

## CONCEPTUAL DESIGN REPORT



## ATMAUTLUAK ELECTRICAL DISTRIBUTION SYSTEM UPGRADE

February 14, 2002

*Prepared by:*  
Wiley W. Wilhelm, P.E

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## EXECUTIVE SUMMARY

This report has been prepared for the State of Alaska, Alaska Energy Authority (AEA), Rural Energy Group. Its purpose is to provide the basis for upgrades to the electrical distribution system with an associated schedule and cost estimate for the community of Atmautluak, Alaska.

The report includes a review of the existing electrical distribution system, an analysis of future needs, a conceptual design to meet these needs, a proposed project schedule, and a budget cost estimate for the project.

The participants in the proposed electrical distribution system upgrade include:

- Atmautluak Traditional Council (ATC)
- Atmautluak Tribal Utilities (ATU)
- Atmautluak Limited

Dryden and LaRue, Inc. evaluated the existing electrical distribution system for Atmautluak on November 2001. The existing distribution system is a three-phase 480 volt system with pole mounted dry-type 480/120-240 transformers. The system is in very poor condition and will require a complete replacement. The power poles are generally in good physical condition, but numerous poles were found to lean severely. The probable cause is due to inadequate guying and pole jacking by frost heave. Heavy structural loading from secondary conductors may also cause the leaning. The anchors are generally in bad condition, most likely due to frost heave and poor soil conditions.

The 480 volt transformers show signs of corrosion and are in poor condition. Several transformers were de-energized and no longer in use. We suspect these units failed and are no longer serviceable. Many secondary runs are quite long and span buildings in numerous locations. Secondaries are supported over buildings utilizing house lumber and tree limbs. Numerous house meters are in poor condition and need replacement. Telephone and CATV are in good condition and National Electric Safety Code clearances are not met in some. See Appendix F for the complete report and cost estimate prepared by Dryden and LaRue, Inc.

The total Budget Cost Estimate for upgrading the electrical distribution system is \$2,100,000. This estimate includes the costs for: design, construction administration, permitting, regulatory plans, construction costs and a 20% construction contingency.



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- Appendix A: Certificate to Plat
- Appendix B: Geotechnical Information Prepared by Duane Miller & Associates
- Appendix C: US Army Corps of Engineers - Flood Plain Management Services ALASKAN COMMUNITIES FLOOD HAZARD DATA, June 2000 Publication Information
- Appendix D: Conceptual Design Drawings
- Appendix E: Budget Cost Estimate
- Appendix F: Report on Electrical Distribution System by Dryden & LaRue, Inc.



## I. INTRODUCTION

This report is prepared for the State of Alaska, Alaska Energy Authority (AEA), Rural Energy Group, to identify the design basis for the development of a new power distribution system in the community of Atmautluak, Alaska.

This report includes a review of the existing power distribution system in the community, a conceptual design for a new power distribution system, a proposed project schedule and a budget cost estimate for the project.

An engineering investigation was made from existing photographs and design documents. The investigation included a review of overhead and oblique aerial photographs, existing surveys, and design documents. The investigation also included conversations with community leaders.

### A. CONTACTS

Information for this report was gathered from the following people:

Lenny Landis	AIDEA/AEA	(907) 269-4684
Kris Noonan	AIDEA/AEA	(907) 269-4697
Terri Harper	AIDEA/AEA	(907) 269-4630
Hugh Denney	ANTHC	(907) 729-3559
Eric Lehan	CH2MHill	(907) 276-6833 x 298

### B. APPLICABLE REGULATIONS AND CODES

The design and operation of a new electrical distribution system is controlled by the following State and Federal regulations:

- State of Alaska Fire and Life Safety Regulations (13 AAC 50);
- 2002 National Electric Code (13 AAC 50);
- Regulatory Commission of Alaska (RCA) Certification (3 AAC 42.05.221)

The current State of Alaska Fire and Life Safety Regulations adopted the 2000 editions of the International Fire Code (IFC) and the International Building Code (IBC). The code requirements of the IFC establish the primary design requirements for new facilities.



