General Background

The proposed Project is located near the community of Old Harbor, Alaska. Old Harbor is on the southeastern coast of Kodiak Island at latitude 57°12' North and longitude 153°18' West. Old Harbor is approximately 70 miles southwest of the City of Kodiak and 320 miles southwest of Anchorage.

The grantee, Alaska Village Electric Cooperative (AVEC), is a non-profit member owned rural electric generation and distribution cooperative. AVEC serves 52 villages in rural Alaska with 47 separate diesel generation plants, 2 standby diesel plants, and 14 wind turbines. The villages are typically served by air year round and by barge traffic during the ice free summer months. The cooperative was formed by Alaska village leaders in 1968 and has grown to serve 7,338 meters and a population of over 22,000 rural Alaskans. Native Americans make up about ninety four percent of the population served. The village of Old Harbor was one of the original villages to form AVEC in 1968.

History

Various agencies including the U.S. Army Corps of Engineers, federal Alaska Power Administration, and state Alaska Energy Authority studied the hydroelectric potential of the Old Harbor area in the 1970's and 1980's. These were map studies with limited field visits. In the early 1990's AVEC and the State of Alaska jointly funded stream gaging efforts on streams in the Old Harbor area. Based on stream flow information, electric loads, fuel prices and cost estimates that were available by 1995, the project looked to have sufficient merit that AVEC filed with the Federal Energy Regulatory Administration to further evaluate the project.

A Preliminary Permit to study the project was issued in March 1996. AVEC coordinated environmental field studies that were required with numerous federal and state agencies. By 1998 sufficient information had been developed to apply for a license to construct the project and the cost was estimated to be $2,445,000 for a 500 kW project on Lagoon Creek. Major features of the project included an eight-foot high diversion dam on
Mountain Creek, a desander box, a 9,800-foot long penstock to the powerhouse on Lagoon Creek, and a 5,500-foot long access road. It was also anticipated that the project could provide an additional source of water to Old Harbor. Costs per kWh were not expected to change at this project cost, but would remain steady if load increased and provide some protection against increasing diesel costs. If managed electric loads could be added, a slight decrease might be expected.

The formal license was applied for on May 9, 1999 and numerous coordination efforts were held with agencies and interested parties. At the same time further detailed field investigations of topography, vegetation, geology, birds, fish, stream flow, and stream temperature continued. The agency reviews resulted in several conditions attached to the license for continuing studies to be made after the project was built. In addition agencies also requested the establishment of a project contingency fund of $25,000 to be used to investigate or evaluate effects of the project.

(The next two pages show the project location and give a legal description of the land).
THE OLD HARBOR HYDROELECTRIC PROJECT
FERC #11690-000
Old Harbor, AK

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Sheet Index
COVER/PROJECT MAP G-1
LEGAL DESCRIPTION OF LANDS OWNED BY THE PROJECT AND THE REQUIRED ACCESS ROUTES G-2
PROJECT LAYOUT F-1
PIPELINE PLAN AND PROFILE F-2
PIPELINE PLAN AND PROFILE F-3
PIPELINE PLAN AND PROFILE F-4
PIPELINE PLAN AND PROFILE F-5
PIPELINE PLAN AND PROFILE F-6
PIPELINE PLAN AND PROFILE F-7
HONIT, TUNES BRIDGE, AND PIPELINE DETAILS F-8
POWERSITE SITE PLAN, BRIDGE, AND ACCESS TRAIL DETAILS F-9
POWERSITE DETAILS F-10

Vicinity Map
The Federal Energy Regulatory Commission issued a 44 page license (Project 11690-001) on December 12, 2000 for a 500 kW run of the river hydroelectric plant with a diversion structure, pipeline, powerhouse, and electric line. The project would collect up to 13.2 cfs of water year round from a tributary (Mountain Creek) of Barling Bay Creek and transport it across a basin boundary to Lagoon Creek just west of the city of Old Harbor. The average annual flow for the East Fork of Mountain Creek is 17 cfs, and for Lagoon Creek is estimated to be 13.4 cfs. The proposed design consisted of a 30' wide x 4' tall diversion structure at the intake site at an elevation of 840 feet above mean sea level. The water would then flow through 3,200' of 20" High Density Polyethylene (HDPE) pipe and 6,600' of 16" steel pipe to a 30' x 22' powerhouse. A 500 kW impulse turbine would be utilized to drive the three-phase, 480 volt generator. The electrical energy would be carried through 5,500' long cables buried under the access road to the existing water treatment plant where it can be connected to the existing electrical system. The cables were agreed to be buried to avoid any conflict with bald eagles nesting in cottonwood trees along the access road.

