CUSHMAN NO. 1 HYDROELECTRIC POWER PLANT, POTLATCH TRANSMISSION LINE
(Cushman Transmission Line)
North Fork of the Skokomish River at Lake Cushman to Hood Canal
Hoodsport vicinity
Mason County
Washington

HAER WA-26-F
HAER WA-26-F

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC WEST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
333 Bush Street
San Francisco, CA 94104

HISTORIC AMERICAN ENGINEERING RECORD

CUSHMAN NO. 1 HYDROELECTRIC POWER PLANT, POTLATCH (CUSHMAN) TRANSMISSION LINE

HAER No. WA-26-F

Location:	East bank of the North Fork of the Skokomish River, Mason County, Washington USGS Topographic Quad: Hoodsport Township 22 North, Range 4 West, Section 5
GPS Coordinates:	Latitude: 47° 25'389 N, Longitude: 123° 13'353 W This coordinate represents the center of the Cushman No. 1 intake house building. Obtained October 17, 2012, using Google Earth (© 2012). The coordinate's datum is North American Datum 1983.
Present Owner:	City of Tacoma, Department of Public Utilities, Light Division (doing business as Tacoma Power)
Present Use:	Hydroelectric Power Production
Significance:	Cushman No. 1 Hydroelectric Power Plant powerhouse represents a significant achievement in power production for the City of Tacoma. Constructed in response to unprecedented increases in power demands in the city, the Cushman No. 1 Development led to further industrial and commercial expansion. Cushman No. 1 dam is a notable example of medium-head hydroelectric technology from the mid-1920s. Moreover, its construction was an engineering feat, located in steep, nearly inaccessible terrain prone to flooding.
Date:	Constructed 1923–1925
Builder:	Tacoma City Light
Report prepared by:	Natalie K. Perrin, M.S., and Heather Lee Miller, Ph.D. Historical Research Associates, Inc. 1904 Third Avenue, Suite 240 Seattle, WA, 98101 and John Stamets, Photographer 493 14th Avenue East Seattle, WA 98112
Submittal Date:	July 17, 2014

I. PROJECT DESCRIPTION

The City of Tacoma, Department of Public Utilities, Light Division (doing business as Tacoma Power) owns and operates the Cushman Hydroelectric Project (the Project). The Project is operated under a 50-year Federal Energy Regulatory Commission (FERC) license (FERC Project No. 460), which was granted on July 15, 2010, following over 20 years of negotiations with federal, state, local, and tribal entities. The Cushman Hydroelectric Project comprises two historic districts listed in the National Register of Historic Places (NRHP) in 1988, specifically the Cushman No. 1 Hydroelectric Plant Historic District and the Cushman No. 2 Hydroelectric Plant Historic District. At the time of this writing, the two districts are being combined into one historic district known as the Cushman Hydroelectric Project Historic District; the district, as revised, encompasses the Cushman Nos. 1 and 2 Developments and a segment of the Potlatch (Cushman) Transmission Line.

The Cushman Hydroelectric Project plays an integral role in the City of Tacoma's infrastructure and economic development. The Cushman No. 1 Hydroelectric Power Plant or, more accurately, the Cushman No. 1 Development, includes buildings and structures from the initial building campaign of the Project, 1923–1925. The Cushman No. 1 Development impounds Lake Cushman, and includes the Cushman No. 1 dam and valve house (HAER No. WA-26-B), the Cushman No. 1 powerhouse (HAER No. WA-26-C), the inclined tram and tram house (HAER No. WA-26-D), the water conveyance system (HAER No. WA-26-E), and the Potlatch (Cushman) transmission line (HAER No. WA-26-F). The original spillway (HAER No. WA-26-A) was removed and replaced with a modern spillway in 1991.

As part of FERC relicensing, Article 414 requires a floating surface collector (FSC) and net transition structure (NTS) be installed at the Cushman No. 1 Development, to facilitate downstream fish passage. Construction of the FSC and NTS is considered an undertaking under Section 106 of the National Historic Preservation Act of 1966 (as amended), and constituted an unavoidable adverse effect on a historic property. To minimize the adverse effect, Tacoma Power consulted with an architectural historian during project design phases; combined the Cushman Nos. 1 and 2 Hydroelectric Power Plant historic districts into one Cushman Hydroelectric Project historic district via a NRHP nomination update; and completed this Historic American Engineering Record (HAER) documentation to addend the 1989 recordation of the Cushman No. 1 spillway. As such, the Potlatch (Cushman) Transmission Line is hereby recorded in accordance with HAER Level II documentation.

