CONCEPTUAL DESIGN REPORT

RURAL POWER SYSTEM UPGRADES PROJECT

LARSEN BAY, ALASKA

Prepared for:
State of Alaska
Alaska Energy Authority /
Rural Energy Group

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FINAL DRAFT

EXECUTIVE SUMMARY

This report was prepared by CRW Engineering Group, LLC. (CRW) for the Alaska Energy Authority / Rural Energy Group (AEA). This study summarizes the existing condition of power generation and distribution systems in Larsen Bay Alaska, lists proposed upgrades to each system and provide a conceptual level construction cost estimate for completing the upgrades.

Multiple site visits were conducted for this project between 2004 and 2008. Site visit personnel documented the City's existing hydroelectric power plant, backup diesel power plant and electrical distribution system, inspected the earthen dam impoundment and intake structures, and disassembled the hydro turbine to perform necessary preventative maintenance. AEA staff also inspected the power generation and electrical distribution systems operated by the local cannery. At the City's request, and with approval from cannery management, AEA staff sectionalized the cannery's electrical load to allow the City to sell additional power to the facility. A meter was installed to allow the cannery's power usage to be monitored and billed by the City.

Existing Conditions

The City operates two power generation facilities, including a prime power hydroelectric plant and a backup diesel plant. The existing hydro turbine is housed within a wood-frame, slab on grade structure. The facility includes a single 475 Kilowatt (kW) pelton turbine coupled to an electrical generator. The turbine is powered via a water reservoir located approximately 600 vertical feet above the power plant. Water is transported to the turbine via 6,000 LF of 18-inch diameter buried PVC penstock. The City's backup diesel power plant is located approximately ½ mile from the turbine house, and consists of two diesel gensets (rated 193 kW and 200 kW) housed within a wood frame, slab on grade building.

The City's electrical distribution system consists of an underground grid and pad mounted transformers. The majority of distribution system components appear to have been installed in the 1980s, although some buried components might be significantly older.

Proposed Improvements

The proposed Scope of Work includes the following major items:

- New backup diesel power plant module with switchgear designed to interface with the hydroelectric plant and maximize available renewable resource benefits.
- Connect new backup diesel power plant to the City's existing 15 kV electrical distribution system.

- Upgrade the City's existing 15 kV distribution system as necessary to meet code.

Project Schedule and Construction Cost Estimate

The proposed project schedule, subject to availability of funding, calls for final design and permitting during the summer of 2008 and module fabrication during winter of 2008/2009. On-site construction tasks will likely begin in the spring of 2009.

The total project cost including all design, supervision, construction, inspection, permitting, insurance, and a 20 percent contingency, is estimated as $2,132,750.

TABLE OF CONTENTS

Section/Title **Page**

EXECUTIVE SUMMARY ES-1

1.0 PROGRAM OVERVIEW 1

2.0 INTRODUCTION 3
- 2.1 Purpose 3
- 2.2 Community Overview 3

3.0 SITE VISITS AND COMMUNITY INVOLVEMENT 4
- 3.1 Site Visits 4
- 3.2 Contacts and community involvement 4

4.0 EXISTING POWER GENERATION AND DISTRIBUTION FACILITIES 5
- 4.1 Description of Existing Facilities 5
  - 4.1.1 Hydroelectric Power Plant 5
  - 4.1.2 Backup Diesel Power Plant 5
  - 4.1.3 Distribution System 5
- 4.2 Equipment Suitable for Reuse 6
- 4.3 Existing System Deficiencies 6

5.0 POWER SYSTEM UPGRADES 8
- 5.1 Electrical capacity considerations 8
  - 5.1.1 Historical Electrical Demand 8
  - 5.1.2 Planned Infrastructure Improvements 8
  - _Airport Improvements 9
  - _Water and Sewer Improvements 9
  - _Projected Community Growth 9
  - 5.1.3 Projected Electrical Demands 9
- 5.2 System Design Considerations 10
  - 5.2.1 Climate 10
  - 5.2.2 Geotechnical Conditions and Borrow Sources 11
  - 5.2.3 Site Control 11
- 5.3 PROPOSED IMPROVEMENTS 11
  - 5.3.1 Scope of work 11
  - 5.3.2 New Backup Diesel Power Plant Module 11
  - 5.3.4 City Distribution System Upgrades 12

6.0 PERMITTING 13
- 6.1 COASTAL ZONE MANAGEMENT 13
- 6.2 FIRE MARSHALL REVIEW 13
- 6.3 U.S. ARMY CORPS OF ENGINEERS WETLANDS FILL PERMIT 13
- 6.4 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) 13

6.5 ADEC REVIEW 13
6.6 RCA CERTIFICATION 13
6.7 FAA REVIEW 14

7.0 CONSTRUCTION PLAN 15
7.1 ADMINISTRATION 15
7.2 ACCESS/ LOGISTICAL CHALLENGES 15
7.3 CONSTRUCTION SCHEDULE 15
7.4 CONCEPTUAL CONSTRUCTION COST ESTIMATE 16

TABLES

Table 1 Contact Information 4

Table 2 Historical Demand Data 10

Table 3 Projected Electrical Demands 10

Table 4 Construction Schedule 16

APPENDICES

Appendix A Project Photos and Figures

Appendix B Construction Cost Estimates

Appendix C Electrical System Inspection Reports

Appendix D Site Control Opinion

PHOTOGRAPHS

Photo 1 Larsen Bay Hydroelectric Power Plant

Photo 2 Hydro Power Plant Tail Race

Photo 3 Access Road to Dam and Reservoir

Photo 4 Humpy Creek Reservoir

Photo 5 Humpy Creek Dam Spillway

Photo 6 Existing Diesel Backup Power Plant Exterior

Photo 7 Existing Diesel Backup Power Plant Interior

Photo 8 Typical Single Phase Transformer

Photo 9 Above Grade Secondary Voltage Conductor Installation

FIGURES

Figure 1 Community Site Plan

Figure 2 Concept Backup Diesel Module Floor Plan

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
AEA	Alaska Energy Authority/Rural Energy Group
APICDA	Aleutian Pribalof Island Community Development Association
CDR	Conceptual Design Report
City	City of Larsen Bay
Corps	U. S. Army Corps of Engineers
CRW	CRW Engineering Group, LLC
EA	Environmental Assessment
KVA	Kilovolt-Ampere
kW	Kilowatt
kWh	Kilowatt-Hour
O&M	operation and maintenance
NESC	National Electric Safety Code

1.0 PROGRAM OVERVIEW

The Alaska Energy Authority / Rural Energy Group (AEA) is pursuing grant funds to upgrade rural power generation and distribution facilities. The following bulleted items provide a brief outline of the program:

- Most of the funds for the program are federal in origin, and are provided through the Denali Commission. Other federal funding sources may include Community Development Block Grants from the U.S. Department of Housing and Urban Development and/or grants from the Environmental Protection Agency. Additional funds may be available from the State of Alaska, through the Department of Environmental Conservation (ADEC) and the Department of Education.
- In order to receive grant funds, each community must demonstrate that the proposed facility will be sustainable by accepting a Business Operating Plan (BOP). The function of the BOP is to establish ownership of the facility's components, and describe how each component will be operated, maintained and, eventually, replaced.
- New Power Plants are funded, designed, and constructed in three phases: Phase 1-Conceptual Design; Phase 2-Final Design; and Phase 3-Construction.
- During Phase 1, staff from the AEA will visit the community to discuss the program and work with residents and the local government to select a site for the new facilities. All planning and decisions concerning the conceptual design will be summarized in a Conceptual Design Report (CDR) and draft BOP.
- At the completion of Phase 1, the community will be requested to review and approve the CDR.
- During Phase 2, the design and permitting tasks for the new facilities will be completed. Other Phase 2 tasks will include preparing an environmental assessment, gathering site control documents, and finalizing the BOP for signing.
- Each community will be asked to provide "in kind" contributions to the project, such as lodging and free use of local heavy equipment. If local equipment is utilized, the project grant funds will pay for fuel, maintenance, and any repairs during construction.
- Projects may include local hire and construction trade training programs, subject to funding.

- If construction funding is awarded, then the project will advance to Phase 3, the final BOP will be sent to the community for signature, and a Construction Manager or Contractor will be selected to construct the project.
- Ineligible Project Components: Funding is not available through AEA for propane facilities, fuel tank trucks or trailers, underground storage tanks, fuel to fill the tank farm and/or consume in the Power Plant, environmental remediation, operation and maintenance costs, or residential upgrades.
- Training is Available: AEA has several training programs available for facility operators and managers. Contact AEA at 907-771-3000 for further information.

2.0 INTRODUCTION

2.1 Purpose

This report was prepared by CRW Engineering Group, LLC. (CRW) for the Alaska Energy Authority / Rural Energy Group (AEA). This study summarizes the existing condition of the hydro power plant and electrical distribution system in Larsen Bay Alaska, lists proposed upgrades to each system and provides a conceptual level construction cost estimate for completing the upgrades.

2.2 Community Overview

The City of Larsen Bay is located in Uyak Bay, at the entrance to Larsen Bay, on the northwest coast of Kodiak Island. It is 60 miles southwest of the City of Kodiak and 283 miles southwest of Anchorage (Figure 1 – Community Site Plan). Local community organizations include the City, Native Village of Larsen Bay, and Kodiak Salmon Packers Inc. (the local cannery). Regional organizations include the Kodiak Island Borough School District, Koniag Incorporated (Regional Native Corporation) and the Kodiak Island Borough.

The current population of Larsen Bay is approximately 90, (estimated by State Demographer). The majority of residents within the City are Alutiiq Alaska Natives.

Based upon the U.S. 2000 Census, there are 70 total housing units in the community, including 28 seasonally vacant and two permanently vacant structures. The majority of homes have water, sewer and electrical utility service.

All community and residential buildings receive electricity via a buried distribution system fed by the Humpy Creek Hydroelectric Plant; a diesel generator power plant provides stand-by power for periods when the hydro is down for maintenance, etc. The hydro power Plant is owned by the State of Alaska and operated by the local utility, Larsen Bay Utility Company. Currently, the local cannery uses City power for daily activities until processing begins; at which point the fish processor switches over to their plant generators entirely.

3.0 SITE VISITS AND COMMUNITY INVOLVEMENT

3.1 Site Visits

Multiple site visits were conducted for this project between 2004 and 2008. Site visit personnel documented the City's existing hydroelectric power plant, backup diesel power plant and electrical distribution system, drained the existing reservoir for inspection of the earthen dam and penstock intake structures, and disassembled the hydro turbine to perform routine maintenance. AEA staff also inspected the power generation and electrical distribution systems operated by the local cannery. At the City's request, and with approval from cannery management, AEA electricians sectionalized the cannery's electrical load to allow the City to sell additional power to the facility. A power meter was also installed to allow the cannery's power usage to be monitored and billed by the City. Site visit photos are shown in Appendix A; copies of site visit reports are provided in Appendix C.

3.2 Contacts and community involvement

Project and background information were obtained from the entities listed in Table 1.

Table 1 – Contact Information

Entity	Contact	Address	Phone Number
City of Larsen Bay	~~Allen Panamaroff, Mayor~~	City of Larsen Bay P.O. Box 8, Larsen Bay, AK 99624	907- 847-2211
Kodiak Salmon Packers Inc.	*No Contact Information Available At Time of Report*	Kodiak Salmon Packers Inc. P.O. Box 38 Larsen Bay, AK 99624	907- 847-2250

4.0 EXISTING POWER GENERATION AND DISTRIBUTION FACILITIES

4.1 Description of Existing Facilities

4.1.1 Hydroelectric Power Plant

The City's existing hydro power plant consists of an early 1990's vintage wood-frame, slab on grade structure (Photos 1-2). The facility includes a single 475 kW pelton turbine genset. The generator output voltage is reported to be 480 volts. The reservoir which drives the turbine is located approximately 600 vertical feet above the plant; the impoundment is formed by an earthen dam which is accessible via a steep, unmaintained 6,000 linear foot access road (Photos 3-5). The turbine is connected to the dam via a buried, 18-inch diameter PVC penstock. The hydro Plant is connected to the distribution system, via underground conductors, at a three-phase 500 KVA pad mount step-up transformer rated 480-volt delta to 12,470/7,200 grounded-wye. When the hydro plant is not running, current is "back fed" through the transformer to operate lights and controls within the plant.

