

EXPLANATORY STATEMENT
for the
SETTLEMENT AGREEMENT
AMONG
PACIFICORP
USDA FOREST SERVICE
NATIONAL MARINE FISHERIES SERVICE
USDI FISH AND WILDLIFE SERVICE
USDI BUREAU OF LAND MANAGEMENT
OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
OREGON DEPARTMENT OF FISH AND WILDLIFE
OREGON WATER RESOURCES DEPARTMENT

June 21, 2001

CONCERNING THE RELICENSING OF THE
NORTH UMPQUA HYDROELECTRIC PROJECT
FERC PROJECT NO. 1927-008
DOUGLAS COUNTY
OREGON

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
2. BACKGROUND	2
2.1 The Project	2
2.2 Settlement Discussions	3
2.3 Ecosystem and Resources	4
3. MANAGEMENT GOALS AND OBJECTIVES	7
4. TIMING, COORDINATION, AND LICENSE TERM	9
4.1 Timing of Measures (Settlement Agreement Section 2.4, Appendix A)	9
4.2 Coordination and Decision Making (Settlement Agreement Section 21)	9
4.3 License Term (Settlement Agreement Sections 1.5, 22.5)	10
5. DESCRIPTION OF AND RATIONALE FOR PROTECTION, MITIGATION, AND ENHANCEMENT MEASURES	10
5.1 Fish Passage Measures (Settlement Agreement Section 4)	10
5.2 In-Stream Flows (Settlement Agreement Section 5)	13
5.3 Ramping (Settlement Agreement Section 6)	17
5.4 Restoration of Fluvial Geomorphic Processes (Settlement Agreement Section 7)	21
5.5 Main-Stem North Umpqua Anadromous Fish Spawning Habitat Enhancement (Settlement Agreement Section 8)	23
5.6 Reservoir and Forebay Management and Mitigation (Settlement Agreement Section 9)	25
5.7 Aquatic, Riparian, and Terrestrial Connectivity (Settlement Agreement Sections 10, 11)	26
5.8 Enhancement of Wetland Species Diversity and Still-Water Amphibian Habitats (Settlement Agreement Section 11.5)	29
5.9 Vegetation Management (Settlement Agreement Section 12)	30
5.10 Avian Protection (Settlement Agreement Section 13)	31
5.11 Erosion and Sediment Control (Settlement Agreement Section 14)	32
5.12 Transportation Management (Settlement Agreement Section 15)	33
5.13 Aesthetics (Settlement Agreement Section 16)	35
5.14 Recreation (Settlement Agreement Section 17)	35
5.15 Cultural Resources (Settlement Agreement Section 18)	37
5.16 Mitigation Funds (Settlement Agreement Section 19)	38
6. LITERATURE CITED	40
7. LIST OF ACRONYMS	43

**EXPLANATORY STATEMENT FOR THE
NORTH UMPQUA HYDROELECTRIC PROJECT SETTLEMENT AGREEMENT**
FERC Project No. 1927-008

1. INTRODUCTION

Pursuant to the Federal Energy Regulatory Commission's ("FERC") regulations at 18 C.F.R. § 385.602, PacifiCorp ("PacifiCorp" or "Licensee") is submitting this separate Explanatory Statement, which describes the hydroelectric project, settlement discussions, responsibilities of PacifiCorp and the agencies, and the rationale behind agreed-upon terms in the Settlement Agreement. This statement is provided in addition to other supporting materials, including the North Umpqua Cooperative Watershed Analysis Synthesis Report, which have been or will be submitted into the FERC relicensing record.

In 1995, PacifiCorp filed with FERC an application for a new license (the "New License") for the North Umpqua Hydroelectric Project, also known as FERC Project No. 1927-008 (the "Project"). After lengthy discussions between PacifiCorp, state and federal agencies, and various nongovernmental organizations, PacifiCorp is submitting an Offer of Settlement describing the terms under which PacifiCorp and the agencies will support FERC's issuance of the New License. The Offer of Settlement includes a Settlement Agreement dated June 13, 2001, among PacifiCorp, an Oregon corporation; USDA Forest Service ("USDA-FS"); USDI Fish and Wildlife Service ("USFWS"); USDI Bureau of Land Management ("BLM"); National Marine Fisheries Service ("NMFS"); Oregon Department of Environmental Quality ("ODEQ"); Oregon Department of Fish and Wildlife ("ODFW"); and Oregon Water Resources Department ("OWRD"), referred to collectively as the "Parties." Parties other than PacifiCorp are referred to collectively as the "Governmental Parties."

The purpose of this Explanatory Statement is to summarize the basis for the Settlement Agreement. Nothing in this Explanatory Statement is intended to modify the terms of the Settlement Agreement. The Parties to the Settlement Agreement intend to submit additional information to FERC concerning the measures contained in the Settlement Agreement during the relicensing and the National Environmental Policy Act (42 U.S.C. § 4321, et seq.) ("NEPA") processes. Further, the Governmental Parties intend to submit final terms, conditions, and prescriptions consistent with the Settlement Agreement.

The Parties to the Settlement Agreement submit that the Settlement Agreement is fair and reasonable and in the public interest within the meaning of FERC Rule 602, 18 C.F.R. § 385.602(g)(3), for the following reasons:

- (1) The Settlement Agreement contains specific measures that will substantially improve environmental conditions in the Umpqua River Watershed;

- (2) The Settlement Agreement provides that certain important resource protection measures will be implemented immediately, providing immediate benefit to fish and other natural resources;
- (3) The Settlement Agreement provides for various interests and waterway uses, including power production and natural resource values; and
- (4) The Settlement Agreement establishes a process for the Parties to collaborate to manage and enhance natural resources in the Umpqua River Watershed throughout the term of the New License.

For these reasons, the Parties request that FERC accept and incorporate, without material modification, as license articles in the New License all relevant provisions of the Settlement Agreement and the provisions of Governmental Parties' Final Terms and Conditions filed with FERC in connection with the Settlement Agreement.

2. BACKGROUND

2.1 The Project

The North Umpqua Hydroelectric Project is located in Douglas County, Oregon, approximately 60 miles east of Roseburg, near the headwaters of the North Umpqua River. Owned and operated by PacifiCorp, its facilities include eight hydroelectric developments constructed between 1947 and 1956 and comprising a total nameplate capacity of 185 megawatts. Each development typically consists of a dam, waterway, penstock, and powerhouse. The Project consists of 34.9 km (21.7 mi) of canals, 15.8 km (9.8 mi) of flumes, and 9.3 km (5.8 mi) of penstocks and tunnels, for a total waterway length of 60.0 km (37.3 mi). The Project also includes 189.2 km (117.5 mi) of electric transmission line. Three reservoirs—Soda Springs, Lemolo, and Toketee—and four forebays provide limited water storage. The Soda Springs development is operated to re-regulate downstream flows and reduce the effect of flow fluctuations resulting from peak power generation at the upstream developments.

The Project operates under FERC license number 1927-008 and is located primarily on lands administered by the USDA-FS and the BLM. All hydroelectric generation facilities are located on USDA-FS lands, as well as eastern portions of transmission lines 39 and 46. The remaining lines are located on private and BLM-administered lands.

Proposed Project lands cover approximately 1,234 ha (3,085 acres) and include dams, waterways, powerhouses, access roads, transmissions lines, and appurtenant facilities. The Project Boundary is proposed to include all existing and proposed new facilities. The boundary should include lands necessary for operation and maintenance of the Project as well as for such purposes as recreation, shoreline control, and protection of environmental resources. Roads used for the sole purpose of accessing Project facilities should be located

within the FERC Project Boundary. Roads that provide access beyond the Project facilities should not be located in the FERC Project Boundary. Revision of the Project Boundary will ensure that all appropriate protection, mitigation, and enhancement (“PM&E”) Measures contained in Sections 4 through 18 of the Settlement Agreement are enforceable by FERC under the New License.

2.2 Settlement Discussions

After completing the first and second stage consultation requirements of the FERC relicensing process and filing an application for the New License in 1995, PacifiCorp initiated a collaborative watershed analysis process to address and resolve specific resource concerns that emerged during relicensing. The settlement discussions were begun in 1997 and were ongoing through 1999 between PacifiCorp, state and federal agencies, and various nongovernmental organizations (“NGOs”). During these settlement discussions, the North Umpqua Resource Management Team was created, and it issued the “North Umpqua Cooperative Watershed Analysis Synthesis Report” (Stillwater Sciences 1998).

In June 2000, PacifiCorp; USDA-FS; BLM; USFWS; NMFS; the State of Oregon (“State”); ODEQ; ODFW; OWRD; the Douglas County Board of Commissioners; and NGOs American Rivers, Pacific Rivers Council, Oregon Trout, Water Watch of Oregon, Umpqua Watersheds, Umpqua Valley Audubon Society, Umpqua Fishermen’s Association, Oregon Natural Resources Council, and Steamboaters (collectively, the “Original Parties”) convened to discuss terms and conditions for the Project’s New License. The Original Parties signed an alternative dispute resolution (“ADR”) agreement in July 2000 with a goal of completing a settlement agreement by the end of September 2000. Although the Original Parties worked to reach a settlement agreement by that date, they were unable to do so.

The majority of the Original Parties felt that a great deal had been accomplished by their efforts up to that point and expressed a desire to continue working toward a settlement agreement. In October 2000, the remaining parties signed a second ADR agreement (“October 2000 ADR”) with a goal of completing an agreement in principle by December 15, 2000. The signatories to the October 2000 ADR were PacifiCorp, USDA-FS, USFWS, BLM, NMFS, the State, ODEQ, ODFW, and OWRD (collectively, the “Parties”).

On November 15, 2000, FERC issued a Notice of Application and Ready for Environmental Analysis requiring that all comments, recommendations, terms and conditions, and prescriptions for the Project be submitted to FERC by March 1, 2001. The Governmental Parties subsequently filed preliminary terms, conditions, prescriptions, and recommendations.

The Settlement Agreement was entered into on June 13, 2001, (the “Effective Date”) for the purpose of resolving all issues between the Parties related to the relicensing and ongoing operation of the Project. The measures contained in the Settlement Agreement represent the Parties’ preferred alternative to measures proposed in PacifiCorp’s 1995 application PacifiCorp’s 1995 application and February 2000 addendum. The Governmental Parties will

file revised terms, conditions, prescriptions, and recommendations consistent with the Settlement Agreement. The Parties intend that this Explanatory Statement, the Settlement Agreement, and the revised terms, conditions, prescriptions, and recommendations to supersede any inconsistent prior filings by the Parties in this proceeding. In the event the Settlement Agreement is rejected or materially altered by FERC or through subsequent litigation, the Parties will employ dispute resolution procedures contained in the Settlement Agreement and reserve their legal rights and authorities.

2.3 Ecosystem and Resources

2.3.1 Watershed setting

The North Umpqua River originates on the west slope of the central Cascade Range in southwest Oregon and drains about 3,400 square km (1,350 square mi) before it joins the South Umpqua River just west of Roseburg.

The North Umpqua Cooperative Watershed Analysis study area covers 2,566 square km (987 square mi or 632,218 acres). The study area extends from the headwaters of the North Umpqua River downstream through the Wild and Scenic River Reach, which terminates at the confluence of the North Umpqua River and Rock Creek and includes all tributary watersheds. Elevations in the study area range from 240 m (780 ft) near Idleyld Park to nearly 1,830 m (6,000 ft) at the headwaters of the North Umpqua River.

Throughout most of the study area, the North Umpqua River flows through a narrow canyon with steep bedrock steps and benches. The study area is characterized by a rich diversity of plants, wildlife, invertebrates, and fish in an area renowned for its natural beauty. About 90 percent of the study area is forested, with most of the hydroelectric project facilities located in western hemlock and mixed conifer forests.

2.3.2 Anadromous fish

Five native anadromous fish species commonly occur in the North Umpqua River basin. These are Chinook and coho salmon, steelhead, sea-run coastal cutthroat trout, and Pacific lamprey. The current populations of summer and winter steelhead and spring Chinook salmon are relatively large and stable. Though annual escapement has varied, and returns of wild fish since 1991 have generally been below average (with the exception of 1995 and 2000 for summer steelhead and 1995 for spring Chinook), there have been no strong declines since 1946. Conversely, populations of sea-run coastal cutthroat trout, coho salmon, and Pacific lamprey are currently in decline.