II. HISTORIC CONTEXT

Public interest in the Cushman transmission line was almost as great as interest in the construction of the dam itself, with particular focus paid to the crossing of the Tacoma Narrows.[1] The whole of the line illustrated "the intricacies of electrical engineering" for the entire project, designed to be the most economical for the needs of Cushman Nos. 1 and 2 and meet safety and power needs through a process "involving studies and computations extending over many weeks

[1] "Narrows Span Gigantic Engineering Feat," *Tacoma Sunday Ledger*, February 28, 1926, 8.

by highly trained engineers headed by A. F. Darland, superintendent of electrical construction."[2] The transmission line enabled Tacoma to have some of the lowest rates in the nation, stimulating the development of electric resources throughout Pierce County.[3]

III. PHYSICAL DESCRIPTION

The Potlatch (Cushman) Transmission Line is a linear feature composed of a variety of pole structures, transmission cables, conductors, insulators, and mounting equipment. The line stretches from the Cushman No. 1 switchyard to an interchange located south of the Cushman No. 2 switchyard, where the two systems link. From the interchange, two 115-kilovolt (kV) transmission lines travel east-northeast approximately 21 miles, crossing the Hood Canal, the Skokomish Estuary, and the North Bay of Case Inlet, to the Vaughn Tap. The Vaughn Tap, located north of the town of Vaughn and just east of the town of Allyn on the Kitsap Peninsula, is the point at which the 115-kV transmission lines tie into Tacoma's integrated transmission system.[4] From the Vaughn Tap, local distribution lines spilt off from the transmission lines, which continue on to the Pearl Street Substation, before continuing on to the historic terminus of the line at the Cushman Substation. The total length of the line is approximately 44 miles.

The segment of the Potlatch line that links the Cushman No. 1 and Cushman No. 2 switchyards via an interchange (located south of the Cushman No. 2 substation) is known as the Cushman Nos. 1 and 2 Transmission Line. The linear corridor was initially constructed concurrent with Cushman No. 1 (ca. 1925) and was connected to Cushman No. 2 when that system was completed (ca. 1930). The predominant pole type found along this segment is a simple wood pole with three insulators, two extending horizontally and spaced in the top third of the pole, and one extending vertically from the top of the pole (hereafter called a three-pronged pole). The insulators are mounted to the poles via steel mounting brackets. Each insulator is connected to one of three transmission cables. Other pole types include T-poles, so called due to a horizontal wood bracket mounted to the main pole and used to support the insulators and mounting hardware. The T-poles have a different type of insulator than the three-pronged poles, but function in exactly the same fashion. The different types of poles, insulators, and hardware are representative of alterations made during ongoing maintenance and repairs to individual pole lines and components with more economical construction types.

The segment of the Potlatch Transmission Line at the crossing of North Bay, aptly named the North Bay crossing, is approximately 1 mile long and consists of six pairs of single-circuit steel-lattice towers on concrete foundations/piers: two on the west side of North Bay in the town of Allyn, two in the bay anchored on concrete piers, and two on the east side of the bay west of the Vaughn Tap (where some power is delivered to local distribution systems). The tower pairs are

[2] "Transmission Line Is Simple," *Tacoma Sunday Ledger*, February 28, 1926, 8.

[3] "Pierce Leads State in Development of Electric Resources," and "Tacoma's Power and Light Rates Lowest in U.S.," *Tacoma Sunday Ledger*, February 28, 1926, 7.

[4] Transmission lines are high-voltage delivery systems spanning long distances from the point of generation to the point of use. These are different from distribution lines, which are lower-voltage lines that typically line streets located within cities and towns.

spaced evenly about 1,000 feet apart. These structures are original to the Cushman electric power generation and transmission system.

East of the North Bay crossing is the Henderson Bay crossing, which roughly parallels the Purdy Sand Spit south of Burley Lagoon between the towns of Wauna to the west and Purdy to the east. Like the North Bay crossing, the Henderson Bay crossing comprises pairs of single circuit steel lattice towers on concrete foundations/piers, in this case two pairs west of the crossing, one pair in-water, one pair straddling Highway 302 on the Purdy Spit, and one pair on the east side of the crossing (for a total of five pairs). These structures are original to the Cushman electric power generation and transmission system.

Also within the right-of-way of the Potlatch transmission line is the Cushman No. 1 concrete water reservoir. The reservoir was designed in July 1925, and is believed to have been built concurrently with the Cushman No. 1 dam. The rectangular concrete structure, located along the transmission-line corridor between Cushman Nos. 1 and 2, was used as a water reservoir for domestic supply as well as generator cooling. Rectangular in plan, and approximately 44½ by 30½ feet in size, the structure is approximately one story tall (11 feet from footing to top of wall and 12 feet from footings to the top of the domestic water-supply chamber wall), a portion of which is below ground level (the ground surface slopes roughly west to east). The entire reservoir is topped by a concrete cap. The domestic water-supply chamber is a square chamber within the reservoir on the northeast corner, approximately 14 by 14 feet, accessed via a manhole cover and iron ladder. The reservoir floor is only 6 feet below the top of the wall; a series of intake, sluice, and outlet pipes are located beneath the floor. The Cushman No. 1 concrete water reservoir is no longer in use, and is not directly affiliated with hydroelectric power production; however, it helps tell the story of conditions during the early days of the Cushman Hydroelectric Project.

