Chakachamna Hydro

AEA Geothermal Conference

August 2007

Chakachamna Hydro

- 300+ MW hydro opportunity identified
- Preliminary FERC License application filed in May 2006
- Initial scoping/informational meetings with stakeholders underway

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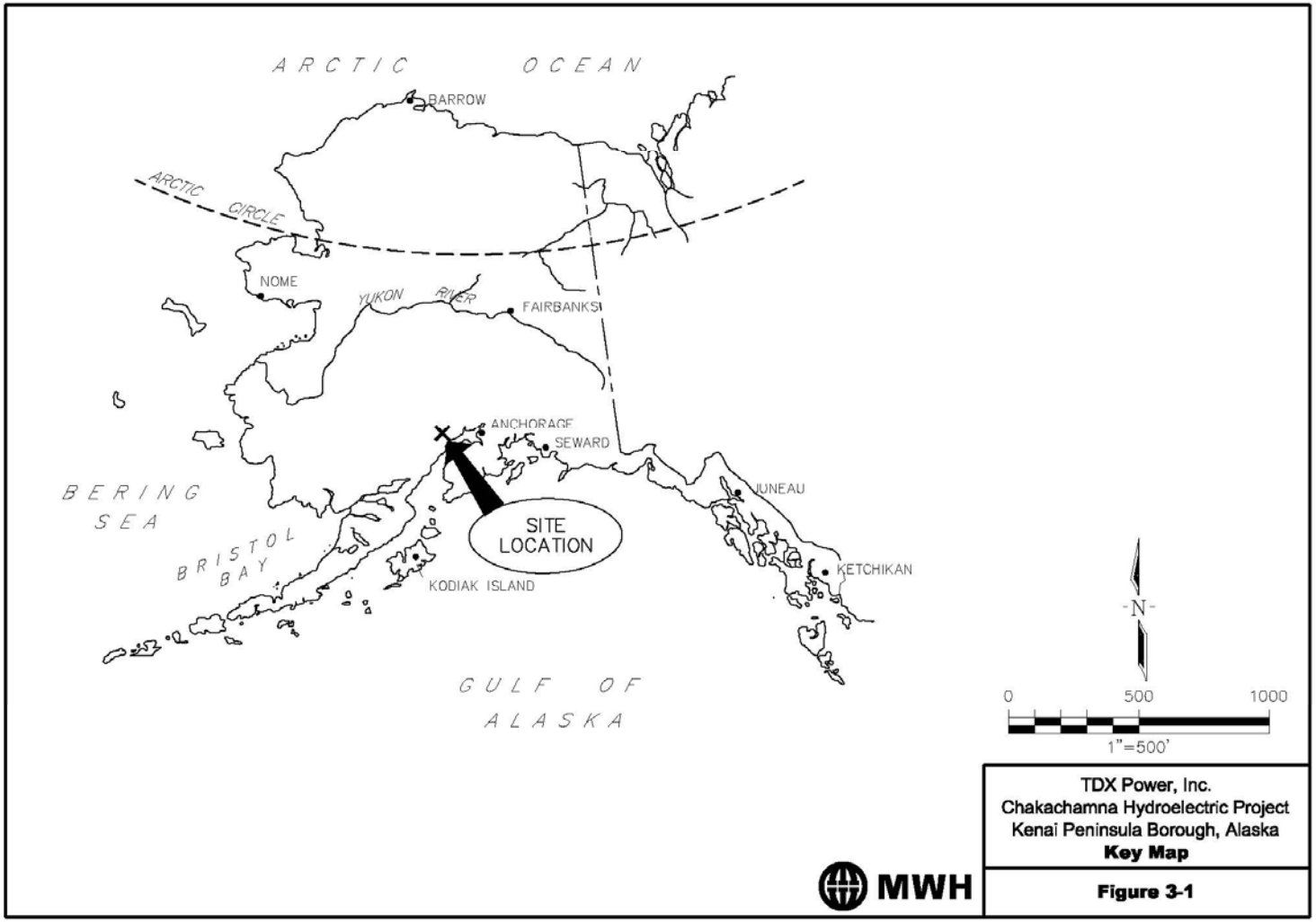
ARCTIC OCEAN
BARROW
ARCTIC CIRCLE
NOME
YUKON RIVER
FAIRBANKS
ANCHORAGE
SEWARD
BERING SEA
BRISTOL BAY
SITE LOCATION
KODIAK ISLAND
JUNEAU
KETCHIKAN
GULF OF ALASKA
N
0
500
1000
1"=500'
TDX Power, Inc.
Chakachamna Hydroelectric Project
Kenai Peninsula Borough, Alaska
Key Map
MWH
Figure 3-1

