/holding and loading facilities should be in an adjacent, off-ladder location where fish targeted for trapping purposes can be routed. This allows operational flexibility to readily switch from passage to trapping operational modes.

7.4.4 A wetted distribution flume shall be used if, after trapping, fish are to be routed to anesthetic/recovery tanks, pre-transport holding tanks, fore bay return, etc. The flume shall have smooth joints, sides and bottom, and no abrupt vertical or horizontal bends. Circular pipes with smooth joints can also be used. Provision of continuous wetted surfaces (to minimize abrasions) is required.

These conditions are satisfied at separation facility.

7.4.5 Holding pool water quality should not be less than the ambient waters from which the fish are trapped. For example, the water temperature, oxygen content and pH should not deviate substantially. Fish shall be provided with a safe, healthy environment.

7.4.6 Trap inflow shall be routed through an upstream diffuser conforming with Section 5.3 , with maximum 1.0 fps average velocity. Baffling should be used to assure against excessive turbulence and surging, which could induce adult jumping within the trap.

7.4.7 Anesthetized fish shall be routed to a recovery pool to allow monitoring of fish to ensure full recovery from anesthetic effects prior to release. Fish recovering from anesthesia shall not be routed directly back to the river where unobserved mortality can occur. Recovery pool inflow shall satisfy the specified water quality guidelines (see 7.4.5). Recovery tank hydraulic conditions shall not result in partially or fully anesthetized fish being carried onto an outflow screen/grating, or any other hazardous area. The recovery pool shall be designed so that fish, once fully recovered, can exit volitionally.

Anesthetized fish recover in adult separation facility tanks and in the fish transport trucks prior to release.

7.5 Trap Holding Pool Guidelines and Criteria

For single-pool traps, refer to Section 7.9. For trap holding pools at multi-pool ladders:

7.5.1 For new or existing fish ladders, fish shall not be trapped and held within the ladder for intermittent sampling or truck-loading. Rather, an off-ladder trap system is required. This type of system allows normal unimpeded ladder passage during non-trapping periods, and intermittent trapping of fish for target collection or sampling, as required. The intent is to minimize adverse impacts (such as delay and elevated jumping injury/mortality) of fish trapping by allowing rapid transition from one operational mode to the other.

There are no non-trapping periods at Cowlitz Salmon Hatchery.

7.5.2 Trap holding pools, for both off-ladder traps and trap and haul facilities, shall be sized to hold a predetermined maximum number of fish (i.e. trap capacity, as specified by NOAA Fisheries biologists) with a minimum allowable volume of 0.25 ft^3 per pound of average fish size

weight times the maximum number of fish.

The trap holding pool is 20'long x 10'wide x 7'deep or 1,400 cubic feet. Therefore, the maximum weight of fish allowed in the holding pool per this criteria would be 5,600 lbs. As mortality and fish injury in holding pool have not been significant issues for history of operations, this criteria appears very conservative and Tacoma Power favors 7.5.3 for guidance.

7.5.3 Off-ladder trap holding pools shall be designed with a separate water supply and drain system. Trap holding pool design water supply capacity shall be at least 0.5 gallons per minute per pound of adult fish for the predetermined adult salmon trap holding capacity.

The total water supply to holding pool is equal to the design ladder flow of 22.4 cfs (10,054 gpm). Therefore, the maximum weight of fish allowed in holding pool per this criteria would be 20,108 pounds.

7.5.4 Trap holding pool designs shall include provisions to minimize adult jumping which can result in injury or mortality. Examples include (but are not limited to): high freeboard on holding pool walls; covering to keep fish in a darkened environment; providing netting over the pool strong enough to prevent adults from breaking through the mesh fabric; sprinkling the holding pool water surface to diffuse the ability of fish to see movement above the trap pool.

High freeboard on holding pool walls is current practice.

7.5.5 Off-ladder holding pools should include intake and exit diffusers designed to prevent adult egress and to conform with Section 5.4, and with an adjustable exit overflow weir to control holding pool water surface elevation.

7.5.6 Removable diffusers within the ladder (that are lowered/installed to block fish ascent within the ladder when fish are to be routed into an off-ladder trapping pool) shall be angled toward the off-ladder trap entrance location, and shall comply with Sections 5.4.2, 5.4.3, 5.4.4, 5.4.5 and 5.4.6. Diffusers shall be completely removed from the ladder when not actively trapping.

7.5.7 Off-ladder holding pool crowders should have a maximum clear bar spacing of 7/8 inch. Side gap tolerances shall not exceed one inch, with side and bottom seals sufficient to allow crowder movement without binding and to prevent fish movement behind the crowder panel.

7.5.8 Where false weirs and steep pass ladders are used to route fish into or out of a trap holding pool, distribution flumes or pipes are used. The distribution flume invert shall be wetted to minimize friction between fish and flume invert surfaces. Where there are horizontal and vertical bends in the distribution flume, a continuous spray shall be used to minimize friction between fish and side walls. Horizontal and vertical bends shall be gradual to minimize risk of fish strike injuries.

This condition is satisfied at separation facility.

7.5.9 The minimum inside width (or diameter) of the distribution flume shall be 15 inches.

Some flumes in separation facility are 12 inches in width.

7.5.10 The minimum sidewall height in the distribution flume shall be 24 inches.

Some flumes appear to be less than this requirement.

7.6 Trapping Mechanism Criteria and Guidelines

The trap holding pool trapping mechanism (e.g., finger weir, vee-trap, false weir, steep pass ladder) allows fish to enter, but not volitionally exit, the holding pool. Fish will not volitionally stay within a confined area if they can find an exit. Design criteria and guidelines include:

7.6.1 All components exposed to fish shall have all welds and sharp edges ground smooth, with other features as required to minimize injuries.

7.6.2 Bars and spacings shall conform with Section 5.4. Circular bars should be used to improve fish safety.

7.6.3 Trapping mechanisms shall allow temporary closure to avoid spatial conflict with brail crowding and loading operations.

Temporary closure is possible.

7.6.4 Trapping mechanisms should be designed to safeguard against fish entry into an unsafe area such as behind a crowder or under floor brail.

7.6.5 A gravity (i.e. not pumped) water supply should be used for false-weirs and steep pass ladders to avoid potential rejection of the trapping mechanism associated with the transmission of pump/motor sounds.

The false weir water supply is pumped but rejection due to noise has not been an issue.

7.7 Lift/Hopper Guidelines – *not applicable*

7.8 Fish Lock – *not applicable*

7.9 Single Holding Pool Trap Design Guidelines and Criteria – *not applicable*

City of Tacoma,
Department of Public Utilities, Light Division
Cowlitz Hydroelectric Project
FERC 2016-071

License Article 415

Anadromous Fish Passage Plan

1. INTRODUCTION

This plan is prepared in compliance with the requirements of the amended license for the Cowlitz River Project No. 2016 and in response to the March 23, 2004 biological opinion filed by NOAA Fisheries for the continued operation and maintenance of the Cowlitz River Project. The Federal Energy Regulatory Commission (the Commission) issued an Order Amending New License for FERC Project No. 2016, effective July 9, 2004. The license article requires the City of Tacoma, Department of Public Utilities, Light Division (Tacoma Power) to develop and file on, an annual basis, a final anadromous fish passage plan for the Cowlitz River Project within one (1) year of the amended order issuance. On July 7, 2005 Tacoma Power requested an extension of time to file both plans. On August 31, 2005 the Federal Energy Regulatory Commission granted an extension until February 9, 2006.

PROJECT DESCRIPTION

The Cowlitz Project (FERC No. 2016) is Tacoma Power's largest electricity generating facility and is located on the Cowlitz River, Lewis County, Washington. The Project consists of two dams, the Mayfield Dam at river mile (RM) 52 and Mossyrock Dam, upstream at RM 65. In addition to the project generating electricity and providing flood control, Tacoma operates 3 major parks, manages approximately 14,000 acres of wildlife lands, and owns and funds operation of the Cowlitz Salmon Hatchery (RM 50) and the Cowlitz Trout Hatchery (RM 42). The Barrier Dam, associated with the Cowlitz Salmon Hatchery is located at RM 49.5. The original 50-year license for the Cowlitz Project was issued on December 28, 1951. A new thirty-five year license was issued and became effective on July 18, 2003.

The Mayfield development completed in 1963 includes a 250-foot-high, 850-foot-long, concrete arch and gravity dam that impounds Mayfield Lake, which has a maximum surface area of 2, 250 acres. In addition to the Cowlitz River, inflows from the Tilton River also contribute to Mayfield Lake, which supports public and private recreational facilities. An 854-foot-long power tunnel passes through the right abutment of the dam and terminates at a concrete fore bay structure. Four penstocks continue from the fore bay structure to the four generating units, which have an installed capacity of 162-megawatts (MW).

The Mossyrock development completed in 1968 includes a 606-foot-high double curvature concrete arch dam that creates Riffe Lake, a 23-mile long, 11,830-acre reservoir with 52 miles of shoreline. Riffe Lake supports several parks and other recreational facilities. Three penstocks, varying in length from 248 to 285 feet, extend down to the powerhouse, which is adjacent to the base of the dam. The powerhouse contains two generating units with room for a third, and has a total installed capacity of 300 MW. Transmission lines link the Mossyrock and Mayfield developments.

2. FERC License Article

Order Amending New License Article 415.

Article 415. As required by condition 4(b) of the incidental take statement, the licensee shall, on an annual basis, file for Commission approval a final Fish Passage Plan. The plan shall be subject to NOAA Fisheries review and approval. In addition to the provisions of settlement articles 1, 2, and 3, the plan shall include, but not be limited to, plans for the operation and maintenance of all fish passage facilities, emergency operations of said facilities, protocols for emergencies, schedule for inspection of facilities (to ensure operation within established criteria), reporting procedures of inspection results, and anticipated special operation of the facilities for research.

3. Plan Background

Fish passage facilities on the Cowlitz River Project are a portion of the overall fisheries mitigation activities built and funded by Tacoma Power to mitigate the impact of Tacoma's hydroelectric generating plants on the Cowlitz River.

Fish passage facilities associated with the Cowlitz River Project are in three separate locations in the Cowlitz River basin:

1. Mayfield Dam
2. The Cowlitz Hatchery Complex
3. Cowlitz Falls Dam (owned by Lewis County Public Utility District No. 1. Tacoma Power provides transportation of downstream migrants collected at Cowlitz Falls Dam to the stress relief ponds downstream at the Cowlitz Salmon Hatchery).

Fish passage facilities owned by Tacoma Power are operated by the Washington Department of Fish and Wildlife (WDFW) and Tacoma Power. Operational and maintenance expenses for these facilities are funded by Tacoma Power. Day-to-day operations of these facilities, short term strategies, and ongoing research are under the providence of the WDFW.

Three (3) separate FERC license articles require Tacoma Power to submit plans or study results of fish passage activities for the Cowlitz River Project. The following section describes the status of the relevant license articles.

License Article 1. Downstream Fish Passage and Collection Plan for Riffe Lake and Cowlitz Falls.

FERC issued an Order Modifying and Approving Downstream Fish Passage and Collection Plan for Riffe Lake and Cowlitz Falls, Articles 401 and 1 on April 22, 2005.

The Director ordered:

(A) The Downstream Fish Passage and Collection Plan, filed July 19, 2004, under license Article 401 and Settlement Agreement Article 1 of the March 13, 2002 Order Approving Settlement and Issuing New License and the Order Amending New License issued July 9, 2004 for the Cowlitz River Project, as modified by paragraphs (B) through (E), is approved.

(B) The license shall file with the Commission by February 15, 2006, and February 15, 2007, a status report describing the activities scheduled for that year. The licensee shall provide a draft status report to the Fisheries Technical Committee for a 30-day review and comment period and receive approval from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service prior to filing the report with the Commission.

(C) The licensee shall file by December 31, 2007, for Commission approval, a report on the effectiveness of the downstream fish passage/collection facilities and measures, including an evaluation of the Fish Passage Survival achieved by the facilities and measures. If the Fish Passage Survival achieved has not reached 95% or at least 75% with the best available technology for all species, the report shall include a plan and schedule providing for any further improvements to downstream passage facilities or measures as are determined by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service to be most likely successful in reaching 95% Fish Passage Survival. The licensee shall provide a draft report, and plan and schedule (if applicable) to the Fisheries Technical Committee for a 30-day review and comment period and receive approval from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service prior to filing the final report, and plan and any schedule with the Commission. The Commission reserves the right to make any changes to the plan to improve downstream passage.

(D) The licensee shall file, for Commission approval, a revised reporting schedule agreed to by the National Marine Fisheries Service, the U.S. Fish and Wildlife Service and the Fisheries Technical Committee. The duration of filing additional reports at 18-month intervals beyond the December 31, 2007 reporting date, regardless if 95% Fish Passage Survival or at least 75% with the best available technology is achieved for all species, shall be approved by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

(E) Pursuant to Paragraphs 12.4, 12.11 and 12.40 of the Commissions regulations, 60 days prior to the planned initiation of construction, the plans and specifications package and a quality control and inspection program shall be submitted to the Regional Engineer. Authorization to start construction activities will be given by the Regional Engineer after all preconstruction requirements are satisfied.

The License Article 1 plan as filed and approved by FERC calls for the development, construction, installation and evaluation of a surface bypass collector (SBS) screening system at Cowlitz Falls Dam by 2007. For more details see *Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage Study Plan, July 19, 2004.*

License Article 2. Downstream Fish Passage: Mayfield. Study Results

The Downstream Fish Passage Study Report for Mayfield Dam, filed July 21, 2004, under Settlement Agreement Article 2 (a) of the March 13, 2002 Order Approving Settlement and Issuing New License for the Cowlitz River Project as amended by the July 9, 2004 Order Amending License, is approved.

This filing was reporting results of previous studies. The record will be added to with the filing of a plan required by License Article 2 due July 19, 2006. That plan will detail the improvements planned to improve upon a 95% fish passage survival rate as applied to Mayfield Dam, and will include plans for an annual monitoring of the compliance with this FPS rate. For more details see *Downstream Fish Passage: Mayfield. Study Results, July 19, 2004.*

License Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock dams. Report Results

FERC issued an Order Modifying and Approving Upstream Fish Passage Study Report on August 18, 2005.

The Director ordered:

(A) The Upstream Fish Passage Study Report, filed July 19, 2004, under Settlement Agreement Article 3 of the March 13, 2002 Order Approving Settlement and Issuing New License for the Cowlitz River Project as amended by the July 9, 2004 Order Amending License, as modified by paragraphs (B) and (C), is approved.

(B) The licensee shall file with the Commission, within 60 days from the date of this order and annually thereafter beginning July 19, 2006, an annual Upstream Fish Passage Study Report. The report shall include the information required under Settlement Agreement Article 3 and be prepared in consultation with the Fisheries Technical Committee. The licensee shall allow the Fisheries Technical Committee 30 days to comment on the report prior to filing the report with the Commission. The report shall include any comments from the Fisheries Technical Committee and the licensee's response to any such comments.

(C) The licensee shall file with the Commission, by July 18, 2008, documentation that the $15 million escrow account has been established.

The record will be added to with the filing of annual plans required by the August 18, 2005 Order. The initial annual Upstream Fish Passage Study Report was filed with FERC on October 18, 2005.

License Article 3 calls for an evaluation of a series of productivity and abundance experiments to determine the feasibility of establishing self-sustaining salmonid populations in the upper Cowlitz River basin. That filing is due to FERC in July 19, 2017 after the initial study results are available. That plan will detail the improvements planned to expend the $15 million (minimum) fund established for upstream passage in the Cowlitz River system. Included will be plans for an annual monitoring for compliance. For the initial report results see *Upstream Fish Passage: Barrier, Mayfield and Mossyrock Report Results, July 19, 2004.*

4. Plan Objectives

The objectives of the Fish Passage Plan (FPP) are as follows:

1. To provide for the provisions of License Articles 1, 2 and 3 in regard to fish passage on the Cowlitz Hydroelectric Project.

2. To provide a description of the operations and maintenance of all fish passage facilities owned by Tacoma Power in the Cowlitz River basin.

3. To provide a description of the emergency operations and protocols of all fish passage facilities owned by Tacoma Power in the Cowlitz River basin.

4. To provide a description of the schedules of inspections, reporting results and anticipated usage of the fish passage facilities for research.

5. Fish Passage Plan (FPP)

1.) Mayfield Downstream Facilities

Description

Mayfield Dam was the first large dam on the Cowlitz River when it was constructed in 1962. Incorporated into the original construction of Mayfield Dam were separate upstream and downstream fish passage facilities. The upstream passage facilities consisted of a fish ladder and a lift system that originally transferred the adult fish into a pipeline that discharged in the Mayfield Dam fore bay, but was later replaced with a system that loaded fish hauling trucks for transportation fish around the dam and into upper basin areas. The Mayfield Dam upstream migration facilities were discontinued in July 1968 when the Barrier Dam two miles downstream was completed.

The downstream fish migration facilities at the Mayfield Dam consist of:

1. An **Attraction and guidance** area
2. A **Capture and enumeration** area (Counting House)
3. A **Transportation and release** area

These downstream migration facilities have been in continuous usage since 1963 to collect downstream migrants originating from the Tilton River systems and other drainages of the Mayfield reservoir.

The **Attraction and guidance** area consists of:

- Coarse trash racks at the upstream end of the louver bays.
- Louvers, bypass slots and bypass pipes.
- A screened secondary separator that uses pumped attraction water and an adjustable weir to provide a transport flow.
- A transport pipe through Mayfield Dam.

The **Capture and enumeration area** consists of:

- A distribution flume with sorting racks prior to the raceways.
- Three (3) holding raceways with a water supply and drainage system.
- A raceway drain/sump area for reducing the volume of the water for handling and sorting of the fish.
- A pipe for transferring the fish into the counting house.
- A counting house with raceways and holding tanks where fish are held, examined and tagged.

The **Transportation and release** consists of:

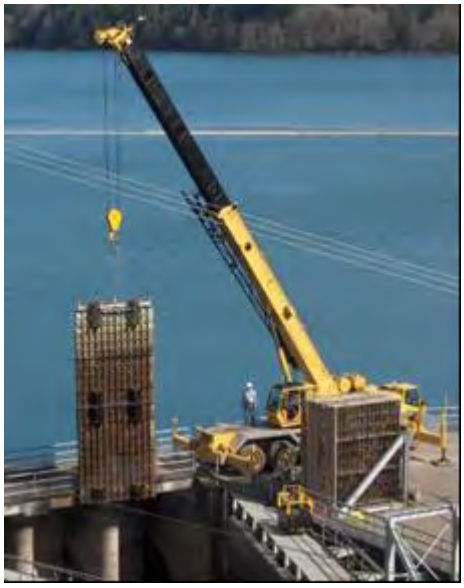
- A transport tank for delivering the fish back into the transport pipe.
- A transport pipeline for water and fish to return to the river below the Mayfield powerhouse.
- A release flume that directs the fish and water into the river below the Mayfield powerhouse tailrace.

The downstream fish migration facilities at the Mayfield Dam consist of three parts:
1) **Attraction and guidance area**
2) **Capture and enumeration area**
3) **Transportation and release area**

1) **Attraction and guidance area** consists of:

coarse trash racks at the upstream end of the louver bays and

a series of **louvers** that direct fish into the bypass slot by the use of



(louvered intake maintenance showing support structure and screens.)

dedicated pumps creates **attraction water flow** into the

secondary separator which directs fish via an **adjustable weir** to a

transport pipeline that passes through the dam (exit shown) with gravity induced water flow.

2) The **Capture and enumeration area** consists of:

a concrete trough **distribution flume** with **sorting racks** to pre-sort fish by size

before they enter one of the

three **holding raceways.** These raceways are manually emptied by draining down into the sump area and manually sending the fish to the

pipe that leads to the

Counting house.

After enumeration and tagging,

the fish are delivered to various **holding tanks** via **flumes or pipes.**

Non-migrant fish are lifted by crane to the top of the dam and transported by Cowlitz River Project personnel and transported via trucks back into Mayfield Lake.

3) The **transportation and release** consists of:

a fish lift and screened hopper, which is hoisted and moved to release fish into the

transport pipeline through which water flows into the **fish flume** that releases fish into the Cowlitz River at the Mayfield powerhouse tailrace.

Attraction and guidance

The downstream fish guidance and collection system is an integrated function of the water intake system for power generation at Mayfield Dam. The system operates 24 hours per day, seven days per week (24/7). Mayfield Lake is a re-regulating reservoir with a ten (10) foot change in elevation. The normal range for reservoir operation is from EL 421' to EL 425' above sea level. Full pool is EL 425'.

The two Mayfield Dam intakes are oriented to the north and to the south upstream of the power tunnel entrance. Each intake has as series of L-shaped louver vanes that only minimally disrupt the hydraulics, but divert migrant fish to a vertical slot at the apex of the louver bay. These eight (8) inch wide entrances accommodate volitional passage for juvenile and adult fish over the entire range of reservoir elevation. The flow and flow lines generated in the louver area are due to the hydraulic effect of the power tunnel.

Upon entering the vertical slots at the apex of each louver bay the juvenile and adult migrants encounter a current induced by the secondary separator pumps. The water flow transports or encourages the migrants to enter the secondary separator from both the north and south louver bays. The secondary separator is a screened holding pool with a waterfall exit that has an adjustable weir set 18" below lake level to create an outflow into the transport pipe. The weir control is linked to the reservoir level to rise and fall as needed and still create an outflow and transportation volume of approximately 10 cubic feet per second (fps). Fish swim through the outfall and into a pipe that runs through Mayfield Dam to the counting house facilities.

Two of the four attraction water pumps supplying the secondary separator and drawing water through the vertical slots at the apex of the louver bays are operational during the outmigration season. During the spring and summer outmigration season the pumps are used to increase the attraction flow into the secondary separator. This is known as the active mode. At other times of the year the pumps are turned off and the system operates by the design head and

consequent flows. This is known as the passive mode. Water not out-flowed into the transport pipe through the dam is returned to the power tunnel.

Capture and enumeration

Juvenile and adult fish emerge from the transport pipe into a concrete trough that spills through a series of bar racks and into raceways. The spacing of the bar racks determine which raceway the fish enter – the adult fish (i.e., steelhead kelts) continue across the bar rack to the west raceway. Fish are held in these raceways until they are manually examined, counted and given a unique wire tag in the counting house. Adult salmonids are enumerated and handled in the same manner as the juvenile fish at the downstream migrant fish collection facility, but are not marked.

Two raceways are 4' 8" wide x 32' long. One raceway is 6' wide x 26' long. Each raceway is supplied with 500 gpm flow. The raceway area is covered in netting for shade and to prevent bird predation.

Smolt holding capacity (based on Cowlitz Salmon Hatchery densities) are as follows:

	Number of smolts	Density
Spring Chinook	11,000	.11 lb/cft
Fall Chinook	20,000	.20 lb/cft
Coho	30,000	.30 lb/cft
Steelhead/Trout	25,000	.25 lb/cft

The density limitation is for smolts that average 180 mm fork length. This equates to 8 fish per pound (fpp) or about 57 grams each.

