Lewis River Hydroelectric Projects Relicensing

Merwin Hydroelectric Project (FERC No. 935)
Yale Hydroelectric Project (FERC No. 2071)
Swift No. 1 Hydroelectric Project (FERC No. 2111)
Swift No. 2 Hydroelectric Project (FERC No. 2213)

USDA Forest Service
Gifford Pinchot National Forest

EXISTING INFORMATION ANALYSIS

4. Aquatic Habitat Condition and Productivity

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I. Existing Conditions

The construction and operation of the four Lewis River hydroelectric projects altered aquatic habitat conditions and production capability within the basin. As stated in the Existing Information Analysis (EIA) for *Fish Passage and Reintroduction of Anadromous Fish Species*, all four hydroelectric projects have truncated upstream passage for salmon and steelhead, thus eliminating much of the anadromous habitat available prior to 1932 when Merwin Dam was completed (PacifiCorp and Cowlitz PUD 1999a). This includes main channel and side channel habitat. This EIA will focus more specifically on changes in aquatic habitat conditions and production capability as related to the four hydroelectric projects in the basin.

Prior to the construction of Merwin Dam in 1932 (known as Ariel Dam at that time), the Lewis River Basin provided an unobstructed, free-flowing river system offering a diverse network of lotic[2] habitats upon which the endemic fish species of the Lewis River evolved. Smaller, headwater tributaries were connected to larger, alluviated mainstem reaches in the mid- to lower-valley portions of the basin. Endemic populations of steelhead, coho salmon, chinook salmon, chum salmon, cutthroat trout, rainbow trout, bull trout, Pacific lamprey, mountain whitefish, pike minnow, and other species colonized and inhabited portions or all of this continuous river network. Construction of the three mainstem dams (Merwin, Yale, and Swift No. 1) inundated much of the mainstem river and its tributary junctions, eliminating these aquatic habitats altogether and converting them to a lentic[3] function. Additionally, construction and operation of Swift No. 2 results in dewatering of the mainstem river for a 2.7 mile reach downstream of Swift Dam. Inundation and dewatering, together, account for a significant loss of lotic habitat throughout the river system. This impact alone is believed to significantly alter the natural

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[2] Lotic – free-flowing, riverine-like.
[3] Lentic – still-water, reservoir-like.

production capability for river-dependent species. Operation of the hydroelectric complex is also believed to alter the quality and function of those remaining lotic habitats downstream of hydroelectric project facilities.

Altogether, the construction and operations of the four Lewis River hydroelectric projects have resulted in significant impacts to aquatic habitat condition, function, and production capability. These aquatic habitat impacts have a direct link to the loss or reduction of anadromous fish species in the Lewis River Basin (USDI 1997, USDI 1998a, and USDI 1998b). The four hydroelectric projects will continue to impact aquatic habitat and fish production as they exist and operate on the landscape today.

II. Forest Plan Direction

Code of Federal Regulations (CFR)

36 CFR 219 covers the planning process for development of National Forest Land and Resource Management Plans. The Code of Federal Regulations provides the implementing direction for the National Forest Management Act (1976).

Under 36 CFR 219.19, paragraph 1 states, "Fish and Wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area."

-219.19 (2) Planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and of animal population trends of the management indicator species. For the Gifford Pinchot NF, cutthroat trout, steelhead trout and bull trout were selected as management indicator species.

-219.19 (3) Biologists from State fish and wildlife agencies and other Federal agencies shall be consulted in order to coordinate planning for fish and wildlife, including opportunities for the reintroduction of extirpated species.

Section 219.27(g) Diversity states in part, "Management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species."

Gifford Pinchot Land and Resource Management Plan

The Gifford Pinchot National Forest Land and Resource Management Plan (1990), as amended by the Northwest Forest Plan in 1994 (the Northwest Forest Plan applies to Bureau of Land Management lands also), provides the management direction for all National Forest System lands and their associated resources directly affected by or within the project vicinity of the four hydroelectric projects in the Lewis River system. This plan was developed and enacted consistent with the requirements of the Forest and Rangeland Renewable Planning Act, as amended by the National Forest Management Act. The Aquatic Conservation Strategy (ACS), a core component of the Northwest Forest Plan, provides management direction aimed at maintaining or restoring the ecological health and functioning of watersheds and the aquatic ecosystems contained within them. ACS objectives that apply most to this issue are:

Objective 1 – Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.

Objective 2 – Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Objective 3 – Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Objective 4 – Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Objective 5 – Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Objective 6 – Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Objective 7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Objective 9 – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Additionally, Northwest Forest Plan Standard and Guideline LH-2 states: "During the relicensing of hydroelectric projects, (the Forest Service shall) provide written and timely license conditions to FERC that require flows and habitat conditions that maintain or restore riparian resources and channel integrity."

