Merwin Hydroelectric Project
FERC Project No. 935

FINAL LICENSE APPLICATION

Exhibit C – Construction History

PacifiCorp
Portland, Oregon

April 2004

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C.1.0 INTRODUCTION

In compliance with the Code of Federal Regulations (18 CFR, Parts 4 and 16), PacifiCorp is applying to the Federal Energy Regulatory Commission (FERC) to relicense the Merwin Hydroelectric Project (FERC Project No. 935) on the North Fork Lewis River, in the State of Washington. The current license for the Merwin Project, which PacifiCorp currently owns and operates, was issued on October 6, 1983 and expires on May 1, 2006.

PacifiCorp is applying for a new license to continue operation of the project. This Exhibit C presents the response to information required by the FERC as described in 18 Code of Federal Regulations (CFR) Section 4.51(d).

Exhibit C contains a history of project construction, including both initial construction and major modifications. Following this introduction, Section C.2.0 describes the history of construction of the project. Section C.3.0 describes major changes to the project since construction. Section C.4.0 discusses proposed changes to the project facilities.

C.2.0 CONSTRUCTION HISTORY

C.2.1 GENERAL DESCRIPTION

The Merwin Hydroelectric Project is one of 3 PacifiCorp hydro projects located on the North Fork of the Lewis River, approximately 10 miles east of Woodland, Washington and 35 miles northeast of Portland, Oregon. The site is about 20 miles upstream of the confluence of the North Fork Lewis River with the Columbia River. It is the first in a string of 4 facilities on the Lewis River. The other three projects are Yale (FERC Project No. 2071), Swift No. 1 (FERC Project No. 2111) and Swift No. 2 (FERC Project No 2213), all upstream of Merwin. Merwin, Yale and Swift No. 1 are owned and operated by PacifiCorp. Swift No. 2 is owned by the Cowlitz County Public Utility District No. 1 (Cowlitz PUD) and maintained and operated by PacifiCorp under contract.

C.2.2 HISTORICAL OVERVIEW

Investigation of the power production potential of the Lewis River date back to at least 1909 and site explorations were started as early as 1914. Northwestern Electric Company, a predecessor of Pacific Power and Light, obtained a preliminary permit from the Federal Power Commission (FPC) to investigate the Yale Project site in 1922. In late 1928, Northwestern Electric Company filed an expanded application for a preliminary permit with the FPC to investigate a comprehensive development of four sites on the Lewis River: Ariel, Basket, Swift and Muddy Creek. Three of the 4 projects have been constructed and are now known as, respectively, Merwin, Yale (FERC Project No. 2071, and Swift No. 1 and Swift No. 2 (FERC Project Nos. 2111 and 2213) (initially proposed as a single project). The fourth project, Muddy, is no longer being considered for development.

C.2.2 MERWIN CONSTRUCTION HISTORY

In August 1929, the FPC issued a preliminary permit for detailed investigations of the Merwin and Yale sites, designating them Project No. 935. In August 1929 Inland Power & Light Company, also a predecessor of Pacific Power & Light, filed an application to construct Merwin and Yale. In October of that year, the FPC approved the construction of Merwin but postponed action pertaining to Yale. Construction of the Merwin Hydroelectric Project began on October 19, 1929. On December 12, 1929, the FPC issued a license to Inland Power & Light Company for a 50-year period. Energy from the project was first delivered into the Northwestern Electric Company power system on September 4, 1931.

The Merwin Project was designed by Ebasco Services, Inc. and constructed by Phoenix Utility Company for Inland Power & Light Company. The initial development consisted of construction of the arch dam and installation of one 45 MW generating unit and a 1 MW house unit. Provisions were made for the installation of 3 additional units, each with a capacity of 45 MW. A second unit was placed in service in 1949 and a third unit in 1958. A chronology of progress of development and construction is presented in Table C.2.1-1.