The raceways can be bypassed such that the fish and transport pipeline continue directly to the Mayfield powerhouse tailrace. The Mayfield collection system is not currently operated in the bypass mode so that all downstream migrants collected at Mayfield Dam can be given a unique mark.

To collect the downstream migrants operators reduce the flow to the raceways and direct the fish to a sump area at the end of the raceways for sorting and capture. Fish are manually netted and placed into a 4" transport pipe that delivers them into a fiberglass trough in the counting house. The fish are dip netted into an anesthetic container, counted and tagged with wire tags. After handling the fish are place into a trough with running water and transported into a lift tank to be released into the transport pipe.

The minimum operation schedule for the Mayfield downstream migrant facility has been weekly year-round. During the spring and summer the operation frequency has been increased to 4 – 5 days per week.

Tacoma proposes that the future Mayfield downstream migrant facility operation schedule consist of a two (2) days per week minimum operation on Monday and Thursday or Friday. When the total fish handling counts average greater than 500 fish per day for the preceding five days, the schedule shall be increased to three days per week - Monday, Wednesday and Friday. When the fish handling counts average greater than 1,500 fish per day for the preceding 5 days, the schedule shall be increased to six days per week - Monday through Friday, and

Saturday. (Exception: the one weekend day, Saturday, will become an operational day when the counts on Friday, eight days preceding, exceed the 1,500 fish per day average). Decreases in schedule are the reverse of increases.

A remote camera system, flow or level alarms for monitoring will be investigated for installation at the facility. Daily physical or remote monitoring of the facility will occur.

Transportation and release

Release consists of lifting the fish in the transport tank and moving the tank to the concrete trough leading to the fish transport pipeline. Fish travel down the pipeline and are released into the Cowlitz River at the Mayfield powerhouse tailrace. Non-indigenous fish (i.e. hatchery rainbow trout and tiger muskie) are recycled back upstream and released into Mayfield Lake.

Maintenance

Attraction and guidance

Cleaning frequencies: The two louver bay trash racks are cleaned as often as inspection reveals the need. This can be biweekly during heavy inflow periods. Cleaning is done using a mobile crane with crew support from a boat if needed.

The louvers have a cleaning schedule on an as-needed basis. Each intake is capable of being isolated, completely drained and entered by crew members and equipment. Cleaning activities in one louver bay can commence without interrupting the flows down the power tunnel, however, this activity can only occur when Mayfield discharge flows are less than 5,000 cfs (and usually only done when flows are below 4,000 cfs). Typically this occurs in the spring. A diver is used to clean the upstream stop log sill of the louver bay prior to placing the stop logs in order to drain the louver bay. A large volume pump is used for dewatering and to allow personnel and equipment to be placed directly in the empty louver bay for cleaning.

Individual louver bay cleaning frequency has been every 5 years or less. Cleaning one louver intake bay does not shut down the downstream migrant collection system at Mayfield Dam.

The bypass pipelines are cleaned by back-flushing at each individual louver bay draw down and cleaning event. A remote operated vehicle (ROV) has been used for individual pipeline inspection during the louver bay draw down.

FERC requires that the power tunnel to be fully drained and inspected for safety and integrity every 10 years. The entire louver system, transport pipes, secondary separator and counting house facilities are cleaned at the time of the power tunnel inspections. Power tunnel inspections interrupt the operation of the downstream migrant collection system at Mayfield Dam.

The secondary separator is cleaned on an as-needed schedule. The screens were last removed, inspected, cleaned and reinstalled in 2003.

The four (4) secondary separator pumps gear box oil is changed yearly. The pumps themselves have a water lubrication system for the bearings to reduce the potential for oil spill.

Capture and enumeration

Counting house and raceway maintenance occurs on an as-needed basis. The operators report problems at the facility and repairs are made by Cowlitz Project personnel. Operators clean the raceways, the screens and the racks every time that they operate the facility.

The hoist mechanism for the transport tank for discharging the fish into the transport pipe has a yearly maintenance protocol.

Transportation and release

The fish transport pipe and the discharge flume is visually inspected weekly and repaired as needed.

Emergency Procedures

See Appendix No. 1 for the emergency protocol model. Tacoma will include the reporting of emergency events occurring to the Cowlitz Project fish transportation program in the annual Upstream Passage Study Report (License Article 3).

Attraction and guidance

The emergency procedures program is limited for attraction and guidance system at the Mayfield downstream migrant facility due to the gravity flow operation. When the secondary separator pumps are off (passive mode) the system still operates because the head of the system continues to drive water through the louver bypass transport pipes, the secondary separator and down the transport pipe through the dam.

When operated in the active mode (secondary separator pumps on) a minimum of two of the pumps run at all times. The Mayfield downsteam migrant collector system has been operated in the passive mode during the winter and non-peak collection months at times in the past.

Capture and enumeration

Fisheries biologists and fish technicians that operate the Mayfield downstream migrant facilities conduct a visual inspection each time the facility is operated. Tacoma has proposed the installation of a remote monitoring or alarm system.

The raceway holding capability is 86,000 smolts, and is not exceeded on a daily or weekly basis due to the frequency of operations. The water supply for the raceways, counting house and the fish transport pipe are via gravity feed. The water originates from the outflow of the secondary separator and outflows into the transport pipe through the dam and to the raceways.

Interruption of the electrical service to the secondary separator pumps would have no effect on water supply as the system is designed for gravity flow operation and would continue to provide water flow downstream to the transport pipeline. Back-up electrical service at the downstream fish migrant facility is supplied by the Mayfield Dam emergency generator system.

Gate failure at the secondary separator outflow could lead to too much water flow through the pipe to the holding ponds. The water flow can also be controlled via a valve located on the downstream side of the dam at the mouth of the transport pipeline. The gate has failed only once since it was put into service in 1965. Stainless steel chains were used to replace the secondary separator weir gate chains that failed in that incident.

Transportation and release

The failure of the transport pipeline or discharge flume would result in increasing the frequency of the counting house operation to a daily occurrence. All fish, including the anadromous downstream migrants would be flumed to an existing holding tank after enumeration and tagging, and lifted to the deck of Mayfield Dam. There the fish would be loaded into Tacoma Power fish hauling trucks and driven to their respective destinations.

Schedules for Inspections of Facilities

A drive-by inspection is performed every day at the Mayfield Dam and downstream migrant facility. Security guards perform this inspection during non-work times and hours. Weekly a more comprehensive inspection is conducted and includes an inspection of the secondary separator attraction pumps, an inspection of all screens, louver faces and entrance slots.

Reporting Procedures of Inspection Results

In the event monitoring or inspection activity conducted under the FPP yields a finding outside of established operational standards Tacoma's employee or Tacoma's agent shall:

- Immediately notify the on duty Cowlitz Project Manager, Generation Section, Tacoma Power, 418 Gershick Road, Salkum, WA 98585 via Tacoma radio or by phone at (360) 985-2222.
- In lieu of contacting the Project manager, immediately notify the security guard at the Mayfield powerhouse at (360) 985-2222.

Tacoma or Tacoma's agent will make an immediate effort to determine if any fish health risk or state water quality standards violation risks have or are occurring. The cause of this risk will be the priority action rather than determining if the risk is the result of Tacoma's actions or discharges into the Cowlitz River. If a direct cause and effect is found Tacoma will implement the following corrective actions:

- Either immediately cease the activity, or correct the cause of the risk to the fish or to pollution into the Cowlitz River as much as possible within operational constraints of the Cowlitz River Project.
- Assess the possible cause(s) of the risks and take appropriate measures to correct the problem and/or prevent further environmental damage.
- In the event of finding distressed or dying fish, Tacoma or Tacoma's agent shall collect fish specimens and, within the first hour of such conditions, collect water samples for analysis of dissolved oxygen and temperature.
- In the event of a fish kill, Tacoma or its agent will immediately notify the Washington Department of Ecology, Southwest Region Spill Response Office at (360) 407-6300, the SWRO Federal Permit Coordinator, and the Washington Department of Fish and Wildlife Enforcement Office, and NOAA Fisheries Law Enforcement Office at 800-853-1964.

Notification shall include a description of the nature and extent of the problem, any actions taken to correct the problem, and any proposed change in operations to prevent further problems.

- Also notify Michelle Day of NOAA Fisheries at 503-736-4734. If Ms. Day cannot be reached at that number, call her cell phone at 503-351-4393. If Ms. Day cannot be reached, leave a message for her, and then call Keith Kirkendall at 503-230-5431. Notification shall include a description of the nature and extent of the problem, any actions taken to correct the problem and any proposed changes in operations to prevent further problems.

Anticipated Special Operations of Facilities for Research

The Mayfield downstream migrant facility will be integral to future studies to establish and verify the 95% fish passage survival (FPS) criterion established for Mayfield Dam in the license. Each calendar year the Cowlitz Evaluations Work Plan submitted by the WDFW details the projects anticipated at the Mayfield facility. In addition, the Cowlitz FTC will be the review team to evaluate fish passage projects utilizing the Mayfield Dam facilities. Projects are submitted to the Cowlitz FTC on a routine basis during the course of a year.

Mayfield Downstream Fish Facility Improvements – November 2005

Note: The following list of proposed improvements will be further investigated and detailed in the License Article 2 plan, due July 19, 2006. That plan will detail the improvements planned to improve upon a 95% fish passage survival rate as applied to Mayfield Dam, and will include plans for an annual monitoring of the compliance with this FPS rate.

1. *Optimal pump operations:* Investigate modifying pump operation to ensure the progressive velocity increase within the louver bays to the original design ratio of 1.4:1 (outlet: entrance) at various plant flows and lake elevations. Evaluate the use of a PLC based monitoring, control and alarm system.

2. *Attraction pump noise:* The attraction pump mechanical system will be examined to see if the noise can be reduced in any manner.

3. *Secondary separator:* Investigate modifications to the secondary separator screens to better satisfy NMFS fish draft criteria including:
   - replace 1/4” screen media to comply with NMFS 12.7 criteria (e.g. 3/32” opening if square or circular)
   - porosity control structures (baffles)
   - improvements to the outfall of the secondary separator to reduce or eliminate strike and impact forces on the fish
   - Investigate methods to minimize acceleration at outlet of secondary separator to better satisfy NMFS 0.2 fps per foot of travel criteria (e.g. ramped floor).
   - automated control of depth/flow over bypass weir with varying reservoir elevation.

4. *Counting house improvements:* Investigate eliminating the double handling and dip netting of the fish to move them around. The operation could be similar in design to how the smolts are delivered to the anesthetic tank at Cowlitz Falls Fish Facility.

5. *Transport pipeline outfall:* Replace the last section of bypass pipeline with a smooth material (e.g., UHMW plastic) or reline with a smooth material. Provide a pipeline extension or a flip bucket at the exit to better satisfy the NMFS 12.10 bypass outfall criteria for juveniles.

6. *O & M manual:* Develop an operations and maintenance manual for the downstream fish collection facility including emergency operations.

7. *Debris management:* Investigate various options of keeping debris out of the system to ensure louver and bypass slot functionality. Provide an automated secondary separator screen cleaning system.

2 a.) Cowlitz Salmon Hatchery facilities

Description

The Cowlitz Salmon Hatchery (CSH) is owned by Tacoma Power and operated by the Washington Department of Fish and Wildlife (WDFW). The CSH began operation in 1968 and all operational and maintenance expenses are paid by Tacoma Power.

The upstream fish migration facilities at the Cowlitz Salmon Hatchery consist of:

1) **Attraction area**
2) **Separator area**
3) **Truck transport**

Downstream fish migration facilities at the Cowlitz Salmon Hatchery consist of:

4) **Stress relief ponds** for downstream migrants

This plan is developed in conjunction with, and as an adjunct to, the License Article 413 plan – the Anadromous Fish Trap and Haul. The Article 413 plan includes detailed descriptions and pictures of the upstream and downstream fish migration facilities at the Cowlitz Salmon Hatchery.

Attraction area consists of:

- The **Barrier Dam at RM 49.5**, a barrier which prevents adult salmonids from migrating further upstream and directs them to the fishway entrances.
- There are two **fishway entrances** located on either end of the Barrier Dam. A transport channel connects the non-functional south fishway to the north fish entrance area. Auxiliary attraction water and is delivered to the north fishway entrance to attract the fish.
- The **fish ladder** connects the fishway entrance with the holding pool. There are three segments to the ladder; an entrance ladder, fishway pipe and a separator ladder. The fish ascend approximately twenty (20) feet to the height of the separator.
- The **holding pool** at the head of the ladder collects the adults.

The **Separator** consists of:

- A **crowder** rack in the holding pool which is occasionally used to encourage fish to jump into the flume.
- The **flume** has an up-well water supply at the entrance that attracts the fish where they are temporarily stranded and then slide down the flume.
- The **sorting tanks** are used to individually handle and examine every fish.
- After handling the fish are flumed into **holding tanks**.

Truck transport consists of:

- **Fish hauling trucks** that couple directly to the holding tanks.
- A **bellows** is used to make the connection where fish are transferred into the truck's tank.
- Fish are transported to designated release sites.
- A **chute and hydraulic gate** to transfer fish from truck tank to a body of water.

The **Stress relief ponds** consist of:

- Twelve (12) 8' x 50' **concrete ponds** each capable of holding one truck load of downstream migrating smolts from the Cowlitz Falls collection facility.
- A volitional **discharge pipeline** that routes the migrants from the stress relief ponds into the Cowlitz River below the Barrier Dam at a discharge point separate from the hatchery drain water.

Attraction and collection

The Barrier Dam has a 13' ogee crest with a concrete apron and is specifically designed to prevent adult salmonids from migrating further up the Cowlitz River. To increase the effectiveness of the dam, a low-voltage D.C. electric barrier is incorporated into the ogee crest. Two strips of stainless steel are embedded one foot apart on the dam crest. The amount of charge delivered to the strips is dependent upon the flow of water in the Cowlitz River but does not exceed 0.5 volts per inch of water surface. Currently juvenile fish releases from the Cowlitz Salmon Hatchery enter the river above the Barrier Dam and during release times (spring and early summer) the current to the Barrier Dam electrical grid is turned off to prevent any incidental harm or additional stress.

The Barrier Dam electrical grid is turned off only on the morning of juvenile fish releases from the Cowlitz Salmon Hatchery. Both the adult ladder attraction flow (the auxiliary ladder water supply system) and the electric grid on the Barrier Dam ogee crest are turned off the morning of scheduled juvenile fish releases at the Cowlitz Salmon Hatchery. Both systems are turned back on or activated based on visual examination of the nearshore waters upstream and downstream of the main hatchery drain pipe, and a determination that the hatchery juveniles are no longer present in large numbers.

The voltage control system for the Barrier Dam electrical grid is set at a minimum setting (30 units) during low-flow conditions on the Cowlitz River, i.e., 2,000 – 4,000 cubic feet per second (cfs), and the system is set at a maximum setting (40 units) at flows above 4,000 cfs. The ladder flows at a constant rate of 22.4 cfs year round.

The adult fish ladder is operated year-around. A total of 22.4 cubic feet per second (cfs) of water is up-welled into the holding pool and flows down the ladder. The adults have access throughout the ladder up to the holding pool at the head of the ladder. An auxiliary attraction water source is used to increase the flow of water at entrance of the fish ladder and offer the fish an alternative to jumping at the water spilling over the Barrier Dam. Scented water from the raceways is added by pumping out of at vault on the hatchery drain line and into the ladder for additional attraction up the ladder. The amount of scented water added to the ladder for additional attraction is a negligible volume.

The lower fish ladder transitions to a transport pipe above the Barrier Dam. The pipe is 53' long, 48" in diameter, and is lined with black mastic for waterproofing. Screened openings (27"

square) occur every 48” for light and ventilation. The gradient is essentially level (< 0.09%) and thus conducive for fish to transition from the pipe to the concrete fish ladder.

The upper fish ladder connects the pipe to the holding pool above the separator facility. This ladder incorporates a 90° turn and is configured to readily guide fish into the holding pool and the up-well water source. In the holding pool a finger weir discourages fish from moving back downstream, but is not a blockage to their movements. The holding pool and adult ladder water supply is pumped directly from the hatchery intake on the Cowlitz River. Water quality at the adult holding facility is monitored by hatchery employees daily. The varying stages or flows of the Cowlitz River flow do not impact the operation of the adult collection and handling facility.

Separator

An up-well water supply is added to the holding pool through grates at the head of the fish flume. This flow induces the fish to jump where they are temporarily stranded on an inclined flume and then slide down a wetted flume into one of two hand sorting tanks. The amount of water used for the up-well attraction can be regulated – a lower water flow will reduce the number of fish attempting to jump into a wetted flume, and a higher (or maximum) setting is used at times of low adult density in the holding pond to attract the maximum number of adult fish into the wetted flume.

The wetted flume has a series of swing gates that can be operated from the control booth or set in fixed positions. The choices of the settings are used to send the adult fish to hatchery brood stock holding ponds, directly into the adult transfer tanks holding tanks (very rarely) or into the hand sorting tanks. An aluminum pipe crowder can be used to force and guide the fish to the flow at the wetted flume entrance by reducing the area of the holding pond. This crowder has a “toe” that effectively crowds the entire fish content of the holding pool into a small area at the mouth of the wetted flume. This process empties the entire holding pool.

In the hand sorting tank, some fish (steelhead and coho) are anesthetized with carbon dioxide upwelling from stones on the bottom of the tanks. Other fish (spring Chinook, fall Chinook and sea-run cutthroat trout) may not be anesthetized. All fish are gently lifted from the hand sort tanks after they settle down. Fish are held by their caudal peduncle and supported under their ventral surface for examination.

Upon a determination of an external mark (or lack thereof) each fish is placed into one of seven wetted fiberglass tubes that transport the fish by gravity into one of the six holding tanks or into the flume to the hatchery ponds reserved for brood stock.

All adult fish are interrogated for wire tags with a hand wand or a fixed wire tag detection device. Currently (in 2005) there are 22 different tag and/or external mark combinations possible and 30 different dispositions possible for adult fish returning to the Cowlitz Salmon Hatcher separator in 2006.

The four concrete adult holding tanks date back to the original hatchery construction in 1968. Two adult holding tanks are fiberglass and date to when the adult fish handling and transport capacity was expanded. This expansion was done in 1996 in conjunction with the *Cowlitz Falls Project, Fisheries Management Plan: Anadromous Fish Reintroduction Plan*. The adult holding tanks have an up-well water supply, constant overhead water spray and fencing around the tanks. Each adult holding tank has a 1,500 gallon capacity and is operated with the same

loading density criteria as the fish trucks, as each tank loads directly into a single fish truck load. The six circular cone shaped holding tanks at the separator are used to hold sorted adult fish prior to transport. The maximum time adult fish will be held in the holding tanks is 24 hours.

All of the separator and adult holding tanks are under a metal roof structure. Public access is restricted in the separator area to protect the fish. Only hatchery and other appropriate personnel have access.

The minimum operation schedule for the CSH separator has been weekly year-round. During the spring and fall the operation frequency has been increased from 4 – 5 days per week to 7 days per week.

Tacoma proposes that future CSH separator facility operation schedule consist of: five (5) days per week minimum operation (except for scheduled maintenance shutdowns of up to one-week per year). Natural-origin adult salmonids, destined for upper Cowlitz River basins, will have the first priority for transportation, followed by fish held over from the previous day. Most all fish will be trucked the day they are processed. The last truck normally leaves the CSH separator facility at 2:00 PM. During peak runs fish sorting will not be completed until 3:30 PM. Tacoma does not believe holding fish up to one (1) day is excessive, and does not support night-time operations due to safety concerns. Adult fish will normally not be held more than 24 hours. If separator operations are not scheduled for a weekend or holiday period, and fish remain in the holding tanks on Friday evening, then trucking may still be required on Saturday.

When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days the operation frequency shall be increased to include the weekend days starting the following week. Decreases in schedule are the reverse of increases.

The CSH separator operational criteria will be reviewed each year.

The holding pool and the holding tanks have an alarm system for monitoring the water levels. The alarm signal is incorporated into the audible hatchery alarm system and enunciator panel.

Truck transportation

Tacoma Power has three 1,500 gallon tanker trucks used to transport adult and juvenile fish. Tacoma maintains the trucks and provides the drivers. The fish hauling trucks are filled with river water at the separator. Operators drive under a holding tank and attach the truck to the holding tank bellows. The bellows are filled with river water and the holding tanks water valve is closed. A pneumatically operated blade valve at the bottom of the holding tank is opened and the tank drains through the truck's two valves, leaving the fish in the truck. This "water to water" transfer does not expose the fish to the air. Oxygen is provided through stones in tank bottom during transport.

The disposition of the adult fish handled at the separator depends upon their origin and the management protocol in place at the time. All tagged fish originating from the Tilton River system, and tagged as juveniles at Mayfield Dam, are transported to Gus Backstrom Park on the Tilton River in Morton, Washington. Unmarked adults are hauled upstream to the upper Cowlitz River basin. Some hatchery-origin fish are recycled downriver for the sport fishery. The

majority of adults returning to the Cowlitz Salmon Hatchery separator are taken to upriver sites once hatchery brood stock requirements are met.

Fish are transported to the various locations in the Cowlitz River basin as directed by the adult handling protocol (AHP). See License Article 413, Anadromous Fish Trap and Haul Plan for the current AHP.

At the adult releases sites the transport truck backs up to the water edge and extends a metal chute up to an additional eight (8) feet over the water. The water and fish are released through a 24" hydraulic gate valve and the truck drains quickly. Some water can be slowly drained from the tank to slow the release of the fish if the drop to the water is higher than usual. Truck transport maximum capacity is up to 130 adult coho salmon or up to 75 adult Chinook salmon per load and is dependent upon the size of the fish.

Stress relief ponds

Tacoma Power personnel transfer smolts originating in the upper Cowlitz River basin with the fish hauling trucks to one of the eight (8) stress relief ponds at the Cowlitz Salmon Hatchery via a flexible 6" hose. A fish mortality count is logged onto data sheets and the pond is tagged to notify hatchery personnel. After 24 hours, smolts are released into Cowlitz River through the stress relief pond drain outlet at the mouth of the fish ladder. The stress relief ponds are fenced and screened to prevent predation while the smolts recover.

Maintenance

Tacoma conducts an on-going maintenance program of all Cowlitz Project facilities whereby all operational systems and equipment are visually or remotely inspected. If anything malfunctions, project managers assign repair priorities as necessary. Anything to do with attracting, collecting, separating, holding, transporting and releasing adult salmonids is assigned the highest priority for repair. This may include call-out of standby personnel and/or personnel overtime charges for the repairs. In addition, an on-going preventative maintenance program is in place at all Tacoma Power Cowlitz Hydroelectric Project major facilities.

Attraction and collection

Routine inspections are performed and cleaning (such as pressure washing the ponds) is done on an as-needed basis by either Tacoma Power or hatchery personnel. All mechanical, electrical and system maintenance is performed by Cowlitz Project personnel on an as-needed basis.