Forest Service Manual Direction
Forest Service Manual (FSM) 2670.12 directs the Forest Service to:

- *Manage habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species,*

- *Conduct activities and programs to assist in the identification and recovery of threatened and endangered plant and animal species, and*

- *Avoid actions that may cause a species to become threatened or endangered.*

Forest Service Manual (FSM) 2670.22 directs the Forest Service to:

- *Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands*. A viable population is further defined by FSM 2670.5 as *one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.*

Federal Power Act (FPA)
Section 4(e) of the FPA provides the USDA Forest Service, as administrators of reserved lands affected within the project area, authority to attach mandatory terms and conditions to Project licenses. This section of the FPA states, "that licenses shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation." Section 4(e) also states that "…the Commission (FERC), in addition to the equal power and development purposes for which licenses are issued, shall give equal consideration to the purposes of enhancement of, fish and wildlife (including related spawning grounds and habitat)…". Forest Service terms and conditions are based upon management direction contained in amended Forest Plans. If the project being relicensed is not located on Forest Service land but affects resources managed by the agency (i.e. migratory fish that historically used NFSL), the Forest Service can make recommendations regarding fish passage to FERC.

Executive Order 12962
Under the Recreational Fisheries Executive Order (Executive Order 12962 of June 7, 1995, Federal Register Notice 60(111): 30769-30770), the President of the United States directs federal agencies to cooperate with state and tribal governments to improve aquatic resources for increased recreational fishing opportunities by:

- Identifying recreational fishing opportunities limited by degraded habitat and water quality,
- Restoring habitat and water quality,
- Providing access and promote awareness of recreational fishing opportunities,
- Stimulating angler participation in conservation and restoration,
- Using cost-share programs and implementing laws to conserve, restore, and enhance aquatic systems to support recreational fisheries,
- Evaluate effects of federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order, and
- Assisting private landowners to conserve and enhance aquatic resources.

Master Memorandum of Understanding, Washington Department of Fish and Wildlife and USDA Forest Service Region Six l

Signatory parties agreed under this MOU to consult on fish and wildlife actions that occur or may affect USDA Forest Service Region Six Forests. Listed below are four key elements of this MOU.

Section A #2. The Forest Service agrees to recognize WDFW as being responsible for the protection, perpetuation, and management of all game fish and wildlife in the State of Washington.

Section B #2. WDFW agrees to solicit Forest Service participation in establishing the desired level of fish and wildlife populations on the National Forests…

Section B #4. WDFW agrees to consider Forest Service's goals and objectives in the development of Fish and Wildlife plans.

Section B #6. WDFW agrees to cooperate with the Forest Service in preparation and conduct of research plans of mutual interest.

III. Information Analysis

Aquatic Habitat Condition and Function

The existing aquatic habitat conditions in the Lewis River Basin are considerably different today as a result of the four existing hydroelectric projects. The three dams (Merwin, Yale, and Swift No. 1) converted the majority of free-flowing riverine habitats along the mainstem Lewis River and many of its tributaries at their junction with the mainstem into reservoir-like, lentic habitats. This large shift in habitat function has significantly affected and will continue to affect the structure and assemblage of aquatic communities within the Lewis River Basin. Approximately 50 miles of mainstem river reaches and tributary junctions have been inundated or partially dewatered as a result of the four Lewis River hydroelectric projects. Many of the mainstem reaches currently inundated or dewatered are believed to have provided the more productive aquatic habitats within the Lewis River Basin. These low gradient, alluvial mainstem reaches flowed through wide, broad valley floors offering a complexity of aquatic habitats in the form of side-channels, alcoves,

beaver ponds, and backwater areas. Due to the position of the four hydroelectric projects in the landscape, it is believed that the majority of these critical aquatic habitat features once present within the basin are now inundated. There are very few other portions of the basin that currently offer these unique and productive aquatic habitat features. Other portions of the basin typically drain rivers and streams that are higher gradient and more geologically confined. This large-scale conversion from lotic to lentic habitat types has profound effects on the production capability of the aquatic ecosystem for various fish species.

The condition of the remaining lotic habitats downstream of project facilities has also been impacted by project operations. These effects include: 1) changes in sediment routing which may affect the streambed substrate and quantity and quality of spawning gravels, 2) changes in temperature regimes, 3) changes in flow regimes, 4) a reduction in large wood inputs, and 5) an alteration of channel stability. All of these effects, when assessed cumulatively, have changed the conditions of lotic habitats downstream of project facilities and have reduced their overall production capability.

Aquatic Study #4 (AQU 4) was designed to assess the Potential Anadromous Fish Habitat upstream of Merwin Dam (PacifiCorp and Cowlitz PUD Technical Report 2000), which included identification of migratory fish barriers as well as several other aquatic habitat parameters. The results of AQU 4 determined that 77.1 percent (74.1 miles) of the 96.1 miles of accessible anadromous aquatic habitat were located above Swift reservoir, i.e., on National Forest System Lands administered by the Gifford Pinchot National Forest. (2000 Technical Report).