## II. EXISTING POWER GENERATION FACILITY & ELECTRICAL DISTRIBUTION SYSTEM

### A. FACILITY DESCRIPTION

The Atmautluak Tribal Utility Company operates the power plant providing electricity to the community. The Power Plant is located west of the Pikmiktalik River, adjacent to the school and fuel tank farm, (see the Conceptual Design Drawings, Appendix D). The generators are supplied with fuel from the combined corporation/power plant tank farm located just west of the plant.

The existing power plant has a potential power generation capacity of 395 kW from three generators with individual capacities of 180 kW; 150 kW; and 65 kW. These existing power generators are located in a modular building on piling foundation. The building is new and in good condition. The existing power generation facility also does not have a waste heat recovery system.

### B. EXISTING POWER GENERATION CAPACITY SUMMARY

The following table lists the existing total power generation capacity.

**Existing Total Power Generation Capacity**

<u>Generator</u>	<u>Capacity (kW)</u>
#1	180
#2	150
#3	<u>65</u>
Total	395

### C. EXISTING ELECTRICAL DISTRIBUTION SYSTEM

Dryden and LaRue, Inc. evaluated the existing electrical distribution system for Atmautluak on November 2001. The existing distribution system is a three-phase 480 volt system with pole mounted dry-type 480/120-240 transformers. The system is in very poor condition and will require a complete replacement. The power poles are generally in good physical condition, but numerous poles were found to be leaning severely. The probable cause is due to inadequate guying and pole jacking by frost heave. Heavy structural loading from the secondary conductors may also cause the leaning. The anchors are generally in bad condition, most likely due to frost heave and poor soil conditions.



The 480 volt transformers were showing signs of corrosion and are in poor condition. Several transformers were de-energized and no longer in use. It is suspected that these units failed and are no longer serviceable. Many secondary runs are quite long and spanned buildings in numerous locations. Secondaries are supported over buildings utilizing house lumber and tree limbs. Numerous house meters are in poor condition and need replacement. Telephone and CATV connections are in good condition and National Electric Safety Code clearances are not met in some locations. Meter bases need replaced in most locations. See Appendix F for the complete report and cost estimate prepared by Dryden and LaRue, Inc.

### **III. PROPOSED SYSTEM**

#### **A. SITE SELECTION**

Following the routing of the existing line in most cases is the most economical choice. Right-of-way and/or easements are assumed to be readily available in the layout of the line(s). Replacing existing poles and conductors will require lengthy outages, so new poles routed roughly parallel to existing lines is assumed. Site selection is further limited by the existing location of the tie in to the power plant.

#### **B. SITE CONTROL**

The lands in and around the village of Atmautluak are held in trust by the Municipal Land Trust Program and have not been subdivided by a U.S. Survey. The site is located on property to which clear ownership has not been determined. Personnel from the Department of Community and Economic Development recommend that the new facility and structures be located on property which does not show any signs of historical use, since sites which have been used in the past may have a legal ownership claim which is not identified at this time. This site will require working with the Municipal Land Trust Program to obtain site control. This site does not appear to be disturbed or have any potential claim for historical use.

#### **C. SOIL CONDITIONS**

The soil conditions around the community are marginally frozen, ice rich, silty soils. A review of aerial photos indicates the soil at the proposed site is probably underlain with marginally frozen, ice rich soils susceptible to severe settlement if they are not maintained in a frozen state.

The attached geotechnical investigation of the area shows a representative sample of the type of existing soil conditions and the need for piling supported power poles. There may be site-specific areas of differing conditions, but that will not change the overall



engineering solution for pole support. Differing site conditions may result in deeper or shallower pile depths.

A complete geotechnical investigation will be performed prior to the completion of the electrical distribution system design to verify the actual site conditions and design assumptions.

#### **D. COMMUNITY FLOOD DATA**

The US Army Corps of Engineers – Flood Plain Management Services ALASKAN COMMUNITIES FLOOD HAZARD DATA 2000 publication indicates that while the community of Atmautluak does not flood, low areas along the river are susceptible to tidal storm surges.

#### **E. LOCAL FILL MATERIAL**

No suitable local fill material is available.

#### **F. GENERATORS, SWITCHGEAR AND METERS**

The existing capacity is 395 kW at 480V, using three generators. The proposed distribution system will be 12.47KV, requiring step up transformers. The generators are sized so the largest generator can handle the peak loading during the winter. Approximately 90% of the existing meter bases are in need of repair and will be replaced under this contract.

