9803

Final Report

To

ALASKA POWER AUTHORITY

On

PELICAN POWER ALTERNATIVES
PHASE I - RECONNAISSANCE ASSESSMENT

APRIL 1982

USKH-ENGINEERING SCIENCE A JOINT VENTURE

2515 "A" STREET • ANCHORAGE, ALASKA 99503 • 907/276-4245

Report On

PELICAN POWER ALTERNATIVES
PHASE 1 - RECONNAISSANCE ASSESSMENT

Prepared for

ALASKA POWER AUTHORITY

April 1982

Prepared by

USKH-ENGINEERING SCIENCE - A Joint Venture

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16 April 1982
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Mr. Jerry Larson
Alaska Power Authority
334 West 5th Street
Anchorage, Alaska

Subject: Pelican Project, Final Phase I Report

Dear Jerry:

This letter transmits five copies of the final Phase I Report on the Pelican Project. It differs from the copy which Harvey gave you at Pelican dated 9 April in the following respects:

1) Appendices E and F are included.
2) The economic analyses are based on a 50-year study period, which represents the economic life of the hydro facility, rather than the 35-year amortization period. The text is edited to reflect these changes.

Harvey reports that we are authorized to complete our obligation under Phase I, so the remaining 45 copies will be printed and expressed to you next week. Have a good holiday, and I hope to be seeing you soon.

Very truly yours,

Pat. Creegan

Patrick J. Creegan
Vice President
Northwest Region

PJC:mmb

cc: H. Hutchinson
USKH
B. C. Haight

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ACKNOWLEDGEMENT

We wish to commend the Pelican Cold Storage Company for their outstanding cooperation in this project and to thank them for the hospitality and help extended to us. Specifically, this refers to Jim Ferguson, President; Tom Whitmarsh and Cal Boord at Pelican; and Cavin Philbin at Seattle.

SECTION 1

SUMMARY AND CONCLUSIONS

SECTION 1

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SUMMARY

The Pelican hydropower plant, located on Pelican Creek, has been and still is a valuable source of renewable energy. This study reviewed the various reports written on one phase or another of the plant and/or creek. The published information was used where applicable and augmented with new data to supply needed information. The report points out that the town of Pelican, with its fish processing plant and cold storage, is a vital link in the economy of the Alaskan fish industry. The report also points out that a reasonable cost energy at Pelican will aid the fishing industry in being competitive with the world market. The report concludes that the Pelican hydropower plant facilities are in need of modernization to overcome the low efficiency that the present equipment is operating at, and take better advantage of available head and water supply.

CONCLUSIONS

1. The energy demand at Pelican is increasing.

2. The present hydropower plant does not have the capacity of meeting present load demands without diesel augmentation.

3. The diversion dam is in need of immediate repair. This would consist of replacing the lost rock mass.

4. The dam is in need of grouting, to keep the abutments from eroding, save water, improve power yield and safety, and extend the life of the facility to 50 years.

5. The intake gate needs to be replaced and remotely operated, for protection of the operator. This can be accomplished by using a simple hydraulic system.

6. Using the full head from the dam to the forebay would increase the hydropower production by 4 percent. It is recommended that a 60" pipe replace the present flume, some of which is in need of replacement. It would also avoid the chronic tunnel caving problem.

7. The forebay should be improved into a surge chamber and efficacious debris basin.

8. The penstock needs to be replaced.

9. The present control valve, turbine, governor, generator and switch gear should be replaced with a new machinery package (one 500 kW and one 250 kW turbine).

10. The powerhouse needs to be remodeled for the new equipment and repaired where needed.

11. Additional head should be utilized by extending the draft tube and building a new afterbay with tailwater elevation at MHW.

SECTION 2

INTRODUCTION

SECTION 2

INTRODUCTION

AUTHORIZATION

USKH-Engineering-Science (USKH-ES), located at 2515 A Street, Anchorage, Alaska 99503, was selected by the Alaska Power Authority (APA) in response to its submittal of qualifications. After being selected to perform the feasibility assignment of Power Alternatives for Pelican, a letter was received from APA, dated 4 November 1981, notifying it to proceed. The contract between the parties was signed November 3, 1981.

PELICAN, ALASKA

Pelican is a small community governed by a town council. It has a permanent population of approximately 180 people and 200 temporary residents during the fish processing season. It is located on the banks of the Lisianski Inlet at the mouth of Pelican Creek on Chichagof Island, 70 miles west of Juneau. The site for the town was selected because of its central location to service the fishing fleets 500 miles north and south, its harboring facilities, its water supply, and its hydropower potential. The economy is based on fishing and fish processing facilities which are located within the community. It has its own high school and grade school. The water is obtained from Pelican Creek for the community and fish processing plant. It is treated with chlorine before being placed into the system. The electrical power provided by the Pelican Utility Company, regulated by the Public Utilities Commission, supplies about

2,500,000 kWh of electricity to the community and storage company annually. The community is small, but served about 1,500 fishing vessels in 1980 and is critical to the fishing industry in that area.

Pelican Potential for the Future

With storage and a small diversion on Phonograph Creek there is a potential of about 1.1 MW of additional hydroelectric capability. The feasibility of that additional power is dependent of whether the cold storage and secondary processing is expanded. The expansion of the fish processing plant, which is presently being investigated (Scenario #2, Section 8) by the Pelican Cold Storage Company, calls for only about .66 MW in total production.

THE PROBLEM

The APA has employed the services of USKH-ES to perform a reconnaissance-level study, as outlined in Section 3, on the power facilities at Pelican, Alaska for the purpose of leading to a feasibility study of a suitable alternative to meet the power needs presently and in the future. The requirements are outlined in the APA register 1981 3AAC 94.055, Sec. 4 as amended.

SECTION 3

SCOPE OF WORK

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SCOPE OF WORK

The scope of work for the Phase I Reconnaissance Assessment of Pelican Power Alternatives is quoted directly from the contract as:

"PHASE 1 RECONNAISSANCE ASSSESSMENT

"1. Data Research

Obtain existing documents and guidelines from Alaska Power Authority in Anchorage. Contact State and Federal agencies in Juneau and Anchorage for reports and projections concerning the project area. Contact the Pelican Utility Company and the cold storage plant at Pelican by phone to obtain data on loads and load projections. Research in-house files of consultants on similar projects. Review regional faulting and seismic data. Interview DNR and COE officials familiar with dam safety programs and the Pelican project, in particular. Consolidate the research information.

"2. Field Investigation

Observe existing crib dam, dam abutments and channel conditions, flume foundation support, wood-stave penstock foundation and anchor support, assess overall slope stability, and tunnel condition. Observe general geologic conditions, and note particular zones of weakness such as faults and shear zones as they may affect the project. Make an initial assessment of cause of "settlement" reported under spillway. Observe power house and foundation conditions. Make initial geotechnical reconnaissance of overall project area to assess possibility of transmitting water directly from sources at higher elevations in the watershed. Document observed conditions using photographs, sketch maps and cross sections.

Obtain and confirm one-line diagram of system, distribution plan, nameplate data of generating equipment. Obtain revenue records and daily load records for the past five years, or obtain the best possible estimate for this data. Determine the amount of potable water provided and the impact on the hydroelectric installation. Obtain information on contemplated load growth and changes in load. Determine to the extent possible the wishes of the community for future power. Obtain data required for environmental assessments. Identify potential thermal loads for cogeneration.

Prepare a brief report of findings illustrated with maps, photos and sketches.

"3. Load Forecast

After examination of population growth, economic activity, future uses, appliance saturation levels, anticipated cost of power and existing power generation facilities, a forecast using APA's regulations will be made of electrical energy and peak load requirements to the year 2002.

"4. Alternatives

Review and determine the marketability of the available power generation options. Include, as a minimum, consideration of: repair and improvement of the existing hydro plant, increasing the hydro capability by drawing water from other watersheds, adding generating capacity to the existing hydro plant, or diesel generation.

Based on initial screening, formulate three or more energy supply plans to satisfy Pelican's forecasted power needs over a 20-year planning period. One plan, termed the base case plan, should be based on a continuation of present practices and a minimum level of repair work to maintain an acceptable level of safety. The other plans should be formulated using one or more of the options earlier identified. All plans should incorporate the utilization of waste heat (if any) to the extent that such use is economically justified.

"5. Cost Estimates

Develop detailed, site specific, cost estimates for each alternative that passes the initial screening. Calculate the present worth of life cycle costs for each energy supply plan in keeping with the Alaska Power Authority standard procedures.

Collect the necessary data and evaluate the impacts of each energy supply plan in keeping with the economic, environmental and technical indicators specified in Power Authority reconnaissance study regulations.

"6. Report

Prepare a draft Phase 1 report in 20 copies, respond in writing to comments received on the draft report and prepare a final report in 50 copies. The Phase 1 report should identify the additional data collection and analysis needed to complete a detailed feasibility report and prepare the necessary permit and license applications for project construction. The draft Phase 1 report will be submitted not later than January 31, 1982, and final report March 15, 1982."

Task 1, Data Research, is reported in Appendix A.

Task 2, Field Investigation, is reported in Appendix B and Sections 5 and 6.

Task 3, Load Forecast, is based on response to a questionnaire sent to the Pelican Cold Storage Company. This method of forecasting was used because Pelican is a "one company town"; the company has the only record of power consumption; and the company alone knows its plans for power consumption. The completed questionnaire is included in Appendix C and the actual load forecast is the subject of Section 10.

Task 4, Alternatives, is the subject of Section 11.

Task 5, Cost Estimates, is included in Appendix E.

SECTION 4

DESCRIPTION OF THE AREA

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LOCATION

Pelican is a small fishing village (population 175-200) located on the westerly side of Chichagof Island in southeastern Alaska.

Its water supply, used for domestic and industrial consumption and for hydroelectric power generation, comes from nearby Pelican Cove Creek on which the Pelican Cove Creek Dam (long. 136°12.4'W; lat. 57°57.4'N) is situated.

REGIONAL GEOLOGY

Chichagof Island lies in a broad belt that strikes northwest and southeast in conformance with the prevailing trend in southeastern Alaska. Within this belt, intrusives, made up largely of quartz diorities and other granitoid rocks, have been intruded parallel to the stratified country rock. These intrusions were accompanied by metamorphism of some rocks and extensive deformation of pre-existing rocks including folding, breaking, and moving of rocks by uplifting along vertical faults, strike-slip faults and possible thrust faulting.

REGIONAL SEISMICITY

Chichagof Island lies within the broad region of earthquake activity that includes much of southeastern Alaska, southeastern Yukon, and northwestern coastal British Columbia. Records are few and of short duration due to the meager population and scarcity of seismology stations in the region. The village of Pelican is located on the hidden Peril Strait fault which appears to join the Fairweather fault with the Chatam Strait (Lynn A. Yehle, 1974). The records show that, within a radius of 50 miles, an earthquake of magnitude 7.1 on the Richter scale took place in 1927 and one of magnitude 6.7 took place in 1973. The village is in seismic zone 3.

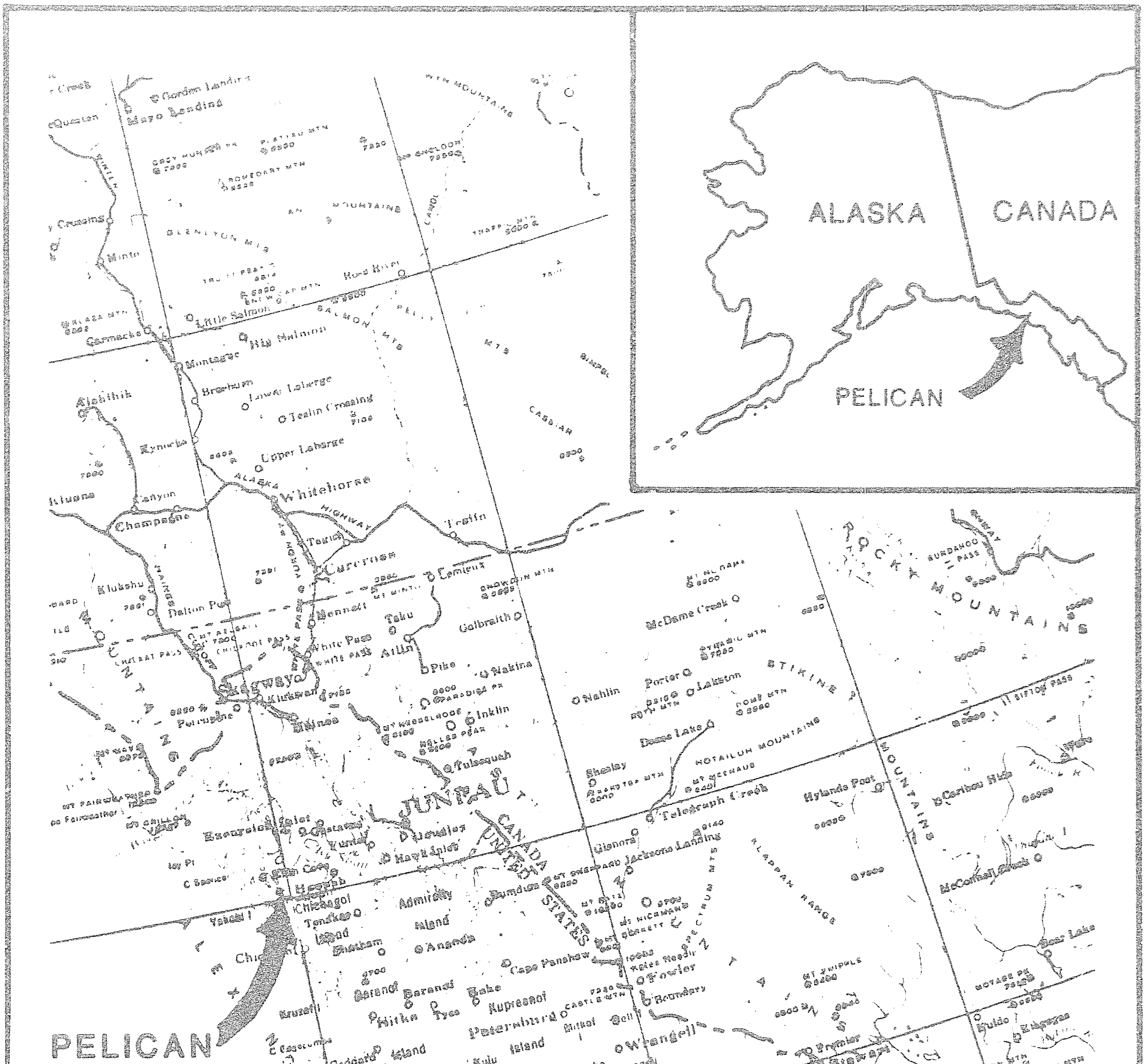
GEOLOGY AT PELICAN DAMSITE

The damsite is on Pelican Cove Creek, a deep, steep, narrow gorge running down the mountainside from a narrow plateau to tidewater. Bedrock has been identified as a syenite. At the damsite, the weathered zones have eroded away due to water action and the exposed foundation rock is a moderately jointed, sound, durable material.

