LEG. FINANCE - BILLS 1983 - 1984 2077

2077

CSSB 269 - SB 272

COMMITTEE REPORT

SENATE

FURTHER:

Date: 5/24/80

Mr. President:

The Committee on FINANCE has had HCS for SB 269 (2d Fin)

Sale of royalty oil by the State of Alaska to Chevron, U.S.A., Inc.
efd

under consideration and (a majority of the committee) (the committee) reports it back with the following recommendations:

[✓] do pass [ ] do not pass

[ ] do pass with attached amendments(s)

[ ] replace with CS for _____ [ ] same title [ ] new title

and recommends _____

[ ] AND attaches a "Letter of Intent" [ ] New Fiscal Note

[ ] reports it back without recommendation

[ ] referred to the _____ Committee

MEMBERS SIGNING
DO PASS

_____

_____

_____

_____

_____

_____

_____

_____

_____

MEMBERS HAVING
OTHER RECOMMENDATIONS:

_____

_____

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_____

_____

_____

_____

CHAIRMAN

S 60 (Rev. 12/78)

Official Business

Alaska State Legislature

Senate

Committee on Finance

Pouch V
State Capitol
Juneau, Alaska 99811

May 24, 1984

Mr. President:

The Senate Finance Committee has considered the House amendments embodied in HCS for SB 269 (2d Finance) and the acccmpanying House Letter of Intent and recommends that the full Senate concur in the House amendments.

Sen. Don Bennett
Co-chairman

Sen. John Sackett
Co-chairman

Sen. Jan Faiks

Sen. Frank Ferguson

Sen. Vic Fischer

Sen. Joe Josephson

Sen. Bob Mulcahy

Alaska State Legislature

Senate

Official Business

Pouch V
State Capitol
Juneau, Alaska 99811

April 26, 1984

MEMO

TO: FINANCE COMMITTEE

FROM: Peggy Mulligan
Secretary of the Senate

President Kerttula referred HOUSE CS FOR SENATE BILL NO. 269(2d Fin) (sale of royalty oil by the State of Alaska to Chevron, U.S.A., Inc; efd) with a House Message to your Committee.

2/20
Res
Resources
finance

Alaska State Legislature

House

JUNEAU, ALASKA

MESSAGE TO THE SENATE Date Feb. 16, 1984

MR. PRESIDENT:

The House has passed SB 269 (sale of royalty oil by the State of Alaska to Chevron, U.S.A., Inc.,; effective date) with the following amendment:

HCS SB 269(2dFin) (same title)

~~and the~~ with letter of intent (p. 2309 of the House Journal)

and it ~~is transmitted~~ returned for consideration.

read 3rd
refer to Resources - Finance.

Chief Clerk of the House

Alaska State Legislature

BETTYE FAHRENKAMP, Chairman
ROBERT H. ZIEGLER, SR., Vice Chairman
RICK ELIASON
PAUL FISCHER
VIC FISCHER
BOB MULCAHY
ARLISS STURGULEWSKI

POUCH V
STATE CAPITAL
JUNEAU, ALASKA 99811
(907) 465-3834
(907) 465-3835

Senate

Committee on Resources

April 25, 1984

Mr. President:

The Senate Resources Committee has considered the House amendments to Senate Bill No. 269 and recommends that the full Senate concur in the House amendments.

Sincerely,

Bettye Fahrenkamp

Sen. Bettye Fahrenkamp
Chairman

Sen. Robert Ziegler

Sen. Arliss Sturgulewski

Arliss Sturgulewski

Sen. Richard Eliason

Sen. Vic Fischer

Paul Fischer

Sen. Paul Fischer

Sen. Bob Mulcahy

LETTER OF INTENT
FOR CSSB 269
January 19, 1984

The House Resources Committee has considered CSSB 269, providing for approval of the Agreement between the State of Alaska and Chevron U.S.A., Inc., for the sale of a portion of Alaska's royalty oil. This Agreement must be approved by the legislature under the provisions of AS 38.06.055(a) which provides that "the commissioner of natural resources may not enter into a sale, exchange, or other disposition of oil or gas or of the rights or waiver of the rights to receive future production of royalty oil or gas under AS 38.05.183 without the prior approval of the legislature."

Section 19.1 of the Agreement provides that the Agreement may be "supplemented, amended or modified at any time, but only by written instrument duly executed by the parties to this Agreement." In making any such changes to the Agreement pursuant to this section, the Commissioner would be acting on behalf of the State of Alaska as one of the parties to the Agreement.

The Committee recognizes that a supplement, amendment, or modification of the Agreement could be a further "sale, exchange, or other disposition" within the meaning of AS 38.06.055(a). The Committee is also cognizant that pursuant to Section 20.1 of the Agreement, the Commissioner has the right to "grant" (consent to) an assignment of the Agreement.

It is the intent of the Committee that it be understood that approval of CSSB 269 does not constitute prior approval of any supplement, amendment or modification or any assignment that would be a further "sale, disposition, exchange, or other disposition" within the meaning of AS 38.06.055(a) and that it is expected that any such action by the Commissioner must first be preceded by compliance with the procedures for obtaining the prior approval of the legislature.

Representative John Bingstad
Co-Chairman, Resource Committee

Representative Dick Shultz
Co-Chairman, Resource Committee

Representative Rick Uehling
Vice-Chairman, Resource Committee

Representative John Cowdery
Member, Resource Committee

Representative Charlie Bussell
Member, Resource Committee

Representative John Liska
Member, Resource Committee

Representative Anthony Vaska
Member, Resource Committee

Representative Peter Goll
Member, Resource Committee

Representative Ronald Larson
Member, Resource Committee

adopted by House 2/16/84

Offered: 2/13/84
Referred: Rules

Original sponsor: Rules/Governor

IN THE SENATE BY THE FINANCE COMMITTEE

HOUSE CS FOR SENATE BILL NO. 269 (2d Finance)

IN THE LEGISLATURE OF THE STATE OF ALASKA

THIRTEENTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act relating to the sale of royalty oil by the State of Alaska to Chevron, U.S.A., Inc.; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. The "Agreement for the Sale and Purchase of Royalty Oil between the State of Alaska and Chevron, U.S.A., Inc.," dated December 9, 1983, for the sale of Prudhoe Bay royalty oil, is hereby approved and ratified.

* Sec. 2. This Act takes effect immediately in accordance with AS 01.-10.070(c).

STATE OF ALASKA 1984 LEGISLATIVE SESSION
FISCAL NOTE

Revision Date:

REQUEST
Bill/Resolution No.: SB 269
Title: sale of royalty oil to Chevron, U.S.A., Inc.
Sponsor: Rules Committee
Requestor: Governor
Date of Request: 4-19-83

FISCAL DETAIL
Agency Affected: Natural Resources
Program Category Affected: Management of Energy Resources
BRU, Program or Subprogram(s) Affected: Oil and Gas Management

EXPENDITURES/REVENUES: (Thousands of Dollars)

	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89
OPERATING						
100 PERSONAL SERVICES						
200 TRAVEL						
300 CONTRACTUAL						
400 SUPPLIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS						
800 MISCELLANEOUS						
TOTAL OPERATING	-0-	-0-	-0-	-0-	-	-0-
CAPITAL	-0-	-0-	-0-	-0-	-0-	-0-
REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER						
TOTAL	-0-	-0-	-0-	-0-	-0-	-0-

POSITIONS:

FULL-TIME						
PART-TIME						
TEMPORARY						

SOURCE OF FUNDS TO OFFSET FISCAL IMPACT OF BILL:

ANALYSIS: Attach a separate page for analysis

Prepared By: Sharon L. Barton Phone: 465-2400
Division: Commissioner's Office Date: 1-12-84

Approved by Commissioner: William D Arnold Deputy Date: 1/12/84
Agency: Department of Natural Resources

Distribution (by Agency preparing fiscal note):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)

12/1/83

SB269

BILL SHEFFIELD
GOVERNOR

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

April 19, 1983

The Honorable Jalmar Kerttula
President of the Senate
Alaska State Legislature
Pouch V
Juneau, Alaska 99811

Dear Mr. President:

Under the authority of art. III, sec. 18, of the Alaska Constitution, I am transmitting a bill which provides for legislative approval of a royalty oil contract between the state and Chevron, U.S.A., Inc. for the sale of Prudhoe Bay royalty oil.

This contract is described in the findings entitled "Proposed Disposition of Royalty Oil, Chevron, U.S.A." issued by the Department of Natural Resources on March 16, 1983. Copies of these findings have been made available to the legislature and the public for review.

This contract is being submitted for legislative approval for two reasons. First, although this and the previous administration have consistently taken the position that the statutory requirement of legislative approval of royalty oil contracts is unconstitutional (AS 38.06.055), as a matter of comity I respect the legislature's desire to have a direct voice in major disposals of royalty oil. Therefore, this contract contains provisions requiring approval by the legislature before it becomes effective. Second, this bill would ratify the agreement for the sale of oil. This ratification would cure any procedural defect that may have occurred in the process of entering into this contract.

Although we believe that all necessary steps have been taken, the statutes and regulations governing the disposal of royalty oil represent often conflicting desires and goals, both procedural and substantive. For example, even if statutorily requiring legislative approval were constitutional, the present statutes provide, on the one hand, that the legislature is to approve the contract by enacting legislation (AS 38.06.055(a)), but, on the other

hand, they also provide that a report of the Royalty Board "shall be submitted for legislative review at the time of [sic] resolution for legislative approval of a proposed disposition of royalty oil and gas is introduced in the legislature" (AS 38.06.070(c)). Since legislative approval is required anyway as a matter of contract, I believe it only prudent to present this contract for legislative approval and ratification at this time.

Sincerely,

Bill Sheffield
Governor

Introduced: 4/19/83
Referred: Resources and Finance

IN THE SENATE

BY THE RULES COMMITTEE BY REQUEST OF THE GOVERNOR

SENATE BILL NO. 269

IN THE LEGISLATURE OF THE STATE OF ALASKA

THIRTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act relating to the sale of royalty oil by the State of Alaska to Chevron, U.S.A., Inc.; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. The "Agreement for the Sale and Purchase of Royalty Oil between the State of Alaska and Chevron, U.S.A., Inc.," dated March 16, 1983, for the sale of Prudhoe Bay royalty oil, is hereby approved and ratified.

* Sec. 2. This Act takes effect immediately in accordance with AS 01.10.070(c).

COMMITTEE REPORT

SENATE

FURTHER:

3/19/83

Date: 3/28/84

Mr. President:

The Committee on _____ has had _____

under consideration and (a majority of the committee) (the committee) reports it back with the following recommendations:

[ ] do pass [ ] do not pass

[ ] do pass with attached amendments(s)

[✓] replace with CS for SB 272 (Finance) [ ] same title [✓] new title

and recommends Do Pass

[ ] AND attaches a "Letter of Intent" [ ] New Fiscal Note

[ ] reports it back without recommendation

[ ] referred to the _____ Committee

MEMBERS SIGNING
DO PASS

MEMBERS HAVING
OTHER RECOMMENDATIONS:

_____

CHAIRMAN

3-28-84

Original sponsors: Faiks, V. Fischer, Bennett and Josepshon

Funding Information

General Fund	$52,056,000
Other Funds	Ø
	$52,056,000

IN THE SENATE BY THE FINANCE COMMITTEE

CS FOR SENATE BILL NO. 272 (Finance)

IN THE LEGISLATURE OF THE STATE OF ALASKA

THIRTEENTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act making special appropriations for payment as grants to the Municipality of Anchorage for the Eklutna Water Project, to the City of Kotzebue for drilling geothermal wells, to incorporated communities for water and sewer projects, and to school districts for school construction projects; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. The sum of $34,000,000 is appropriated from the general fund for payment as a grant to the Municipality of Anchorage for phase III final design of the Eklutna Water Project, including design of the water treatment plant and lake intake structure; construction of pipeline segment p-2 from Eagle River to Peters Creek and pipeline segment p-3 from Peters Creek to the Eklutna River; and miscellaneous costs of permitting and right-of-way acquisition.

* Sec. 2. The sum of $7,956,000 is appropriated from the general fund for payment as a grant to the City of Kotzebue for drilling exploratory geothermal wells.

* Sec. 3. The sum of $400,000 is appropriated from the general fund for payment as a grant to the City of Akiak for construction of a water and sewer system.