#### **G. OWNERSHIP AND OPERATION**

The proposed upgraded electrical distribution system will be owned and operated by Atmautluak Tribal Utilities. ATU will also control the fuel connection to the tank farm supplying the plant.

#### **H. PERMITTING**

The construction and operation of the new electrical distribution system requires the following permitting:

##### **1. Coastal Project Questionnaire**

Projects located in a coastal region must submit a Coastal Project Questionnaire under the Alaska Coastal Management Program to the State of Alaska, Department of Governmental Coordination (DGC). The DGC reviews the questionnaire and assists in identifying required permits pertinent to the project. The standard review spans a 30 day period, subsequent to the Corps of Engineers



issuance of the DA Permit. Projects outside of coastal zones are excluded from this process.

## **2. FAA Review**

Power lines located less than 5 miles from a runway or airport should complete Form 7460-1, "Notice of Proposed Construction or Alteration", and submit all necessary elevation and height of structure information to the Federal Aviation Administration, Alaska Region (FAA) prior to construction. The FAA reviews the distribution lines and determines whether the construction or project will present a hazard to air traffic in the vicinity. Projects located beyond the 5 mile range should be reviewed on a case by case basis as to whether Form 7460-1 should be submitted. The FAA has typically provided project determinations within one week of the completed form submittal.

## **3. RCA Certification**

The Regulatory Commission of Alaska regulates public utilities by certifying qualified providers of public utility and pipeline services; and ensuring that they provide safe and adequate services and facilities at just and reasonable rates, terms, and conditions. This keeps rates as low as possible while allowing the utility to earn a fair return. The commission also determines the eligibility and the per kilowatt-hour support for electric utilities under the Power Cost Equalization program.

# **I. CONSTRUCTION METHOD**

Construction of the new electrical distribution system will use Force Account methods. Under qualified management, this construction method has traditionally produced cost effective results, fast construction schedules and increased local hire.

When working on a Force Account basis, the project typically hires a qualified superintendent and local labor where available. Additional personnel may need to be brought in to supplement the local labor force for specialty trades, such as pipe welding and electrical installation.

Traditionally, Force Account projects enlist the use of local equipment where available. Where the local equipment use cannot be donated to the project, equipment rental rates are negotiated or traded off for equipment repair.



### **1. Local labor**

The Atmautluak Traditional Council was questioned about the local available labor force. They indicated that no formal list was available which identified personnel and skills.

### **2. Local Equipment**

No equipment, other than for airport maintenance, is available in the community. All equipment for this project will have to be shipped in.

## **J. SCHEDULE**

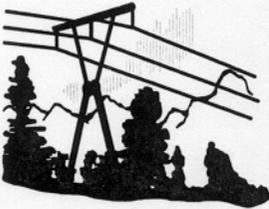
A construction schedule has been prepared based on historical force account construction methods and crew sizes. Due to the ground conditions, most of the construction must occur while the ground is frozen. For this reason, the schedule identifies material delivery and equipment delivery to the village in the fall with construction started in the winter. All heavy equipment use must be completed and the equipment must be staged for demobilizing from the village prior to the spring thaw.

Note: The proposed schedule is very dependent upon many interrelated factors, such as project start time, material availability and weather. If any of these items creates a delay, the project may run into the following season, which will increase the construction costs. In order to address this potential delay, and increased cost, and a 20% construction contingency should be used in cost estimating for the project.

## **K. BUDGET COST ESTIMATE**

A Budget Cost Estimate has been prepared for construction of the electrical distribution system and step-up transformers, as presented on the Conceptual Project Layout Plan, (see Appendix E for the complete detailed estimates). The estimate was developed based on historical Force Account construction costs for recent electrical distribution projects in southwest Alaska. Equipment rental rates are based on historical rental rates for similar equipment. This estimate includes design cost, construction costs, regulatory plan development costs, project management costs and a construction contingency of 20%. Refer to Appendix F for the cost estimate to upgrade the electrical distribution system. The total Budget Cost Estimate is approximately \$2,100,000.