PHYSIOGRAPHY AND CLIMATE AT PELICAN COVE CREEK

The drainage basin (see Figure 4.1) above Pelican Dam is 12.95 square miles and is located about 1/4 mile above the mouth of Pelican Creek which empties into the Lisianski Strait near Pelican about 70 miles west of Juneau. The drainage basin is one of a multitude of watersheds which drain excess precipitation and snowmelt from Chichagof Island. Basin topography ranges from a steep narrow canyon at the damsite to gentle sloping streambeds in the intermediate elevation zone with headwater areas beginning on steep precipitous mountain slopes whose peaks reach about 3,000 feet. Lower elevations of the watershed are covered with dense stands of conifer trees underlayed by a thick blanket of low growing vegetation and a surface mantle of spongy peat. As elevation increases, vegetation decreases. At about 1,500 feet, vegetation is near non-existent with the soil mantle removed to near bedrock by past glaciation. Prevailing maritime storms drench the area with heavy precipitation

FIGURE 4.1



LOCATION MAP

during the summer and cover the higher elevation zones with deep snow in the winter. As temperature moderates in the spring, snowmelt occurs, leaving the island nearly snowfree by the end of July. Late October and early November rain normally produces the most severe runoff condition when 24-hour accumulation reaches 8 inches or more. Long-term climatic data are not available at Pelican; however, climatic conditions at Sitka could be used for correlation. Climatic conditions at Sitka for a 99-year period show a mean annual temperature of 43°F with extremes of 90°F and -15°F and average annual precipitation is 97 inches. During the last five years, the Pelican precipitation has averaged 150" per year, while at Sitka the average was 120" per year during the same period.

PRECIPITATION

G. O. Balding reports average annual precipitation at Pelican for the period of 1967-1972 to be 126 inches, distributed as follows:

January	10"
February	12"
March	9"
April	7"
May	9"
June	3"
July	3"
August	11"
September	19"
October	15"
November	15"
December	8"

HYDROLOGY

Any surface water supply or power study requires knowledge of the hydrology of tributary watershed. When no raw data exist, they must be inferred by correlating to points where there are data.

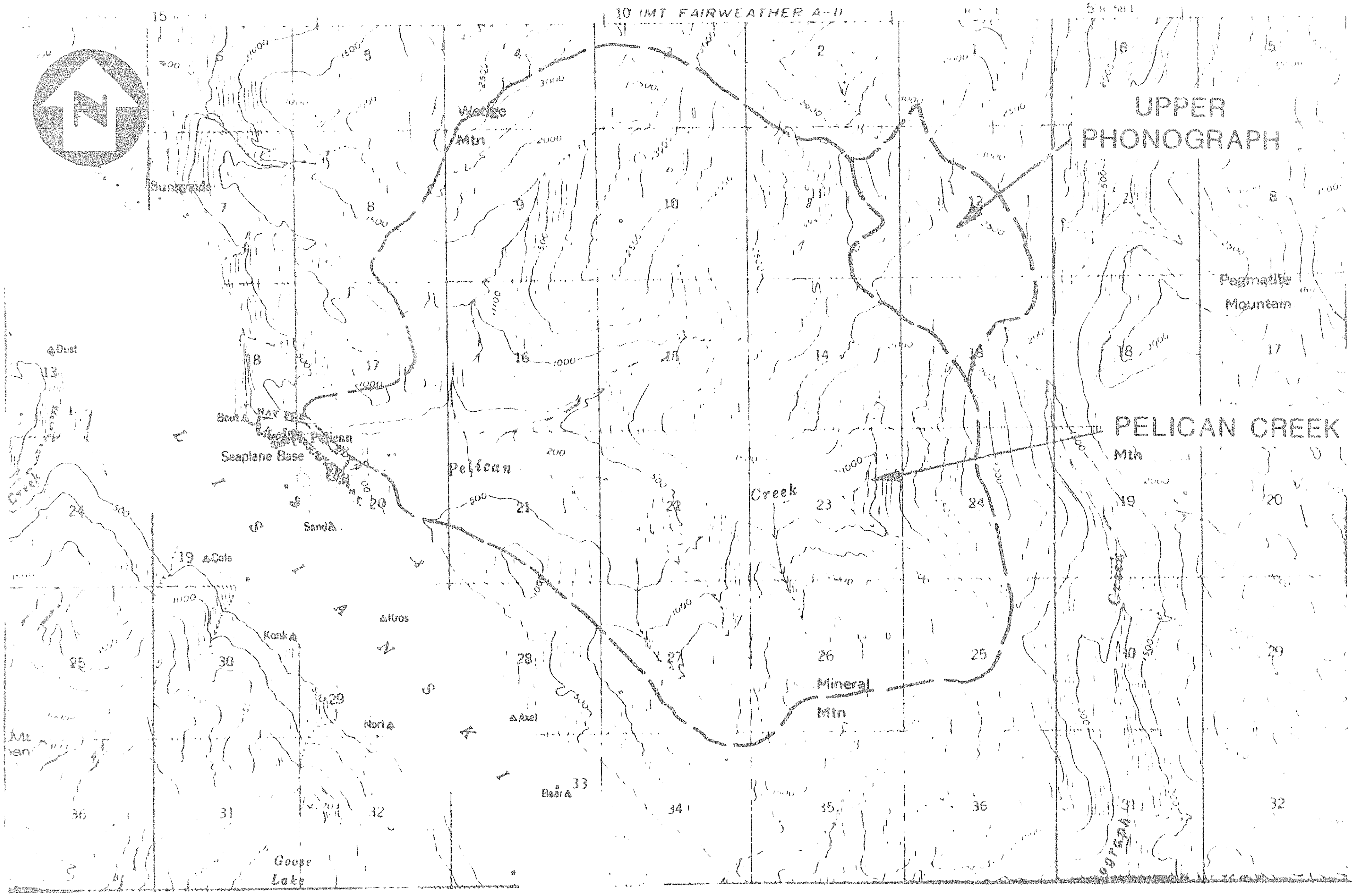
The U.S. Weather Bureau reports that no published precipitation records exist for Pelican. G. O. Balding reports an average rainfall of 126 inches per year at sea level, while others report 180 inches per year to be common. But both are significant because they indicate that Pelican is in one of the wettest spots in the north American continent. Topographically, it produces very high rates of runoff. The land above elevation +750 has been polished through glacial action and will produce almost 100 percent runoff. The land below elevation +750 supports conifers, is steep and has quite a thin soil mantle. Therefore, it will also have a high runoff factor. These observations related to precipitation were not used directly in the hydrologic investigations related to the project studies, but were used indirectly as checks on the reasonableness of conclusions.

There are no runoff records on Pelican Creek, but the U.S.G.S. does have some gaging stations nearby. One is at Black River on the far western slopes of Chichagof Island only about 20 miles southerly from Pelican. Two are on Hook Creek, located about 43 miles southeasterly from Pelican on the leeward side of Chichagof Island. Another is on Tonolite Creek, sometimes known as Kadashan River, into which Hook Creek flows. Black River has only one year of published record, while Hook Creek has eleven years. Oddly, the mean runoff of Black River during the year of record (8.91 cfs/sq mi) was exactly as recorded at one of the Hook Creek gages during that same period. Since Black River is judged to be representative of conditions on Pelican Cove Creek, it was decided that Hook Creek would be ideal to use for correlation studies. This was done (refer to Appendix D) and the significant estimates used in project formulation are contained in Table 4.1.

TABLE 4.1

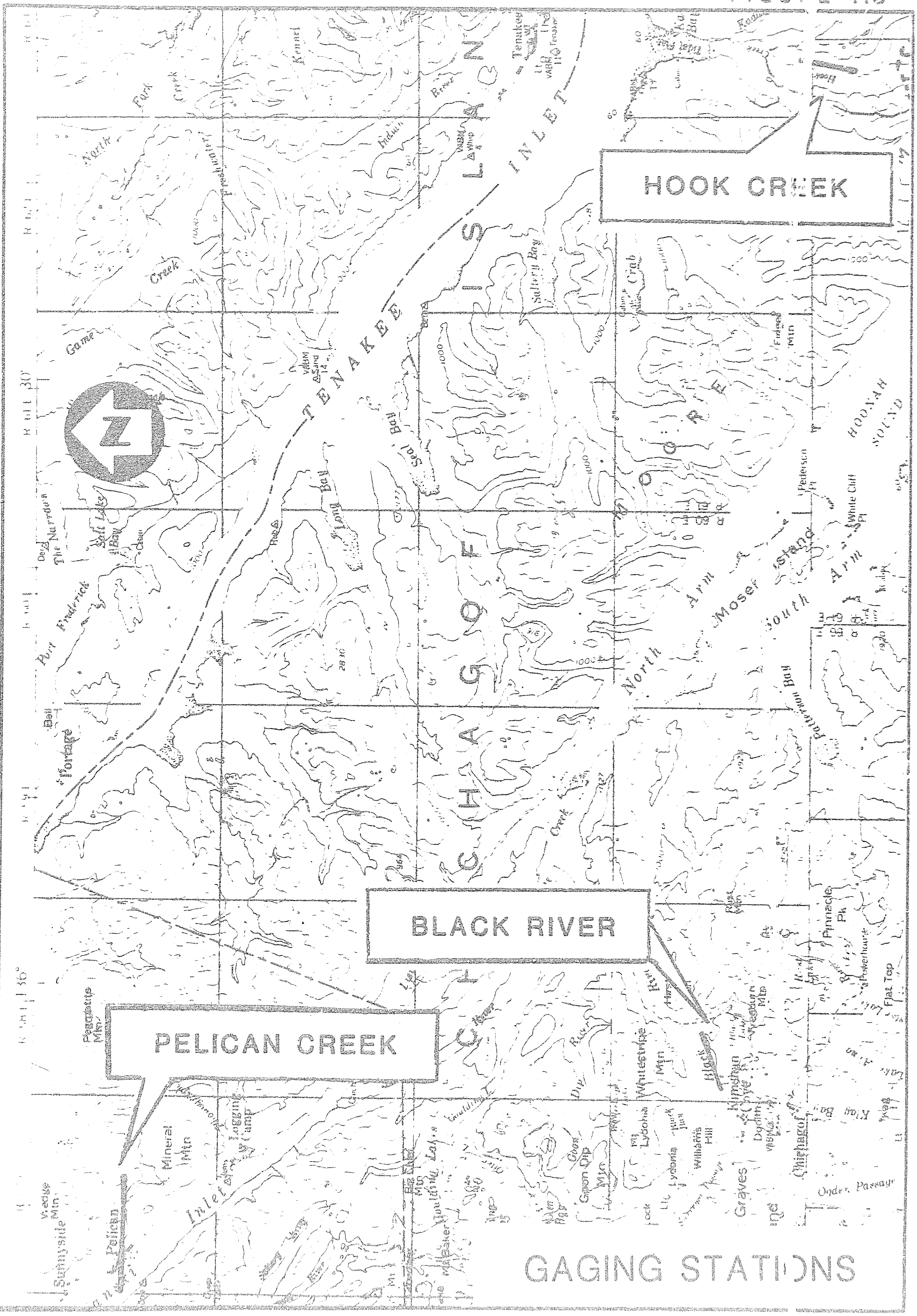
MEAN MONTHLY RUNOFF FOR STUDY AREA
(cfs)

Month	Upper Phonograph	Pelican >EL+750	Pelican <EL+750	Total Pelican @ Damsite
		Normal Year Average		
Oct	19.0	150.0	19.3	169.3
Nov	10.2	80.0	19.3	99.3
Dec	5.7	45.0	11.5	56.5
Jan	2.5	20.0	13.0	33.0
Feb	4.0	31.7	16.7	48.4
Mar	3.5	27.5	11.5	39.0
Apr	7.3	57.5	9.1	66.6
May	19.9	156.7	10.2	166.9
Jun	16.3	128.4	3.9	132.3
Jul	6.4	50.8	9.1	59.9
Aug	3.1	24.2	14.1	38.3
Sep	7.8	61.7	24.5	86.2
		Dry Year (75% of Mean)		
Oct	14.2	112.4	14.6	127.0
Nov	7.6	59.8	14.6	74.4
Dec	4.3	33.6	8.6	42.2
Jan	1.9	15.0	9.7	24.7
Feb	3.0	23.8	12.5	36.3
Mar	2.6	20.8	8.6	29.4
Apr	5.5	42.8	6.8	49.6
May	14.9	117.5	7.6	125.1
Jun	12.2	96.1	2.9	99.0
Jul	4.8	38.0	6.8	44.8
Aug	2.3	18.1	10.6	28.7
Sep	5.8	46.2	18.4	64.6



MAP OF WATERSHEDS

FIGURE 4.2



GAGING STATIONS

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SECTION 5

DESCRIPTION OF EXISTING FACILITY

SECTION 5

DESCRIPTION OF EXISTING FACILITY

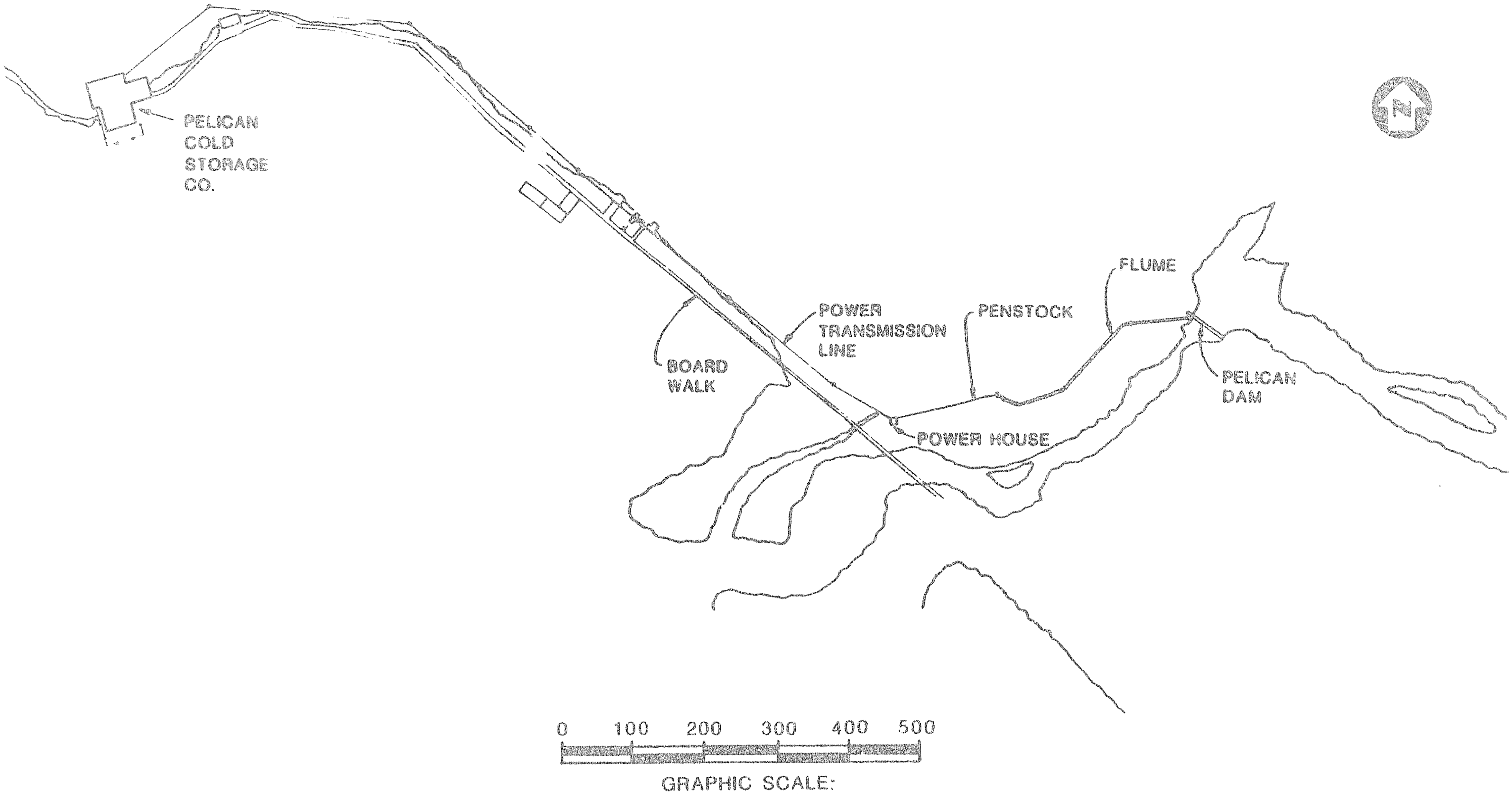
PELICAN HYDROELECTRIC STATION

The Pelican hydro system, mapped on Figure 5.1, is comprised of a diversion dam, gate structure, flume complex, penstock, and powerhouse. In 1940, the Pelican Cold Storage Company constructed a wood frame powerhouse, 18' x 33', with concrete foundations. Within the foundation wall is a draft tube sump (afterbay) with a 10' wide weir set above the tidewater level leading to a 6' wide x 5' deep concrete tailrace.