The species' different life history and habitat requirements likely influenced their declines. For example, spring Chinook and steelhead can utilize the North Umpqua River's higher-quality main-stem habitat for rearing. By rearing for long periods in these higher-quality freshwater habitats, juveniles may experience higher summer and overwinter survival and may

be able to emigrate to estuarine environments as larger smolts. In contrast, sea-run cutthroat trout and coho salmon depend more on spawning and rearing on tributaries, which have been degraded by land use practices. The Oregon Coast Evolutionarily Significant Unit (“ESU”) of coho salmon was listed as threatened under the Endangered Species Act (16 U.S.C. § 1531, *et seq.*) (“ESA”) on August 10, 1998. The ESU includes all naturally spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco. The Umpqua Basin ESU of the coastal cutthroat trout was listed by the NMFS as endangered in August 1996. Reassessment of the population resulted in a determination that the Umpqua River population is part of the Oregon Coast ESU and was therefore delisted in April 2000. The Oregon Coast ESUs for steelhead and cutthroat trout are designated as candidates for listing due to concerns over specific risk factors. Pacific lamprey populations, although not proposed for listing, have declined substantially in many Oregon rivers and the species is thought to be vulnerable to extinction in the North Umpqua basin. The USFWS has designated Pacific lamprey as a Species of Concern on its Notice of Review. Species of Concern were previously categorized as Category 2 Candidates, indicating that proposing to list as threatened or endangered may be appropriate.

Toketee Falls is the downstream-most natural barrier to anadromous fish migration in the main-stem North Umpqua River under historical conditions. This 85-foot waterfall is impassable to all species at all flows. Fish Creek is an important tributary to the North Umpqua downstream from Toketee Falls that was historically used by anadromous species and is part of the Project area. Passage on Fish Creek is impeded by a quarter-mile-long complex of falls and chutes up to 16 feet high. This feature is not considered to be a complete barrier to anadromous fish movement. Some species such as steelhead and lamprey may be able to pass the obstacle under some flow conditions. However, conclusive evidence regarding this obstacle’s effects on movement will not exist until anadromous species are reintroduced to Fish Creek.

2.3.3 Resident fish

There are several species of resident trout in the Project area’s impoundments (reservoirs and forebays) and stream reaches (including the main-stem North Umpqua River and tributaries upstream of and including Rock Creek). These include rainbow trout, coastal cutthroat trout, brook trout, and brown trout. Coastal cutthroat trout have been documented to occur only downstream of Soda Springs Dam under current conditions. Of these four species, only rainbow and coastal cutthroat trout were historically present in the basin and represent potentially native stocks. However, native trout may have interbred with out-of-basin hatchery rainbow and cutthroat trout stocks, as well as other potentially hybridizing trout species that have been introduced into the basin for many years. Rainbow trout introductions to the North Umpqua River system have been documented to have occurred as early as 1910. Hatchery rainbow trout were stocked using out-of-basin stocks in Toketee Lake from 1958 through 1976 and in Lemolo Reservoir from 1955 through 1972. The stocking of out-of-basin hatchery rainbow trout in the upper North Umpqua River ceased in the mid-1970s, except in Diamond Lake. ODFW has recently stocked out-of-basin rainbow trout in the Clearwater No. 2 forebay

and Lemolo Reservoir to supplement fisheries that do not currently meet ODFW fishery management goals.

The distribution of resident fish species in the basin may have been affected by volcanic events. In particular, the eruption of Mt. Mazama approximately 7,500 years ago may have temporarily extirpated fish in some reaches of the upper North Umpqua River basin. In that situation, barriers such as Toketee Falls could have restricted recolonization from downstream areas. This suggests that native trout and other fish were restricted in distribution to downstream of Toketee Falls under historical conditions and that resident trout currently existing upstream of this natural barrier may be descendants of hatchery fish or fish that survived the eruption. Rainbow trout in Fish Creek and in reaches of the main-stem North Umpqua River between Soda Springs Dam and Toketee Falls may be descendants of hatchery fish stocked in the basin or native resident trout that survived the eruption of Mt. Mazama. Native resident and migratory coastal cutthroat and rainbow trout exist in tributaries to the North Umpqua River downstream of Soda Springs Dam.

The construction of the Project's reservoirs and subsequent fisheries management have created lentic habitats that support a popular and productive trout fishery. Brown, rainbow, and brook trout occupy Project reservoirs and forebays, and there is a relatively small population of kokanee in Lemolo Lake. There are also trout in the Project's stream reaches. Tui chub are found in large numbers in Diamond Lake. Smaller numbers of tui chub are present in Lemolo Lake and other main-stem reservoirs downstream.

2.3.4 Wildlife

The Project area supports a wide variety of terrestrial species, including large ungulates such as elk and mule deer. There are also smaller mammals present such as American marten, fisher, long-tailed weasel, western red-backed vole, and red tree vole. Bald eagle (federally listed as threatened), peregrine falcon (Regional Forester's sensitive species), northern spotted owl (federally listed as threatened), and osprey are also present. The area also supports many amphibian and reptile species, including tailed frog, Pacific chorus frog, Pacific giant salamander, rough-skinned newt, and Cascades frog. The North Umpqua Cooperative Watershed Analysis (Stillwater Sciences 1998) and PacifiCorp's 1995 license application (PacifiCorp 1995) include a general description of the wildlife species and terrestrial resources issues in the North Umpqua River basin and a summary of existing conditions.

2.3.5 Recreation

The North Umpqua River and its tributaries offer opportunities for sport fishing, whitewater boating, hiking, camping, and other recreation. Many recreational opportunities, such as reservoir trout fishing and camping, were created by the hydroelectric project and are supported by PacifiCorp. Sport fisheries exist for steelhead, spring Chinook salmon, and hatchery coho salmon downstream of Soda Springs Dam and for trout upstream of the dam. The North Umpqua River between Rock Creek and the Soda Springs Powerhouse is a world-

renowned fly-fishing reach for summer steelhead. The Diamond Lake resort area has been popular for trout fishing since the 1920s, when rainbow trout were stocked in this previously fishless lake.

Recreational sites in the Project vicinity include Lemolo Lake, Stump Lake, Clearwater River corridor, Toketee Lake, Lemolo No. 2 forebay, and Soda Springs Reservoir. Angling (boat and bank) is a popular activity in the Lemolo and Toketee areas, particularly with local residents. Camping is also popular in all areas because of the number of existing lake-edge or river-edge campgrounds, good access, and the general remoteness from surrounding communities. Other popular activities include sightseeing, hiking, biking, boating, waterskiing, hunting, swimming, sunbathing, nature observation, and snow-related activities. Recreation activities are more limited at Soda Springs reservoir due to steep canyon walls and limited access. The segment of the North Umpqua River from Soda Springs Powerhouse downstream to Swiftwater Park and Rock Creek contains USDA-FS and BLM campgrounds and day-use areas, whitewater boater put-ins and take-outs, and the North Umpqua Trail, which parallels the river (PacifiCorp 1995).

Activities expected to increase in demand by more than 5 percent annually in the region include day and overnight hiking, bicycling, swimming, sightseeing, boat angling, nonmotorized boating, nature study/observation, camping (RV and tent), and visiting information centers. As a result, the facilities in greatest demand are trails, nonmotorized boating facilities (river and lake), interpretive facilities, and campsites (RV and tent) (PacifiCorp 1995).

3. MANAGEMENT GOALS AND OBJECTIVES

The North Umpqua Cooperative Watershed Analysis provided a collaborative process to resolve resource issues within an objective scientific framework. The analysis was conducted by the North Umpqua Cooperative Watershed Analysis Science Team (“Science Team”) that included PacifiCorp, state and federal resource agencies, conservation groups, academic institutions, independent scientists, and interested members of the public. The Science Team provided watershed analysis study results to the Parties for the purpose of determining appropriate measures for incorporation in the Settlement Agreement.

The overall objective of the Parties in drafting the Settlement Agreement was to develop measures for the protection of ecological resources affected by the Project while providing for other beneficial uses, including hydroelectric power generation and recreation, in support of the New License for the Project. As a platform for their decision making, the Parties adopted the following management goals derived from the North Umpqua Cooperative Watershed Analysis. The Parties believe that the PM&E Measures contained in the Settlement Agreement, together with the final prescriptions, recommendations, conditions, and certifications of the Governmental Parties, will fully satisfy these management goals.

- (1) *Fluvial Geomorphic Processes*
Maintain and/or restore the geomorphic processes characteristic of the watershed under reference conditions in order to maintain habitat for native species and promote the long-term ecological health of the North Umpqua River watershed. These objectives reflect the guidelines of the ACS of the NFP.
- (2) *Aquatic and Riparian Habitat Connectivity*
Maintain ecological processes and habitat in condition sufficient to support interconnected and well-distributed populations of native species in the North Umpqua River watershed. This goal includes maintaining and/or restoring aquatic and riparian connectivity across the landscape on lands under the jurisdiction of the NFP.
- (3) *In-Stream Flows*
Maintain and/or restore flows that sustain well-connected and functional riparian and aquatic habitats to which the native aquatic and riparian community are adapted.
- (4) *Reservoir and Forebay Management*
Maintain and/or restore aquatic habitat to support productive recreational trout fisheries. Maintain a catch rate of 0.5 trout per angler-hour in Lemolo Lake (ODFW 1980). For stillwater amphibians, create an environment that supports healthy populations in Project reservoirs and forebays or, if this is infeasible, in other areas of the watershed.
- (5) *Water Quality*
Manage the hydroelectric facilities in a manner that maintains and/or improves water quality in the watershed, meet water quality standards and antidegradation requirements, and protect beneficial uses. These goals are also integral to meeting the water quality objectives defined in the ACS of the NFP. The relevant goal, as stated in the ACS (USDA Forest Service and USDI Bureau of Land Management 1994), is to “maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.”
- (6) *Anadromous Fish Passage and Off-Site Mitigation*
Maintain and/or restore native anadromous fish populations.

- (7) *Terrestrial Habitat Connectivity and Wildlife Entrapment*
Maintain terrestrial habitat connectivity so that movement, dispersal, migration, and interbreeding among subpopulations of all terrestrial wildlife species can occur. Create a waterway system that has insignificant effects on populations of wildlife species in the Project vicinity and that minimizes wildlife entrapment-related injury and mortality of individuals.

4. TIMING, COORDINATION, AND LICENSE TERM

4.1 Timing of Measures (Settlement Agreement Section 2.4, Appendix A)

A significant benefit provided by the Settlement Agreement is increased certainty concerning the timing and implementation of resource protection and enhancement measures. The Parties have negotiated a comprehensive schedule for implementing the PM&E Measures contained in the Settlement Agreement. The Parties' intent in developing this schedule is to ensure that beneficial measures are implemented in a timely way, recognizing the potential delays often encountered in the relicensing process. Such a schedule likewise enables PacifiCorp to better plan and coordinate its future capital expenditures and to implement measures in a manner that will minimize disturbance to sensitive areas.

The Parties have agreed to implement a suite of environmental PM&E measures before the New License issued by FERC becomes final. Such measures include (1) reduction in flow fluctuations below Soda Springs Dam to reduce the likelihood of fish stranding events; (2) initiation of an enhancement fund to permit various enhancement projects discussed below to be implemented; and (3) implementation of in-stream flow increases and restoration of spawning habitats to benefit salmonids and other aquatic organisms. Such early implementation measures provide significant resource benefits that would not otherwise occur without settlement. These early implementation measures are an important factor in the Parties' determination that the Settlement Agreement is fair and reasonable and in the public interest.

4.2 Coordination and Decision Making (Settlement Agreement Section 21)

The Settlement Agreement designates a Resource Coordination Committee ("RCC") and a Resource Coordination Plan ("RCP"). The goal of the RCP is to facilitate efficient and economical Project operation, maintenance, and construction activities, while protecting natural and cultural resources in the Project vicinity, particularly those on public lands. The RCP establishes a process for information exchange and coordination of efforts in the implementation of New License conditions, ongoing operations, and maintenance activities across the Project. The Parties' will appoint members to the RCC within 60 days of the Effective Date of the Settlement Agreement.

The RCC and RCP will improve protection of ecological, cultural, aesthetic, and recreational resources by ensuring that there is a high level of communication and coordination among

resource agencies and PacifiCorp prior to implementation of management actions. Implementation of an RCC will likewise ensure that collaborative processes and relationships developed during the settlement process will be maintained and continued, thus fostering an atmosphere of cooperation that will speed implementation of the Settlement Agreement and ensure its efficacy.

4.3 License Term (Settlement Agreement Sections 1.5, 22.5)

After considerable discussion and negotiation, the Parties agreed to recommend that FERC adopt a 35-year license term in the New License. In doing so, the Parties likewise agreed to establish an interim “check-in” date, to permit the Governmental Parties to evaluate if modifications to the Project are warranted in light of new legal or management plan requirements. This “check-in” is in addition to license reopeners that may be available in accordance with Section 22.5.1 of the Settlement Agreement. The Parties believe that the recommended license term, coupled with the recommended “check-in” process, balances PacifiCorp’s need to recover its investment in the Project with the desire to ensure that Project operations conform with applicable laws and regulations.

5. DESCRIPTION OF AND RATIONALE FOR PROTECTION, MITIGATION, AND ENHANCEMENT MEASURES

5.1 Fish Passage Measures (Settlement Agreement Section 4)

Fish passage measures address the issue of restoring anadromous fish access to historically accessible spawning and rearing habitat. The goal for fish passage is to restore, maintain, and/or enhance native anadromous and resident fish populations, including summer and winter steelhead, spring Chinook salmon, coho salmon, sea-run cutthroat trout, Pacific lamprey, and rainbow trout.