The majority (77.1 percent) of the remaining lotic habitats within the Lewis River Basin are found on National Forest System lands. The contribution of these aquatic habitats on National Forest System lands to riverine-dependent fish species is critical. Due to past land management practices and the catastrophic eruption of Mount St. Helens in 1980, many of these lotic habitats on National Forest System lands do not meet desired conditions (USDA 1995, USDA 1996, USDA 1997, and USDA 1998).

Gifford Pinchot National Forest Tributaries

Aquatic habitat and fishery data located in the files were summarized for the listed streams (USDA Forest Service Tributary Summary 2002). Two important physical characteristics found to be generally below standards were large wood per mile and Pools per mile. Stream surveys are generally conducted during summer low flow conditions.

Much of the reported water temperature data was collected by various methods and should not be considered anything more than cursory water temperature data. However, reported within several of the summaries are water temperature data collected more recently using standardized methods, which included using state-of-the-art water temperature data loggers. Water temperature data collection typically begins in late May to early June and runs through late September to early October.

Chickoon Creek is a 3rd order stream entering the Lewis River just below Lower Falls (Figure 1). It was most recently surveyed in 1989 from river mile (RM) 0.0 to 0.7. The average gradient of the stream is 11percent with an average wetted width of 13 feet. Measured substrate composition was generally boulder, rubble, and large boulder. The

mean temperature at the time of the survey was 15°C, which is just under Washington State's water quality temperature standard of 16°C (USDA Forest Service, 1985). Pools averaged 48 per mile, compared to the desired future condition (DFC) of 83 pools per mile (CRBPIG). Large Wood (LW) averaged 43 pieces per mile, compared to the CRBPIG's standard of 80 pieces per mile. There is a 60 foot waterfall at the end of reach one, which blocks fish migration to the upper reaches. Fourteen unknown salmonids (*Oncorhynchus spp*.) were counted in the first reach.

Crab Creek is a 2nd order stream last surveyed in 1989 from RM 0.0 to 0.38. The average gradient of the stream is 5percent with an average wetted width of 14 feet. Measured substrate composition is mostly large boulder and bedrock. The mean temperature was 9.75°C. Pools averaged out to 22.5 per mile and LW was reported at moderate levels. Fish were not sighted, as both reaches of the surveyed section were reported too steep for fish passage. However, there were unidentified fish present near the confluence with the Lewis River.

Cussed Hollow Creek is a 2nd order stream surveyed in 1989 from RM 0.0 to 3.5. The average gradient of the stream is 8percent with an average wetted width of 20 feet. Measured substrate composition consists mostly of boulder, large boulder, and bedrock. The mean temperature was 8°C. Pools averaged out to 22 per mile and LW was 66 pieces per mile. There are eight different waterfalls in reaches one, two, and three blocking fish migration. Fish were not observed in the 1989 survey, however in 1984, Cussed Hollow Creek was electrofished and eight (8) trout (one rainbow trout, *Oncorhynchus mykiss*, and seven unknown salmonids) were present (Mount St. Helens stream survey files).

Spencer Creek is a 2nd order stream surveyed in 1984 from RM 0.0 to 0.7. The average gradient of the stream is 8 percent with an average wetted width of 9 feet. Measured substrate composition is generally cobble and boulder. The mean temperature was 16°C. Pool data was not available and LW was stated as low. There are 3 waterfalls in reach two, one of which is 4′, and considered to be fish-passable during higher water flows. Twenty eight (28) cutthroat trout and rainbow trout were shocked and 101 unknown trout were sighted while surveying, all in the first reach (MSH stream survey files).

Big Creek is a 1st order stream surveyed in 1989 from RM 0.0 to 0.1. The average gradient of the stream is 11 percent with an average wetted width of 27 feet. Measured substrate composition is mainly rubble and boulder. The mean temperature was 11°C. Pools averaged out to 22 per mile and LW was 33 pieces per mile. Big Creek is divided into a main channel and a side channel, both of which have waterfalls that are fish migration barriers. Many falls are reported beyond the first barriers. Fish were not sighted in the measured reach, although unknown trout were seen above the first falls.

Little Creek is a 2nd order stream last surveyed in 1990 from RM 0.0 to 0.7. The average gradient of the stream is 10 percent with an average wetted width of 11 feet. Measured substrate is very deep sand and silt deposition (2 to 3 feet deep). The mean temperature was 8°C. Pools accounted for about 50 percent of the site surveyed and LW was figured at a mere 34 pieces per mile. A migration barrier was reported (appearing as a chute or cascade), and fish were not observed.

