



Hiilangaay Hydroelectric Project – Final Report

DOE Award DE-EE0002502

Prince of Wales Island, Alaska

June 20, 2016



Contents

Executive Summary	1
1 Project Overview	1
2 Objectives.....	1
3 Project Features	2
3.1 Dam/Intake	2
3.2 Penstock.....	3
3.3 Powerhouse	3
3.4 Tailrace.....	3
3.5 Transmission Line to Hydaburg/Switchyard.....	3
3.6 Access Roads	4
4 Description of Activities Performed	4
4.1 Construction Planning	4
4.2 Permit Coordination and Compliance	4
4.2.1 FERC License	4
4.2.2 Fish Habitat Permit.....	5
4.2.3 Corps of Engineers Permit	5
4.2.4 Transmission Line Easement and Coastal Management Program Review.....	6
4.2.5 Water Right Permit	6
4.2.6 State Historic Preservation Office Approval	6
4.3 Final Design	6
4.3.1 Penstock Route	6
4.3.2 Powerhouse and Tailrace	6
4.3.3 Transmission Line	7
5 Conclusions and Recommendations.....	7
6 Lessons Learned.....	7

Photos

Photo 1. Rich's Pond from Outlet to Inlet.....	2
Photo 3. Overview of Powerhouse Road Construction.....	4
Photo 4. Soil Core Samples.....	4
Photo 5. Bear looking for fish along the shoreline of Reynolds Creek.	5
Photo 6. Transmission Line Installation	7

Executive Summary

The Hiilangaay Hydroelectric Project (“Hiilangaay” or the “Project”) is a 5-megawatt hydroelectric resource currently under construction on Prince of Wales Island (POW), Alaska, approximately ten miles east of Hydaburg. The objective of the Project is to interconnect with the existing transmission grid on Prince of Wales Island, increasing the hydroelectric generation capability by 5 MW, eliminating the need for diesel generation, increasing the reliability of the electrical system, and allowing the interconnected portion of the island to have 100 percent renewable energy generation.

Pre-construction activities, funded in part by the Department of Energy (DOE) including construction planning, permit coordination and compliance, and final design have made it possible to move forward with construction of the Hiilangaay Project. Despite repeated delays to the schedule, persistence and long-term planning will culminate in the construction of the Project, and make Prince of Wales Island independent of diesel-fueled energy.

1 Project Overview

The Hiilangaay Hydroelectric Project (“Hiilangaay” or the “Project”) is a 5-megawatt hydroelectric resource currently under construction on Prince of Wales Island (POW), Alaska, approximately ten miles east of Hydaburg. The Project will interconnect with the existing transmission grid on the island and will be used by the residents and businesses of Craig, Klawock, Hollis, Hydaburg, Thorne Bay, Kasaan, Coffman Cove, and Naukati. The Project will be constructed and owned by Haida Energy, Inc., a Joint Venture between the Haida Corporation and Alaska Power & Telephone (AP&T). Alaska Power Company (APC), a subsidiary of AP&T, and the local electric utility on Prince of Wales Island will operate and construct parts of the project. Haida Energy will be a utility regulated by the Regulatory Commission of Alaska (RCA).

The Project is a conventional hydroelectric project. Hydroelectric technology is well developed, and provides most of the renewable energy generated in the world in general, and Southeast Alaska in particular. The Project will utilize the abundant rainfall and steep topography afforded by the Reynolds Creek basin to generate renewable energy. Other potential hydroelectric sites exist in the area but are much smaller than Hiilangaay and would have significantly less energy potential. Tidal generating technology may be applicable to the area but is considered too experimental and expensive to compete with Hiilangaay. Wind, biomass, wave, and other renewable technologies are not suitable to the area.

Hiilangaay will be fully incorporated with the other hydro resources so that the renewable resources will be dispatched as an integrated system. Hiilangaay is also lower in altitude than other hydroelectric projects and should not experience icing problems during the winter months. Therefore, it is expected that the Project will eliminate the need for essentially all diesel generation on the interconnected grid.