The concrete in these facilities is heavily deteriorated. The deterioration appeared to be caused by freeze-thaw action on outside walls, lack of converting water energy to electrical energy in the afterbays, and saltwater freeze-thaw on the lower foundation outer wall and the raceway walls.

The equipment in the structure is a James Leffel & Co. horizontal hydraulic turbine, 23-inch double discharge, constructed in 1906, 26-inch twin draft tubes, 42-inch diameter intake and gate valve (Ludlow Valve), 4-7/8-inch diameter shaft, 14-inch pressure relief valve, Woodward Type VR 3000 ft lb, 5-1/2 x 9, Patents 5/13/1890, 8/2/1898, 7/15/1890, 8/30/1901, and 8/11/1914, hydraulic oil governor that was rebuilt in 1974.

The turbine was originally manufactured in 1906 for a Denver, Colorado manufacturing plant to operate under 85-foot head delivering 560 horsepower at 600 rpm with 58 cfs



PELICAN GENERAL PLAN

FIGURE 5.1

USKH-ENGINEERING SCIENC

of water. Two 150 kW generators were originally connected directly on shaft--one on each end. In 1940, the Pelican Cold Storage Company purchased it. Since that time, the turbine has been partially rebuilt in 195 when a new runner was installed and the Woodward governor added to the installation. Other items have been replaced or additional items added on the turbine as the need for improved efficiency and greater reliability has arisen. One of the added items was the necessity to lubricate the wicket gates which were sticking under certain loads. However, the system of lubricating would prevent the Pelican Storage Company from using the water from the power plant afterbay for a planned fish hatchery due to the water quality during the time of lubrication. From tests that have been run recently, the turbine has lost from about 20 to 30 percent of its efficiency. Tom Whitmarsh, the plant superintendent, inspected the interior of the turbine and found some of the sharp edges of the impeller bent in the same manner as the old one that is stored in the powerhouse.

The 42-inch shut-off gate valve (Ludlow Type) just ahead of the turbine had developed a crack in an old repair. The cause was determined to be water hammer generated when a tree fell on the penstock and broke it. In 1980, this valve caused a two-month shut-down. The condition of the valve was recorded in Tom Whitmarsh's report, January 1981, where he reported the valve to be in poor shape. Its condition is due to age.

The penstock, constructed in 1940, is a continuous wood stave pipe 36 inches in diameter expanded to 42 inches just ahead of the Ludlow Valve in the powerhouse. It is about 310 feet long on a grade of about 19°, on a timber (yellow cedar) trestle. It terminates at a wooden box forebay. In November 1981, a tree fell on the penstock and broke it. The repair necessitated bringing in new material and a specialist to make the repair. Before the repairs were made, the specialist inspected the remaining penstock and found several places that were thin and the H connectors corroded and failed. He felt that the facility was nearing the end of its useful life. This winter at low water and freezing temperatures, the penstock is leaking so badly that it is dangerous for a person to walk along it.

The generator is General Electric Schnectady A.C. No. 607224 PFI Type ATB 10/500(750/735) Form C, 500 kW, 2300 volt, 125 amp speed 750/735 Patented 12/15/96, 8/29/99, 11/20/1900, 4/2/1901, and 12/2/1902. This generator was designed for and driven by an induction motor. It was rated for 500 KVA at unity P.F. and suitable for a 50 percent overload for 2 hours. The field winding was designed for a 125 volt excitation. The calculated field current for 500 KVA at 1 P.F. is 65 amps and at 50 percent overload it is 75 amps. The field resistance at 25°C was measured to be .75 ohms. This type motor-driven generator was not designed for the overspeeds that occur on water-driven turbines. Overspeeds have been recorded on the volt and cycle meters. Those meters pegged out at 3000 V and 64 cycles. The overspeed didn't seem to do any damage to the generator. The insulation is flaking off, but is being painted over with glyptol. This past summer when water was available, the generator was brought up to its 500 kW capacity.

The generator excitor is a Westinghouse 10 kW, 80 A (amps), 125 V, 1150 rpm, Type SK, Fram 63, Style 1167920, serial 244, D.C. driven by a CV belt pulley. This piece of equipment runs hot and must have a cooling system to operate. The new excitor is a Fidelity Electrical of Lancaster, PA, 10 kW, 120 V, 83.3 amps, serial 046380, 1450 rpm. It has never operated as intended. Both of these excitors are not reliable enough to continue operation for any extended period.

The switch gear is as follows: 1 synchroscope, 1 W.C. ammeter, reads to 150 amps, 1 G.E. voltage regulator, (director type GDA-32) 1 AC voltmeter reading 2210 through

2480-4160 V/240-480 transformer to produce 480 V in engine room, 1 frequency meter, 1 time meter recording hours of operation, 1 G.E. power circuit-breaker (type MG-5B, solenoid operated, oil-ballast circuit breaker), 1 G.E. type P C-7 time-delay under voltage device, 1 Cutter hammer 180 ohm max late type filed rheostat CR-8000-B1, 1 G.E. copper oxide rectifier for circuit breaker closing service, 1 transformer 2400 V/240/120 V for safety cut out trip voltage.

Several pieces of the above listed equipment are obsolete and do not perform within the time of new equipment and they are only partially reliable.

The forebay past the head of the penstock has a 3'-6" x 4'-4" rising stem, handwheel-operated gate. This was designed to shut the water off for maintenance of the lower system. The gate is too small to handle the flow and does not seal tightly. It also allows the water to flow over the top.

The manually-cleaned screens are also located in the forebay. These screens take care of removing about 97 percent of the debris, however, at the velocity that the water travels through this structure, some larger sticks and rocks do not get removed and pass into the system. The old impeller showed evidence of being struck by objects at high velocities which cut the efficiency of the impeller and cause loss of power and revenue. The impeller that is now in the turbine is reported to show the same type of damage.

The wooden flume from the forebay to the tunnel is 511 feet long, 5 feet wide, and 4 feet deep. Most of this section was replaced in 1974 and 1977. This section has a variable slope. Some of the slopes appear to be critical and some subcritical so that at the point that the two meet, a small hydraulic jump occurs and water is lost over the side, washing out some of the support system. This has been adjusted by adjusting the flow at the dam, but that doesn't last long because the turbine has a variable demand.

The tunnel is 5' x 5' x 85' long. The flumes are attached at each end and show some leakage at the connecting points. The tunnel has had cave-ins that have closed off about 1/3 of the capacity. The flume from the tunnel to the dam is 5' x 5' x 104' long and is the original structure. This section is in need of replacement due to the condition of the timbers and loss of water. The maintenance of this area is very costly. The intake gate at the dam is worn out and very dangerous to operate. It will not shut the water out of the flume which causes a slowing of the maintenance workers who have to get into the facilities.

The rock-filled timber crib dam is 135' long and is 22' high. The spillway is 50' wide and has had as much as 5' flowing over it at one time. Due to the lack of soil and vegetation to cover the drainage areas, the flow over the spillway can vary 5' in a 12-hour period. This variance is not an unusual occurrence. During the cold months, December, January, and February, there is rarely enough water to generate much power. Most of the available water is used for the town. During most winters, the hydropower plant is completely shut down for a period of up to 4 weeks. The planking on the lake side of the crib dam is vertical T & G 3" thick and 8" wide. The dam top surface is 2" x 12" double-planked with the lower board joints lapped by the upper boards. The wing walls are vertical planks. The rock fill under the spillway has slumped about 3 to 5 feet. The abutments that did not have a tight seal are showing signs of heavy erosion.

STANDBY DIESEL PLANT

There are four diesel generators which provide about 25 percent of the electrical power and are used when the hydropower plant cannot supply the needs. Those periods of time are usually in the summer when the fishing season is at its peak and the winter when Pelican Creek is at low-flow and the town system needs the majority of the creek flow to keep the water system from freezing. The generators are:

1. Caterpillar D-333A, 1800 rpm, 100 kW, 480 volts, 3-phase, serial 105 SH 489, purchased 1964.
2. Caterpillar D-333A, 1800 rpm, 100 kW, 480 volts, 3-phase, serial 105SH501, purchased 1964.
3. Caterpillar D-343, 1800 rpm, 285 kW, 480 volts, 3-phase, serial 200TH3669, purchased 1974.
4. Caterpillar D-3408, 1800 rpm, 200 kW, 480 volts, 3-phase, serial 205SH1099, purchased 1974.

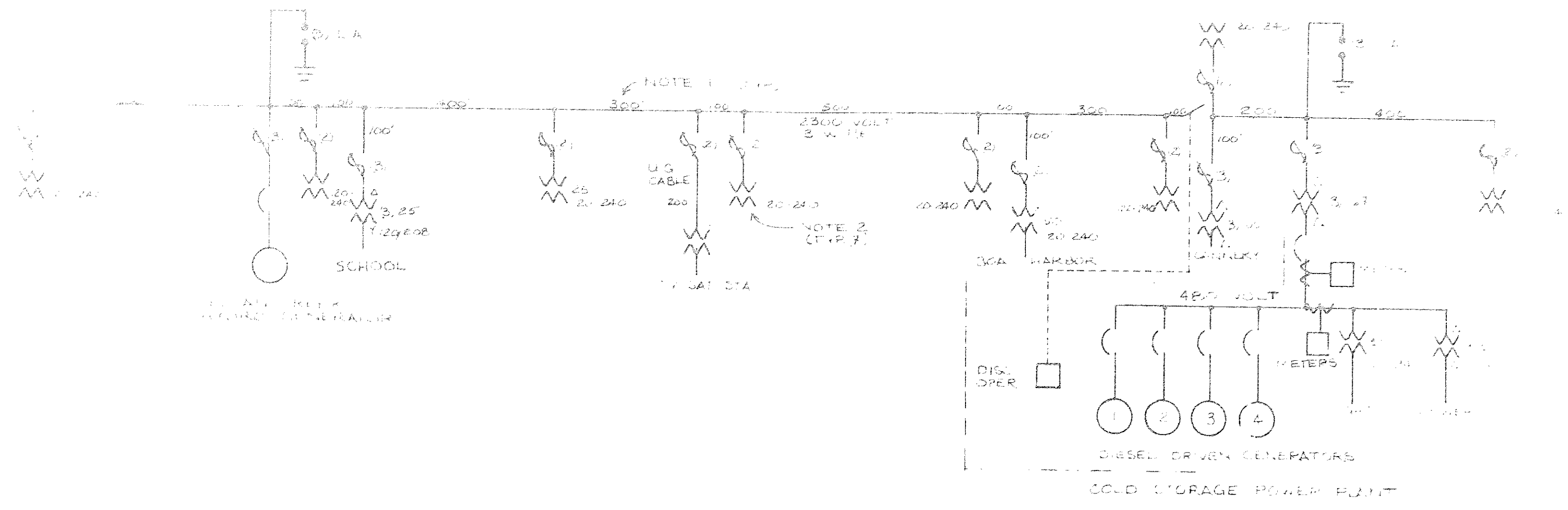
WATER SYSTEM

The water system is supplied directly out of Pelican Creek after it is chlorinated. The Cold Storage Company uses most of the water for its fish processing. The water system is under pressure which is provided from a connection to the penstock. During most of the year, there is adequate water for all users, hydropower, town, and processing plants. In the winter, water from the creek is passed through the system to keep it from freezing. This winter use is a wise use of the heat that is in the water. If this heat could not be taken advantage of, then the town would have to heat the water system with electrical power.

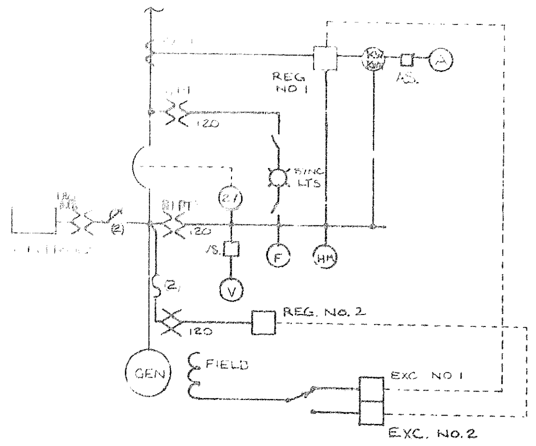
The watershed that provides the water has little cover to provide some natural purifying processes. The water, when it rains, will often find its way into the town system within a few hours, too short a time to catch some form of contaminents. Since the water is used for processing food and preserving fish throughout southeastern Alaska in the form of ice made from the waters of Pelican Creek, the system in the future may need a means of protecting its water quality from some forms of biological contamination.

POWER DISTRIBUTION SYSTEM

Appendix H contains the report of Benjamin C. Haight, our project electrical engineer, and describes the status of the power distribution system. Figure 5.2 shows the single line diagrams for that system.