Rush Creek is a 4th order stream surveyed in 1994 from RM 0.0 to 1.7. The average gradient of the stream is 8 percent and the average wetted width was not recorded. Measured substrate composition is generally gravel, cobble, and bedrock. The mean temperature was 9°C. Pools were calculated at 28 per mile, and LW averaged 51 pieces per mile. There is a 70′ waterfall at river mile 1.7 which functions as an upstream migration barrier to all fish species. Brook trout were reportedly stocked above the falls (MSH stream survey files, 1994).

Meadow Creek is a 1st order stream surveyed in August of 1996, just a few months after a massive flood, from RM 0.8 to 4.5. It is a tributary of Rush Creek with an 8 percent gradient with an average wetted width of 17.5 feet. Measured substrate composition is mostly small boulder and fines (sand and mud). The mean temperature was not recorded. Pools per mile were not reported, although LW was figured at 30 pieces per mile. There was no mention of fish migration barriers, or of any fish sighted.

Curly Creek is a 3rd order stream surveyed in 1989 from RM 0.0 to 4.8. The average gradient of the stream is 5 percent with an average wetted width of 23 feet. Measured substrate composition is generally cobble, rubble, and boulder. The mean temperature was 9°C. Pools were calculated at 47 percent of the surveyed habitat and LW was measured at 79 pieces per mile. There are 15 waterfalls constituting fish barriers throughout the surveyed sections of Curly Creek. In addition to other smaller falls, a 100′ falls is located in reach one and falls were also reported in reaches 6-10, 12, and 14. Unknown trout were sighted in reaches four, six, and nine.

North Fork Curly Creek is 1st order stream surveyed in 1989 from RM 0.0 to 0.3. The average gradient of the stream is 3 percent and the average wetted width was not available. Measured substrate composition is mostly sand, cobble, and large boulder. The mean temperature was 14°C. Pools were figured at 65 percent and LW was reported as being present in low amounts. There aren't any fish migration barriers and brook trout were sighted in reach two.

South Fork Curly Creek is a 2nd order stream surveyed in 1989 from RM 0.0 to 2.0. The average gradient of the stream is 3 percent with an average wetted width of 14 feet. Measured substrate composition is generally sand and mud. The mean temperature was 6°C. Pools accounted for 29 percent of the stream, while LW was again reported as low. There is a beaver pond in reach six that is reported as a fish barrier. Unknown trout were sighted in reaches two and five.

Outlaw Creek is a 1st order stream surveyed in 1985 from RM 0.0 to 1.6. It is also a tributary of Curly Creek (Figure 1). The average gradient of the stream is 5 percent with an average wetted width of 16.7 feet. Measured substrate composition consists mostly of boulder, sand, cobble, and bedrock. The mean temperature was 4.5°C. Pools were figured to be 39 percent of the stream, and LW was summarized as moderate. There is a 10′ chute located in reach four, said to be a migration barrier. Fish were not observed in Outlaw Creek.

Hardtime Creek also joins Curly Creek and is a 3rd order stream surveyed in 1988 from RM 0.0 to 3.4. The average gradient of the stream is 3 percent with an average wetted

width of 11.5 feet. Measured substrate composition is generally gravel, cobble, and rubble. The mean temperature was 9°C. Pools constituted 43 percent of the stream and LW was reported as moderate. There are subterranean flows, and a bed slide that act as migration barriers in reaches seven, eight, and nine, as well as several LW jams. An abundance of unknown trout was sighted throughout the stream in reaches one, two, five, six, seven and eight.

Miller Creek is a 1st order stream surveyed in 1988 from RM 0.0 to 3.0. The average gradient of the stream is 7 percent with and average wetted width of 10.8 feet. Measured substrate composition is mostly rubble, boulder, and cobble. The mean temperature was 13°C. Pool information was not recorded, and the LW appeared to be moderate. There are numerous woody debris jams throughout the surveyed section, however, there was no indication of fish nor fish barriers.

Pepper Creek is a 1st order stream last surveyed in 1989 from RM 0.0 to 2.5. The average gradient of the stream is 4 percent with an average wetted width of 7.5 feet. Measured substrate composition is made up of gravel, cobble, rubble, and bedrock. The mean temperature was 11°C. Pools constituted 13 percent of the stream, although LW numbers were at 84 pieces per mile. There is a waterfall barrier in reach one that may be passable by fish during high flows. There are several sarge wood jams throughout the stream. Cutthroat trout were found in all reaches.