* Sec. 4. The sum of $750,000 is appropriated from the general fund for payment as a grant to the City of Fortuna Ledge for phase II construction of a water and sewer system.

* Sec. 5. The sum of $1,500,000 is appropriated from the general fund for payment as a grant to the City of Fort Yukon for phase II construction of a water and sewer system.

* Sec. 6. The sum of $1,500,000 is appropriated from the general fund for payment as a grant to the Galena City School District for construction of an elementary addition to Galena School.

* Sec. 7. The sum of $1,450,000 is appropriated from the general fund for payment as a grant to the Iditarod Area School District for construction of an elementary addition to Grayling School.

* Sec. 8. The sum of $2,500,000 is appropriated from the general fund for payment as a grant to the Lower Kuskokwim School District for constuction of an elementary addition to Quinhagak School.

* Sec. 9. The sum of $1,000,000 is appropriated from the general fund for payment as a grant to the Yukon Flats School District for construction of a new school in Stevens Village.

* Sec. 10. The sum of $1,000,000 is appropriated from the general fund for payment as a grant to the Yukon/Koyukuk School District for construction of a secondary addition to Manley Hot Springs School.

* Sec. 11. The appropriations made by this Act shall be disbursed in accordance with AS 37.05.315-317.

* Sec. 12. This Act takes effect immediately in accordance with AS 01.-10.070(c).

EKLUTNA STATUS REPORT

March 27, 1984

In the 1983 bond election Anchorage voters supported Eklutna Water Project bonding by a 3-to-1 margin. The $55 million bonding authorization will contribute Anchorage's 25 % share of total Eklutna project cost.

Gov. Sheffield before the Alaska State Chamber of Commerce in Sitka Sept. 29, 1983 said he would work to secure funding for this vitally needed project.

The project is on schedule and within budget. Bids for the P-1 segment (Ship Creek to Eagle River) construction were opened March 15.

The Municipality's $51 million request for Eklutna will keep the project on schedule. Funding at the $34 million level will threaten continuity of the project in late 1985/early 1986. Without funding by the 1984 Legislature the project will be delayed.

Significant underfunding of Eklutna in 1984 will result in added costs during construction estimated at $6 million to $8 million per year. Delays now mean completion delays. If funding delays completion of the project until 1989, water shortages may occur.

170,400 Alaskans will reside in the Eklutna service area in 1985. By 2024 the number of residents will increase to 449,200. Based on 150 gallons per capita per day (GPCD) usage, water requirements are:

YEAR	AVERAGE	MAXIMUM
1985	26 million	46 million
2025	67 million	117million

Present water supplies (Ship Creek and wells) provide 24 million gallons per day and 22 million gallons per day respectively. Demand will exceed supply in 1988.

FUNDING SUMMARY (in $ millions)

1982	1983	1984	1985	1986
$13.6 (approp.)	$22.5 (approp.)	$51.0 (request)	$47.0 (request)	$31.0 (request)
		$17.0 (bonds)	$15.0 (bonds)	$23.0 (bonds)

EKLUTNA
WATER PROJECT

Municipality of Anchorage
Water and Wastewater Utility

PROJECT EXECUTIVE SUMMARY

JANUARY 1984

James M. Montgomery, Consulting Engineers, Inc.
In association with
QUADRA Engineering, Inc.
Ott Water Engineers, Inc.
Sverdrup/SPCM

EKLUTNA WATER PROJECT
Phone: (907) 279-2461 • 237 E. Fireweed Lane, Suite 201 • Anchorage, AK 99503

Dear Reader:

If you desire additional information about the Eklutna Water Project, please contact one of the following:

Charley L. Bryant
Project Manager

William H. Blackmer
Program Manager

Sarah Barton
Public Involvement

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INTRODUCTION

This document summarizes the salient information about the Eklutna Water Project, a major water resource development for the future. It has been written so that interested citizens and affected parties can be knowledgeable about the project. The most commonly asked questions are answered in this summary, the project's history is traced, a description of the project is given, recent project activities are described, future activities are given, and project funding is detailed.

Not all information on the project can be contained in a document this size. If unanswered questions arise about any aspect of the project, interested parties should contact the Eklutna Water Project office.

NEED FOR PROJECT

The need for an additional water source was determined based on projections of future service area populations, estimates of per capita water use, and expected capacities of existing and planned water supplies.

Since there is a large variance in the previous population projections for the Municipality that have been made by others, it was decided to utilize the Municipality's Community Planning Department's projections for the purposes of the Eklutna Water Project. Those projections have been made for the Anchorage Bowl and the Northern Communities through the turn of the century. Extrapolating the population projections to the end of the project planning period, the project team has determined that the service area population will be about 449,000 in the year 2025. Of that total, 385,000 are expected to reside in the Anchorage Bowl while the remaining 64,000 are expected to live in the communities of Eagle River, Birchwood, Chugiak, Peters Creek, and Eklutna. These population projections are shown in Table 1 by five-year increments.

TABLE 1

EKLUTNA WATER PROJECT

SERVICE AREA POPULATION PROJECTIONS

Year	Anchorage Bowl	Northern Communities	Total EWP Service Area
1985	149,600	20,800	170,400
1990	179,700	26,200	205,900
1995	209,700	31,600	241,300
2000	239,800	37,000	276,800
2005	269,900	42,400	312,300
2010	298,800	47,800	346,600
2015	327,600	53,200	380,800
2020	356,400	58,600	415,000
2025	385,200	64,000	449,200

The area to be served by the Eklutna Water Project is divided into two service areas, that of the Anchorage Bowl, and that of the Northern Communities. The Anchorage Bowl service area includes the region south of the military bases to Turnagain Arm just south of Potter Marsh, excluding some Hillside areas which use on-site supply systems. It has been assumed that the military complexes will continue to supply their own water.

The Northern Communities water service area extends from north and east of Fort Richardson to the village of Eklutna, including the communities of Eagle River, Chugiak, Peters Creek, Brichwood, and Eklutna. It is anticipated that Chugach State Park will not receive water and some rural areas will continue to supply their own water.

Data on historic water demands from 1969 to the present showed an average use of 174 gallons per capita per day (gpcd). However, because of the trend of decreasing consumption and accelerated water conservation efforts by the Municipality, an amount of only 150 gpcd was used for project planning purposes. The ratio of maximum day demand to average day demand of 1.75 has been used for the project based on historical information and risk analyses.

The water utility has instituted several measures for conserving water. Education programs are given in schools, flow restricters are continuing to be distributed, and industrial, commercial and multi-family domestic users are now billed for water consumption based on metered usage. Leak detection and repair of distribution systems is ongoing. This program has resulted in measurable water conservation throughout the system. While these methods of water conservation have been effective in limiting use, they do not have the potential of eliminating the need for expansion of the water supply.

Based on the population projections, per capita water demands, and ratios of maximum day to average day demands described in the preceding paragraphs, future water requirements were determined. These requirements are displayed in Table 2.

To meet these water demands, Anchorage will have a supply of about 46 million gallons per day (mgd). This is based on 24 mgd from the Ship Creek Water Treatment Plant after its expansion in 1985 and 22 mgd from wells. However, demand is expected to exceed supply by 1988. Therefore, a new water source must be obtained.

TABLE 2

MUNICIPALITY OF ANCHORAGE
EKLUTNA WATER PROJECT SERVICE AREA
PROJECTED WATER REQUIREMENTS

Year	Average Annual Water Requirements (mgd)	Maximum Day Water Requirements (mgd)
1985	26	46
1990	31	54
1995	36	68
2000	42	74
2005	47	82
2010	52	91
2015	57	100
2020	62	109
2025	67	117

HISTORY OF THE PROJECT

Many alternative sources of supplemental water for the Anchorage water service area have been examined over the past decade.

A report on Anchorage Water Sources (Tryck, Nyman & Hayes, et. al., 1973) examined at least 25 potential water sources, ranging from artificial recharge of Anchorage Bowl aquifers and Cook Inlet desalinization to tapping streams from Portage to Chickaloon. That study recommended offstream storage of Ship Creek water on Fort Richardson as the most feasible solution to Anchorage's water problems.

Military opposition to Tryck, Nyman & Hayes' proposal eventually led to studies performed as part of the U.S. Army Corps of Engineers' Metropolitan Anchorage Urban Study (MAUS) in 1979. The MAUS study reexamined several of the alternatives studied previously, including a different offstream storage site at Ship Creek, groundwater alternatives, and other Ship Creek, Eagle River, Eklutna Lake, and Campbell Creek alternatives. Final MAUS recommendations included development of an Eklutna diversion or an Eagle River dam and reservoir. The Ship Creek storage basin option was eventually eliminated based on military opposition, MAUS findings, and other considerations.

Between the programs mentioned above, and other studies, at least 28 alternative water sources have been considered for an Anchorage area water supply. These are listed below with summarized reasons for rejection or acceptance.

The following streams were rejected as sources primarily because of lack of a suitable storage site, inadequate discharge, high sediment loads, or long or difficult water transmission line requirements: Little Susitna River, Matanuska River, Knik River, Peters Creek, South Fork Eagle River, Campbell Creek, Chester Creek, Rabbit/Indian/McHugh Creeks, Bird Creek, Twenty-Mile River, Portage Lake, Placer River, Six-Mile Creek, Resurrection Creek, and Chickaloon River. Pt. MacKenzie surface and groundwater sources were found to be inadequate, as were Eagle River, Matanuska-Knik and Portage area groundwater sources. Desalinization of Cook Inlet would not be economically feasible, reuse of present sources would be too costly, and additional conservation measures would not be adequate.

Seven other, more apparent, potential sources were gradually narrowed down to one most feasible alternative: tapping the Eklutna drainage. Use of Anchorage Bowl groundwater resources, with or without artificial recharge of the aquifers, was rejected mainly because of already near-capacity development of that source, energy requirements, unknown impacts on present groundwater supplies, and because it offers only a short-term solution.

Use of a dam on Ship Creek, or offstream storage there, was rejected because of high capital costs, adverse environmental impacts, inadequate long-term supply and complex water and land rights problems.

Tests of Eagle River area groundwater supplies indicated that very little water is available. A dam on Eagle River was rejected because of extreme adverse environmental impacts, great capital costs, technical complexity and difficulty of land acquisition.

These latter two sources, as well as the Eklutna drainage, were examined in detail by CH_2M Hill in their 1981-82 Eagle River Water Resource Study.

Eklutna Lake was determined to be the best solution to Anchorage's long-term water supply problems. The lake would be able to supply up to 200 mgd, more than enough to meet Anchorage's anticipated needs in planning year 2025. Potential adverse environmental impacts of this project would be minimal. No geotechnical problems have been identified which would prevent or significantly complicate construction of the project, nor have other difficulties been encountered which would delay completion of the project beyond the time additional water is needed for Anchorage. Although tapping the Eklutna water source would have a high capital cost, its unit cost over the life of the project is the lowest of any alternative examined. The main disadvantages included the high capital cost, water treatment requirements, and the deprivation of power-generating water to the Eklutna powerhouse.

As recommended during CH_2M Hill's study, the potential for Eklutna water was further studied and refined. CH_2M Hill proposed three different alternatives: one tapped the Eklutna Power Plant tunnel upstream of the power plant; one tapped the tailrace after water was used for power generation; and the third proposed pumping

water from Eklutna Lake into Eklutna River, and then taking the water from the river near the lower end of the valley. The CH_2M Hill studies recommended the alternative which would take water from the tailrace because of its relative technical simplicity, and because it would not impact power plant generation.

In continuing efforts to develop a new water supply, the Anchorage Water and Wastewater Utility (AWWU) contracted with the Eklutna Water Project team in November, 1982, to act as the Program Management Consultant. The project team examined an additional means of using Eklutna water as a water source. This is known as Alternative IV and involves diversion of water directly from Eklutna Lake, or the power plant tunnel near the lake, and transmission of the water from there to Anchorage by pipeline. This alternative was found to be superior when environmental, permitting, right-of-way, geotechnical, energy, and cost aspects were considered. This is the alternative finally selected and now being developed as the Eklutna Water Project (EWP).