The Project intake was to be located in a sub-alpine environment dominated by an intermixed willow/alder habitat and grass/moss/lichen environment. Shortly below the intake elevation, the habitat changes to open fields of sedges and grasses interspersed with dense alder thickets. Along the access route from the powerhouse to the water treatment building the habitat consists of cottonwoods and Kenai birch with an understory of willow and alder thickets and some open grass fields. Mammals in the area include the Kodiak brown bear, Sitka black-tailed deer, mountain goat, red fox, land otter, beaver, weasel, snowshoe hare, tundra vole, and little brown bat. Along the Project, a total of 14 species of birds were recorded, the most common being the Fox Sparrow, Wilson's Warbler, and Savannah Sparrow. A total of 30 species of birds were observed in general vicinity of the Project and around the town of Old Harbor.

While the project was in the licensing process, AVEC also received commitments for state and federal funds totaling $2,100,000. AVEC anticipated its own equity commitment of approximately $350,000 to complete the financing of the project. During the course of project investigation and licensing, the City of Old Harbor and the Old Harbor Village Corporation were strong supporters of the project.

As the licensing of the project proceeded, the consultant conducted field investigations that also found topographic and geologic information that would require updating cost estimates. It became apparent from field surveys that additional trenching and blasting would be required to place the penstock near the dam. Engineering reviews determined that automated control systems would need to be added to the diesel plant to have it operate efficiently with the hydro plant. Environmental stipulations required that schedules be modified to accommodate the presence of salmon in Lagoon Creek and the possibility of eagles in trees along the proposed road route. New costs estimates that take these items and the current cost of materials into account now show an estimated cost of $3,827,000 in 2001 dollars. In addition engines at the diesel plant would also need to be upgraded in order to efficiently operate in parallel with the new hydro plant.
About the same time Old Harbor began losing population and the electrical load began dropping. In 1999 and 2000 the City of Old Harbor and AVEC proposed development of a new tank farm for Old Harbor to provide a reliable supply of fuel that could be supplied from the mainline barge that would be a less expensive source of fuel than the smaller barge that has supplied Old Harbor for many years. The Denali Commission committed funds for this tank farm project in January 2001 and the project was completed during the summer of 2001. AVEC’s fuel costs dropped nearly thirty per cent with the new pipeline and delivery arrangement and for a time this reduced the fuel surcharge for electricity in Old Harbor. Costs of gasoline and heating oil also dropped for village residents.

The good news was that there was continuous strong local support for the hydro project and that, although a lengthy process, all of the agencies had issued permits for the project by late 2001.

The bad news was that the project was anticipated to cost much more to construct due to a variety of factors which included excavation of a rock ridge that was not evident until detailed field surveys and engineering was conducted: escalation in costs of materials—especially the increase in costs of steel pipe for the penstock; the need to conform project activities to environmental schedules such as a prohibition for crossing streams during months when salmon were present; and the need to modify controls on the diesel plant and upgrade the engines as part of the project cost.

In addition operational costs of the hydro project were significantly higher than anticipated due to the need for five years of environmental studies after project construction and the required capitalization of a contingency fund.

Of significant concern were the three-year loss in population and the nearly eleven-month decline in electricity usage in Old Harbor in late 2001. It did not appear to the best fiscal sense to finance a major project into a declining market unless some changes could be made that would improve the economics.

What was done next?

AVEC proposed to work with the City and other interested parties to try to find additional grant funds for the project. AVEC approached other funding entities that had programs to support projects such as this or which supported economic development projects that may increase the load. Sufficient funds were not readily available to confidently begin construction that could be completed.

AVEC then proposed to conduct a review of the project in late 2001 and 2002 to see if there were any possible places where costs might be reduced without affecting the integrity of the project. One area to be examined was the cost of transportation of material. Nearly 600,000 pounds of pipe and other material must be shipped to Old Harbor for the project. Early estimates were $300,000 for this effort and reductions were thought possible if the work could be coordinated with other projects such as harbor
improvement. Other ways of financing the control system will be examined to see if it can be removed from the hydro project cost.

Since the amount of the electric load affects the operational cost per kWh, AVEC proposed to work with the City and others to see if there may be ways to increase the electric load and thereby reduce costs per kWh without increasing expenses. Possible options involved improving the harbor and providing electricity to the docks to allow the boats to use shore power.