Muddy River, a 5th order stream, was surveyed in 1995 from RM 0.0 to 13.8. The average gradient of the river is 2 percent with an average wetted width of 37.5 feet. Measured substrate composition consists mainly of cobble. The mean temperature was 12.2°C. However, the highest temperature recorded was 18.8°C. Water temperature data collected from 15 June through 15 September 2000, provided the following information on two mainstem sites. Above the Clear Creek confluence, the maximum temperature recorded was 20.1°C, with a maximum seven-day average of 20.1°C. Below the Clear Creek confluence, the maximum daily temperature was 21.5°C, with a maximum seven-day average of 21.5°C. Muddy River's pools per mile and LW per mile are at 6 and 7, respectively. There are no recorded fish migration barriers. Rainbow trout, mountain whitefish, unknown suckers (*Catostomus spp*.), and unknown sculpins (*Cottus spp*.) were all found in the lower 6.2 miles.

Clear Creek is a 3rd order stream most recently surveyed in 1997 from RM 0.0 to 14.6. It enters the Muddy River at RM 4.7 (Figure 1). The average gradient of the stream is 4 percent with an average wetted width of 37.5 feet. Measured substrate composition is generally gravel, cobble, and bedrock. The mean temperature was 11.5°C. Water temperature data collected from 15 June through 15 September 2000, yielded the following information from one site. The site, near the confluence with the Muddy River, had a maximum daily temperature of 17.9°C, with a seven-day average of 17.7°C. Pools were calculated at 13 per mile and LW averaged out to 50 pieces per mile. There are waterfalls and woody debris jams throughout the surveyed stream, however, cutthroat and rainbow trout were present up until reach seven, where there is a very high waterfall.

Wright Creek is a 2nd order stream surveyed in 1988 from RM 0.0 to 2.5. It is a tributary of Clear Creek (Figure 1). The average gradient of the stream is 6 percent with an average

wetted width of 9.8 feet. Measured substrate composition is mostly cobble, rubble and bedrock. The mean temperature was 9.6°C. Pools comprised 33 percent of the stream, while LW was ranked at moderate-to-low. Several waterfalls are located throughout the four reaches, acting as fish barriers. Nonetheless, unknown trout were sighted in all reaches.

Elk Creek is a 2nd order stream surveyed in 1988 from RM 0.0 to 4.1. It is also a tributary of Clear Creek (Figure 1). The average gradient of the stream is 6 percent with an average wetted width of 22 feet. Measured substrate composition consists mainly of rubble, bedrock, and boulder. The mean temperature was 11.5°C. Pools accounted for 20 percent, and LW was again, moderate-to-low. There are several waterfalls in each of the nine reaches, excluding reaches six and seven. Reaches two and three contained Eastern brook trout.

Hungry Creek is a 1st order stream surveyed in 1988 from RM 0.0 to 2.1. This creek is a tributary of Elk Creek (Figure 1). The average gradient of the stream is 6 percent with an average wetted width of 10.2 feet. Measured substrate composition is mostly bedrock. The mean temperature was not recorded. Pools were calculated at a low 19 percent and LW was figured to be at moderate rates. All five reaches surveyed have numerous waterfalls, some of which are migration barriers. Fish were not sighted in Hungry Creek.

Bean Creek is a 2nd order stream surveyed in 1983 from RM 0.0 to 6.3. Bean Creek is a tributary of Clearwater Creek (Figure 1). The average gradient of the stream is 7 percent with an average wetted width of 18.6 feet. Measured substrate composition is generally cobble and gravel. The mean temperature was 15.1°C. Pools are quite low and LW was at the opposite end, recorded as high. Chutes and waterfalls accounted for the thirteen fish migration barriers beginning at RM 0.7. Fish were not observed in Bean Creek.

Clearwater Creek, a tributary of Muddy River, water temperature data collected from 15 June through 15 September 2000, provided the following information from one site. Water temperature data was collected at a site eight (8) miles above the confluence with the Muddy River. That site had a maximum daily water temperature of 18.4°C, with a maximum seven-day average of 18.1°C.

Smith Creek is a 4th order stream most recently surveyed in 1998 from RM 0.0 to 5.7. It is a tributary of the Muddy River (Figure 1). The average gradient of the stream is 2 percent with an average *bankfull* width of 19.8 feet (average wetted width not recorded). Measured substrate composition consists mainly of fines and gravel. The mean temperature was 19.1°C. Pools were calculated at 22 per mile, and LW was measured at 20 pieces per mile. There was no indication of any fish barriers. Cutthroat trout, rainbow trout, unknown dace (*Rhinichthys spp*.), unknown suckers, and unknown sculpin were present in all reaches.