DESCRIPTION OF THE PROJECT

The Eklutna Water Project will divert water from Alaska Power Administration's (APA) existing tunnel connecting Eklutna Lake with the Eklutna Power Plant (EPP). From there, water will flow by gravity through another tunnel and a buried pipeline down the Eklutna River Valley to a water treatment plant located on a bench above the river. After treatment, the water will flow by gravity through a 23-mile-long buried pipeline through the communities of Eklutna, Peters Creek, Chugiak, Birchwood, and Eagle River, to the distribution system near the expanded Ship Creek Water Treatment Plant (SCWTP). Energy will be recovered from the flowing water at each treatment plant location. This system will supply water to the Anchorage service area, from Eklutna Village to Potter Marsh in South Anchorage. The selected alignment and location of facilities are depicted on Figure 1.

The maximum day design flow in the year 2025 is 70 mgd and the average flow during that year is 41 mgd. Until EWP facilities are completed, an interim booster pump station near the SCWTP will be used to supply Ship Creek water to the Eagle River area.

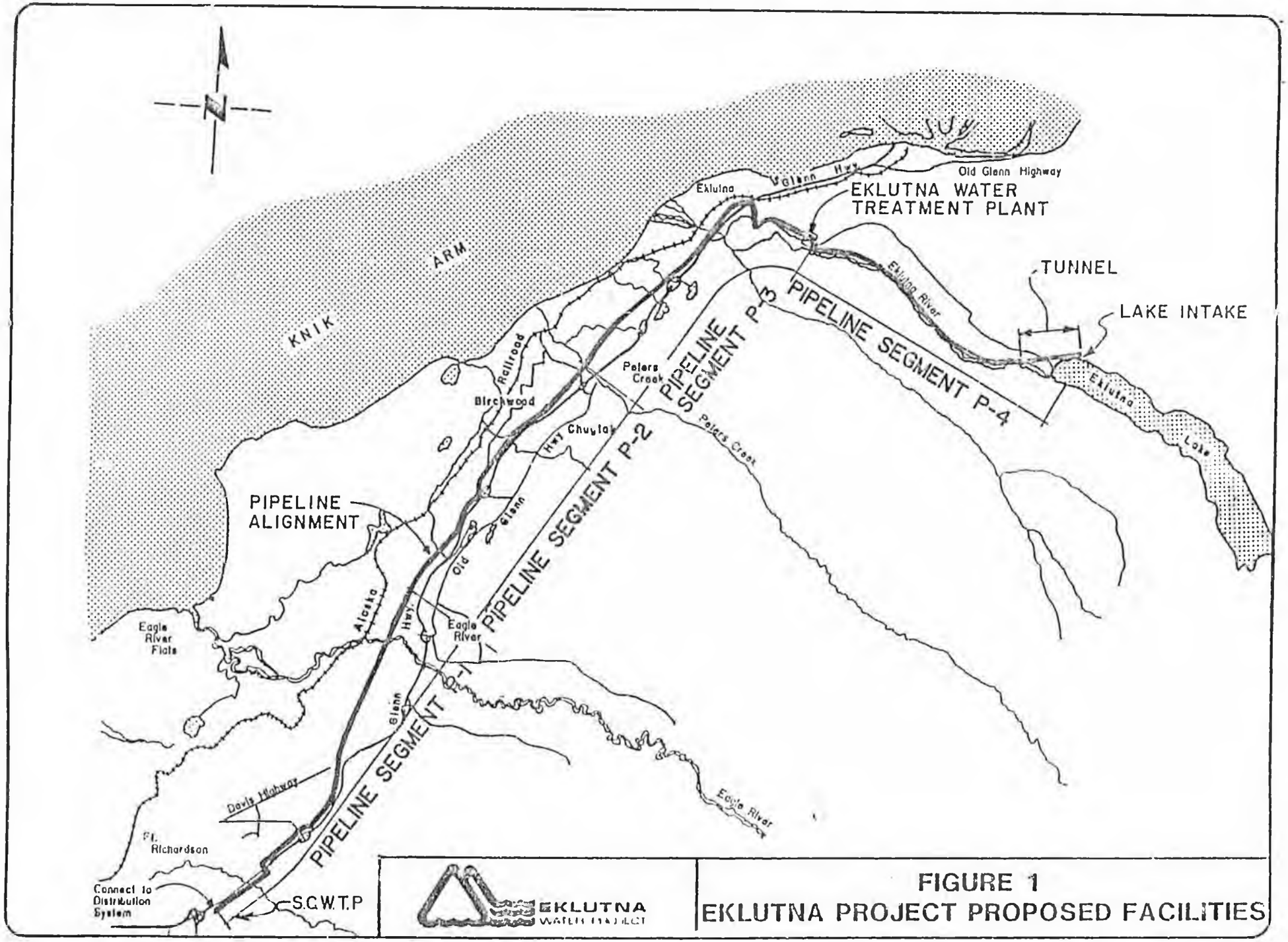


FIGURE 1
EKLUTNA PROJECT PROPOSED FACILITIES

Diversion of Eklutna Lake water involves tapping the 9-foot diameter tunnel to the Eklutna Power Plant. The new 7-foot diameter tunnel will connect this existing tunnel with a new pipeline located in the Eklutna River bed below the dam at the downstream end of Eklutna Lake. The new tunnel will be over one mile in length. Connection to the existing tunnel will be precisely planned and carefully executed so as to minimize disturbance to EPP. A gate house will be constructed near the connection of the two tunnels. The top of the gate house will be the only visible evidence of a diversion for the EWP. Downstream of the diversion tunnel, water will be conveyed in a buried 54-inch pipeline which will be constructed along the Eklutna River bed (pipeline segment P-4) to an energy recovery station at the Eklutna Water Treatment Plant (EWTP) which will be located above the river bed at about 620 feet elevation. Generating capacity of this station will be approximately 1.0 MW. It is estimated that in the year 2025, this energy recovery station will produce over eight million KWH per year with water diverted from Eklutna Lake.

The Eklutna Water Treatment Plant will be designed to use either conventional treatment or direct filtration to achieve the desired water quality. Conventional treatment entails rapid mixing, flocculation, sedimentation, and filtration. During most of the year direct filtration, which bypasses the sedimentation basins, is feasible. It is also preferable because it requires a lower coagulant dosage and reduces the amount of sludge.

Pilot water treatment plant studies have been conducted in three phases using water from Eklutna Lake during all the seasons. The first phase, which investigated treatability of Eklutna Lake water during winter, determined that good quality water could be produced using conventional treatment or direct filtration. Phase 2 examined treatability of lake water during spring transition/early summer conditions using direct filtration. The third phase of the pilot plant studies examined treatability of lake water during the expected period of highest turbidity in the fall. The findings of the whole program are that Eklutna Lake water, with its sometimes high concentrations of glacial flour, is treatable and that direct filtration will be possible most of the year, with conventional treatment being utilized during periods of high turbidity.

A treated water reservoir will be constructed at about elevation 600 feet, just downstream of the EWTP. The purpose of the reservoir is to absorb normal diurnal

fluctuations in water demand while maintaining a relatively constant flow through the EWTP. This reservoir will have an initial capacity of 10 to 15 million gallons.

Pipeline segments P-3 and P-2 extend from the treated water reservoir to Eagle River. P-3 begins at the reservoir, running down the slope to a crossing of Glenn Highway near the community of Eklutna. From there it crosses the river, and parallels Glenn Highway a short distance on the northwest side. It then follows the APA powerline easement and residential streets to its end in Peters Creek. The P-2 segment begins at that point, crosses Peters Creek, parallels the APA powerline easement and local streets, then parallels the Glenn Highway to Chugiak High School. It skirts the high school, crosses through the Lake Ridge Terrace Subdivision along residential streets, then parallels the APA powerline easement again to Artillery Road.

This 54-inch buried pipeline will have seven turnouts for delivery of water to northern communities along the route of pipeline segments P-2 and P-3.

Construction and permanent easements must be acquired along the pipeline alignment. Most of the property along P-2 and P-3 is owned by Eklutna, Inc. Other property owners include: Alaska Division of Parks, Fort Richardson Military Reservation, Alaska Department of Transportation and Public Facilities, Federal Highway Administration, Alaska Railroad, various utilities, native corporations, and approximately 50 private property owners. Permits and/or easements will be obtained from these owners before construction takes place.

A geotechnical study concluded that no major construction problems will be encountered along P-2 and P-3. Crossings of wetlands and streams, however, are specific environmental concerns. Construction schedules and procedures have been designed to minimize disturbance of existing biological and hydrologic regimes of wetlands. Special water management, trench, and backfill techniques will also be employed. The proposed alignment was moved in several cases to avoid designated wetlands. Impacts caused by stream crossings will be mitigated by construction practices such as timing, temporary diversions and bank stabilization. Crossing plans and mitigation means will be approved by the Alaska Department of Fish and Game.

Pipeline segment P-1, the first to be constructed, will extend generally parallel to the Glenn Highway from the vicinity of the SCWTP to a powerline easement, then roughly parallel with and adjacent to that easement as far as Artillery Road near Eagle River. The pipeline will vary between 54 and 48 inches in diameter, decreasing closer to the SCWTP. A 24-inch pipeline will also be constructed along Artillery Road to connect with the existing Eagle River water supply system.

Property owners or agencies with jurisdiction in the P-1 segment include: The U.S. Army Corps of Engineers and the Bureau of Land Management, the Alaska Department of Fish and Game, the Alaska Department of Transportation and Public Facilities, the Municipality of Anchorage, and several utilities. Permits, approvals, and/or letters of non-objection must be obtained from each of these agencies for their respective areas of jurisdiction. This permitting and approval process is almost complete for pipeline segment P-1.

A booster pump station/energy recovery station will be constructed upstream of the SCWTP. Until the entire pipeline is completed and supplying water from Eklutna Lake, this station will pump as much as 4.5 mgd from the SCWTP to Eagle River. Only the booster pump portion will be constructed as part of the P-1 phase, but the facility will be designed so it can be expanded and modified easily for energy recovery. After the entire project is complete, conversion to an energy recovery station will take place. The capacity of this generating station will be about 500 kw.

Lake level and storage records are available from 1946 to the present. Annual inflow over the past 30 years has averaged 210 mgd, varying between 150 and 290 mgd. Approximately one-half of this inflow comes from glacial melt, the other half coming from runoff. Lake level is generally lowest in late spring and highest in early fall. The EWP will not impact lake levels, because all water used by EWP will be diverted from that which normally flows to the Eklutna Power Plant.

The Eklutna Power Plant currently withdraws all the inflow except for infrequent spills. When the EWP comes on line, water diversions for domestic uses will reduce the EPP supply approximately 6 to 8 percent; by the year 2025 that will increase to 21 percent. The water project will decrease the amount of energy generated by the EPP, by that same 6 to 21 percent during the period from 1988 to 2025. However, the 1.5

MW energy recovery facilities constructed as part of the EWP will recover about 45 percent of the EPP deprived energy.

The Municipality of Anchorage Water and Wastewater Utility has reached an agreement with the Alaska Power Administration for an equitable method of replacing energy taken from the EPP by the EWP.

PROJECT SCHEDULE

All Eklutna Water Project facilities should be completed by mid-1988 pending availability of sufficient funding. Dates of completion of each pipeline segment and of the other facilities are shown in Figure 2.

Bids will be received for the first pipeline segment (P-1) in March, 1984, and construction is expected to start in June. That pipeline segment will be completed in the summer of 1985.

STATUS OF THE PROJECT

Many studies and other activities have been performed by the Eklutna Water Project team in the past year. These activities, are separated by task and listed below.