In the past the fish ladder was shut down for service annually during February and March. In recent years it has been operated continuously. It is only shut down for maintenance as needed. A five day shut down has been proposed for February 13 – 17, 2006 for necessary holding pool diffusion screen cleaning and/or repair, installation of a submerged weir at the ladder entrance and ladder pool cleaning and repair.

Separator

Routine inspections are performed and cleaning (such as pressure washing the holding tanks) is done on an as-needed basis by Tacoma Power personnel. All mechanical, electrical and system maintenance is performed by Cowlitz Project personnel on an as-needed basis. The seal areas of the holding tanks are greased yearly. Overhead valves are greased yearly. Brillo pads are used to clean the insides of the newest adult holding tanks as these fiberglass tanks need special attention to avoid damaging the gel coat finish.

The separator system is taken out of service for maintenance in February, although not annually. To prepare for the shut down the attraction flow is turned off for several days. On the day of the shut down the holding pool crowder is run repeatedly to empty the pool, the holding pool water level is increased with bin boards to block the finger weir, the ladder water supply is then gradually reduced, and personnel chase or net and hand-transport all residual fish within the ladder within the ladder and the transportation channel downstream to the Cowlitz River water level below the Barrier Dam.

Truck transportation

Tacoma Power maintains and operates three 1,500 gallon fish hauling trucks on the Cowlitz Project. The WDFW maintains and operates another 1,500 gallon fish hauling truck for exclusive use at the Cowlitz Trout Hatchery. Per Washington State Department of Transportation requirements for commercial vehicles these trucks are inspected prior to use and on a monthly basis. Regular maintenance is performed by the Cowlitz Project. Repairs and maintenance are performed on an as-needed basis.

Stress relief ponds

Routine inspections are performed and cleaning (such as pressure washing the ponds) is done on an as-needed basis by either Tacoma Power or hatchery personnel. All mechanical, electrical and system maintenance is performed by Cowlitz Project personnel on an as-needed basis.

Emergency Procedures

See Appendix No. 1 for the emergency protocol model. Tacoma will include the reporting of emergency events occurring to the Cowlitz Project fish transportation program in the annual Upstream Passage Study Report (License Article 3).

Attraction and collection, Separator

The WDFW is responsible for current hatchery operations and their personnel are the first responders to any emergencies. Audible and phone activation alarm systems are in place at the CSH to warn of low water levels or security breaches. If electrical supply disruptions limit or stop the hatchery water supply, routine procedures are in place to restore water supply including the use of back-up generators. Tacoma maintenance personnel are notified and respond on an as-needed basis. Cowlitz Project personnel are assigned to perform emergency repairs per hatchery operator requests.

Truck transportation

Each of the fish hauling trucks are equipped with Tacoma radios as well as cellular phones. The Project personnel assigned to drive the trucks are trained in routine and emergency communications, and in monitoring the water quality and quantity in the trucks during transit and upon release. Any contraindications are reported to the Cowlitz Project managers.

If a truck tank seal fails and water is leaking rapidly the truck is immediately routed to the nearest routine release site, usually the Barrier Dam boat launch. If a truck cannot reach its destination release site the truck is routed to nearest routine release site, usually into a Cowlitz Project reservoir or into Lake Scanewa.

Notification

The procedure, in the event of a fish kill, is to immediately notify the Project Lead, Ecology's Southwest Regional Spill Response Office at (360) 407-6300, the SWRO Federal Permit Coordinator, Washington Department of Fish and Wildlife, and NOAA Fisheries Law Enforcement Office at 800-853-1964. Also notify Michelle Day of NOAA Fisheries at 503-736-4734. If Ms. Day cannot be reached at that number, call her cell phone at 503-351-4393. If Ms. Day cannot be reached, leave a message for her, then call Keith Kirkendall at 503-230-5431. Notification shall include a description of the nature and extent of the problem, any actions taken to correct the problem and any proposed changes in operations to prevent further problems.

Schedule of Inspections

Attraction and collection, Separator

The Barrier Dam, entrance ladder and separator ladder are inspected daily. A thorough inspection of the Barrier Dam abutments is done monthly. Once a year, a complete Barrier Dam safety inspection is performed by crossing the river and inspecting the earthen fill portion of the dam.

The transport pipe, the upper ladder section, the adult holding pool, the hand sorting facilities and the adult holding tanks are inspected daily.

Truck transportation

Vehicle inspections are performed by the operators prior to use and logged on the inspection record sheets located in each truck. Per Washington State Department of Transportation requirements for commercial vehicles the fish hauling trucks are inspected prior to use and on a monthly basis.

Stress relief ponds

The hatchery operators visually inspect the stress relief ponds daily when they are in use.

Reporting Procedures of Inspection Results

Attraction and collection, Separator

A monthly report is compiled by Tacoma personnel for the Barrier Dam abutment inspection. An annual report is compiled by Tacoma personnel for the annual Barrier Dam safety inspection.

Truck transportation

Vehicle inspections logs are filed with Tacoma Power, Fleet Maintenance office in Tacoma, Washington.

Stress relief ponds

The hatchery operator records the results of pond inspections at the Salmon Hatchery. All records are maintained at the hatchery and provided to Tacoma Power quarterly.

Anticipated Special Operation of Facilities for Research

Each calendar year the Cowlitz Complex annual budget submitted by WDFW to Tacoma Power details the projects anticipated at the hatchery facilities. In addition, WDFW often requests the use of the hatchery facilities for special research or investigative needs. These requests are done through the Cowlitz Complex manager, the Tacoma Power administrative contact or through the Cowlitz FTC.

Cowlitz Salmon Hatchery Upstream Fish Facilities Improvements – November 2005

Note: Most of these proposed facility improvements will occur in conjunction with the Cowlitz Complex rebuild, as detailed in the Cowlitz Complex Remodel and Phase-in Plan, January 2005.

1. *O & M manual:* Develop an operations and maintenance manual for all upstream fish facilities including emergency operations. This manual will include the frequency of inspection, cleaning, and other preventative maintenance activities.

2. *Submerged entrance weir:* Installation of a submerged weir at fish ladder entrance to obtain hydraulic drop greater than 1 foot at low flows and less than 2 feet for high design flow.
    - Fish ladder outage scheduled for week of February 12, 2006 to allow for inspection and maintenance of attraction water structure and fish ladder to NOAA criteria.

3. *Adult fish counting system:* Installation of trial adult fish counting system near entrance to holding pool at top of fish ladder. This system will assist with the management of adult holding pool to its maximum holding capacity and will provide a warning when this limit is approached. Data collected from this system will help forecast the required processing speed at separation facility to avoid delay of migrating fish.

4. *Water quality instrumentation:* Installation of dissolved oxygen (DO), level, and temperature instrumentation in all six holding tanks in separation facility, holding pool at top of ladder, and at river intake. DO instrumentation also added to all 3 fish trucks. Investigate the installation of temporary oxygen tanks at separation facility for response to emergency conditions.

5. *Upgrades for fish ladder holding pool:* investigate crowder design modifications, the addition of a new exit gate, and/or system hydraulics changes to improve safe removal of fish that do not volitionally exit at the false weir.

6. *Automation of primary water supply:* To improve emergency response for the potential loss of water, variable frequency drives (VFDS) may be added to fish ladder pump(s) and/or Valve #2D for fish ladder inter tie may be automated.

7. *Observation of adults during anesthetic recovery:* Investigate methods to improve observation of recovering adults in separation facility's holding tanks.

8. *Increase water flow to the fish ladder*: Investigate methods and feasibility of increasing water supplied to fish ladder. New impellers for fish ladder pumps may be considered along with some water control structure modifications.

2 b.) Cowlitz Trout Hatchery Facilities

Description

The Cowlitz Trout Hatchery (CTH) is owned by Tacoma Power and operated by the Washington Department of Fish and Wildlife (WDFW). The CTH began operation in 1967 and all operational and maintenance expenses are paid by Tacoma Power.

The upstream fish migration facilities at the Cowlitz Trout Hatchery consist of:

1) **Attraction area**
2) **Ponds**
3) **Truck transport**

This plan is developed in conjunction with, and as an adjunct to, the License Article 413 plan – Anadromous Fish Trap and Haul. The Article 413 plan includes detailed descriptions and pictures of the upstream fish migration facilities at the Cowlitz Trout Hatchery.

The **Attraction** area consists of:

- A **barrier** on Blue Creek at entrance of the fish ladder to prevent fish from continuing upstream. **Attraction** water flows down the ladder into the creek.
- A **fish ladder** to allow fish access.
- A **holding pond** for collection.

The **adult holding Ponds** consist of:

- A **central pond** that is directly accessible to the fish ladder.
- Two **auxiliary ponds** parallel to the central pond are used to hold adult fish.

The **Truck transportation** consists of;

- One 1500 gallon **fish hauling truck** with an oxygen delivery system, and a rear gate designed to release fish into bodies of water.

1) The **Attraction area** consists of:

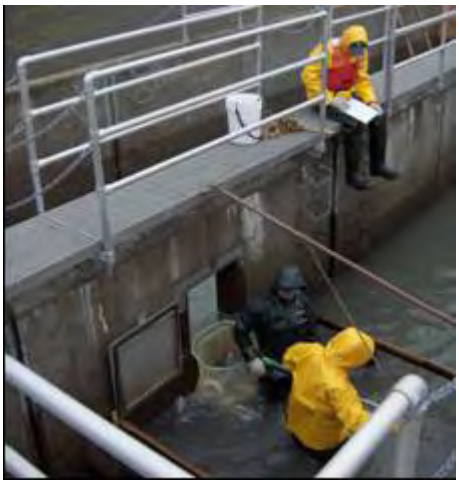
The **barrier** on Blue Creek at entrance of the fish ladder prevents fish from continuing upstream.

Attraction water flows into the creek from the **fish ladder**, whose purpose is

to route the fish to the level of the **holding pond**.

2) The **Holding ponds** consist of:

A **central pond** that is directly accessible to the fish ladder, and



two **auxiliary ponds**, one parallel to each side of the main pond, used to segregate and hold broodstock and fish for transport.

The blockage consists of an adult fish exclusion barrier on Blue Creek just upstream of the entrance to the fish ladder. Water flowing down the fish ladder is from the hatchery raceways and the adult holding areas within the hatchery. The fish ladder terminates in a holding pond where the adults are held and sorted by hand.

The holding pond consists of a central pond directly accessible to two side auxiliary ponds through ports in the pond walls. Each auxiliary pond is parallel to the central pond and is further subdivided to hold and segregate adult fish.

Operation of the Cowlitz Trout Hatchery fish migration facilities is currently performed by the WDFW. The upstream migration facility is fenced and not accessible to the public to protect the adult steelhead and cutthroat trout from undue noise and stress.

Attraction

The adult fish ladder at the Cowlitz Trout Hatchery is operated seasonally. Normal operating times are from October through early April. A total of 1,500 gallons per minute (gpm) of water is up-welled into the head of the holding pond. An additional 1,500 gpm is added at the top of the fish ladder and both sources drain down the ladder. The adults have access throughout the ladder to the holding pond at the head of the ladder.

When fish congregate at the instream barrier in Blue Creek, hatchery personnel open the fish ladder by filling the adult holding pond with a mix of water sources; hatchery reuse water, first pass river water or ozone-treated water, and well water. The blend of different water sources is dependent upon availability of the source water and the time of the year. Hatchery reuse water is a supply that has passed through raceways and used for rearing of juveniles.

Adult holding ponds

Fish enter the adult holding pond by swimming up the ladder. There are two auxiliary ponds, one located on each side of the holding pond.

The minimum operation schedule for the CTH holding pond has been weekly from October through April. During the winter the operation frequency has been increased from one day per week to 2 days per week Hatchery personnel hand sort the fish from the holding pond into one of two auxiliary ponds via closeable port holes through the concrete walls.

Truck transportation

At times when the Blue Creek flow is too low for upstream fish migration, the CTH receives its brood stock from the CSH via truck transportation. After sorting at the CSH separator, the fish are transported to the CTH and released into the auxiliary holding ponds. Upon sorting, surplus adults in the holding pond are transported to release sites in the lower Cowlitz River.

Maintenance

Attraction and holding ponds

Hatchery personnel conduct a physical inspection of the fish ladder and Blue Creek barrier weir every week day. The ladder and weir cleaning are done on an as-needed basis. Annually during the ladder shutdown the entire area is pressure washed by hatchery staff.

Routine inspections are performed and cleaning (such as pressure washing the ponds) is done on an as-needed basis by hatchery personnel. All mechanical, electrical and system maintenance is performed by Cowlitz Project personnel on an as-needed basis.

Truck transportation

Fish hauling trucks are inspected daily prior to operation by operator. Per Washington State Department of Transportation requirements for commercial vehicles the fish hauling truck is inspected prior to use and on a monthly basis. The CTH fish planting truck is serviced annually and all necessary repairs are done by local dealer. All routine repairs and maintenance to the vehicle (hoist system, etc.) are done by the hatchery operators.

Emergency Procedures

See Appendix No. 1 for the emergency protocol model. Tacoma will include the reporting of emergency events occurring to the Cowlitz Project fish transportation program in the annual Upstream Passage Study Report (License Article 3).

Attraction and holding ponds

In the case of a power outage and loss of water from the pump supply, an emergency generator system automatically starts and comes on-line. The protocol for hatchery operators is to respond to the alarm, verify water is flowing and notify hatchery managers. Tacoma personnel are notified and respond on an as-needed basis. The supply priorities are:

1. Incubation
2. Raceways (juveniles)

3. Holding Ponds (adults)
4. Rearing lakes (juveniles)

In a power loss situation, as many hatchery staff will be called back to duty as necessary and the supply priorities will be followed. If water supply is not available via PUD or emergency generator within two hours, all adult fish in the central holding pond will be forced out of the pond, down the ladder and into Blue Creek. The adults in the auxiliary ponds will be retained, and a water recirculation system activated.

The WDFW is responsible for current hatchery operations and their personnel are the first responders to any emergencies. Extensive alarm systems are in place at the CTH to warn of low water levels or security breaches. If electrical supply disruptions limit or stop the hatchery water supply, routine procedures are in place to restore water supply including the use of back-up generators. Tacoma maintenance personnel are notified and respond on an as-needed basis. Cowlitz Project personnel are assigned to perform emergency repairs per hatchery operator requests.

Truck transportation

The CTH fish hauling truck operators are equipped with cellular phones. The WDFW personnel assigned to drive the trucks are trained in routine and emergency communications, and in monitoring the water quality and quantity in the trucks during transit and upon release. Any contraindications are reported to the Cowlitz Complex managers.

If a truck tank seal fails and water is leaking rapidly the truck is immediately routed to the nearest routine release site, usually the Blue Creek boat launch. If a truck cannot reach its destination release site the truck is routed to nearest routine release site, usually into a Cowlitz Project reservoir.

Schedule of Inspections

Attraction and holding ponds

A physical inspection of the holding ponds is done daily when adult fish are present. The Blue Creek weir, fish ladder and adult holding ponds are inspected daily. A more thorough inspection of the facility is done once a year with a complete safety inspection performed by hatchery personnel. All supply and discharge valves are inspected and serviced annually during the ladder shut down period.

Water quality inspections are done weekly with flow and dissolved oxygen readings taken by the hatchery personnel. All records are maintained at the hatchery and provided to Tacoma Power quarterly.

Truck transportation

Vehicle inspections are performed by the operators prior to use and logged on the inspection record sheets located in each truck. Per Washington State Department of Transportation requirements for commercial vehicles the fish hauling truck is inspected prior to use and on a monthly basis.

Reporting Procedures of Inspection Results

Attraction and holding ponds

No specific records are kept of the visual inspections. Reporting is verbal to the hatchery managers if a problem exists.

Records of chemical treatments administered to the adults are tracked by the hatchery operators on monthly forms. Records of sorting performed by the hatchery operators are also compiled on weekly loading forms. All records are maintained at the hatchery and provided to Tacoma Power quarterly.

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Flow and dissolved oxygen readings are recorded by the hatchery operators. Data is compiled weekly into loadings forms. All records are maintained at the hatchery and provided to Tacoma Power quarterly.

Truck transportation

Vehicle inspections are performed by the operators prior to use and logged on the inspection record sheets located in each truck.

Anticipated special operations of facilities for research

Each calendar year the Cowlitz Complex annual budget submitted by WDFW to Tacoma Power details the projects anticipated at the hatchery facilities. In addition, WDFW often requests the use of the hatchery facilities for special research or investigative needs. These requests are conducted through the Cowlitz Complex manager to the Tacoma Power administrative contact, or through the Cowlitz FTC process.

3.) Cowlitz Falls

Description

The Cowlitz Falls Project is located in Southwestern Washington approximately 19 miles north of Mount St. Helens and 28 miles south-southwest of Mount Rainier (GAIA, 1994). The Cowlitz Falls Fish Facility is located adjacent to the Cowlitz Falls Dam at river mile 88 of the Cowlitz River. The Cowlitz River enters the lower Columbia River at Longview, Washington, at river mile 68. The stress relief ponds (SRPs) are located at the Cowlitz Salmon Hatchery, river mile 50.

Cowlitz Falls Dam was completed and began commercial operation in 1994. The surface bypass collection system, modeled after the successful hydro-combine system at Wells Dam on the mid-Columbia River, and the fish facility was completed at the end of 1996. The dam incorporates fish attraction, surface collection, handling, sampling, and transport facilities.

The Cowlitz Falls fish collection facility (CFFF) is the result of a collaborative effort among Lewis County Public Utility District No. 1, the Bonneville Power Association, the Washington Department of Fish and Wildlife and Tacoma Power.

The Bonneville Power Association (BPA) funded the construction of downstream fish collections facilities that began operating in 1996. The WDFW operates the fish migration facilities and is responsible for all decisions concerning collection, sorting, tagging, and disbursement of the fish. Tacoma Power provides truck transportation from the CFFF to the stress relief ponds at the CSH or to other locations as per WDFW direction.

Tacoma Power interfaces with the CFFF only to provide fish transportation and is not involved with any operating or maintenance aspects of the facility. The operation and maintenance of the stress relief ponds is covered in Section 2 a. (Cowlitz Salmon Hatchery) of this plan.

Fish migration facilities at the CFFF (related to Tacoma Power's Cowlitz Hydroelectric Project) consist of:

1) **Transfer facilities**
2) **Truck transportation**

The **Transfer facilities** consists of:

- A juvenile **holding tank**.
- A **transfer station** for adults.

Truck transportation consists of:

- **Fish hauling trucks** that couple directly to the holding tank or transfer station.
- A **bellows** is used to make the connection where fish are transferred into the truck's tank.
- Fish are transported to designated release sites.
- A **chute and hydraulic gate** to transfer fish from truck tank to a body of water.

The Lewis County Public Utility District No. 1, Cowlitz Falls Project downstream migration facilities utilized by Tacoma Power are:

1) Transfer facilities
2) Truck transport

1) Transfer facilities

There are two transfer stations, one for adults and one for smolts.

Smolt transfer station

2) Truck transport consists of:

The **fish hauling trucks** operated and maintained by Tacoma Power's Cowlitz River Project which transports the smolts to the

stress relief ponds at the Cowlitz Salmon Hatchery.

Transfer facilities

Tacoma Power has three 1,500 gallon tanker trucks used to transport adult and juvenile fish from the CFFF. The fish hauling trucks are filled with ambient temperature river water at the CFFF. Operators drive under the juvenile holding tank or the adult transfer station and attach the truck to the bellows. The bellows are filled with river water and the holding tanks water valve is closed. A pneumatically operated blade valve at the bottom of the holding tank is opened and the tank drains through the truck's two valves, leaving the fish in the truck. This "water to water" transfer does not expose the fish to the air. Oxygen is provided through stones in tank bottom during transport.

Truck transportation

The disposition of the adult fish transported from the CFFF depends upon their origin and the management protocol in place at the time. Some adults are transported back upstream to the upper Cowlitz River basin. Other adults (steelhead kelts) are transported downstream and released into the Cowlitz River at the Barrier Dam boat launch.

Juvenile fish transported from the CFFF are released into the stress relief ponds at the Cowlitz Salmon Hatchery.

Maintenance

Transfer facilities

The fish migration facilities at Cowlitz Falls are maintained by the Lewis County Public Utility District No. 1. Tacoma Power Cowlitz Project personnel are assigned to assist with emergency repairs per operator requests on an occasional basis.

Truck transportation

Tacoma Power maintains and operates three 1,500 gallon fish hauling trucks on the Cowlitz Project. The WDFW maintains and operates another 1,500 gallon fish hauling truck for exclusive use at the Cowlitz Trout Hatchery. Per Washington State Department of Transportation requirements for commercial vehicles these trucks are inspected prior to use and on a monthly basis. Regular maintenance is performed by the Cowlitz Project. Repairs and maintenance are performed on an as-needed basis.

Emergency Operations

Transfer facilities

Emergency operations at the CFFF are under the jurisdiction and responsibility of Lewis County PUD and the BPA. Tacoma personnel are trained to notify CFFF operators of any problems or contraindications.

Truck transportation

Each of the fish hauling trucks are equipped with Tacoma radios as well as cellular phones. The Project personnel assigned to drive the trucks are trained in routine and emergency communications, and in monitoring the water quality and quantity in the trucks during transit and upon release. Any contraindications are reported to the Cowlitz Project managers.

If a truck tank seal fails and water is leaking rapidly the truck is immediately routed to the nearest routine release site, usually the Day Use Site in Lake Scanewa. If a truck cannot reach its destination release site the truck is routed to nearest routine release site, usually into a Cowlitz Project reservoir or into Lake Scanewa.

Schedule for Inspection of Facilities

Transfer facilities

The schedule for the inspection of the facilities at the CFFF are under the jurisdiction and responsibility of Lewis County PUD No. 1 and the BPA. The CFFF fish migration facilities are inspected by the WDFW.

Truck transportation

Vehicle inspections are performed by the operators prior to use and logged on the inspection record sheets located in each truck. Per Washington State Department of Transportation requirements for commercial vehicles the fish hauling trucks are inspected prior to use and on a monthly basis.

Reporting Procedures of Inspection Results

Transfer facilities

The reporting of the inspection results of the facilities at the CFFF are under the jurisdiction and responsibility of Lewis County PUD and the BPA.

Truck transportation

Vehicle inspections logs are filed with Tacoma Power, Fleet Maintenance office in Tacoma, Washington.

Anticipated Special Operation of Facilities for Research

Each calendar year Lewis County PUD No. 1, BPA and WDFW determine the special operations of the facility. Tacoma Power does not have any involvement in this process. WDFW requests the use of the Tacoma's truck transportation system for special research or investigative needs. These requests are conducted through the Cowlitz Complex manager to the Tacoma Power administrative contact, or through the Cowlitz FTC process.