In June 2002 AVEC entered into an understanding with the State of Alaska Energy Authority (AEA) to have AEA contract for an independent cost estimate and constructability review of the project. In August 2002 AVEC applied to FERC for an extension of time to construct the project. In October 2002 AEA selected the engineering firm of HDR to perform an updated cost estimate and constructability review. In December 2002 a team of AVEC and AEA contractors visited the site by helicopter and on foot to review the project setting and prepare an updated cost estimate. In October 2002 FERC granted an extension of time to December 12, 2004 to construct the project.

In April 2003 HDR submitted a draft cost estimate of $5.9 million to construct a reduced size project of 300kW as an alternative to the 500kW original project. However, HDR added an access road feature that was not previously planned as part of the project. This proposed project arrangement would require a new road through the Kodiak National Wildlife Refuge to the reach the dam site. The cost and effort required to permit a road in a restricted land area was not fully developed in the cost estimate.

In mid-2003 AVEC staff met with their consultants and key agency representatives to try find an alternative that was less expensive. One alternative held promise that would involve a relocated penstock and powerhouse location. The penstock would be shorter and not have as many bends in it. The water would discharge into Big Creek above a small pond rather than directly into Lagoon Creek which would mitigate concern about adverse affects on stream water temperature. The powerhouse would be at a higher elevation which reduced the head and energy available but would allow the entire penstock to be constructed of HDPE and avoid the use of steel. The access road to the powerhouse and connecting distribution line would be longer than the earlier project concept. While the agencies were supportive, they requested further studies of the receiving waters and exploration with FERC indicated that they would require new environmental exhibits and an amendment to the original application. In the meantime the cost of fuel delivered to Old Harbor had dropped substantially due to the new tank farm that had been installed.

While considering the new option, it appeared that at least three constructive efforts could be made to prepare the Old Harbor system to receive hydropower if the Big Creek option progressed. One was to install a diesel engine that could efficiently work in concert with the hydro project; a second option was to install a control system that would operate both the hydro and diesel plant and the third option was to install a metering system to better track the usage of electricity in Old Harbor and provide more accurate information for
sizing the hydro system and specifying its controls. AVEC communicated with USDOE about these options and the USDOE approved partial funding of the metering program, installation of a compatible diesel engine and a milestone to electronically archive all information available on the project to date. The metering and engine installation were completed by September 2005. The archiving of project data was also completed and is available on a DVD.

Lessons Learned

1) Sensitivity of a small project to cost changes—At 300 to 500kW the project is a relatively small project that serves a small village load of less than one million kWh. Changes in equipment, installation, or environmental monitoring costs can have a huge effect on the feasibility of such a small project.

2) Thorough knowledge of local field conditions – Field information turned up a rock feature that would have to be excavated that was not evident in early map and photo studies. Numerous changes in the grade of the penstock route as it approached the powerhouse affected both cost and constructability. Fisheries data that was acquired during the course of the project satisfied agencies that the project could be developed without adverse impact but involved a significant effort in money and time.

3) Load profile data would have been useful earlier – The metering project funded in 2005 is yielding good information. One of the pieces of information is that it appears that the diesel would have to be operated in the winter months because the water flow would drop below the level to meet the entire village needs. This type of information would help verify the project feasibility and supports the decision to install a diesel engine that will operate efficiently in conjunction with the hydro.

4) Monitoring requirements can affect feasibility – Conditions on the FERC license required nearly five years of post-project monitoring. On a small project it is difficult to forecast the effects of such costs far into the future.

5) Fuel costs can change rapidly and affect feasibility—During the course of investigating this project, a new tank farm was built in the village that lowered fuel costs for power generation by about 30%. After the new tank farm was commissioned in 2002 fuel was delivered at less than $1.00 per gallon. However in 2006 fuel costs ranged from $2.32 to $2.72 per gallon. The rising fuel cost should improve the project feasibility if it has not been outpaced by costs of permitting, materials and installation.

6) Periodically revisit assumptions—Small project feasibility is especially sensitive to changes in costs, load, and permit conditions. It is useful to test these parameters periodically during the development of the project.

7) Archive data – This project has an excellent archive of data on the project and the area. This material is useful for periodic updates and as a basis for any future project that might be developed at this site.
Old Harbor Diesel Plant and Dock
Old Harbor Village with Ferry Dock