- A Management Plan for Design and Construction was completed in June 1983. (Task 2)

- The Preliminary Water Supply Master Plan Update report was completed in April, 1983. (Task 3)

- The Alternative IV Evaluation (tapping the lake directly) was completed in April, 1983. (Task 4)

- A Regional Geotechnical Report was completed in September, 1983. (Task 5)

- Pilot Plant Summary Reports have been completed for all three phases of the study. A summary and conclusion report for the entire study will be completed within the next few weeks. (Task 7)

- Several reports have been produced as part of the Public Involvement task. These speak to alternative sources of supply, project funding, and the project as a whole. This Executive Summary is also part of the Public Involvement program. (Task 9)

- The Environmental Information Document was completed in June, 1983. This document was the basis of permit support. (Task 10)

- Several reports have been completed under the First Technical Advisory Committee/Value Engineering task, which reviewed the pipeline segment P-1 alignment and lake diversion alternatives. (Task 11)

- The Predesign Report - Pipeline Segment P-1 was drafted in April, 1983, and for segments P-2, P-3 in October, 1983. Work is underway on the predesign report for P-4. (Task 12)

- Two preliminary studies for the lake diversion were completed in 1983. The draft of the predesign report for the lake diversion will be completed in January, 1984. (Task 13)

- The Second Technical Advisory Committee/Value Engineering task is partially completed. In October, 1983, the first session of this task reviewed the tunnel, P-4 alignment, and pipeline in general. The second session, to be held in March, 1984, will review the water treatment plant and look at the tunnel again. The following document has been produced: Value Engineering Study - 2nd Session. (Task 16)

- The Initial Design Report Pipeline Segment P-1 was completed in July, 1983. The draft of a similar report for pipeline segment P-2 will be completed in February, 1984. (Task 18)

- Water rights are currently in the process of being secured through negotiations with the APA. Legislation will be introduced in Congress in February to secure water rights. (Task 23)

- A document on Eagle River Water Supply and Energy Recovery was produced in July, 1983. (Task 24)

- Bids were received in November, 1983, for the prepurchase of valves for pipeline segment P-1. Plans and specifications for the construction of P-1 were 95% complete in 1983. This contract will be advertised in January, 1984. (Task 52)

- Ground surveys for final design of the pipeline segment P-2 were made in 1983. (Task 53)

- Ground surveys for final design of pipeline segment P-3 were completed in 1983. (Task 54)

In addition to the numerous studies made and documents produced, several permitting and environmental activities have been performed and completed. The U.S. Army Corps of Engineers Section 404 Permit which will allow crossing of wetlands was acquired in November, 1983, for the entire pipeline. The Alaska Department of Environmental Conservation Certificate of Reasonable Assurance (protecting water quality) was obtained. The Alaska Coastal Management Plan Consistency Determination was also accomplished. The Alaska Department of Fish and Game Title 16 Anadromous Fish Protection Permit was granted for the four stream crossings made in segments P-1 through P-3. The Municipality of Anchorage Urban Beautification Commission and the Planning and Zoning Commission have approved plans for the Ship Creek Interim Booster Pump Station.

A right-of-way grant must be obtained from the Bureau of Land Management (BLM) for the entire project. The BLM has joint jurisdiction (with the U.S. Army Corps of Engineers) over the Fort Richardson land, and also serves as the lead/coordinating agency for other landholders and utilities along the alignment. The required letters of non-objection have been received from affected parties, and the right-of-way grant for the entire pipeline is expected to be received early in March, 1984.

ACTIVITIES DURING 1984

Many activities key to the progress of the project will take place during 1984. For the P-1 segment, the contract for supply of the large valves was awarded on January 3. Advertisement for bid of construction contracts will take place on January 31, and bids will be received on March 15. Construction of this segment will begin in June. The P-1 segment will be further divided into four schedules to maximize opportunities for bidding by local contractors.

Final design of P-2 is expected to be complete in July and the construction contracts for that segment will be awarded in the fall of 1984. Final design of P-3 will be complete in October, and will be advertised for bids in November. Easements for both segments will be acquired during spring and summer of 1984.

Pipeline segment P-4 will continue through the predesign and initial design phases during 1984. The predesign report will be completed in October. Initial design will be finished in December. The consultant for final design will be selected during the summer.

Initial design of the lake diversion will be completed during the summer of 1984. The final design consultant also will be selected during the summer, and final design will commence in the fall.

The predesign report for the Eklutna Water Treatment Plant will be completed in April, 1984. Initial design will be finished in September. The final design consultant will be selected during the summer, with final design beginning in the fall.

Water rights to Eklutna Lake water will be acquired in 1984. Application for these rights will be filed with DNR, Land and Water Management, in January. A bill amending the APA's enabling legislation will be introduced before the U.S. Congress in February.

PROJECT FUNDING

Construction of the Eklutna Water Project will require a total expenditure of $220 million. This figure was estimated in late 1982 and, after a year of planning and

...n, still represents a viable estimate for completion of the project in 1988. ...nding must be obtained in a timely manner in order to maintain costs at the $220 ...llion level.

...itial appropriations for the project have been received from the State Legislature, ...d continued support from that source will be required through the years 1984 to ...986. In 1982, $13.7 million was appropriated and $22.5 million was appropriated in ...983.

NOVEMBER

In November of 1983, public approval was received with over 75% favorable vote for sale of $55 million in bonds to help fund the project. These bonds will be sold on an as-needed basis. As a result of these bond sales, usage charges will increase by approximately 40 percent over present rates, or by about $5.40 per household per month. This increased rate will not be charged until water is actually supplied. No increase in charges will result from the portion of the project funded by legislative appropriations.

Three quarters of the total funds will be requested from the State Legislature, and one quarter of the funds will be obtained from the Municipality through bond sales. In order for the project to proceed on schedule, the following additional funding will be required. In October, 1984, $68 million will be required, $51 million of which will be requested from the Legislature. In 1985, a total of $62 million is needed, including $47 million from the Legislature. In 1986, the funding required for completion of the project will be $54 million, which will necessarily include a legislative appropriation of $30.8 million.

A barchart depicting funding needs and activity periods is included as Figure 3.

PROGRAM MANAGEMENT STRUCTURE

The Municipality of Anchorage Water and Wastewater Utility executed a contract in November, 1982, with James M. Montgomery, Consulting Engineers, Inc. (JMM), which placed that company in the principal role of Program Management Consult nt for the Eklutna Water Project. JMM has overall responsibility for planning and design of the project, as well as supervision of construction. In additi to overall responsibility,

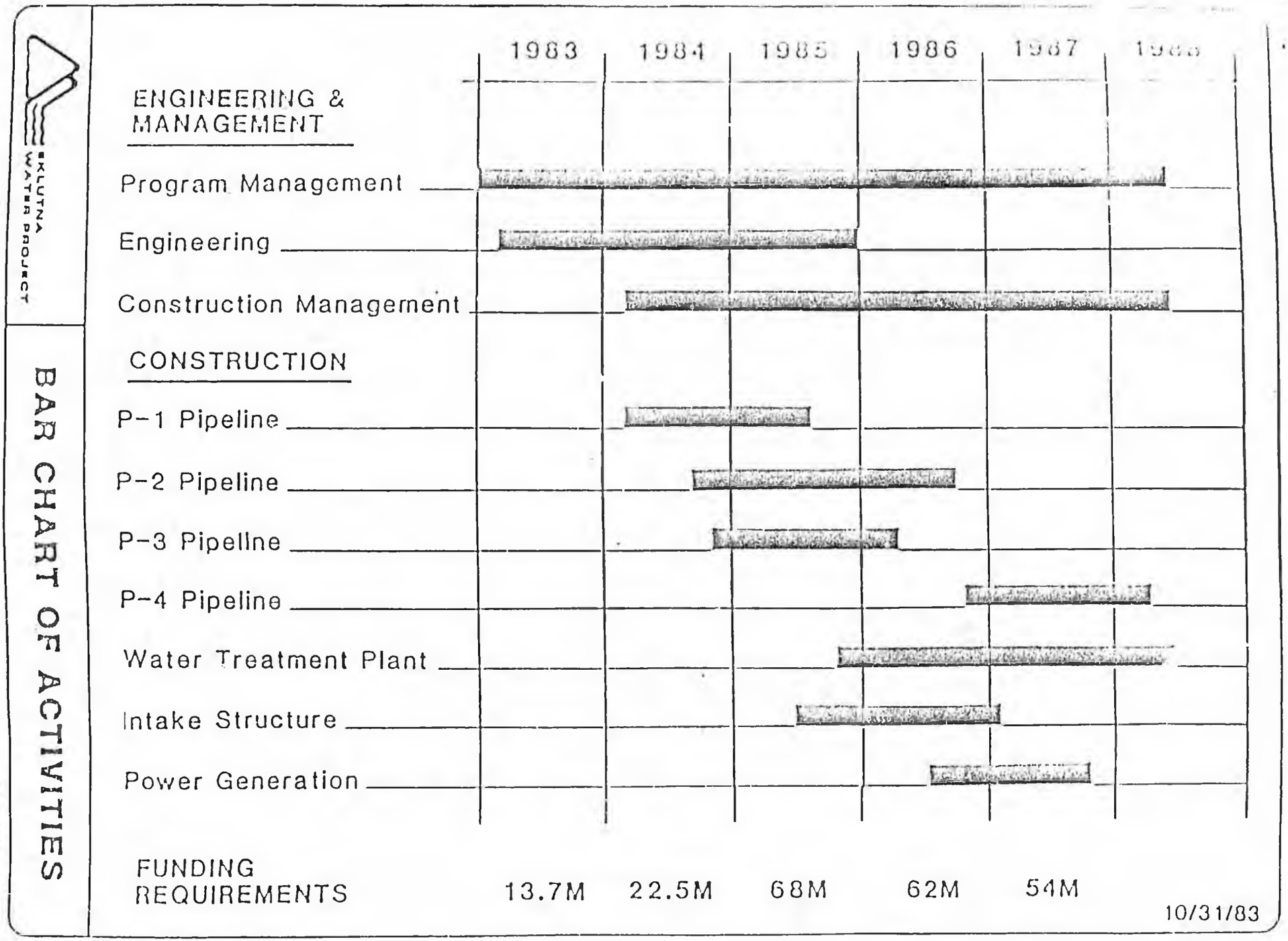

EKLUTNA WATER PROJECT
BAR CHART OF ACTIVITIES
1983
1984
1985
1986
1987
1988
ENGINEERING & MANAGEMENT
Program Management
Engineering
Construction Management
CONSTRUCTION
P-1 Pipeline
P-2 Pipeline
P-3 Pipelne
P-4 Pipeline
Water Treatment Plant
Intake Structure
Power Generation
FUNDING REQUIREMENTS
13.7M
22.5M
68M
62M
54M
10/31/83

FIGURE 3

SPCM has primary responsibility for designing the project facilities. Three associate firms are in charge of other key aspects of the project and numerous other local firms are involved with the project.

QUADRA Engineering, Inc. is responsible for Geotechnical, Surveying, and Engineering Support for the project. QUADRA is assisted in that role by Woodward-Clyde Consultants, Inc., which is performing seismic studies.

Ott Water Engineers, Inc. is conducting the Environmental, Permitting, and Public Involvement programs, which includes obtaining necessary permits, rights-of-way and easements. Assisting with securing of Eklutna Lake water rights is the legal firm of Burr, Pease, and Kurtz. R. W. Beck and Associates, Inc. is a special consultant relating to energy replacement matters.

Sverdrup/SPCM, Inc. is responsible for Planning and Control tasks of the project, and Construction Management. In the latter responsibility, they are assisted by Triad Engineering, Inc. with consultation regarding construction practices. Sverdrup is also performing engineering for the lake diversion and tunnel.

Coffman Engineers, Inc. is conducting corrosion studies and is performing final design of the corrosion control system.

Three additional local firms have been retained for final design of segments of the pipeline. Tryck, Nyman and Hayes, Inc. is performing final design for segment P-1; DOWL Engineers, Inc. for segment P-2; and URS Engineers, Inc. for segment P-3. Other local firms will be added to perform final designs of the following facilities as the project progresses: Eklutna Water Treatment Plant, lake diversion, pipeline segment P-4, treated water reservoir, and energy recovery stations at Eklutna and Ship Creek.

The Anchorage Water and Wastewater Utility (AWWU) is the overall project administrator for the Eklutna Water Project. In that capacity, AWWU provides general direction to the consultants and makes detailed reviews of their work. AWWU has placed a full time project manager in the Eklutna Water Project office to more easily manage the large amount of work being performed on the project.

This management team has kept the project on schedule and within budget.

AKIAK - WATER AND SEWER FACILITIES (VSW) 400.0

Village Safe Water has identified Akiak as having one of the most serious water problems in the State. Residential wells are producing water which exceeds water quality standards for iron by as much as 27,000%. USPHS began drilling wells for individual homes, and, while early test results showed relatively "good" water during the early stages of the drilling program, recent water analysis has shown many wells are producing unacceptable water.

FORTUNA LEDGE WATER/SEWER SYSTEM - PHASE II

Fortuna Ledge 1,000.0

The City of Fortuna Ledge proposes to construct 10,600 linear feet of water transmission line and 15,100 linear feet of sewer main to serve the 119 lots included in the new residential subdivision area. Water and sewer study plans also provide for a lift station and water works building modifications. The proposed water and sewer extention will utilize an existing system which appears capable of handling the additional load.