4.1.2 Backup Diesel Power Plant

The City's backup diesel power plant is located approximately ½ mile from the turbine house, and consists of two diesel gensets (rated 193 kW and 200 kW) within a wood frame, slab on grade building (Photos 6-7). The units are set for isochronous load control without load sharing, and cannot be paralleled. Each unit has its own manual breaker connecting the generator to a transfer switch. The transfer switch is connected to the City's grid via freestanding paralleling switchgear with an 800 amp breaker. Switchgear protection consists of a synchronization check, as well as over/under voltage and frequency monitors. Synchronizing is accomplished with a synch scope, and an incoming/running voltmeter and ammeter. The diesel plant is connected to the distribution system, via underground conductors, at a three-phase 300 KVA pad mount step-up transformer rated 480-volt delta to 12,470/7,200 grounded-wye.

4.1.3 Distribution System

Power is distributed via an underground, direct burial type electrical grid. The majority of visible distribution system components appear to have been installed in the 1980s, although some buried components may be significantly older. The system operating voltage is 12,470/7,200 grounded-wye.

Transformers are pad mounted with load break primary bushings, and a feed through bus on the single-phase units. There are two three-phase 15 kV switch cabinets, two three-phase pad mount 15 kV step-up transformers, one three-phase pad mount 15 kV step-down transformer, two three-phase 15 kV junction boxes, 2 single-phase 7,200 volt junction boxes, approximately 25 single-phase pad mount transformers, and several

secondary pedestals on the system. The single-phase transformers are all reported to be either 15 kVA or 25 KVA units (Photo 8); the three-phase units all appear to be 500 kVA units.

Primary conductor type, size, lengths, and condition could not be determined due to lack of access to the buried primary line. Secondary conductor and service conductor appears to be aluminum underground triplex for single phase, and aluminum underground quadruplex for three phase. Several runs of secondary conductor were never buried, and lie exposed on the ground surface (Photo 9).

4.2 Equipment Suitable for Reuse

The hydroelectric turbine, turbine house, earthen dam and penstock are less than 20 years old and continue to function well. The hydro system controls and switchgear are malfunctioning and will be upgraded / replaced under a separate project.

The existing diesel generator sets are too old and inefficient for re-use in the new Power Plant. However, the units retain considerable value and could be sold or parted out by the City. The existing primary and secondary voltage buried distribution system is suitable for reuse with the exception of several rusted out 3-phase transformers which should be replaced. Secondary voltage conductors currently running above grade may be suitable for reuse. Exposed lines should be tested and either buried in place, or replaced with new buried conductors as appropriate.

The existing fuel storage tank and secondary containment system at the backup power plant will be decommissioned. The proposed diesel power plant will include a code compliant, double wall fuel storage tank.

4.3 Existing System Deficiencies

Power generation and distribution system deficiencies noted during the site visits are listed below.

<u>Hydroelectric Power Plant Deficiencies:</u>

- The reservoir capacity is inadequate for continuous operation of the hydro facility. During periods of water shortage, the City must operate their diesel plant more frequently than desired.
- The hydro's existing switchgear and control systems are malfunctioning, causing infrequent, but disruptive, power outages.

<u>Backup Diesel Power Plant Deficiencies</u>

- The existing engine-generator sets are old and have exceeded their intended service life. While it may be possible to extend their life for a few more years with rebuilds, all existing generation units need to be replaced.

- Many of the supporting mechanical systems such as ventilation, fuel handling, and cooling are also aging and due for replacement.
- The existing plant switchgear does not allow for paralleling of the gen-sets. As a result, the plant is undersized for current peak loads.
- The switchgear and panel boards do not have placards defining protective gear requirements and flash protection distances.
- The bulk fuel storage and day tank systems do not meet code requirements./ The lack of proper secondary containment presents a real threat of spill and environmental harm.

Distribution System Deficiencies

- Existing 3-phase pad mount transformers are severely corroded, and the majority of 1-phase units are out of plumb.
- In several areas active primary and secondary direct bury cables are exposed, or have been purposefully routed above grade. Exposed conductors are a serious danger to residents and, without adequate cover, the wires are very vulnerable to damage, resulting in frequent outages and costly repairs.

5.0 POWER SYSTEM UPGRADES

5.1 Electrical capacity considerations

Electrical demands in rural Alaskan villages, while relatively small in overall magnitude, tend to be significantly more variable than those for larger communities. This is due to dynamic fluctuations in seasonal populations, temperatures, local industrial activities, and other factors. Properly sizing power generation systems for these communities requires the integration of hard data, such as historical consumption records, with socio-economic and other factors, such as projected housing and population growth, planned infrastructure improvements, and the applicability of alternative energy sources and emerging system control technologies.

The following sections summarize the historical electrical usage in the community, and identify factors such as planned infrastructure improvements, alternative energy sources, and shifts in population that were considered in sizing the system.

5.1.1 Historical Electrical Demand

Larsen Bay participates in the State's Power Cost Equalization (PCE) Program, and is required to submit monthly reports to the AEA itemizing a myriad of power system related items - most notably the quantity of electric power generated and sold, as well as peak monthly electrical demands. Historical PCE report data was analyzed to determine trends in the community's energy consumption (see Appendix C). The current average community load is approximately 80 kW, rising to around 120 kW when the cannery is online, with brief spikes as high as 160 kW. The higher loads are typically attributed to pre-season cannery activity. In recent years, the hydro plant has produced the majority of power. The highest demands occur in December and January, which is typical of rural Alaskan communities. In Larsen Bay, high demand also occurs in June / July, when seafood processing is at its peak

The City's existing power generation system can run in either hydro or diesel mode. The hydro plant can theoretically generate up to 475 kW of power, however this upper limit has never been tested, and is probably not attainable for extended periods due to the small reservoir volume. The diesel plant can run only one generator at a time, with a maximum output of 200 KVA; the diesel and hydro plants cannot run in parallel at this time. Based on a load bank setting of 60 kW, the hydro plant currently has approximately 295 kW in reserve. In contrast, the City stand-by diesel plant has very little reserve generation capacity.

5.1.2 Planned Infrastructure Improvements

Future infrastructure improvement projects can affect community electrical demands and must be considered when sizing the proposed power plant. The scope and

anticipated impact of planned infrastructure improvements are discussed in the following sections.

Airport Improvements

The Alaska Department of Transportation and Public Facilities is planning an airport improvement project in Larsen Bay; construction is scheduled to begin in 2011. Proposed upgrades include widening and extending the existing runway, installing runway lighting, and constructing a snow removal equipment storage building.

Based upon preliminary coordination with ADOT&PF, the combination of runway lights and the equipment storage facility will result in an estimated 10 kW average demand consuming around 100,000 kWh per year.

Water and Sewer Improvements

The Community has received a grant through the Alaska Native Tribal Health Consortium (ANTHC) for renovation of the existing water supply and distribution system. Typical improvements include increasing water treatment and storage capacities, as well as the tap pressure available to residents. These improvements, along with possible future sewer and sanitary landfill upgrades, are anticipated to boost residential and commercial development within the community, causing populations and energy consumption rates to increase. For the purposes of this report it is assumed that an additional 10,000 kWh per year will be required to support these improvements.

Projected Community Growth

Historical census data shows that the population of Larsen Bay has varied significantly over the past 70 years (reaching a peak population of 168 in 1980.). The community has seen a recent decline in population; the current population is approximately 90.

The population is expected to increase after completion of the infrastructure improvements discussed in Section 5.1.2. For the purposes of this CDR, an average population growth of 1% is assumed, resulting in a design population of 100 in 2018. Assuming that the average household size remains at 3.54 residents per house, approximately 3 new homes will be constructed by the design year. The resulting increases in electrical demand will be approximately 2 kW (20,000 kWH) per year.

5.1.3 Projected Electrical Demands

A summary of the community's electrical demands and peak loads during recent years is shown in Table 2. Peaking Factors based upon the ratio between historic annual average and peak loads are also shown.

Table 2 – Larsen Bay Historical Demand Data

Year	Annual Consumption (kWH)	Annual Average (kW)	Annual Peak Load (kW)	Peaking Factor
2004	771,380	88	160	1.8
2005	727,197	83	147	1.8
2006	727,518	83	N/A	N/A

Source – Historic PCE Data

The annual kWH consumption in 2004 was used as a baseline value for estimating future demands. Anticipated future loads from Section 5.1.2 were added to this baseline to estimate the average demand at design (see Table 3). Peak demand in the design year was calculated by applying a peaking factor of 1.8.

Table 3 – Projected Electrical Demands

TYPE	DEMAND
Baseline Consumption (Larsen Bay 2004 PCE Data)	771,380 kWh
Estimated Increase (10-year outlook)	130,000 kWh
Estimated Annual Consumption (2016)	**901,380 kWh**
Projected Average Demand	**103 kW**
Projected Peak Demand (Peaking Factor = 1.8)	**185 kW**

5.2 System Design Considerations

5.2.1 Climate

The climate of the Kodiak Islands is dominated by a strong marine influence. There is little or no freezing weather, moderate precipitation, and frequent cloud cover and fog. Severe storms are common from December through February. Annual precipitation is 23 inches. Temperatures typically remain within a narrow range, from 32° F to 62° F.

Design snow loading for the community is 40 pounds per square foot. Design wind speed is 110 miles per hour, Exposure D.

5.2.2 Geotechnical Conditions and Borrow Sources

A detailed geotechnical investigation was not completed for this report. During the site visit, two test pits were excavated near the proposed power plant site using the City-owned backhoe. The test pits revealed 1-foot to 3-feett of organics underlain by bedrock. Fill material is available from several local rock pits owned by Koniag Inc. A bulldozer equipped with a ripping blade is required for material extraction. Special use permits and the payment of royalties ($1 to $3 per cubic yard) will be required for all borrow source operations.

5.2.3 Site Control

A site control opinion was prepared by Rick Elliot, Land Consultant, and is provided in Appendix D. The proposed power plant site is located within Tract A, Plat 96-9, which is located within the SW1/4NE1/4SE1/4, Lot 13, Lot 20 and Tract 37 in section 31, Township 30 South, Range 29 West, Seward Meridian, Alaska. Legal title to this site appears to be vested in the City of Larsen Bay.

5.3 PROPOSED IMPROVEMENTS

5.3.1 Scope of work

The proposed Scope of Work includes the following major items:

- New backup diesel power plant module with switchgear designed to interface with the hydroelectric plant and maximize benefits of the renewable resource.
- Connect new backup diesel power plant to existing 15 kV electrical distribution system.
- Upgrade the existing 15 kV distribution system as necessary to meet code.

Detailed discussions of each project component are provided in the following sections. Conceptual design drawings for the proposed improvements are provided in Appendix D.

The final scope of work will depend upon the availability of funding; a discussion of estimated project costs is provided in Section 7.4 of this report.

5.3.2 New Backup Diesel Power Plant Module

The project will include a new backup diesel power plant designed to interface with the City's existing hydro plant, and maximize the benefit of this renewable resource. The proposed diesel power plant will consist of a skid mounted module (approximate dimensions of 16' x36') with three diesel powered generators, including two 180 kW units and one 100 kW unit (total capacity of 460 kW). This plant is sized to meet the

community's anticipated peak loads over the next ten years. The plant's switchgear will incorporate remote monitoring capabilities, allowing AEA engineers in Anchorage to assist the local operator with maintenance and troubleshooting. A concept level backup module floor plan is shown on Figure 2.

5.3.4 City Distribution System Upgrades

Some components of the City's existing electrical distribution system, including exposed primary and secondary voltage direct-bury cables, transformers, meter bases, etc., are nearing the end of their useful design lives and/or do not meet current NESC code requirements. Further, the corroded condition of several transformers and the presence of exposed primary and secondary cables present serious threats to public safety and the environment. The primary goal of the proposed electrical distribution system upgrades is to bring the system into code compliance. Compromised transformers will be replaced with new, corrosion resistant units; exposed direct bury conductors will be evaluated and either buried or replaced; conductor and transformer sizes will be evaluated; and a spare parts list (splice kits, tools, etc) will be developed and purchased for the City's use.

6.0 PERMITTING

6.1 COASTAL ZONE MANAGEMENT

Projects for communities in coastal regions, such as Larsen Bay, must complete a Coastal Project Questionnaire in accordance with the Alaska Coastal Management Program. The questionnaire is submitted to the State of Alaska Department of Natural Resources, Office of Project Management and Permitting (ADNR).