6. CONSULTATION AND COMMENTS

Date	Agencies/ Committee	Participants	Type of Communication	Topics
May 17, 2005	Cowlitz Fisheries Technical Committee (FTC)	Tacoma Power, WDFW, Yakama Nation, NMFS, WDOE, USFWS & AR/TU	Draft License Article 413 plan	• Distribution of draft Anadromous Fish Trap and Haul Plan for review.
June 15, 2005	Washington Department of Fish and Wildlife	WDFW	Draft letter	• WDFW comments on Tacoma Power License Articles 409, 413 and 415 drafts.
June 16, 2005	National Marine Fisheries Service	NMFS	Draft letter	• Preliminary comments on deficiencies in the City of Tacoma draft Anadromous Fish Trap and Haul Plan (license article 413) and Anadromous Fish Passage Plan (license article 415) dated 5/23/2005.
June 20, 2005	Cowlitz FTC	Tacoma Power, NMFS, Yakama Nation, USFWS & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.

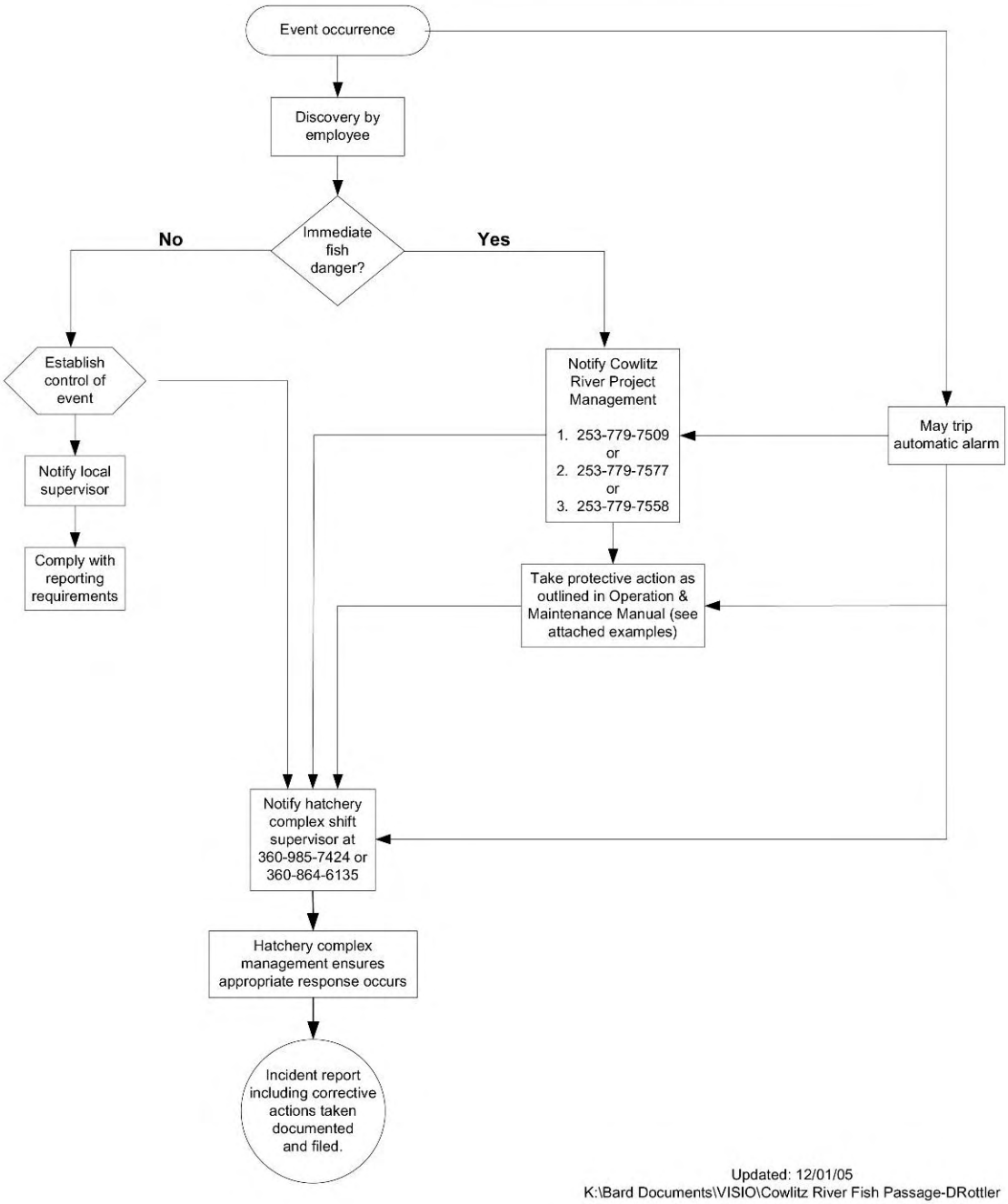
June 23, 2005	Washington Department of Fish and Wildlife	WDFW	Letter	• WDFW comments on Tacoma Power License Articles 409, 413 and 415 drafts.
June 23, 2005	National Marine Fisheries Service	NMFS	Letter	• Comments on Tacoma Power's draft plans for License Articles 409, 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).
August 19, 2005	Tacoma Power	Tacoma Power	Letter	• Response letter to NMFS regarding the June 23, 2005 comment letter.
August 23, 2005	Cowlitz FTC	Tacoma Power, Yakama Nation, USFWS, WDOE, WDFW & AR/TU	Meeting	• Review of Anadromous Fish Passage and Trap and Haul Plans.
September 14, 2005	Cowlitz FTC	Tacoma Power, Yakama Nation, NMFS USFWS, WDFW & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.
October 4, 2005	Cowlitz FTC	Tacoma Power, NMFS USFWS, WDOE, WDFW & AR/TU	Meeting	• Discussion of Anadromous Fish Passage and Trap and Haul Plans.
October 11, 2005	Cowlitz FTC	Tacoma Power, NMFS, USFWS & WDFW.	On-site meeting	• Viewing and discussion of downstream passage improvements at Mayfield Dam. Discussion of Cowlitz Salmon Hatchery adult fish ladder and holding pool.
November 18, 2005	National Marine Fisheries Service	Tacoma Power & NMFS	On-site meeting	• Viewing and discussion of Cowlitz Salmon Hatchery adult fish ladder and holding pool.
December 6, 2005	Cowlitz FTC	NMFS Tacoma Power, WDFW, Yakama Nation, NMFS, WDOE, USFWS & AR/TU	Draft License Article 413 plan	• Distribution of final draft Anadromous Fish Trap and Haul Plan for review.
December 6, 2005	Cowlitz FTC	NMFS Tacoma Power, WDFW, Yakama Nation, NMFS, WDOE, USFWS & AR/TU	Draft License Article 415 plan	• Distribution of final draft Anadromous Fish Passage Plan for review.

December 6, 2005	Cowlitz FTC	Tacoma Power, Yakama Nation, USFWS, WDOE, & AR/TU	Meeting	• Review of Anadromous Fish Passage and Trap and Haul Plans.
January 3, 2006	Cowlitz FTC	Tacoma Power, NMFS, USFWS, & AR/TU	Meeting	• Review of Anadromous Fish Passage Plan.
January 9, 2006	National Marine Fisheries Service	NMFS	Letter	• Comments on Tacoma Power's final draft plans for License Articles 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).
January 9, 2006	American Rivers/Trout Unlimited	AR/TU	Email/letter	• Comments on Tacoma Power's final draft plans for License Articles 413 and 415 for the Cowlitz River Hydroelectric Project (FERC No. 2016).

APPENDIX No. 1

Emergency Protocol

COWLITZ RIVER PROJECT FISH PASSAGE
Emergency Response Logic Chart



APPENDIX No. 2

Mayfield downstream migrant facility improvements list

Mayfield Downstream Fish Facility Improvements – November 2005

Note: The following list of proposed improvements will be further investigated and detailed in the License Article 2 plan, due July 19, 2006. That plan will detail the improvements planned to improve upon a 95% fish passage survival rate as applied to Mayfield Dam, and will include plans for an annual monitoring of the compliance with this FPS rate.

1. *Optimal pump operations:* Investigate modifying pump operation to ensure the progressive velocity increase within the louver bays to the original design ratio of 1.4:1 (outlet: entrance) at various plant flows and lake elevations. Evaluate the use of a PLC based monitoring, control and alarm system.

2. *Attraction pump noise:* The attraction pump mechanical system will be examined to see if the noise can be reduced in any manner.

3. *Secondary separator:* Investigate modifications to the secondary separator screens to better satisfy NMFS fish draft criteria including:

- replace 1/4" screen media to comply with NMFS 12.7 criteria (e.g. 3/32" opening if square or circular)
- porosity control structures (baffles)
- improvements to the outfall of the secondary separator to reduce or eliminate strike and impact forces on the fish
- Investigate methods to minimize acceleration at outlet of secondary separator to better satisfy NMFS 0.2 fps per foot of travel criteria (e.g. ramped floor).
- automated control of depth/flow over bypass weir with varying reservoir elevation.

Counting house improvements: Investigate eliminating the double handling and dip netting of the fish to move them around. The operation could be similar in design to how the smolts are delivered to the anesthetic tank at Cowlitz Falls Fish Facility.

Transport pipeline outfall: Replace the last section of bypass pipeline with a smooth material (e.g., UHMW plastic) or reline with a smooth material. Provide a pipeline extension or a flip bucket at the exit to better satisfy the NMFS 12.10 bypass outfall criteria for juveniles.

O & M manual: Develop an operations and maintenance manual for the downstream fish collection facility including emergency operations.

Debris management: Investigate various options of keeping debris out of the system to ensure louver and bypass slot functionality. Provide an automated secondary separator screen cleaning system.

APPENDIX No. 3

Cowlitz Salmon Hatchery fish ladder improvements list

Cowlitz Salmon Hatchery Upstream Fish Facilities Improvements – November 2005

Note: Most of these proposed facility improvements will occur in conjunction with the Cowlitz Complex rebuild, as detailed in the Cowlitz Complex Remodel and Phase-in Plan, January 2005.

1. *O & M manual:* Develop an operations and maintenance manual for all upstream fish facilities including emergency operations. This manual will include the frequency of inspection, cleaning, and other preventative maintenance activities.

2. *Submerged entrance weir:* Installation of a submerged weir at fish ladder entrance to obtain hydraulic drop greater than 1 foot at low flows and less than 2 feet for high design flow.
    - Fish ladder outage scheduled for week of February 12, 2006 to allow for inspection and maintenance of attraction water structure and fish ladder to NOAA criteria.

Adult fish counting system: Installation of trial adult fish counting system near entrance to holding pool at top of fish ladder. This system will assist with the management of adult holding pool to its maximum holding capacity and will provide a warning when this limit is approached. Data collected from this system will help forecast the required processing speed at separation facility to avoid delay of migrating fish.

Water quality instrumentation: Installation of dissolved oxygen (DO), level, and temperature instrumentation in all six holding tanks in separation facility, holding pool at top of ladder, and at river intake. DO instrumentation also added to all 3 fish trucks. Investigate the installation of temporary oxygen tanks at separation facility for response to emergency conditions.

Upgrades for fish ladder holding pool: investigate crowder design modifications, the addition of a new exit gate, and/or system hydraulics changes to improve safe removal of fish that do not volitionally exit at the false weir.

Automation of primary water supply: To improve emergency response for the potential loss of water, VFDS may be added to fish ladder pump(s) and/or Valve #2D for fish ladder inter tie may be automated.

Observation of adults during anesthetic recovery: Investigate methods to improve observation of recovering adults in separation facility's holding tanks.

Increase water flow to the fish ladder: Investigate methods and feasibility of increasing water supplied to fish ladder. New impellers for fish ladder pumps may be considered along with some water control structure modifications.

APPENDIX No. 4

Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities

October 2005

Mayfield downstream migrant facilities

Review of Guidelines Applicable to Mayfield Downstream Migrant Facilities

Tacoma Power's review responses of NMFS fish passage guidelines applicable to Cowlitz Hydroelectric Project Fish Passage Facilities are included below in italics and underlined.

Section 12. Fish Screen and Bypass Facilities

12.0 Description, Purpose and Rationale: This section provides criteria and guidelines to be utilized in the development of designs of downstream migrant fish screen facilities for hydroelectric, irrigation, and other water withdrawal projects. Consistent with the terminology used throughout this document, criteria are specified by the word "shall" and guidelines are specified by the word "should". Criteria are required design features, unless site specific conditions preclude their use and a site-specific written waiver is provided by NOAA Fisheries (also see Foreword). Guidelines are not required, but deviation from a guideline require a written explanation by the project designer. It is suggested that deviation from a guideline be discussed with NOAA Fisheries prior to final design.

In designing an effective fish screen facility, the swimming ability of the fish is a primary consideration. Research has shown that swimming ability of fish varies and may depend upon a number of factors relating to the physiology of the fish, including species, size, duration of swimming time required, behavioral aspects, migrational stage, physical condition and others, in addition to water quality parameters such as dissolved oxygen concentrations, water temperature, lighting conditions, and others. For this reason, screen criteria must be expressed in general terms.

Since these criteria and guidelines are general in nature, there may be cases where site constraints or extenuating biological circumstances dictate that certain criteria or guidelines be waived or modified, without delaying or otherwise adversely impacting fish migration. It is the responsibility of the project sponsor provide compelling evidence in support of any proposed waiver. Particular fishway elements that can not be designed to meet these criteria and guidelines should be discussed with NOAA Fisheries engineering staff as early in the design process as possible to explore potential options. Conversely, where NOAA Fisheries deems there is a need to provide additional protection for fish, more restrictive site-specific criteria may be added. These circumstances will be considered by NOAA Fisheries on a project-by-project basis. To facilitate construction of any fish passage facility, rationale for criteria waivers shall accompany design documents sent to NOAA Fisheries staff for review.

Several categories of screen designs are in use but are still considered as experimental technology by NOAA Fisheries. These include Eicher screens, modular inclined screens, coanda screens, and horizontal screens. Criteria for experimental screens can be developed through discussions with NOAA Fisheries engineers, on a case-by-case basis. The process to evaluate experimental technology is described in Section 17.

12.1 A functional screen design should be developed that defines type, location, size, hydraulic capacity, method of operation, and other pertinent juvenile fish screen facility characteristics. In the case of applications to be submitted to the FERC and for consultations under the ESA, a

functional design for juvenile (and adult) fish passage facilities shall be developed and submitted as part of the FERC License Application or of the Biological Assessment for the facility. It shall reflect NOAA Fisheries input and design criteria and be acceptable to NOAA Fisheries.
Functional design drawings shall show all pertinent hydraulic information, including water surface elevations and flows through various areas of the structures. Functional design drawings shall show general structural sizes, cross-sectional shapes, and elevations. Types of materials shall be identified where they will directly affect fish. The final detailed design shall be based on the functional design, unless changes are agreed to by NOAA Fisheries.

12.2 To minimize risks to anadromous fish at some locations, NOAA Fisheries may require investigation (by the project sponsors) of important and poorly defined site-specific variables that are deemed critical to development of the screen and bypass design. This investigation may include factors such as fish behavioral response to hydraulic conditions, weather conditions (ice, wind, flooding, etc.), river stage-discharge relationships, seasonal operational variability, potential for sediment and debris problems, resident fish populations, potential for creating predation opportunity, and other information. The life stage and size of juvenile salmonids present at a potential screen site usually is not known, and can change from year to year based on flow and temperature conditions. Thus, adequate data to describe the size-time relationship requires substantial sampling efforts over a number of years. For the purpose of designing juvenile fish screens, NOAA Fisheries will assume that fry-sized salmonids and low water temperatures are present at all sites and apply the appropriate criteria listed below, unless adequate biological investigation proves otherwise. The burden-of-proof is the responsibility of the owner of the diversion facility.

12.3 Acceptance criteria for existing screens: If a fish screen was constructed prior the establishment of these criteria, but constructed to NOAA Fisheries criteria established August 21, 1989, or later, approval of these screens will be considered providing that all of the following conditions are met:

1) the entire screen facility is still functioning as designed. 2) the entire screen facility has been maintained and is in good working condition. 3) when the screen media wears out, it shall be replaced with screen media meeting the current criterion stated in this document. Structural constraints may limit this activity in some instances, and these should be discussed with NOAA Fisheries engineering staff prior to replacing screen media. 4) no mortality, injury, entrainment, impingement, migrational delay or other harm to anadromous fish has been noted that is being caused by the facility; 5) no emergent fry are likely to be located in the vicinity of the screen, as agreed to by NOAA Fisheries biologists familiar with the site; and 6) when biological uncertainty exists, access to the diversion site by NOAA Fisheries is permitted by the diverter for verification of numbers 1 through 5.

12.4 Structure Placement -Streams and Rivers:

12.4.1 Where physically practical and biologically desirable, the screen shall be

constructed at the point of diversion with the screen face generally parallel to river flow. Physical factors that may preclude screen construction at the diversion entrance include excess river gradient, potential for damage by large debris, and potential for heavy sedimentation. For screens constructed at the bank line, the screen face shall be aligned with the adjacent bank line and the bank line shall be shaped to smoothly match the face of the screen structure to prevent eddies in front, upstream, and downstream of the screen. Adverse alterations to riverine habitat shall be minimized.

12.4.2 Where installation of fish screens at the diversion entrance is not desirable or impractical, the screens may be installed in the canal downstream of the entrance at a suitable location. All screens installed downstream from the diversion entrance shall be provided with an effective bypass system approved by NOAA Fisheries, designed to collect and transport fish safely back to the river with minimum delay. The screen location shall be chosen to minimize the effects of the diversion on in-stream flows by placing the bypass outfall as close as biologically and practically feasible to the point of diversion.

12.4.3 All passage facilities shall be designed to function properly through the full range of hydraulic conditions in the river (see Section 4) and in the diversion conveyance, and shall account for debris and sedimentation conditions which may occur.

12.5 Structure Placement -Lakes, Reservoirs and Tidal areas:

12.5.1 Intakes shall be located offshore where feasible to minimize fish contact with the facility. When possible, intakes shall be located in areas with sufficient ambient velocity to minimize sediment accumulation in or around the screen and to facilitate debris removal and fish movement away from the screen face. Intakes in reservoirs should be as deep as practical, to reduce the numbers of juvenile salmonids that encounter the intake.

12.5.2 If a reservoir outlet is used to pass fish from a reservoir, the intake shall be designed to withdraw water from the most appropriate elevation based on providing the best juvenile fish attraction and appropriate water temperature control downstream of the project. The entire range of fore bay fluctuation shall be accommodated in design.

12.6 Screen Hydraulics - Rotating Drum Screens, Vertical Screens and Inclined Screens

12.6.1 The approach velocity shall not exceed 0.40 feet per second (ft/s) for active screens, or 0.20 ft/s for passive screens. For screen design, approach velocity is calculated by dividing the vertical projection of the effective screen area into the diverted flow amount. This approach velocity will minimize screen contact and/or impingement of juvenile fish.

The secondary separator is not an active screen by definition as it does not have an automatic cleaning system. However, minimal debris makes it past primary separator due to change in direction at louvers so TPU asserts that the 0.40 fps requirement would be more applicable to the secondary separator. Table 12.1 shows the flow rates through the turbines and the secondary separator for both approach velocity criteria: This criterion is not applicable to primary separator.

Table 12.1: Maximum flow rates through Mayfield power tunnel and secondary separator screen for original design velocity ratio and compliance with NOAA approach velocities.

Reservoir Elevation (ft from M.S.L)	Effective Screen Area (ft^2)	V_A = .4 fps		V_A = .2 fps	
		Turbine Flow (Q_{pt})	Diverted Flow (Q_b + Q_p)	Turbine Flow (Q_{pt})	Diverted Flow (Q_b + Q_p)
425	543	NL	NL	6,238	121.6
424	509	NL	NL	5,887	114.8
423	475	10,407	202.9	5,537	108.0
422	441	9,706	189.3	5,186	101.1
421	406	9,005	175.6	4,836	94.3
420	372	8,304	161.9	4,485	87.5
419	338	7,603	148.2	4,135	80.6
418	304	6,901	134.6	3,784	73.8
417	270	6,200	120.9	3,433	66.9
416	236	5,499	107.2	3,083	60.1
415	201	4,798	93.6	2,732	53.3

Notes: *Maximum turbine flow is approximately 14,000 cfs*
Q_b = 13 cfs = design flow rate through fish bypass
Qp; 4 pumps available each capable of ≤ 50 cfs
Maximum total diverted flow = 213 cfs
NL = Not Limiting

Table 12.1 applies when the original design velocity ratio of 1:1.4 (inlet to outlet velocity) is maintained at the primary separator by pumping the appropriate flow through the secondary separator using the attraction pumps. There are four attraction pumps available to generate this flow, each capable of approximately 50 cfs. See Appendix A - "Mayfield Dam Downstream Migrant Fish Facility Evaluation Program, 1964", page 12, for Mayfield intake structure water quantities and velocities.

12.6.2 The effective screen area required is calculated by dividing the maximum diverted flow by the allowable approach velocity.

Per Table 1, the secondary separator appears to need more effective screen area under certain circumstances. At normal reservoir level of 425 ft. M.S.L., the total submerged screen area (excluding structural members) is 543 square feet. Applying the 0.4 fps and 0.2 fps criteria at this reservoir elevation, the maximum diverted flow is 217 cfs (> 4 pump operation) and 121.6 cfs (> 2 pump operation), respectively. However, under higher turbine flow rates at lower reservoir elevations (e.g. 10,000 cfs turbine flow rate at

a reservoir elevation of 420 ft M.S.L.) even the approach velocity criteria of 0.4 fps is exceeded.

12.6.3 For rotating drum screens, the design submergence shall not exceed 85%, nor be less than 65% of drum diameter. Submergence over 85% of the screen diameter increases the possibility of entrainment over the top of the screen (if entirely submerged), and increases the chance for impingement with subsequent entrainment if fish are caught in the narrow wedge of water above the 85% submergence mark. Submerging rotating drum screens less than 65% will reduce the self-cleaning capability of the screen. In many cases, stop logs can be installed downstream of the screens to achieve proper submergence. If stop logs are used, they should be located at least two drum diameters downstream of the back of the drum.

Not applicable.

12.6.4 The screen design shall provide for nearly uniform flow distribution (see section 16) over the screen surface, thereby minimizing approach velocity over the entire screen face. The screen designer shall show how uniform flow distribution is to be achieved. Providing adjustable porosity control on the downstream side of screens, and/or flow training walls may be required. Large facilities may require hydraulic modeling to identify and correct areas of concern. Uniform flow distribution avoids localized areas of high velocity, which have the potential to impinge fish.

No porosity control is provided on downstream side of secondary separator screens so existing flow distribution may not be uniform. Since there are two sets of screen guide slots for each installed panel, the downstream guide slot could be utilized to install adjustable porosity control. The porosity control panels could be designed for easy removal so that original design intent of extra guide slots is maintained (e.g. facilitate removal of screens for manual cleaning without losing fish).

12.6.5 Screens longer than six feet shall be angled and shall have sweeping velocity greater than the approach velocity. This angle may be dictated by site specific geometry, hydraulic, and sediment conditions. Optimally, sweeping velocity should be at least 0.8 ft/s and less than 3 ft/s.