Cost estimates for the water and sewer system are based on 1984 dollars and using local labor and equipment.

r4/t

EXHIBIT A
MARSHAL MASTER PLAN
JUNE 1983
ESTIMATED WATER & SEWER COSTS
119 LOTS
LOCAL LABOR AND EQUIPMENT

WATER

10600 Lin. Ft. 4" Arctic Pipe Installed @ $50 =	$530,000
Modifications in Water Works Building	50,000
	580,000
20% Contingencies & Engineering	116,000
	$696,000

SEWER

15100 Lin. Ft. 6" Arctic Pipe Sewer Installed @ $70 =	$1,057,000
Lift Station	45,000
	1,102,000
20% Contingencies & Engineering	220,400
	$1,322,400

Total Estimated Installed Cost	$2,018,400

CITY OF FORT YUKON

CAPITAL BUDGET

FOR

WATER AND SEWER IMPROVEMENTS PHASE II
(ANGEL POND SUBDIVISION)

WATER SYSTEM:

Main Line 13,500 ft 6" insulated @ $69.00/lf	931,500
Hydrants 13 @ $3500	45,500
House Services to 66 lots @ $4000/lot	264,000
New booster pump and building	100,000
Construction Cost	1,341,000
Engineering	130,000
Administration and Legal	220,000
Contingency	250,000
Water Project Estimated cost	$ 1,941,000

SEWAGE DISPOSAL:

Subsurface Disposal 66 units @ $7500 ea	495,000
Engineering and layout	15,000
Administration and Legal	44,000
Contingency	40,000
Sewer Project Estimated Costs	$594,000

TOTAL REQUEST FOR FORT YUKON WATER AND SEWER PROGRAM PHASE II	$2,535,000

Galena Elementary School Program

CONCEPTUAL COST ESTIMATE

A cost estimate has been prepared based upon the information contained in the "Design Criteria" section of this document. This estimate is based upon the premise that the new building will be located as shown on the site plan (2-3), and that construction will begin in 1984.

Listed below is a summary of the construction furnishings and equipment costs for Galena Elementary School. The costs per square foot of the building average $213.

DIVISION	1	GENERAL CONDITIONS	$ 536,000
DIVISION	2	SITE WORK	$ 47,000
DIVISION	3	FOUNDATION WORK	$ 344,000
DIVISION	5	METALS	$ 10,000
DIVISION	6	CARPENTRY	$ 269,000
DIVISION	7	MOISTURE PROTECTION	$ 221,000
DIVISION	8	DOORS & WINDOWS	$ 82,000
DIVISION	9	FINISHES	$ 265,000
DIVISION	10	SPECIALTIES	$ 36,000
DIVISION	11	EQUIPMENT	$ 8,000
DIVISION	12	FURNISHINGS	$ 250,000
DIVISION	15	MECHANICAL	$ 434,000
DIVISION	16	ELECTRICAL	$ 278,000
MARKUPS	17	OVERHEAD & PROFIT	$ 370,000
TOTAL			$ 3,150,000

Budget

INTRODUCTION

The following is a construction budget which is based on a cost of $250/square foot. This was determined as follows:

- Average bid at Nikolai in 1983 was $262/square foot. This school is of similar construction and built for the Iditarod Area School District.
- 8% escalation to summer of 1984 = $282/square foot
- Reduction due to size of Grayling and accessibility = $250/square foot

BUDGET

2,000 square feet (remodeled) X $125/square foot =	$250,000
12,538 square feet X $250/square foot =	$3,147,000
Subtotal	$3,397,000

Project Overhead and Other Costs		
Administration Cost	7.25%	$246,282
Design Costs	8.00%	$281,951
Furnishing and Equipment Costs	8.00%	$271,760
Art	1.00%	$33,970
Subtotal		$4,230,963
Project Contingency	5.00%	$211,548
Project Total		$4,442,511

This project could be funded by a direct grant from the state. The grant could be supplemented by funds available from the federal government. These funds are available to those school sites being omitted by the Bureau of Indian Affairs education program.

To begin construction in 1984 and finish before June of 1985, which is the date the B.I.A. will curtail its sponsorship of the elementary program, would should begin immediately. This would insure the state of not occupying the B.I.A. school which has never been required to meet local building codes. If the state were to occupy the school additional funding would have to be found to upgrade the existing B.I.A. school to current fire/life safety codes.

QUINHAGAK

Village Profile

Quinhagak is located on the mouth of the Kanektok River. The population is an estimated 340 (1980). Two school sites exist; an elementary school with current K-8 enrollment of 85, and a high school with 9-12 enrollment of 56. Total enrollment 141.

Building Data

Building 203 is a two-classroom school/quarters of wood frame construction consisting of 4,233 square feet built in 1963 and relocated in 1979. Building 204 houses storage and two standby generators in a wood frame structure of 1,332 square feet built in 1963 and relocated in 1979. Building 206 is a two-classroom wood frame structure of 2,844 square feet constructed in 1968 and relocated in 1979. Building 208 is a classroom/quarters wood frame structure of 2,880 square feet constructed in 1979. The school is of one-hour construction containing 9,480 square feet built in 1979.

Summary Diagram

1A
UPGRADE OF EXISTING ELEM SCHOOL (7,877 SQ. FT.) + 20 YEAR LIFE CYCLE

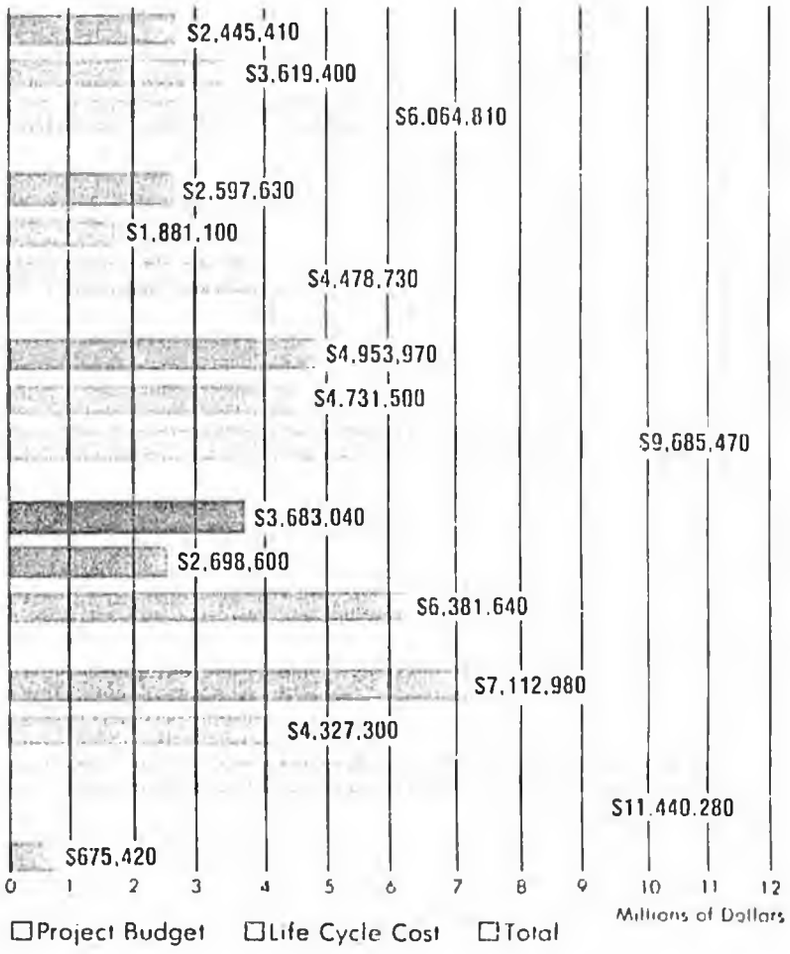
1B
ADDITION OF 7,877 SQ. FT. TO HIGH SCHOOL + 20 YEAR LIFE CYCLE

2A
REMODEL OF EXISTING ELEM SCHOOL (7,877 SQ. FT.) & ADDITION OF 3,423 SQ. FT. + 20 YEAR LIFE CYCLE

2B (Recommended)
ADDITION OF 11,300 SQ. FT. TO HIGH SCHOOL + 20 YEAR LIFE CYCLE

3
REMODEL OF EXISTING HIGH SCHOOL (9,480 SQ. FT.) & ADDITION OF 18,120 SQ. FT. + 20 YEAR LIFE CYCLE

PREVIOUS BIA STUDY



Recommendation

Alternate 2B would provide a new building which addresses the educational goals of the district as well as provides common use of staff and facility without the inherent problems of operating four separate buildings for a 20 year cost 5.5% more than Alternate 1A. Alternate 2B should be pursued.

Yukon Flats School District
P.O. Box 359
Fort Yukon, Alaska 99740

CAPITAL IMPROVEMENT PROJECT

Priority Rank 2 of 11

Project: Stevens Village, New Elementary/High School

Capital Request: $2,800,000

PROJECT DESCRIPTION AND PUBLIC BENEFITS

Stevens Village is on the north bank of the Yukon River, 10 miles east of the Elliot Highway crossing and about 50 miles west of Beaver. This is a traditional Native village, settled in the late 1800's. Income here is obtained from construction work, railroad work, river transportation work, and fishing.

There were secondary age students attending Mt. Edgecumbe School. With the closing of that facility, Stevens Village school has been impacted.

Two teachers, a teacher aide, and 16 students, grades K-12, are presently housed in a 800 square foot former BIA school, circa 1960. Conditions are already extremely overcrowded and with the addition of students returning from Mt. Edgecumbe, the situation has become very difficult.

There is no room at the present site to remodel and expand the present building. The project must be relocated and a new site has been selected with the cooperation of the Village Council.

The present school is energy inefficient. There have been waste water and sewage disposal problems at each spring thaw due to the small site and inadequate space for a sewage disposal system large enough to accommodate school needs. Department of Environmental Conservation had intimated possible school closure if sewage continues to contaminate village and school property due to inability of frozen soils to disperse waste water underground.

Finally, the school does not meet minimum space requirements mandated by the Tobeluk ("Hootch") Decree.

We propose a combined K-12 facility to include an elementary classroom, a secondary classroom, a vocational shop, a multipurpose room, kitchen, and mechanical area to total 6,210 square feet.

Costs:		
	Planning and architectural	$ 270,000
	Site Development	70,000
	Construction	2,228,000
	Legal	10,000
	Administration	22,000
	Equipment	200,000
	Total Project Cost	$2,800,000

YUKON/KOYUKUK SCHOOL DISTRICT - MANLEY HOT SPRINGS SCHOOL 1,000.0

This is a direct appropriation to the Yukon/Koyukuk School District through the DOE. Manley Hot Springs currently has a high school consisting of 960 square feet of classroom space and 556 square feet of supplementary space. The school district is requesting an additional 5,700 square feet of secondary space.

COST ESTIMATE

GEOTHERMAL WELL-KOTZEBUE, ALASKA

Medium Depth Well	6,000 to 8,000	
Pre Stand by		100,000
Moving & Rig up & Down		210,000
Day Work		675,000
Overhead		100,000
Camp & Catering		195,000
Post Standby		100,000
Extra Labor Rental		103,000
	SUBTOTAL	1,483,000
Other Drill Costs		
1. Raw Materials		600,000
2. Service Contractors		
a. Drill Consultant		50,000
b. Wellsite Geologist		20,250
c. Mud Logging		55,200
d. Wire Surveys		180,000
e. Cont. Service		200,000
f. Carting		29,300
g. Shooting & Perforating		70,000
h. Csg Inspection		18,000
3. Other Direct Cost (fuel,water,ect)		500,000
	SUBTOTAL	1,722,750
4. Build Location Permafrost Bed		750,000
5. By/Air Rig Transport in & out		4,000,000
	TOTAL	7,955,750

ESI - Alaska DEPD
BRU 08-71-7-500

KOTZEBUE GEOTHERMAL PROJECT

Final Report

Summary of Project Tasks and Findings

February 1981

Prepared For
The State of Alaska
Division of Energy & Power Development
338 Denali
Anchorage, Alaska 99501

Energy Systems, Inc.
P.O. Box 6065
Anchorage, Alaska 99502

ALASKA POWER AUTHORITY

CONTENTS

FINAL REPORT--KOTZEBUE PROJECT

Introduction

This report summarizes work done by Energy Systems Inc. on the Kotzebue Geothermal Project for the State of Alaska Department of Commerce and Economic Development, Division of Energy and Power Development. The work reported covered the period July 1, 1980 to Feb 1, 1981. The work was done in fulfillment of two contracts, BRU Kotzebue Geothermal, 08-71-7-500 and ATN 81-525, CC 08-1582.