All fish passage measures in the Settlement Agreement incorporate the following elements:

- Fish passage facilities will have undergone engineering and technical feasibility review.
- Fish passage measures will be coordinated with implementation of habitat mitigation and/or enhancement measures, including modification of reservoir operations as needed to meet the design limitations of passage facilities; adequate minimum in-stream flows; and ramping restrictions to protect fish in Project bypass and full-flow reaches.
- Biological goals that cannot be met with fish passage and/or habitat restoration and enhancement will be attained through the mitigation funds and activities described in Section 19 of the Settlement Agreement, which will support habitat enhancement and restoration projects that provide a net benefit to fish populations on-site and/or in proximity to the Project.

5.1.1 Fish passage at Soda Springs Dam (Settlement Agreement Section 4.1)

Soda Springs Dam is a barrier to upstream migration of anadromous and resident fish and restricts downstream fish migration, putting juvenile and adult fish moving downstream at risk of injury or mortality as they negotiate the dam and powerhouse and/or pass through turbines.

Providing fish passage facilities at Soda Springs Dam is intended to maintain ecological processes and habitat in condition sufficient to support interconnected and well-distributed populations of native species in the North Umpqua River watershed. This goal includes maintaining and/or restoring aquatic and riparian connectivity across the landscape on lands under the jurisdiction of the NFP and maintaining or restoring native anadromous fish populations in the watershed.

In order to restore access for anadromous fish to the areas above Soda Springs Dam, and for their populations to be maintained or enhanced in the North Umpqua basin as a whole, PacifiCorp will install a vertical-slot fish ladder to allow upstream passage at Soda Springs Dam. In addition, a fish-counting facility using a video camera and recording system will be installed in the fish ladder. PacifiCorp will install a downstream fish bypass system (fish screens) and modify the dam spillway design to facilitate safe and timely juvenile outmigration and will provide tailrace barriers at the Soda Springs and Slide Creek powerhouses to prevent injury to migrating fish.

The Parties discussed at length the potential removal of Soda Springs Dam to restore access to habitat areas above Soda Springs Dam and to otherwise improve connectivity in the North Umpqua River. After considerable discussion, the Parties concluded that significant negative economic and power production impacts to PacifiCorp could be avoided and that resource goals and objectives could be achieved by installing a fish ladder and screens at Soda Springs Dam and by undertaking a variety of other habitat enhancement activities, including (1) passing sediment and large woody debris (“LWD”) by Soda Springs Dam and (2) improving spawning habitats both above and below Soda Springs Dam via habitat enhancement projects. Habitat enhancement actions are discussed in more detail below.

Fish passage measures at Soda Springs Dam will address the biological requirements of the upstream and downstream movement of fish at Soda Springs Dam, enabling their safe, timely, and unimpeded upstream or downstream movement regardless of life stage. Installation of a fish ladder will provide access to at least 10.6 km (6.6 mi) of additional habitat in the main-stem North Umpqua River and Fish Creek. In addition, Pacific lamprey may be able to access habitat upstream of the obstacle (at RM 3.2) in Fish Creek. Fish-screening criteria have been established by NMFS and ODFW to adequately protect juvenile salmonids at screening facilities. The performance standards include the possibility of changing operations if the screens fall short of meeting the performance criteria and providing PacifiCorp with the opportunity to explore design options that could improve operating efficiency. Of the anadromous species that occur in the basin, spring Chinook salmon and steelhead are likely to benefit most from construction of passage facilities at Soda Springs Dam.

Numerous studies concerning the potential benefits of fish passage at Soda Springs were conducted during the watershed analysis and subsequent investigations. Fish passage issues are discussed in Section 7 (“Anadromous fish passage and off-site mitigation”) of the Synthesis Report. Additional Science Team reports concerning anadromous fish passage at Soda Springs Dam include “Dam-in-place alternative: further responses to questions from the Soda Springs Connectivity Subgroup” (Stillwater Sciences 1999), “Pros and cons of dropping the ‘trap and haul’ alternative from the list of fish passage options under consideration for Soda Springs Dam” (Stillwater Sciences 1998), and “Determine whether a barrier to fish migration exists under Soda Springs Reservoir” (Stillwater Sciences 1998).

5.1.2 Fish passage at Fish Creek and Lemolo No. 2 dams (Settlement Agreement Section 4.3)

Fish Creek and Lemolo No. 2 dams have existing fishways that will remain in place and functional for the term of the New License. These fishways, constructed for resident trout, are located upstream of the historical distribution of anadromous fish.

The Fish Creek and Lemolo No. 2 dam fishways will be kept in repair and open and free from obstructions at all times, consistent with state and federal law. In consultation with ODFW, USFWS, USDA-FS, and NMFS, PacifiCorp will modify the Lemolo No. 2 fishway to provide safe and timely upstream fish passage for resident trout. In addition, PacifiCorp will install a fish screen at the Fish Creek intake to reduce entrainment of juvenile fish into the Fish Creek forebay.

A summary of issues and management options related to fish passage at these dams is provided in Section 3.6.1 of the Synthesis Report. A discussion of the benefits of providing a fish screen at Fish Creek is provided in Section 2.2.16 of “Stillwater Sciences’ Proposed Resource Enhancement Packages” (Stillwater Sciences 1999). These installations and modifications will facilitate upstream access and downstream passage of resident trout and improve aquatic habitat connectivity in the watershed.

5.1.3 Slide Creek Dam and Toketee, Clearwater Nos. 1 and 2, and Lemolo No. 1 dams (Settlement Agreement Section 4.3)

The ODFW MOU (Appendix E to the Settlement Agreement) waives upstream fish passage facilities at Slide Creek Dam and the Toketee, Clearwater Nos. 1 and 2, and Lemolo No. 1 dams and prescribes alternative mitigation measures to be implemented or funded by PacifiCorp that provide a net benefit to wild anadromous and other migratory native fish on-site and/or in proximity to the Project.

Specifically, three measures are included in the MOU as mitigation for the waiver of fish passage at Slide Creek Dam:

- upgrading the Rock Creek Diversion Dam fishway to improve upstream passage for migratory fish and to allow for sorting of hatchery from wild fish,
- adding LWD to East Fork Rock Creek to enhance in-channel habitat for fish, and
- increasing riparian protection through purchase of conservation easements in portions of the Rock Creek basin.

Mitigation measures for the waiver of fish passage at Toketee, Clearwater Nos. 1 and 2, and Lemolo No. 1 dams include a combination of elements in the upper North Umpqua watershed and in the Canton Creek basin that are designed to benefit native resident trout populations. These elements are:

- reconnecting the Clearwater River to the main-stem North Umpqua River downstream of Toketee dam,
- implementing measures such as controlling brook trout populations to benefit native rainbow trout populations in the upper North Umpqua River watershed, and
- undertaking habitat enhancement measures such as LWD enhancement and riparian conservation easements on private lands in the upper Canton Creek basin upstream of anadromous fish barriers (including upper Pass Creek and East Fork Pass Creek subbasins).

After considerable discussion, the Parties agreed that installation of fish passage facilities at Slide Creek Dam was not warranted and that alternative enhancement measures would fully address the Parties' goals and objectives concerning the availability of spawning and rearing habitat in the main-stem North Umpqua River. The MOU, Section VI, Alternative Mitigation Measures, contains a detailed description of the proposed measures and their expected ecological benefits. Options for providing fish passage at Slide Creek Dam are discussed in Section 5.4.1 of the Synthesis Report. Providing passage at Slide Creek Dam would have allowed anadromous fish access to an additional 2.3 km (1.4 mi) of stream habitat in the North Umpqua River, up to Toketee Falls, the historical upstream barrier to anadromous fish. The North Umpqua River upstream of Slide Creek Dam is a relatively high-gradient, confined reach that contains extremely limited spawning gravels and relatively little habitat for anadromous salmonids. Habitat conditions upstream of Slide Creek Dam are discussed in the Science Team report "Assessment of spawning gravel in the North Umpqua River upstream of Slide Creek dam" (Stillwater Sciences 2000).

5.2 In-Stream Flows (Settlement Agreement Section 5)

In-stream flows are a critical component of the physical and ecological processes that influence aquatic and riparian habitat conditions in the North Umpqua basin. In-stream flows are discussed in Section 4 of the Synthesis Report.

The goal in developing in-stream flow recommendations was to maintain or restore flows to sustain well-connected and functional riparian and aquatic habitats to which the native aquatic and riparian communities are adapted. This includes meeting water quality objectives related

to in-stream flows, as established by Oregon’s water criteria. Seven policy elements were used in developing the in-stream flows included in the Settlement Agreement:

- A range of flows is needed to provide habitat for anadromous fish.
- A range of flows is needed in areas upstream of anadromous fish habitat to sustain resident trout and amphibian populations, aquatic invertebrate production, and other aquatic attributes.
- Winter and summer flows for each reach are needed to reflect seasonal shifts in habitat use.
- Native species need to receive consideration over nonnative species.
- Seasonal flow patterns need to meet the ACS objective that includes “the timing, magnitude, duration, and spatial distribution of peak, high and low flows.”
- Flows must address the ODFW trout management plan.
- The selected flow regime must consider impacts on Project economics and power generation.

Measures related to in-stream flows for fish and other aquatic organisms included in the Settlement Agreement include:

- increasing in-stream flows in bypass reaches;
- increasing in-stream flows in stages: first in the reach already accessible to anadromous fish (Soda Springs Bypass Reach), then in all other reaches, and then upon providing fish passage facilities at Soda Springs Dam, further increasing flows in newly accessible reaches;
- reevaluating minimum in-stream flows in the Clearwater No. 2 Bypass Reach using the spatial niche analysis (“SNA”) methodology;
- installing and maintaining new gauge stations;
- continuing to provide water for use in the ODFW salmon-holding ponds adjacent to the Soda Springs Bypass Reach; and
- removing diversions on and reconnecting tributary streams (see Section 6.7 below).

Implementation of minimum in-stream flows contained in the Settlement Agreement will result in increased flows in all bypass reaches compared with existing FERC license conditions. Bypass reach flows will increase to 2 to 3.2 times the current minimum in-stream flows in the Lemolo Nos. 1 and 2 and Toketee bypass reaches. In the Clearwater Nos. 1 and 2 bypass reaches, minimum flows will increase 8 to 12 times over the current minimum flows.

Minimum flows in reaches that will become accessible to anadromous fish as a result of providing passage at Soda Springs Dam will also be increased as a result of implementing the Settlement Agreement. Prior to providing fish passage, minimum flows in the Fish Creek and Slide Creek bypass reaches will be increased 2.5 to 8 times and 2 to 3.2 times, respectively. Subsequent to providing fish passage, minimum flows in the Fish Creek and Slide Creek bypass reaches will be increased by 6.5 to 13 times and 9.6 times over current conditions,

respectively. Minimum flows in the Soda Springs Bypass Reach will be increased by 11 times under both pre- and post-passage conditions.

The flow habitat relationship is not a linear function (i.e., habitat does not increase or decrease in the same rate as quantity of flow). For example, available habitat in September for juvenile steelhead trout for the Slide Creek bypass reach increases by 64 percent when flow is increased by over 900 percent. Similarly, pool habitat in the Lemolo 1 bypass reach increased 40 percent for the month of September with the approximately 300 percent increase in flow.

During the Cooperative Watershed Analysis, the assessment of instream flows focused on (1) characterizing the hydrology of study area streams under reference and current conditions and (2) assessing the effects of changes in flow regimes on aquatic ecosystems. Changes in instream flow conditions resulting from the hydroelectric project were assessed by comparing current and pre-project (reference) hydrologic conditions. Hydrological data and analyses are presented in Technical Appendix 4-1 to the Synthesis Report: “Daily average hydrographs for instream flow studies” (Stillwater Sciences 2000). This information is summarized and discussed in Sections 4.3 through 4.5 of the Synthesis Report.

Three approaches were used to assess ecological effects of changes in flow regimes: trout growth modeling, a literature-based assessment, and Instream Flow Incremental Methodology (IFIM). The methods used for these analyses are described in Section 4 of the Synthesis Report (“Instream Flows”) and in Appendix 4-2 to the Synthesis Report (“Methods for trout growth model”). A discussion of the effects of altered flow regimes on channel morphology and sediment transport is presented in Section 2 of the Synthesis Report (“Fluvial geomorphic processes, channel morphology, and aquatic and riparian habitat”).

Various flow alternatives for the bypass reaches are discussed in Section 4.7 of the Synthesis Report; in Appendix 7-3 to the Synthesis Report (“Minimum flow release alternatives for Slide Creek, Toketee, and Fish Creek bypass reaches under fish passage scenarios”); in “Stillwater Sciences’ Proposed Resource Enhancement Packages” (Stillwater Sciences 1999); and in “Percent peak weighted usable area (WUA) analysis of instream flow alternatives” (Stillwater Sciences 2000).