Project Summary

- The proposed Chakachamna Hydroelectric Project is roughly 85 miles west of the Anchorage load center and 42 miles from the existing Chugach 230 KV transmission line into the railbelt grid.
- Development would divert water from Chakachamna Lake on the Chakachatna River to a powerhouse in the McArthur River basin 200 feet above sea level.

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Project History

- Previous reconnaissance grade studies by the U. S. Bureau of Reclamation in the 1960s and later by the State of Alaska through the Alaska Power Authority in the early 1980s identified a Chakachamna power potential of roughly 400 megawatts (MW) at a 50 percent plant factor.
- Optimization studies to accommodate downstream fish releases keyed in on a 330 MW development that would entail an interbasin transfer of water by way of a 10 mile power tunnel that would join a lake tap at Chakachamna Lake with an underground power plant and tailrace at the McArthur River, for a maximum power head of 938 feet

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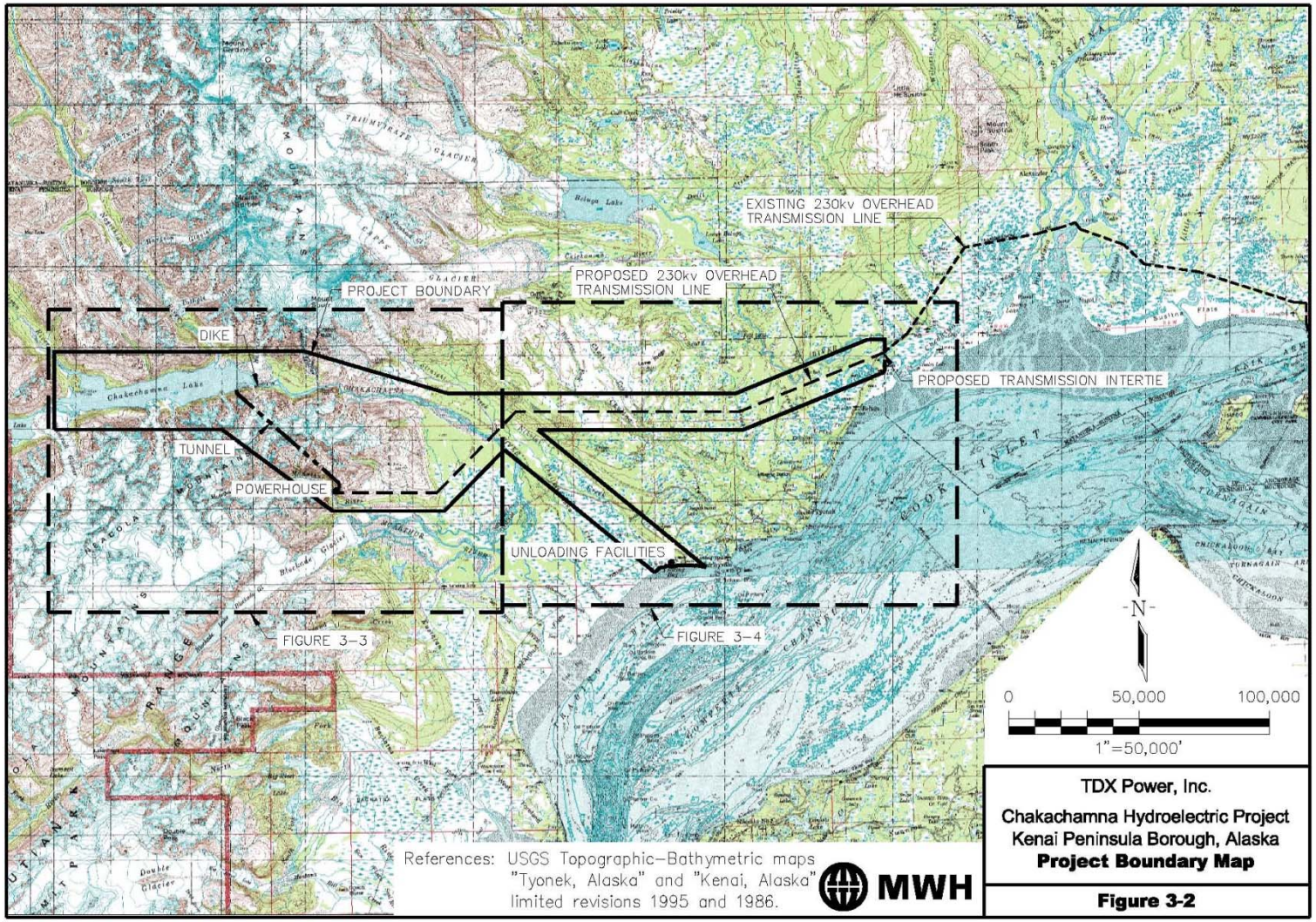
EXISTING 230kv OVERHEAD TRANSMISSION LINE
PROPOSED 230kv OVERHEAD TRANSMISSION LINE
PROJECT BOUNDARY
DIKE
PROPOSED TRANSMISSION INTERTIE
TUNNEL
POWERHOUSE
UNLOADING FACILITIES
FIGURE 3-3
FIGURE 3-4
N
0
50,000
100,000
1"=50,000'
References: USGS Topographic-Bathymetric maps "Tyonek, Alaska" and "Kenai, Alaska" limited revisions 1995 and 1986.
MWH
TDX Power, Inc.
Chakachamna Hydroelectric Project
Kenai Peninsula Borough, Alaska
Project Boundary Map
Figure 3-2

Technical Summary

Diversion and Spillway

- Rock-fill dike, approximately 600 feet long, 49 feet high, and with a volume of approximately 250,000 yards, constructed at the existing natural outlet of Chakachamna Lake.
- Ultimate size and composition of the structure will be established after geotechnical investigations. The spillway would be a free overflow structure capable of accommodating 55,000 cfs. This, along with flow over the top of the rock dike could pass the probable maximum flood of 100,000 cfs anticipated for the upstream drainage area.
- Crest elevation of the spillway would be equal to that of the maximum natural-condition lake surface elevation of 1,155 feet. The spillway would be carved out of the rock in the right abutment of the natural channel and the spoil material would be used to construct the dike.