# Dryden & LaRue, Inc.

CONSULTING ENGINEERS

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December 21, 2001

Mr. Willey Wilhelm  
**LCMF, Inc.**  
139 East 51<sup>st</sup> Avenue  
Anchorage, Alaska 99503

Reference: **Kongiganak & Amautluak Village Electric Distribution System**

Attached find construction cost estimates for a conceptual design for an Electric Distribution System at both Kongiganak and Amautluak Village.

The estimate for the Village of Kongiganak reflects replacement of anchors with pilings and secondary, telephone and CATV repair and maintenance. Also included is the installation and/or replacement of 5 power poles with primary assemblies. After field inspection of the village's electric system it was determined that the electric system's poles and assemblies were in good condition and do not require complete replacement. The anchors were found in poor condition and the secondary, telephone and CATV generally needs reworked for code separation and ground clearances. The estimate assumes winter construction and utilization of pile driving equipment on site at the Village.

The estimate for the Village of Amautluak reflects the complete replacement of the electric system. The existing system is in very poor condition and is in need of replacement. The estimate is based on the conceptual design of a 12.47 kV Electric Distribution System which was accomplished utilizing aerial photographs. Revision to the design will be required during field surveying of the final locations of the facilities. Right-of-way and/or easements were assumed to be readily available in the layout of the facilities. The design uses a primary three-phase feeder with primary single-phase taps off of this main feeder. It was assumed for estimating purposes that the existing telephone and CATV could be transferred to the new electric distribution facilities. While the existing poles were found to be in fair to good condition, reuse for the new distribution system would require lengthy outages; therefore, new poles were assumed.

DRYDEN & LaRUE, INC.

Jack S. Anderson, P.E.  
JSA:jf/kong.repletter.rep.doc  
Encl.

## ATMAUTLUAK

### **Cost Estimate**

The following construction cost estimate is based the complete replacement of the existing distribution system at Atmautluak. A conceptual design for a 12.47 kV distribution system was developed utilizing field inspection findings and aerial photographs. Construction labor, material costs and freight to Atmautluak is included in the estimate. The existing telephone and CATV facilities are assumed to be reused and transferred to the new systems poles. Power plant and step up transformer is not included in the estimate.

### Scope of Work & Major Materials:

- 59 Power Pole Piles
- 59 Power Poles with Assemblies
- 143 Down Guys
- 51 Anchor Piles
- 19,900 Feet of #2 ACSR conductor
- 20 Ea. 15 KVA 120-240 Overhead Transformers
- 6 Ea. 50 KVA 120-240 Overhead Transformers
- 10,200 Feet of 1/0 Al. Triplex
- 60 CATV and Telephone Attachments

Labor	\$ 786,834
FRT and Materials	\$ 592,625
Mob/Demob & Camp	\$ 240,000
Subtotal	\$1,619,459
20% Contingency	\$ 323,892
Total	\$1,943,351

### **Field Notes- Atmautluak Electric Facility Inspection**

November 9, 2001:

Arrived in Atmautluak approximately 9:00 a.m. and immediately began system inspection. Met with Mr. Bill Gillman at approximately 12:00 noon and discussed his electric system concerns.

Overall condition of the Atmautluak Power system is very poor. The electric system is three phase 480 Volt system with pole mounted dry type 480/120-240 transformers.

Power poles were generally in good physical condition but numerous poles were found to be leaning quite severely. The probable cause is due to inadequate guying and pole

jacking by frost heave. In addition to frost heave, the leaning poles was also caused by heavy structural loading from the secondary conductors.

Anchors for the power poles were in bad condition, most probably due to frost heave and poor soil conditions.

The 480 Volt transformers were showing signs of corrosion and were generally in poor condition. Several transformers were de-energized and no longer used. It is suspected that these units have failed and are no longer serviceable.

Secondary runs were quite long in several locations and also spanning buildings in numerous locations. Secondaries were found to be supported over buildings utilizing house lumber and of tree limbs. Numerous house meters were in poor condition and in need of replacement.

Telephone and CATV facilities appeared in good condition. National Electrical Safety Code clearances were not adhered to in several locations.