The primary separator louver racks are angled at 20 degrees to the flow direction and sweeping velocities appear to always be greater than the approach velocities. The sweeping velocities are almost always greater then 0.8 fps. The sweeping velocities do exceed 3 ft/s at high flow rates and reservoir elevations (>10,000 cfs for reservoir elevation 425 ft M.S.L.) and at moderate flow rates at lower elevations (e.g. 7,250 cfs for reservoir elevation 415 ft M.S.L.).

Secondary separator screens are angled at 20 degrees to flow direction and sweeping velocities appear to be always greater than approach velocity. For normal reservoir elevation of 425 ft. M.S.L., sweeping velocities drop below 0.8 fps for a total turbine flow of approx. 8,800 cfs and don't exceed 3 fps at the maximum turbine flow of 14,000 cfs.

12.6.6 Sweeping velocity shall not decrease along the length of the screen.

If applicable to primary separator, this criterion may not be satisfied under all circumstances if the wrong number of attraction pumps are being operated. As the flow through the secondary separator may not be uniform, this criterion may not be fully satisfied by current design. With uniform flow, this criterion would be met at secondary separator.

12.6.7 The plane of an inclined screen shall be oriented at 45° or more relative to the downstream water surface. Horizontally inclined screens are currently under evaluation, and considered as experimental technology (see Section 17).

Not applicable.

12.7 Screen Media

12.7.1 Circular screen face openings shall not exceed 3/32 inch in diameter. Perforated plate openings shall be punched through in the direction of flow

Not applicable.

12.7.2 Slotted screen face openings shall not exceed 1.75 mm (approximately 1/16 inch) in the narrow direction.

Not applicable.

12.7.3 Square screen face openings shall not exceed 3/32 inch on a side.

The secondary separator screen was constructed using "Calwico" Calif. wire cloth (or equal) with 0.25" mesh, 14 gage construction which doesn't satisfy this criteria and may allow escapement of some fry.

12.7.4 The screen media shall be corrosion resistant and sufficiently durable to maintain a smooth uniform surface with long term use.

The wire mesh appears to have not shown any significant signs of corrosion with long term use.

12.7.5 Other components of the screen facility (such as seals) shall not include gaps greater than the maximum screen opening defined above.

This has not been verified, but there is potential for the gaps in the screen facility to be slightly greater than the 3/32 inch maximum gaps required.

12.8 Civil Works and Structural Features

12.8.1 The face of all screen surfaces shall be placed flush (to the extent possible) with any adjacent screen bay, pier noses, and walls to allow fish unimpeded movement parallel to the screen face and ready access to bypass routes.

As long as the secondary separator screens are installed in the most forward guide slots, this criterion is satisfied.

12.8.2 Structural features shall be provided to protect the integrity of the fish screens from large debris, and to protect the facility from damage if overtopped by flood flows. A trash rack, log boom, sediment sluice, and other measures may be required.

A trash rack is currently in use to protect the primary separator from damage due to large debris. The majority of the smaller debris appears to never make it to the secondary separator screens.

12.8.3 The civil works shall be designed in a manner that prevents undesirable hydraulic effects (such as eddies and stagnant flow zones) that may delay or injure fish or provide predator habitat or predator access.

No undesirable hydraulic effects have been observed.

12.9 Bypass System

12.9.1 Bypass layout

12.9.1.1 The screen and bypass shall work in tandem to move out-migrating salmonids (including adults) to the bypass outfall with a minimum of injury or delay. The bypass entrance shall be located so that it can easily be located by out-migrants. Screens greater than or equal to six feet in length shall be constructed with the downstream end of the screen terminating at a bypass entrance. Screens less than or equal to six feet long may be constructed perpendicular to flow with a bypass entrance at either or both ends of the screen, or else could be constructed at an angle to flow, with the downstream end terminating at the bypass entrance. Some screen systems do not require a bypass system. For example, an end of pipe screen located in a river, lake or reservoir does not require a bypass system because fish are not removed from their habitat. A second example is a river bank screen with sufficient hydraulic conditions to move fish past the screen face.

The overall screen length is approximately 20 feet per side, and the downstream end of the single vee shaped screen terminates at the bypass entrance.

12.9.1.2 Multiple bypass entrances may be required if the sweeping velocity will not move fish to the bypass within 60 seconds, assuming fish are transported along the length of the screen face at this velocity.

Table 12.2: Minimum flow rates through Mayfield power tunnel to move fish from the entrance of secondary separator to the bypass in less than 60 seconds

Reservoir Elevation (ft from M.S.L)	*Power Tunnel Flow (Q_{pt})*
425	*4,084*
424	*3,869*
423	*3,654*
422	*3,439*
421	*3,224*
420	*3,009*
419	*2,794*
418	*2,579*
417	*2,364*
416	*2,149*
415	*1,934*

Table 12.2 applies when the original design velocity ratio of 1:1.4 (inlet to outlet velocity) is maintained at the primary separator by pumping the appropriate flow through the secondary separator using the attraction pumps. There are four attraction pumps available to generate this flow, each capable of approximately 50 cfs. See Appendix A - "Mayfield Dam Downstream Migrant Fish Facility Evaluation Program, 1964", page 12, for Mayfield intake structure water quantities and velocities.

If the primary separator is treated as if it were a screen, the total bypass time within it is always less than 60 seconds except for extreme low flows – less than 1,500 cfs total turbine flow. For the majority of conditions, it takes less time to move the fish through the primary separator as compared to the secondary separator.

If this guideline was intended to be the total time through both primary and secondary separation, the 60 second bypass time would be satisfied for turbine flows over approx. 7,500 cfs at normal reservoir elevation. Perhaps, this is the reason that there are two entrances to Mayfield's downstream migrant facility as this appears to meet the intent of this guideline.

12.9.1.3 The bypass entrance and all components of the bypass system shall be of sufficient size and hydraulic capacity to minimize the potential for debris blockage.

No debris blockage has ever occurred in any of the fish bypass pipes.

12.9.1.4 In order to improve bypass collection efficiency for a single bank of vertically-oriented screens, a bypass training wall shall be located at an angle to the screens, with the bypass entrance at the apex and downstream-most point. This will aid fish movement into the bypass by creating hydraulic conditions that conform to observed fish behavior. For single or multiple vee screen configurations, training walls are not required, unless an intermediate bypass is used.

The screen has a single vee configuration and therefore does not need a training wall.

12.9.1.5 In cases where there is insufficient flow available to satisfy hydraulic requirements at the bypass entrance (entrances) for the main screens, a secondary screen may be required. This is a screen located in the main screen bypass which allows the prescribed bypass flow to be used to effectively attract fish into the bypass entrance(s) and then allows for all but a reduced residual bypass flow to be routed back (by pump or gravity) to the diversion canal for the primary use. The residual bypass flow (not passing through the secondary screen) would then convey fish to the bypass outfall location or other destination.

A secondary screen and 4 bypass pumps are used in the secondary separator to dewater the main diversion down to a bypass flow of 13 cfs.

12.9.1.6 Access for inspection and debris removal is required at locations in the bypass system where debris accumulations may occur. If trash racks are used, sufficient hydraulic gradient is required to route juvenile fish from between the trash rack and screens to the bypass.

Debris has not historically been a problem. The secondary separator has two sets of screen guide slots so that a screen panel may be removed for manual cleaning without interrupting separator operation.

12.9.1.7 The screen civil works floor shall be designed to allow fish to be routed back to the river safely when the canal is dewatered. This may entail a sump drain with a small gate and drain pipe, or similar provisions. If this can not be accomplished, an acceptable fish salvage plan shall be developed in consultation with NOAA Fisheries and included in the operation and maintenance plan.

When secondary separator is drained, all fish depart via the 30" diameter bypass pipe as the adjustable bypass weir's minimum elevation is

12.9.1.8 To assure that fish move quickly into the bypass system, the rate increase in velocity between any two points in the screen/bypass system should not decrease and should not exceed 0.2 ft/s per foot of travel.

The acceleration requirement is never a problem in the primary fish separator. But, due to rapid velocity change at the outlet of the secondary separator (approx. 1.2 fps to 6 fps in 2 feet), acceleration requirements are exceeded the majority of the time. Ignoring this fact, the overall rate of change of velocity for the screen's entire length still exceeds criteria for most conditions at approx. 0.25 foot per second per foot.

12.9.2 Bypass Entrance

12.9.2.1. Each bypass entrance shall be provided with independent flow-control capability.

The main bypass entrance is controlled by an adjustable weir gate, giving full bypass flow control. The flows through bypass pipes between primary and secondary separators are controlled by staging of 4 pumps and operation of their discharge valves.

12.9.2.2. The minimum bypass entrance flow velocity should be greater than 110% of the maximum true velocity upstream of the bypass entrance. At no point shall flow decelerate along the screen face or in the bypass channel. Bypass flow amounts should be of sufficient quantity to ensure these hydraulic conditions are achieved over the entire range of operations throughout the smolt out migration period.

The entrance to the transportation tunnel at the end of the primary separator has a velocity that is designed to be 140% of the velocity at the entrance to the primary separator. The secondary separator has a large acceleration where the final velocity is about 300% of the maximum possible entrance velocity into the secondary separator. Although there is deceleration from the exit of the transportation tunnel into the secondary separator entrance, a capture velocity of greater than or equal to 6 fps is maintained the majority of the time in the transportation tunnel. This capture velocity insures that the fish will not back out of the secondary separator and move back into the primary separator.

Because there is no porosity control in the secondary separator, there may be some screen areas that don't satisfy the intent of this guideline.

12.9.2.3 Ambient lighting conditions are required upstream of the bypass entrance and should extend to the bypass flow control device. Where lighting transitions can not be avoided, they should be gradual, or should occur at a point in the bypass system where fish can not escape the bypass and return to the canal
(i.e. when bypass velocity exceeds swimming ability).

Ambient lighting is provided upstream of bypass entrance.

12.9.2.4 For diversions greater than 3 cfs, the bypass entrance shall extend from the floor to the canal water surface, and be a minimum of 18 inches wide. For diversions of 3 cfs or less, the bypass entrance shall be a minimum of 12 inches wide.

The bypass entrance is 8 inches wide rather than the applicable 18 inch width.

12.9.2.5 For weirs used in bypass systems, depth over the weir shall be a minimum of one foot throughout the smolt out-migration period.

A minimum depth of one foot is maintained over weir by manually adjusting weir for any significant changes in reservoir elevation. An approximate depth of 3 feet over weir is required to achieve 13 cfs bypass flow.

12.9.3 Bypass Conduit and System Design

12.9.3.1 Bypass pipes and joints shall have smooth surfaces to provide conditions that minimize turbulence, risk of catching debris and the potential for fish injury. Pipe joints may be subject to inspection and approval by NOAA Fisheries prior to implementation of the bypass. Every effort should be made to minimize the length of the bypass pipe.

12.9.3.2 Fish should not be pumped within the bypass system.

The design did not intend for any fish to travel through pumps.

12.9.3.3 Fish shall not be allowed to free-fall within a pipe or other enclosed conduit in a bypass system. Down wells shall be designed with a free water surface, and designed for safe and timely fish passage by proper consideration of turbulence, geometry and alignment.

Fish are allowed to free fall into 30" diameter bypass pipe. Down well design doesn't appear to satisfy the intent of this criterion.

12.9.3.4 In general, bypass flows in any type of conveyance structure should be open channel. If required by site conditions, pressures in the bypass pipe shall be equal to or above atmospheric pressures. Pressurized to non-pressurized (or vice-versa) transitions should be avoided within the pipe. Bypass pipes shall be designed to allow trapped air to escape.

Bypass pipe is not open channel and may have some issues related to transitions and/or venting.

12.9.3.5 Bends should be avoided in the layout of bypass pipes due to the potential for debris clogging and turbulence. The ratio of bypass pipe center-line radius of curvature to pipe diameter (R/D) shall be greater than or equal to 5. Greater R/D may be required for super-critical velocities (see section 12.9.3.9).

The 30" diameter bypass pipe has several 90 degree bends.

12.9.3.6 Bypass pipes or open channels shall be designed to minimize debris clogging and sediment deposition and to facilitate inspection and cleaning as necessary. For bypass pipes longer than 150 feet, access ports should be provided at spacing of less than 100 feet to allow for detection and removal of debris.

Access ports to 30" diameter pipe were not provided at every 100 feet and no inspection or cleaning has been documented.

12.9.3.7 The bypass pipe diameter or open channel bypass geometry should generally be a function of the bypass flow and slope but shall also comply with velocity and depth criteria in 12.9.3.9 and 12.9.3.10. Generally, a bypass pipe less than 18 inches in diameter is not acceptable. However, if other hydraulic criteria cannot be reasonably satisfied with that size of pipe, the diameter can be reduced with special consideration given to management of debris. In no case can a pipe diameter of less than 10 inches be used. For bypass flows greater than 20 cfs, a 30 inch diameter bypass pipe is recommended. Bypass flows greater than 50 cfs are special cases that need specific consultation with NOAA Fisheries engineers.

The 30 diameter bypass pipe satisfies this guideline for a total design flow of 13 cfs.

12.9.3.8 Design bypass flow should be at least 5% of the total diverted flow amount, unless otherwise approved by NOAA Fisheries.

The design bypass flow of 13 cfs is 6% of the maximum diverted flow.

12.9.3.9 The design bypass pipe velocity should be between 6 and 12 ft/s for the entire operational range. If higher velocities are approved, special attention to pipe and joint smoothness is required. In no instance shall pipe velocity be less than 2 ft/s.

Some areas in the bypass conduit have velocities that exceed 12 fps (e.g. flume section at outlet). The design bypass velocity between secondary separator and sorting facility is 2.6 fps (13 cfs/4.91 sq. ft.). There may be areas in pipe between sorting facility and flume that have velocities less than 2 fps.

12.9.3.10 The design minimum depth of free surface flow in a bypass pipe should be at least 40% of the bypass pipe diameter, unless otherwise approved by NOAA Fisheries.

At 13 cfs design flow, this guideline appears to be satisfied.

12.9.3.11 Closure valves of any type should not be used within the bypass pipe unless specifically approved based on demonstrated fish safety.

No closure valves appear to be present in bypass pipe.

12.9.3.12 Sampling facilities installed in the bypass conduit shall not in any way impair operation of the facility during non-sampling operations.

This criterion appears to be satisfied.

12.9.3.13 There should not be a hydraulic jump within the pipe, unless a

weak jump is specifically approved by NOAA Fisheries engineers.

There may be hydraulic jumps present in bypass pipe.

12.9.3.14 Spillways upstream of the screen facility also act as a bypass system. These facilities should also be designed to provide a safe passage route back to the stream, adhering to the bypass design principles described in sections 12.9 and
12.10.

Not applicable.

12.10 Bypass Outfall

12.10.1 Bypass outfalls should be located where ambient river velocities are greater than
4.0 ft/s.

Bypass outfall is located at turbine outlets to satisfy this guideline.

12.10.2 Bypass outfalls shall be located to minimize predation by selecting an outfall location free of eddies, reverse flow, or known predator habitat. Predator control systems may be required in areas with high avian predation potential. Bypass outfalls should be located to provide good egress conditions for downstream migrants.

Improvements to bypass outfall are being investigated. No significant predation has been observed in the 35+ years of operation.

12.10.3 Bypass outfalls shall be located where the receiving water is of sufficient depth (depending on the impact velocity and quantity of bypass flow) to ensure that fish injuries are avoided at all river and bypass flows. The bypass flow shall not impact the river bottom or other physical features at any stage of river flow.

The impact velocity appears to be greater than 25 fps due to the approximate drop of 15 feet to normal tail water elevation. The 13 cfs bypass flow does not impact river bottom as there appears to be sufficient river depth at outlet of turbines. However, this criterion may be better satisfied by ending bypass outfall closer to normal water surface to minimize drop / velocity.

12.10.4 Maximum bypass outfall impact velocity (i.e. the velocity of bypass flow entering the river) including vertical and horizontal velocity components shall be less than 25.0 ft/s.

This requirement appears to be exceeded for some tail water conditions.

12.10.5 The bypass outfall discharge into the receiving water shall be designed to avoid attraction of adult fish thereby reducing the potential for jumping injuries and false

attraction. The bypass outfall design shall allow for the potential attraction of adult fish, by provision of a safe landing zone if attraction to the outfall flow can potentially occur.

This requirement appears to be satisfied by Barrier Dam which blocks adults from entering this portion of the river.

12.11 Debris Management

12.11.1 A reliable, ongoing inspection, preventative maintenance and repair program is necessary to assure facilities are kept free of debris and that screen media, seals, drive units, and other components are functioning correctly during the out migration period. A written plan should be completed and submitted for approval with the screen design.

A maintenance plan is being submitted as part of overall fish passage plan due in 2006.

12.11.2 Active screens shall be automatically cleaned as frequently as necessary to prevent accumulation of debris. The cleaning system and protocol shall be effective, reliable, and satisfactory to NOAA Fisheries.

The screens in secondary separator are not automatically cleaned.

12.11.3 A passive screen can only be used when all of the following criteria are met:

12.11.3.1 The site is not suitable for an active screen.
An active screen could be installed.
12.11.3.2 Uniform flow characteristics can be demonstrated.
Uniform flow characteristics may not be present without porosity control measures.
12.11.3.3 The debris load is expected to be low.
Debris loading is low.
12.11.3.4 The rate of diversion is less than 3 CFS.
The rate of diversion is significantly greater than this.
12.11.3.5 Sufficient ambient river velocity exists to carry debris away from the screen face.
Not applicable.
12.11.3.6 A maintenance program is approved by NOAA Fisheries and implemented by the water user.
Not applicable.
12.11.3.7 The screen is inspected at least daily and debris accumulations are removed, with more frequent inspections as site conditions dictate.
Screen is not inspected daily but infrequent debris is removed when observed.
12.11.3.8 Sufficient stream depth exists at the screen site to provide for distance of at least 1 screen radius around the screen.
Not applicable.
12.11.3.9 The screen can be easily removed for maintenance, and to protect from flooding.

Yes. There are two sets of guide slots to facilitate manual cleaning without interrupting operation.

12.11.4 Intakes shall include a trash rack in the screen facility design which shall be kept free of debris. In certain cases, a satisfactory profile bar screen design can substitute for a trash rack. Based on biological requirements at the screen site, trash rack spacing may be specified that reduces the probability of entraining adult fish.
12.11.5 The head differential to trigger screen cleaning for intermittent type cleaning systems shall be a maximum of 0.1 feet or as agreed to by NOAA Fisheries. A variable timing interval trigger shall also be used for intermittent type cleaning systems as the primary trigger for a cleaning cycle.

12.11.6 The completed screen and bypass facility shall be made available for inspection by NOAA Fisheries, to verify that the screen is being operated consistent with the design criteria.

12.11.7 At some sites, screen and bypass facilities may be evaluated for biological effectiveness and to verify that hydraulic design objectives are achieved. At the discretion of NOAA Fisheries, this could entail a complete biological evaluation especially if waivers to screen and bypass criteria are granted, or merely a visual inspection of the operation if screen and bypass criteria is met in total.

12.11.8 Provision shall be made to limit the build-up of sediment, where it could impact screen operations.

12.12 Additional criteria for end of pipe screens (including pump intake screens)

12.12.1 End of Pipe Screen Location: When possible, end of pipe screens shall be placed in locations with sufficient ambient velocity to sweep away debris removed from the screen face.

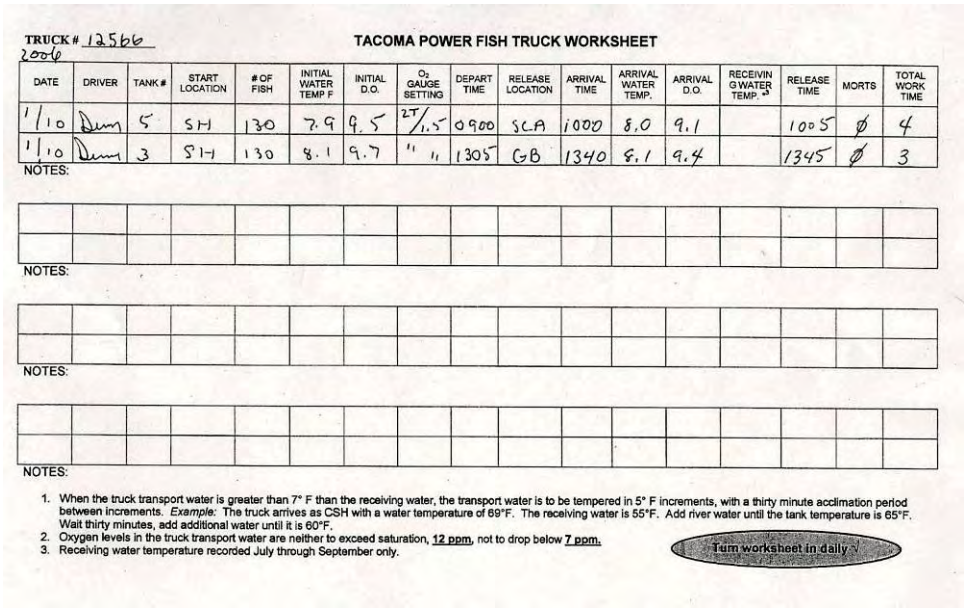
12.12.2 End of pipe screens shall be submerged to a depth of at least one screen radius below the minimum water surface, with a minimum of one screen radius clearance between screen surfaces and natural or constructed features. For approach velocity calculations, the entire submerged effective area can be used.

12.12.3 A clear escape route should exist for fish that approach the intake volitionally or otherwise. For example, if a pump intake is located off of the river (such as in an intake lagoon), a conventional open channel screen should be placed in the intake channel or at the edge of the river to prevent fish from entering a lagoon.

APPENDIX No. 5

Tacoma Power Fish Truck Worksheets

Example form – completed



TRUCK # 12566 2006

TACOMA POWER FISH TRUCK WORKSHEET

DATE	DRIVER	TANK #	START LOCATION	# OF FISH	INITIAL WATER TEMP F	INITIAL D.O.	O_2 GAUGE SETTING	DEPART TIME	RELEASE LOCATION	ARRIVAL TIME	ARRIVAL WATER TEMP.	ARRIVAL D.O.	RECEIVING WATER TEMP. *	RELEASE TIME	MORTS	TOTAL WORK TIME
1/10	Dan	5	SH	130	7.9	9.5	2T/1.5	0900	SCA	1000	8.0	9.1		1005	Ø	4
1/10	Dan	3	SH	130	8.1	9.7	" "	1305	GB	1340	8.1	9.4		1345	Ø	3

NOTES:

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1. When the truck transport water is greater than 7° F than the receiving water, the transport water is to be tempered in 5° F increments, with a thirty minute acclimation period between increments. *Example:* The truck arrives as CSH with a water temperature of 69°F. The receiving water is 55°F. Add river water until the tank temperature is 65°F. Wait thirty minutes, add additional water until it is 60°F.
2. Oxygen levels in the truck transport water are neither to exceed saturation, **12 ppm**, not to drop below **7 ppm.**
3. Receiving water temperature recorded July through September only.