The first section of this report lists the tasks contracted for item by item and summarizes the work done. Reference is made to four items that were completed as part of the contract tasks: geological and geophysical data for the Kotzebue Selawik Basin, "Kotzebue Geothermal Project:Currently Available Information and Report of the Advisory Group Meeting", "Geologic Analysis of Geothermal Energy at Kotzebue", and a proposal to the Department of Housing and Urban Development on behalf of the City of Kotzebue to study the district heat prospects at Kotzebue. These four items are bound separately and are referred to as appendices A,B,C and D respectively. Reference should be made to them for a more detailed description of the results of the tasks performed, and described below.

Task 1

An energy needs analysis for the City of Kotzebue including electrical power and fuel demands to the year 2000. This task will take existing projections from a recent needs analysis by the Alaska Power Authority and put it in a form for presentation at the geothermal meeting in Task 3. Potential local use geothermal applications will be projected under the assumption that if the geothermal resources were developed geothermal energy availability would stimulate commercial development to some degree.

Three independent estimates of energy use at Kotzebue were located, analyzed, and compared. No significant commercial uses of geothermal energy were identified, either in the literature or in discussion. The most beneficial application was determined to be space heat. The possibility of space heat was further examined by conceptually designing a district heat system, with a geothermal heat source, and estimating the cost of heat obtained from it. The estimated cost of the geothermal heat was too high, but the district heat portion of the system looked moderately promising. A summary of this work can be found on pp. 34 to 42 of Appendix B.

Task 2

Research currently available geological and geophysical information for the Kotzebue-Selawik Basin. This information shall be put in a form for oral, visual and written presentations on the geological possibility of developing geothermal resources.

Mr. Arlen Ehm, consulting geologist, was hired to carry out this task. The raw information is included in Appendix A, and a summary of it with some analysis is given on pp. 24-28 of Appendix B. A bibiliography is on pp. 45-46. A more detailed, and up-to-date, analysis of this data is given in Appendix C. Appendix A was supplied to the Department of Commerce and Economic Development, Division of Energy and Power Development, in only one copy because of its voluminous nature.

Task 3

Organize and host an interdisciplinary meeting of geothermal experts to develop a work plan for the development of the Kotzebue project and the expenditure of the State appropriation. This meeting will be held at or around the Geothermal Resource Council Annual Meeting in mid-September 1980 unless otherwise agreed upon.

A list of geothermal experts and people involved in the Kotzebue geothermal project was compiled by Energy Systems Inc. with the help of the Division of Energy and Power Development. The people contacted included representatives of the City of Kotzebue, the NANA Corporation, the University of Alaska Geophysical Institute, the State Division of Geological and Geophysical Surveys, the Alaska State Legislature, the Alaska Power Authority, Universities with relevant geothermal programs, National Laboratories with Geothermal Programs, and the US Geological Survey. These people were contacted by phone and it was determined that a meeting on September 12, 1980, immediately following the meeting of the Geothermal Resources Council would be feasible. In many cases people on the list could not attend, and it was necessary to find alternates. In the end a suitable advisory group was assembled, with Dr. William Ogle of Energy Systems Inc. as chairman. It also proved advantageous to hold a preliminary meeting in Anchorage to allow more local experts to attend.

Arrangements were made for the meeting in Salt Lake City. Informatio that had been uncovered in Tasks 1 and 2 and at the meeting in Anchorage was mailed to the advisory group for their review prior to the meeting. It was also organized into viewgraphs suitable for presentation to the group. The members of the advisory group generously donated their time at no cost to the State of Alaska. Their advice and aid was quite helpful. The final composition of the advisory group is on p.10 of Appendix B. Notes of this meeting are on pp.11-33 of Appendix B.

The basic conclusion from the meeting was that the geothermal prospec did not look as promising as first thought, but also that the possiblility of direct use or use through heat pumps could not be ruled out. The district heat portion of the project looked moderately promising. Specific recommendations were to get additional (proprietary) geological data from NANA and Chevron, and to apply to the Department of Housing and Urban Development for funds to look at district heat in greater detail.

Task 4

A written final report detailing the task findings, the preliminary ideas broached at the meeting in Task 3 and possible cost and impacts of the different elements of the work plan will be required. The state geothermal development plan Kotzebue section is the preliminary plan to be critiqued at this meeting.

Appendix B is the written report. Pages 4-8 summarize the ideas presented at the meeting. Page 9 gives some conclusions and recommendations for future work. On pp. 28 and 29 is a critique, by Mr. John Reeder, of the Kotzebue section of the State's geothermal implementation plan. Pages 11-44 contain a lot of information relevant to developing a plan for further geothermal work at Kotzebue, including drilling costs and estimates of the cost of a district heat system.

After the advisory group meeting, and acting on conclusions and recommendations coming from that meeting, the Division of Energy and Power Development extended its contract with Energy Systems Inc. to perform tasks 5 to 10, outlined below.

Task 5

Request from Northwest Alaska Native Association information pertinent to determining depths at Kotzebue equivalent to depths observed in the Nimiuk Point and Cape Espenberg wells, and to the salinity, specific gravity, and dissolved solids in the water from these wells.

Arlen Ehm wrote a letter to the NANA corporation requesting the required information and detailing the need for that information. NANA forwarded the request to the Chevron Resources Company, which generously allowed Mr. Ehm to view the requested material in San Francisco. The formation water chemistry information is shown in Fig.17 of Appendix C and the equivalent depths to basement at Kotzebue is Fig.19 of Appendix C.

This information is crucial to determining the feasibility of geothermal energy at Kotzebue.

Task 6

Obtain further information on what data and information could be obtained by electrical geophysical methods at Kotzebue. Design same and cost out.

The results of Task 5 were such that task 6 was no longer relevant. The seismic depth to basement obtained in Task 6 is far more reliable than what could be obtained by any electrical method, and the 2000 ft. depth to basement obviates the need for the information on salinity. Thus it was decided to determine the cost of drilling a 2000 ft. well at Kotzebue.

Battelle Pacific Northwest Laboratories was drilling similar wells at Bethel. We asked their contractor and Battelle themselves

to estimate the cost of a 2000 ft well at Kotzebue. Both estimated that the cost would be about $350,000, including mobilization and demobilization. However, the contractor contacted would only do the job on a time and materials basis, and he has never drilled that deep with the rig he anticipated using on the job. He did not think the anticipated depth would be a problem, however, as long as a slim-hole is used.

Task 7

Integrate information obtained in tasks 5 and 6 with previously obtained gravity surveys, well logs, surface geology maps, and other pertinent information to formulate the best estimate presently obtainable of subsurface temperature, permeability, pressure, and porosity at Kotzebue.

The information requested in the above task is given in the report that is Task 8. The geological information gives a fairly complete picture of the subsurface geology at Kotzebue relevant to determining the feasiblity of using geothermal energy there. Of course, no amount of information could ever be sufficient for answering every conceivable question.

The depth to impermeable basement at Kotzebue is about 2000 ft. The probability of finding sufficiently permeable rocks below 2000 ft. is very low. The temperature at 2000 ft. depth is predicted to be low (105F to 135F). Above the basement, the rocks would have permeable zones that would produce adequate volumes of water. Of course, this water would be at a temperature below 135F. The downhole pressures would not be sufficient to bring the water to the surface. In general, the only feasible way to determine pumping requirements is to drill a well and test it. The water would have a lot of dissolved solids. Drilling costs would be low in comparison to the costs usually quoted for petroleum wells in the area because there is little point in drilling below 2000 ft, and the formations are easy to drill, both because of the sedimentary rocks and because no extraordinary downhole pressures are anticipated. A truck mounted rig could be used.

Task 8

Write a report on the geology of the Kotzebue Selawik basin as it applies to the utilization of geothermal energy, including figures that summarize the surface geology (rocks and faults), regional geology, temperature profiles from the Cape Espenberg and Nimiuk Point wells, lithologic sections, electric logs, etc.

Mr. Arlen Ehm compiled the requested information in the report titled "Geologic Analysis of Geothermal Energy at Kotzebue", which is Appendix C to this document.

Task 9

Answer H.U.D. solicitation for district heating for the village of Kotzebue. The work plan for this solicitation will be an economic scoping study considering wind, coal, wood, geothermal, and waste heat separately and in conjuction with each other for the most economical district heating system for the village.

An outline of the proposal was constructed by Energy Systems Inc. John Beebee of Energy Systems and Don Markle of the Division of Energy and Power Development traveled to Kotzebue and discussed the draft of the proposal with as many people who would participate in it as possible. In particular, Gene Moore, the City Manager of Kotzebue, was most helpful in setting up the District Heat Working Group, suggesting changes in the management plan of the proposal, and getting background information and letters of support. The proposal was sent to HUD on January 16, 1981. Appendix D is a partial copy of the proposal. Complete copies were sent to HUD, the City Manager of Kotzebue, and the Division of Energy and Power Development. Missing from the copy given in Appendix D is "Appendix B" of the proposal, which is essentially the same as Appendix B attached to this report.

Task 10

Work in conjunction with the City of Kotzebue and the Mauneluk Native Association to form a District Heating System Association for Kotzebue.

After some discussion, it was decided that the City Manager's suggestion of using the City Council as the core of the District Heat Working Group called for in the HUD proposal was most satisfactory. The composition and duties of this group can be found in Appendix D of this report, p.3. Since the Department of Commerce and Economic Development contemplated participating financially in the project, representatives of the Alaska Power Authority and the Division of Energy and Power Development were added. This should be a useful advisory group in beneficially expending the remainder of the geothermal project appropriation.

Findings and Recommendations

The general conclusion of the geothermal advisory group meeting was that geothermal energy was not likely to be an economical source of heat for Kotzebue, but that district heat might be feasible. The specific recommendations were that further data be sought from Chevron and NANA and that HUD should be approached for funds for a more detailed study of district heat. The Division of Energy and Power Development followed these recommendations. The geological information obtained from Chevron clearly reinforced the conclusion that geothermal energy would not be feasible at Kotzebue. The conclusion is based on several interrelated facts that are described in greater detail in Appendix C. (1) The depth to impermeable basement at Kotzebue is only about 2000 ft. (2) The temperature at 2000 ft. will be too low (105F-135F) for direct use. (3) The formation pressures are too low to push the water to the surface

(4) Pumping will be required to get adequate volumes of water to the surface, and this pumping will be expensive. (5) The water is so saline that it must be passed through a heat exchanger and reinjected. (6) Higher temperature water cannot be economically produced from the Nimiuk point well and transported to Kotzebue, both because of the pumping cost and because of the pipeline cost. (7) Because of the high cost of diesel generated electricity at Kotzebue heat pumps would not be advantageous, either if used individually or in a central installation. (8) The hot dry rock technique of energy extraction would require drilling wells that would be too expensive to deliver energy at a cost competitive with the anticipated cost of oil.

Of course, the geological parameters are predictions, based on data and assumptions that are explained in detail in Appendix C. The best method for verifying these predictions of temperature, permeability, porosity, and formation pressure is to drill a well at Kotzebue, and test it. Such a well, to a depth of 2000 ft, would probably not cost less than $350,000. The $350,000 cost is based on using a rig that has not drilled to 2000 ft, must drill a 4 in. or less diameter hole, and it assumes that there are no hole problems. To be certain of getting the results desired, it would be necessary to anticipate expenses that would be much greater than $350,000. Other than verifying the geological predictions, such a hole could be used to locate aquifers suitable for thermal energy storage, to gather subsurface water quality data, and would be of interest simply as a source of subsurface information at Kotzebue.

The recommendation that district heat be examined more closely is based on a feasiblity study done in preparation for the advisory group meeting. This study, which used general costs for components of district heat systems and experience by the Public Health Service in constructing the present water and sewer system, predicted that the cost of delivering 1.16 X 10 3tu per year was $1.1 million per year, or $9.48 per million btu. (This cost includes an allowance for retrofitting house heating systems, but does not include the cost of heating the water.) This estimate was based on using low temperature geothermal water, which resulted in mains that were larger than necessary for higher temperature water. Also, due to the danger of subsidence around the geothermal wells it was necessary to transport the water from over a mile out of town, which added considerably to the cost. The present cost of fuel for oil heat is about $14.80 per million Btu.