Ape Canyon Creek is a 1st order stream surveyed in 1983 from RM 0.0 to 3.6. It is a tributary of Smith Creek (Figure 1). The average gradient of the stream is 6 percent with an average wetted width of 8.3 feet. Measured substrate composition is generally cobble and bedrock. The mean temperature was 14.3°C. Pools and LW counts were both reported as low. Waterfalls, chutes and cascades act as fish barriers between RM 1.0 and

2.6. Above RM 2.6 there was not enough flow for fish passage. Cutthroat trout were present in reach one.

Pine Creek is a 3rd order stream last surveyed in 1994 from RM 0.0 to 8.0. The average gradient of the stream is 4 percent with an average wetted width of 27.5 feet. Measured substrate composition is mostly cobble and small boulder. The mean temperature was 9.2°C. Pools accounted for 13.8 per mile while LW was at 8.6 pieces per mile. Brook trout, bull trout, rainbow trout, brown trout (*Salmo trutta*), and mountain whitefish were all present in reach one, and there is no indication of any migration barriers.

Drift Creek and Siouxon Creek are both located below the pool tail out of Swift Reservoir, tributary to Swift Reservoir and Yale Lake, respectively (Figure 1).

Drift Creek is a 3rd order stream surveyed in 1995 from RM 0.0 to 1.34. It flows into Swift Reservoir from the south (Figure 1). The average gradient of the stream is 3.5 percent with an average wetted width of 26.6 feet. Measured substrate composition consists mainly of gravel and cobble. The mean temperature was 11.7°C. Drift Creek's pool ratio is reported as 41.59 per mile, while LW was figured to be 14.4 pieces per mile. There is no indication of any fish barriers. Rainbow trout, cutthroat trout, and brook trout were found in all reaches, while largescale suckers (*Catostomus macrocheilus*) and unknown sculpin were present only in reach two. Siouxon Creek is a 4th order stream surveyed in 1989 from RM 6.0 to 12.98. It enters Yale Lake from the east (Figure 1). The average gradient of the stream is 3 percent with an average wetted width of 31.9 feet. Measured substrate composition is generally small boulder, cobble, and bedrock. The mean temperature was 10°C. Pools per mile were calculated at 34 percent and LW was reported as low. There are several barriers (mostly waterfalls) between reach seven and the end of the survey (reach eleven), however, in reaches three, six, and seven, rainbow trout were identified; fish in other reaches were unidentified.