Turn worksheet in daily

APPENDIX 6

Respone to Comments on Article 413 Trap & Haul Plan
and
Article 415 Final Fish Passage Plan

F/NWR5

January 9, 2006

Debbie C. Young, Natural Resources Manager
Tacoma Power
3628 South 35th Street
Tacoma, WA 98409-3192

RE: Comments on the Anadromous Fish Passage Plan (License Article 415) and the Anadromous Fish Trap and Haul Plan (License Article 413)

Dear Ms. Young:

We appreciate Tacoma's collaboration and discussions over the last few months regarding the Anadromous Fish Passage Plan (License Article 415) and the Anadromous Fish Trap and Haul Plan (License Article 413). Since the meeting in mid-September, we have made great strides and improvements on issues within the documents. Although we have made lots of progress, we still have a ways to go to complete these. There are substantive as well as structural issues with both documents.

Reflecting over what, we as a group (Tacoma, National Marine Fisheries Service (NMFS), and the Fisheries Technical Committee (FTC)) have done over the past six months since the extension request for the due date to Federal Energy Regulatory Commission (FERC), there were things that we did really well and things that could have been done that would have been helpful. We've had very good discussions, made progress and agreements on many specific issues in the fish passage realm related to Tacoma's Cowlitz River Project. Examples of this include the realization that the south bank entrance at the Barrier Dam never functioned, detailed review of the physical structures to the NMFS' criteria, and agreement to expand the holding pool on the fish ladder at the Cowlitz Salmon Hatchery. Things that would have been helpful: 1) if we had began meeting sooner or had more meetings (acknowledging that our, NMFS', schedule was restrictive at times); 2) if we had systematically stepped through the original comments; and 3) if NMFS and the FTC had been able to review the revised drafts of the plans in their entirety sooner than beginning on December 6.

It is important for us to stress that developing the plans has been valuable and in our opinion resulted in positive outcomes related to fish passage including agreements to document procedures for emergencies, and planned modifications to the facilities to improve conditions. Even though this comment letter contains numerous items, it is not meant to detract from or undermine the progress we have made. We appreciate Tacoma's willingness to work with us on this.

General comments

There is not an alignment between Tacoma's idea of an adaptive management approach and ours. In our June 23, 2005, letter providing comments on Tacoma's draft plans for License

Articles 409, 413, and 415, we reminded you that the Adaptive Management Plan must be carried out according to the description in the Analysis of Effects of the Proposed Action (Section 6) of the March 23, 2004, Biological Opinion on the Cowlitz River Project. In your August 19, 2005, response you indicated that rather than an overarching adaptive management plan for the reestablishment of salmonid populations as a separate plan you would include specific adaptive management provisions in all of the relevant plans that are prepared for the reestablishment of salmonid populations. Including specific adaptive management provisions in all of the relevant plans, does not meet the intent of Biological Opinion – items important to fish will be missed by this type of an approach. Also, except for the annual revision of the Fish Passage Plan which includes the Trap and Haul Plan, there are no specific adaptive management provisions identified.

Along the same lines as the comment as in our June 23, 2005, letter, the plans still need more documentation and reporting of fish transport and passage. For NMFS and other resource management agencies to monitor and evaluate the success of the fish passage and transportation operations, documentation of the operations must be made available in a timely manner. We want to look at the history of what went wrong and what worked and learn from it. The adaptive management measures required in both the FERC License and Biological Opinion require the availability of timely, complete and accurate data for the adaptive management paradigm to work. Annual reports should include data down to the level of individual fish truck hauls with summaries and detailed descriptions of mortalities and deviations from established operating standards. This should include performance of each portion of fish passage including, but not limited to, survival rates, water quality conditions, report of the number by species of adults transported as well as release locations, success of such, and number by species of juveniles transported and passed. Problems related to fish passage including those related to the trucking operations should also be reported along with corrective actions taken. Future evaluations will be necessary to assess performance.

The Anadromous Fish Trap and Haul Plan (License Article 413) should really be a subset of the Anadromous Fish Passage Plan (License Article 415) since the latter deals with fish passage through the entire project. Alternately, the Anadromous Fish Passage Plan could reference the Anadromous Fish Trap and Haul Plan for more information on the trap and haul aspects of Cowlitz Hydro. In subsequent years during the annual review of the Anadromous Fish Passage Plan, we expect it to include the Anadromous Fish Trap and Haul Plan. The purpose or objective of the Anadromous Fish Passage Plan is to clearly document all aspects of fish passage associated with Tacoma including the trap and haul aspects to allow for assessment, improvements where necessary, and to layout operations under various circumstances.

Tacoma's use of color photos coupled with the description in both plans is very helpful.

We appreciate Tacoma's agreement to enlarge the holding pool on the ladder at the Cowlitz Salmon Hatchery. Since the agreement occurred after the written plans were submitted for comment, please add this detail to the final plans. The designs and specific details of the increased holding pool (e.g., such things as the crowder design) should be developed collaboratively between Tacoma and NMFS in consultation with the FTC and with NMFS approval at the conclusion.

The description sections in both the Anadromous Fish Passage Plan and the Anadromous Trap and Haul plan lack detail regarding the facilities. The specific information on the physical and hydraulic aspects found in the Operations sections of the plans should be moved to the

Description section. The Operations section should describe how the facilities are operated under the full range of conditions during different times of the year and what triggers these changes to operation.

License Article 415 – Anadromous Fish Passage Plan

Tacoma needs to add a section on kelt out migration through the Mayfield and Cowlitz Falls juvenile collection systems. How are adults handled at the evaluators? Are they enumerated?

Regarding the Cowlitz Trout Hatchery: Per our discussions at the Dec 6, 2005, FTC meeting, it appears that this facility does not trap very many wild steelhead and salmon due to timing and the flows in Blue Creek. Tacoma should provide more data for how many wild steelhead and salmon are trapped. There may be handling protocol changes necessary depending on the number of fish.

Page 1, 1st paragraph, 1st sentence: add "the March 23, 2004," to identify the biological opinion.

Page 2, section 3. Plan Background: While day-to-day operations may be done by Washington Department of Fish and Wildlife, Tacoma is ultimately responsible for the outcome. Also, this plan is meant to be comprehensive and those actions conducted for Tacoma must be included in the plan.

Page 3, License Article 1, Downstream Fish Passage and Collection Plan for Riffe Lake and Cowlitz Falls, (B): The approval from NMFS on this and any other item requiring NMFS' approval must be on the final plan and not a draft that is simultaneously receiving first time Fisheries Technical Committee review. The current request received via December 20, 2005, e-mail from Mark LaRiviere to Michelle Day is asking for approval of something that has not received the benefit of competed FTC review. This type of approach makes redundancies and does not allow for full benefit of the agreed upon process. There may be rare exceptions to this.

Page 4, section 4. Plan Objectives: The objective of the Anadromous Fish Passage Plan is to clearly document all aspects of fish passage associated with Tacoma to allow not only for descriptions but for assessments, improvements where necessary, and to layout operations under various circumstances. The listed items 1 through 4 are ways to do that but there may be additional items as indicated by "…shall include, but not be limited to…" language in Article 415 of the license.

Page 5, Description section: The description section of the document does not provide much detail of the facilities. A complete description should be provided. Most of the information in the Operations section is more appropriate for the Description section (see next comment). This appears to be consistent throughout the document.

Page 13, Operation Section: The operation section provides more of a physical description of the facilities rather than a description of how they are operated. What constitutes normal operation and what triggers any deviation from the norm?

Page 14, frequency of operation of the Mayfield downstream facility: Given that the goal is to re-establish runs in this basin above the project, operations should be such to minimize impacts to the fish including minimizing delay. While what is proposed is an improvement from existing, it should be more. We would prefer for a maximum holding time of 24 hours which means the facility would be operated daily, but we recognize that it is reasonable to have less frequent

operations during low juvenile migration numbers. We appreciate the information you provided on the operation of the downstream migrant facility, however, we are still concerned with proposed trigger levels for increased operation of the facility. We would like to discuss this further.

Page 16, Capture and enumeration, 1st paragraph: When will Tacoma install a remote monitoring and alarm system and what are the details of the system?

Page 17, Schedule for Inspection of Facilities: A drive-by inspection of the facilities at Mayfield Dam is not sufficient. The facility should be physically inspected every day.

Page 17, Reporting Procedures of Inspection Results: This section should make reference to the information in Appendix No. 1 Emergency Protocol.

Page 17, Reporting Procedures of Inspection Results: The emergency notification does not include NOAA Enforcement as on page 23 and there is a "1" missing from the last part of Keith Kirkendall's phone number; the phone number is 503-230-5431.

Page 18, Cowlitz Salmon Hatchery facilities: Where appropriate, applicable comments in this letter from the Anadromous Fish Trap and Haul Plan section should be applied to the appropriate areas in the Anadromous Fish Passage Plan and vice versa.

Page 18, Description section: Additional information should be included here such as the physical dimension of the barrier dam, the fishway entrances, the ladder, the holding pool, etc. Also include such items as flow through the ladder, auxiliary water supply systems and entrances, forebay and tailwater rating curves (with regards to the barrier dam), auxiliary water supply rating curve, discussion of the functionality of the south entrance and of the north entrance, etc.

Page 18, 2a.) Cowlitz Salmon Hatchery facilities, Attraction Area: Some fish can get over the Barrier Dam and now that the tailrace is higher than when the dam was constructed, its efficiency may be reduced. Therefore, "full exclusion" should be changed or removed. Also, this section mentions the south bank entrance. This should be revised to acknowledge that the south bank entrance was never functional.

Page 19, Operation Section: Most of the information presented here is more appropriate for the description section. The Operation section should describe how the system is operated as well as what would trigger any changes in operation. For example, how often and when is the trap operated? What are the loading densities for the holding pool, for the holding tanks, for the truck transport, etc. Are flows down the ladder or through the auxiliary water supply system ever changed? How are fish sorted, anesthetized and recovered? How long are fish held before transport, etc.?

A section should be added to the Operation describing how the facility is taken out of service in preparation for annual maintenance or unanticipated shutdown. This should include a description of how the system is operated in preparation for shutdown; how the holding pool, ladder and entrance areas are dewatered; how fish are evacuated from the system, etc.

Page 19, Attraction and collection, 1st paragraph, 2nd sentence: Rather than "To ensure that no adult fish make it past the dam…" it should be "To increase the effectiveness of the dam," or

something similar. We are not convinced that the dam constitutes a total barrier 100 percent of the time.

Page 20, Separator, 3rd paragraph: There should be a couple of sentences in the plan about the proper procedures for handling fish e.g., fish should be held by the caudal peduncle but the body should also be supported on their underside near their pectoral fins. Also, in our June 23, 2005, comments on the draft 413 and 415 plans, we conveyed that all fish should be anesthetized before handling.

Page 20, Separator, 5th paragraph: For clarity, the last sentence should be changed to "public access is restricted in the separator area to protect the fish, only hatchery and other appropriate personnel have access."

Page 20, Separator Section, last paragraph: In concept, we agree with the approached proposed by Tacoma for operation of the Cowlitz Salmon Hatchery (CSH). The trap facility should be operated a minimum of 5 days per week (except for scheduled maintenance shutdowns of up to one week per year). However, we recommend that that Tacoma commence operating 7 days a week when any of these conditions are met: (1) When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days, the operation frequency should include weekend days, (2) the weekend fish accumulation (from close of operation Friday to beginning Monday morning) exceeds the normal carrying capacity of the holding pool (5600 pounds of fish or approximately 700 coho [averaging 8 pounds each] or 350 Chinook [averaging 16 pounds each])(with the proposed holding pool expansion this is expected to occur much less frequently), or (3) when fish destined for transport upstream are entering the trap ripe and ready to spawn ((to be defined by the FTC and subject to NMFS approval). Also, all fish destined for transport upstream should be moved on the same day they are processed.

Page 21, Separator, last paragraph: Fish destined for transport upstream should not be held in the holding tanks for as long as 72 hours. Fish in the holding pool should be processed and transported in the same working day.
Page 21, Truck Transport: It appears in the last sentence that the maximum capacity is up to 130 adult coho salmon and up to 75 adult Chinook salmon in combination. A maximum total of 205 fish will likely over load the capacity of the tank trucks. This sentence should probably read "the maximum capacity is up to 130 adult coho salmon or up to 75 adult Chinook Salmon" based upon 1 pound of fish per 1 gallon of water (based upon Tacoma's guidelines for fish hauling trucks as outlined in Appendix No. 1 in Anadromous Fish Trap and Haul Plan). NMFS criteria requires a minimum of 0.15 cubic feet of water per pound of fish which translates into approximately 1300 pounds of fish for a 1500 gallon tank.

Page 22, Attraction and collection, 1st paragraph: "as-needed basis" This comment applies throughout both the Anadromous Fish Passage Plan and the Anadromous Fish Trap and Haul Plans. As we conveyed in our June 23, 2005, letter, the plans need more specificity regarding triggers and actions, such as details on what triggers maintenance on an "as-needed" basis, and what is covered in inspections.

Page 22, Emergency Procedures: Are there any procedures for the annual reporting of emergency events? These should be reported (written report) to the FTC on an annual basis.
Page 31, Cowlitz Falls: Future decisions of what to do for downstream fish passage at Mossyrock or Riffe Lake or both regarding downstream fish passage hinge on the performance

of the collection facility at Cowlitz Falls; therefore, it is incumbent on Tacoma to ensure collection and survival is maximized. Tacoma has taken steps to improve fish collection at Cowlitz Falls including the installation of a new fish guidance screen. This Anadromous Fish Passage Plan is meant to be comprehensive and should incorporate fish passage aspects at Cowlitz Falls. Please provide a comprehensive assessment and analysis of these and all other effects at Cowlitz Falls. Even though Cowlitz Falls is not a Tacoma Facility, this is where the Settlement Agreement and the FERC License incorporating it is having Tacoma focus on collecting fish.

Page 34, Transfer facilities: Different acronyms for the Cowlitz Falls Fish Collection Facility are used: CFFCF and CFFF. Please standardize across both plans.

Page 35, Anticipated Special Operation of Facilities for Research: What about the evaluations of the new screens Tacoma is placing at Cowlitz Falls?

Page 38, Appendices: None of the appendices attached to this License article are referenced in the body of the report. All the appendices should be incorporated into the appropriate location in the body of the document except perhaps the review of our guidelines and criteria.

Page 44, Appendix 4, Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities: This needs an explanation that Tacoma took the applicable sections from the NMFS document and in italics added a comparison of the criteria with the project. Tacoma's response to the NMFS criteria and guidelines should be highlighted better to help it stand out for a reader. We suggest underlining as well as italics.

<u>License Article 413 – Anadromous Fish Trap and Haul Plan</u>

A section should be added to the Operation section describing how the facility is taken out of service in preparation for annual maintenance or unanticipated shutdown. This should include a description of how the system is operated in preparation for shutdown; how the holding pool, ladder and entrance areas are dewatered; how fish are evacuated from the system, etc.

We need additional information and discussion with Tacoma regarding the release of adults from the transport trucks as illustrated in the picture at the bottom of page 15 and 21.

Page 1, 1st paragraph: Please reword the sentence that describes the extension request to remove the word "behest" from "at the behest of the Cowlitz Fisheries Technical Committee". This implies that Tacoma was only asking for the extension because others urgently prompted instead of a group decision.

Page 2, 3. Background, 2nd paragraph: Used CFFCF in this plan, but used CFFF in all but one place in the Fish Passage Plan. Please standardize across plans (see comment under License Article 415, pg 34). Also, a literature cited section is needed in the document.

Page 3, Objectives: The descriptions of the facilities and operation should be accompanied by ways to minimize or eliminate harm to fish. Also, all the trap and haul operations should be covered not just those operated by Tacoma. The plan is meant to be comprehensive and those actions conducted for Tacoma must be included in the plan.

Page 3, Objectives, note: it should say License Article 415 rather than 15. Also, that plan does not cover the new Cowlitz Falls screen except by reference to the reports that are due. In the future annual updates, this should be included.

Page 5, Plan: This plan is part of the Fish Passage Plan not adjunct to it.

Page 9, Crowder: It would help if the sentence read "Crowder in the holding pool, which is lowered into the water and by moving it forward and lifting it, it reduces the available area . . ."

Page 23, Truck Description, 3rd paragraph: The paragraph indicates that the fish from the Cowlitz Trout Hatchery (CTH) are released from the trucks using a 10 ft long 4 ft diameter and 10 inch deep flume. The picture on page 21 does not show this. The use of the flume should be standard operation when releasing adults.

Page 23, Trap and Haul Facilities Operation section: The majority of the information provided in this section should be moved to "description" section of the plan. This section provides useful and valuable information on the physical configuration of the fish passage facilities but provides little information on how the facilities are operated. Operational information should include such things as when the facility is operated, how often and under what conditions the trap is operated, conditions that necessitate the closure of ladder system, when is the fish passage system is taken out of service for maintenance and or inspection, etc. For example, with regards to the barrier dam, what dates specifically (or historically) has the electric barrier been turned off to prevent any incidental harm to the juvenile salmon releases from the CSH? Under what conditions is the voltage to the electric barrier changed (higher flows over the barrier dam versus lower flow conditions). Are there times and conditions that necessitate shutting down the auxiliary water supply system? Are there times and conditions where it is necessary to reduce the flow down the ladder and, if so, for what reason? These are just a few examples of operational information. Please be comprehensive.

Page 24, Barrier Dam, 2nd paragraph: Rather than "To ensure that no adult fish make it past the dam…" It should be "To increase the effectiveness of the dam," or something similar. We are not convinced that the dam constitutes a total barrier 100% of the time.

Page 24, Ladder section, 1st paragraph: Please correct the width dimension of the primary entrance. It should be 5 ft 9 inches not 5.75 inches.

Page 25, Holding Pool: A description of the existing holding pool (including such items as volume, flow and holding capacity, etc.) should be included.

Page 25, Separator section, 1st paragraph: All fish that are handled should be anesthetized and all anesthetized fish should be placed in recovery tanks where their recovery can be monitored and the fish retrieved and resuscitated if necessary. As we stated in our earlier June 23, 2005, letter, "According to NMFS guidelines (section 7.3.3) fish should be anesthetized before handling. What proof is there that the Chinook and cutthroat trout undergo less stress and damage without anesthetic and what guarantee is there that an experience operator is performing the work?"

Page 26, Separator section, 4th paragraph: In concept, we agree with the approached proposed by Tacoma for operation of the Cowlitz Salmon Hatchery (CSH). The trap facility should be operated a minimum of 5 days per week (except for scheduled maintenance shutdowns of up to

one week per year). However, we recommend that that Tacoma commence operating 7 days a week when any of these conditions are met: (1) When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days, the operation frequency should include weekend days, (2) the weekend fish accumulation (from close of operation Friday to beginning Monday morning) exceeds the normal carrying capacity of the holding pool (5600 pounds of fish or approximately 700 coho [averaging 8 pounds each] or 350 Chinook [averaging 16 pounds each])(with the proposed holding pool expansion this is expected to occur much less frequently), or (3) when fish destined for transport upstream are entering the trap ripe and ready to spawn ((to be defined by the FTC and subject to NMFS approval). Also, all fish destined for transport upstream should be moved on the same day they are processed.

Pages 26, 27, and 29: the Appendices are not numbered correctly, but please refer to comment on Appendices below.

Page 27, Release section, Downstream releases: Please list and describe the modifications to the stress relief pond outlet structure. Also, when will Tacoma make minor modifications to the stress relief pond outlet structures to encourage volitional release?

Page 27, Notification: There is a "1" missing from the last part of Keith Kirkendall's phone number; the phone number is 503-230-5431.

Page 29, Release section, 2nd paragraph: Why isn't the fish discharge trough (as described on page 23) used when releasing fish? Also, the last sentence of this paragraph seems to indicate that a total of 325 fish (130 adult coho, 120 adult steelhead, and up to 75 adult Chinook) can be hauled per load. Please correct. According to NMFS criteria, a 1,500 gallon tanker truck could only hold approximately 1300 pounds of fish or about 160 adult coho (averaging 8 pounds each) in a single load.

Page 33, Appendices: All the appendices should be incorporated into the body of the document except perhaps the review of our guidelines and criteria.

Page 33, Appendix No.1, Smolt release section: Juvenile fish should not be brushed out of the tank even with soft bristle brooms without water. They should be flushed out using water. A source of flush water should be available for the trucks at the release points (for example, using a small portable pump). Any remaining fish should then be gently crowded out during the flushing process with a soft bristle broom with water. The broom should not touch fish but rather guide the water.

Page 33, Procedures for Tacoma Power Fish Hauling Trucks, temperature:
The water temperatures at the fish trapping and holding site, transport truck, and release site should be measured and recorded during all fish transport operations. Water temperature at the release site should be checked before fish are released. If the water temperature of the release site (measured at 1 foot below the water surface) exceeds 18 degrees Celsius, fish should be released at an alternate site. This rule applies primarily to the Lake Scanewa release sites. If water temperatures at the Cowlitz and Cispus River release sites is found to exceed 18 degrees (an unlikely event based upon historical records) and no release sites with cooler water temperatures are available, the fish should be returned to the trapping/holding site and transported at a later time (night time temperatures are typically cooler), when the water temperature has dropped below 18 degrees Celsius. If there is a regular pattern of excessively

high temperatures observed at a release site, alternative release sites should be identified, and developed as soon as possible.

In addition to the 18 degree maximum temperature standard, we want operations to result in no more than a 3 degree Celsius change (warmer or colder) from the water the fish originated from including truck water to release. A change from 15 degree Celsius to 12 degree Celsius back to 15 degree Celsius is acceptable. These limits apply to both upstream and downstream transport of all fish (juvenile and adult). We would like further discussions with Tacoma and the FTC about tempering water.

If maximum temperatures or temperature differential limits require returning the fish to the holding water or require warming or cooling of the holding water (tempering) more than three times within a calendar month, "immediate" action (as defined by the FTC and subject to approval by NMFS) should be taken to resolve the problem. Both tempering procedures and returning fish to the capture site (thus exposing them to additional handling) represent measures which significantly increase the amount of stress upon the transported fish. The actions should take the form of modifying transport schedules so transport and release occurs at a time of day when water temperatures are cooler, or there is less differential between originating and receiving bodies of water, or using alternate release sites where the water is cooler or there is less differential between originating and receiving bodies of water. Water temperature data for each fish transport trip (originating water temperature, transport water temperature, receiving water temperature) should be recorded in a logbook with the date, time of fish loading, time of fish release, and dissolved oxygen level in the fish hauling truck at time of fish loading and release. This data should be made available to NMFS upon request and a summary of this data should be presented in annual reports.

We recognize that these measures may seem tedious or difficult to meet, but it is important that the physiology needs of the fish take priority over ease of operation. Creative ways of addressing temperature changes experience by the fish due to hauling should be used such as changing release locations or times.

Page 37, Appendix No. 2, Emergency Protocol: There does not appear to be a reference to this particular appendix in the body of the license article.