The arch dam was constructed in columnar sections approximately 30 feet long with 2-foot slots between sections. The slots were left open to assist in cooling the concrete during construction and the last concrete placed was utilized to fill these slots at a time when the columnar sections had reached their future average annual temperature. Consequently, the radial joints between the sections of the arch dam were not grouted. It was found by experimentation that an appreciable increase in rate of cooling could be accomplished by the insertion of pipes or by coring out concrete so that water could be circulated to take away the heat.

The heavy thrust block at the north end of the arch was built with one vertical construction joint that was thoroughly grouted just before the reservoir was filled and after the concrete had had a number of months to cool and shrink. The overflow section of the dam is an extension of the thrust block and was built with construction joints between the spillway piers. These joints were grouted prior to filling the reservoir and after the concrete had cooled and shrunk for nearly a year. The grouting of construction joints was done through 1-inch pipes placed horizontally every 5 feet in elevation.

For the powerhouse, each end is on solid rock while the central portion bridges over the deeply eroded part of the river canyon on a heavy concrete arch built on steel arches used as forms and embedded in the concrete. The arch has a span of approximately 70 feet, a thickness of 12 feet at the crown, and was built in blocks to minimize the stress on the steel arches during construction.

Penstocks for 4 main units were embedded in the dam at the time of initial construction, 3 of them being bulkheaded at the lower end. Powerhouse substructure below the turbine block was constructed for all 4 units although draft tubes were not built for Units 3 and 4. For Unit 2, the draft tube was built and sealed with a steel bullhead. Only Unit 1 was completely installed during initial construction.

Table C.2.1-1. Chronology of progress of development and construction.

Date	Item
January 1914	Investigations into the Lewis River power production potential begin
November 24, 1928	Application for Preliminary Permit for development of four Lewis River Projects filed with the FPC
October 1929	FPC approves construction of Merwin Construction begins
December 1929	FPC issues license for Merwin Construction of diversion tunnel and upper cofferdam begin Stripping of abutments for dam begins
March 1930	Reservoir clearing begins Reconstruction of Woodland-Ariel Road complete Gravel, cement, concrete and diamond drilling at dam site complete Diversion tunnel holed through
April 1930	Pouring of concrete thrust block at north end of dam begins Diversion tunnel lined Excavation of dam above water line begins
May 1930	Installation of gates at ends of tunnel
June 1930	Upper and lower cofferdams closed; diversion of Lewis River begins Pouring of concrete against south abutment of dam begins
June – September 1930	Clearing or reservoir, construction of fish wheel at mouth of diversion tunnel, construction of hatchery holding ponds
September 1930	Excavation of dam complete Construction of powerhouse begins Construction of earth dike at the north end of the dam begins
October 1930	Upper bench of dike complete Powerhouse foundation arch and draft tubes for units 3 & 4 installed Construction of 4 penstocks complete
February 1931	Powerhouse substructure, excluding operating floor and concrete around scroll case, complete
April 1931	Pouring of concrete into the arch dam complete
May 1931	Intake, trash rack and screens for all 4 penstocks complete Diversion tunnel closed Reservoir begins filling
June 1931	Spillway gates and operating hoists complete Parapet walls on top of dam complete 150-ton crane for handling the intake gate installed
July 1931	1 MW house unit placed in service (July 7, 1931)
October 1931	First unit placed in service (October 16, 1931)

C.3.0 CHANGES TO PROJECT FACILITIES SINCE CONSTRUCTION

Since original construction, significant improvements have been made to project facilities. An extreme flood in 1933 washed away the left abutment of the downstream access bridge and the bridge itself. Between 1934 and 1937, the height of the spillway gates were raised by 5 feet by means of wood flashboards.

On May 14, 1942, the FPC approved the transfer of Merwin from Inland Power & Light to Pacific Power & Light. On May 1, 1948, the project name was changed from Ariel to Merwin in honor of L.T. Merwin, president of Northwestern Power & Light.

A new bridge of longer span and improved alignment was constructed in 1948. At that time, a small retaining wall was constructed abutting the right spillway training wall near the river. This collects seepage water from springs on the right abutment area and directs it over the top of the training wall approximately 150 feet from the downstream end of the wall. Also in 1948 and 1949, the top of the parapet wall along the nonoverflow section and walls between the spillway and the right abutment were raised by 2 feet to Elevation 242. This was done to preclude the possibility of waves during extreme high water washing over the nonoverflow section and into the space between the two parapet walls or around the right abutment. Completion and installation of Unit 2 expanded the project with a capacity of 45 MW in 1949. In 1958 the construction and installation of the 45 MW Unit 3 further expanded the project.