6.2 FIRE MARSHALL REVIEW

Before construction of the new backup diesel power plant begins, a set of stamped construction drawings must be submitted, along with the appropriate fee, to the State of Alaska, Department of Public Safety, Division of Fire Prevention (Fire Marshal) for plan review and approval. Review times depend upon the agency's current work load; a typical review will take up to a month to complete.

6.3 U.S. ARMY CORPS OF ENGINEERS WETLANDS FILL PERMIT

Projects that result in the placement of fill in wetlands require a Corps of Engineers (COE) permit. This project will not disturb wetlands areas and therefore no COE permit should be required.

6.4 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

In accordance with the NEPA an Environmental Assessment (EA) must be completed prior to construction of the project. The EA format should be based on the guidance documents provided in the AEA Project Reference Manual. The EA process should include the development and distribution of a project-scoping letter to all interested agencies. Responses from the agencies should be attached to the EA checklist as justification for a Finding of No Significant Impact (FONSI) for the project. AEA will act as the lead agency for FONSI determination.

6.5 ADEC REVIEW

ADEC regulates the operation of diesel power plants with the potential to emit more than 100 tons of dioxides per year (roughly equating to a diesel power plant with a generation capacity greater than 540 kW). The proposed power plant will be rated at 460 kW and, therefore, will not require an ADEC air permit.

6.6 RCA CERTIFICATION

Public utilities which meet certain criteria must obtain a Certificate of Public Convenience and Necessity (CPCN) from the Regulatory Commission of Alaska (RCA), which describes the authorized service area and scope of operations of the utility. The

City of Larsen Bay was issued a certificate by the RCA in April 26, 1986 (CPCN #353). The RCA requires that a utility update their CPNC after any major facility upgrade or operational change. To update the CPNC the utility must complete and submit the RCA form entitled "Application for a New or Amended Certificate of Public Convenience and Necessity."

6.7 FAA REVIEW

Projects located within 5 miles of any airport runway must complete the Federal Aviation Administration (FAA) Form 7460-1 "Notice of Proposed Construction or Operation," and submit it to the FAA Alaska Regional Office for review.

7.0 CONSTRUCTION PLAN

7.1 ADMINISTRATION

The AEA has a history of administering projects on a "modified" force-account basis. Force-account construction involves the owner or grantee acting as the employer and utilizing primarily local labor. This method tends to achieve a higher percentage of local hire and is strongly supported by many communities and funding agencies.

The technical nature of this project will require a limited number of imported workers with specific experience and expertise. All work will be supervised and managed by a superintendent with extensive experience in the construction of rural power facilities. Skilled craftsmen, with appropriate certifications, must perform all specialty work, such as pipe welding and electrical panel installation. An experienced Construction Manager will be required to recruit the necessary skilled labor, coordinate the construction team, and oversee procurement and project logistics. The Design Engineer will provide quality control through communication with the Construction Manager, review of submittals, and periodic site inspections

7.2 ACCESS/ LOGISTICAL CHALLENGES

Larsen Bay is accessible by air and by water. Scheduled and charter flights are available from Kodiak. There is a State-owned, lighted, 2,700 ft long by 75 ft wide gravel airstrip in town. The Corps of Engineers completed construction of a breakwater and boat harbor in the fall of 2002. A cargo barge arrives every six weeks from Seattle WA. Lodging is generally available at the Uyak Bay Lodge (907-847-2350) or the Larsen Bay Lodge (907-847-2238).

7.3 CONSTRUCTION SCHEDULE

The proposed project schedule, subject to availability of funding, calls for final design and permitting during summer 2008 and procurement of long lead items in the fall of 2008 and module fabrication during winter of 2008/2009. On-site construction will likely begin in the spring of 2009.

A preliminary project schedule is shown in Table 4 on the next page.

Table 4 – Construction Schedule – Larsen Bay Power System Upgrades

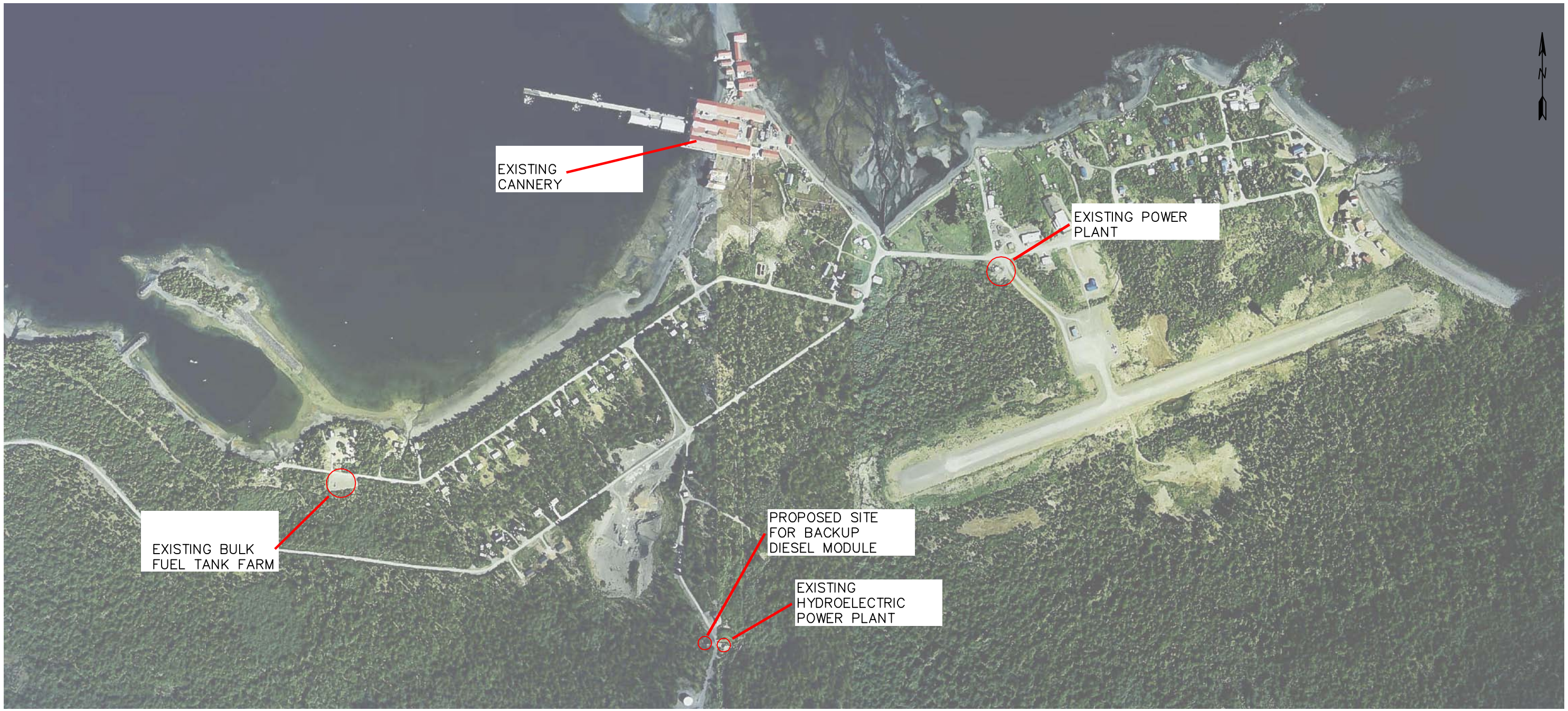
Task	JUN (2008)	JUL	AUG	SEP	OCT	NOV	DEC	JAN (2009)	FEB	MAR	APRIL	MAY	JUNE	JUL	AUG
Final Design	■	■	■												
Permitting			■	■	■										
Procurement – Long Lead Items			■	■	■	■	■	■							
General Procurement						■	■	■							
Diesel Module Fabrication						■	■	■	■	■					
Mobilization and Shipping Time											■	■			
Install Power Plant Module													■		
Perform Distribution System Upgrades													■	■	
Startup and Testing															■

7.4 CONCEPTUAL CONSTRUCTION COST ESTIMATE

A conceptual cost estimate for the construction of proposed upgrades is included in Appendix B. The estimate includes labor, materials, and shipping costs for all project components. The cost estimate was developed based on information gathered during the site visits and subsequent reports by Electric Power Systems Inc. (Appendix C). The total project cost including all design, supervision, construction, inspection, permitting, insurance, and a 20 percent contingency, is estimated as $2,132,750.

APPENDIX A

Project Photos and Figures



300 0 150 300 600
GRAPHIC SCALE

CRW ENGINEERING GROUP, LLC

PROJECT: 30401.13
STATUS: FINAL

LARSEN BAY, ALASKA

RURAL POWER SYSTEM UPGRADE PROJECT
COMMUNITY SITE PLAN

DATE: MAY 2008
SCALE: 1" = 300'
FIGURE: 1

File: J:\Jobsdata\30401.13 Larsen Bay RPSU\00 CADD\02 Figures\3040113 LarsonBay Aerial.dwg