Page 47, Appendix No. 6, Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities: This needs an explanation that Tacoma took the applicable sections from the NMFS document and in italics added a comparison of the criteria with the project. Tacoma's response to the NMFS criteria and guidelines should be highlighted better to help the reader. We suggest underlining as well as italics.

Page 48-49, Appendix No. 6, Response to Forward: Since this is a preliminary review and additional information and further analysis may be forthcoming, we look forward to continuing to work with Tacoma to identify potential solutions to any identified deficiencies.

Page 49, last paragraph under Foreword, 1st sentence: We believe that the sentence "*All of the Cowlitz River Project passage facilities have been successful at meeting their original design intent."* should be deleted or modified since it was concluded that the south bank ladder entrance likely never functioned as designed and the function of the north bank entrance has

been compromised by the raise in tailwater level (although this will be corrected in the near future).

Page 63, Appendix No. 6, Section 6.4.1: Given the increase in the normal tailwater level downstream of the barrier dam, updated forebay and tailwater rating curves should be provided for the barrier dam.

Thank you for our good discussions, progress, and agreements on many specific issues regarding fish passage. We look forward to working with you in the finalization of these plans. If you have any questions, please contact Michelle Day of my staff at 503-736-4734.

Sincerely,

Keith Kirkendall, Chief
FERC & Water Diversions Branch
Hydropower Division

cc: Craig Burley, WDFW
Brad Caldwell, WDOE
Mark LaRiviere, Tacoma
George Lee, Yakama Nation
Tammy Mackey, Washington Council, Trout Unlimited
Brian Peck, USFWS

TACOMA'S RESPONSES TO COMMENTS RECEIVED ON

DRAFT Anadromous Fish Passage Plan (License Article 415) and the Anadromous Fish Trap and Haul Plan (License Article 413), December 5, 2005

Comments from NMFS, January 9, 2006:

Comment 1:

There is not an alignment between Tacoma's idea of an adaptive management approach and ours. In our June 23, 2005, letter providing comments on Tacoma's draft plans for License Articles 409, 413, and 415, we reminded you that the Adaptive Management Plan must be carried out according to the description in the Analysis of Effects of the Proposed Action (Section 6) of the March 23, 2004, Biological Opinion on the Cowlitz River Project. In your August 19, 2005, response you indicated that rather than an overarching adaptive management plan for the reestablishment of salmonid populations as a separate plan you would include specific adaptive management provisions in all of the relevant plans that are prepared for the reestablishment of salmonid populations. Including specific adaptive management provisions in all of the relevant plans, does not meet the intent of Biological Opinion – items important to fish will be missed by this type of an approach. Also, except for the annual revision of the Fish Passage Plan which includes the Trap and Haul Plan, there are no specific adaptive management provisions identified.

Response to Comment 1

The adaptive management provisions applicable to the fisheries mitigation license articles of the Cowlitz Project FERC license, including the License Article 415 Anadromous Fish Passage Plan and the License Article 413 Anadromous Fish Trap and Haul Plan, are included in the License Article 6 Fisheries and Hatchery Management Plan (FHMP), Adaptive Management Plan (chapter 6.0). Excerpts from that chapter follow:

> The overall objective of the adaptive management plan (AMP) in the FHMP is to implement initial strategies and actions with a methodology that allows for scientific evaluation of results, and to provide for development of modified strategies should initial ones fail to achieve desired results. The AMP requires the formation of both a technical and a policy team to address scientific and policy issues, respectively.
>
> The FTC will constitute the policy team for the FHMP. A description of their role in the process is discussed under Section 6.2.2 of the FHMP, Institutional Support. Implementation of a successful adaptive management plan requires both analytical tools for developing and evaluating strategies and institutional support for decision-making.

Tacoma continues to believe that the approach of integrating adaptive management into individual plans is the most practical way to implement an adaptive management approach that is both aligned with NMFS desire for an overarching approach, and fulfills the FHMP objective of an adaptive approach for implementing provisions of that plan. NMFS' continued cooperation in applying adaptive management through involvement in, and support of, the AMP process included in the FHMP will be critical to the success of the plan.

As an initial approach to an adaptive process for the License Articles 413 and 415 plans, Tacoma recommends retaining the operational procedures for adult transportation, the upper Cowlitz River basin distributions and the physical release of the fish from the Tacoma fish transport trucks as written in the final plans. New adult transportation procedures Tacoma has followed since 2004 include: tempering transport water, additional water quality parameter monitoring, flexibility in release locations dependent upon site-specific conditions and annual data summary reporting. The procedures, criterion and data collection methodologies implemented since 2004 for the Cowlitz Project fish transportation program represent a major change from previous years' practices. These changes should be followed for several years so that an appropriate amount of data can be collected in order to determine if further changes are needed. Tacoma's willingness to embrace these recent changes to long standing procedures demonstrates its commitment to adaptive management. In addition, Tacoma is in ongoing negotiations with NMFS regarding changes in hatchery design and operation which will in turn affect fish trap and haul.

Tacoma does not view NMFS' elaboration of its understanding of adaptive management in its Biological Opinion to have substituted an alternative approach to that which was negotiated and integrated into the Settlement Agreement and incorporated in the FERC Project license. Moreover, it is not apparent that the current system is inadequate, defective, or significantly different from NMFS desired approach. Tacoma proposes continuation of the current approach. If in the future, the need for a broader alternative approach to adaptive management becomes apparent; such a program should be the subject of negotiation and concurrence by all settlement parties and include amendment of the Project's FERC license. Tacoma is committed to a flexible and practical approach to implementing the agreed upon measures for the reestablishment of salmonid populations in the Cowlitz River basin and will continue to work closely with NMFS and all interested parties to that end.

Comment 2:

Along the same lines as the comment as in our June 23, 2005, letter, and the plans still need more documentation and reporting of fish transport and passage.

Response to Comment 2:

Tacoma will include copies of completed Tacoma Power Fish Truck Worksheets in the final plan.

Comment 3:

For NMFS and other resource management agencies to monitor and evaluate the success of the fish passage and transportation operations, documentation of the operations must be made available in a timely manner. We want to look at the history of what went wrong and what worked and learn from it. The adaptive management measures required in both the FERC License and Biological Opinion require the availability of timely, complete and accurate data for the adaptive management paradigm to work. Annual reports should include data down to the level of individual fish truck hauls with summaries and detailed descriptions of mortalities and deviations from established operating standards.

Response to Comment 3:

Tacoma will include the individual data sheets and/or data summaries in the Upstream Passage Annual Report (License Article 3 annual report due to FERC in July of each year).

Comment 4:

This should include performance of each portion of fish passage including, but not limited to, survival rates, water quality conditions, report of the number by species of adults transported as well as release locations, success of such, and number by species of juveniles transported and passed.

Response to Comment 4:

Tacoma recommends the inclusion of juvenile transportation summaries in the License Articles 1 & 2 annual reports (currently this data is reported in the Cowlitz Falls Fish Facility (CFFF) annual report and the Cowlitz Evaluations annual reports – both produced by the Washington Department of Fish and Wildlife (WDFW)).

Comment 5:

The Anadromous Fish Trap and Haul Plan (License Article 413) should really be a subset of the Anadromous Fish Passage Plan (License Article 415)… since the latter deals with fish passage through the entire project.

Response to Comment 5:

Tacoma has re-arranged these plans to make the Anadromous Fish Trap and Haul Plan a subset of the Anadromous Fish Passage Plan. They are being submitted together.

Comment 6:

Alternately, the Anadromous Fish Passage Plan could reference the Anadromous Fish Trap and Haul Plan for more information on the trap and haul aspects of Cowlitz Hydro.

Response to Comment 6:

There are cross-referenced notations in each plan

Comment 7:

We appreciate Tacoma's agreement to enlarge the holding pool on the ladder at the Cowlitz Salmon Hatchery. Since the agreement occurred after the written plans were submitted for comment, please add this detail to the final plans.

Response to Comment 7:

The detail will not be available until the next iteration of the Cowlitz Complex Hatchery Remodel and Phase-in Plan. See plan development schedule. (Next hatchery remodel meeting scheduled for February 22, 2006).

Comment 8:

The designs and specific details of the increased holding pool (e.g., such things as the crowder design) should be developed collaboratively between Tacoma and NMFS in consultation with the FTC and with NMFS approval at the conclusion.

Response to Comment 8:

The hatchery remodel collaborative design and development work with National Marine Fisheries Service (NMFS), WDFW and the Cowlitz Fisheries Technical Committee has been on-going since 2004 and will continue through the implementation of the FERC Order.

Comment 9:

The description sections in both the Anadromous Fish Passage Plan and the Anadromous Trap and Haul plan lack detail regarding the facilities. The specific information on the physical and hydraulic aspects found in the Operations sections of the plans should be moved to the Description section.

Response to Comment 9:

Tacoma has re-arranged the plans as suggested.

Comment 10:

The Operations section should describe how the facilities are operated under the full range of conditions during different times of the year and what triggers these changes to operation.

Response to Comment 10:

Tacoma has made changes to the plans as suggested.

Comment 11: **- <u>License Article 415 – Anadromous Fish Passage Plan</u>**

Tacoma needs to add a section on kelt out migration through the Mayfield and Cowlitz Falls juvenile collection systems. How are adults handled at the evaluators? Are they enumerated?

Response to Comment 11:

Tacoma has made changes to the plans as suggested. The CFFF operations are not a Tacoma Power responsibility. Refer to the CFFF annual reports for further information. Adults are enumerated in the same manner as juveniles at the downstream migrant collection systems on the Cowlitz River.

Comment 12:

Regarding the Cowlitz Trout Hatchery: Per our discussions at the Dec 6, 2005, FTC meeting, it appears that this facility does not trap very many wild steelhead and salmon due to timing and the flows in Blue Creek. Tacoma should provide more data for how many wild steelhead and

salmon are trapped. There may be handling protocol changes necessary depending on the number of fish.

Response to Comment 12:

Adult return data summaries at the Cowlitz Trout Hatchery are included in the Upstream Passage Annual Report (License Article 3 annual report due to FERC in July of each year).

Comment 13:

Page 1, 1st paragraph, 1st sentence: add "the March 23, 2004," to identify the biological opinion.

Response to Comment 13:

Tacoma has added this date.

Comment 14:

Page 2, section 3. Plan Background: While day-to-day operations may be done by Washington Department of Fish and Wildlife, Tacoma is ultimately responsible for the outcome. Also, this plan is meant to be comprehensive and those actions conducted for Tacoma must be included in the plan.

Response to Comment 14:

Operations of Tacoma's fish passage facilities, regardless of operators, are included in this plan.

Comment 15:

Page 3, License Article 1, Downstream Fish Passage and Collection Plan for Riffe Lake and Cowlitz Falls, (B): The approval from NMFS on this and any other item requiring NMFS' approval must be on the final plan and not a draft that is simultaneously receiving first time Fisheries Technical Committee review. The current request received via December 20, 2005, e-mail from Mark LaRiviere to Michelle Day is asking for approval of something that has not received the benefit of competed FTC review. This type of approach makes redundancies and does not allow for full benefit of the agreed upon process. There may be rare exceptions to this.

Response to Comment 15:

Approval for the License Articles 1, 2 & 3 plans was received from NMFS on July 15, 2004. Those plans and the final plans for License Articles 413 & 415 are submitted to NMFS for their approval concurrent with their submission to FERC.

Comment 16:

Page 4, section 4. Plan Objectives: The objective of the Anadromous Fish Passage Plan is to clearly document all aspects of fish passage associated with Tacoma to allow not only for descriptions but for assessments, improvements where necessary, and to layout operations under various circumstances. The listed items 1 through 4 are ways to do that but there may be

additional items as indicated by "…shall include, but not be limited to…" language in Article 415 of the license.

Response to Comment 16:

Comment noted.

Comment 16:

Page 5, Description section: The description section of the document does not provide much detail of the facilities. A complete description should be provided. Most of the information in the Operations section is more appropriate for the Description section (see next comment). This appears to be consistent throughout the document.

Response to Comment 17:

Tacoma has made changes to the plans as suggested.

Comment 18:

Page 13, Operation Section: The operation section provides more of a physical description of the facilities rather than a description of how they are operated. What constitutes normal operation and what triggers any deviation from the norm?

Response to Comment 18:

Normal operation is twenty four hours per day, seven days per week (24/7) – the Mayfield downstream migrant facility is operated at all times except for scheduled maintenance shut-downs.

Comment 19:

Page 14, frequency of operation of the Mayfield downstream facility: Given that the goal is to re-establish runs in this basin above the project, operations should be such to minimize impacts to the fish including minimizing delay. While what is proposed is an improvement from existing, it should be more. We would prefer for a maximum holding time of 24 hours which means the facility would be operated daily, but we recognize that it is reasonable to have less frequent operations during low juvenile migration numbers. We appreciate the information you provided on the operation of the downstream migrant facility, however, we are still concerned with proposed trigger levels for increased operation of the facility. We would like to discuss this further.

Response to Comment 19:

Tacoma proposes the operational triggers be retained as written and implemented prior to any decisions that more stringent trigger levels are needed.

Comment 20:

Page 16, Capture and enumeration, 1st paragraph: When will Tacoma install a remote monitoring and alarm system and what are the details of the system?

Response to Comment 20:

Tacoma will review choices of video cameras, level or flow devices and alarm features to decide on the best plan. The details will be included in the License Article 2 plan due to FERC in July 2006.

Comment 21:

Page 17, Schedule for Inspection of Facilities: A drive-by inspection of the facilities at Mayfield Dam is not sufficient. The facility should be physically inspected every day.

Response to Comment 21:

The Mayfield downstream migrant fish holding facilities will be inspected physically or remotely by camera daily.

Comment 22:

Page 17, Reporting Procedures of Inspection Results: This section should make reference to the information in Appendix No. 1 Emergency Protocol.

Response to Comment 22:

Tacoma has made changes to the plans as suggested.

Comment 23:

Page 17, Reporting Procedures of Inspection Results: The emergency notification does not include NOAA Enforcement as on page 23 and there is a "1" missing from the last part of Keith Kirkendall's phone number; the phone number is 503-230-5431.

Response to Comment 23:

Tacoma has made changes to the plans as suggested.

Comment 24:

Page 18, Cowlitz Salmon Hatchery facilities: Where appropriate, applicable comments in this letter from the Anadromous Fish Trap and Haul Plan section should be applied to the appropriate areas in the Anadromous Fish Passage Plan and vice versa.

Response to Comment 24:

There are cross-referenced notations in each plan

Comment 25:

Page 18, Description section: Additional information should be included here such as the physical dimension of the barrier dam, the fishway entrances, the ladder, the holding pool, etc. Also include such items as flow through the ladder, auxiliary water supply systems and entrances, forebay and tailwater rating curves (with regards to the barrier dam), auxiliary water supply rating curve, discussion of the functionality of the south entrance and of the north entrance, etc.

Response to Comment 25:

Tacoma has made changes to the plans as suggested. The requested drawing has been added to the Plan. See section 5.2.7 of Appendix No. 4 for more information.

Comment 26:

Page 18, 2a.) Cowlitz Salmon Hatchery facilities, Attraction Area: Some fish can get over the Barrier Dam and now that the tailrace is higher than when the dam was constructed, its efficiency may be reduced. Therefore, "full exclusion" should be changed or removed. Also, this section mentions the south bank entrance. This should be revised to acknowledge that the south bank entrance was never functional.

Response to Comment 26:

Tacoma has made changes to the plans as suggested.

Comment 27:

Page 19, Operation Section: Most of the information presented here is more appropriate for the description section. The Operation section should describe how the system is operated as well as what would trigger any changes in operation. For example, how often and when is the trap operated? What are the loading densities for the holding pool, for the holding tanks, for the truck transport, etc? Are flows down the ladder or through the auxiliary water supply system ever changed? How are fish sorted, anesthetized and recovered? How long are fish held before transport, etc.?

Response to Comment 27:

Tacoma has made changes to the plans as suggested.

Comment 28:

A section should be added to the Operation describing how the facility is taken out of service in preparation for annual maintenance or unanticipated shutdown. This should include a description of how the system is operated in preparation for shutdown; how the holding pool, ladder and entrance areas are dewatered; how fish are evacuated from the system, etc.

Response to Comment 28:

Tacoma has made changes to the plans as suggested.
Comment 29:

Page 19, Attraction and collection, 1st paragraph, 2nd sentence: Rather than "To ensure that no adult fish make it past the dam…" it should be "To increase the effectiveness of the dam," or something similar. We are not convinced that the dam constitutes a total barrier 100 percent of the time.

Response to Comment 29:

Tacoma has made changes to the plans as suggested.

Comment 30:

Page 20, Separator, 3rd paragraph: There should be a couple of sentences in the plan about the proper procedures for handling fish e.g., fish should be held by the caudal peduncle but the body should also be supported on their underside near their pectoral fins. Also, in our June 23, 2005, comments on the draft 413 and 415 plans, we conveyed that all fish should be anesthetized before handling.

Response to Comment 30:

Tacoma has made changes to the plans as suggested.

Comment 31:

Page 20, Separator, 5th paragraph: For clarity, the last sentence should be changed to "public access is restricted in the separator area to protect the fish, only hatchery and other appropriate personnel have access."

Response to Comment 31:

Tacoma has made changes to the plans as suggested.

Comment 32:

Page 20, Separator Section, last paragraph: In concept, we agree with the approach proposed by Tacoma for operation of the Cowlitz Salmon Hatchery (CSH). The trap facility should be operated a minimum of 5 days per week (except for scheduled maintenance shutdowns of up to one week per year). However, we recommend that that Tacoma commence operating 7 days a week when any of these conditions are met: (1) When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days, the operation frequency should include weekend days, (2) the weekend fish accumulation (from close of operation Friday to beginning Monday morning) exceeds the normal carrying capacity of the holding pool (5600 pounds of fish or approximately 700 coho [averaging 8 pounds each] or 350 Chinook [averaging 16 pounds each])(with the proposed holding pool expansion this is expected to occur much less frequently), or (3) when fish destined for transport upstream are entering the trap ripe and ready to spawn ((to be defined by the FTC and subject to NMFS approval). Also, all fish destined for transport upstream should be moved on the same day they are processed.

Response to Comment 32:

Tacoma has included proposed changes to prioritize the upstream transportation of natural-origin adult salmonids destined for the Tilton or upper Cowlitz River basins. Tacoma's proposed adult separator operations schedule is retained as previously written to reflect the personnel and equipment scheduling necessities once the daily numbers of adults handled are tallied. Tacoma Power and WDFW personnel on-site at the Cowlitz Salmon Hatchery separator facility have used tried and true criteria and are the best judge of adult fish maturation. The criterion that has been used successfully for the 40 fours years include a determination of; skin coloration, kype development, belly firmness/softness and ease of expression of eggs or milt. Tacoma recommends these individual, daily and on-site evaluations be followed for the determination of when fish are ripe and ready to spawn.

Comment 33:

Page 21, Separator, last paragraph: Fish destined for transport upstream should not be held in the holding tanks for as long as 72 hours. Fish in the holding pool should be processed and transported in the same working day.

Response to Comment 33:

Tacoma has made changes to the plans as suggested.

Comment 34:

Page 21, Truck Transport: It appears in the last sentence that the maximum capacity is up to 130 adult coho salmon and up to 75 adult Chinook salmon in combination. A maximum total of 205 fish will likely over load the capacity of the tank trucks. This sentence should probably read "the maximum capacity is up to 130 adult coho salmon or up to 75 adult Chinook Salmon" based upon 1 pound of fish per 1 gallon of water (based upon Tacoma's guidelines for fish hauling trucks as outlined in Appendix No. 1 in Anadromous Fish Trap and Haul Plan). NMFS criteria require a minimum of 0.15 cubic feet of water per pound of fish which translates into approximately 1300 pounds of fish for a 1500 gallon tank.

Response to Comment 34:

Tacoma has made changes to the plans as suggested.

Comment 35:

Page 22, Attraction and collection, 1st paragraph: "as-needed basis" This comment applies throughout both the Anadromous Fish Passage Plan and the Anadromous Fish Trap and Haul Plans. As we conveyed in our June 23, 2005, letter, the plans need more specificity regarding triggers and actions, such as details on what triggers maintenance on an "as-needed" basis, and what is covered in inspections.

Response to Comment 35:

Tacoma conducts an on-going preventative maintenance program of all Cowlitz Project facilities whereby all operational systems and equipment are visually or remotely inspected. If anything malfunctions, project managers assign repair priorities as necessary. Anything to do with

attracting, collecting, separating, holding, transporting and releasing adult salmonids is assigned the highest priority for repair. This may include call-out of standby personnel to make the repairs.

Comment 36:

Page 22, Emergency Procedures: Are there any procedures for the annual reporting of emergency events? These should be reported (written report) to the FTC on an annual basis.

Response to Comment 36:

Tacoma will include the reporting of emergency events in the Upstream Passage Annual Report (License Article 3 annual report due to FERC in July of each year). The FTC members are provided a copy of this report.

Comment 37:

Page 31, Cowlitz Falls: Future decisions of what to do for downstream fish passage at Mossyrock or Riffe Lake or both regarding downstream fish passage hinge on the performance of the collection facility at Cowlitz Falls; therefore, it is incumbent on Tacoma to ensure collection and survival is maximized. Tacoma has taken steps to improve fish collection at Cowlitz Falls including the installation of a new fish guidance screen. This Anadromous Fish Passage Plan is meant to be comprehensive and should incorporate fish passage aspects at Cowlitz Falls. Please provide a comprehensive assessment and analysis of these and all other effects at Cowlitz Falls. Even though Cowlitz Falls is not a Tacoma Facility, this is where the Settlement Agreement and the FERC License incorporating it is having Tacoma focus on collecting fish.

Response to Comment 37:

The Cowlitz Falls Fish Collection Facility is owned by the Bonneville Power Administration (BPA) who funds the operation by the Washington Department of Fish and Wildlife. The facility is located on Cowlitz Falls Dam which is owned and operated by Lewis County Public Utility District No. 1 (LCPUD). The Settlement Agreement License Article No. 1 includes provisions for Tacoma to negotiate with LCPUD and BPA regarding shared funding of cooperative efforts to improve downstream passage and collection effectiveness at or near Cowlitz falls. Tacoma has negotiated an agreement which makes the CFFF available to Tacoma for research and testing activities to improve fish collection including the installation of the new fish guidance screen. The CFFF is not being operated by Tacoma and Tacoma does not have the ability or desire to do a comprehensive analysis and assessment of Cowlitz Falls. There is much information provided in the CFFF annual reports and in the SA License Article No. 1 Plan annual reports. Any other information or analysis would need to be provided by BPA or LCPUD. Tacoma is committed to working cooperatively with LCPUD and BPA to meet the fisheries obligations on the Cowlitz River.

Comment 38:

Page 34, Transfer facilities: Different acronyms for the Cowlitz Falls Fish Collection Facility are used: CFFCF and CFFF. Please standardize across both plans.
Response to Comment 38:

Tacoma has made changes to the plans as suggested and will use the acronym CFFF.