To develop initial flow recommendations, the Parties used IFIM, which was developed by USFWS (Bovee et al. 1998). The initial analyses focused on the weighted useable area (WUA) results of the IFIM analysis. WUA results are expressed as the relationship between discharge and an estimate of the habitat area available for a specific species and lifestage to a specific instream flow.

In addition to the above analyses, the Forest Service conducted Time Series Analysis of the existing WUA results. Time series analysis integrates existing and proposed hydrology to calculate habitat available over time (Bovee et al. 1998). This is a more valid representation of effects of proposed operations than just discussing differences in points on the WUA vs. discharge output. Results from time series analysis can be used to quantify differences in

available habitat over time for various flow regimes at different time scales. The time step implemented for the bypass flow reaches was summed for monthly habitat values. Time series analysis also allows one to assess the effects of the proposed flow regime on project operations over time.

Implementation of minimum instream flow guidelines contained in the settlement agreement will result in increased flows for all bypass reaches compared to existing conditions.

Minimum flows provided by the settlement agreement will provide from 77% to 100% of the peak WUA for adult rainbow trout in bypass reaches remaining inaccessible to anadromous fish (Lemolo Nos. 1 and 2, Clearwater Nos. 1 and 2, Toketee). For bypass reaches that will become accessible to anadromous fish as a result of providing passage at Soda Springs Dam (Fish Creek, Slide Creek), WUA for adult rainbow trout will range from 90% to 99% of peak WUA prior to providing passage. Subsequent to providing passage, minimum flows for the Slide Creek bypass reach will provide 76% to 97% of peak WUA for anadromous salmonid (steelhead, coho and chinook salmon) rearing. Settlement agreement flows in the Fish Creek bypass reach will provide 88% to 97% of peak WUA for anadromous salmonid (steelhead and sea-run cutthroat trout) rearing once access is provided. Minimum flows for the Soda Springs bypass reach will provide 94% to 99% of peak WUA for juvenile anadromous fish (steelhead, coho and chinook salmon) rearing under both pre- and post-passage conditions.

An SNA was conducted for areas upstream of the proposed anadromous fish accessible reaches of the river (upstream of Slide Creek diversion dam). The SNA simulates a range of hydraulic conditions using depth and velocity criteria that correspond to known habitat types or criteria, was conducted by the Forest Service to reflect the habitat needs of a larger suite of aquatic organism and channel functions. The flows derived from the SNA analysis in the settlement agreement are designed to support higher aquatic biodiversity than flows developed from the resident trout analysis in the application and watershed analysis. The selected flows will support a higher biodiversity because they provide more habitat area over time for a greater variety of aquatic habitat types, or “spatial niches,” as defined by water depths and velocities. A spatial niche analysis is a way of analyzing communities of organisms when there are multiple species and life stages for which detailed habitat use information is limited (Bowen et al. 1998). This type of analysis has been used in assessing flow habitat relationships for highly diverse ecosystems such as those that occur in the Southeastern United States (Bowen et al. 1998). The USFS will provide a separate document describing the methodology and results of the SNA.

The depth and velocity criteria for the spatial niche analysis were selected to closely correspond to the resident salmonid life stages previously modeled. Other niches modeled were those that represented hydraulic characteristics of important habitat types such as pools (deep, slow), glides (shallow slow) and riffles (deep or shallow fast). This allowed the Forest Service to determine the effects of the proposed flow regimes to the target resident salmonids along with the amount of habitat available for a diversity of habitat conditions. The results of the analysis typically showed that the deeper, slower habitat types (e.g., pools) were underrepresented when focusing only on the resident salmonids. In addition, the results

showed that shallow slow habitat at the stream margins remained relatively stable over the range of flows analyzed. The margin habitat niche would primarily be used by young-of-the-year salmonids for rearing. Proposed flow regimes and those agreed upon in the Settlement Agreement are those that start to provide reasonable amounts of the underrepresented habitat types along with maintaining high levels of the resident trout habitat over time.

Investigations used to develop minimum in-stream flows also included temperature modeling conducted during relicensing studies (PacifiCorp 1995), information on water quality summarized in Section 6 of the Synthesis Report ("Water quality"), and further analysis of water quality characteristics and standards by ODEQ. Additional investigation and analysis to establish in-stream flows and other Project PM&E Measures to attain ODEQ numeric and narrative water quality standards will occur in the 401 Certification process. TMDLs for the North Umpqua basin will also be developed in 2002.

The Parties looked extensively at proposing an adaptive management program with sideboards and a dispute resolution component as a method for determining instream flows. After careful consideration, the Parties came to consensus that a single flow table addressing fish and spatial niche needs would meet law, policy, and science requirements; would be more certain and less cumbersome; and would allow better use of resources. The Agreement therefore requires that PacifiCorp implement the minimum instream flow regimes for the North Umpqua River reaches designated in the terms of the Agreement in conjunction with provisions for anadromous fish passage. Results of the SNA for Clearwater No. 2 bypass reach will be re-evaluated before implementation of pre-anadromous fish passage flows. The bypass reach flows specified in the Agreement will meet the biological, hydrological, and economic objectives listed above by increasing instream flows and adjusting flows throughout the year to benefit anadromous and resident fish and provide appropriate hydrological variability.

5.3 Ramping (Settlement Agreement Section 6)

The term "ramping" refers to Project-induced increases and decreases in river discharge and associated changes in water surface elevation over time (see the "Definitions" section of the Settlement Agreement for a precise definition of this term). Project operations influence the frequency, magnitude, timing, and rate of ramping events. Increases in stage ("upramping") may displace eggs, juveniles, or adults of fish and other aquatic species; increase turbidity as rising water mobilizes sediments; and alter other aspects of water quality such as temperature and dissolved oxygen. Decreases in stage ("downramping") can strand eggs, juveniles, and adults of aquatic species in dewatered or disconnected areas of the channel and reduce available habitat and macroinvertebrate food production. Chinook salmon and steelhead fry and Pacific lamprey ammocoetes may be very susceptible to stranding, as these fish tend to rear along the margins of main-stem stream channels. Ramping may also reduce benthic macroinvertebrate and mollusk species diversity, density, and biomass by reducing or eliminating species that are less mobile or less tolerant of flow fluctuations and the changes in water quality and habitat that may result. Fluctuations in in-stream flows caused by project operations may affect water quality parameters such as temperature, dissolved oxygen, and turbidity.

The effects of the Project on flow fluctuations in the North Umpqua River are discussed in Section 4.4.2 of the Synthesis Report. The ecological impacts of ramping are discussed in Section 4.6 of the Synthesis Report. Management alternatives concerning ramping rates are discussed in Section 4.7.3 of the Synthesis Report and in Section 2.2.4 of “Stillwater Sciences’ Proposed Resource Enhancement Packages” (Stillwater Sciences 1999).

General goals derived from the watershed analysis concerning ramping in the project area include (reach-specific goals are discussed below):

- Maintain ecological processes and habitat in condition sufficient to support interconnected and well-distributed populations of native species in the watershed.
- Maintain and/or restore flows that sustain well-connected and functional riparian and aquatic habitats to which the native aquatic and riparian community are adapted.
- Manage the hydroelectric facilities in a manner that maintains and/or improves water quality in the watershed, meets water quality standards and antidegradation requirements, and protects beneficial uses. The relevant goal, as stated in the ACS (USDA-FS and BLM 1994), is to “maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.”
- Maintain and/or restore native anadromous fish populations.

5.3.1 Full-flow Reaches

“Full-flow reaches” are reaches in which no diversion of flow occurs, but in which flows may be subject to ramping due to Project operations upstream. Full-flow reaches along the North Umpqua River include the following: (1) Lemolo No. 2 Powerhouse downstream to Toketee Lake, (2) Toketee Powerhouse downstream to Slide Creek Dam, (3) Slide Creek Powerhouse downstream to Soda Springs Reservoir, and (4) the North Umpqua River downstream of the Soda Springs Powerhouse. Flow fluctuations related to load factoring occur nearly every day, frequently changing water levels 30 to 120 cm/day (1 to 4 ft/day) in full-flow reaches (Synthesis Report, Section 4.5.2). The largest flow changes occur during late summer and early fall, when low natural flows allow the greatest range of storage and manipulation.

Lemolo No. 2 Full-Flow Reach

The Lemolo No. 2 Full-Flow Reach extends 1.4 km (0.9 mi) from the Lemolo No. 2 Powerhouse downstream to Toketee Lake. The reach currently experiences frequent flow fluctuations due to releases at the Lemolo No. 2 Powerhouse. This reach contains low-gradient, braided channels and unconfined areas with side channels, conditions that are relatively rare in the upper North Umpqua basin. Flow fluctuations in this reach may therefore have greater ecological impacts than in other Project-affected reaches. Ramping rates of 12

cm/hr (0.4 ft/hr) have been recorded in this reach (PacifiCorp 1995). The Parties' goals for this reach are to:

- Meet ODEQ water quality standards and protect beneficial uses;
- Enable the Lemolo No. 2 development to continue operating as a peaking facility;
- Protect biodiversity: The Lemolo Full-Flow Reach is characterized by low-gradient unconfined aquatic habitat that is uncommon in the upper North Umpqua River system. The Parties' objective for this reach is to provide a flow regime that, in terms of the magnitude of discharge and flow fluctuations, meets the intent of ACS objectives and enhances natural ecological functions and processes and provides productive habitat for native aquatic species; and
- Create and/or enhance productive trout habitat and reduce adverse impacts to the ecosystem caused by ramping.

As described in the Settlement Agreement, peaking flows from the Lemolo No. 2 Powerhouse will be rerouted out of the Lemolo 2 Full-Flow Reach to an expanded wetland complex around the Stinkhole Pond. In addition to the benefit of reducing the variations in water quality (dissolved oxygen, temperature, total dissolved gases, pH) and eliminating Project-induced flow fluctuations in the North Umpqua River, this would also provide ecological benefits by creating wetland and stillwater habitat in the area north of Toketee Lake and west of the river channel, processing nutrients, and reducing habitat for nonnative species.

A discussion of the potential benefits to water quality and habitat of the proposed measure for diverting peaking flows from the Lemolo No. 2 Powerhouse to the Stinkhole can be found on pages 4 to 5 of "Preliminary Conceptual Design (10% Design): Created Wetland and Alternative Conveyance of Peaking Flows from Lemolo No. 2 Powerhouse, Preliminary Draft for Science Team Review" (Stillwater Sciences 2000). This measure is also discussed in Section 2.2.3 of "Stillwater Sciences' Proposed Resource Enhancement Packages" (Stillwater Sciences 1999).

Slide Creek Full-Flow Reach

The Slide Creek Full-Flow Reach extends 0.3 km (0.2 mi) from Slide Creek Powerhouse downstream to Soda Springs Reservoir. The reach consists of a high-gradient riffle with steep bedrock banks ending in the reservoir. Under the terms of the Settlement Agreement, this reach will be accessible to anadromous fish. The Parties' goals for this reach are to:

- protect spawning habitat, if fish choose to spawn there;
- protect migratory habitat for upstream and downstream anadromous fish movement;
- protect fish from stranding; and
- retain peaking capacity and ability to tie in with the peaking function of Toketee Powerhouse.

In order to meet the above goals, PacifiCorp, in consultation with ODFW, USFWS, USDA-FS, and NMFS, will develop a monitoring and evaluation plan to determine the effects of current ramping levels and emergency shutdowns on anadromous fish. The Settlement Agreement includes ramping measures that PacifiCorp will implement should it be determined from monitoring and evaluation results that spawning or migratory movement in the reach is significantly affected.

Toketee Full-Flow Reach

The Toketee Full-Flow Reach extends from Toketee Powerhouse 0.3 km (0.2 mi) downstream to the Slide Creek Diversion Dam. This reach will continue to be inaccessible to anadromous fish. The reach consists of a deep, steep-sided bedrock pool. The Parties have not identified any significant resource concerns for the Toketee Full-Flow Reach under flows contained in the Settlement Agreement. Therefore, no ramping restrictions are specified for this reach.

Wild and Scenic River Reach

The Wild and Scenic River Reach extends downstream of Soda Springs Powerhouse to the confluence of the North Umpqua River with Rock Creek. Anadromous salmonids and other fish species may be sensitive to flow fluctuations in the North Umpqua River caused by releases from Soda Springs Powerhouse.

- The Parties' goals for this reach are to minimize the dewatering of redds, stranding of fish, disturbance of spawning adults, and other adverse impacts caused by ramping. In order to meet these goals, the Project will be operated, as provided in Section 6.4, in such a way so as to minimize Project-induced flow fluctuations at flows below 1,600 cfs, unless studies show that some fluctuation would not adversely affect resources. At flows above 1,600 cfs and up to the point where natural flows result in spilling at Soda Springs Dam, Project-induced fluctuations will be restricted unless studies show that more fluctuation would not adversely affect resources. PacifiCorp, in consultation with ODFW, ODEQ, USDA-FS, NMFS, and USFWS, will prepare a study to evaluate whether these goals can be met under a more flexible ramping regime.