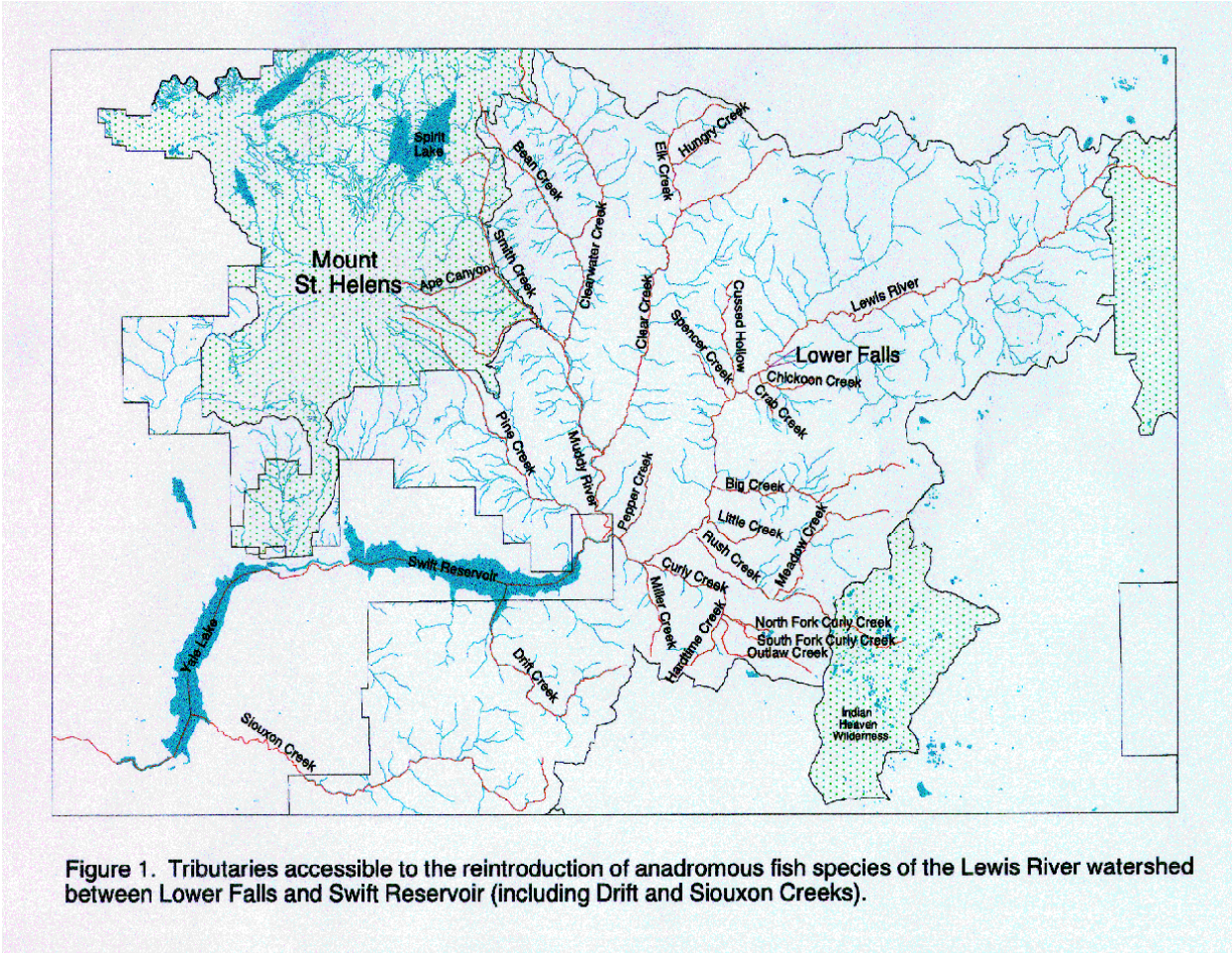

Figure 1. Tributaries accessible to the reintroduction of anadromous fish species of the Lewis River watershed between Lower Falls and Swift Reservoir (including Drift and Siouxon Creeks).

Aquatic Habitat Productivity

Due to the loss of productive riverine habitats, the production capability of existing aquatic habitats in the Lewis River Basin has been substantially reduced. The capacity for natural fish production within the basin was greatly reduced compared to pre-project conditions. This not only affects the natural production capability for anadromous fish, but also resident or fluvial fishes as well that depend on riverine habitats. This reduction in natural fish production capability will continue as the four hydroelectric projects presently exist and operate on the landscape. Elimination of anadromous fish from the upper basin subsequently eliminated the transfer of marine derived nutrients to the aquatic, riparian and upland habitats, thereby affecting the overall biological productivity of the aquatic system (Cederholm et al. 2000).

Furthermore, aquatic habitat production capability is further reduced due to degradation of remaining aquatic habitats from operations of the four hydroelectric projects. This is caused by:

1) flooding 50 miles of relatively low gradient mainstem habitat and the adjacent riparian habitat;
2) blocking access to approximately 100 miles of anadromous fish habitat in the upper Lewis Basin;
3) disruption of sediment and large wood movement through the system; and

4) the project's role in disconnecting the lower river from its floodplain.

These cumulative losses in aquatic habitat production capability have not been quantified. The relationship between aquatic habitat availability and condition to fish species viability or recovery have not been examined for the Lewis River Basin. The Lewis River's Hydroelectric complexes' share of aquatic habitat losses in the basin and consequent affect on fish species declines needs to be assessed for development of equitable protection, mitigation, and enhancement measures.

IV. Preliminary Forest Service Objectives

Restoration and (or) mitigation of habitat that is inundated, altered, or made *inaccessible* due to the continued effects of the project operation. This would be accomplished by establishing an aquatic habitat protection, mitigation and enhancement fund to be used to implement aquatic habitat protection, improvement and enhancement projects throughout the basin to mitigate for the continued loss of natural fish production for the terms of the renewed licenses. Specific improvements and enhancements would be prioritized throughout the basin, including lower river tributaries such as Cedar Creek and the East Fork Lewis River and its tributaries. A post settlement agreement Aquatics Team would be established (from the aquatics resource group) that would evaluate all aquatic habitat projects on their merits for funding and implementation. Funds may be used for, but not limited to:

1) land acquisitions to ensure long term aquatic habitat protection,
2) rehabilitation projects to improve or enhance aquatic habitat conditions,
3) removal of road-related, fish passage barriers,
4) riparian or upslope improvements,
5) mitigation for the continued loss of inundated aquatic habitat through the identification and implementation of aquatic habitat enhancement projects and
6) monitoring and evaluation of project implementation and effectiveness.

V. Information Needs

The licensees have developed a few pertinent study proposals to address aquatic habitat conditions and productivity. These proposals were presented to the participants in the collaborative relicensing process for their review and input in October 1999 (PacifiCorp and Cowlitz PUD 1999b). Those study proposals presented that are pertinent include:

- AQU 2 Swift Bypass Reach Instream Flow Study
- AQU 3 Merwin Dam Ramping Rate Study
- AQU 4 Anadromous Fish Habitat Inventory
- WTS 3 Sediment Budget Study
- WTS 4 Stream Gravel and Large Woody Debris Study

The AQU 4 Anadromous Fish Habitat Inventory Study Proposal examines only the upper limits of anadromy upstream of Merwin Dam, and does not assess habitat quality nor the amount of habitat lost due to the continued inundation of the Lewis River. The WTS 3 Sediment Budget Study Proposal will provide minimal results for assessing the

hydroelectric projects' effects on sediment routing and spawning gravel availability. Finally, the WTS 4 Stream Gravel and Large Woody Debris Study Proposal is limited in scope and extent, and it is likely to produce minimal results to assess the hydroelectric projects' effects on aquatic habitat conditions. As a result of these study proposal inadequacies and omissions, the following studies were proposed in the August 2000 Aquatic Habitat Condition and Productivity EIA:

1. **Evaluation of Direct Aquatic Habitat Losses** – an evaluation of the direct aquatic habitat losses will be required to quantify the amount of lotic habitat lost due to continued inundation and dewatering. This will entail quantifying the amount of riverine habitat available prior to the construction of Merwin Dam in 1932. The existing production capability of this habitat loss must also be determined in order to develop equitable mitigation and enhancement measures for this continued loss of natural fish production.

   Current situation relative to this proposal – based upon the information presented in the Technical Reports (2000 and 2001) an evaluation of historical aquatic habitat loss was limited to linear measurements, which were developed into areas of aquatic habitat. These areas were not defined in terms of habitat units or quality of habitat.

2. **Evaluation of Aquatic Habitat Conditions Downstream of Project Facilities** – an evaluation of aquatic habitat conditions downstream of project facilities is necessary to determine the continued effects of project operations. This should include loss of floodplain areas and changes in channel forming processes.

   Current situation relative to this proposal – WTS-3 (Stream Channel Morphology and Aquatic Habitat Study), AQU-4 (Potential Anadromous Habitat Upstream of Merwin Dam), and AQU-13 (Salmon Behavior and Habitat Selection in the Upper Watershed) attempted to assess several factors relative to aquatic habitat. The Forest Service has provided comment on these Technical Report studies. After review of the 2001 Technical Report, we have concluded that, although much data was collected and it does serve a limited purpose, the data collection and analysis was insufficient to draw any conclusions relative to quality of accessible anadromous aquatic habitat. Furthermore, the data was insufficient to support conducting an Ecological Diagnostics and Treatment assessment, which would support drafting of a Basin-wide Fish Plan.

   We did not locate any real discussion of floodplain loss or changes in channel forming processes. There was limited reference to floodplains and wetlands and no discussion of their value in WTS-4's "Summary of In-stream Flow" section. WTS-3 incorrectly states, "…that the projects have had little influence on channel position…", and, "…continued operation…does not appear to have had any major effects on river morphology."

3. **Evaluation of Aquatic Habitat Conditions Throughout the Lewis River Basin** – a basin-wide evaluation of aquatic habitat conditions is necessary to prioritize aquatic habitat improvement and enhancement opportunities to mitigate for aquatic habitat losses. These evaluations would also be conducted in tributaries downstream of Merwin Dam, such as Cedar Creek and the East Fork Lewis River and its tributaries,

in an effort to determine priority habitat improvement and enhancement projects to mitigate for the continued loss of aquatic habitat and productivity. Existing Forest Service stream habitat survey information may be utilized as appropriate. Stream habitat information was summarized and provided, by the Forest Service, to the licensees.

Current situation relative to this proposal – based upon information presented in the Technical Reports (2000 and 2001) the level of aquatic habitat evaluation was minimal and it reflected a limited understanding of the available aquatic habitat accessible to an assemblage of reintroduced fish species. In 2002, the USDA Forest Service summarized all tributary aquatic habitat survey data into a report for submission to the Aquatics Resource Group (USDA Forest Service 2002).

4. **Evaluation of In-stream Flows** – see In-Stream Flow EIA.

   Current situation relative to this proposal – AQU 2 addressed various physical questions relative to flow conditions and habitat within the Swift Bypass Reach. Four flows (50, 100, 200, 400 cfs) were modeled. Bull trout habitat and fish passage will drive most decisions relative to some form of restoration within this reach of the Lewis River. Historically, low flows were in the 500-600 cfs range. However, according to the 2001 Technical Report (PacifiCorp and Public Utility District #1 of Cowlitz County 2002), the ARG decided to use a range of flows below the historical low flow level.

5. **Evaluation of Ramping Rates at Project Facilities** – see In-Stream Flow EIA.

   Current situation relative to this proposal – Deferred to the Regulatory Agencies

6. **Evaluation of Spawning Gravel Availability and Quality** – see Sediment EIA

   Current situation relative to this proposal – spawning gravels were located within the Swift Bypass Reach (WTS 3). They appear to be very limited in terms of quantity and distribution within the reach. Surveys indicated that the majority of spawning gravels are located downstream of Ole Creek. Even though historical low flows were in the 500-600 cfs range, WTS 3 states, "modeling at the 3 riffle transects indicate that transport of gravel-sized particles…would be initiated at flows of approximately 500 cfs." Further analysis and discussion of this interpretation of the transect data seems warranted. How does this data fit with the PHABSIM study?

VI. References

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