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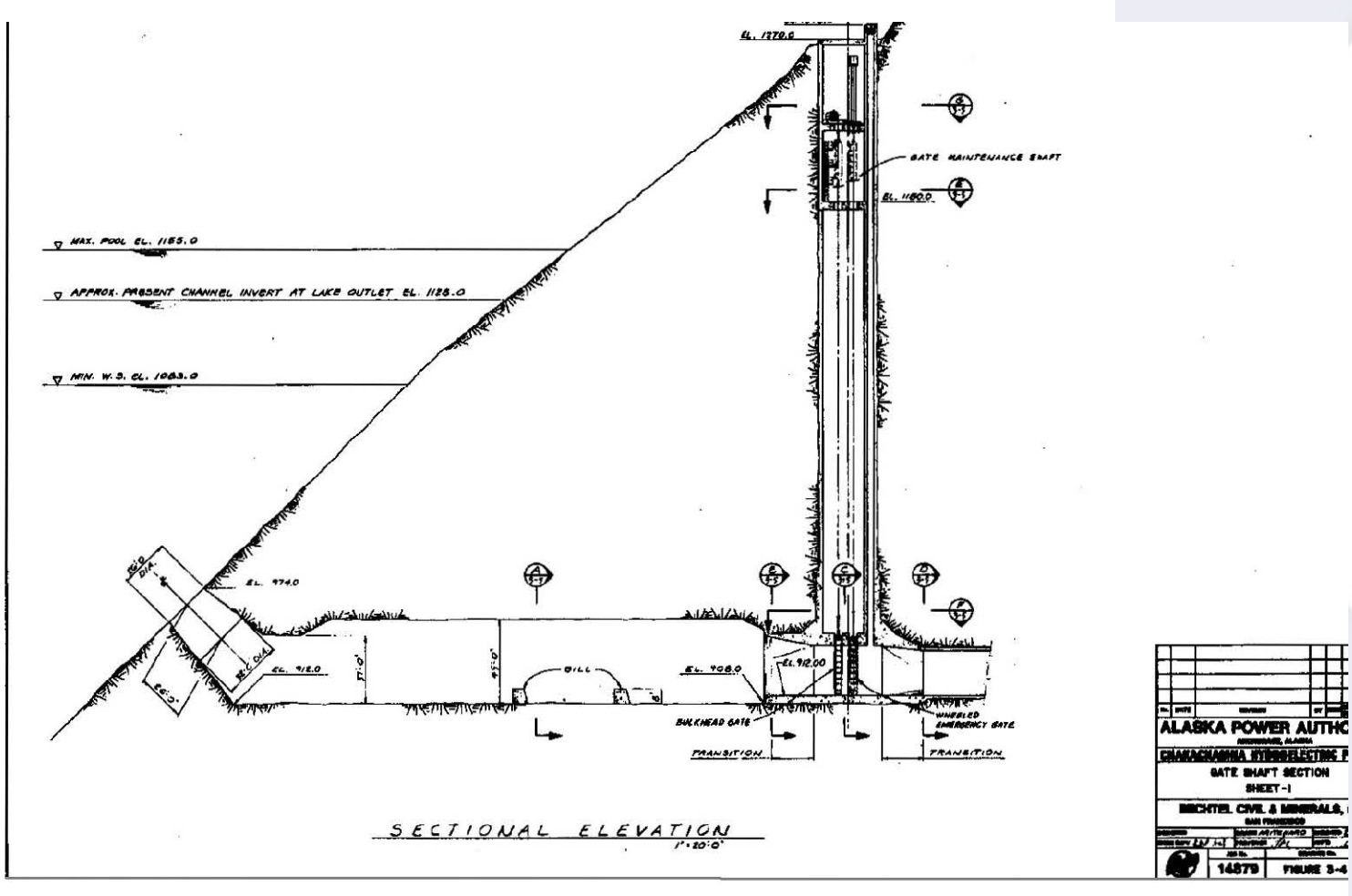
Chakachamna Lake Tap Gate Shaft Inflow to Power Tunnel



Project Structures

Outlet Discharge

- Reservoir drawdown would be limited to the natural-condition channel invert elevation of 1,083 feet. This coupled with a maximum water surface elevation controlled by the water release facility at the right abutment gives a 72-foot active zone in which to provide appropriate fish passage and water release facilities that can operate under free gravity flow.
- Fish passage would be by way of a tunnel in the right abutment in which fish ladders at both the upstream and downstream ends would interconnect two contiguous channels within the tunnel for both upstream and downstream fish migrants. Reservoir inflow to the discharge and fish passage facilities would be by way of three fixed wheel gates stacked one above the other. Approach channels would be constructed both upstream and downstream of the tunnel portals to accommodate fish access and egress in both directions.