The Department of Energy (DOE) awarded funding to the Project under their Renewable Energy and Energy Efficiency Deployment in Indian Country grant program in August of 2010. With the financial assistance provided by the DOE, Haida Energy, Inc, has been able to complete pre-construction activities and the preliminary steps required to resume on-site construction, planned for the second half of 2016.

2 Objectives

The objective of the Project is to interconnect with the existing transmission grid on Prince of Wales Island, increasing the hydroelectric generation capability by 5 MW, eliminating the need for diesel generation, increasing the reliability of the electrical system, and allowing the interconnected portion of the island to have 100 percent renewable energy generation.

3 Project Features

Hiilangaay will be interconnected to the grid with a 12-mile, 34.5-kV transmission line that is considered part of the Project and included in the Project. Limited construction has started on certain preliminary components such as transmission right-of-way clearing and the first mile of transmission line on the Deer Bay road. 1.1 miles of the transmission line follows the path of an existing 2.4 kV line and required the installation of new poles. The Project's transmission line conductors have been installed at the top of the poles and the existing 2.4 kV line was installed underneath. The extended line interconnects with the existing 34.5 kV line in Hydaburg.

Annual energy production by the Project during an average water year is estimated to be 19.3 million kilowatt-hours, subject to usability in the area load. The principal Project components are as follows:

3.1 Dam/Intake

A diversion will be constructed near the outlet of Rich's Pond, a small sub-basin at the outlet of Lake Mellen. The spillway crest of the dam will be at elevation 876 feet mean sea level (fmsl). The diversion structure will be grouted riprap with a concrete core cutoff wall. The crest length of the structure will be approximately 28 feet and the section will act as a weir with uncontrolled overflow when the lake is above elevation 876 fmsl. The backwater from the dam will inundate Rich's Pond and interconnect to the existing surface elevation of Lake Mellen. The intake structure will include a fish screen. A steel transition piece will connect the intake to the penstock. A small valve house will be located immediately downstream of the intake. The valve house will include the penstock shutoff valve and operator as well as an uninterruptible power supply to ensure fail-safe operation of level control elements and flow sensors.

Investigations are underway to consider raising the height of the dam to increase winter storage capacity that would enhance the project's capability to further displace winter diesel usage.

A bypass pipe will pass directly through the center of the diversion structure. This bypass pipe will provide uninterrupted flow to the bypass reach downstream of the diversion. The bypass pipe will be oversized for the required flows. The inlet of the bypass pipe will be protected by a bar structure to prevent debris from entering. The outlet of the bypass pipe will be equipped with either an orifice plate or valve which will be used to regulate discharge flows.



Photo 1. Rich's Pond from Outlet to Inlet

3.2 Penstock

An approximate 3,200-foot-long welded steel penstock will convey water from the intake to the powerhouse. The penstock will have a diameter of 42 inches corresponding to a maximum flow rate of 90 cubic feet per second. The penstock will be of aboveground construction on simple saddle supports. The penstock will have an epoxy lining and coating to provide corrosion protection. Thrust blocks will be provided at changes in alignment and grade as well as at the powerhouse. The penstock will have a leak detection system installed which will automatically close the intake pipeline shutoff valve in the event that a leak occurs.

3.3 Powerhouse

The powerhouse will be located in plan at the approximate location of the anadromous fish barrier of Reynolds Creek. The powerhouse will sit on an excavated bench at or about elevation 110 fmsl, which is approximately 20 feet above the ordinary high water mark of Reynolds Creek. The actual design elevation will be determined once geotechnical investigations are completed.

The powerhouse will be an insulated, pre-engineered metal building on a concrete slab foundation. The powerhouse will contain a single 5 MW horizontal Turgo impulse turbine/generator set, flywheel, inlet piping, guard valve, switchgear, and controls. Centerline of the turbine will be at approximately elevation 115.0 fmsl.

3.4 Tailrace

A 54-inch diameter steel pipe will return project flows back to Reynolds Creek as near as possible to the anadromous fish barrier. The pipe will extend from the powerhouse back to Reynolds Creek. It is proposed to have the tailrace return to Reynolds Creek at the base of the falls where the creek daylights from the canyon at the approximate location of the base of the existing log jam at about elevation 90 fmsl. The tailrace will return flow over a perched ledge to act as a barrier to fish migration into the tailrace.