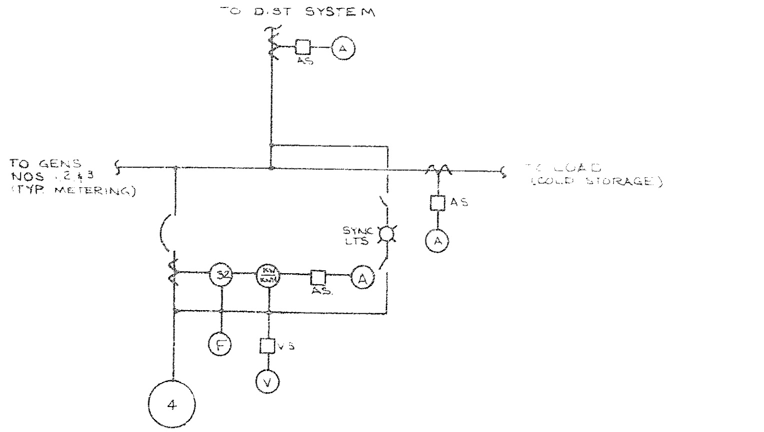


SINGLE LINE DIAGRAM - DISTRIBUTION SYSTEM



SINGLE LINE DIAGRAM - HYDRO GENERATOR

NOTE 3



SINGLE LINE DIAGRAM - DIESEL GENERATORS

NOTE 3

STATE OF ALASKA
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PELICAN UTILITIES
ELECTRICAL GENERATION AND DISTRIBUTION FACILITIES

SINGLE LINE DIAGRAMS

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SECTION 6

CRITIQUE OF THE PELICAN HYDRO SYSTEM

SECTION 6

CRITIQUE OF THE PELICAN HYDRO SYSTEM

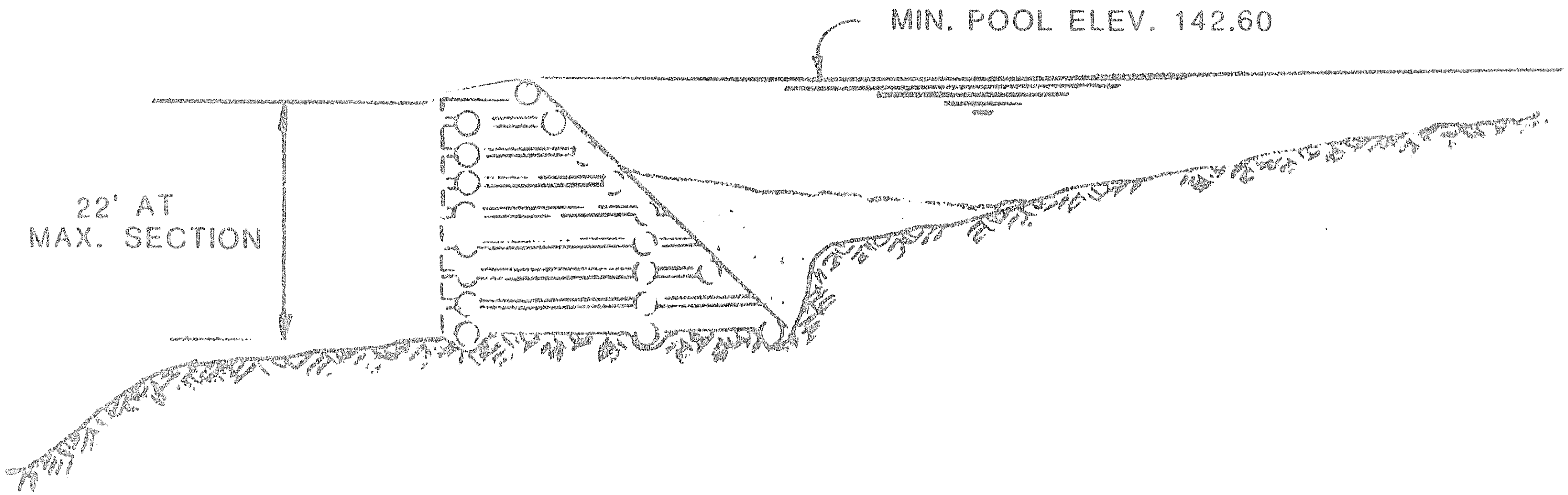
INTRODUCTION

On the dates of 9 and 10 November 1981, an inspection was made of the Pelican hydroelectric generation system for purposes of surveying the condition of the facilities and determining what would constitute a minimum and required restoration program, and what would constitute a recommended and desirable restoration program to keep the system in operation. Appendix B includes the trip diary of that inspection. Section 5 describes the system composed of diversion dam, gate structure, flume complex, penstock and powerhouse. This section describes the works in more detail, critiques their condition and discusses remedies.

DAM

Pelican Dam was constructed in 1941 to divert water from Pelican Cove Creek into a powerhouse about 120 feet below and into the water system serving the domestic and industrial needs of the community. It is a rock-filled timber crib structure about 135 feet long and 22 feet at its greatest height. As-built plans of the structure do not exist, but the approximate section, as described in the 1978 COE Phase I inspection report for the National Dam Safety Program, is shown on Figure 6.1.

The cribs are skinned logs of Alaska yellow cedar, approximately 8.5 feet on centers. The upstream face, the braced right wing wall and the overflow spillway are all 3 x 8 Alaska yellow cedar planking.



SECTION THRU PELICAN DAM

FIGURE 6.1

USKH-ENGINEERING SCIENCE

The dam serves a valuable function but is in urgent need of repair. Should it wash out, it would be difficult and expensive structure to replace. Accordingly, if it survives the spring runoff of 1982, restoration is recommended during the next low flow months so as to give it renewed economic life.

Pelican Lake, behind the dam, is a shallow reservoir having a volume of perhaps 50 acre-feet or less. Total failure of the dam is envisioned to occur during an exceptionally high flow, and would probably be progressive. No downstream loss of life or property would be expected from the dam failure itself, although such could be expected from the one-half probable maximum flood. Restoration and upgrading is required to protect the investment and permit continued hydroelectric power generation for the community of Pelican.

The dam leaks badly and the rockfill in the cribs is reported to have slumped 3-5 feet. This slumping is judged to be the result of a combination of bottom rock being carried away by leakage through the dam and higher rock being sucked out of the downstream face of the dam by negative pressure under the lower nappe of the spill during high discharge.

Abutment abrasion has been reported. This is interpreted as the effect of jetting action at leaks.

The crib logs, connected with iron pins, are reported to be in basically sound condition, with rot around some of the pin holes.

The right wing wall also leaks badly and gives the impression of being rather flimsy in the face of high flows, which often reach 1000 cfs. The dam should be made capable of passing 8,000 cfs.

The 54" slide gate at the flume intake needs to be replaced. At the present time, a jack is used to accomplish closure. It is located in the right wing wall, which is a precarious and dangerous location for the man being asked to operate the valve. Remote operation is recommended.

Minimum maintenance at this time calls for lifting the spillway planks, refilling the cribs with rock, replacing the spillway planks and replacing the valve. That progam is "band-aid" in nature and is at best a temporary solution. The dam would remain unsafe due to its inadequate spillway capacity and would require subsequent repairs at frequent intervals.

The recommended program is to convert the dam proper from a rock-filled timber crib with a questionable life to a permanent gravity concrete dam by intrusion grouting of the existing structure. The procedure would be to:

1. Stop seepage by covering the upstream face of the dam with tough temporary construction fabric.
2. Ballast the sheet with 2 feet of gravel.
3. Remove spillway planking.
4. Set 4 heavily perforated pipes 8" Ø steel pipes vertically to bedrock at 15' ± c/c along the axis of the dam.
5. Backfill these pipes and the dam itself to spillway grade with 3" to 5" open graded gravel or shot rock.
6. Cover the downstream face of the dam with a tough construction fabric. Sheet over that fabric with vertical 1x planking nailed to cribbing. Support the planking with wales bolted to the cribbing. Caulk at abutment contacts.
7. Set 2" Ø grout pipes in the 8" PMPs, and connect these to a flexible header leading to the discharge of a grout pump connected to a grout mixing tank. Each grout pipe will be valved at the header and

will have a union at 4' on centers to facilitate gradual withdrawal during the grouting process.

8. Intrusion grout the dam. The grout should be a low viscosity but rich mixture of cement and water. The grouting operation should be continuous, and the grout pipes progressively withdrawn--the grout pipes functioning as tremies with the tip of the pipes being maintained about 1 foot below the level of grout in the 8" Ø PMP.

9. Pour a reinforced concrete spillway slab as a cap on the dam.

10. Replace the timber wing wall with a buttressed reinforced concrete wall, anchored into the rock foundations. This wall will include a diversion port covered by trash racks, with the existing gate removed and replaced by a new hydraulically operated gate with remote control. This modification will permit the dam to safely pass the 8,000 cfs design flood, recommended by the COE, by overtopping the wing wall; and will provide for a secluded and safe location for the valve operator.

FLUME AND PENSTOCK

The flume between the dam and penstock is a 5' wide x 4' deep "U" shaped timber channel, supported on timber bents, set on a gentle slope running 104 feet from the dam to a tunnel portal; thence through 85 feet of 6' Ø unlined tunnel dug through a point of rock; thence returning to the bent supported timber channel, to a bar screen and diversion and overflow box; thence continuing as a bent supported timber channel to its terminus at a rock catcher box and surge chamber at the penstock forebay. The length from the tunnel to the rock box is 511 feet, making the total flume system 700 feet long.

The penstock is a 36" Ø nominal circular wood stave pipe with steel reinforcing hoops. It is 326 feet long, running on a straight alignment and about a 19 percent grade.

The only way the dam can pass design flood is by overtopping the wing wall. This would take out the flume in that section. In addition, the tunnel has experienced roof spalling from time to time. To eliminate these problems, under Alternative #1, it is recommended that the flume be replaced from the dam to the downstream end of the tunnel with a 5' Ø pipe, properly anchored and with a timber roof protecting it from being carried away in flood. Phase II studies should determine whether this pipe be wood stave or metal. Under Alternative #3 it is recommended to replace the flume all the way from the dam to the penstock forebay in order to take advantage of full head in the reservoir and elimnate the need for the overflow structure.

Under Alternative #1 both the bar screen and overflow structure and the rock box surge chamber (penstock forebay) are called to be redesigned and reconstructed. The existing bar screen is difficult to maintain and has passed sticks through the turbine, causing damage to the impeller. The latter is also recommended under Alternative #3, so as to efficiently prevent rocks from passing down the penstock.

The penstock is worn to an estimated 1/2" wall thickness in places and is called to be replaced. Because of construction logistics, redwood wood-stave pipe is selected over steel. It has a life of 35-40 years.

The area under the flume and penstock is in need of housekeeping to reduce rot potential. Threatening trees should be guyed back so as to preclude windfalls such as took out the penstock last November.

The braced timber bent support structure is in fair condition. Certain members, on a selected basis, should be replaced to give the system a new life. This relates to perhaps 10 percent of the members. The pile members are founded directly on natural ground and can be expected to have a longer life if supported up about 1' off the ground with concrete footings.

POWERHOUSE AND GENERATING FACILITIES

The 42-inch Ludlow Valve is old and has failed. The water hammer which cracked the bonnet was only one in a series of problems in the last three years. In 1980, this valve caused a two-month down time of the hydro-system, at a great loss of revenue.

The Leffel Turbine has an impeller that is producing perhaps 20 percent less energy than a new one that would have less down time, and more flexibility to operate efficiently over a greater range of flows. The water quality change caused by the lubrication prevents the company from using the water for their proposed fish hatchery. The wall thickness of the turbine casing is 1/2 inch. Certainly, erosion during the 75 years of use has cut into its designed safety factor. A major overhaul of this turbine would be necessary but may not extend its useful life significantly. The turbine was purchased because it was available, not because it was the best suited for the flow of the creek. To continue this equipment's life may not be the best decision in lieu of the spiraling cost of energy.

The generator needs to be at least rewound.

The switch gear needs to be replaced with new equipment because most of the components are old and not reliable during times of stress.

The powerhouse needs major repairs to the foundation, especially in the afterbay and tail race sections of the facility. These, as a minimum, would require repair of the walls and installation of new steel liner. For optimum improvements, it is recommended that the draft tubes be extended and a new afterbay constructed that will take advantage of extra head available and thereby increase plant capacity by an additional 10 percent.

SECTION 7

HISTORY OF PELICAN UTILITY COMPANY LOADS AND REVENUES

SECTION 7

HISTORY OF PELICAN UTILITY COMPANY LOADS AND REVENUES

INTRODUCTION

Table 7.1 is drawn from information contained in Appendices C and H.

TABLE 7.1

LOAD AND REVENUE TRENDS

Fiscal[a] Year	kWh Produced	Gross Revenues From Water Sold Pelican Utility	Gross Revenues From Power Sold Pelican Utility	Revenue per kWh Produced (mils)
1977	2,350,000	$ 6,000	$ 75,000	31.9
1978	2,540,000	6,000	125,000	49.2
1979	2,650,000	6,000	140,000	52.8
1980	2,450,000	6,000[b]	144,000[c]	58.8
1981	2,625,000	11,000	210,000	80.0

[a]Pelican's FY is April 1 to March 31.
[b]Pelican Utility water rates increased about 40% during FY 1981.
[c]Pelican Utility power rates increased 22% during FY 1980.

SECTION 8

PLANNING SCENARIOS

SECTION 8

PLANNING SCENARIOS

There are two planning scenarios:

#1 - The industrial and urban power requirements of Pelican will remain more or less at present levels.

#2 - The industrial and urban power requirements of Pelican will increase 34 percent within the next few years, due to plans by the Pelican Cold Storage Company to change their regional operations.

SECTION 9

PUBLIC REACTION TO PROJECT

SECTION 9

PUBLIC REACTION TO PROJECT

PUBLIC QUESTIONNAIRE

The data of this section were obtained through questionnaires sent by the Town Council to each household in Pelican. There were only six questionnaires returned out of 50 sent out. The results of responses to that questionnaire are tabulated in Table 9.1.

TABLE 9.1

RESULTS OF PUBLIC QUESTIONNAIRE
(November 1981)

	Existing Utilities and Appliances				
	Wood	Oil	Electric	Gas	Other
Heating	3	6			
Cooking	1	5	3		
Toaster			5		
Dishwasher			1		
Clothes dryer			1	4	
Washing machine			6		
Hair dryer			4		
Water heater		4	1		
TV			3		
Radio			2		
Clock			2		
Baseboard heating					
Other					

TABLE 9.1 - Continued

	Utility Costs for 1981		
Questionnaire No.	Water $	Electric $	Fuel $
1	60.00	540	1950
2	134.40	458	950
3	--	-	--
4	--	572	1006
5	67.20	480	1380
6	72	577	1200

Even though only six questionnaires were received, they do contain some very valuable information. Out of the six questionnaires received, all said that they now use oil for heating and five use it for cooking. All said that if hydropower were cheaper than oil they would change to electrical heating. One user reported his costs over the last six years for electricity and fuel. That information is as follows.

Electrical Bill

Year	1976	1977	1978	1979	1980	1981	Increase
Cost($)	300	300	360	360	420	480	60%

Fuel Bill

Cost($)	700	700	750	1320	1825	1950	178%

This points to be beneficial effect that the hydrogeneration has had on the price of power. The hydropower costs have escalated about 60 percent in the past four years, whereas the fuel costs increased at almost three times that rate.

One questionnaire pointed out that power fluctuations have destroyed many radios, freezers, clocks and other major electrical items. This is borne out in other parts of the study and is caused by obsolete and worn equipment that needs replacing.

SECTION 10

WATER AND POWER DEMANDS

SECTION 10

WATER AND POWER DEMANDS

INTRODUCTION

The water and power demands shown in Tables 10.1 and 10.2 are derived from data presented in Appendix C. This is the response of Cavin Philbin, of the Pelican Cold Storage Company, to a questionnaire sent to the company. There is only about a 15 percent growth in power demand anticipated for Scenario #2 over Scenario #1.

They estimate that on an average year, 25 percent of their power has been generated at the diesel plant. This agrees well with Lowell's report of 1977 and Haight's report (Appendix H) taken from the annual reports of the Pelican Utility Company:

Year	% Diesel Generation
1971	23.0
1972	24.9
1973	19.2
1974	36.9
1975	30.6
1977	21.3
1978	31.5
1979	20.4
1980	14.7
Mean	24.7

TABLE 10.1

PELICAN WATER AND POWER DEMANDS
SCENARIO #1

Month	Water Demands		Power Demands[a]			Total[c]
	1000 gal/mo	cfs	1000 kWh/mo	HP	cfs[b]	cfs
Oct	2,425	.124	186	346	31.767	32
Nov	8,625	.441	186	346	31.767	32
Dec	8,625	.441	173	322	29.564	30
Jan	8,625	.441	173	322	29.564	30
Feb	8,625	.441	252	469	43.061	44
Mar	1,648	.084	252	469	43.061	43
Apr	1,648	.084	191	356	32.686	33
May	30,648	1.568	191	356	32.686	34
Jun	30,648	1.568	187	348	31.951	34
Jul	30,648	1.568	187	348	31.951	34
Aug	1,648	.084	324	603	55.364	56
Sep	2,425	.124	324	603	55.364	56

[a]These are production demands. Comparing Table 7.1 with Scenario #1 in the Pelican Cold Storage questionnaire response (Appendix C), $\frac{\text{kWh produced}}{\text{kWh consumed}} = \frac{2,625,000}{2,201,000} = 1.193$ This factor .193 is made up of distribution losses and apparently some unmetered consumption.