Project Structures

Power Tunnel, Penstock and Tailrace

- Proposed water intake would be by way of a lake tap similar to other such projects in Alaska, with control from a vertical shaft to both bulkhead and wheeled emergency gates.
- The rock tap chamber would include a trash rack at its portal, and interior rock sills. The power tunnel would be an inclined, 24-foot diameter concrete lined circular structure, approximately 10 miles long, with a hydraulic capacity of 7,200 cfs. It would include a surge chamber, approximately 48 feet in diameter by 450 feet high, at the down stream end that would be connected to the power tunnel by way of a vertical shaft.
- The tunnel would descend into a four-branched manifold comprising 10-foot diameter steel lined penstocks with upstream gates located in a gate chamber adjacent to the power house. The tailrace would be a pressurized tunnel with an upstream surge chamber.

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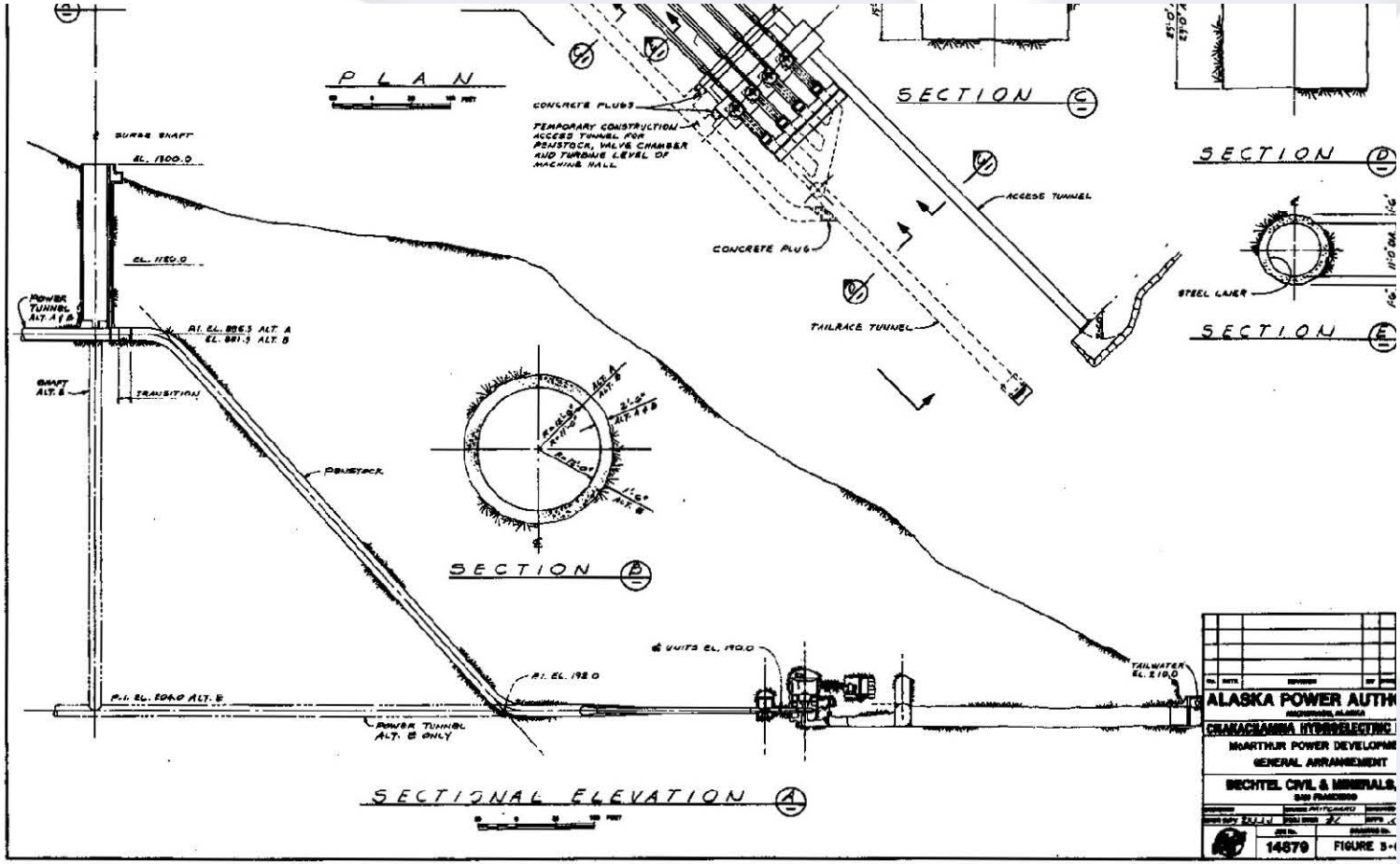
McArthur River Underground Powerhouse (Chakachamna)