The above-described limits on ramping will minimize risks to anadromous fish and protect the special ecological and aesthetic values of the Wild and Scenic River Reach. The potential benefits of measures to reduce the ecological effects of ramping in this reach are discussed in Section 2.2.4 of "Stillwater Sciences' Proposed Resource Enhancement Packages" (Stillwater Sciences 1999).

5.3.2 Bypass Reaches

Bypass reaches are reaches from which water is diverted for Project operations. The eight bypass reaches on the Project are Soda Springs, Slide Creek, Toketee, Fish Creek, Lemolo Nos. 1 and 2, and Clearwater Nos. 1 and 2. The Parties' goals for these reaches are to protect

fish and wildlife from stranding during downramping and from displacement downstream during upramping and to minimize adverse effects on water quality. As described in the Settlement Agreement:

- Until the first anniversary of the New License, PacifiCorp will make all reasonable efforts, with existing Project facilities and operation capabilities, to limit ramping in the Soda Springs Bypass Reach to a target of 0.2 ft/hr and in all other bypass reaches to a target of 0.5 ft/hr. PacifiCorp will also consider a ramping rate of 0.2 ft/hr in the bypass reaches other than Soda Springs between June and October for the added protection of rainbow trout fry.
- After the first anniversary of the New License, PacifiCorp will eliminate all ramping in the eight bypass reaches, except during planned maintenance and emergency shutdowns. Fluctuations during these activities will be limited to minimize any impacts on fish or other aquatic resources.
- PacifiCorp will minimize impacts of Project maintenance in bypass reaches by taking into consideration the time of year and length of shutdown, attempting to release high flows to coincide with the high-flow period of the natural hydrograph, planning maintenance to prevent water-quality standard violations, and adhering to ramping regimes designed to protect salmonid fry.

These limits are designed to protect fish during their most vulnerable life stages, with particular emphasis on protecting juvenile anadromous salmonids. Limits on ramping included in the Settlement Agreement were developed based on extensive review of the scientific literature, including Hunter (1992). Potential benefits of measures to reduce the ecological effects of ramping in bypass reaches are discussed in Section 2.2.4 of “Stillwater Sciences’ Proposed Resource Enhancement Packages” (Stillwater Sciences 1999).

5.4 Restoration of Fluvial Geomorphic Processes (Settlement Agreement Section 7)

Fluvial geomorphic processes influence stream channel morphology and the types and quality of aquatic and riparian habitats found within a watershed. The hydrologic regime, sediment regime, riparian vegetation, and LWD are important components of fluvial geomorphic processes. Project dams and diversions, Project and non-Project roads, timber harvesting, and LWD removal have been the main anthropogenic causes of geomorphic change in North Umpqua River basin streams. Restoration and enhancement of fluvial geomorphic processes are proposed to reduce Project impacts.

The goal of the Settlement Agreement is to maintain or restore the geomorphic processes characteristic of the watershed under reference conditions, in order to maintain habitat for native species and promote the long-term ecological health of the North Umpqua River watershed. This goal reflects the ACS of the NFP, “which was developed to restore and

maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands (ROD B-9).”

In order to meet this goal, the Settlement Agreement incorporates measures to restore sediment and LWD dynamics. Measures included in the Settlement Agreement to address restoration of fluvial geomorphic processes include:

- continued spawning gravel augmentation below Soda Springs Dam,
- gravel augmentation in Soda Springs alluvial restoration reach,
- passage of LWD over Project dams,
- passage of sediment past Slide Creek Dam,
- reconnection of the Clearwater River to the main-stem North Umpqua River,
- reconnection of numerous tributaries and drainages along the canal and flume systems, and
- replacement and upgrading of culverts to accommodate 100-year flood events.

These measures will provide greater connectivity of fluvial geomorphic processes in the Project area by allowing sediment and wood to be transported from tributaries in the upper North Umpqua River watershed, and much of it then transported past the Slide and Soda Springs dams into the Wild and Scenic River Reach and downstream. Restoration and enhancement of sediment dynamics and wood contribute to the formation of habitat for fish and other aquatic species.

The watershed analysis examined the effects of the Project, forest management activities, and other land uses on fluvial geomorphic processes, channel morphology, and aquatic and riparian habitats in the North Umpqua River basin. A summary of these analyses is presented in Section 2 of the Synthesis Report (“Fluvial geomorphic processes, channel morphology, and aquatic and riparian habitats”).

Numerous studies conducted during the watershed analysis and subsequent investigations provided the technical basis for determining the effects of the Project and the expected effectiveness of the measures contained in the Settlement Agreement. Investigations conducted as part of the sediment budget analysis indicates that Project impoundments trap nearly all bed load transported from upstream reaches. Bed load delivery to the Slide Creek bypass and full-flow reaches has been reduced, although the effects are less evident downstream of the confluence with Fish Creek. In addition, bed load delivery to the Soda Springs Bypass Reach and the reach from Soda Springs Powerhouse to Boulder Creek have been reduced. The magnitude of bed load supply reductions downstream of Soda Springs Dam decreases in a downstream direction between Boulder Creek and Steamboat Creek, due to increased sediment production associated with roads and timber harvest in tributary basins.

Additional investigations (*e.g.*, geomorphic effects analysis) indicate little evidence of substantial change in channel morphology due to Soda Springs Dam downstream of Boulder Creek. Upstream of Boulder Creek, however, the changes were evident as a result of reduction of bed load supply from the upper basin. Similarly, the effects of Soda Springs Dam

on downstream aquatic habitat are limited to the reaches just below the dam, and there is little evidence of channel change downstream.

Reconnection of the Clearwater River to the main-stem North Umpqua River will allow bed load from the Clearwater River (downstream of Stump Lake) to be transported to the main-stem North Umpqua River below Toketee Lake and through the Toketee Bypass Reach. Passage of sediment at Slide Creek Dam will then allow sediment transport to extend through the Slide Creek Bypass Reach downstream to Soda Springs Reservoir. Gravel augmentation at sites below Soda Springs Dam will enhance sediment transport processes within the Soda Springs Bypass Reach and downstream into the Wild and Scenic River Reach.

Although LWD is not common in most of the main-stem North Umpqua River even under reference conditions, it provides important habitat components for riparian and aquatic species. Passing LWD at Project dams will improve LWD transport processes and habitat connectivity for LWD-dependent species.

Additional Science Team reports concerning fluvial geomorphic processes in the watershed include:

- Appendix 2-1 of the Synthesis Report (“Sediment budget report”),
- Appendix 4-1 of the Synthesis Report (“Daily average hydrographs for in-stream flow studies”),
- Appendix 7-1 of the Synthesis Report (“Bed substrate mobility in the North Umpqua River, Copeland gauging station”),
- “Geomorphic effects of Soda Springs Dam and potential effects on aquatic habitat” (Stillwater Sciences 2000),
- “Criteria for evaluation of management alternatives for connectivity at Soda Springs Dam” (Stillwater Sciences 1999),
- “Methods for achieving connectivity at Soda Springs Dam under a dam-in-place scenario” (Stillwater Sciences 1999),
- “Dam-in-place alternative: further responses to questions from the Soda Springs Connectivity Subgroup” (Stillwater Sciences 1999),
- “Summary of existing information related to connectivity at Soda Springs Dam” (Stillwater Sciences 1999), and
- “Preliminary assessment of issues related to sediment augmentation at Soda Springs Dam” (Stillwater Sciences 1999).

5.5 Main-Stem North Umpqua Anadromous Fish Spawning Habitat Enhancement (Settlement Agreement Section 8)

The Project affects channel conditions and anadromous fish habitat in the main-stem North Umpqua River. Soda Springs Dam restricts bed load transport to reaches downstream, resulting in a reduction of potential spawning gravel and inundates riverine habitat in reaches upstream. Surveys from 1952 indicate that Soda Springs Reservoir inundates relatively rare

main-stem habitat with potentially suitable spawning habitat for anadromous salmonids. In addition, Soda Springs Reservoir inundates reaches with potentially suitable summer- and winter-rearing and adult-holding habitat for steelhead and spring Chinook salmon. Other Project effects include the reduction of flows in the North Umpqua River below Soda Springs Dam and rapid changes in flows in the Project full-flow reach between Slide Creek Powerhouse and Soda Springs Reservoir.

To address these impacts, the Parties have agreed to terms to (1) maximize usable spawning habitat for anadromous fish, with a priority on Chinook salmon spawning, given the natural constraints of the river channels and fish barriers; and (2) mitigate for the continued inundation of pre-Project anadromous habitat under Soda Springs Reservoir and habitat lost due to construction of Soda Springs Dam.

PacifiCorp will implement measures to restore, enhance, or create spawning habitat in the North Umpqua Basin. Potential enhancement sites include the Slide Creek Bypass Reach above Slide Creek Powerhouse upstream to the confluence of Fish Creek, the Soda Springs Bypass Reach, and in-proximity, in-kind restoration measures funded by the mitigation funds specified in Section 19 of the Settlement Agreement. The Parties have agreed to a plan for studying, testing, and monitoring potential sites and for implementing an adaptive and comprehensive management plan.

Enhancing spawning habitat in the lower Slide Creek Bypass Reach, the Soda Springs Bypass Reach, and other sites in proximity to the Project will provide important spawning habitat for Chinook salmon and potentially for steelhead. Because the uncommon nature of spawning habitat in the main-stem North Umpqua River may limit the potential production of Chinook salmon, providing more spawning habitat will potentially increase the population size of this species in the North Umpqua River watershed.

Numerous studies conducted during the watershed analysis and subsequent investigations provide the technical basis for determining the effects of the Project and the expected effectiveness of the spawning habitat enhancement measures contained in the settlement agreement. Investigations conducted to assess spawning gravel availability and redd superimposition indicate that spawning gravel availability in the main-stem North Umpqua River limits spring Chinook salmon production in the basin. Further investigations of reference and current habitat conditions in the basin indicate that a reach with potentially suitable spawning habitat may have occurred historically in the reach currently inundated by Soda Springs Reservoir.

As discussed in Section 6.4 above (“Restoration of Fluvial Geomorphic Processes”), elimination of coarse sediment supplied from upstream of Soda Springs Dam appears to have reduced available spawning habitat to some degree upstream of Boulder Creek. It is likely that eddy zones were saturated with gravel under reference conditions. However, the reach is confined and very steep, and spawning habitat was probably limited under reference conditions as well. There is no evidence that Soda Springs Dam has affected spawning habitat

downstream of Steamboat Creek. Continued spawning gravel augmentation measures included in the Settlement Agreement are intended to improve conditions downstream of Soda Springs Dam. Spawning habitat enhancement measures in the Slide Creek Bypass Reach and the Soda Springs Bypass Reach are intended to mitigate for potential spawning habitat lost due to inundation of habitat by Soda Springs Reservoir. Increasing spawning habitat in the Slide Creek Bypass Reach and downstream of Soda Springs Dam will likely increase salmon production in the basin.

A summary of issues related to anadromous salmonid habitat in the main-stem North Umpqua River is provided in Section 7 of the Synthesis Report (“Anadromous fish passage and off-site mitigation”). Additional reports concerning anadromous fish spawning habitat include:

- Appendix 7-1 of the Synthesis Report (“Bed substrate mobility in the North Umpqua River, Copeland gauging station”),
- Appendix 7-2 of the Synthesis Report (“Spawning gravel availability and redd superimposition among spring chinook salmon in the North Umpqua River”),
- “Assessment of historical habitat conditions in the reach of the North Umpqua River currently inundated by Soda Springs Reservoir” (Stillwater Sciences 1998),
- “Preliminary assessment of issues related to sediment augmentation at Soda Springs Dam” (Stillwater Sciences 1999),
- “Geomorphic effects of Soda Springs Dam and potential effects on aquatic habitat” (Stillwater Sciences 2000),
- “Potential spawning habitat for anadromous salmonids in the upper reach of Soda Springs Reservoir” (Stillwater Sciences 2000), and
- “Assessment of spawning gravel in the North Umpqua River reach upstream of Slide Creek Dam” (Stillwater Sciences 2000).

5.6 Reservoir and Forebay Management and Mitigation (Settlement Agreement Section 9)

Reservoirs and forebays associated with the Project contain populations of resident fish and offer opportunities for angling. These impoundments also provide potential habitat for stillwater amphibians; this issue is discussed separately in Section 6.8 below. Trout populations in reservoirs and forebays are affected by habitat characteristics within the impoundments, water quality, entrainment into diversion intakes and penstock intakes, and water level fluctuations and seasonal drawdowns at Lemolo Reservoir. The Parties’ goal for reservoir and forebay resident trout fisheries management, which was addressed in the watershed analysis, is to maintain and/or restore aquatic habitat in the reservoirs and forebays sufficient to support productive trout fisheries. An additional ODFW goal is to maintain a catch rate of 0.5 trout per angler-hour.