[b]Assumes 100 percent hydroelectric generation and an upgraded plant that will have improved efficiency and will utilize 10 feet additional head in the system by extending the draft tube(s), constructing a new afterbay to a lower elevation, and replacing the flume with pressure conduit.

$$Q = \frac{550\ \text{HP}}{62.4(110+10)(.8)}$$

[c]Total if all power is to be furnished by hydroelectric generation.

TABLE 10.2

PELICAN WATER AND POWER DEMANDS
SCENARIO #2

Month	Water Demands 1000 gal/mo	cfs	Power Demands[a] 1000 kWh/mo	HP	cfs[b]	Total[c] cfs
Oct	2,568	.131	280	521	47.835	48
Nov	9,388	.480	280	521	47.835	48
Dec	9,388	.480	215	400	36.725	37
Jan	9,388	.480	215	400	36.725	37
Feb	9,388	.480	301	560	51.416	52
Mar	1,767	.090	301	560	51.416	52
Apr	1,767	.090	240	447	41.041	41
May	33,667	1.722	240	447	41.041	43
Jun	33,667	1.722	258	480	44.017	46
Jul	33,667	1.722	258	480	44.017	46
Aug	33,667	1.722	464	864	79.327	81
Sep	1,767	.090	464	864	79.327	80

[a] These are production demands. Comparing Table 7.1 with Scenario #1 in the Pelican Cold Storage questionnaire response (Appendix C), $\frac{\text{kWh produced}}{\text{kWh consumed}} = \frac{2,625,000}{2,201,000} = 1.193$ This factor .193 is made up of distribution losses and apparently some unmetered consumption.

[b] Assumes 100 percent hydroelectric generation and an upgraded plant that will have improved efficiency and will utilize 10 feet additional head in the system by extending the draft tube(s), constructing a new afterbay to a lower elevation, and replacing the flume with pressure conduit.

$$Q = \frac{550 \text{ HP}}{62.4(110+10)(.8)}$$

[c] Total if all power is to be furnished by hydroelectric generation.

SECTION 11

ALTERNATIVES

SECTION 11

ALTERNATIVES

ALTERNATIVES DISCARDED

Phonograph

The alternative of diverting water from Phonograph Creek by a dam at Phonograph Lake was studied in detail. The system would consist of a 10-foot dam at Phonograph Creek with about 1,700 acre-feet of storage which would be diverted into the head waters of Pelican Creek during low flow periods and piped to a new 1.2 MW powerhouse (Powerhouse #2) that would discharge into Pelican Lake. A pipeline would also collect the Pelican Creek water at the 750-foot elevation and convey it to Powerhouse #2. The hydro capacity of the Pelican Utility Company would be increased from .50 MW or .75 MW to 1.75 or 1.95 MW, respectively. After receiving the questionnaire response from the Pelican Cold Storage Company, it was determined that their expansion requirements were smaller than first anticipated. The present cold storage rooms were found to be using about twice the energy of similar modern facilities. Phase II should consider the power savings potential in replacing the existing sawdust insulation with new and more efficient material. It was determined that the Phonograph alternative is viable, but there is no present market for the power. When the town grows, this alternative is a good one to expand its present power supply, and is compatible with the continued operation of the proposed program.

Wind

The high electrical load requirements of Pelican are periodic. The electrical demands are greatest during the time of processing, therefore the electrical facilities have to produce energy on call. The wind generated energy is not dependable enough to supply those energy needs on an on-call basis.

The town of Pelican is located several miles inland from the mouth of the Lisianski Inlet. The town is surrounded by mountains that reach heights above 3,000 feet. These mountains deflect the winds. The winds at Pelican are moderately light compared with sites that are optimum for wind power generators.

Since these moderate winds are not steady, it would take a great amount of money to build the storage system to make wind generation even workable. For that reason, it was discarded as not being a viable alternative when compared with hydro and diesel.

Solar

The solar alternative was considered and judged not feasible due to the generally prevailing conditions found at the Pelican site. The cloud cover, which provides the rains that make an ideal site for a hydropower plant, curtail the opportunity for a productive solar site. The construction of the town on piers due to the steep rock slopes that it is constructed against does not lend itself to burrowing in to provide cover of above 2/3 of the structure for installation purposes. There may be a few sites that could supplement heating by heavier insulation and construction of insulated windows to collect the heat. Others could use solar collectors for water heating.

Solar generation of electricity is still in its infancy and has no commercial generation equipment.

Geothermal

The alternative of geothermal was considered. The only sites that provided any possibilities were on Chichagof Island nearer to Hoonak. There was not enough information on those sites to determine whether they could be economically developed or not. Even so, the long transmission lines of above 30 miles would be required for this alternative to be workable. Due to the high costs of construction and other factors, this alternative was discarded.

Fossil Fuel

Of all the fossil fuel options, it is obvious that diesel generation would be the most competitive, since a plant exists at Pelican and there would be no capital works to construct except an additional Cat. 3408 size or larger standby generator. Diesel is presented as Alternative #2, under the options studied.

ALTERNATIVES STUDIED

Three alternatives were studied, each under load conditions of Scenario #1 and Scenario #2. The cost estimates for each alternative are included in Appendix E, and each is analyzed on the basis of the present worth of life cycle costs in Appendix F.

Alternatives #1 and #3 relate to upgrading the existing hydroelectric generating facilities, and have a minimal environmental impact because they represent a continuation of the status quo. Alternative #2 features abandonment of hydroelectric power in favor of an all diesel supply. This has the negative environmental impact of mining a nonreplenishable resource. In addition to the adverse economics of Alternative #2, it would require the continuous annual consumption of 6,700 barrels and 7,700 barrels of diesel, respectively, under Scenarios #1 and #2.

O&M costs (exclusive of fuel) for this reconnaissance portion were not included in Phase I in the economic analyses of alternatives because of the way Pelican Cold Storage Company operates. The same crew maintains both the hydro and the diesel system. Since labor is such a large component of the O&M costs of a modern facility, it was judged that the O&M costs would be comparable for all alternatives. Accordingly, in comparing the differences between alternatives, the O&M costs were deleted. Phase II will address this issue in more depth.

Heat recovery from the diesel engines in this situation could only be practical under Alternative #2, the all diesel option, because under Alternatives #1 and #3, hydro will be on line for such a high percentage of the time, with the diesels being idle. This waste heat recovery potential for Alternative #2 has not been evaluated since it is judged that only the cold storage plant could benefit from its use. That will be addressed in Phase II.

Heat recovery from the refrigeration compressors is a source that needs to be investigated. The existing compressors are larger than needed in a current design, because of the improvement in modern insulation. It is assumed that heat recovery off existing equipment would be reduced by about 40 percent due to Pelican Cold Storage upgrading the insulation of the existing cold storage facilities. Using rough figures and assuming a 40 hp motor to drive the refrigeration compressor, there may be as much as 120,000 Btu that could be utilized for heating or processing that is presently being supplied from electricity and/or oil. This cost saving will be evaluated in the Phase II study.

Alternative #1 (Base Case)

This alternative calls for:

1. Repairing Pelican Dam and reconstructing the wing wall, as recommended in Section 6.

2. Replacing the upper 189 feet of flume and tunnel with a 60" Ø pipe.

3. Replacing the diversion valve at Pelican Dam with a 48" Ø remotely operated sluice gate.

4. Reconstructing both the screen diversion box and the rock box on the lower flume.

5. Replacing the penstock with a new 36" Ø wood stave pipe.

6. Housekeeping under the total flume and penstock support system.

7. Making minor repairs to the flume and penstock support system, and providing concrete footings for the bent columns.

8. Completely abandoning the now obsolete generating machinery and switch gear in favor of a modern 500 kW package, including: 30" motorized Class 150 butterfly control valve; francis type turbine; Woodward governor; new generator and switch gear.

9. Refurbishing the afterbay.

The capital costs for Alternative #1 are estimated at $1.68 million; and the present worth of life cycle costs, including the standby diesel operation, are $3.97 million under load Scenario #1 and $8.43 million under load Scenario #2. The essential objectives of Alternative #1 are:

1. Restoration of the entire system to a new economic life.

and 2. Replacement of the worn out and obsolete machinery with a system that will operate an estimated 15 to 20 percent more efficiently.

Alternative #2 (All Diesel)

This alternative assumes abandonment of the Pelican Creek hydroelectric system in favor of relying 100 percent on the use of the existing diesel plant to furnish industrial and domestic power for Pelican. The scheme would be reliable with the addition of a Cat. 3408 or larger generator for standby. The maintenance costs would increase with this alternative, but were neglected. Capital costs for Alternative #2 are $.06 million and the present worth of the life cycle costs for this alternative is very high, being $13.18 million for load Scenario #1 and $17.55 million for load Scenario #2.

The all diesel alternative would provide the opportunity for excellent waste heat recovery. The specific applications that the heat could be used for will be covered in the Phase II study when in-plant uses are defined and the capital costs of the facilities estimated.

Alternative #3 (Improved Hydro)

This alternative is essentially the same in concept and has the same objectives as Alternative #1 (restored life to the existing plant, plus increased efficiency), but in addition, provides the following advantages:

1. Takes full advantage of the head in the reservoir by replacing the flume in its entirety with a 60" Ø pressure conduit.

2. Further increases plant efficiency and makes better use of both high and low flows by installing two turbines (500 kW and 250 kW) with flexibility for adding another 250 kW turbine.

and 3. Further increases of power yields (by 10 percent) may be available through increased use of available head. This is accomplished by extending the draft tube and constructing a new afterbay providing for tailwater at mean high water level.

The capital costs for this Alternative are $2.36 million and the present worth of its life cycle costs, including fuel costs for the standby diesel operation, are $2.77

million under load Scenario #1 and $7.99 million under load Scenario #2.

AFTERWORD

Under either Alternatives #1 or #3, the only shortcoming of the hydro system is the fact that it is essentially run-of-the-river and must rely to a degree on standby diesel power during low flow periods. The diesel power plant exists, however, and the investigation has indicated that the costs for storage, either at Pelican or through a trans-watershed diversion from Upper Phonograph Creek, simply can not be justified at this time. This is because the escalation of power requirements for Scenario #2 over Scenario #1 are really quite modest. The solution is to make optimum use of the naturally abundant watershed by increasing plant efficiency and taking full advantage of available head.

SECTION 12

RECOMMENDED ALTERNATIVE

SECTION 12

RECOMMENDED ALTERNATIVE

INTRODUCTION

Alternatives #1, #2, and #3 (reference Section 11) were compared under Scenarios #1 and #2 (reference Section 8). The alternatives are engineering options which are the responsibility of the planners; while the scenarios are operations options, exclusively within the prerogative of the Pelican Cold Storage Company. The cost estimates for Alternatives #1, #2, and #3 are presented in Appendix E. The present worth economic analyses for the six combinations are presented in Appendix F.

SUMMARY OF ECONOMIC ANALYSES

The economic analyses were made on the basis of the following criteria, dictated by the APA guidelines:

1. 1982 fuel costs at Pelican (from information furnished by the Pelican Cold Storage Company) are $1.18/gallon. These are escalated for 20 years at the rate of 2.6 percent per year, and then continue at a constant level ($1.92/gal) for the balance of the study period.

2. Diesel generators have a 20-year life.

3. Hydroelectric facilities have a 50-year life; except that the runners are assumed to be replaced after 20 years and the wood-stave pipe after 35 years.

4. Inflation rate is assumed at 0 percent. Therefore, replacement costs are assumed to be 1982 costs.

5. The discount interest rate is 3 percent.

6. O&M costs (except for fuel) are assumed the same under all options and therefore are not included in the analyses.

7. A 35-year study period, equal to the amortization period on capital works, is used.

Table 12.1 recapitulates the analyses.

TABLE 12.1

SUMMARY OF COST ESTIMATES AND ECONOMIC ANALYSES

Alt. #	Description	Capital Cost million $	Present Worth million $	Mill. kWh Generated during 35-Year Study Period	P.W./kWh $
			Scenario #1		
1	Base plan	1.68	3.01	86.905	.035
2	All diesel	.06	9.92	86.905	.114
3	Upgraded base plan	2.36	2.78	86.905	.032
			Scenario #2		
1	Base plan	1.68	4.54	100.319	.045
2	All diesel	0.06	11.42	100.319	.114
3	Up graded base plan	2.36	4.31	100.319	.043

DISCUSSION AND RECOMMENDATION

Alternative #2 is presented to show the economic importance of preserving the hydroelectric plant. Neither

Alternative #1 or #3 is a "band-aid" solution, but rather refurbishes the existing facilities to a new 50-year life. Alternative #1 features dam, flume, penstock, and powerhouse improvements and a modern and efficient 500 kW turbine. Alternative #3 features dam, flume, penstock, and powerhouse improvements with a modern and more efficient 500 kW and 250 kW pair of turbines, plus provision for a future 250 kW unit; plus replacement of the flume with a pipeline that will take advantage of the full reservoir head; and an extended draft tube to gain suction head on the turbine. Using the very same flows, Alternative #1 increases power output over present conditions by a conservatively estimated 15 percent, and Alternative #3 by 27 percent.

Alternative #3 is recommended. It goes a long way toward totally firming the power supply to Pelican by hydro. Table 12.2 is very interesting in that it shows the effect on the Pelican Utility Company for fiscal year 1980-81 if either the Alternative #1 or Alternative #3 plans had been on line. This assumes using the very same water that ran through the turbine.

TABLE 12.2

ANALYSIS OF OPERATING YEAR (FISCAL) 1980-81
(kWh)

Month	Actual			Alternative #1		Alternative #3	
	Total Produced	Produced by Diesels	Produced by Hydro	1.15 x Hydro Produced	Remaining to be Produced by Diesels	1.27 x Hydro Produced	Remaining to be Produced by Diesel
Apr	205,440	63,040	142,400	163,760	41,680	180,850	24,590
May	192,160	8,160	184,000	211,600	0	233,680	0
Jun	237,440	15,840	221,600	254,840	0	281,430	0
Jul	259,680	14,080	245,600	282,440	0	311,910	0
Aug	296,640	67,040	229,600	264,040	32,600	291,590	5,050
Sep	206,880	11,680	195,200	224,480	0	247,900	0
Oct	199,360	147,360	52,000	59,800	139,560	66,040	133,320
Nov	107,780[a]	100,480[a]	7,300[a]	--[a]	--[a]	--[a]	--[a]
Dec	161,280[a]	161,280[a]	0[a]	--[a]	--[a]	--[a]	--[a]
Jan	124,480	6,080	118,400	136,160	0	150,370	0
Feb	227,040	40,640	186,400	214,360	12,680	236,730	0
Mar	198,080	59,680	138,400	159,160	38,920	175,770	22,310
10 Mo. Totals	2,147,200	433,600			265,440		185,270

	Diesel Production as % of 10-Month Total
Actual	20.2%
Alternative #1	12.4%
Alternative #3	8.6%

[a]Power plant was down for repair of the Ludlow Valve.

SECTION 13

REQUIRED SUPPLEMENTAL INFORMATION

SECTION 13

REQUIRED SUPPLEMENTAL INFORMATION

INTRODUCTION

Certain information, beyond the scope of services already authorized for the Pelican project, must be gathered in order to complete:

The Phase II Studies
The FERC Application
The Dam Restoration Application
The Water Rights Application
and The PUC Rate Adjustment Application.