Project Structures

Powerhouse

- The powerhouse would be an underground cavern with dimensions of approximately 250’L x 65’W x 130’H.

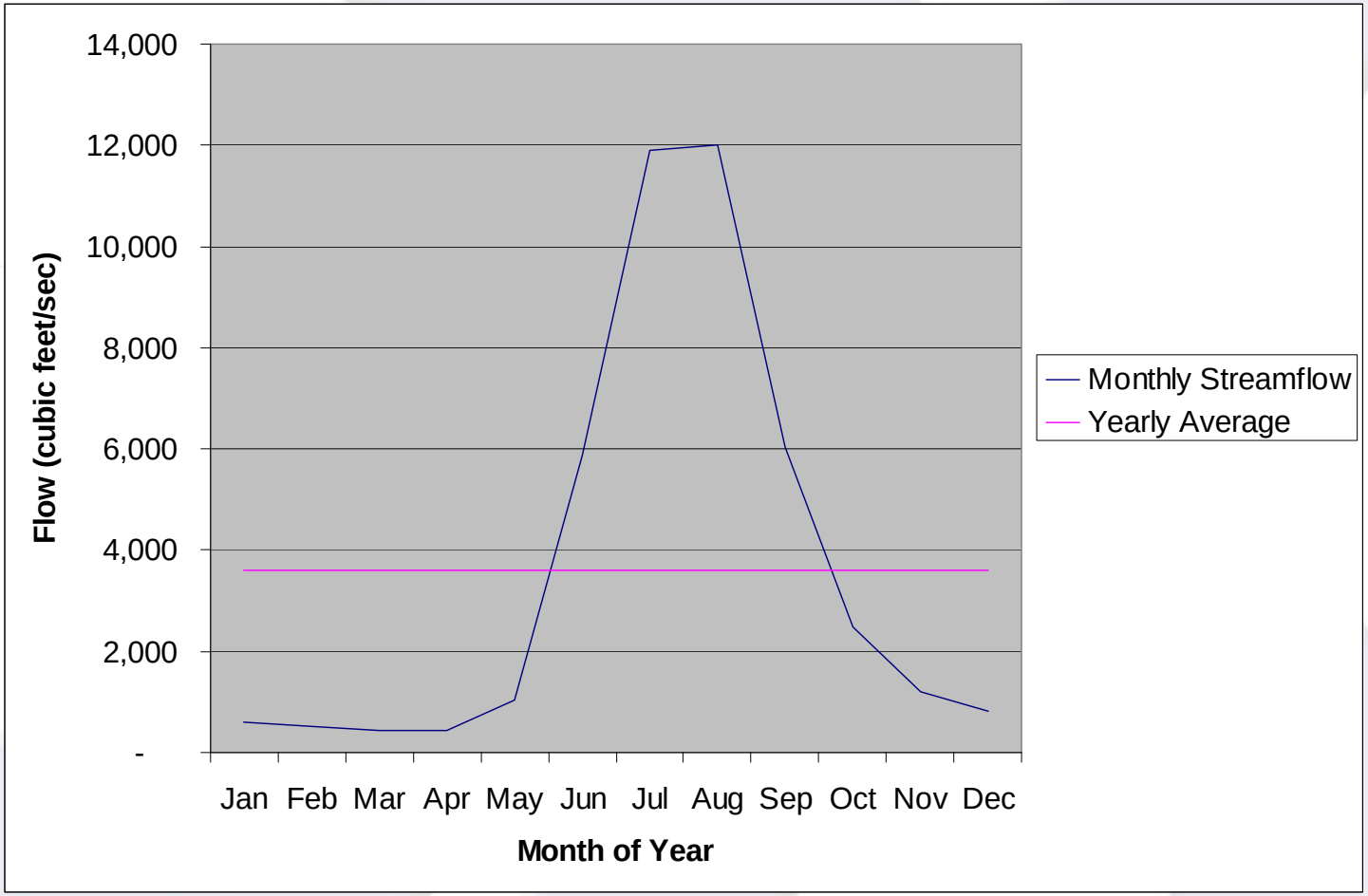
- Included in the powerhouse would be four vertical-shaft Francis turbines each with a unit output of 82.5 MW connected to individual synchronous generators.