FIGURE 2 - BACKUP MODULE FLOOR PLAN

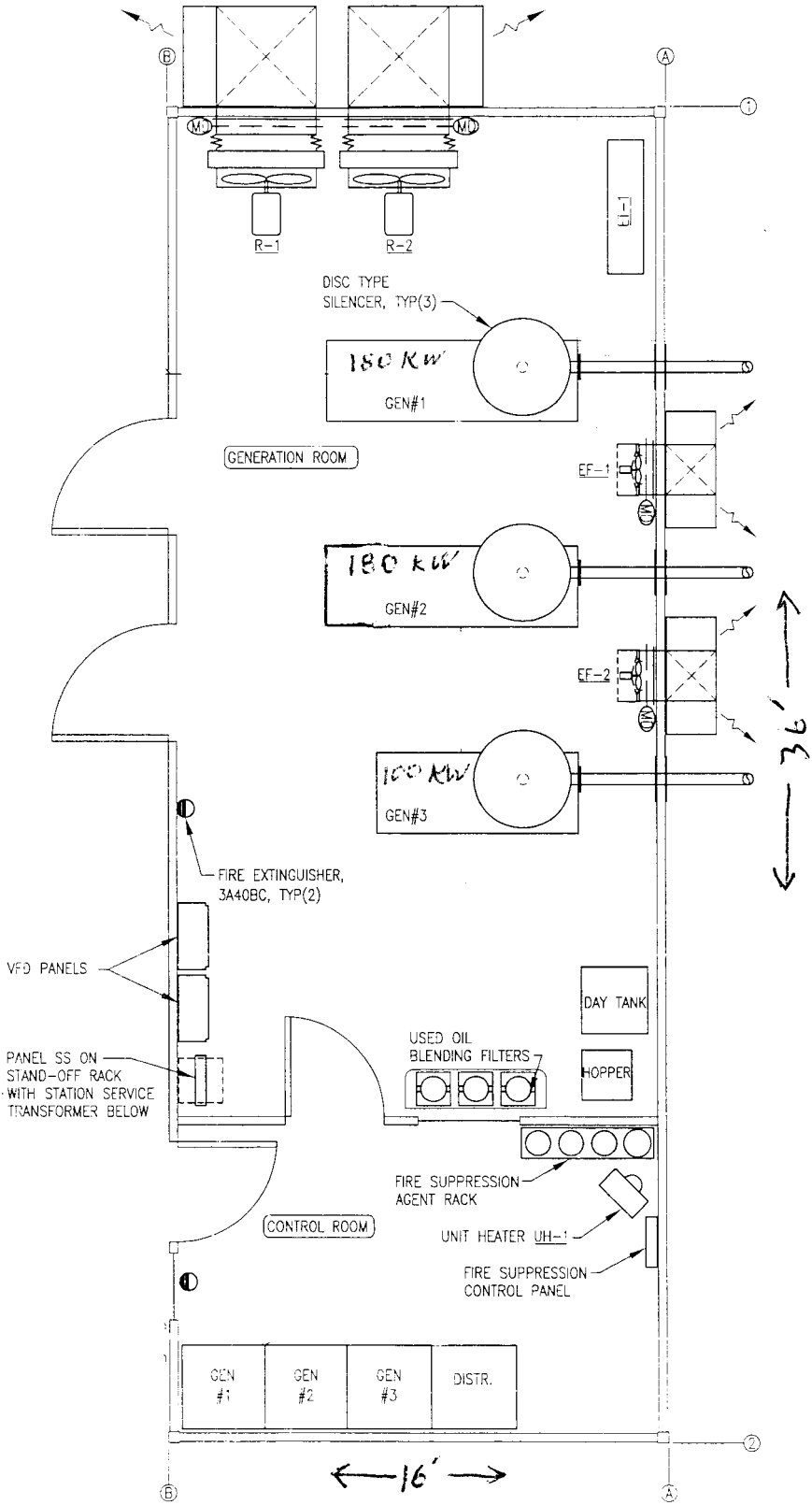


Photo 1 – Larsen Bay Hydroelectric Power Plant

Photo 2 – Hydro Power Plant Tail Race

Photo 3 – Access Road to Dam and Reservoir

Photo 4 – Humpy Creek Reservoir

Photo 5 – Humpy Creek Dam Spillway

Photo 6 – Existing Diesel Backup Power Plant Exterior

Photo 7 – Existing Diesel Backup Power Plant Interior

Photo 8 – Typical Single Phase Transformer

Photo 9 – Above Grade Secondary Voltage Conductor Installation

APPENDIX B

Construction Cost Estimate

	COST CATEGORIES													
	MATERIALS AND FREIGHT							LABOR				RENTAL		TASK SUB-TOTALS
TASK	ITEM	QTY	UNIT COST	MATL COST	UNIT WEIGHT	TOTAL WEIGHT	FREIGHT COST	CATEGORY	MAN HR	UNIT COST	LABOR TOTAL	RATE (MONTH)	COST	
1- Mob and Demob Task Description: Mob and demob covers all consolidation, barge loading and off loading, camp setup and staging of materials on site. This task will take approximately 2 weeks.								Operators (2) Truck Drivers (1) Laborers (2)	360 180 360	$60 $60 $60	$21,600 $10,800 $21,600			Material $0 Freight $0 Labor $54,000 Rental $0 **Item 1 Total - $54,000**
2- Gravel Pad and Concrete Pedestal Foundation Task Description: Items will include all earthwork required to provide a stable gravel foundation pad, fabrication and placement of concrete foundation pedestals. This task will take approximately 1 week.	Pre-Cast Concrete (CY) Gravel Royalties- Foundation (CY)	11 100	$500 $2	$5,500 $200	4,000	44,000	$26,400	Operators (1) Truck Drivers (1) Laborers (2)	60 60 120	$60 $60 $60	$3,600 $3,600 $7,200			Material $5,700 Freight $26,400 Labor $14,400 Rental $0 **Item 2 Total - $46,500**
3- Modular Power Plant Fabrication and Field Erection* Task Description: Item will include fabrication of the module in Anchorage, setting the module, securing the module to the concrete pedestals, and performing all electrical and mechanical tasks necessary for startup. The field work portion of this task will take approximately 4 week.	Lump Sum	1	$639,000	$639,000 .	60,000	60,000	$36,000	Fabrication Field Setup: Operator (1) Laborer (2) Electrician (.5)	1230 240 480 120	$75 $60 $60 $85	$92,250 $14,400 $28,800 $10,200			Material $639,000 Freight $36,000 Labor $145,650 Rental $0 **Item 3 Total - $820,650**
4- Diesel Plant Tie In and Distribution System Upgrades Task Description: This item will include connection of the proposed power module to the existing distribution system as well as required distribution system upgrades to meet code requirements. This task will take approximately 8 weeks.	New Primary Conductor (ft) New Secondary Conductor (ft) 3-phase transformers 1-phase transformers Meters (50% of Existing)	1,000 500 5 10 30	$50 $50 $6,000 $3,000 $500	$50,000 $25,000 $30,000 $30,000 $15,000	1 1 1,000 600 75	1,000 500 5,000 6,000 2,250	$600 $300 $3,000 $3,600 $1,350	Electrician (1) Operator (1) Laborer (2)	480 480 960	$85 $60 $60	$40,800 $28,800 $57,600			Material $150,000 Freight $8,850 Labor $127,200 Rental $0 **Item 5 Total - $286,050**
5- Miscellaneous**

APPENDIX C

Electrical System Inspection Reports

electric Power Systems inc.
Consulting Engineers

Village of Larsen Bay
Electrical Power System Inspection

May 2004

Prepared by:

Earl W George, P.E.
David Burlingame, P.E.

PHONE (907) 522-1953 • 3305 ARCTIC BLVD., SUITE 201, ANCHORAGE, ALASKA 99503 • FAX (907) 522-1182 • WWW.EPSINC.COM
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PHONE (425) 883-2833 • 3938 150 AVE. N.E., REDMOND, WASHINGTON 98052 • FAX (425) 883-8492

Table of Contents

1. Scope of Work 3

2. Existing Power Generation and Distribution Facilities 3

2.1. Description of Existing Facilities 3

2.1.1. Power Plant 3

2.1.2. Distribution System 4

2.1.3. Equipment Suitable for Reuse 4

2.2. Existing Power Generation Capacity ..... Error! Bookmark not defined.

2.3. Existing Power Generation and Distribution System Deficiencies 4

3. Recommended Improvements 6

3.1. Distribution System Improvements 6

3.1.1. Transformers ..... **Error! Bookmark not defined.**

3.1.2. Buried Distribution System 6

3.1.3. Service Connections 6

3.2. Diesel Power Generation Facility Improvements ..... Error! Bookmark not defined.

3.2.1. Planned Infrastructure Improvements ..... **Error! Bookmark not defined.**

3.2.2. Recommended Electrical Generation Capacity ..... **Error! Bookmark not defined.**

3.2.2.1. Diesel Generator Sizes and Switchgear Considerations ..... **Error! Bookmark not defined.**

3.2.3. Tie in / Synchronization to Existing Distribution System ..... **Error! Bookmark not defined.**

4. Distribution System Improvement Cost Estimate 7

5. Appendix A 8

6. Appendix B 9

6.1. Pictures ..... Error! Bookmark not defined.

6.1.1. Generators ..... **Error! Bookmark not defined.**

6.1.2. Single Phase Transformer ..... **Error! Bookmark not defined.**

6.1.3. Secondary Pedestal & Conductors ..... **Error! Bookmark not defined.**

1. Scope of Work

Electric Power Systems, Inc. (EPS) was contracted to perform an on-site inspection of the electrical distribution system at Larsen Bay, Alaska and develop a list of required improvements and deficiencies. This report will document what was found during the on-site inspection of the electrical distribution system and recommend improvements required for continued service of reliable electrical power.

2. Existing Power Generation and Distribution Facilities

2.1. Description of Existing Facilities

A visual inspection of the electrical system in Larsen Bay was conducted on May 12-13, 2004. The underground electrical distribution system was toured on foot and by truck to allow good access and close examination. The hydro power plant and the standby diesel power plant were also toured.

2.1.1. Power Plants

The hydroelectric plant consists of a 475 kW machine complete with monitoring, controls, and protection. The building that houses the hydro machine appears to be slab on grade. The hydro machine generates power at 480 volts.

The hydroelectric machine connected to the distribution system via a three-phase 500 kVA oil-filled pad mounted step-up to 12.47/7.2 kV grounded WYE transformer.

The standby power plant consists of two 480 volt three-phase generators. Each generator is as follows:

1. 200 kW
   480 Volts
   1800 RPM
   Onan Generator
   Onan Engine

2. 193 kW
   480 Volts
   Marathon Generator
   Cummins Engine

2.1.2. Distribution System

The entire system consists entirely of underground direct buried primary and secondary conductors.

Primary conductor type, size, lengths, and condition could not be determined due to lack of access to the buried primary.

Transformers are pad mount with a load break primary bushings, and a feed through bus on the single-phase units. There are two three-phase 15 kV switch cabinets, two three-phase pad mount 15 kV step-up transformers, one three-phase pad mount 15 kV step-down transformer, two three-phase 15 kV junction boxes, 2 single-phase 7,200 volt junction boxes, approximately 25 single-phase pad mount transformers, and several secondary pedestals on the system. The single-phase transformers are all reported to be either 15 kVA or 25 KVA units; the three-phase units all appear to be 500 kVA units.

Secondary conductor and service conductor appears to be aluminum underground triplex for single phase, and aluminum underground quadruplex for three phase. Soil conditions are reasonably good for direct burial of electrical conductor.

Most secondary conductors terminate within secondary junction pedestals.

Meters in the community are socket type and were probably installed with the distribution system.

2.1.3. Equipment Suitable for Reuse

The primary and secondary conductors appear to be in good condition however, the use of direct buried conductor in this location may render the cables not suitable for future use in new projects.

Existing Distribution System Deficiencies

The distribution system is in generally fair condition. Single-phase transformers are in good condition however many of these transformers are not plumb. All of the three-phase padmount transformers are in fair condition. The oil containment for all of the three-phase pad mount transformers is destroyed or rapidly crumbling. No three-phase transformer was properly locked and secured.

Splice kits and spare primary cable will be needed for maintenance and repair purposes. Secondary conductors are not buried in several areas. Many primary and secondary trenches are still open with a small amount of covering so as to hide cables from view.

Meters appear to be in fair condition. Sockets are generally in fair to poor condition, due to rust.

3. Recommended Improvements

3.1. Distribution System Improvements

3.1.1. Buried Distribution System

The long runs of underground primary cable on the system, and the relatively light system load could result in difficulty in voltage control. Consideration should be given to having an analysis of the system performed, to determine if voltage control problems are likely to be present, and what actions can be taken to solve any such problems.

If at a future time there is any section of a primary conductor replaced, it is recommended that a sample portion of the old conductor be sent to a qualified test lab for analysis. To follow are two recommendations:

Georgia Technology Research Corp / Neetracc
Attn: Angelo Lawton, Research Coordinator
PO Box 100117, Atlanta GA 30384 (billing)
62 Lake Muir Building, Forest Park GA 30297-1613 (lab)
(404) 675-1893

Cable Technology Laboratories, Inc.
Attn: Carlos Katz, Chief Research Engineer
690 Jersey Ave, New Brunswick NJ 08903
(732) 846-3133

A minimum of six splice kits, two elbow kits, and basic cable preparation tools should be provided for each of the three types of primary cable in use. The correct dies and tools for installing the splices and elbows should also be provided.

3.1.2. Service Connections

Though the meters appear to be in fair condition, meters should be cleaned and tested due to extended exposure to harsh weather conditions. Sockets are generally in fair condition due to rust, and should be monitored and replaced as needed with aluminum or stainless steel units.

electric Power Systems inc.
Consulting Engineers

City of Larson Bay
Electrical Power Generation and Cannery Load Inspection

May 2004

Prepared by:

William Brimstein, P.E.
David Burlingame, P.E.

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Table of Contents

1. Scope of Work 3

2. Existing Power Generation and Distribution Facilities 3

2.1. Description of Existing Facilities 3

2.1.1. Cannery Power Plant 3

2.1.2. City Diesel Power Plant 3

2.1.3. City Hydro Power Plant 4

2.2. Cannery Loads 5

2.3. Operating Deficiencies 6

2.4. Hydro Plant Deficiencies 6

2.5. City Diesel Plant Deficiencies 6

3. Recommended Improvements 7

3.1. Cannery Facility Improvements 7

3.1.1. System monitoring/control 7

3.1.2. Partial Supply of Cannery Loads 7

3.2. Hydro Plant Improvements 8

3.2.1. Protection 8

3.2.2. Speed/Frequency Control 8

3.3. City Diesel Power Plant Improvements 8

3.3.1. Protection 8

4. Generation System Improvement Cost Estimate 9

5. Appendix A 10

6. Appendix B 11

6.1. Pictures 11

6.1.1. Cannery Panel "A" 11

Photo 2 shows possible mounting location for Transfer switch to right of panel A. 11

6.1.2. J-Box Incoming City to Cannery 12

1. Scope of Work

Electric Power Systems, Inc. (EPS) was contracted to perform an on-site inspection of the power generation system at Larson Bay, Alaska and develop options for Cannery use of hydro generated power. This report will document what was found during the on-site inspection and recommend improvements for the use of hydro power.

2. Existing Power Generation and Distribution Facilities

2.1. Description of Existing Facilities

An inspection of the electrical generation systems in Larson Bay was conducted on May 12th and 13th, 2004. The Cannery generation, tie-in, and loads were inspected along with inspection of the City diesel plant and hydro.