The tailrace location is approximately 50 feet downstream of the location of the anadromous barrier identified by the agencies. This location was selected because it would return the water to the creek with the least amount of construction-related impacts to the stream.

3.5 Transmission Line to Hydaburg/Switchyard

The switchyard at the powerhouse will consist of a pad-mounted disconnect switch and a pad-mounted step-up transformer. An overhead 34.5 kV transmission line will travel 12 miles along existing logging roads along the edge of Copper Harbor north along Hetta Inlet. Approximately 3.3 miles from the powerhouse, the transmission line will make an aerial crossing of Hetta Inlet via Jumbo Island. The line will then follow the existing road to a point approximately 1.4 miles northeast of the town of Hydaburg where it will connect with an existing power line. Total length of the transmission line will be approximately 12 miles. Except for the aerial crossing of Hetta Inlet, the poles would be designed as tangent line structures on about 300 foot centers. Design of the line also

incorporates the latest raptor protection guidelines. Collision avoidance devices will be installed on the line at appropriate locations to protect migratory birds.

3.6 Access Roads

A limited amount of new access road will be needed to construct the Project. The major landowner, Sealaska Corporation, constructed much of the road system when the area was logged. It is estimated that less than 3000 feet of new road will be required to access both the powerhouse site and the diversion site. Access roads constructed in conjunction with the Project are of the same design as the primary logging roads.



Photo 2. Overview of Powerhouse Road Construction

4 Description of Activities Performed

The following activities have been performed since 2010, with funding assistance provided by the DOE's Renewable Energy and Energy Efficiency Deployment in Indian Country grant program:



Photo 3. Soil Core Samples

4.1 Construction Planning

Coordination of design and construction-related activities has continued between Haida Energy, AP&T, the FERC, the Alaska Energy Authority (AEA), and the Project Construction Organization. To date, construction has been limited to certain preliminary components such as transmission right-of-way clearing and the first mile of transmission line on the Deer Bay road, new access road construction, and geological exploration of the dam site and repair of existing Project access roads.

4.2 Permit Coordination and Compliance

The following coordination activities for the following major permits and approvals have been completed to date:

4.2.1 FERC License

The Project received its Federal Energy Regulatory Commission (FERC) License on October 24, 2000. During the first 6 months of 2010, Haida Energy prepared and filed a variety of plans and documents required by the FERC license (jointly referred to as "compliance plans"). Due to final design changes included in those compliance plans that

were not approved in the original FERC license issued to Haida Corporation, the FERC concluded that those changes were “material amendments” and required filing an application for amendment of license under 18 CFR S 4.201. The application for amendment of license was filed on August 31, 2010, along with updated versions of some of the compliance plans.

An Order Amending License was issued on October 8, 2010. That Order approved material changes to the penstock route, the powerhouse and tailrace, and the transmission line. During the license amendment process, the Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR), the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), and the State Historic Preservation Office (SHPO) had all been contacted and had agreed to waive further consultation regarding the changes requested in the amendment.

In a letter to the FERC dated July 10, 2015, Haida Energy requested that the name of the project be changed to the Hiilangaay Hydroelectric Project.

4.2.2 Fish Habitat Permit

The Alaska Department of Natural Resources issued a Fish Habitat Permit on December 22, 2000. The permit was revised in August 2013 and included new stipulations. The new permit expires at the Project’s end of life.



Photo 4. Bear looking for fish along the shoreline of Reynolds Creek.

4.2.3 Corps of Engineers Permit

The U.S. Army Corps of Engineers issued the original Department of the Army Permit on September 7, 1999. An application to amend the permit was filed in July 2010 to provide for changes to the access roads and installation of the marine access facilities.