IV. CONSTRUCTON AND MAINTENANCE

The City of Tacoma, Cushman Power Project, was granted a permit from the War Department on December 3, 1924, to construct and maintain an electric transmission line across Case Inlet, an arm of Puget Sound, at Allyn, Mason County, Washington.[5] Since 1926, the replacement of wood poles has occurred as maintenance conditions have dictated, and most segments of the Potlatch line have been modified over the years.

In December 1935, the Department of Public Utilities, Light Division, put in a project proposal to the Works Progress Administration (WPA) for work along the Henderson Bay to North Bay section of the Potlatch line right-of-way, including surface clearing, cutting dangerous trees, and constructing a sixteen foot road. The cost of the proposed project totaled $24,503.02, including $13,352.33 in labor costs provided by federal funds in the form of WPA laborers. It is unclear (based on the available records) if the Department of Public Utilities was awarded the

[5] W. J. Bardon, War Department Permit 667.19/21, December 3, 1924, Cushman Project/Historical Information, 1988–1929, Water Rights files provided by Steve Fischer, Tacoma Public Utilities.

funds/laborers to complete the project, or if the roadwork was completed with the use of day laborers hired in 1938 with Light Department funds.[6]

In 1947, in anticipation of construction of the Pearl Street Switching Station (now known as the Pearl Street Substation, completed in 1949), the original steel lattice structures connecting the Cushman Substation to the Tacoma Narrows crossing were rerouted. This was the first of several major alterations that would be made to the transmission-line corridor.

In April 1952, wood H-frames at the Skokomish Flats crossing were replaced with steel lattice poles and a steel "dead-end" tower. The new steel poles did not conform to the historic location of the wood structures, and were of a different size, material, and type than the previous poles. In all, approximately 30 wood H-frames were replaced with 20 steel lattice poles, beginning at the Cushman No. 2 switchyard and stretching across the Skokomish Flats.

In 1966, plans for the Olympic Village Shopping Center, located northwest of the Tacoma Narrows crossing on State Route 16, necessitated further realignment of the Cushman Transmission Line corridor. At that time, the corridor was shifted from a straight, linear path paralleling State Route 16 to a jogged alignment north of and around the shopping center. The alteration replaced three sets of paired wood H-poles with nine steel monopoles.

Further alterations occurred in 1996, when a segment of transmission-line corridor stretching from the east side of the Hood Canal to just west of the city of Allyn was replaced with 115-kV double-circuit steel poles. Other replacements have occurred between Purdy and the Skokomish Flats. Multiple alterations have been made in Gig Harbor, where three steel poles were necessitated in a new alignment for a park-n-ride complex and an additional relocation was required to accommodate St. Anthony's Hospital.

Additionally, the Tacoma Narrows crossing, which historically featured 325-foot-tall latticed-steel riveted towers, was completely replaced in 2006 with modern, double-circuit lattice towers designed with six arms and a slightly flared body. The new towers were located in the open space between the preexisting pairs of single-circuit towers, and are taller than the original towers. The need for and modifications to the Tacoma Narrows crossing was well documented by POWER Engineers Inc. employees, who noted of the replacement, "it became clear that this crossing would no longer be anything like the longest span in the world. The towers were not going to be nearly the tallest in the world, and the conductors were not going to be pulled nearly as tight as some of the tightest in the world. However, the combination of span length, conductor tension, tower height, right-of-way constraints, and schedule and outage limitations made the project very challenging."[7]

Finally, the Cushman Transmission Line no longer connects directly to the Cushman Substation in Tacoma. In 1947, the Pearl Street Substation in Tacoma was under construction. By 1949, the transmission line was rerouted from the Cushman Substation to the Pearl Street Substation. Although the transmission line continues on to the Cushman Substation, the line's

[6] "Works Progress Administration Project Proposal," December 7, 1935, Cushman Project/Historical Information, 1930s–1940s, Water Rights files provided by Steve Fischer, Tacoma Public Utilities.

[7] Bob Kirchmeier and Peter Catchpole, "Crossing the Tacoma Narrows," *Transmission and Distribution World* (October 2007): 3.

historic alignment and terminus have been altered. The Cushman Substation (discussed below) now acts as a storage building, and all interior equipment has been removed; the switchyard, located on the Cushman Substation property, is still active.

V. REFERENCES

Kirchmeier, Bob and Peter Catchpole. "Crossing the Tacoma Narrows." *Transmission and Distribution World*. October 2007.

Tacoma Sunday Ledger. "Special Cushman Power Project Edition." Washington State Library, Olympia, Washington.