2.1.1. Cannery Power Plant

The existing generation plant consists of five 350kW diesel gensets.

Controls are presently being upgraded to provide isochronous load share capabilities between units with provisions for droop operation if desired. Reactive load sharing is accomplished via droop voltage regulation.

The 480-volt switchgear includes a breaker for each generating unit, and a breaker panel for outgoing feeders to the cannery. Each unit has adequate metering of kilowatts, amps, volts, power factor and frequency.

Three additional taps off the generation bus supply main-lug sub-panels (“A”, “B” & “C”) in an electrical room adjacent to the generation area.

The plant is connected to the city utility system via freestanding paralleling switchgear located alongside the generation switchgear. An 800 amp breaker ties the generation bus to the city utility. Protection consists of a synch check, over/under voltage and over/under frequency. Synchronizing is accomplished with a synch scope, and an imcoming/running voltmeter and ammeter. Plant metering is limited to amps only.

2.1.2. City Diesel Power Plant

The existing generation plant consists of two diesel gensets rated xxkW and xxkW.

Units are set for isochronous load control without load sharing. Voltage control is operated in droop.

Each unit has its own manual breaker connecting the generator to a transfer switch. Unit metering is limited to amps, volts, and frequency. The units cannot be paralleled.

The transfer switch is connected to the city utility system via freestanding paralleling switchgear located between the diesel gensets. An 800 amp breaker ties the generator to the city utility. Protection consists of a synch check, over/under voltage and over/under frequency. Synchronizing is accomplished with a synch scope, and an imcoming/running voltmeter and ammeter. Plant metering is limited to amps only.

2.1.3. City Hydro Power Plant

The existing hydro generation plant consists of a single 475kW pelton turbine genset.

Controls consist of Thomson & Howe (T&H) speed/Hz control and EPS load control. The unit will run standalone in isochronous mode or in parallel with city/cannery in base mode. Reactive load sharing is accomplished via droop voltage regulation.

When supplying the entire city/cannery load, the hydro is running in isochronous mode with the frequency controlled by the T&H module and associated load bank. A reserve setpoint on the HMI determines the amount of load on the load bank. A reserve setpoint of 60kW (half of total load bank capability) would allow for block load increases/decreases of 60kW. If a 60kW load is placed on the system, the load bank will respond by giving up its 60kW reserve load and thereby maintain a system frequency of 60Hz. The spears would then slowly open to put 60kW back on to the load bank. The opposite of the preceding occurs for load decreases. A lower reserve setpoint would allow for smaller block load increases but greater load decreases.

The 480-volt switchgear includes a 1200 amp breaker that connects the plant to the step-up transformer and city system. Complete metering and control is provided through a local HMI (personal computer & monitor). Limited manual control is provided on the switchgear.

Protection consists of individual Thomson & Howe electronic protection modules for over/under voltage and synch-check. Reverse power and over/under frequency is provided by PLC logic.

2.2. Cannery Loads

There are two times a year that the cannery relies on the hydro for its sole means of power, before full production starts and immediately after (spring and fall) for a period of about six weeks total. During this time average load is approximately 40 to 60kW and consists primarily of heating and lighting loads, although small motor loads are present. Construction projects may increase this load by 20kW.

During the two to three months of production, the cannery transfers all loads to the cannery power plant at which point it is operating isolated from the city utility.

2.3. Operating Deficiencies

During times that the cannery is operating completely on city power, the cannery personnel have no easy means of determining system capacity or ability to start a small motor load or pick up an additional feeder or transformer load.

It is typical that the cannery operating personnel are not able to contact city personnel regarding ability of city to take on additional load. After repeated calls and leaving messages with no response, the cannery will add an additional load in the blind hope that it doesn’t cause an outage.

While on site, I was told by cannery personnel that they have to keep the cannery load under 100 amps. This was their only condition for operation of the cannery (besides avoiding large load changes). At this time of year, with the hydro reservoir overflowing, the hydro should theoretically be able to produce its full output of 475kW. The 100 amp limit has no relation to what is actually available from the city utility. It could be substantially more or less (less if only the small city diesel is on-line).

2.4. Hydro Plant Deficiencies

Erratic operation of the T&H protection modules has necessitated the implementation of generator protection via PLC logic. Both the Reverse Power and Over/Under Frequency protection is now performed by the PLC.

During the site visit by EPS, two outages were observed to have occurred from over frequency conditions. The first outage occurred while the cannery was adding small loads of approximately 10kW (load bank reserve setpoint was 30kW). The second occurred during stable operation with a load bank reserve setpoint of 60kW!

Based on the above observed outages, it is suspected that the T&H frequency controller is failing.

2.5. City Diesel Plant Deficiencies

During times of load transfer from diesel to hydro, the diesel has been motored by the hydro. Besides causing system instability, continued motoring can damage the diesel generator.

3. Recommended Improvements

3.1. Cannery Facility Improvements

3.1.1. System monitoring/control

In order to provide the cannery with an indication of available power from the city utility, it is recommended that an HMI monitor be installed with communication to the hydro PLC. This monitor could display to the cannery the total power that is available from the hydro, or indicate limited city diesel power. This indication, coupled with a real-time head level indication, could greatly improve the cannery power usage.

An indication of the reserve (load bank) setpoint would also allow the cannery personnel to efficiently determine the amount of block load the hydro is capable of supporting. When bringing on multiple loads, the cannery personnel could also determine if the hydro spears have sufficiently opened (again putting load on the load bank) to allow additional load increases.

A limited amount of control by the cannery could allow for the hydro reserve setpoint (load bank) to be momentarily increased for the addition of cannery loads. Following addition of cannery load (or a period of time), the load bank reserve setpoint could return to the original setting.

3.1.2. Partial Supply of Cannery Loads

One of the main lug panels (“A”), fed off of the cannery generation bus, supplies a fairly stable group of three loads; “Can Shop”, “Sockeye” and “Campus”. The average total load on this panel is estimated at 93 kW. (Only the Campus load was active and could be measured directly).

It is proposed that this panel be supplied by the city utility during times when the cannery is in full production operating on its own generation.

The Sockeye and Campus loads are primarily heating and lighting loads of approximately 27 and 40 kW respectively. The Can Shop load consists of three canning lines with seven motors per line. The total connected load of the seven motors is approximately 26kW @ 0.8PF. Cannery personnel indicated that the lines run at approximately 50% of maximum speed with a total of two lines running at any single time. The total average Can Shop load is estimated at 26kW.

It should be noted that the three canning lines are each supplied from their own Variable Frequency Drive (VFD). This should allow for smooth start/stop of the canning lines without adverse impact to the utility system. If only a single canning line is started/stopped at any one time, a load bank reserve setpoint of 25kW should be sufficient for operation of the canning lines on hydro supplied power.

A manual transfer switch can be located next to panel “A” with tie-in to the city utility at the junction box located outside, immediately prior to the cannery paralleling switchgear.

3.2. Hydro Plant Improvements

3.2.1. Protection

Since the PLC is not designed for generator protection, it is recommended that a state-of-the-art multifunction generator protection relay be installed, and the remaining T&H protection modules be removed.

3.2.2. Speed/Frequency Control

It is recommended that replacement of the frequency control be considered. Initial monitoring with a power system analyzer may be warranted prior to replacement of controller.

3.3. City Diesel Power Plant Improvements

3.3.1. Protection

It is recommended that reverse power protection be added to the city diesel plant paralleling switchgear.

APPENDIX D

Site Control Opinion

Rick Elliott
Land Consultant
5452 Cape Seville Drive
Anchorage, Alaska 99516
Phone/Fax: (907)868-4043
e-mail: rickelliott@gci.net

November 29, 2007

Karl Hulse, PE
CRW Engineering Group
3940 Arctic Blvd, Suite 300
Anchorage, AK 99503

Dear ~~Mr.~~ Karl Hulse:

Here is the final version of the site control opinion for the power project in Larsen Bay.

If you have any questions or need additional information, please let me know.

Sincerely,

Rick Elliott

Rick Elliott
Land Consultant

Site Control Opinion
Power Plant Project
Larsen Bay, Alaska

As requested, I have reviewed the land status for the proposed power plant project in Larsen Bay, Alaska. Two alternate sites were researched as shown on the attached map.

Land Status Report

Land records were researched at the Bureau of Land Management (BLM), the State Department of Community, Commerce and Economic Development, and the State Recording Office. All research was conducted on line.

Proposed alternate site 1 appears to be located within Tract A, Plat 96-9, which is located within the SW1/4NE1/4SE1/4, Lot 13, Lot 20 and Tract 37 in section 31, Township 30 South, Range 29 West, Seward Meridian, Alaska. A copy of Plat 96-9 is attached. Proposed alternate site 2 appears to be located partially within Tract A and partially within the SW1/4NE1/4SE1/4 and Tract 37 of Section 31. From the map, it appears that both proposed sites are within the SW1/4NE1/4SE1/4 of Section 31. This property was conveyed to Nu-Nachk Pit Inc. by patent no. 50-78-0089 on August 24, 1978. (Koniag Inc. is the successor in interest.) The patent was recorded on September 21, 1978, at Book 41, Page 897 in the Kodiak Recording District. This parcel of land is outside the boundaries of the Kodiak National Wildlife Refuge. (See attached BLM master title plat.)

Other property to the south of the above described land conveyed by patent no. 50-78-0089 was conveyed to Nu-Nachk Pit Inc. by interim conveyance 117 on August 24, 1978. The interim conveyance was recorded on September 21, 1978, at Book 41, Page 875 in the Kodiak Recording District. This property is now described as Lot 20 and a portion of Tract 37, Section 31, Township 30 South, Range 29 West, Seward Meridian, Alaska. This parcel of land appears to be within the boundaries of the Kodiak National Wildlife Refuge and is subject to the requirements of Section 22(g) of the Alaska Native Claims Settlement Act (ANCSA). This provision states that even though the property is conveyed to the Native Corporation, the property remains subject to the laws and regulations governing use and development of the refuge. Thus, any development of land that is actually within the refuge would require the involvement of U.S. Fish and Wildlife Service. Therefore, the selected site should be located in such a manner to be outside the legal boundaries of the wildlife refuge. In fact, it appears from the location map that the parcels are just outside the boundaries of the refuge. This should be confirmed by survey.

On July 30, 1997, the SW1/4NE1/4SE1/4 and Lot 20 and Tract 37 of Section 31, Township 30 South, Range 29 West, Seward Meridian, Alaska, (among other property) was conveyed by statutory quitclaim deed by Koniag, Inc., successor in interest to Nu-Nachk Pit Inc., to the City of Larsen Bay under the provisions of

Section 14(c)(3) of the ANCSA. This deed was recorded at Book 151, Page 426 on August 18, 1997, in the Kodiak Recording District. A copy of the recorded deed is attached.

Site Control Summary. Legal title to both alternate sites appears to be vested in the City of Larsen Bay. However, some of the property within Tract 37 and Lot 20 may be within the boundaries of the Kodiak Island National Refuge and still subject to some level of federal jurisdiction. Therefore, it is recommended that the site be located within an area that is clearly outside the refuge boundaries.