As a result of Mount St. Helens volcanic activity, about 11,000 acre-feet of mudflow entered the upper Swift Reservoir on May 18, 1980. While the mudflows had no direct effect on the Yale and Merwin reservoirs, PacifiCorp convened a Board of Consultants to evaluate the implication of the volcanic activity and to recommend criteria for the prudent operation of all the Lewis River Projects. PacifiCorp subsequently prepared operating procedures for 3 plans corresponding to 3 potentially controlling natural events. These were submitted to the Washington State Department of Ecology and the Federal Energy Regulatory Commission on October 16, 1980. Current operations reflect acceptance of these plans by both agencies.

The initial license for the project expired in 1979. An application for a new license was filed with the FERC and a competing license application was filed by a joint venture composed of the Clark County's and Cowlitz County's public utility districts. A new license was issued to PacifiCorp effective October 6, 1983.

During 1989 and 1990, all the spillway gates were repainted and also fitted and tested with new seals and lifting chains that were provided with individual link grease fittings. During the same period, both the dam and headgate crane and the powerhouse gantry crane were repainted.

In 1990, the thrust block and nonoverflow section were anchored to the foundation rock by post-tensioned anchors in order to provide sufficient stability to meet the cracked base uplift requirements in the FERC guidelines.

Work performed in 1996 included the installation of automated and supervisory controls for more automated and remote controlling of the powerhouse and spillway and the overall Lewis River hydro system.

In 1999, the gate struts were replaced with heavier members, and the cracks downstream and above the trunnions were epoxy grouted.

Additionally, many routine improvements and upgrades have been made to the project. A list of improvements and upgrades conducted during the current license period are listed in Table C.3.0-1.

Table C.3.0-1. Improvements and upgrades to the Merwin Project.

Activity	Dates
Fish trap improvements	1999
Powerhouse interior painted	1999
Gate struts replaced	1999
Cracks downstream and above trunnions epoxy grouted	1999
Powerhouse roof replaced	1999
Installation of automated and supervisory controls	1996
Ariel gaging station access upgraded	1996
Spillway gate controls upgraded	1996
Unit 1 governor replaced	1996
Butterfly valves rewired and new TIV controls upgraded	1995-1996
Air circulation system installed in powerhouse	1995
Merwin Village houses remodeled	1995
Transformer deck sealed	1995
SPCC modifications	1995
AC & DC panel replaced	1995
Turbine bearing lubrication system replaced	1994
Turbine decking replaced	1994
Lewis River Control Center operations relocated from Merwin powerhouse to new Lewis River Headquarters building	1994
Merwin Village houses remodeled	1993
Intake Substation Fencing	1993
J/B Crane Maintenance	1993
Merwin Fish Hatchery – Intake Load Center	1993
Asbestos Monitoring Inspection	1992
Headgate and powerhouse cranes upgraded	1992
Installation of plant air compressor	1991
Powerhouse and microwave house re-roofed	1990
Thrust block and nonoverflow section anchored foundation rock by post-tensioned anchors	1990
Dam and headgate crane, powerhouse gantry crane repainted	1989-1990
Spillgate gates fitted and tested with new seals and lifting chains	1989-1990
Spillway gates repainted	1989-1990
Modify Water Gage	1989
Hatchery	1988-1989
Construction of domestic water main	1987-1988
Construction of warehouse	1987
Merwin Village water system upgrade	1986
Wash Basin	1986

C.4.0 PROPOSED CHANGES TO PROJECT FACILITY

As part of this license application, PacifiCorp is not proposing any major modifications or upgrades. However, the Company will continue to evaluate the potential for project upgrades and modifications as future market and other conditions change, to ensure the most cost-effective, efficient and environmentally balanced use of the water resources available.

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