PHASE II STUDIES

Under Alternative #1 (base plan - restoring existing facilities), a topographic survey of the existing works, including floor plans and sections through the powerhouse, should really be made to more accurately estimate the rehabilitation costs. Alternative #2 (all diesel system) requires no additional information. Alternative #3 (restored and upgraded hydroelectric generation system) will require that survey cited for Alternative #1 and supplemental topographic surveying of the tailrace channel.

Alternative #1

Right now the only topographic information that exists is an unreliable profile of the penstock. Three field party days and four designer-draftsmans office days are estimated to produce:

1. A plan of the system from Pelican diversion dam to the end of the tailrace.

2. Topography, axis profile and cross sections through the dam.

3. Profile and cross section through the flume.

4. Cross section of the tunnel.

5. Plan and cross sections of rock box at head of the penstock.

6. Structural sections through penstock support framing, including member sizes.

7. Floor plans, elevations and cross sections through powerhouse.

Alternative #3

In addition to the surveys specified for Alternative #1, Alternative #3 will require detailed topography of the tailrace channel from the existing afterbay to mean sea level.

FERC APPLICATION

If there is an increase of hydropower capacity (Alternative #3), it would be necessary to submit a request to the FERC for an Exemption from a Permit or License. The request for Exemption is not as detailed or complex as one for a Permit or License. The Phase II feasibility study agreement should satisfy the requirements for this exemption. No EIS is anticipated, since neither Alternative #1 or #3 modifies existing environmental impacts.

DAM RESTORATION APPLICATION

Application should be filed with the Stage Forest Land and Water Division Office (Dam Safety) for the restoration of Pelican Dam. The technical information required in that Application will be contained in the Phase II report.

WATER RIGHTS APPLICATION

This Application must be made to the State Forest Land and Water Division Office (Water Rights) under Alternative #3. No supplemental information beyond the Phase II report will be required.

PUC RATE ADJUSTMENT APPLICATION

This requires no supplemental information at this time. Actual construction costs and O&M costs will serve as the basis for any rate adjustment for the Pelican Utility Company.

APPENDIX A

REFERENCE DOCUMENTS AND INTERVIEWS

APPENDIX A

REFERENCE DOCUMENTS AND INTERVIEWS

1. Interviews with Jim Ferguson, Cavin Philbin, Tom Whitmarsh, and Cal Boord of Pelican Cold Storage Co.

2. Interviews with State Forest Land and Water Division
   Rindy Patterson - Water Rights
   Paul Janke - Dam Safety

3. U.S.G.S. water supply papers

4. U.S.C.&G.S. topographic quad sheets

5. Pelican Cold Storage Company questionnaire (Appendix C)

6. Citizens/Town Council questionnaire (Section 9)

7. Phase I Inspection Report for the National Dam Safety Program. COE 1978

8. Water Reconnaissance Study of Pelican Alaska. G. O. Balding, U.S.G.S. 1974

9. Electrical Study of the Pelican Utility. Leonard Lowell and Associates 1977

10. Pelican Hydro System Repair Requirements. Thomas Whitmarsh January 1981

11. Pelican Hydroelectric Plant Modernization. Thomas Whitmarsh August 1980

12. Engineer's Report. Hubbell and Waller Engineering Corporation 1955

13. Correspondence from the James Leffell & Co. October 1978; May 1968

14. Preliminary Appraisal Report to the Alaska Power Authority on the hydroelectric potential for 10 Alaskan communities, including Pelican. Robert W. Retherford Associates 1977

15. Increasing Generator Capacity and Saving Fuel by System Power Factor Improvement. Thomas Whitmarsh July 1981

16. J. W. McKinley work report to Pelican Cold Storage Co. 1966

APPENDIX B

REPORT OF FIELD INVESTIGATION

USKH-ENGINEERING SCIENCE A JOINT VENTURE
2515 "A" STREET • ANCHORAGE, ALASKA 99503 • 907/276-4245

9503

December 23, 1981

Alaska Power Authority
334 West Fifth Avenue
Anchorage, Alaska 99501

Attn: Jerry Larson

Dear Jerry:

This letter is a diary report of the visit of myself and Pat Creegan to Pelican and Anchorage, Alaska, November 9-13, 1981. The purpose of this visit was outlined in Alaska Power Authority's "Pelican Power Alternative;" Scope of Work, Phase I: Reconnaissance Assessment; Phase II: Field Investigation. The team of Creegan and Hutchinson arrived at Pelican on the afternoon of November 9, 1981. Jim Ferguson, President of Pelican Cold Storage Co. was also in Pelican to investigate the break of the power plant penstock.

The timing of our visit was due partially to the shutdown of the power station that was necessitated when a large tree fell on the power penstock and ruptured it. The shutdown allowed access to critical areas of the facilities. When we arrived, Pelican Power Company was using the auxiliary diesel generator to take the place of the hydropower plant. This allowed us the opportunity to review the auxiliary and supplemental power supply under operation. Special thanks should be given to Jim Ferguson and Cal Boord for their help and cooperation in giving us an understanding of the overall picture of the impact that the existing (or an expanded) hydropower facility has or would have on the town of Pelican and the fishing industry in the area. One item discussed at length was the impact fixed-cost hydropower energy could have over the next 50 to 80 years on the Alaskan fishing industry. It was concluded that a stable source of energy would help to keep the Alaskan fish industry competitive with those in the world who had to rely on inflating oil as their source of energy. Jim explained that the fishing area of Alaska now serviced out of Pelican was 500 miles in both directions. The number of fishing boats serviced last year was about 1500. Much of the ice and freezing was done using energy from the Pelican Hydropower Plant, however, at the peak of the harvest diesel power had to be used which raised the costs for services significantly.

In reviewing the history and records, it was found that the town of Pelican was established because of its ideal site for a hydropower plant and water supply.

One key item that was discussed with Jim was: "What would the company do if more hydropower were developed?" The company was going to study and respond to that question.

The records and studies of the present status of the town, processing plant and service company indicated that they are at their maximum capacity unless an additional energy source, and a water supply less susceptible to contamination from outside sources are developed. The low-water period is when the maximum energy is needed and presently not available without diesel generator augmentation. These low periods are in the months of June, July, August, January, February and March. During the summer, due to low-water, the company has to operate its diesel generators to conserve water for the town, fish processing and ice plant.

One of the most critical items evaluated was the timber crib dam. An evaluation of the timber in the crib dam could not be made due to the heavy rains which cause the water to spill over the dam, not allowing accessibility to the structural members. However, a report from the chief operator revealed that when the timbers were accessible this past year, they found the nailings and lag bolts tight, but the wood was rotten adjacent to some connections. The depths of rot were not noted.

The reports indicated that about 4 feet of rock had been lost out of the upper portion of the dam. After seeing the dam and reviewing the pictures, we suspect the loss of rock is due to erosion of the lower rock by water flowing through the dam which caused a slumping of mass. This loss of rock mass reduces the dam's stability. The lost rock should be replaced as soon as possible.

Some rot in the timber connections also causes some immediate concern. It is recommended that rock be added and a well-designed intrusion grouting be done as soon as possible. The intrusion grouting would make a concrete dam instead of a crib dam.

The wing walls were unstable to handle a high flood. The abutments and channel conditions seemed adequate to take care of the ultimate flood. The height of the dam could be raised, however, a careful design of the spillway will have to be done to dissipate the higher energy water passing over the dam. By heightening the dam, water which now is spilled could be stored and used for peaking power when it is needed. An evaluation of the new dam height should be made based on available water supply, town, processing and power loads.

An evaluation of the flume foundation supports was made. They show some rot. The company, in its maintenance program, has periodically replaced the supports that became unstable as well as other portions of the flume. The maintenance of these appears to be a constant and costly effort.

The woodstave penstock was noted to have several problems. The foundation supports had the same problem as the flume supports. The penstock appeared to have some thin sections at the top where the water-flow lines from the flume are forced to change direction. The company records indicated that other locations where the flow-lines were forced to change were also thin and in need of replacement. The material from the section where the tree had broken through was close to the new material's thickness.

A serious problem on the penstock and flume is trying to maintain it safely. Two men have to traverse the length twice a day. That takes about an hour each time. The safety problem is compounded in the winter when the walkways are covered with ice. It is difficult, if not impossible, to make the existing facilities safe under that condition.

The slopes in the area of the power facility appeared to be stable. The local terrain is bedrock. No faulting was noted, however, the Lisianski Inlet was made by faulting, so whatever is constructed at Pelican should be constructed to Zone 3 requirements with a credible earthquake established to define the design requirements for structures. The geology of the Pelican Creek drainage basin will be included in the final report.

The flume tunnel was not accessible for inspection, so an evaluation of that facility could not be made, however, a review of past reports revealsthat some caving was experienced in the last two years.

The powerhouse superstructure was in good condition as can be seen in the various pictures, however, the aging process is beginning to show on the concrete foundations, especially in the afterbays. The process of wear on the turbine's impellers appears to be causing more and more erosion of concrete in the afterbays from the erosion of high energy water.

The upper sections of Pelican Creek were inaccessible due to the rain and snowstorm that had moved in. However, a Quad sheet and a geologic map reconnaissance was made using Jim Ferguson, who has flown in and photographed the upper reaches of Phonograph Creek, especially the large lake at its head. This lake picture is included in this report. From the information gathered, it appeared as if the upper lake with a small dam on Phonograph Creek could be used to store water in the dry months. The elevation difference between the upper lake and the present power plant is about 2000 feet. It appears that small flows delivered in a penstock to a turbine above the existing crib dam from the lake at the head of Phonograph Creek could generate 1100 kw to give a good reliable supply of power and water during the dry period when the town, cold storage, and fish processing needs are greatest. In the wet months, use of Pelican Creek's upper reaches through the same facility could be accomplished. This would supply about 1100 kw. One big item that could not be addressed at Pelican was the reliability of the water. The water quality supplied from the Phonograph Lake and upper Pelican Creek source would be less susceptible to contamination.

The Pelican Power could have placed a staff gauge on their dam and recorded the height of the water whenever anyone regulated the water. This type of record would be very valuable. We recommend that a staff gauge be installed at the dam.

The intake at the dam is dangerous to personnel at high flows as shown in Photo #7 and should be high on the list for modification in combination with the other improvements that may be necessary.

The turbine and generator are almost 75 years old and appear to work, but the records indicate that there has been a necessary increase of the flow to produce the same amount of energy. The internal wear of the turbine could not be evaluated, but the afterbay shows erosion from high energy water coming off the turbine, indicative of worn turbine blades.

The generator was evaluated and found in need of improvement. In order to generate at its past capacity, it was necessary to install a cooling fan. This is not a serious condition, but indicative of the condition of the facilities and equipment. The generator and system is beyond its design life and may need replacement or a major overhaul. A comparison between the two alternatives will have to be made as a portion of the final report.

A visit by the electrical engineer is to be made and his letter will include the one-line diagram of the system distribution plan.

After a day at Pelican, we traveled to Anchorage. November 11, 1981 was spent at USKH's offices detailing tasks for the final report, reviewing data that had been obtained from previous reports, getting copies of reports that had not been available previously, obtaining information from agencies and meeting with Jerry Larson of APA. After Wednesday, the most critical item had not been resolved--the obtaining of the precipitation and run-off records. Without some good records of the Pelican Creek or a creek or river close enough to extrapolate data from, all that could be done was guess at what the hydropower potential of Pelican Creek was.

Most of Thursday, November 12, was spent researching the water records of Southeastern Alaska, trying to find records of Pelican

Creek or creeks and river in the near vicinity. The type record that we sought was long-term that would have a record of a dry year. The longer the record, the more reliable and dependable would be our conclusions and recommendations. At the USGS we were able to find such records. The stream records that were found were Hook Creek near Tenakee and Tonolite River near Tenakee as shown on Map #1. The Black River at the windward side of Pelican had a 3-year record. Hook Creek and Tonolite River had 13-year records. Hook Creek is on the leeward side of the mountain from Pelican and has a gauging station on the stream at elevations comparable to 75% of Pelican Creek. After receiving the records, it was concluded that these records were adequate to extrapolate data from to provide a reliable hydropower evaluation of Pelican Creek.

Friday was spent traveling.

After arriving home, questionnaires were sent to the Pelican Town Council and Pelican Storage Company. We are waiting a response. When those are received, the final report can be completed.

A book is enclosed which has the appropriate maps and several photographs of our visit.

If you have any questions, please call.

Yours truly,

Harvey L. Hutchinson

Harvey L. Hutchinson
Project Manager

cc: USKH
Pelican Cold Storage Co.
Pat Creegan

APPENDIX C

RESPONSE TO QUESTIONNAIRE

1. Pelican Cold Storage Company Response Included
2. Response from Citizens Summarized in Section 9

LOCATIONS
P.O. BOX 60[illegible] PELICAN, ALASKA [illegible]
P.O. BOX 128 SAND POINT, ALASKA [illegible]

PELICAN
UTILITY COMPANY

GENERAL OFFICES: 653 N.E. NORTHLAKE WAY, SEATTLE, WASHINGTON 98105 • PHONE (206) 632-9000
GENERAL OFFICES MAILING ADDRESS: P.O. BOX 5538, SEATTLE, WASHINGTON 98105

January 8, 1982

Mr. Harvey Hutchinson
USKH-Engineering Science
2515 "A" Street
Anchorage, AK 99503

Dear Harvey:

The following power and water usage figures are offered for use in Engineering Science's study of Pelican's hydro resource. They are based on calendar 1981 production figures from Pelican, Port Alexander and Sand Point.

Before any final plans are made to utilize additional water from Phonograph Creek, it will be necessary to determine if Pelican is suited for a terminus for storage and boxing of all the company's products. Some questions that still need to be answered are:

1. Is shipping from Pelican to the marketplace economically feasible?

2. Is shipping from Sand Point to Pelican economically feasible?

3. Will the costs associated with developing the hydro and the additional storage space at Pelican be more or less than is presently being spent for storing and boxing products in Washington and for fuel for product storage in Sand Point?

If you have further questions, please call.

Sincerely,

Cavin W. Philbin
General Manager

CWP/ak
Enclosure

cc: Jerry Larson, Alaska Power Authority

REVISED 3/25/82

SCENARIO # 2 - AMPLIFY HYDRO SYSTEM TO FULLY ACCOMMODATE POTENTIAL PLANT AND COMMUNITY EXPANSION WITH HYDRO POWER

Month	Water Consumption (000's omitted) Industrial (1)	Domestic (2)	Total	Power Consumption - KWHs (000's omitted) Industrial	Marina	Domestic	Total	
J	7,920	1,468	9,388	269	25	66	360	Dec/Jan
F	7,920	1,468	9,388					
M	1,100	667	1,767	417	25	62	504	Feb/Mar
A	1,100	667	1,767					
M	33,000	667	33,667	333	8	61	402	Apr/May
J	33,000	667	33,667					
J	33,000	667	33,667	362	6	64	432	June/July
A	33,000	667	33,667					
S	1,100	667	1,767	694	14	70	778	Aug/Sept
O	1,100	1,468	2,568					
N	7,920	1,468	9,388	369	6	94	469	Oct/Nov
D	7,920	1,468	9,388					
	Annual Total:		180,089		Annual Total:		2,945	

(1) Industrial water use increases est. 10% over Scenario #1.
(2) Domestic water use increases est. 3% over Scenario #1.