The Parties have agreed on the following general principles to guide decision making for reservoir and forebay management:

- ODFW has the following management guidelines for North Umpqua trout: (1) make native rainbow trout the highest priority, (2) maintain and improve reservoir fisheries, (3) reduce the abundance and distribution of brook trout and nonnative rainbow trout, (4) reduce impacts from nonnative fish on native species, and (5) provide “basic yield” fisheries in all the reservoirs.
- USDA-FS is charged by the ACS to restore and maintain the ecological health of watersheds and the aquatic ecosystems contained within them on public lands. Mitigation for continuing effects of reservoir and forebay presence on National Forest System lands beyond what can be mitigated in or adjacent to these facilities is included in the Mitigation Fund.

The Parties recognize that there are limited opportunities to make significant progress towards these resource objectives at most reservoirs and forebays on the Project without having significant consequences for Project operations and economics. Therefore, the Settlement Agreement includes measures to manage for a net benefit to fish and wildlife over the upper North Umpqua basin as a whole. Mitigation measures include:

- stocking of rainbow trout and developing a native rainbow trout broodstock;
- fish passage improvements;
- cooperative management at Lemolo Reservoir to balance the interests of power generation, fisheries, and recreation;
- in-vicinity stream habitat enhancements;
- modifications to the penstock intake at Toketee Reservoir; and
- habitat restoration measures identified in Section 6.5.

These measures will enhance rainbow trout populations and fishing opportunities and improve connectivity for resident trout in the North Umpqua River basin. In addition, the modification of the penstock intake at Toketee Reservoir may reduce the movement of nonnative brown trout into anadromous fish reaches downstream, benefiting anadromous fish populations by reducing predation, and may keep larger brown trout in the reservoir to provide additional angling opportunity.

Some measures related to management of Lemolo Reservoir relate to providing benefits to recreational use of Lemolo Reservoir. These include maintaining the reservoir at or near full pool for the peak recreation season as well as providing improved boater access during the majority of the fishing season. The Settlement Agreement includes interim measures for the management of Lemolo Reservoir between the Effective Date of the Settlement Agreement and the date of New License issuance to address energy emergencies while protecting downstream reaches, including the Wild and Scenic River Reach.

5.7 Aquatic, Riparian, and Terrestrial Connectivity (Settlement Agreement Sections 10, 11)

Habitat connectivity is important for maintaining healthy populations of species across the landscape. Habitat fragmentation—reduction in habitat area and isolation of habitat areas—reduces available habitat for species and isolates subpopulations from one another, which may increase the risk of extirpation or extinction for some species.

The effects of the Project on connectivity for riparian/aquatic and terrestrial species are documented in the Synthesis Report in Chapter 3 (“Aquatic and Riparian Connectivity”) and Chapter 8 (“Terrestrial Resources”). Significant effects on riparian and aquatic species connectivity due to Project facilities occur at intercepted tributary streams and drainages and to a lesser extent at Project diversions. The most significant effects take place on the Project’s waterway system, including the canals, flumes, and penstocks. Project diversions, forebays, and reservoirs may also affect the movement of aquatic/riparian and terrestrial species. Other Project facilities, principally transmission lines and roads, may also adversely affect movement of some wildlife species, especially those with limited mobility or restrictive habitat requirements.

The Parties’ goals for aquatic and riparian habitat connectivity are to maintain habitat in conditions sufficient to maintain ecological processes and interconnected and well-distributed populations of native species. This goal includes maintaining and restoring the Riparian Reserve function of providing habitat corridors across the landscape. The Parties’ goals for terrestrial species connectivity are to maintain habitat connectivity so that dispersal, migration, and interbreeding among subpopulations can occur. This includes modifying the waterway system so that there are insignificant effects on populations of wildlife species in the Project vicinity and wildlife entrapment-related injury and mortality of individuals are minimized.

The NFMA requires that National Forests provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives. Specific direction for achieving diversity objectives is contained within the UNFP as amended by the NFP. The ACS focuses on the restoration of ecosystem functions and processes important to the maintenance of the ecological health of watersheds. Objectives of the ACS that relate to diversity and connectivity include:

- maintain and restore spatial and temporal connectivity within and between watersheds;
- maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands; and
- maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

As described in the Settlement Agreement, the following measures will be taken to enhance and restore habitat connectivity:

- removal of diversion dams on eight tributary streams along the Lemolo waterways;
- restoration of riparian vegetation along two tributary streams;

- reconnection of up to 67 small tributary streams intercepted or blocked by Project waterways;
- enhancement of connectivity between Stump Lake and the Clearwater No. 1 Bypass Reach at the Clearwater No. 1 Dam;
- reconnection of the Clearwater River to the North Umpqua River at Toketee Dam;
- increasing the width of the 29 existing wildlife bridges;
- adding wood and other natural materials to wildlife bridge surfaces to facilitate use by small as well as large terrestrial species;
- installing 34 new wide wildlife bridges; and
- excavation of at least nine wildlife crossings under Project penstocks.

Measures to provide for fish passage at Soda Springs Dam (see Section 6.1.1 above) and to restore connectivity for fluvial geomorphic processes such as large wood and sediment transport (see Section 6.4 above) will also address habitat connectivity in the main-stem North Umpqua River for some species. While Project diversions, forebays, and reservoirs may affect the movement of aquatic/riparian and terrestrial species, there are limited opportunities to mitigate these effects without significantly affecting Project operations or removing these features from the landscape. The Parties concluded that mitigation and enhancement for connectivity across transmission lines will be adequately addressed during the development of the Vegetation Management Plan (Section 6.9 below), which will focus on controlling undesirable vegetation, restoring native species, and reestablishing effective ground cover, thus enhancing habitat components important to riparian/aquatic and terrestrial species in areas affected by the Project. Establishing any level of habitat connectivity across roads is problematic but is expected to improve with the upgrading of culverts and road decommissioning described in Section 6.12 below.

A wide range of management alternatives to address aquatic/riparian and terrestrial species movement across the Project's waterways were considered by the Parties, as described in Sections 3.6 and 8.3.5 of the Synthesis Report; Sections 3.2.5, 3.2.9, 3.2.16, and 3.2.20 of "Stillwater Sciences' Resource Enhancement Packages" (Stillwater Sciences 1999); "Wildlife enhancement conceptual design and cost estimates" (Raytheon Corporation 1997); "North Umpqua canal connectivity/geologic assessment of mitigation measures" (Raytheon Corporation 1999); and the review summary of Raytheon (1999) by Stevenson (1999).

The Parties have concluded that management options to cover, bury, or elevate entire sections of the canals and flumes are not needed to ensure well-distributed and viable populations of terrestrial species. There is little to no site-specific evidence to indicate that any particular species has been adversely affected by the Project to the degree that doubts about population persistence or population viability arise. Due to the linear bisecting nature of the Project's waterways on Riparian Reserves, the Parties placed emphasis on developing measures to restore connectivity within the floodplain of the tributary drainages. These measures will make measurable progress in restoring the ecological function and processes affected by the Project within Riparian Reserves, in particular the movement of woody debris and sediment through the aquatic systems of these tributaries. For terrestrial species, while the placing of a large

number of small crossings may provide greater numbers of crossing opportunities, there is doubt that all classes of wildlife could negotiate these crossings.

The Parties are confident that the measures to be implemented as part of the Settlement Agreement will significantly reduce the adverse impacts of the Project on connectivity for aquatic, riparian, and terrestrial species. These measures will also provide a high likelihood that the improved conditions are capable of supporting healthy, interconnected, and well-distributed populations of species across the landscape in the area of the Project.

5.8 Enhancement of Wetland Species Diversity and Still-Water Amphibian Habitats (Settlement Agreement Section 11.5)

Wetland ecosystems consist of specialized communities that provide habitat for a variety of amphibian, bird, and other wildlife species. They increase overall habitat diversity in a watershed and contribute to processing nutrients that affect water quality. Reservoirs and forebays associated with the Project inundated some wetlands but also provide some potential lower-quality habitat for still-water amphibians. Amphibian populations in Project impoundments may be affected by habitat structure, water quality, entrainment into diversion and penstock intakes, predation, and water level fluctuations and seasonal drawdowns.

The Parties' goals for wetland and still-water amphibian habitats are to:

- create an environment that supports healthy and diverse populations of still-water amphibians and other native vertebrate and invertebrate species; and
- create and maintain wetland species diversity.

In addition, the USDA-FS is charged by the ACS to restore and maintain the ecological health of watersheds and the aquatic ecosystems contained within them on public lands. The continued loss of wetland species diversity and still-water amphibian habitat due to inundation and reservoir fluctuations needs to be mitigated as much as possible in or adjacent to these Project features. Mitigation compensation for continuing effects of reservoir and forebay presence on National Forest lands beyond what can be mitigated in or adjacent to these facilities is included in the Mitigation Fund established under Section 19.3 of the Settlement Agreement.

The Parties recognize that there are limited opportunities to make significant progress towards resource objectives for wetlands and still-water habitats at most reservoirs and forebays on the Project without having significant consequences for Project operations and economics. Therefore, in order to meet ecological goals for wetlands and still-water habitats, the Settlement Agreement provides that:

- wetlands at five locations will be enhanced or created in the near term, with three additional wetlands being completed later in the New License term;
- site-specific plans will be designed in consultation with USDA-FS;

- surveys will be conducted for rare, endemic wetland and still-water species; and
- all site-specific plans will include measures to prevent erosion.

Creation of wetlands will provide critical habitat for wetland-associated plants, invertebrates, amphibians, birds, and other wildlife. The new wetlands will provide breeding habitat for amphibians that is superior to the Project reservoir and forebay habitat currently used by some species. It will increase the diversity of wildlife habitat across the Project area.

Wetland and still-water habitats in the Project area and impacts of the Project on these habitats are described in Section 5 of the Synthesis Report. Management alternatives are discussed in Section 5.6.2 of the Synthesis Report and in “Reservoir and forebay management options addressing still-water amphibians” (Stillwater Sciences 1998).

5.9 Vegetation Management (Settlement Agreement Section 12)

The Synthesis Report describes Project effects on erosion, stream channels, water quality, riparian/aquatic and terrestrial habitat, and species connectivity. Vegetation management is interrelated to all of these resource issues. The Parties have agreed that a comprehensive vegetation management plan will be developed to integrate the various goals for the management of vegetation and to establish the appropriate vegetation management measures to be taken.

The proper management of vegetation contributes to meeting many of the resource goals identified in the Synthesis Report and the NFP, including:

- maintaining or restoring the geomorphic and ecological processes characteristic of the watershed to maintain habitat and interconnected and well-distributed populations for native species and to promote the long-term health of the watershed;
- restoring function of Riparian Reserves;
- maintaining and/or improving water quality in the watershed;
- meeting water quality standards and antidegradation requirements and protecting beneficial uses; and
- maintaining and restoring the species composition and structural diversity of plant communities.

The Parties’ specific objectives for vegetation management of Project rights-of-way, including power lines, are:

- continued operation of the hydroelectric facilities and transmission and distribution system in a reliable, safe, and environmentally responsible manner;
- preventing and controlling the spread of noxious and invasive plant species;
- encouraging native plant species;
- reducing erosion; and
- enhancing wildlife habitat at and adjacent to Project facilities.

The UNFP, as amended by the NFP, provides general guidance on the management of vegetation to meet several resource management objectives. Specific direction is identified for Riparian Reserves, including ACS Objective 2 related to spatial and temporal connectivity and ACS Objective 8 that requires that the species composition and structural diversity of plant communities in riparian areas and wetlands be maintained or restored. Other pertinent direction and guidance for vegetation management are included in the Federal Noxious Weed Act of 1974, as amended (7 U.S.C. § 2801 (note)); “Final environmental impact statement for managing competing and unwanted vegetation” (November 1988) and the associated Mediated Agreement; “A guide to conducting vegetation management projects in the Pacific Northwest Region” (USDA Forest Service 1992); “USDA Forest Service and USDA noxious weed strategies” (1996); and the Region Six Memo “Use of native and nonnative plants on National Forests and Grasslands” (April 1994).

PacifiCorp will develop a Vegetation Management Plan, in consultation with USDA-FS and BLM, for noxious weed control and vegetation management procedures to be implemented within the FERC Project Boundary and other areas directly affected by the Project. The plan will include measures to:

- prevent the establishment and spread of noxious weeds;
- inventory, monitor, and evaluate weeds as part of a long-term adaptive management program;
- establish effective ground cover;
- reduce erosion; and
- reestablish native plant species.

Specific treatments will be developed and implemented to improve wildlife habitat and connectivity and visual resource objectives, especially along the Project’s transmission lines. Vegetation management measures will benefit the ecosystem by favoring native plants and reducing the spread of nonnative weedy plants, which will enhance habitat use by wildlife and improve ecosystem function and processes in riparian areas.

5.10 Avian Protection (Settlement Agreement Section 13)

Power lines can cause injury or mortality to birds that interact with the lines and associated facilities. The Parties’ goal for avian protection is to minimize adverse interactions between Project power lines and birds. To meet this goal, PacifiCorp will implement specific measures to minimize adverse interactions between Project power lines and birds, including:

- following the existing Settlement Agreement for Management of Birds on Powerlines on avian protection with ODFW and the USFWS;
- following established procedures for monitoring and managing bird mortalities and problem nests;
- retrofitting or rebuilding poles involved in bird fatalities; and

- constructing new power poles in accordance with published “raptor-safe” guidelines.