- Transformers would be located in separate underground chambers contiguous to the powerhouse.

Project Energy and Capacity

Initial reservoir analysis yields an average head of 920 feet for an average firm energy of 1,301 GWH and average annual secondary energy of 290 GWH based on a 45 percent plant factor and a 330 MW installed capacity consisting of four 82.5 MW Francis turbines.

Chakachatna Streamflow



Chakachamna and Mt. Spurr

Proximity to the Market:

- The proposed Chakachamna project powerhouse lies approximately 40 miles from the CEA Beluga Plant.
- CEA has 3 transmission lines on the west side of Cook Inlet1(38kV built in 1967; 230kV built in 1974; amd 230kV built in 1981
- CEA has 3 submarine cable circuits between the west side and Anchorage: two138kV built in1990 and 1999; and one 230kV - 1981.

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Next Steps

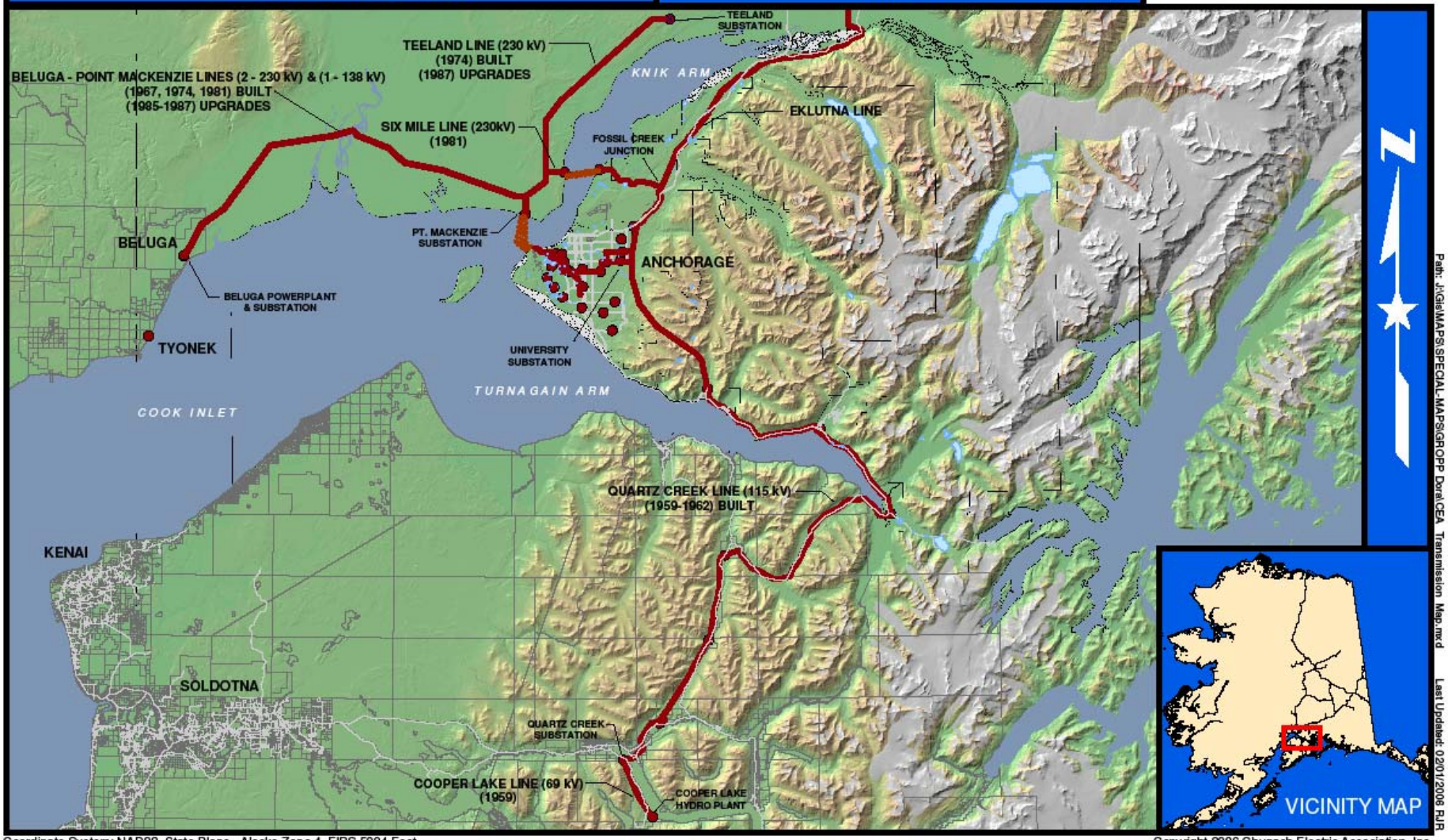
Study Plan

- Engage in consultations with responsible federal, state and local resource agencies and non-governmental stakeholders regarding Project-related resources.
- Conduct environmental surveys and studies to expand upon and enhance earlier efforts.
- Evaluate the Project's technical, economic and financial feasibility, and refine the Project layout.
- Conduct geotechnical investigations to determine the suitability for construction of the project elements.
- Conduct such other studies and consultations as are necessary to prepare for the licensing process.

CHUGACH ELECTRIC ASSOCIATION, INC. TRANSMISSION MAP

0 5 10 20 30 40 Miles
SCALE
1:545,000

CHUGACH
POWERING ALASKA'S FUTURE