Since Kotzebue presents some rather difficult engineering problems for a district heat system, both in soil conditions and the need for extreme system reliability, it is felt that pursuing the district heat option will require a detailed feasibility study, as outlined in the proposal, Appendix D. The total cost of this study was estimated to be $185,500, of which the City of Kotzebue would provide $10,500, the State of Alaska would provide $120,000, and HUD would supply $55,000. The cost of the contract for a detailed study of the district heat system is $135,000. The remaining costs were for administration and to fulfill HUD goals.

In fulfilling this contract, Energy Systems Inc and the Division of Energy and Power Development had considerable contact with

the City of Kotzebue. In particular, the City Council agreed to serve as an advisory group on the proposed district heat study. This group could be asked to help direct how the remaining funds in the Kotzebue geothermal appropriation should be spent.

Further study of the district heat option, as outlined in appendix D, pp. 1-18, would be a useful application for the funds.

The proposed district heat study, and the geothermal study reported h appendices B and C, could be considered parts of an integrated space heat study for Kotzebue. Other possible sources of heat that might be examined as part of such an integrated study are the direct use of coal in home furnaces and distributing low btu gas from coal to the city.

KOTZEBUE GEOTHERMAL PROJECT

Analysis of Currently Available Information and Report of Advisory Group Meeting

October 1980

Prepared For
The State of Alaska
Division of Energy & Power Development
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Anchorage, Alaska 99501

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ALASKA POWER AUTHORITY

TABLE OF CONTENTS

ACKNOWLEDGEMENT

The following individuals donated time and effort to reviewing the Kotzebue project. We are grateful to them and to the organizations who supported them. Also, a proposal submitted by Dr. Robert Forbes of the University of Alaska Geophysical Institute to the San Francisco Operations Office of the Energy Research and Development Administration (Ref. 18), was the first expression of the possibility of using geothermal energy at Kotzebue.

Name	Organization
Bill Ryan	Indian Health Service
Gene Wescott	Geophysical Institute - U. of A.
Don Turner	Geophysical Institute - U. of A.
Dee Lane	Rural Alaska Community Action
Keith E. Brown	New Mexico Energy Institute
Gay Hammer	Eng. & Econ. Research, Inc.
Linda Fassbender	Battelle-Northwest
John W. Reeder	Alaska Div. of Geol. & Geophy. Surveys
Gene Moore	City Manager - Kotzebue, Alaska
Duncan Foley	Earth Science Lab - University of Utah
Bob Schultz	EG&G Idaho Inc.
Don Argetsinger	NANA Regional Corporation
Jeff Smith	Mauneluk Association
Don Markle	Division of Energy And Power Development
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Ed BiBello	EG&G, Idaho, Inc.
Patti DeJong	Information Services of Alaska
Brent Petrie	Alaska Power Authority

INTRODUCTION - DESCRIPTION OF TASKS

The Alaska Legislature appropriated $600,000 to the Alaska Power Authority for a Kotzebue geothermal project. The Alaska Division of Energy and Power Development, on behalf of the Power Authority, contracted with Energy Systems, Inc. to gather together the existing information on the energy needs at Kotzebue, to research currently available geological and geophysical information for the Kotzebue-Selawik Basin, and to organize and host an interdisciplinary meeting of geothermal experts to help develop a plan for the Kotzebue project. (In addition to the meeting called for in the contract, it proved necessary to also hold a preliminary meeting in Anchorage). This is Energy Systems' written report on the tasks above.

William Ogle of Energy Systems was Chairman of both meetings. John Beebee compiled this report. Robert Henson contributed Figure 2. Arlen Ehm, consultant geologist, compiled and reviewed the geologic data. Linda Ibarra prepared the manuscript.

HEATING NEEDS AT KOTZEBUE

We located two guesses of heating oil use in Kotzebue. They are compared in Figure 2, p. 35. The study by Retherford, Assoc., Reference 1, estimated the amount of residential space heating by assuming 467 houses, 900 sq.ft. each, R-11 insulation, 2 air changes per hour, 16,039 degree days. They came up with residential heating use of $.91 \times 10^{11}$ Btu/year. No estimate was given for use by commercial and public buildings.

The draft study by Louis Berger and Associates, Reference 2, had an estimate of residential fuel oil consumption based on a house to house survey by the Mauneluk Association and the Alaska Public Forum. The survey found that in January the average house used 2.21 drums (55 gal per drum) of oil. This was projected, based on degree days, to heating needs for the entire year. Heating requirements for commercial and public buildings were estimated by trying to find actual consumption figures for buildings of the same type, reducing these to consumption per square foot, and then projecting this on the basis of square footage. Louis Berger and Associates' estimate was $.72 \times 10^{11}$ Btu per year for residential and commercial space heating combined.

The mayor of Kotzebue, Mr. Royal Harris, estimated that Kotzebue uses about 1.2 millior gallons of oil per year for space heat, based on the fuel dealer's sales. Converted to Btu's at 65% efficiency that is about 1.1×10^{11} Btu/year.

We think the actual space heating need for Kotzebue is between $.72 \times 10^{11}$ Btu per year and 1.1×10^{11} Btu per year. Other than for space heat, we could

not identify any planned major uses for low temperature energy at Kotzebue.

Figure 2 also shows electric energy consumption and cost. Only about half as much electric energy is consumed as is used for space heating. Using the rule of thumb that a diesel electric plant produces about as much usable heat as electricity, there presently isn't enough surplus heat from that source to heat all of Kotzebue, especially since part of it is already used to heat the culinary water. The actual generation cost is around $.13 per Kw-hr. This means that diesel electric energy for downhole pumps, fan-coil heat exchangers, or heat pumps is very costly.

According to the Retherford Study, Reference 1, the Kotzebue electric association has had an annual load growth of 10% per year. Some of this (7%) is due to population increase and part is due to higher consumption per person. We note that the number of people per house (5.5) is high, and that the houses are small (under 1000 sq.ft., average). Thus there is a substantial incentive for more or larger houses. On the other hand, conservation measures have had a strong effect. We have guessed (Figure 3) that the total oil used for space heat will grow 7% per year. The current (Sept. 1980) cost of oil for space heat is about $1.22 per gallon plus a delivery charge. Figure 3 also shows what we guess Kotzebue might spend for heat in the coming years.

CORRECTION

THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY

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FEASIBILITY OF DISTRICT HEAT

In preparation for the meeting, we did a small feasibility analysis for district heat, which is outlined in Figures 4,5 and 6, pp. 38, 39 & 40. There are several engineering problems that would have to be solved in a more detailed analysis:

1. How do you deal with Kotzebue soil conditions? Possible solutions are shallow burial, burial in a concrete culvert, placing the system above ground.
2. Do you use a one pipe or a two-pipe system?
3. What kind of system backup do you use?

From our analysis, based on what we infer to be the subsurface temperatures at Kotzebue, we find that the wells must produce 1500 gallons per minute. A 750 gpm geothermal well is unusually good, though not very unusual. A key problem is the cost of pumping so much water out of the well. The annual electric energy cost for the pumps would cost no less than $205,000, based on our present view of downhole pressures and permeability, and present generating costs in Kotzebue.

Our estimate, outlined in Figures 4, 5 and 6, is that the total annual cost of geothermal district heat would be about $2,500,000.

The above annual cost is based on an estimate of $7,590,000 for the district heat system and $12.5 million for the wells. If the wells were located closer to the center of town, which is feasible only if fears of subsidence could be overcome, the cost of the district heat system could

be reduced to $6,000,000. With the most optimistic reasoning, well costs could be reduced to $4,000,000, using a truck mounted rig. Thus, the lowest imaginable cost for the system is $10,000,000. Thus the capital cost alone (ignoring operating and maintenance) would be $943,900 per year ($10,000,000 amortized at 7% for 20 years). My conclusion is that the lowest conceivable cost of geothermal district heat is similar to the present cost of oil, so that economics alone do not justify geothermal, but since the district heat system without geothermal might be useful, an effort should be made to further refine the feasibility analysis of district heat.

GEOLOGIC ASSESSMENT

From the geological information compiled by Arlen Ehm, References 4 to 15 and Figure 10, p. 44, we come to the following conclusions:

1. We can probably find a formation at 6-8000 ft. depth below Kotzebue that will produce saline water (2 x seawater) at 160-178°F.
2. The downhole pressure may be sufficient to bring the water to a static level 250-500 ft. below the surface.
3. The data indicates thick sections of high porosity under Kotzebue, but the only way to determine well production rates is to drill a well at Kotzebue and pump it.

All of this is based on extrapolations from the Nimiuk Point and Cape Espenberg wells, and general geologic reasoning. The best available data to supplement these predictions is the seismic data owned by Chevron and NANA. Water analysis data from the Nimiuk and Cape Espenberg wells would also be useful. If seismic data is not available, electrical methods are the only way to verify the presence of saline water and the depth to equivalent basement with the budget available.

RECOMMENDATIONS

1. Request seismic and water chemistry information from NANA and Chevron.
2. Integrate this information with the geological data in the references to obtain the best possible prediction of what a geothermal well at Kotzebue would produce.
3. Get more information on what electrical and magnetic geophysical techniques will show.
4. Apply to HUD for funds to do a district heat scoping study for Kotzebue including geothermal, coal, and heat pump energy sources.

EDITORS NOTE

The following are notes of the advisory committee meeting. The headings refer to the person who was leading the discussion. The paragraphs following are a summary of the discussion, not a verbatim transcript. The notes were reviewed with a tape recording of the meeting to be sure the relevant points were included.

Participants

Name	Organization
John Beebee	Energy Systems, Inc.
William E. Ogle	Energy Systems, Inc.
Keith E. Brown	New Mexico Energy Institute
Gay Hammer	Eng. & Econ. Research, Inc.
Linda Fassbender	Battelle-Northwest
John W. Reeder	Alaska Div. of Geol. & Geophy. Surveys
Gene Moore	City Manager - Kotzebue, Alaska
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Leland Roy Mink	DOE/Idaho, Idaho Falls, Idaho
Roman Motyka	Alaska Div. of Geol. & Geophy. Surveys
Ed DiBello	EG&G Idaho, Inc.
Arlen Ehm	Geological Consultant/Energy Systems, Inc.
Jack Howard	Lawrence Berkeley Laboratory
Gene Wescott	University of Alaska-Geophysical Institute

NOTES

ALASKA STATE DIVISION OF ENERGY AND POWER DEVELOPMENT

KOTZEBUE ADVISORY PANEL MEETING

September 12, 1980
Salt Lake City, Utah

Energy Systems, Inc. - William Ogle

The purpose of the meeting is to determine what to do with the $600,000 appropriated for the Kotzebue Geothermal Project. The question is pretty open - we could "return" the money to the State or go all out on drilling a well.

Division of Energy and Power Development - Don Markle

The purpose of the appropriation is to develop a local energy source. The program started when Chevron drilled two wells, at Nimiuk Point and Cape Espenberg, for petroleum. There seemed to be a normal gradient geothermal resource. (The wells didn't seem to show petroleum and were abandoned.) Bob Forbes, of the University of Alaska Geophysical Institute, who is unfortunately not able to be here today, and some others submitted a proposal to look into the possibility of using the geothermal waters. That was 4 years ago. The proposal was turned down by the Department of Energy, but was resubmitted by the City of Kotzebue 2 years ago. It was turned down again.

Kotzebue is the regional center for the northwest Arctic region, in the sense that state social services for this region are centered there, and supplies are landed there and distributed.

The State of Alaska has a "policy" of trying to put oil revenues into renewable resource projects. Senator Frank Ferguson asked the State Division of Geological and Geophysical Surveys for figures on what a normal gradient geothermal project would cost. They recommended $6 million, primarily for a well. The other alternative was $60,000 for a feasibility study. The upshot was a $600,000 appropriation for a Kotzebue geothermal project. Its an odd amount of money. We could design a district heat system for geothermal or coal, and return the balance to the State. We could use it as leverage for participating in federal programs like the user coupled drilling program.

Now that the State has an energy institute, which is presumably responsible for research and development of this sort, could the management of the project change? The answer is probably no.