Month	Boat Days @ Marina Scenario #1	Scenario #2	Employees Scenario #1	Scenario #2	Residents (1) Scenario #1	Scenario #2	Homes (1) Scenario #1	Scenario #2
J)		No appreciable change	50	60	175	180		
F)	4,500		50	60	175	180		
M)			60	70	175	180		
A)	1,830		65	75	175	180		
M)			90	100	200	205		
J)			110	120	200	205	75	78
J)	7,360		120	130	200	205		
A)			120	140	200	205		
S)	3,720		40	80	175	180		
O)			40	80	175	180		
N)	3,050		40	60	175	180		
D)			50	60	175	180		

(1) Increases in residents and homes only reflect change in processing strategies and do not account for an estimated 5% increase in population over the next 5 years due to a natural influx of people.

Business Trends (000's omitted)

Year (1)	Seafood	Gross Sales Pelican C.S. Pelican Store	Gross Revenues Water Pelican U.	Gross Revenues Power Pelican U.
~~1976~~				
1977	6,438	682	6	75
1978	7,234	679	6	125
1979	9,888	923	6	140
1980	14,861	964	6 (3)	144 (2)
1981	13,658	712	11	210

What do you anticipate the 1982 cost/kilowatt-hour for diesel generation will be at Pelican? Assuming fuel costs at $1.18/gal and diesels generate same amount of KWHs in 1982 as 1981, expect cost/KWH should be 23.5¢/KWH. Costs associated with this include labor for maintaining diesels, supplies, fuel, generating equipment annual depreciation and 25% of Distribution and Transmission Line Expense. This is based on the diesels supplying about 25% of the total power generated.

What do you anticipate the 1982 costs per gallon of diesel will be at Pelican?

Average 1982 price for diesel (heating fuel #2) will be approximately $1.18/gallon.

(1) Pelican's FY is April 1 to March 31.
(2) Pelican Utility power rates increased 22% during FY 1980.
(3) Pelican Utility water rates increased about 40% during FY 1980.

Pelican Cold Storage Company

Questionnaire

A. How the Sand Point operation would be cut back.

The Sand Point operation could be cut back in the areas of product storage and boxing. By storing more product in Pelican and utilizing the location to box seafood into a final marketable form, electric power that is used to run refrigeration equipment at Sand Point to store products could be saved. If this project were undertaken, a slight reduction in employees is possible at Sand Point. The big savings, however, would be in discontinuing Pelican Cold Storage Company's reliance on Seattle cold storage companies for product storage and secondary processing.

B. Additional plant and community expansion potential when certain Sand Point and Seattle processing activities are shifted to Pelican.

Plant Expansion. Additional storage capacity will have to be added to the Pelican facility to store product from Sand Point, Port Alexander and Pelican throughout the year. Pelican is presently able to store roughly two million pounds of product and if the Sand Point and Port Alexander facilities utilized the Pelican location to store products, it is estimated that Pelican would need space for over 4 million pounds during the months of August, September and October, providing the three plants produce on a scale comparative to 1981 season poundage. This assumes salmon roe, opilio crab and roe herring are sold FOB plant and 1981 levels of salmon are canned. This also assumes utilizing Pelican totally for storage and secondary processing. Additional storage requirements would probably necessitate an additional load of 175,000 KWHs per year for the additional refrigeration needed. Boxing operations would not require a substantial increase in power demand except for an increased use of heat, lighting and employee power needs, creating an additional power demand approximately 100,000 KWHs/year. An additional annual use of 50,000 KWHs per year would be needed for heat, lighting and miscellaneous other needs to support the added cold storage area over and above the refrigeration requirements. An additional 325,000 KWHs per year would be required at Pelican providing this project were undertaken. Based on 1981 storage amounts from the three plants and estimated product life in storage at Pelican, the 325,000 KWHs were spread over the six bi-monthly billing periods in the following percentiles, (see Scenario #2 power consumption estimates):

December/January	-	15%
February/March	-	10%
April/May	-	10%
June/July	-	15%
August/September	-	30%
October/November	-	20%

The domestic load would only increase by 15,000 KWHs as a result of Pelican's expansion. There would be no effect on the harbor's power use.

Conserving energy will become an increasing effort by all users but as electric power becomes more readily available and fuel prices continue to increase, any savings from conserving will be negated by converting over to electric power from fuel powered machinery.

APPENDIX D

HYDROLOGIC BASIC DATA

TABLE D.1

COMPARISON OF GAGING STATIONS, 1977-1978
(cfs/sq mi)

Month	Black River (24.7 sq mi)	Hook Creek (4.48 sq mi)	Hook Creek (8 sq mi)	Tonolite Creek (14.5 sq mi)
Oct	25.2	31.3	26.6	34.1
Nov	6.15	13.7	15.0	12.3
Dec	3.15	8.1	5.41	7.83
Jan	5.14	1.21	.75	1.30
Feb	7.41	.75	.44	.70
Mar	5.06	4.22	2.83	2.48
Apr	10.2	8.35	5.65	6.97
May	15.1	17.5	10.9	13.2
Jun	10.5	8.86	6.26	7.17
Jul	6.92	5.13	3.49	4.54
Aug	4.49	2.66	1.70	2.79
Sep	7.65	5.09	2.76	4.4
Total	106.97	106.87	81.79	97.88
Mean	8.91	8.91	6.81	8.16

Upon analysis of Table D.1, Hook Creek (4.48 sq mi) was selected for correlation to Pelican Cove Creek. The statistics used are:

HOOK CREEK

Area: 4.48 sq mi total
3.82 sq mi above EL 750
0.66 sq mi below EL 750

Period of record: since August 1967
Historical peak: 1290 cfs max.
1.5 cfs min.
12 year average runoff: 20,810 AF/yr
or 85.5 in/yr
or 28.2 cfs

Year	Runoff (acre-feet)
1978-79	29,070
1977-78	16,050
1976-77	21,980
1975-76	23,070
1974-75	28,980
1973-74	16,820
1972-73	22,140
1971-72	17,450
1970-71	17,950
1969-70	21,480
1968-69	13,920
Mean	20,810

PELICAN CREEK

Area: 12.95 sq mi total
10.53 sq mi above EL 750
2.42 sq mi below EL 750

UPPER PHONOGRAPH

Area: 1.34 sq mi total (all above EL 750)

TABLE D.2

HOOK CREEK RECORD
(cfs/sq mi)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
78-79	31.3	13.7	8.1	1.21	.75	4.22	4.35	17.5	8.86	5.13	2.66	5.09
77-78	16.4	4.4	1.4	2.12	2.18	4.09	6.54	10.9	4.38	1.6	.83	4.35
76-77	12	11.2	6.67	6.05	12.60	3.21	8.46	7.48	6.92	2.39	.77	4.24
75-76	8.37	2.34	6.54	3.62	2.68	3.1	5.71	17.3	15.2	7.52	2.61	10.1
74-75	23.9	14.2	8.86	2.88	1.27	.98	3.62	17	16.6	7.25	2.86	7.19
73-74	10.1	1.72	1.33	.73	3.66	1.21	6.18	15.5	11	4.73	1.54	4.46
72-73	14	6.83	1.77	1.6	2.66	1.79	7.14	16.4	12.6	5.6	5.54	5.78
71-72	7.28	7.46	1	0.7	.5	1.79	1.49	14.6	13	4.64	5.67	6.21
70-71	9.02	4.87	1.46	2.75	1.78	2.23	3.84	11.3	15.2	4.2	3.57	6.23
69-70	4.83	11.3	7.87	2.46	7.49	5.15	5.33	10	8.47	6.11	3.68	8.01
68-69	6.99	4.84	2.05	1.91	3.4	4.05	3.6	5.8	3.0	1.2	1.08	9.16
Mean	13.11	7.53	4.28	2.37	3.54	2.89	5.11	13.07	10.47	4.58	2.80	6.44
Mean % R.O.	17.3	9.9	5.6	3.1	4.6	3.8	6.7	17.2	13.7	6.0	3.7	8.4

TABLE D.3

HOOK CREEK MINIMUM FLOWS
(cfs)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
78-79	21	18	9.4	4.2	2.4	3.4	9.6	48	18	8.7	3.9	4.2
77-78	7.5	7.6	4.4	2.9	3.0	4.0	12	29	6.6	4.3	2.6	3.0
76-77	10	17	14	11	25	6.9	10	20	20	5.0	2.0	1.7
75-76	11	6.4	5	5	5.5	5	6.7	38	45	14	5.5	7.1
74-75	22	14	11	6	2.5	2.9	5.6	25	46	14	6.3	8.4
73-74	13	3	3.5	2	2.6	4	9	4.2	33	9.2	2.6	2.3
72-73	12	11	2.5	2	3.5	4	12	41	29	12	10	7.1
71-72	11	11	1.5	1.5	1.7	2	4	9	35	9	7.4	7
70-71	16	3.5	2.5	1.5	1.5	5	5	18	35	5.3	5	6.1
69-70	6.2	9.9	9.4	4	9.4	9.7	12	20	23	7.4	5.7	9.9
68-69	8.2	9	4.5	2.8	5	8.5	8	16	8.2	3.5	2.1	13
Mean	12.5	10.0	6.1	3.9	3.6	5.0	8.5	24.4	27.2	8.4	4.8	6.3

APPENDIX E

COST ESTIMATES

APPENDIX E

COST ESTIMATES

Cost Estimate
Alternative #1

Description of Item	Unit	Quantity	Unit Price	Cost
Mobilization & Demobilization	L.S.	--	$100,000	$100,000
Dam Restoration				
Visqueen Facing (Upstream)	S.F.	6,000	2	12,000
Visqueen Ballasting	C.Y.	250	20	5,000
Remove Spillway	L.S.	--	5,000	5,000
Replace Rock in Dam	C.Y.	250	20	5,000
Seal Downstream Face	S.F.	1,450	10	14,500
Set Grout Pipes	EA.	5	1,000	5,000
Grout Dam	C.F.	18,000	20	360,000
Replace Wingwall	S.F.	510	30	15,300
Topping Dam	L.S.	--	7,500	7,500
Flume Restoration				
New Trash Racks	L.S.	--	4,000	4,000
Replace Flume w/60"Ø Pipe through Tunnel	L.F.	189	250	47,250
New 48"Ø Sluice	L.S.	--	12,000	12,000
Seal Tunnel Portals	L.S.	--	2,000	2,000
Upgrade Diversion Box	L.S.	--	10,000	10,000
Reconstruct Rock Box @ Penstock Forebay	L.S.	--	20,000	20,000
Misc. Flume Repairs	L.S.	--	5,000	5,000
Penstock				
New 36"Ø Woodstave Penstock	L.F.	326	150	48,900
Demolition	L.S.	--	5,000	5,000
Flume & Penstock Substructure				
Cleanup	L.S.	--	5,000	5,000
Misc. Repairs	L.S.	--	10,000	10,000
Powerhouse				
Modify & Repair	S.F.	600	80	48,000
(500 kW) New Machinery Package	L.S.	--	400,000	400,000
Freight & Installation	L.S.	--	200,000	200,000
	Subtotal			$1,346,450
	Contingency @ 25%			336,650
	TOTAL			$1,683,100

Cost Estimate
Alternative #2

Description of Item	Unit	Quantity	Unit Price	Cost
CAT 3408 FAS Seattle	E.A.	1	38,000	38,000
CAT 3408 Installation	L.S.	--	10,000	10,000
	Subtotal			$48,000
	Contingency @ 25%			12,000
	TOTAL			$60,000

Cost Estimate
Alternative #3

Description of Item	Unit	Quantity	Unit Price	Cost
Mobilization & Demobilization				$100,000
Dam Restoration				
Per Alt #1	--	--	--	429,300
Flume Restoration				
Per Alt #1	--	--	--	100,250
Replace Flume from Tunnel to Surge Chamber Rock Box	L.F.	511	400	204,400
Penstock				
Per Alt #1	--	--	--	53,900
Flume & Penstock Substructure				
Per Alt #1	--	--	--	15,000
Powerhouse				
Modify & Repair	S.F.	600	80	48,000
New Machinery Package (750 kW)	L.S.	--	600,000	600,000
Freight & Installation	L.S.	--	300,000	300,000
Extended Draft Tube	L.S.	--	10,000	10,000
New Afterbay	L.S.	--	25,000	25,000
	Subtotal			$1,885,850
	Contingency @ 25%			471,450
	TOTAL			$2,357,300

APPENDIX F

ECONOMIC ANALYSES

APPENDIX F

ECONOMIC ANALYSES

INTRODUCTION

The economic analyses are based on the present worth of the following combinations of three alternative projects and two load scenarios:

Combination	Description: Alternative	Description: Required kWh of Annual Power Production (kWh)
Alt. #1, Scenario #1	500 MW hydro + diesel standby	2,626,000
Alt. #1, Scenario #2	500 MW hydro + diesel standby	3,516,000
Alt. #2, Scenario #1	All diesel	2,626,000
Alt. #2, Scenario #2	All diesel	3,516,000
Alt. #3, Scenario #1	750 MW hydro + diesel standby	2,626,000
Alt. #3, Scenario #2	750 MW hydro + diesel standby	3,516,000

Assumptions

Assumptions are:

1) Inflation rate is 0 percent.

2) The discount interest rate is 3 percent.

3) Except for fuel, the O&M costs are the same under all options and therefore are not included in the analyses.

Fuel costs are $1.18/gallon in 1982, escalating at 2.6 percent for 20 years (to 1.92/gal in the year 2202) and thereafter remaining level.

4) The economic life of hydro facilities is 50 years, except that runners are assumed to be replaced at 20 years and wood stave pipe at 35 years. 1982 runner costs are taken at 10 percent of installed machinery costs, i.e., $60,000 for Alt. #1 and $90,000 for Alt. #3.

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5) The economic life of diesel generators is 20 years. The data on these costs are:

	Unit				
	#1	#2	#3	#4	#5*
	Cat D333A	Cat D333A	Cat 343	Cat 3408	Cat 3408
Exists	Yes	Yes	Yes	Yes	Yes
Service	Prime	Prime	Standby	Prime	Prime
Existing rating	100 kW	100 kW	285 kW	200 kW	225 kW
Purchased	1964	1964	1974	1974	1982
Replace	1984	1984	1994	1994	2002
	2004	2004	2014	2014	2022
	2024	2024			
Life remaining at 50 years	13	13	3	3	11
1982 equivalent	Cat 3306T	Cat 3306T	Cat 3406T	Cat 3408	Cat 3408
New rating	130 kW	130 kW	300 kW	225 kW	225 kW
1982 cost FOB Seattle	$24,000	$24,000	$35,000	$38,000	$38,000
Ship & install	$10,000	$10,000	$10,000	$10,000	$10,000
New constr. cont. 25%	--	--	--	--	12,00C
1982 replacement cost	$34,000	$34,000	$45,000	$48,000	$48,000

*Required for Alt. #1, Scenario #2
Alt. #2, Scenario #1 & #2
Alt. #3, Scenario #2

6) A 50-year study period is used, because this is the longest economic life among the options compared.

7) Straight-line depreciation is assumed in calculating the salvage value of diesel components at the end of the study period.

8) No growth period is assumed for the load scenarios. That is to say that under Scenario #1 the required power production is 2,626,000 kWh per year for each year in the study period, and under Scenario #2 is 3,516,000 kWh (refer to tables 10.1 and 10.2).

9) Fuel costs per kWh for diesel production are taken from

a) $1.18/gal - information furnished by Pelican Cold Storage Co.

and b) 111.1 gal of diesel and .6 gal of lube oil required per MWh of diesel production - a figure approved by APA.