**BUDGET COST ESTIMATE**  
**Atmautluak Electrical Distribution System**

PROJECT: Amautluak Electrical Distribution System  
PROJECT No.: 01-429  
LEVEL: Budget  
DATE: 2/7/02  
REFERENCE DRAWING(S): Conceptual Design (10/8/01)  
BASIS: Force Account  
FREIGHT RATE: \$0.50/lb

BY: MLF/WWW  
FILE NAME: Amaut EDS Cost 2\_7\_02

**COST SUMMARY**

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Construction Cost .....	1,911,889
Miscellaneous Project Costs .....	<u>249,000</u>
<b>Project Total:</b>	<b>2,160,889</b>

**BUDGET COST ESTIMATE**  
**Atmautluak Electrical Distribution System**

No.	ITEM	QTY	UNITS	MATERIAL		LABOR			OTHER OR EQUIP RENT	FREIGHT	TOTAL
				UNIT COST	MATL TOTAL	MAN DAYS	UNIT COST	LABOR TOTAL			

Estimated Project Duration                    90 DAYS  
Foreman    2 EA  
Carpenters/Welders                                4 EA  
Local Labor    4 EA

Labor .....	<b>405,000</b>										
1 Foreman			MD's			180	650	117,000			117,000
2 Carpenters/Welders			MD's			360	550	198,000			198,000
3 Local Labor			MD's			360	250	90,000			90,000

Miscellaneous .....	<b>449,720</b>										
4 Mob/DeMob	1	SUM		240,000.00	240,000						240,000
5 Crew Per Diem	900	MD's		42.00	37,800						37,800
6 Crew Housing	900	MD's		30.00	27,000						27,000
7 Crane Rental	3	MO		15,000.00					45,000	15,000	60,000
8 Skid Steer Rental	3	MO		3,500.00					10,500	2,000	12,500
9 Welder Rental	3	MO		4,000.00					12,000	500	12,500
10 Auger Rental	3	MO		2,500.00					7,500	500	8,000
11 Four Wheeler Rental	3	MO		1,500.00					4,500	420	4,920
12 Fuel	1	SUM							6,000		6,000
13 Tool Rental	3	MO		10,000.00					30,000	5,000	35,000
14 Consumables	1	SUM		5,000.00	5,000					1,000	6,000

Electrical .....	<b>738,521</b>										
15 Power Poles Piles	59	EA		500.00	29,500				140,000		169,500
16 Poles	59	EA		500.00	29,500				65,000		94,500
17 PP Assemblies	59	EA		250.00	14,750				35,000		49,750
18 Down Guys	143	EA		22.00	3,146				5,000		8,146
19 Anchor Piles	51	EA		500.00	25,500				100,000		125,500
20 ACSR Conductor	19,900	FT		0.15	2,985				3,500		6,485
21 Transformers	26	EA		1,200.00	31,200				90,000		121,200
22 1/0 Triplex	10,200	FT		0.70	7,140				7,000		14,140
23 CATV/Phone attachments	60	EA		40.00	2,400				500		2,900
24 Step-up Transformers	1	LS		15,000.00	15,000				2,000		17,000
25 Step-up Xformer Support	1	LS		5,000.00	5,000				1,000		6,000
26 Secondary Drops	70	EA		700.00	49,000				2,400		51,400
27 Meter Bases	70	EA		1,000.00	70,000				2,000		72,000

Subtotals				475,921			405,000	115,500	473,420	1,593,241
							Contingency @ 20%			318,648

**BUDGET COST ESTIMATE**  
**Atmautluak Electrical Distribution System**

No.	ITEM	QTY	UNITS	MATERIAL		LABOR			OTHER OR EQUIP RENT	FREIGHT	TOTAL
				UNIT COST	MATL TOTAL	MAN DAYS	UNIT COST	LABOR TOTAL			