Following submittal of the application for amendment of license, the Juneau Field Office of the U.S. Army Corps of Engineers contacted HDR (Engineer of Record) with concerns that the changes to the Project could result in changes in impacts to waters of the U.S. Corps reviewers specifically observed that the staging areas shown on Exhibit F-2 were not present on the existing permit submittal package, and that Exhibit F-5 appeared to show that the powerhouse was to be constructed entirely within a designated wetland area due to the symbols shown on the drawing. Following review of the design changes, meetings with engineers and construction staff, and a site visit, the Exhibit F-2 drawing was changed. The staging area blocks were removed from the drawing. Project staging now occurs within already disturbed land. The staging area on the west end of the Project is at the Copper Harbor landing site. That location was used for copper processing and log staging in the past. The confusion regarding the symbols on Exhibit F-5 was resolved and the site visit confirmed that the new powerhouse location was not in a wetland.

4.2.4 Transmission Line Easement and Coastal Management Program Review

The Alaska Department of Natural Resources (ADNR) issued authorization for a permanent easement for the transmission line crossing of Hetta Inlet on December 15, 2010, following a Public Notice period of 30 days initiated on October 27. Additionally, the ADNR issued a letter dated October 26, 2010, indicating that no additional Alaska Coastal Management Program review was required for the final design changes discussed above.

4.2.5 Water Right Permit

Haida Energy applied for a water right for a withdrawal from Lake Mellen in July 1995 and amended the application in November 1997. In 2012 a permit was issued, but approval is currently pending to incorporate amendments to the FERC license.

4.2.6 State Historic Preservation Office Approval

A cultural resources report finding that there are no historic properties in the project area was submitted in 1996, and a letter of concurrence was received from the Alaska Office of History and Archaeology in September 1998. Following several changes to the project, a request to reissue the determination of no effect was submitted in July 2010 and approved in August 2010.

4.3 Final Design

Final project design has continued to progress as new information has become available. Geotechnical investigations have been completed at the dam and powerhouse locations, and results were favorable. The following design elements were changed and approved in the Order Amending License issued on October 8, 2010:

4.3.1 Penstock Route

The route for the penstock was modified such that the western end would be located up to about 300 feet north of the original route resulting in a straighter alignment. The new penstock path crosses Reynolds Creek about 1,200 feet upstream of the powerhouse rather than 500 feet upstream of the powerhouse as originally approved. The length, diameter, and material of the penstock did not change.

4.3.2 Powerhouse and Tailrace

The site of the powerhouse was moved approximately 100 feet to the northwest. This area is flatter and will require less excavation and land disturbance. The site is also farther from Reynolds Creek, and will result in the powerhouse access road being about 100 feet shorter.

Due to the relocation of the powerhouse, the tailrace will be lengthened to 380 feet, but will discharge into the same location about 50 feet downstream of the anadromous fish barrier. The design of the tailrace changed from an open, riprap-lined channel to a 54-inch-diameter steel pipe.

4.3.3 Transmission Line

The Project's transmission line has been increased in length by about 1.1 miles. The extension follows the path of an existing 2.4 kV line and required the installation of new poles. The Project's transmission line conductors were installed at the top of the poles and the existing 2.4 kV line was installed underneath. The extended line interconnects with the existing 34.5 kV line in Hydaburg. The resulting total length of the transmission line is now about 12 miles.



Photo 5. Transmission Line Installation

5 Conclusions and Recommendations

Pre-construction activities, funded in part by the DOE, including construction planning, permit coordination and compliance, and final design have made it possible to move forward with construction of the Hiilangaay Project. After years of construction delays, Haida Energy is completing the necessary steps to resume on-site construction preparation activities during the second half of 2016. The need for electrical generating resources on Prince of Wales Island, regulatory considerations, and funding have all aligned to make construction possible.

6 Lessons Learned

Planning for the Project began in 1996. However, because Hydaburg was not yet integrated with the electrical grid on Prince of Wales Island and the electrical load growth in Hydaburg was minimal, Haida Energy chose to delay construction. Since initiation of the DOE grant in 2010, management changes within Haida Energy and delays in additional funding sources have created further obstacles to Project construction.

Throughout the years, Haida Energy has maintained the FERC License and the other approvals that were received and continued to monitor the need for new electrical generating resources on the island. Now, 20 years after the Project was initially planned, persistence and long-term planning will culminate in the construction of the Project, and make Prince of Wales Island independent of diesel-fueled energy.