These measures will effectively protect birds from hazards associated with Project power lines.

5.11 Erosion and Sediment Control (Settlement Agreement Section 14)

Project facilities and operations can cause erosion and the delivery of sediment to stream channels, degrading aquatic habitat and causing unanticipated turbidity. Section 2.4.1 of the Synthesis Report describes Project-induced erosion and its effects on stream channels, and Section 2.7.1 of the Synthesis Report describes some possible management solutions. PacifiCorp’s (1998) “Response to FERC Additional Information Request (AIR)” also documents the history of erosion caused by the Project, primarily by the waterways and the associated road system. The AIR also identifies over 70 sites where erosion is occurring or has the potential to occur and identifies possible actions for controlling erosion on some of these sites.

The Parties objectives for controlling erosion and sediment are encompassed within the goals for fluvial geomorphic processes and water quality. The goal for fluvial geomorphic processes is maintaining or restoring the geomorphic processes characteristic of the watershed to maintain habitat for native species and promote the long-term health of the watershed. The goals for water quality are:

- managing the hydroelectric facilities in a manner that maintains and/or improves water quality in the watershed;
- meeting water quality standards and antidegradation requirements;
- protecting beneficial uses; and
- meeting the water quality objectives defined in the ACS of the NFP, which include (1) maintaining and restoring water quality necessary to support healthy riparian, aquatic, and wetland ecosystems; and (2) maintaining water quality in the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals in aquatic and riparian communities (USDA Forest Service and USDI Bureau of Land Management 1994).

The NFMA, in part, requires that protection is provided for streams, stream banks, shorelines, wetlands, and other bodies of water from blockages of water courses and deposits of sediment. Soil productivity and water quality goals, objectives, and standards and guidelines related to the erosion and sediment control issues are detailed in the UNFP (IV-66 through IV-72).

To address the Project’s effects on erosion, PacifiCorp will:

- implement a waterway shutoff and drainage system to reduce excess erosion from occurring in the event of a waterway failure, along with an aggressive response in the event of such a failure or a tripping of the system;

- implement remedial measures for all Erosion Sites with a rating of 3 or higher (Medium and High Priority) as identified in the AIR; and
- conduct a monitoring and adaptive management program to address erosion and sediment control over time.

The general programs listed above will include several measures similar to treatment options in the AIR to address erosion control on the Project's waterways, such as:

- removing sidecasted soil,
- installing drainage pipes at stream crossings,
- installing large-diameter culverts beneath access road embankments, and
- site-specific remediation for all High and Medium Priority Sites.

Since site-specific remediation is proposed, the actual treatment option to be employed will be determined for each site on a least-cost, fit-to-site basis to meet soil productivity standards in the UNFP. These measures incorporate elements of both prevention and rehabilitation, which the Parties believe will make significant progress towards restoring soil productivity and improving water quality that has been impacted by the waterway system. The finalization of the Erosion Control Plan, as well as the development of the Vegetation Management Plan (Section 6.9 above) and the Transportation Management Plan (Section 6.12 below), will contribute to the reduction of erosion caused by the Project and to the marked improvement of ecosystem conditions.

5.12 Transportation Management (Settlement Agreement Section 15)

Roads and bridges used for Project operations and other activities on the Umpqua National Forest and the Roseburg District of the Bureau of Land Management can affect both natural resources and public safety.

The Parties' goal for transportation management is to develop and implement a transportation management plan ("TMP") that addresses the access needs, resource protection and public safety requirements, and maintenance responsibilities for roads and bridges associated with the Project, consistent with USDA-FS and BLM land management plans. Transportation management objectives of the Settlement Agreement include:

- establishing a process for sharing the responsibilities for maintenance and capital improvements for the affected roads and bridges;
- reducing adverse environmental effects of the transportation system, including the reduction of sediment delivery to the watershed (also see goals in Section 6.11 above);
- establishing standards for operation and maintenance of the roads and bridges associated with the Project; and
- establishing a process to annually coordinate operation and maintenance of the affected roads.

The National Forest Roads and Trails Act of 1964 (16 U.S.C. § 1601) and Title 36 Code of Federal Regulations Part 212 (36 C.F.R. part 212) authorize the imposing of requirements upon commercial road users for maintaining and reconstructing roads and bridges, including methods of financing of such work commensurate with their use. The Highway Safety Act of 1966 (23 U.S.C. § 402, Public Law 89-564) requires federal agencies to design, construct, and maintain roads in accordance with safety standards and to apply sound traffic control principles.

The estimates of the shares of annual and deferred road maintenance costs for the USDA-FS and PacifiCorp are based upon the 1995 Draft TMP. The estimates also are based upon USDA-FS engineering judgments of the use on various roads types or classes associated with the Project. PacifiCorp will be responsible for 100 percent of the road maintenance and improvements for (1) low standard hydropower facility and transmission line access roads and (2) public use recreation roads located within Project-induced developed recreation sites. Road maintenance and improvements on other roads that provide access to Project facilities and Project-induced recreation sites and that have other commercial, recreation, or administrative use not associated with the Project will be jointly shared between the USDA-FS and PacifiCorp, commensurate with the use by each party, with the USDA-FS responsible for any use by third parties.

USDA-FS Manual 7700 establishes a priority for decommissioning roads where anticipated management needs for the road no longer exist, or the road creates significant adverse environmental effects. Additionally, the access policy under the NFP includes a goal of reducing road mileage within key watersheds. Some of the transmission line access roads are within or adjacent to key watersheds.

Standards and Guidelines for Riparian Reserves under the NFP establish requirements for assessments and improvements to road culverts. Many of the roads associated with the Project are within or adjacent to Riparian Reserves. Existing culverts, bridges, and other stream crossings determined to pose a substantial risk to riparian conditions will be improved to accommodate at least the 100-year flood, including associated bed load and debris (NFP Standard and Guide RF-4). Additionally, there is a requirement to provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams (NFP Standard and Guide RF-6).

In order to accomplish the above, the Settlement Agreement includes provisions for PacifiCorp to develop a TMP in consultation with the USDA-FS and BLM. The TMP will include measures for:

- maintaining roads and bridges in accordance with USDA-FS and BLM performance standards;
- paying for road and bridge maintenance commensurate with use;
- decommissioning 8.6 miles of identified roads;
- maintaining and inspecting bridges, and methods for paying for bridge maintenance; and

- upgrading or replacing culverts to provide fish passage and accommodate 100-year floods.

These measures will maintain public safety and reduce soil erosion and sediment delivery to stream habitat.

5.13 Aesthetics (Settlement Agreement Section 16)

The Project is located in a forested setting and affects the visual resources of the area. PacifiCorp conducted aesthetic studies as part of the Application for New License (see Volume 6, Exhibit E, Section 7 of the license application (PacifiCorp 1995).

The Parties agree that Project facilities should conform to visual resource direction of the UNFP. To that end, PacifiCorp will prepare a Visual Resource Management Plan (“VRMP”) that will address the preservation and enhancement of visual resources in the Project area. The plan will finalize the proposed Aesthetic and Visual Enhancement measures contained in Table 7.3.1, Exhibit E of PacifiCorp’s 1995 license application.

The VRMP will identify actions to reduce the visual impact of Project facilities through landscaping measures and will paint penstocks and surge tanks in a manner that reduces their visual impact. Plan development and implementation will incorporate and utilize the current scenery management standards applicable to the USDA-FS. Reductions of visible or objectionable impacts to waters of the State shall be achieved through appropriate water quality PM&E Measures. The measures included in the VRMP will protect the aesthetic values of the Umpqua National Forest in the Project area.

5.14 Recreation (Settlement Agreement Section 17)

The Umpqua National Forest is visited by the public in large numbers and provides a range of recreational opportunities. The Project provides valuable recreational opportunities, such as reservoir fishing and boating, but can have negative impacts on other recreation uses as well. The Project-related recreation use in the area can also adversely affect other resource values.

The Parties’ goal for recreation management is to develop and implement a Recreation Resource Management Plan (“RRMP”) that addresses planning, design, construction, renovation, operation, maintenance, and monitoring of existing and future public outdoor recreation activities and programs in the Project vicinity. The recreation management objectives of the Settlement Agreement include:

- establishing a recreation operation and maintenance program that defines the responsibilities of PacifiCorp and the USDA-FS;
- mitigating adverse effects of the Project on existing recreational activities and facilities and reducing adverse environmental effects of public recreation facilities;
- providing safe public access to and use of Project water bodies and shorelines;

- providing for accomplishment of deferred maintenance, enhancements, and future expansion (as many be needed and appropriate) of recreation facilities;
- establishing a recreation monitoring program; and
- establishing standards for the operation and maintenance of recreation facilities.

The Electric Consumer Protection Act of 1986, which amends the FPA, requires that recreation opportunities be given equal consideration with protection of environmental quality and natural resources under FERC licenses. Title 18 Code of Federal Regulations sections 2.7 and 4.51 requires the licensee to develop suitable public recreation facilities upon Project lands and waters and to consult on recreation opportunities with federal agencies with managerial authority over any part of Project lands. This consultation is to result in the identification of existing or new measures and facilities for creating, preserving, or enhancing recreational opportunities at the Project or in its vicinity. Both the USDA-FS and PacifiCorp are required to comply with the requirements of the Americans with Disabilities Act of 1990 in providing public recreation facilities.

The Lemolo Lake area is in an Administratively Withdrawn Area land allocation under the NFP as well as part of the Management Area 2 land allocation in the UNFP. The focus of this land allocation is to provide for concentrated developed recreation activities in the areas immediately surrounding Diamond and Lemolo Lakes. The USDA Forest Service Handbook (FSH 2709.15, 23.4) states that “the licensee is responsible for construction, operation, maintenance, and replacement of Project recreation facilities. Where it is in the Governments interest, the USDA Forest Service may perform the operation and maintenance of facilities on National Forest system lands with funds provided by the licensee in accordance with a collection agreement.”

PacifiCorp conducted a two-year comprehensive assessment of recreation demand, supply, preferences, and conditions to fulfill requirements of Title 18 Code of Federal Regulations sections 4.41 and 16.8. This is presented in the Report on Recreation Resources, Exhibit E, Section 6.0 of the 1995 Application for New License.

The findings of the recreation study resulted in the evaluation of several alternatives and a selection of a preferred alternative. This preferred alternative was the basis for the development of the Draft RRMP, submitted to FERC in 1995. The development of the Draft RRMP was a consensus-based planning process involving National Parks, Oregon State Parks, Umpqua National Forest, Douglas County Recreation, and PacifiCorp. PacifiCorp will finalize the RRMP with further consultation with the Parties. The RRMP will incorporate the terms of the Settlement Agreement, further clarify roles and responsibilities, and analyze and implement direction contained in the NFP.

The Draft RRMP includes the following programs:

- a *Recreation Facility and Enhancement Program* that defines construction-related responsibilities of PacifiCorp and the USDA-FS, identifies proposed recreation

- enhancement and development projects, provides conceptual site plans, and discusses facility enhancement and development criteria;
- a *Recreation Operations and Maintenance Program* that defines responsibilities of PacifiCorp and the USDA-FS and discusses facility and use area maintenance standards; and
 - a *Recreation Monitoring Program* that defines annual monitoring and reporting, data gathering and/or survey requirements, and, most importantly, their results on new facility development.

The Draft RRMP establishes goals and objectives for managing recreation resources, identifies measures for existing and proposed recreation enhancements, and describes programs designed to implement those enhancements. The RRMP also contains composite plans for the Toketee and Lemolo Lake areas. These plans represent the preferred Alternative C selected by the USDA-FS following a public review and comment period and public meetings held during August 1995. These plans consider the opportunities, issues, and constraints surrounding the potential siting, construction, and operation of existing and potential recreation facilities. Alternative C can be characterized as improving the existing condition plus providing for some compatible facility expansion to meet future needs. The terms of the Settlement Agreement include the preferred Alternative C (Draft RRMP) along with additional funding for law enforcement, deferred maintenance, dispersed recreation management, and NFP compliance.

Some of the enhancements represent a shared responsibility between PacifiCorp and the USDA-FS. The USDA-FS will operate and maintain the recreation facilities within the FERC Project Boundary with annual reimbursement of costs by PacifiCorp. New facilities will be based on conducting additional user surveys, USDA-FS monitoring information, and physical evidence of overuse. Policy and forest plan changes that could shift demand to other areas will also be evaluated prior to constructing any new facilities. Roles and responsibilities are defined in the Draft Recreation Settlement Agreement located in RRMP Exhibit 4 (PacifiCorp 1995). These measures will manage and protect the recreational resources in the Project area.