**Construction Total: 1,911,889**

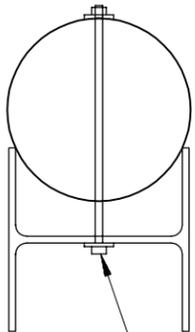
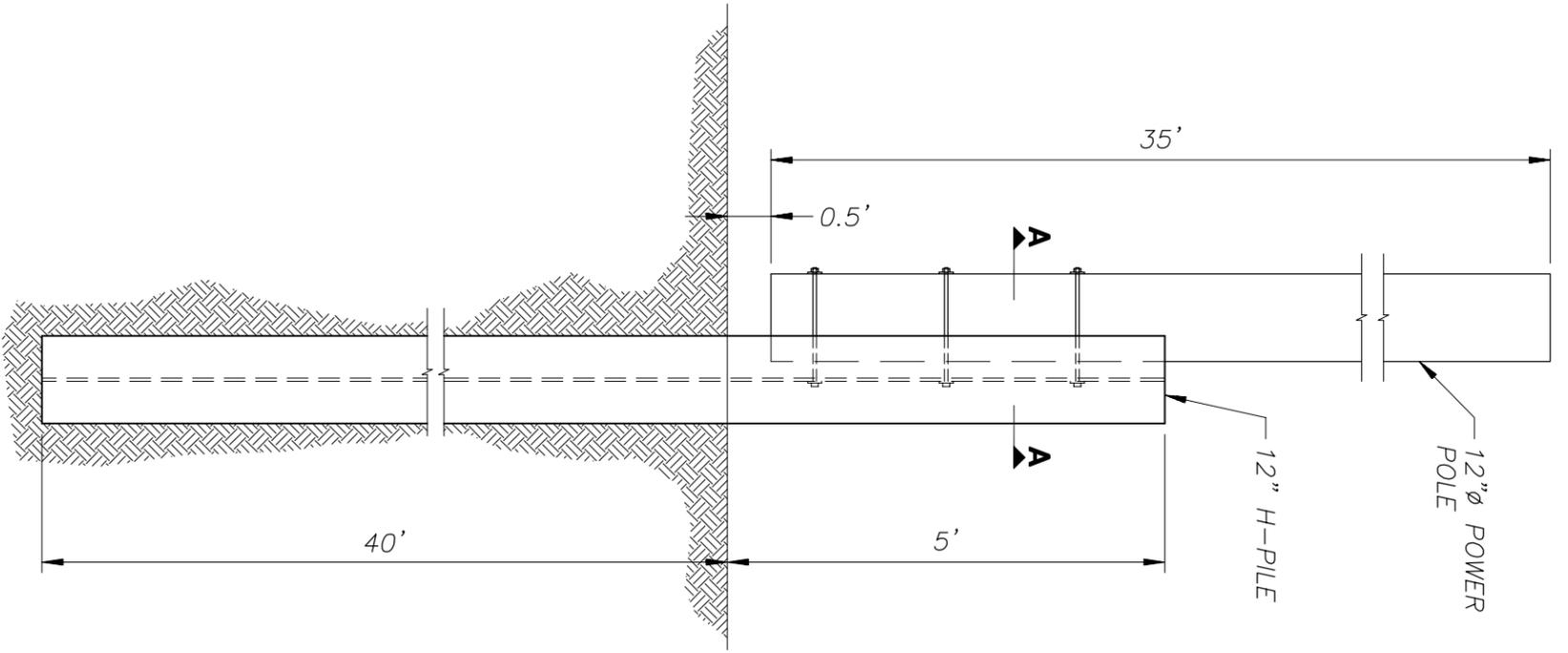
**MISCELLANEOUS COSTS**

18	Project Insurance .....	20,000
19	ROW Legal Work .....	15,000
20	Engineering Allowance .....	110,000
21	Construction Management Allowance .....	100,000
22	Grant Audit .....	4,000

**Misc Cost Total = 249,000**

# TYPICAL PILE SECTION

SCALE: 1" = 2'



(3) 1 1/2"  $\phi$  GALV.  
 BOLT WITH WASHERS  
 AND NUTS

## A - A

SCALE: 1" = 1'

**ATMAUTLUAK POWER PLANT**  
**ATMAUTLUAK, ALASKA**

**DETAILS**

**LCMF Incorporated**  
 A subsidiary of Ukpegivik Iñupiat Corporation  
 Anchorage, Alaska (907) 273-1830  
 Barrow, Alaska (907) 852-8212



State of Alaska  
 Department of Community  
 and Economic Development  
**AIDEA/AEA**  
 Rural Energy Group  
 813 West Northern Lights Blvd.  
 Anchorage, Alaska 99503



CHECKED BY: DH  
 DRAWN BY: CR  
 DATE: 1/23/02  
 W.O. No: 01-429  
 REVISION:

DRAWING NO.

**C-2**