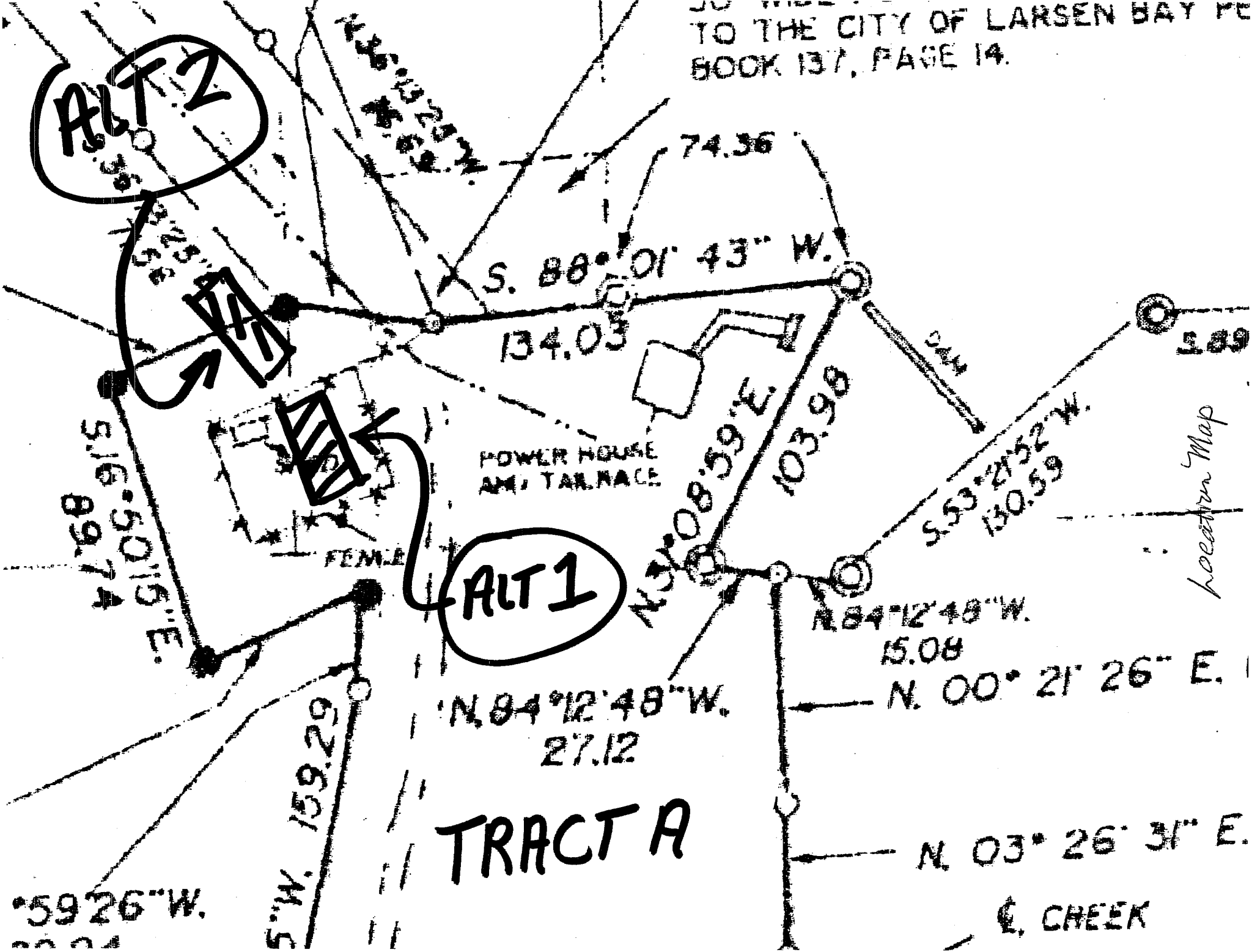
Disclaimer: This site control opinion does not purport to insure, warrant or certify title. This opinion is not a legal opinion. The research of the Kodiak Recording Office records was limited to a review of the computerized files. The opinion is the result of a diligent research effort as described above.

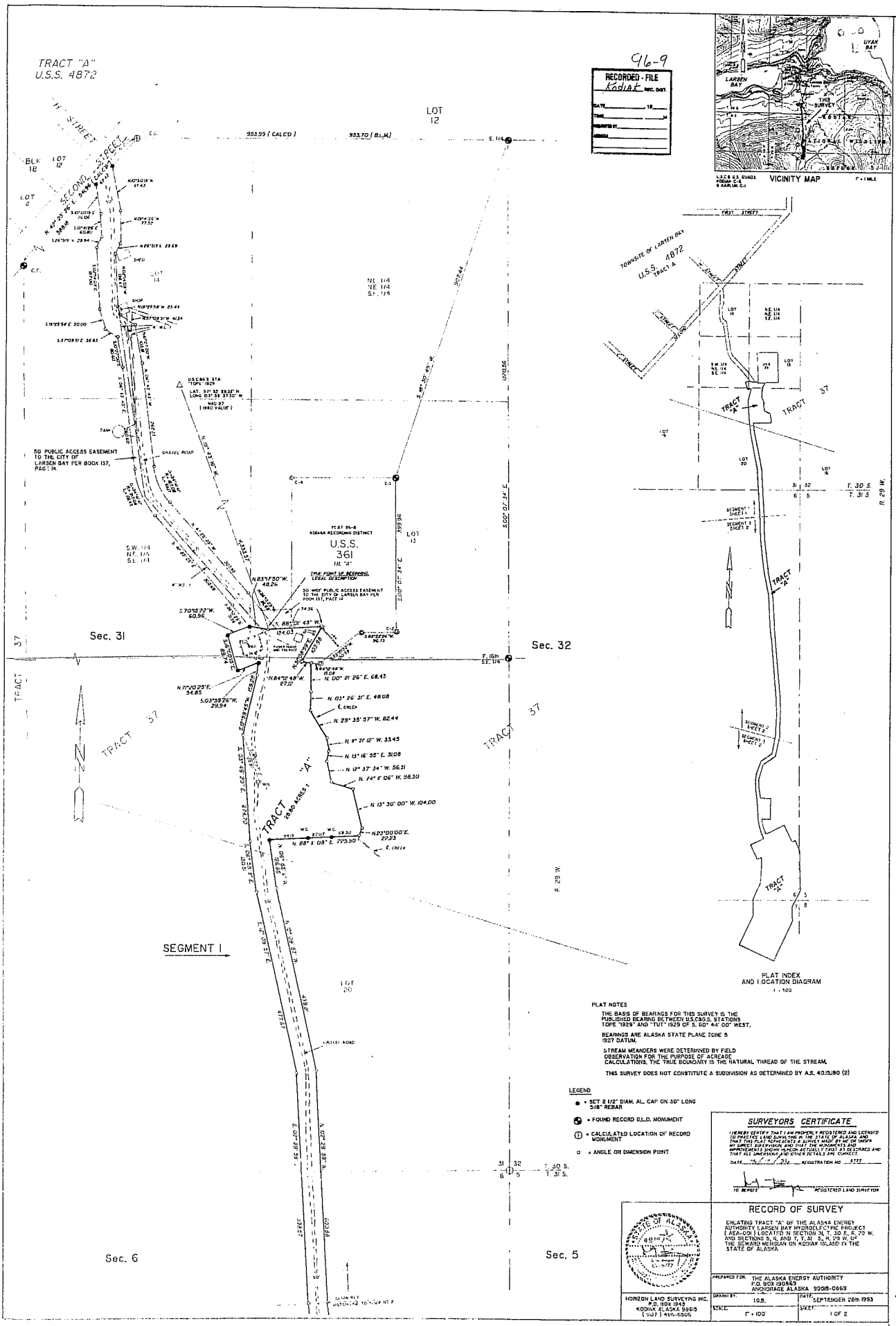
Prepared by

Rick Elliott

Rick Elliott
Land Consultant for CRW
November 29, 2007

Attachments: a/s


TO THE CITY OF LARSEN BAY PE
BOOK 137, PAGE 14.
ALT 2
74.36
S. 88° 01' 43" W.
134.03
POWER HOUSE
AND TAILRACE
103.98
S.53°21'52"W.
130.59
Location Map
ALT 1
N.84°12'48"W.
15.08
N. 00° 21' 26" E.
N.84°12'48"W.
27.12
TRACT A
N. 03° 26' 31" E.
℄ CHEEK
159.29



TRACT "A"
U.S.S. 4872
96-9
RECORDED - FILE
Kodiak
VICINITY MAP
LARSEN BAY
UYAK BAY
THIS SURVEY
LOT 12
953.99 (CALCD)
953.70 (BLM)
SECOND STREET
BLK 18
LOT 11
LOT 14
NE 1/4
NE 1/4
SE 1/4
U.S.C.&G.S. STA. "TOPS" 1929
LAT. 57° 52' 28.32" N.
LONG. 153° 39' 37.50" W.
NAD 27 (1980 VALUE)
50' PUBLIC ACCESS EASEMENT TO THE CITY OF LARSEN BAY PER BOOK 137, PAGE 14.
GRAVEL ROAD
PLAT 96-8
KODIAK RECORDING DISTRICT
U.S.S. 361
TRACT "A"
TRUE POINT OF BEGINNING LEGAL DESCRIPTION
50' WIDE PUBLIC ACCESS EASEMENT TO THE CITY OF LARSEN BAY PER BOOK 137, PAGE 14
Sec. 31
Sec. 32
Sec. 6
Sec. 5
TRACT 37
TRACT "A"
28.80 ACRES ±
N. 00° 21' 26" E. 68.43
N. 03° 26' 31" E. 48.08
N. 29° 35' 57" W. 82.44
N. 13° 16' 55" E. 31.08
N. 12° 37' 34" W. 56.31
N. 74° 11' 06" W. 98.30
N. 13° 30' 00" W. 104.00
N. 23° 00' 00" E. 27.23
N. 88° 5' 08" E. 225.30
SEGMENT 1
LOT 20
GRAVEL ROAD
T. 30 S.
T. 31 S.
R. 29 W.
TOWNSITE OF LARSEN BAY
U.S.S. 4872
TRACT A
FIRST STREET
SEGMENT 1 SHEET 1
SEGMENT 2 SHEET 2
SEGMENT 3 SHEET 3
PLAT INDEX AND LOCATION DIAGRAM
1" = 500'
PLAT NOTES
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE PUBLISHED BEARING BETWEEN U.S.C.&G.S. STATIONS TOPE "1929" AND "TUT" 1929 OF S. 60° 44' 00" WEST.
BEARINGS ARE ALASKA STATE PLANE ZONE 5 1927 DATUM.
STREAM MEANDERS WERE DETERMINED BY FIELD OBSERVATION FOR THE PURPOSE OF ACREAGE CALCULATIONS. THE TRUE BOUNDARY IS THE NATURAL THREAD OF THE STREAM.
THIS SURVEY DOES NOT CONSTITUTE A SUBDIVISION AS DETERMINED BY A.S. 40.15.190 (2)
LEGEND
• SET 2 1/2" DIAM. AL. CAP ON 30" LONG 5/8" REBAR
• FOUND RECORD G.L.O. MONUMENT
• CALCULATED LOCATION OF RECORD MONUMENT
• ANGLE OR DIMENSION POINT
SURVEYORS CERTIFICATE
I HEREBY CERTIFY THAT I AM PROPERLY REGISTERED AND LICENSED TO PRACTICE LAND SURVEYING IN THE STATE OF ALASKA AND THAT THIS PLAT REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION AND THAT THE MONUMENTS AND IMPROVEMENTS SHOWN HEREON ACTUALLY EXIST AS DESCRIBED AND THAT ALL DIMENSIONS AND OTHER DETAILS ARE CORRECT.
DATE
REGISTRATION NO. 4777
TO BERGER
REGISTERED LAND SURVEYOR
RECORD OF SURVEY
CREATING TRACT "A" OF THE ALASKA ENERGY AUTHORITY LARSEN BAY HYDROELECTRIC PROJECT (AEA-001) LOCATED IN SECTION 31, T. 30 S., R. 29 W. AND SECTIONS 5, 6, AND 7, T. 31 S., R. 29 W. OF THE SEWARD MERIDIAN ON KODIAK ISLAND IN THE STATE OF ALASKA
STATE OF ALASKA
PREPARED FOR: THE ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE ALASKA 99519-0869
DRAWN BY: I.G.B.
DATE: SEPTEMBER 20th 1993
SCALE: 1" = 100'
SHEET: 1 OF 2
HORIZON LAND SURVEYING INC.
P.O. BOX 1943
KODIAK ALASKA 99615
(907) 486-6506

96-9

Plat 96-9

96-9

96-9

RECORDED - FILED
Kodiak REC. DIST.
DATE 3/7 19 96
TIME 1:41 PM
RECORDED BY Horizon Land
ADDRESS Surveying