5.15 Cultural Resources (Settlement Agreement Section 18)

Important cultural sites and resources exist within the Project Boundary that may be affected by Project operations as well as construction and maintenance activities. The Parties have agreed to minimize impacts to such resources, to establish a process and mechanism to detect such sites, and to mitigate for or avoid destruction of such sites during implementation of the Settlement Agreement.

The Parties will be developing and complying with the conditions of a Programmatic Agreement to which the Forest Service will be a signatory party. As part of the Programmatic Agreement and the Settlement Agreement, PacifiCorp will finalize and implement a Cultural Resources Management Plan ("CRMP") that will define and describe the manner in which archaeological and historic properties will be protected or how impacts will be mitigated. In addition, the CRMP will define how and when consultation with the land management agencies

will occur, interpretation and public outreach will be completed, and the monitoring for potential impacts from construction and maintenance projects and looting will be conducted.

Management of heritage resources on the public lands is based on the Organic Administration Act of June 4, 1897, authorizing the Secretary of Agriculture to regulate occupancy and use of National Forests. The USDA-FS heritage program operates under the authority of the Archaeological and Historic Preservation Act of 1974 (Public Law 93-291), National Historic Preservation Act of 1966 (36 C.F.R. part 800), and other various statutes and regulations. The UNFP requires implementation of all established prescriptions and consultation procedures as defined by historic preservation laws, regulations, and policies on National Forest System lands.

Heritage resources are recognized as fragile, irreplaceable resources with potential public and scientific uses, representing an important and integral part of our nation's heritage. To protect these resources, studies were conducted as part of the application for the New License. These studies included surveys, which identified 12 historic properties associated with the hydroelectric facilities determined eligible for the National Register of Historic Places and identified 43 archaeological sites within the area of potential effect during inventories from 1992 to 1994. Six additional archaeological sites in the area of potential effect have been identified by USDA-FS and BLM employees since that inventory. The Historic Buildings Plan (PacifiCorp 1995) will be incorporated in the CRMP. The CRMP will provide for protection, restoration, and data recovery for prehistoric resources.

Implementation of the CRMP will meet the FERC requirement for Section 106 compliance and will ensure that Licensee activities protect and do not unduly affect cultural, historic, and Native American resources.

5.16 Mitigation Funds (Settlement Agreement Section 19)

To offset Project impacts on fish and wildlife that are not otherwise mitigated by the PM&Es of the Settlement Agreement, four mitigation funds will be established that may be used to implement tributary enhancement, monitoring and predation control, riparian restoration, and other measures in the North Umpqua basin, and to provide for early implementation of PM&E measures. The purposes of the funds are to:

- Mitigate for impacts of the Project to aquatic, terrestrial, and other resources that are not otherwise being mitigated by specific terms and conditions of the New License, water quality certification, TMDL, water quality management plan, or water right;
- Increase wild anadromous fish populations and their habitat within the North Umpqua River basin pursuant to the goals and objectives of the Oregon Plan for Salmon and Watersheds and the North Umpqua River Fish Management Plan (OAR 635-500-0200) and the requirements of Oregon Laws 1999, chapter 882, and the Fish and Wildlife Habitat Mitigation Policy (OAR 615-415-0000 to 0025);

- Promote the objectives of the NFP’s ACS and other federal mandates; and
- Encourage efforts that promote or enhance partnership opportunities, collaborative relationships with stakeholders, and community benefits.

The four mitigation funds include:

- *Tributary Enhancement Fund*: This fund will be used to implement habitat enhancement projects in the vicinity of the Project that are approved by ODFW. This program will fund the habitat enhancement measures described in the Memorandum of Understanding for Fish Passage Waiver (e.g., stream and riparian habitat restoration projects in the Rock Creek basin, upgrading of the Rock Creek diversion to improve fish passage) as well as other habitat enhancement and restoration projects in Rock Creek and nearby basins. The need for and ecological benefits of these types of projects are discussed in the MOU (PacifiCorp and ODFW 2001); Section 7 of the Synthesis Report (“Proposed off-site enhancement package”) (Stillwater Sciences 2000); “Estimate potential costs of specific off-site mitigation alternatives, including conservation easements, land acquisition, and habitat enhancements, using a case study of the Canton Creek basin” (Stillwater Sciences 1998); and “Estimates of potential pre-smolt production using the reference model under various enhancement scenarios in the Canton Creek basin” (Stillwater Sciences 1998).
- *Long-Term Monitoring and Predation Control Fund*: This fund will be used to (1) formulate and implement a study plan, implementation plan, and monitoring and adaptive management plan concerning the potential predation of anadromous salmonid juveniles by nonnative predator species in Soda Springs Reservoir; and (2) monitor and evaluate the success of the reintroduction of anadromous fish populations in the North Umpqua River upstream of the Soda Springs Dam. The potential impacts of predation in Soda Springs Reservoir on anadromous fish are discussed in “Potential predation on juvenile anadromous salmonids in Soda Springs Reservoir under a fish passage scenario” (Stillwater Sciences 2000), which indicates that a predator-control program may be essential to the success of reintroducing anadromous fish upstream of Soda Springs Dam. The funding for monitoring the overall success of reintroducing anadromous salmonids upstream of Soda Springs Dam will allow the Parties, through the RCC (see Section 5 above), to gauge the success of various measures and make adjustments to the measures over the term of the New License as needed.
- *Mitigation Fund*: This fund, administered by the USDA-FS, will be used to implement mitigation and enhancement measures on National Forest System lands and BLM-administered lands within the North Umpqua basin. The projects may include stream or riparian restoration, road decommissioning, or other measures to benefit aquatic and terrestrial species and habitats. The need for and ecological benefits of these types of projects are discussed in the reports listed above for the Tributary Enhancement Program.

- *Early Implementation Fund*: The RCC will set priorities for this fund, which will be used during the period before the New License becomes final for highly visible measures not otherwise funded before the New License becomes final, such as (1) high-priority erosion sites, (2) riparian restoration at Potter Creek, (3) enhancement of up to two wetland areas, (4) road decommissioning, (5) tributary reconnections, and (6) culvert replacement. These measures and their benefits are described in earlier sections of this document.

In addition to the creation of these mitigation funds, the Settlement Agreement also provides funding for monitoring and oversight of mitigation and enhancement measures.

6. LITERATURE CITED

Bovee, K. D., B. L. Lamb, J. M. Bartholow, C. B. Stalnaker, J. Tayler, and J. Henricksen. 1998. Stream habitat analysis using the in-stream flow incremental methodology. Information and Technology Report USGS/BRD-1998-0004. U.S. Geological Survey, Biological Resources Division.

Bowen, Z. H., M. C. Freeman, and K. D. Bovee. 1998. Evaluation of generalized habitat criteria for assessing impacts of altered flow regimes on warmwater fishes. Transactions of the American Fisheries Society 127:455-468.

FERC (Federal Energy Regulatory Commission). 1997. Scoping Document 2, North Umpqua Hydroelectric Project (FERC 1927), Appendices A, B, and C. FERC, Washington, D.C.

Hunter, M. A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes, and options for mitigation. Technical Report No. 119. State of Washington Department of Fisheries, Olympia.

ODFW. 1980. Fish Management Plan--Lemolo Reservoir. ODFW, Umpqua District, Roseburg.

ODFW. 1996. Additional Oregon Department of Fish and Wildlife comprehensive plans relevant to North Umpqua Hydroelectric Project (FERC 1927). Letter dated July 12, 1996 from Mr. Lou Fredd (ODFW) to Mr. Jim Haines (FERC). Oregon Department of Fish and Wildlife, Roseburg, Oregon.

ODFW and PacifiCorp. 2001. Memorandum of Understanding (MOU): Waiver of fish passage. Submitted to Oregon Fish and Wildlife Commission, Portland.

OFWC (Oregon Fish and Wildlife Commission). 2001. Memorandum of Understanding (MOU): Waiver of fish passage. Approved by Oregon Fish and Wildlife Commission, Portland, March 2001.

PacifiCorp. 1995. Application for new license for major modified project. North Umpqua Hydroelectric Project, FERC Project No. 1927, Douglas County, Oregon. Portland, Oregon.

PacifiCorp. 1998. Response to FERC Additional Information Request (AIR). PacifiCorp, Portland, Oregon.

PacifiCorp. 2000. Addendum to the 1995 application for new license for major modified project. North Umpqua Hydroelectric Project, FERC Project No. 1927, Douglas County, Oregon. Portland, Oregon.

Raytheon Corporation. 1997. Wildlife enhancement conceptual design and cost estimates. Final draft report. Prepared for PacifiCorp, Portland, Oregon.

Raytheon Corporation. 1999. North Umpqua canal connectivity/geologic assessment of mitigation measures. Prepared for PacifiCorp, Portland, Oregon.

Stevenson, R. G. 1999. North Umpqua canal connectivity/geologic assessment of mitigation measures Lemolo No. 2, Clearwater No. 2, and Fish Creek, including estimates of construction costs: Review summary. 3 November 1999.

Stillwater Sciences. 1998. The North Umpqua cooperative watershed analysis synthesis report. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 1998. Pros and cons of dropping the "trap-and-haul" alternative from the list of fish passage options under consideration for Soda Springs Dam. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1998. Determine whether a barrier to fish migration exists under Soda Springs Reservoir. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1998. Reservoir and forebay management options addressing stillwater amphibians. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1998. Assessment of historical habitat conditions in the reach of the North Umpqua River currently inundated by Soda Springs reservoir. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1998. Estimate potential costs of specific off-site mitigation alternatives, including conservation easements, land acquisition, and habitat enhancements, using a case

study of the Canton Creek basin. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1998. Estimates of potential pre-smolt production using the reference model under various enhancement scenarios in the Canton Creek basin. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Stillwater Sciences' proposed resource enhancement packages. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Dam-in-place alternative: Further responses to questions from the Soda Springs Connectivity Subgroup. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Criteria for evaluation of management alternatives for connectivity at Soda Springs dam. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Methods for achieving connectivity at Soda Springs dam under a dam-in-place scenario. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Summary of existing information related to connectivity at Soda Springs dam. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 1999. Preliminary assessment of issues related to sediment augmentation at Soda Springs Dam. Resource Team Information Request Report. Prepared for the North Umpqua Cooperative Watershed Analysis Resource Team. Berkeley, California.

Stillwater Sciences. 2000. Assessment of spawning gravel in the North Umpqua River reach upstream of Slide Creek dam. Response to Mediation Team information request. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Percent peak weighted usable area (WUA) analysis of in-stream flow alternatives. Response to Mediation Team information request. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Potential predation on juvenile anadromous salmonids in Soda Springs Reservoir under a fish passage scenario. Response to Mediation Team information request. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Preliminary conceptual design (10 percent design): Created wetland and alternative conveyance of peaking flows from Lemolo No. 2 powerhouse. Response to Mediation Team request. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Geomorphic effects of Soda Springs dam and potential effects on aquatic habitat. North Umpqua Cooperative Watershed Analysis additional information request. Working draft report. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Potential spawning habitat for anadromous salmonids in the upper reach of Soda Springs Reservoir. Response to Mediation Team information request. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

Stillwater Sciences. 2000. Proposed off-site enhancement package. North Umpqua Cooperative Watershed Analysis additional information request. Working draft report. Prepared by Stillwater Sciences, Berkeley, California for PacifiCorp, Portland, Oregon.

USDA Forest Service. 1988. Final environmental impact statement for managing competing and unwanted vegetation.

USDA Forest Service. 1992. A guide to conducting vegetation management projects in the Pacific Northwest Region.

USDA Forest Service. 1994. Use of native and nonnative plants on National Forests and Grasslands.

USDA Forest Service. 1996. USDA Forest Service and USDA noxious weed strategies.

USDA Forest Service and USDI Bureau of Land Management. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl and Standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl.

7. LIST OF ACRONYMS

ACS	Aquatic Conservation Strategy
ADR	Alternative Dispute Resolution
AIR	Additional Information Request
ARPA	Archaeological Resources Protection Act
BLM	Bureau of Land Management
CFR	Code of Federal Regulations

CRMP	Cultural Resources Management Plan
CWA	Clean Water Act
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FWCA	Fish and Wildlife Coordination Act
HART	Hydroelectric Application Review Team
HB	House Bill
IFIM	In-stream Flow Incremental Methodology
LWD	Large Woody Debris
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFP	Northwest Forest Plan
NGO	Nongovernmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OFWC	Oregon Fish and Wildlife Commission
OPUD	Oregon Public Utility Commission
ORS	Oregon Revised Statutes
OWRD	Oregon Water Resources Department
PM&E	Protection, Mitigation, and Enhancement
RCC	Resource Coordination Committee
RCP	Resource Coordination Plan
ROD	Record of Decision
RRMP	Recreation Resource Management Plan
SNA	Spatial Niche Analysis
TMDL	Total Maximum Daily Load
TMP	Transportation Management Plan
UNFP	Umpqua National Forest Land and Resource Management Plan
USDA-FS	U.S. Department of Agriculture Forest Service
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
VRMP	Visual Resource Management Plan
WQMP	Water Quality Management Plan
WUA	Weighted Usable Area