Path: J:\Gis\MAPS\SPECIAL-MAPS\GROPP Dorat\CEA Transmission Map.mxd Last Updated: 02/01/2006 RJR

Coordinate System: NAD83, State Plane, Alaska Zone 4, FIPS 5004 Feet

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Next Steps

Strategic Partners

- Discussions with local stakeholders including rail belt utilities, environmental community, government agencies underway.

- Financial partner discussions to date have been with large international utility and development companies with large scale hydro experience.

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Closing Thoughts

Our ability to successfully address fish issues is a major driver for the project. Consultation with agencies and the environmental community is critical.

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Closing Thoughts

Is Chakachamna too expensive?

- – Initial estimate in 1980's (including environmental assessment, reservoir regulation modeling, reconnaissance grade design and cost estimates, and economic assessment) conducted on a budget of $300,000. This was a reconnaissance grade approach.
- – Bechtel and FERC acknowledge this number is quite conservative. FERC actually used a lower number in their economic viability analysis.
- – Examples of areas we feel the original estimates may be too expensive include concrete lining of entire 10 mile tunnel.
- – Even with this conservative approach, Bechtel found that Chakachamna would be economically superior to a combination of natural gas and coal fired generation based on a 50 year net present worth life cycle analysis of Chakachamna and its thermal alternatives.

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