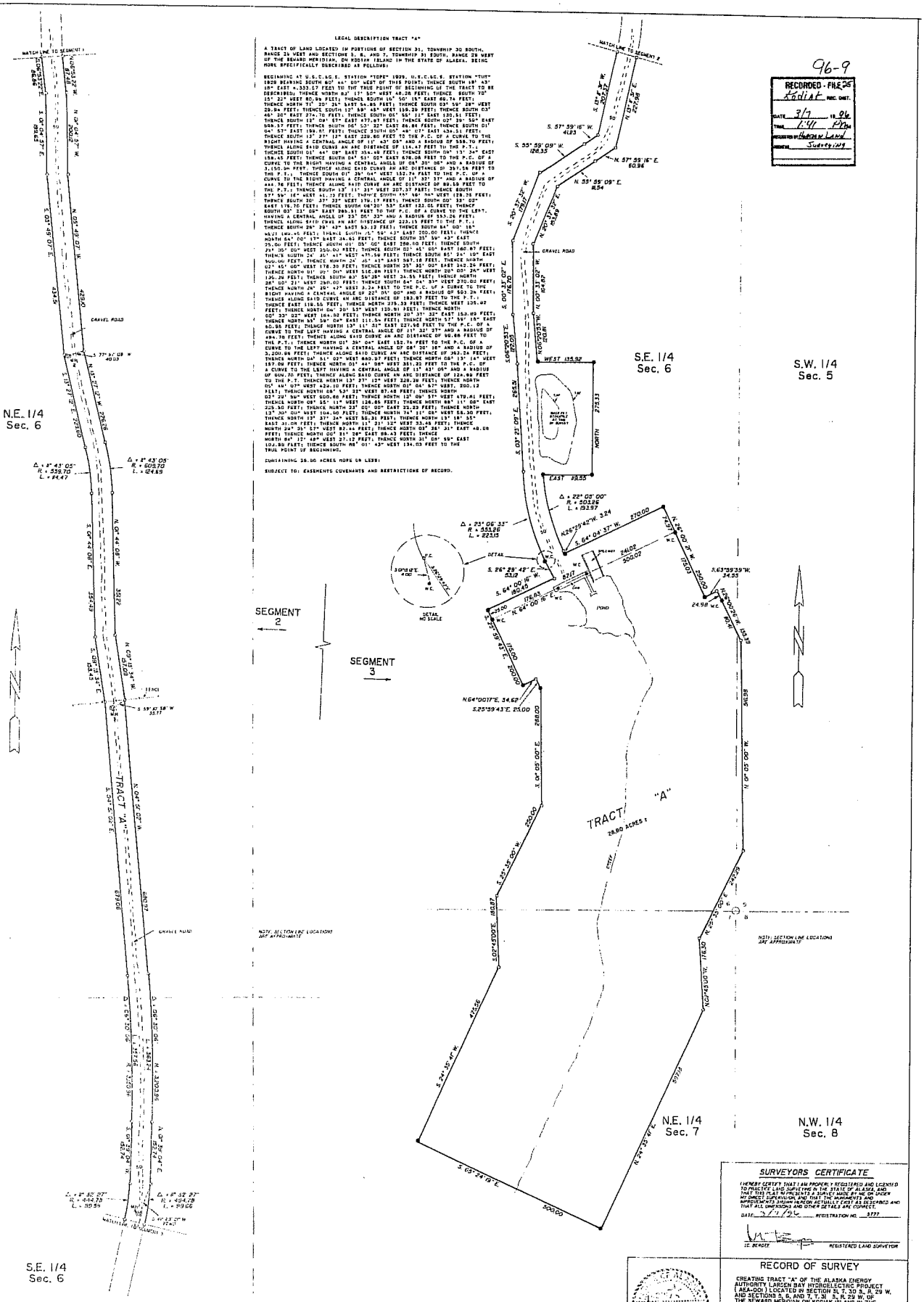
LEGAL DESCRIPTION TRACT "A"

A TRACT OF LAND LOCATED IN PORTIONS OF SECTION 31, TOWNSHIP 30 SOUTH, RANGE 28 WEST AND SECTIONS 5, 6, AND 7, TOWNSHIP 31 SOUTH, RANGE 28 WEST OF THE SEWARD MERIDIAN, ON KODIAK ISLAND, ALASKA IN THE STATE OF ALASKA. SAIMC MORE SPECIFICALLY DESCRIBED AS FOLLOWS:

BEGINNING AT U.S.C.&G.S. STATION "TOPE" 1929, U.S.C.&G.S. STATION "TUT" 1929 BEARING SOUTH 80° 44' 00" WEST OF THIS POINT; THENCE SOUTH 18° 43' 18" EAST 4,333.57 FEET TO THE TRUE POINT OF BEGINNING OF THE TRACT TO BE DESCRIBED; THENCE NORTH 82° 13' 50" WEST 48.28 FEET; THENCE SOUTH 70° 15' 22" WEST 80.94 FEET; THENCE SOUTH 16° 50' 15" EAST 82.74 FEET; THENCE NORTH 71° 20' 24" EAST 54.85 FEET; THENCE SOUTH 03° 50' 28" WEST 29.94 FEET; THENCE SOUTH 12° 58' 48" WEST 159.26 FEET; THENCE SOUTH 03° 46' 20" EAST 274.76 FEET; THENCE SOUTH 05° 55' 14" EAST 130.51 FEET; THENCE SOUTH 12° 09' 57" EAST 477.87 FEET; THENCE SOUTH 02° 39' 56" EAST 569.17 FEET; THENCE SOUTH 06° 53' 32" EAST 86.84 FEET; THENCE SOUTH 01° 04' 57" EAST 199.81 FEET; THENCE SOUTH 05° 48' 07" EAST 434.34 FEET; THENCE SOUTH 13° 27' 12" EAST 220.60 FEET TO THE P.C. OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 13° 42' 08" AND A RADIUS OF 588.70 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 114.42 FEET TO THE P.T.; THENCE SOUTH 01° 44' 08" EAST 354.48 FEET; THENCE SOUTH 04° 13' 34" EAST 158.45 FEET; THENCE SOUTH 04° 51' 02" EAST 676.08 FEET TO THE P.C. OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 08° 30' 06" AND A RADIUS OF 3,150.34 FEET. THENCE ALONG SAID CURVE AN ARC DISTANCE OF 297.56 FEET TO THE P.T.; THENCE SOUTH 01° 39' 04" WEST 152.74 FEET TO THE P.C. OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 11° 37' 37" AND A RADIUS OF 444.78 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 90.18 FEET TO THE P.T.; THENCE SOUTH 13° 11' 31" WEST 207.37 FEET; THENCE SOUTH 57° 59' 16" WEST 41.23 FEET; THENCE SOUTH 45° 58' 08" WEST 128.35 FEET; THENCE SOUTH 20° 37' 32" WEST 176.17 FEET; THENCE SOUTH 00° 33' 02" EAST 178.70 FEET; THENCE SOUTH 04°20' 53" EAST 122.01 FEET; THENCE SOUTH 02° 23' 08" EAST 298.91 FEET TO THE P.C. OF A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 23° 05' 33" AND A RADIUS OF 553.26 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 223.15 FEET TO THE P.T.; THENCE SOUTH 26° 28' 42" EAST 53.12 FEET; THENCE SOUTH 64° 00' 16" WEST 180.45 FEET; THENCE SOUTH 25° 59' 43" EAST 200.00 FEET; THENCE NORTH 64° 00' 17" EAST 34.62 FEET; THENCE SOUTH 25° 59' 43" EAST 288.00 FEET; THENCE SOUTH 25° 00' 00" EAST 25.00 FEET; THENCE SOUTH 01° 05' 00" EAST 288.00 FEET; THENCE SOUTH 24° 06' 00" WEST 350.04 FEET; THENCE SOUTH 02° 41' 00" EAST 160.67 FEET; THENCE SOUTH 24° 35' 41" WEST 475.56 FEET; THENCE SOUTH 85° 24' 19" EAST 300.00 FEET; THENCE NORTH 24° 35' 41" EAST 967.16 FEET; THENCE NORTH 02° 45' 00" WEST 178.30 FEET; THENCE NORTH 25° 35' 00" EAST 242.26 FEET; THENCE NORTH 01° 00' 00" WEST 516.04 FEET; THENCE NORTH 20° 00' 00" WEST 135.20 FEET; THENCE SOUTH 63° 59'35" WEST 34.55 FEET; THENCE NORTH 26° 00' 21" WEST 249.00 FEET; THENCE SOUTH 64° 04' 39" WEST 270.00 FEET; THENCE NORTH 26° 00' 42" WEST 3.24 FEET TO THE P.C. OF A CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 22° 05' 00" AND A RADIUS OF 503.24 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 193.93 FEET TO THE P.T.; THENCE EAST 118.55 FEET; THENCE NORTH 279.33 FEET; THENCE WEST 125.02 FEET; THENCE NORTH 06° 30' 53" WEST 120.91 FEET; THENCE NORTH 00° 33' 02" WEST 184.80 FEET; THENCE NORTH 20° 37' 32" EAST 153.09 FEET; THENCE NORTH 84° 59' 04" EAST 111.54 FEET; THENCE NORTH 57° 59' 16" EAST 60.96 FEET; THENCE NORTH 13° 11' 31" EAST 227.98 FEET TO THE P.C. OF A CURVE TO THE LEFT HAVING A CENTRAL ANGLE OF 11° 37' 37" AND A RADIUS OF 484.78 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 98.38 FEET TO THE P.T.; THENCE NORTH 01° 39' 04" EAST 152.74 FEET TO THE P.C. OF A CURVE TO THE LEFT HAVING A CENTRAL ANGLE OF 08° 30' 16" AND A RADIUS OF 3,200.34 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 282.24 FEET; THENCE NORTH 04° 51' 02" WEST 840.57 FEET; THENCE NORTH 06° 13' 34" WEST 157.04 FEET; THENCE NORTH 01° 44' 08" WEST 351.32 FEET TO THE P.C. OF A CURVE TO THE LEFT HAVING A CENTRAL ANGLE OF 13° 42' 08" AND A RADIUS OF 504.70 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 120.80 FEET TO THE P.T.; THENCE NORTH 13° 27' 12" WEST 228.28 FEET; THENCE NORTH 05° 44' 07" WEST 432.10 FEET; THENCE NORTH 01° 04' 57" WEST, 200.12 FEET; THENCE NORTH 08° 53' 32" WEST 87.48 FEET; THENCE NORTH 03° 29' 36" WEST 600.66 FEET; THENCE NORTH 12° 09' 57" WEST 479.41 FEET; THENCE NORTH 08° 55' 11" WEST 126.86 FEET; THENCE NORTH 88° 11' 08" EAST 225.30 FEET; THENCE NORTH 23° 00' 00" EAST 23.23 FEET; THENCE NORTH 13° 30' 00" WEST 104.50 FEET; THENCE NORTH 74° 31' 08" WEST 58.30 FEET; THENCE NORTH 13° 37' 34" WEST 55.31 FEET; THENCE NORTH 13° 18' 55" EAST 31.08 FEET; THENCE NORTH 13° 21' 12" WEST 31.48 FEET; THENCE NORTH 24° 31' 57" WEST 82.44 FEET; THENCE NORTH 03° 36' 31" EAST 48.08 FEET; THENCE NORTH 00° 21' 38" EAST 88.43 FEET; THENCE NORTH 84° 12' 48" WEST 27.12 FEET; THENCE NORTH 31° 08' 59" EAST 102.93 FEET; THENCE SOUTH 88° 01' 43" WEST 134.05 FEET TO THE TRUE POINT OF BEGINNING.

CONTAINING 28.80 ACRES MORE OR LESS:

SUBJECT TO: EASEMENTS COVENANTS AND RESTRICTIONS OF RECORD.



SURVEYORS CERTIFICATE

I HEREBY CERTIFY THAT I AM PROPERLY REGISTERED AND LICENSED TO PRACTICE LAND SURVEYING IN THE STATE OF ALASKA, AND THAT THIS PLAT REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION AND THAT ALL DIMENSIONS AND OTHER DETAILS ARE CORRECT.