Could the $600,000 be redirected to the Pilgrim Springs Project? The answer is no, but there is $250,000 in the Energy Center appropriation for the Pilgrim Springs project. Incidentally, since some of the people at this meeting helped us with that project, I can say that project is a success - there seems to be a good resource there. We are waiting on roads and leases before proceeding further. We also have a project at Unalaska, looking into the possibility of electricity. There is a "district heat" prospect at Tenakee Springs. The University of Alaska is compiling a geothermal atlas for the State.

City of Kotzebue - Gene Moore

Kotzebue has about 2500 people who live on 294 acres located on a spit 3 mi. long and 3600 ft. wide in Kotzebue Sound, 30 mi. N of the Arctic circle. The Corporate limits include 26 1/2 sq. mi. It is the regional center for 10 villages dependent on Kotzebue for hospitals, schools, fuel, and transportation. The region is about the size of Ohio. The population is 84% (approximately) Inupiat Eskimo. The economic mainstay is government. Kotzebue swells in population in summer, to 4-5000, as people come in to fish. Kotzebue has a 5 acre campground to accommodate them. Kotzebue influences the region. It has the only airport that can handle jets. (It is 1 hr. and 10 min. to Anchorage by jet.) Supplies mostly come on 4 barges between July and September. The barges have to dock 13 miles off-shore and lighter goods ashore. This adds 25% to the cost of goods.

People work when it is available, but the economy is mostly subsistence. Officially, 22% of the working population is unemployed. The real figure is higher. The total region has about 5000 people.

There has been a lot of building going on in Kotzebue. There have been 20 new homes, a 29 unit apartment complex, a $2,000,000 human services complex, and a new school. We will be building a larger skills center.

People are enthused about geothermal, peat, and coal. The coal is about 60 miles across the water, near Deering.

Some people have personal gardens, and there is a little research into commercial grain and potato growing.

The Public Health Service built a water and sewer system, over a 17 year period. They started with plain uninsulated plastic pipe in the ground. It

eventually failed due to freezing problems. The system was rebuilt and rebuilt again. The water is heated to 47°F at the source and it is sent 8000 ft. to the treatment plant, at which point it is about 32°F. The water circulates constantly through 4 loops. Waste heat from the power plant is used to heat it. The sewer system is based on gravity, with force mains. A lagoon is used for treatment. The sewer system has an infiltration problem.

Northwest Alaska Native Association (NANA) - Don Argetsinger

NANA is a native regional corporation. It has 5000 shareholders, and $65 million in assets. It has title to 2 1/2 million acres. The regional corporation merged with all the village corporations except Kotzebue (the Kikitagamniut Inupiat Corporation). Except for the case of Kotzebue, NANA owns both the surface and the subsurface estate. NANA is involved in a number of businesses, mostly related to oil. In the region, it has a hotel in Kotzebue, reindeer herds and a jade plant.

By agreement with NANA Chevron drilled the two wells to be considered here, in 1975. Chevron and NANA share the information. Chevron is obligated to do further work when NANA gets all land entitlements - in the next few weeks. They must look at a certain number of acres in a given time frame. NANA needs the consent of the villages it merged with when exploration takes place on their lands. NANA has 8 or 9 employees in Kotzebue, and the local corporations have some more. All villages are second class cities. NANA probably owns the Deering coal but not the Hope coal.

Mauneluk Association - Jeff Smith

Mauneluk is a village non-profit corporation. It is quasigovernmental, but has no government authority. It is a contractor for government services like planning and health, manpower studies and training. It is funded mainly by the State and Federal governments. It has 80 direct employees, and 150 indirect employees through the Community Employment Training Act. It administers $8 million in grants.

Mauneluk is doing a vegetation mapping study and is involved in a regional strategy plan for economic development, coastal management, etc.

If there was a district heat system in Kotzebue, it would be a municipal utility. The electric association is an REA coop.

The Kikitagarmiut Corporation is the Kotzebue village profit corporation.

Energy Systems, Inc. - John Beebee

Energy Systems estimated space heating fuel needs at Kotzebue and made a preliminary assessment of District heat

Figure 1 shows Kotzebue, as it appeared in 1978. The city is only 10 feet above sea level, making subsidence a serious consideration. The Public Health Service installed a water system. The mains are shown as dashed lines. There are four loops, mostly 4 in. diameter pipe in 12 in. casing, with insulation between. There are about 500 connections to the system at present. (There are 467 houses). The pipe is shallowly buried. Once the water reaches the treatment plant, it is heated by means of waste heat from the diesel-electric power plant. We don't know what portion of the heat from the diesels is used. The water system, as it

exists today, including the collection works, cost $5 million. However, it is hard to set an exact figure, because the sewer and water were built together, and parts of the system were reconstructed, over a 17 year period.

Don Clemson at EG&G has been looking at the possibility of circulating 100°F water by means of water mains and using it for both heating and culinary purposes by means of heat pumps. Since Kotzebue has a circulating system, it might be well worth looking at. A rough calculation shows that a lot of the heat could be supplied by the diesel electric generators. At this temperature expansion is not a problem, but the 4 in. diameter sounds too small, for Kotzebue. Also, the heat pumps would have to work off of diesel electricity at $.22 per kw-hr. Nobody in Kotzebue heats with electricity. A permafrost engineer would have to look to see if the higher temperatures would be a problem. In the Soviet Union there are some installations where treated 140°F water is piped to the houses and used for heating and sanitary purposes, and then cooled for cold water.

I am not sure how the engineers will handle the permafrost problem. Although the permafrost is not bad at Kotzebue, the effect of adding a lot of heat to the ground is hard to predict. There is a military installation 3 miles south of Kotzebue, a radar site with about 100 employees. They have a central heat supply with above ground distribution. The feasibility of above ground or surface level utilidors would have to be looked at. Some of the sewer mains are pretty deep, 10-15 ft. Below 5 ft. you have to use a jackhammer or thawing all year.

Figure 2 shows some figures on oil use at Kotzebue. We compared a study by Retherford Associates and one by Louis Berger and Associates, and then chose the figures we liked best. The conclusion is that Kotzebue seems to use about .875 million gallons of oil per year for space heat. The Mayor, Mr. Royal Harris, who is manager of the fuel supply, estimates 1.2 million gallons were used in the past year, and that consumption is more or less level. It is hard to favor either figure. The .875 million gallon figure is based on a house to house survey of oil use by the Mauneluk Association, and estimates for commercial buildings by square footage. It was not able to take wind chill effects into account. The 1.2 million gallon estimate is based on records of fuel sales, and hence does not account for the fuel after it leaves Arctic Lighterage, the fuel dealer. It also appears that some of the difference may be accounted for by leaks.

Fuel at the dealer costs $1.22/gal, but in many cases there is a delivery charge that must be added. Also note that the cost of electricity is around $.20 per kw-hr to residential users. The actual cost of generation alone is around $.13 per kw-hr, and this is charged to large users, consumption over 10,000 kw-hr/mon.

Houses in Kotzebue are pretty well insulated--6 in. thick walls. The houses are small, 600 to 900 sq. ft. for a family of 4 to 6. People have trouble paying their fuel bill. Water and sewer cost $60 per month per residence, but this doesn't completely cover system operation and maintenance. Most houses burn the oil in a space heater, but commercial buildings and new apartments have hydronic heat, using a very small

circulation pump.

It is easy to forget, when talking about $20 million district heat systems, that over the years you may pay this for oil. Figure 3 shows our estimate of what Kotzebue will pay for space heat based on oil in the coming years. The main points are that they are presently paying about $1 million per year for space heat, but with a 4% per year increase in population, a 3% increase in per capita consumption, and a 5% (above inflation) per year increase in oil prices, they will spend $20 million (1980 dollars) for oil between now and 1990.

Using the figures already developed, on energy use for space heat, and estimates what geothermal wells will produce, we made a small feasibility study for district heat, shown in Figures 4,5, and 6. We used 158°F for the well temperature, vs. the 162°F measured bottomhole temperature in the Nimiuk well. By using a two pipe system things could be arranged so that all houses get an approximately equal supply temperature. This was about the absolute minimum temperature for a district heat system. A 40°F drop from 150°F requires a large heat exchanger, or one that uses a lot of electricity, in the houses. A 400 watt fan running all year would consume over $770 worth of electricity.

For planning the geothermal wells, we need 1500 gpm flow. This is usually two or three wells.

Salinity of the geothermal water is predicted to be twice seawater, and hence you need a flat-plate heat exchanger at the wellhead.

The Public Health Service estimates a cost of $60-70 per foot for 4 in. diameter mains in a 12 in. aluminum jacket, buried, with a normal

number of fittings. I assumed cost increased linearly with diameter, and that one-way lines cost 75% as much as dual lines. The resulting costs are similar to estimates in the literature for pipes layed in downtown Stockholm and eastern U.S. cities, though obviously in these places a lot of money is spent displacing existing utilities and breaking pavement.

The City of Kotzebue finds it costs about $35 per foot, with an average number of fittings, for materials and labor, for the 4 in. diameter Arctic pipe. This is an awful lot lower than ESI's estimate. With a district heat system, there would be a lot more cutting and filling, and possibly a concrete culvert, to keep heat from leaking into the ground, and to keep traffic from breaking the system. Also, with such a low supply temperature you may need a 2 pipe system. It is hard to figure out the cost of dealing with the permafrost, or how to best deal with it. A more detailed study needs to be done to determine the cost more reliably, but even it couldn't nail down things like contractor contingency fees.

As will be seen later, when Arlen talks about the geology, it looks like the pump setting depth will be at least 1000 ft. This is a problem, because pumping an average of 660 gpm against a 1000 ft. head is going to use at least $205,000 per year in electricity. The well cost, $5,000,000 per well, is based on commonly quoted figures for petroleum wells in the bush. There doesn't seem to be any logical reason why the wells should cost this much. The 2 1/2 wells assumes 2 production and one injection well. Similar wells at Raft River cost $1 million each,

and there are some on the East Coast that cost $600,000.

A 250 HP pump would require an 8" casing.

As can be seen, our estimate gives a total annual cost for geothermal district heat for Kotzebue of $2,500,000. Fuel for space heat in Kotzebue now costs about $1,000,000 per year.

The last figure (Figure 7, p. 41) shows some other considerations for Kotzebue district heat. The most outstanding advantage of district heat is that it can use a variety of heat sources. In the case of Kotzebue, waste heat from a coal fired electric plant might be worth looking at. Geothermal district heat is extremely capital intensive. It would create about the same number of local jobs it would displace in fuel sales. It is, however, a local source of heat.

Do you need some sort of backup heat for the geothermal system? The diesel exhaust heat is a good topping source. Perhaps by using waste heat or auxilliary boilers you could reduce the size and cost of the mains and household heat exchangers. Perhaps, but the cost of the mains goes up linearly with diameter, while the energy carrying capacity goes up with the square. Thus it is cheap to oversize the mains, within limits.

Comparison with Reykjavik, a successful geothermal heating system, shows that Kotzebue has a much lower heat density, and the supply temperature is lower. Thanks to Battelle, I did find a couple of geothermally heated towns in Iceland with heat densities similar to Kotzebue.

Energy Systems, Inc. - William Ogle

I did a parametric study, based on alternative well costs and depths to John's.

Looking at Figure 8, p. 42, the well depth affects the supply temperature, the flow rate required, the probable number of wells, and the pumping cost, as well as the cost per well. I assumed you could get 400-500 gpm per well. Note that there is a depth at which the cost is minimum (around 6000 ft.).

The first column shows well depth in feet. The second column shows the predicted bottomhole temperature. The gradient used is the measured gradient for the Nimiuk well. The third column shows the useful temperature drop, assuming a reject temperature of 110°F. It would be hard to use water below this temperature without heat pumps. The fourth column shows the average system power, in megawatts. The fifth column shows the required amount of water. The sixth column shows different assumptions for pump setting depths. The next column is the number of wells, rounded off to an integral number. The eighth column, headed Y$, is the cost for the first 4000 ft. of drilling. I assumed that after this the cost was only half as much. If we don't think optimistically the answer is too obvious. The ninth column, Z$, is the estimated cost of the district heat system. There is a funny sort of economics being discussed in Alaska, in which oil revenues are invested for capital equipment for utilizing renewable energy resources, and the cost of that equipment is not considered in computing the cost of that energy. Thus I looked at the case where the district heat system costs nothing. The tenth column is the 30 year amortization rate. (The Alaska Power Authority has 8.5% money.) The current