Comment 39:

Page 35, Anticipated Special Operation of Facilities for Research: What about the evaluations of the new screens Tacoma is placing at Cowlitz Falls?

Response to Comment 39:

This information will be contained in the CFFF annual reports and the License Article 1 Plan annual reports.

Comment 40:

Page 38, Appendices: None of the appendices attached to this License article are referenced in the body of the report. All the appendices should be incorporated into the appropriate location in the body of the document except perhaps the review of our guidelines and criteria.

Response to Comment 40:

Tacoma has made changes to the plans as suggested.

Comment 41:

Page 44, Appendix 4, Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities: This needs an explanation that Tacoma took the applicable sections from the NMFS document and in italics added a comparison of the criteria with the project. Tacoma's response to the NMFS criteria and guidelines should be highlighted better to help it stand out for a reader. We suggest underlining as well as italics.

Response to Comment 41:

Tacoma has made changes to the plans as suggested.

Comment 42: **- <u>License Article 413 – Anadromous Fish Trap and Haul Plan</u>**

A section should be added to the Operation section describing how the facility is taken out of service in preparation for annual maintenance or unanticipated shutdown. This should include a description of how the system is operated in preparation for shutdown; how the holding pool, ladder and entrance areas are dewatered; how fish are evacuated from the system, etc.

Response to Comment 42:

Tacoma has made changes to the plans as suggested.

Comment 43:

We need additional information and discussion with Tacoma regarding the release of adults from the transport trucks as illustrated in the picture at the bottom of page 15 and 21.

Response to Comment 43:

Tacoma recommends that the operational procedures for adult releases from the Tacoma fish transport trucks be retained as written. The detailed data currently being collected and reported on individual truck hauls will help determine if any changes are needed in the future.

Comment 44:

Page 1, 1st paragraph: Please reword the sentence that describes the extension request to remove the word "behest" from "at the behest of the Cowlitz Fisheries Technical Committee". This implies that Tacoma was only asking for the extension because others urgently prompted instead of a group decision.

Response to Comment 44:

Tacoma has made changes to the plans as suggested.

Comment 45:

Page 2, 3. Background, 2nd paragraph: Used CFFCF in this plan, but used CFFF in all but one place in the Fish Passage Plan. Please standardize across plans (see comment under License Article 415, pg 34). Also, a literature cited section is needed in the document.

Response to Comment 45:

Tacoma has made changes to the plans as suggested.

Comment 46:

Page 3, Objectives: The descriptions of the facilities and operation should be accompanied by ways to minimize or eliminate harm to fish. Also, all the trap and haul operations should be covered not just those operated by Tacoma. The plan is meant to be comprehensive and those actions conducted for Tacoma must be included in the plan.

Response to Comment 46:

Operations of Tacoma's fish passage facilities, regardless of operators, are included in this plan. In addition, a description of the operation of the BPA stress relief ponds at the CSH is included.

Comment 47:

Page 3, Objectives, note: it should say License Article 415 rather than 15. Also, that plan does not cover the new Cowlitz Falls screen except by reference to the reports that are due. In the future annual updates, this should be included.

Response to Comment 47:

Tacoma has made changes to the plan as suggested. Refer to the CFFF annual reports and the License Article 1 Plan annual reports for more information.

Comment 48:

Page 5, Plan: This plan is part of the Fish Passage Plan not adjunct to it.

Response to Comment 48:

Tacoma has re-arranged these plans to make the Fish Trap and Haul Plan a subset of the Anadromous Fish Passage Plan.

Comment 49:

Page 9, Crowder: It would help if the sentence read "Crowder in the holding pool, which is lowered into the water and by moving it forward and lifting it, it reduces the available area . . ."

Response to Comment 49:

Tacoma has made changes to the plan as suggested.

Comment 50:

Page 23, Truck Description, 3rd paragraph: The paragraph indicates that the fish from the Cowlitz Trout Hatchery (CTH) are released from the trucks using a 10 ft long 4 ft diameter and 10 inch deep flume. The picture on page 21 does not show this. The use of the flume should be standard operation when releasing adults.

Response to Comment 50:

The fish transportation truck stationed at the Cowlitz Trout Hatchery is used for transportation and recycling of surplus hatchery and non-indigenous adult salmonids only. At such time this truck is retrofitted to transport adults from the CSH separator, the truck will be modified to include a release flume.

Comment 51:

Page 23, Trap and Haul Facilities Operation section: The majority of the information provided in this section should be moved to "description" section of the plan. This section provides useful and valuable information on the physical configuration of the fish passage facilities but provides little information on how the facilities are operated. Operational information should include such things as when the facility is operated, how often and under what conditions the trap is operated, conditions that necessitate the closure of ladder system, when is the fish passage system is taken out of service for maintenance and or inspection, etc.

Response to Comment 51:

Tacoma has made changes to the plans as suggested. See the License Article 415 Plan for the proposed adult separator operational schedule.

Comment 52:

For example, with regards to the barrier dam, what dates specifically (or historically) has the electric barrier been turned off to prevent any incidental harm to the juvenile salmon releases from the CSH? Under what conditions is the voltage to the electric barrier changed (higher flows over the barrier dam versus lower flow conditions). Are there times and conditions that necessitate shutting down the auxiliary water supply system? Are there times and conditions where it is necessary to reduce the flow down the ladder and, if so, for what reason? These are just a few examples of operational information. Please be comprehensive.

Response to Comment 52:

The Barrier Dam electrical grid is turned off only on the morning of juvenile fish releases from the Cowlitz Salmon Hatchery. Both the adult ladder attraction flow (the auxiliary ladder water supply system) and the electric grid on the Barrier Dam ogee crest are turned off the morning of scheduled juvenile fish releases at the Cowlitz Salmon Hatchery. Both systems are turned back on or activated based upon visual examination of the nearshore waters upstream and downstream of the main hatchery drain pipe, and a determination that the hatchery juveniles are no longer present in large numbers.

The voltage control system for the Barrier Dam electrical grid is set at a minimum setting (30 units) during low-flow conditions on the Cowlitz River, i.e., 2,000 – 4,000 cubic feet per second (cfs), and the system is set at a maximum setting (40 units) at flows above 4,000 cfs. The ladder flows at a constant rate of 22 cfs year round. See the License Article 415 Plan for scheduled maintenance shut-down periods. Tacoma has made changes to the plans as suggested.

Comment 53:

Page 24, Barrier Dam, 2nd paragraph: Rather than "To ensure that no adult fish make it past the dam…" It should be "To increase the effectiveness of the dam," or something similar. We are not convinced that the dam constitutes a total barrier 100% of the time.

Response to Comment 53:

Tacoma has made changes to the plans as suggested.

Comment 54:

Page 24, Ladder section, 1st paragraph: Please correct the width dimension of the primary entrance. It should be 5 ft 9 inches not 5.75 inches.

Response to Comment 54:

Tacoma has made changes to the plans as suggested.

Comment 55:

Page 25, Holding Pool: A description of the existing holding pool (including such items as volume, flow and holding capacity, etc.) should be included.

Response to Comment 55:

Tacoma has made changes to the plans as suggested.

Comment 56:

Page 25, Separator section, 1st paragraph: All fish that are handled should be anesthetized and all anesthetized fish should be placed in recovery tanks where their recovery can be monitored and the fish retrieved and resuscitated if necessary. As we stated in our earlier June 23, 2005, letter, "According to NMFS guidelines (section 7.3.3) fish should be anesthetized before handling. What proof is there that the Chinook and cutthroat trout undergo less stress and damage without anesthetic and what guarantee is there that an experience operator is performing the work?"

Response to Comment 56:

Tacoma Power and WDFW personnel have been operating the CSH separator for nearly 40 years. The experienced gained in the almost daily handling of adult salmonids at the separator by the technical professionals employed by Tacoma and WDFW, the constant on-the-job training and reinforcement received from close public scrutiny of the separator operations have led to the development of the site-specific operational methodologies being employed by the separator operators.

Comment 57:

Page 26, Separator section, 4th paragraph: In concept, we agree with the approached proposed by Tacoma for operation of the Cowlitz Salmon Hatchery (CSH). The trap facility should be operated a minimum of 5 days per week (except for scheduled maintenance shutdowns of up to one week per year). However, we recommend that that Tacoma commence operating 7 days a week when any of these conditions are met: (1) When fish handling counts, calculated on Friday, average greater than 500 fish per day for the preceding 5 days, the operation frequency should include weekend days, (2) the weekend fish accumulation (from close of operation Friday to beginning Monday morning) exceeds the normal carrying capacity of the holding pool (5600 pounds of fish or approximately 700 coho [averaging 8 pounds each] or 350 Chinook [averaging 16 pounds each])(with the proposed holding pool expansion this is expected to occur much less frequently), or (3) when fish destined for transport upstream are entering the trap ripe and ready to spawn ((to be defined by the FTC and subject to NMFS approval). Also, all fish destined for transport upstream should be moved on the same day they are processed.

Response to Comment 57:

Tacoma has included proposed changes to prioritize the upstream transportation of natural-origin adult salmonids destined for the Tilton or upper Cowlitz River basins. Tacoma's proposed adult separator operations schedule is retained as previously written to reflect the personnel and equipment scheduling necessities once the daily numbers of adults handled are tallied. Tacoma Power and WDFW personnel on-site at the Cowlitz Salmon Hatchery separator facility

have used tried and true criteria and are the best judge of adult fish maturation. The criterion that has been used successfully for the 40 fours years include a determination of; skin coloration, kype development, belly firmness/softness and ease of expression of eggs or milt. Tacoma recommends these individual, daily and on-site evaluations be followed for the determination of when fish are ripe and ready to spawn.

Comment 58:

Pages 26, 27, and 29: the Appendices are not numbered correctly, but please refer to comment on Appendices below.

Response to Comment 58:

Tacoma has made changes to the plan as suggested.

Comment 59:

Page 27, Release section, Downstream releases: Please list and describe the modifications to the stress relief pond outlet structure. Also, when will Tacoma make minor modifications to the stress relief pond outlet structures to encourage volitional release?

Response to Comment 59:

See Appendix No. 2, Mayfield downstream migrant facility improvements list in License Article 415 Plan. In addition the License Article 2, Mayfield Downstream Passage Plan will be forwarded to the Cowlitz FTC members for review and comment in May 2006, and filed with FERC in July 2006. The timeline for the modifications will be based upon the FERC Order issued in response to the plan submittal.

Comment 60:

Page 27, Notification: There is a "1" missing from the last part of Keith Kirkendall's phone number; the phone number is 503-230-5431.

Response to Comment 60:

Tacoma has made this correction to the plans.

Comment 61:

Page 29, Release section, 2nd paragraph: Why isn't the fish discharge trough (as described on page 23) used when releasing fish? Also, the last sentence of this paragraph seems to indicate that a total of 325 fish (130 adult coho, 120 adult steelhead, and up to 75 adult Chinook) can be hauled per load. Please correct. According to NMFS criteria, a 1,500 gallon tanker truck could only hold approximately 1300 pounds of fish or about 160 adult coho (averaging 8 pounds each) in a single load.

Response to Comment 61:

Tacoma has made the suggested changes to the plan. Also, the fish transportation truck stationed at the Cowlitz Trout Hatchery is used for transportation and recycling of surplus hatchery and non-indigenous adult salmonids only. At such time this truck is retrofitted to transport adults from the CSH separator, the truck will be modified to include a release flume.

Comment 62:

Page 33, Appendices: All the appendices should be incorporated into the body of the document except perhaps the review of our guidelines and criteria.

Response to Comment 62:

Tacoma believes the appendices are better suited as stand-alone protocols as presented in, and referred to appendices of the plans.

Comment 63:

Page 33, Appendix No.1, Smolt release section: Juvenile fish should not be brushed out of the tank even with soft bristle brooms without water. They should be flushed out using water. A source of flush water should be available for the trucks at the release points (for example, using a small portable pump). Any remaining fish should then be gently crowded out during the flushing process with a soft bristle broom with water. The broom should not touch fish but rather guide the water.

Response to Comment 63:

Water is not readily available at all release sites for a non-contact final flushing. Experienced fish truck transport operators can routinely and safely release the residual fish from the transport trucks with the described gentle brushing action. Water is used for flushing as much as possible.

Comment 64:

Page 33, Procedures for Tacoma Power Fish Hauling Trucks, temperature:
The water temperatures at the fish trapping and holding site, transport truck, and release site should be measured and recorded during all fish transport operations. Water temperature at the release site should be checked before fish are released. If the water temperature of the release site (measured at 1 foot below the water surface) exceeds 18 degrees Celsius, fish should be released at an alternate site. This rule applies primarily to the Lake Scanewa release sites. If water temperatures at the Cowlitz and Cispus River release sites is found to exceed 18 degrees (an unlikely event based upon historical records) and no release sites with cooler water temperatures are available, the fish should be returned to the trapping/holding site and transported at a later time (night time temperatures are typically cooler), when the water temperature has dropped below 18 degrees Celsius. If there is a regular pattern of excessively high temperatures observed at a release site, alternative release sites should be identified, and developed as soon as possible.

Response to Comment 64:

See Appendix No. 1 of the 413 Plan for the procedures for transportation and release water quality monitoring. It is not feasible, nor desirable to haul the same load of adult salmonids upstream and then back downstream in the Cowlitz River basin and seems contrary to NMFS desire to have the adult fish moved within 24 hours of handling at the separator. Tacoma Power does not endorse this action.

There are several release options available in upper Cowlitz River basin tributaries if the surface water temperatures of Lake Scanewa are too warm. However, to impose a strict 18 degree Celsius limitation is not workable. Tacoma recommends the operational procedures for adult releases from the Tacoma fish transport trucks be retained as written as they represent a significant change from previous practices and should be implemented. Data collected over the next few years will help determine if further changes are needed.

Comment 65:

In addition to the 18 degree maximum temperature standard, we want operations to result in no more than a 3 degree Celsius change (warmer or colder) from the water the fish originated from including truck water to release. A change from 15 degree Celsius to 12 degree Celsius back to 15 degree Celsius is acceptable. These limits apply to both upstream and downstream transport of all fish (juvenile and adult). We would like further discussions with Tacoma and the FTC about tempering water.

Response to Comment 65:

Tacoma recommends that the operational procedures for adult releases from the Tacoma fish transport trucks be retained as written. The detailed data currently being collected and reported on individual truck hauls will help determine if any further changes are needed.

Comment 66:

If maximum temperatures or temperature differential limits require returning the fish to the holding water or require warming or cooling of the holding water (tempering) more than three times within a calendar month, "immediate" action (as defined by the FTC and subject to approval by NMFS) should be taken to resolve the problem. Both tempering procedures and returning fish to the capture site (thus exposing them to additional handling) represent measures which significantly increase the amount of stress upon the transported fish. The actions should take the form of modifying transport schedules so transport and release occurs at a time of day when water temperatures are cooler, or there is less differential between originating and receiving bodies of water, or using alternate release sites where the water is cooler or there is less differential between originating and receiving bodies of water. Water temperature data for each fish transport trip (originating water temperature, transport water temperature, receiving water temperature) should be recorded in a logbook with the date, time of fish loading, time of fish release, and dissolved oxygen level in the fish hauling truck at time of fish loading and release. This data should be made available to NMFS upon request and a summary of this data should be presented in annual reports.

Response to Comment 66:

There are no feasible alternatives to transporting the daily arriving adults upstream in the Cowlitz River basin regardless of upper basin water temperatures. Please refer to the Comment 64 response.

Daily water temperature fluctuations in transport and release waters used in the upstream adult fish transportation program on the Cowlitz River are negligible, and therefore it is unnecessary to impose release limitations upon loads based on daily water temperature fluctuations. Tacoma Power does not support the transportation and release of adult salmonids during darkness, or at night because of safety concerns.

See Appendix No. 1 of the 413 Plan for the procedures for transportation and release water quality monitoring. Tacoma will include the individual data sheets and/or data summaries in the Upstream Passage Annual Report (License Article 3 annual report due to FERC in July of each year).

Comment 67:

We recognize that these measures may seem tedious or difficult to meet, but it is important that the physiology needs of the fish take priority over ease of operation. Creative ways of addressing temperature changes experience by the fish due to hauling should be used such as changing release locations or times.

Response to Comment 67:

The operational procedures for adult releases from the Tacoma Power fish transport trucks adequately address temperature changes as written. The detailed data currently being collected and reported on individual truck hauls will help determine if any further changes are needed.

Comment 68:

Page 37, Appendix No. 2, Emergency Protocol: There does not appear to be a reference to this particular appendix in the body of the license article.

Response to Comment 68:

Tacoma has made changes to the plans as suggested.

Comment 69:

Page 47, Appendix No. 6, Review of Draft Anadromous Salmonid Passage Facility Guidelines and Criteria and application to Cowlitz Hydroelectric Project Fish Passage Facilities: This needs an explanation that Tacoma took the applicable sections from the NMFS document and in italics added a comparison of the criteria with the project. Tacoma's response to the NMFS criteria and guidelines should be highlighted better to help the reader. We suggest underlining as well as italics.

Response to Comment 69:

Tacoma has made changes to the plans as suggested.

Comment 70:

Page 48-49, Appendix No. 6, Response: Since this is a preliminary review and additional information and further analysis may be forthcoming, we look forward to continuing to work with Tacoma to identify potential solutions to any identified deficiencies.

Response to Comment 70:

Comment noted.

Comment 71:

Page 49, last paragraph under Foreword, 1st sentence: We believe that the sentence "All of the Cowlitz River Project passage facilities have been successful at meeting their original design intent." should be deleted or modified since it was concluded that the south bank ladder entrance likely never functioned as designed and the function of the north bank entrance has been compromised by the raise in tailwater level (although this will be corrected in the near future).

Response to Comment 71:

Tacoma has made changes to the plans as suggested.

Comment 72:

Page 63, Appendix No. 6, Section 6.4.1: Given the increase in the normal tailwater level downstream of the barrier dam, updated forebay and tailwater rating curves should be provided for the barrier dam.

Response to Comment 72:

Tacoma has made changes to the plans as suggested.

From: Tammy M [tammymackey@yahoo.com]
Sent: Monday, January 09, 2006 6:56 PM
To: LaRiviere, Mark
Cc: Kaitlin Lovell; Connie Kelleher
Subject: National TU and American Rivers comments on Articles 413 and 415

Hi Mark,

Here are the comments for Article 415-

1. American Rivers and Trout Unlimited support the improvements outlined in Appendices 2 and 3. We hope to see these appendices updated each year with the date of completion for each improvement and a list of new improvements (if necessary).
2. AR/TU have concerns about the outfall of the transport pipeline. We hope to see that outfall modified into something more benign for juvenile fish in the future.
3. AR/TU would like to see delay reduced to less than 24 hours at the Mayfield downstream migrant facility.
4. Visual inspections of facilities and transportation vehicles should be recorded. Results of inspections (items out of fish passage criteria, maintenance, etc) should be reported in weekly/annual reports.

Comments on Article 413-
1. American Rivers and Trout Unlimited are concerned about the handling of fish at the CSH separator. Fish should not be picked up by the caudal peduncle without being supported along the belly. Failure to support the entire fish may result in broken spines.
2. AR and TU are concerned about the fish released from the transportation truck. The photo on page 15 of the DRAFT License Article 413 document shows fish flopping out of the flume during release. While the photo may be misleading, our concern is that fish may hit the sides of the release flume while flopping about. This potential source of injury should be eliminated, if at all possible.
3. AR and TU support reducing delay of migrating fish to less than 24 hours.
4. AR and TU also support the redesign of the holding pool as a means to reduce fish crowding and fish delay.

Have a wonderful day!
Tammy

Tammy Mackey
360-513-3725
tammymackey@yahoo.com

TACOMA'S RESPONSES TO COMMENTS RECEIVED ON

DRAFT Anadromous Fish Passage Plan (License Article 415) and the Anadromous Fish Trap and Haul Plan (License Article 413), December 5, 2005

Comments from American Rivers/Trout Unlimited, January 9, 2006:

Article 415-

Comment 1:

American Rivers and Trout Unlimited support the improvements outlined in Appendices 2 and 3. We hope to see these appendices updated each year with the date of completion for each improvement and a list of new improvements (if necessary).

Response to Comment 1:

The annual Upstream Fish Passage Study Report (License Article 3), and future annual reports required under License Article 2 Mayfield Downstream Passage Improvements, will include the status of each project.

Comment 2:

AR/TU have concerns about the outfall of the transport pipeline. We hope to see that outfall modified into something more benign for juvenile fish in the future.

Response to Comment 2:

Tacoma agrees with this comment. The License Article 2 Mayfield Downstream Passage Improvements Plan will include the detail and timeline of the modified outfall at the Mayfield powerhouse tailrace.

Comment 3:

AR/TU would like to see delay reduced to less than 24 hours at the Mayfield downstream migrant facility.

Response to Comment 3:

Tacoma recommends that the operational procedures for adult and juvenile fish handling at the Mayfield downstream migrant trap be retained as written. The detailed data currently being collected and reported will help determine if any further changes are needed.

Comment 4:

Visual inspections of facilities and transportation vehicles should be recorded. Results of inspections (items out of fish passage criteria, maintenance, etc) should be reported in weekly/annual reports.

Response to Comment 4:

Tacoma will review choices of video cameras, level or flow devices and alarm features to decide on the best plan. The details will be included in the License Article 2 plan due to FERC in July 2006. The Mayfield downstream migrant fish holding facilities will be inspected physically or remotely by camera daily.

Tacoma will include the reporting of emergency events occurring to the Cowlitz Project fish passage program in either the annual Upstream Passage Study Report (License Article 3), or future annual reports required under License Article 2 Mayfield Downstream Passage Improvements.

Article 413-

Comment 5:

American Rivers and Trout Unlimited are concerned about the handling of fish at the CSH separator. Fish should not be picked up by the caudal peduncle without being supported along the belly. Failure to support the entire fish may result in broken spines.

Response to Comment 5:

Tacoma has made changes to the plan as suggested.

Comment 6:

AR and TU are concerned about the fish released from the transportation truck. The photo on page 15 of the DRAFT License Article 413 document shows fish flopping out of the flume during release. While the photo may be misleading, our concern is that fish may hit the sides of the release flume while flopping about. This potential source of injury should be eliminated, if at all possible.

Response to Comment 6:

The release in this photo was distorted by the perspective and has been removed from the plan. The fish release protocols, including the extension of the release flume (see Appendix No. 1), will be followed by all Tacoma Power fish truck drivers.

Comment 7:

AR and TU support reducing delay of migrating fish to less than 24 hours.

Response to Comment 7:

Tacoma acknowledges this concern, but maintains the program as proposed is reasonable and meets the biological needs of the migrating adult salmonids.

Comment 8:

AR and TU also support the redesign of the holding pool as a means to reduce fish crowding and fish delay.

Response to Comment 8:

Tacoma has made changes to the plans as suggested. The detail will not be available until the next iteration of the Cowlitz Complex Hatchery Remodel and Phase-in Plan. See plan development schedule. (Next hatchery remodel meeting scheduled for February 22, 2006).