DATE: 3/1/96 REGISTRATION NO. 5777

LC BENDER REGISTERED LAND SURVEYOR

RECORD OF SURVEY

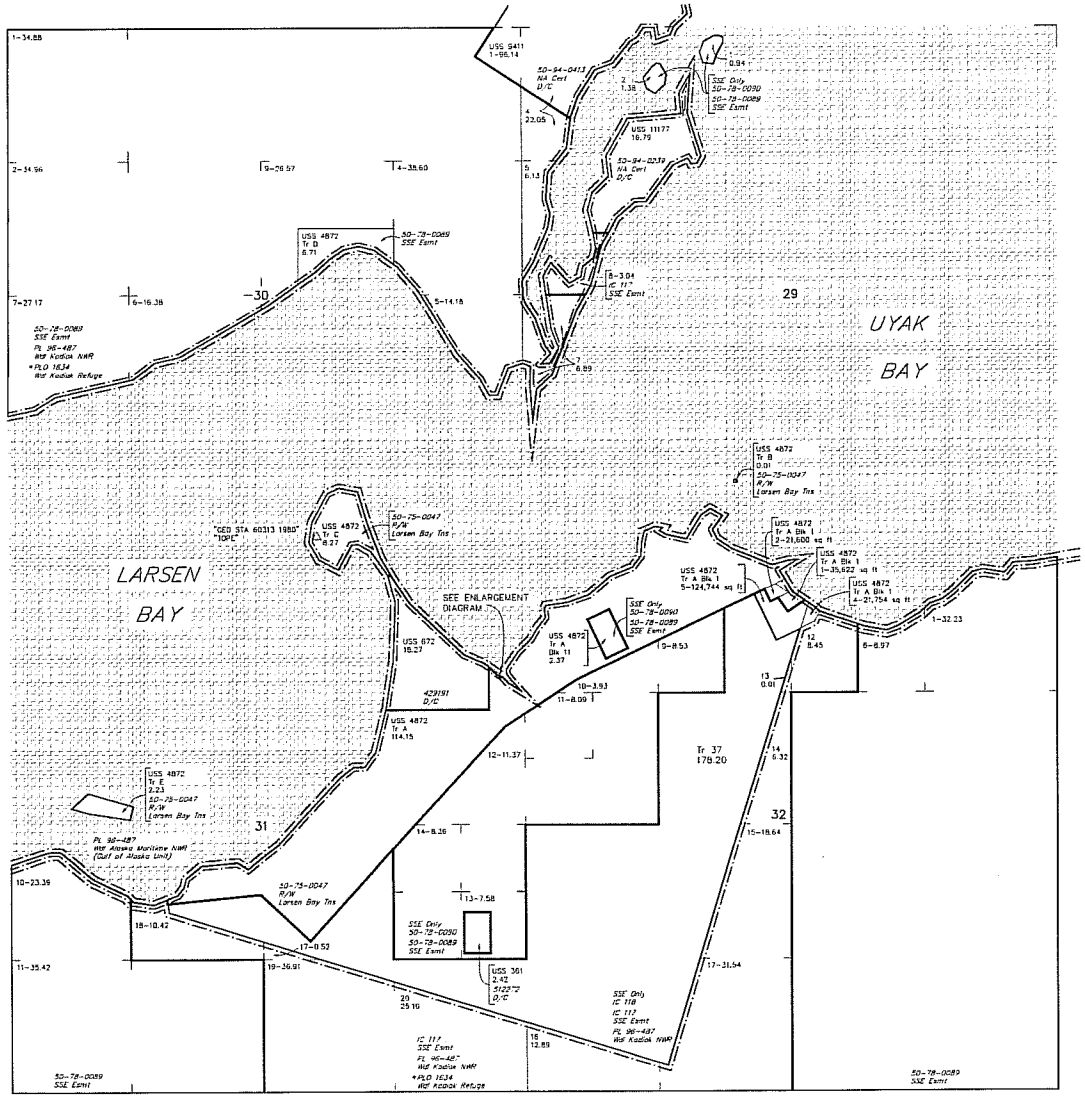
CREATING TRACT "A" OF THE ALASKA ENERGY AUTHORITY LARGEN BAY HYDROELECTRIC PROJECT (ASA-001) LOCATED IN SECTION 31, T. 30 S., R. 29 W. AND SECTIONS 5, 6, AND 7, T. 31 S., R. 29 W. OF THE SEWARD MERIDIAN ON KODIAK ISLAND IN THE STATE OF ALASKA

PREPARED FOR: THE ALASKA ENERGY AUTHORITY
P.O. BOX 190869
ANCHORAGE, ALASKA 99519-0869

HORIZON LAND SURVEYING INC.
P.O. BOX 1045
KODIAK, ALASKA 99615
(907) 486-6506

DRAWN BY: LCJL	DATE: SEPTEMBER 28th 1995	
SCALE: 1" = 100'	SHEET: 2 OF 2	

SURVEYED TOWNSHIP 30 SOUTH, RANGE 29 WEST OF THE SEWARD MERIDIAN, ALASKA



STATUS OF PUBLIC DOMAIN LAND AND MINERAL TITLES AND ACQUIRED LANDS

MTP SUPPL SECS 29 – 32

NO 1

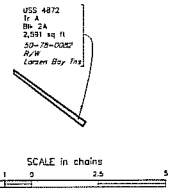
FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

* affects Lds./Interests not conveyed. Excl an area one mile square surrounding the village of Larsen Bay

PL 92-203 Wdl AA6677 Lds W/I AA6677-A

PLO 5183 Wdl Aid of Leg & Cl W/I Kodiak NWR affects Lds/Interests not conveyed

ENLARGEMENT DIAGRAM



WARNING
This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by natural movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

CURRENT TO	
9-25-2007	

Sew Mer
T 30 S
R 29 W

NO 1
Acq
ACAD

BLM Master Title Plat

Kodiak Recording District
After Recording Return To:

City of Larsen Bay
P.O. Box 8
Larsen Bay, Alaska 99624

STATUTORY QUITCLAIM DEED

KONIAG, INC., an Alaska corporation (hereinafter "Grantor"), the address of which is 4300 B Street, Suite 407, Anchorage, Alaska 99503, as the successor in interest to the rights and obligations of Nu-Nachk Pit Inc., the former village corporation for the community of Larsen Bay, Alaska, hereby conveys and quitclaims to CITY OF LARSEN BAY, an Alaska municipal corporation, the address of which is P.O. Box 8, Larsen Bay, Alaska 99624, (hereinafter "Grantee"), as settlement of Grantee's claims under § 14(c)(3) of the Alaska Native Claims Settlement Act, P. L. 92-203, 85 Stat. 688, as amended (hereinafter "ANCSA"), all interest Grantor may have, if any, in the surface estate of the following described real property located in the Kodiak Recording District, Third Judicial District, State of Alaska:

T.30S., R.29W., Seward Meridian

Section 30
SE $\frac{1}{4}$ NW $\frac{1}{4}$, containing 40.00 acres
Lot 2, containing 34.96 acres
Lot 6, containing 16.38 acres
Lot 7, containing 27.17 acres
Lot 9, containing 26.57 acres

Section 31
NE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, containing 10.00 acres
→ SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, containing 10.00 acres
SE $\frac{1}{4}$ SW $\frac{1}{4}$, containing 40.00 acres
Lot 10, containing 23.39 acres
Lot 11, containing 35.42 acres
Lot 12, containing 11.37 acres
Lot 13, containing 7.58 acres
Lot 14, containing 8.36 acres
Lot 15, containing 13.37 acres
Lot 19, containing 36.91 acres
→ Lot 20, containing 25.16 acres

Deed to the City of Larsen Bay

→ Tract 37, (extended into Section 32) containing 178.20 acres

Section 32
W $\frac{1}{2}$ W $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$, containing 20.00 acres
NW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, containing 10.00 acres
NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$, containing 10.00 acres
S $\frac{1}{2}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$, containing 20.00 acres
Lot 1, containing 32.23 acres
Lot 6, containing 8.97 acres
Lot 9, containing 8.53 acres
Lot 10, containing 3.93 acres
Lot 11, containing 8.09 acres
Lot 12, containing 8.45 acres
Lot 13, containing 0.01 acres
Lot 14, containing 6.32 acres
Lot 15, containing 18.64 acres
Lot 16, containing 12.89 acres

and

Lot 3, Block 1, Tract A, USS 4872, containing 3.363 acres;

Block 11, Tract A, USS 4872, containing 2.37 acres;

and

Tracts A, C, F and H of Plat No. 97-9 filed in the Kodiak Recording District on April 21, 1997, containing 512.32 acres

Altogether containing a total of 1,231.953 acres.

TOGETHER WITH, ALL AND SINGULAR, the tenements, hereditaments and appurtenances thereunder belonging or in anywise appertaining.

SUBJECT to all restrictions, reservations, limitations, terms and conditions of record and the provisions of Section 14(c)(3) of ANCSA.

THOSE LANDS described as being in Lots 15, 19, 20 and Tract 37 in Section 31, in Lots 12, 13, 14, 15, 16 in Section 32, in Lot 3, Block 1 of Tract A in USS 4872 and in Tract A, C, F and H as described on Plat No. 97-9 are also SUBJECT TO all restrictions, reservations, limitations and terms set forth in

Interim Conveyance No. 117, issued by the United States of America to Koniag, Inc. and recorded at Book 41, page 875 et seq. in the Kodiak Recording District.

ALL OTHER LANDS conveyed hereunder are also SUBJECT TO all restrictions, reservations, limitations and terms set forth in Patent No. 50-78-0089 issued by the United States of America to Koniag, Inc. and recorded at Book 41, Page 897 et seq. in the Kodiak Recording District.

Grantee acknowledges that this conveyance is to be made pursuant to the provisions of Section 14(c)(3) of ANCSA, and is in satisfaction of Grantee's claims under said section. This conveyance is expressly subject to all reservations and rights arising under ANCSA, if any.

DATED this 30th day of July, 1997.

GRANTOR:

KONIAG, INC.

By: Dennis Metrokin
Dennis Metrokin
Its President

ATTEST:

By: Debra A. Sulin
Assistant Secretary

GRANTEE:

CITY OF LARSEN BAY

By: Frank M. Pulos
Its Mayor

ATTEST:

By: Flora Nagy
City Clerk

STATE OF ALASKA)
) ss.
THIRD JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 30th day of July, 1997, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared DENNIS METROKIN of KONIAG, INC., a corporation organized and existing under the laws of the State of Alaska, to me known and known to me to be the President of said corporation and acknowledged to me that he signed the foregoing instrument freely and voluntarily for and on behalf of said corporation by authority of its Board of Directors for the uses and purposes therein mentioned.

GIVEN UNDER MY HAND and official seal the day and year last above written.

OFFICIAL SEAL
STATE OF ALASKA
NOTARY PUBLIC
DEBRA ANN LUKIN
My Comm. expires 9-1-99

Debra A. Lukin
Notary Public in and for Alaska
My Commission Expires: 9-1-99

STATE OF ALASKA)
) ss.
THIRD JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 30th day of July, 1997, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared Debra A. Lukin of KONIAG, INC., a corporation organized and existing under the laws of the State of Alaska, to me known and known to me to be the Assistant Secretary of said corporation and acknowledged to me that he signed the foregoing instrument freely and voluntarily for and on behalf of said corporation by authority of its Board of Directors for the uses and purposes therein mentioned.

GIVEN UNDER MY HAND and official seal the day and year last above written.

Carole L. Pagano
Notary Public in and for Alaska
My Commission Expires: 6/17/2000

STATE OF ALASKA)
) ss.
THIRD JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 30th day of July 1997, 1997, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared Frank M. Carlson of CITY OF LARSEN BAY, a municipal corporation organized and existing under the laws of the State of Alaska, to me known and known to me to be the Mayor of said municipal corporation and acknowledged to me that he had in his official capacity aforesaid executed the foregoing instrument as the free act and deed for the uses and purposes therein stated.

GIVEN UNDER MY HAND and official seal the day and year last above written.

Janice R. Martin
Notary Public in and for Alaska
My Commission Expires: _____

JANICE R. MARTIN
My Commission Expires
JULY 22 1998
ALASKA
NOTARY PUBLIC

STATE OF ALASKA)
) ss.
THIRD JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 30th day of July, 1997, 1997, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared Flora Moya of CITY OF LARSEN BAY, a municipal corporation organized and existing under the laws of the State of Alaska, to me known and known to me to be the City Clerk of said municipal corporation and acknowledged to me that he had in his official capacity aforesaid executed the foregoing instrument as the free act and deed for the uses and purposes therein stated.

GIVEN UNDER MY HAND and official seal the day and year last above written.

Janice R. Martin
Notary Public in and for Alaska
My Commission Expires: _____

JANICE R. MARTIN
My Commission Expires
JULY 22 1998
ALASKA
NOTARY PUBLIC

97-1874
21-
RECORDING DISTRICT
REQUESTED BY
City of Larsen Bay
'97 AUG 18 PM 1 52