Then, 111.1 x \$1.18 = \$131.10
0.6 x 3.95 = 2.37
\$133.47/MWh
or \$.133/kWh

10) Waste heat recovery is only practical under Alternative #2, and even then it is questionable. The points of use are believed to be only at the cold storage plant and realistic capital costs for the system that would utilize it are not now known. Accordingly, waste heat recovery is not included in these analyses but will be looked into in more detail in Phase II.

Peak Demands

Assume industrial peaking = 1.2 x Aug/Sep load (ref. Appendix C).

Assume domestic peaking = 2.0 x Aug/Sep load (ref. Appendix C).

Assume distribution and "non-metered" losses = 19.3% (tables 10.1 and 10.2).

Scenario #1

$\frac{465{,}000 \text{ kWh}}{60 \text{ days}} \times \frac{\text{Days}}{24 \text{ hrs}} \times 1.193 \times 1.2 = 462$ kW industrial peak

$\frac{79{,}000 \text{ kWh}}{60 \text{ days}} \times \frac{\text{Days}}{24 \text{ hrs}} \times 1.193 \times 2.0 = 131$ kW domestic peak

Total = 593 kW

Scenario #2

$\frac{694{,}000 \text{ kWh}}{60 \text{ days}} \times \frac{\text{Days}}{24 \text{ hrs}} \times 1.193 \times 1.2 = 690$ kW industrial peak

$\frac{84{,}000 \text{ kWh}}{60 \text{ days}} \times \frac{\text{Days}}{24 \text{ hrs}} \times 1.193 \times 2.0 = 139$ kW domestic peak

Total = 829 kW

Plant Capacities

Alternative #1

Installed hydro = 500 kW

Installed diesel = 685 kW (existing)

Total = 1,185 kW

Scenario #1. Required capacity = 593 kW <685.

Scenario #2. Required capacity = 829 kW >685, <1,185.

Since August is a peak month of industrial production and the low month of runoff, diesel unit #5 is recommended for standby to give complete reliability to the system in the event of outage at the hydro plant. Installed diesel kW = 685 + 225 = 910 >829.

Alternative #2

Installed diesel = 685 + 225 = 910 kW (Scenario #1 & #2)*.

*NOTE: Diesel #5 added even for Scenario #1 as a required standby under the year around load factor

Scenario #1. Required capacity = 593 kW <910.

Scenario #2. Required capacity = 829 kW <910.

Alternative #3

Installed hydro = 750 kW.

Installed diesel = 685 kW (Scenario #1).

Installed diesel = 850 kW (Scenario #2).

Scenario #1. Required capacity = 593 kW <910.

Scenario #2. Required capacity = 829 kW <910.

Production

The following table is derived from Table 7.1 and page 10-1.

Year	kWh Produced	Produced by Diesel (%)	Produced by Diesel (%)	Produced by Hydro (%)
1977	2,350,000	21.3	500,550	1,849,450
1978	2,540,000	31.5	800,100	1,739,900
1979	2,650,000	20.4	540,600	2,109,400
1980	2,450,000	14.7	360,150	2,089,850
			Mean (existing)	1,947,150
		x 1.15 = hydro production (Alt. #1)	=	2,239,200
		x 1.27 = hydro production (Alt. #3)	=	2,472,900

Table--Continued

Year	kWh Produced	Produced by Diesel (%)	Produced by Diesel (%)	Produced by Hydro (%)

Accordingly (ref. tables 10.1 and 10.2)

	Scenario #1 (kWh)	Scenario #2 (kWh)
Required annual production	2,626,000	3,516,000
Alt. #1 hydro production	2,239,200	2,239,200
Alt. #2 diesel production	386,800	1,276,800
Alt. #2 diesel production	2,626,000	3,516,000
Alt. #3 hydro production	2,472,900	2,472,900
Alt. #3 diesel production	153,100	1,043,100

Present Worth of Diesel Costs

Alternative #1, Scenario #1

Present worth of the escalating annual amount for years 1-20.

A = 386,800 kWh x \$.133/kWh = \$51,444

$$PW_{1-20} = A \frac{\left(\frac{1+e}{1+i}\right)\left(\frac{1+e}{1+e}\right)^n - 1}{\left(\frac{1+e}{1+i}\right) - 1}$$

e = .026 escalation factor
i = .03 discount factor
n = 20

PW_{1-20} = A (19.204) = \$51,444(19.204) = \$987,931

Present worth of fixed annual amount for years 21-50.

$A = \$51,444(1.026)^{19} = \$83,779$

@ 3% discount

$PW_{21-50} = PW_{50} - PW_{20}$ = A(25.73-14.877) = \$83,779(10.853) = \$909,253

Alternative #1, Scenario #2

A_{1-20} = (1,276,800 kWh)(\$.133/kWh) = \$169,814

PW_{1-20} = (\$169,814)(19.204) = \$3,261,108

$A_{21-50} = \$169,814(1.026)^{19} = \$276,550$

PW_{21-50} = (\$276,550)(10.853) = \$3,001,397

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Alternative #2, Scenario #1

A_{1-20} = (2,626,000 kWh)($.133/kWh) = $349,258

PW_{1-20} = $349,258(19.204) = $6,707,151

A_{21-50} = $349,258(1.026)^{19} = $568,782

PW_{21-50} = $568,782(10.853) = $6,172,991

Alternative #2, Scenario #2

A_{1-20} = (3,516,000 kWh)($.133/kWh) = $467,628

PW_{1-20} = $467,628(19.204) = $8,980,328

A_{21-50} = $467,628(1.026)^{19} = $761,553

PW_{21-50} = $761,533(10.853) = $8,265,135

Alternative #3, Scenario #1

A_{1-20} = (153,100 kWh)($.133/kWh) = $20,362

PW_{1-20} = $20,362(19.204) = $391,032

A_{21-50} = $20,362(1.026)^{19} = $33,160

PW_{21-50} = $33,160(10.853) = $359,885

Alternative #3, Scenario #2

A_{1-20} = (1,043,100kWh)($.133/kWh) = $138,732

PW_{1-20} = $138,732(19.204) = $2,664,209

A_{21-50} = $138,732(1.026)^{19} = $225,931

PW_{21-50} = $225,931(10.853) = $2,452,029

Recapitulation

	PW/Fuel Costs	
	Scenario #1	Scenario #2
Alternative #1	$ 1,897,184	$ 6,262,505
Alternative #2	12,880,142	17,245,463
Alternative #3	750,917	5,116,238

ECONOMIC ANALYSES

Present Worth, Alternative #1, Scenario #1

	Present Worth
Capital Cost	$1,683,100
Replacement Costs	
Runners at yr. 2002 $60,000(.5537)	33,222
at yr. 2022 $60,000(.3066)	18,396
Penstock and flume	
at yr. 2018 $373,550(.3553)	132,760
Fuel Costs	1,897,184
Replacement Costs of Diesels	
#1 at yr. 1984 $34,000(.0426)	32,048
at yr. 2004 $34,000(.5219)	17,745
at yr. 2024 $34,000(.2890)	9,826
#2 at yr. 1984 $34,000(.9426)	32,048
at yr. 2004 $34,000(.5219)	17,745
at yr. 2024 $34,000(.2890)	9,825
#3 at yr. 1994 $45,000(.7014)	31,563
at yr. 2014 $45,000(.3883)	17,474
#4 at yr. 1994 $48,000(.7019)	33,667
at yr. 2014 $48,000(.3883)	18,638
Salvage Value of Diesels	
#1 (13/20)($34,000)(.2281)	(5041)
#2 (13/20)($34,000)(.2281)	(5,041)
#3 (3/20)($45,000)(.2281)	(1,540)
#4 (3/20)($48,000)(.2281)	(1,642)
Total	$3,971,978

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Present Worth, Alternative #1, Scenario #2)

	Present Worth
Capital Costs	$1,683,100
Diesel #5 +	60,000
Replacement Cost	
Runners, perstock and flume	
per Alt. #1, Scen. #1	184,378
Fuel Costs	6,262,505
Replacement Costs of Diesels	
#1, 2, 3, 4, per Alt. #1, Scen. #1	220,580
#5 at yr. 2002 $48,000(.5537)	26,578
2022 $48,000(.3066)	14,717
Salvage Value of Diesels	
#1, 2, 3, 4, per Alt. #1, Scen. #1	(13,264)
#5 (11/20)($48,000)(.2281)	(6,022)
Total	$8,433,572

Present Worth, Alternative #2, Scenario #1

	Present Worth
Capital Cost	$ 60,000
Fuel Costs	12,880,142
Replacement Costs of Diesels	
#1, 2, 3, 4, 5, per Alt.#1, Scen. #2	261,875
Salvage Value of Diesels	
#1, 2, 3, 4, 5, per Alt. #1, Scen. #2	(19,286)
Total	$13,182,731

Present Worth, Alternative #2, Scenario #2

	Present Worth
Capital Cost	$ 60,000
Fuel Costs	17,245,463
Replacement Costs of Diesels	
#1, 2, 3, 4, 5, per Alt. #1, Scen. #2	261,875
Salvage Value of Diesels	
#1, 2, 3, 4, 5, per Alt. #1, Scen. #2	(19,286)
Total	17,548,052

Present Worth, Alternative #3, Scenario #1

	Present Worth
Capital Cost	$2,357,300
Replacement Costs	
Runners at yr. 2202 $90,000(.5537)	49,833
at yr. 2022 $90,000(.3066)	27,594
Penstock & flume per Alt. #1, Scen. #1	132,760
Fuel Costs	750,917
Replacement Costs of Diesels	
#1, 2, 3, 4, per Alt. #1, Scen. #1	220,580
Salvage Value of Diesels	
#1, 2, 3, 4, per Alt. #1, Scen. #1	(13,264)
Total	$2,774,803

Present Worth, Alternative #3, Scenario #2

		Present Worth
Capital Cost		$2,357,300
Diesel #5	+	60,000
Replacement Costs		
Runners, penstock & flume per Alt. #3, Scen. #1		210,187
Fuel Costs		5,116,238
Replacement Costs of Diesels		
#1, 2, 3, 4, & 5, per Alt. #1, Scen. #2		261,875
Salvage Value of Diesels		
#1, 2, 3, 4, & %, per Alt. #1, Scen. #2		(19,286)
Total		7,986,314

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APPENDIX G

PHOTOGRAPHS
(Submitted with Diary Report)

APPENDIX H

REPORT OF BENJAMIN C. HAIGHT
PROJECT ELECTRICAL ENGINEER

B.C. HAIGHT
Consulting Engineer

January 21, 1982

USKH
2515 "A" Street
Anchorage, Alaska 99503

ATTN: Mr. Richard Mayes, P.E.
RE: Pelican Electrical System Study

Dear Rick:

I have completed a survey of the Pelican Utility Company System as you requested in your letter to me on January 8. Enclosed is all the information that you requested, plus graphs of the energy usage and energy production by the two power plants.

Due to the short length of time that I was there, I could not visually check the control and instrumentation connections. My single line diagrams assume some connections based upon standard practice, and are intended to primarily show the operational relationships of the equipment.

As you may note from my enclosed report, a certain amount of system rehabilitation is necessary just to optimize the energy consumption by the existing facility, to optimize the operations time by the plant engineers, and to maintain the past good record of reliability. This rehabilitation should include reconditioning the hydro generator and exciters, installing a new control and switch gear panel with a new voltage regulator for the hydro generator, adding remote controls and supervision of the hydro plant from the diesel plant, adding protective relaying and more metering to the diesel generators, and testing and calibrating the existing equipment. You may also observe in the single line diagram that there appears to be no protection of the feeders, transformers, and panelboards for the cold storage plant. This should be corrected. Also note in the nameplate data that diesel generator no. 3 must be derated for continuous operation.

Please call if you have questions or a need for additional information.

Sincerely,

Benjamin C. Haight

Benjamin C. Haight, P.E.

Enclosures

c.c. Mr. Thomas Whitmarsh
c.c. Mr. Harvey Hutchinson

Pelican Utility Company
Electrical Generation and Distribution System

1. Hydro Electric Generator

This generator is located in a building on Pelican Creek near the south end of town. The generator is driven by a James Leffel & Co. horizontal hydraulic turbine. Detailed information can be obtained from a report written by the chief engineer, Tom Whitmarsh, January 1981. The generator field is excited by a rotating d.c. generator. In 1978 a second d.c. generator and regulator was purchased and installed as backup excitation. This unit has never been functional. The existing excitation equipment has operated a long time with minimal maintenance. The controls and switchgear are an accumulation of equipment mounted in a single open panel.

A. Generator:

The generator is still a very functional machine. It is dirty, losing its paint. The winding and lead insulations are questionable. A telephone call was made to Lloyd Electric in Seattle, Washington, seeking recommendations and an estimate to entirely rewind the unit. Due to the fact that it is still a functional unit with no apparent problems, they do not recommend a rewind. They do recommend what they call a "basic," which is defined to be an inspection and test of the unit in their shop for an approximate cost of $450. They expect that the most that they would propose to do would be to clean, dip the stator and rotor in type H insulation, bake, replace the bearings, balance, and retest the machine. The scope of work would be best determined during the "basic." A total rewind cost is approximately $22,000 in Seattle.

B. Excitation:

The original excitation system needs replacement. At the time of the field survey, January 13 and 14, 1982, this unit was non-functional, and attempts were being made to troubleshoot the problems. The second excitation system utilizes a modern Basler regulator and is arcing badly at the brushes while in operation. The regulator is mounted on the wall separately from the main control panel. The excitation systems can be rebuilt and tested by Lloyd Electric when the generator is rebuilt and tested.

C. Controls and Instrumentation:

The controls and instrumentation are very minimal and in poor condition. The control panel has been modified many times with no indications left of the internal wiring and connections. Much of the equipment and wiring is unaccessible for connection verification. The control wiring is located with the 2400 volt conductors. The entire control panel needs to be replaced with a standard designed panel with new controls and instrumentation.

D. Protective Relaying:

The only protection to the generator is an undervoltage device on the circuit breaker and overcurrent fusing. It is recommended that new relaying in accordance to today's standards be installed with the above mentioned new control panel.

E. Turbine Safety Devices:

The unit is provided with standard safety devices monitoring bearing oil temperatures, governor oil pressure, governor belt condition, and turbine water pressure. There is no overspeed sensor; overspeed conditions have occurred. These devices need overhauling and recalibration. They should be reconstructed to show their alarm condition at one annunciator panel assiciated with the main control panel.

2. Diesel Power Plant

The diesel power plant which contains four diesel driven generators is located on the opposite end of Pelican from the hydro plant in a building which also contains the refrigeration equipment for the cold storage plant. Each generator unit is a standard packaged, skid mounted unit. The controls and safety devices are all self-contained. The engines are all cooled via radiators mounted to their skids. The building is in good condition.

A. Controls and Instrumentation:

The generator circuit breakers and instruments are enclosed in individual enclosures floor mounted against a wall at one end of the room. Two additional enclosures contain the outgoing feeder and cold storage feeder equipment. The control and instrument connections were not verified. The meters should be tested and calibrated and the circuit breakers should be adjusted and tested.

B. Protective Relaying:

The only protection for each generator other than the circuit breakers are reverse power relays. It is unlikely that these have been calibrated since installation. It is recommended that new additional relaying in accordance to today's standards be installed.

3. Distribution System

The distribution system consists of a 2400 volt insulated overhead line routed the length of the town. The overhead line consists of three conductors on pin insulators and crossarms. The poles and crossarms are being replaced on a regular basis and appear to be in good condition.

With the exception of the crab cannery and the cold storage plant, all secondary services are developed from pole mounted transformers. Most of the residential transformer containers are rusted with no visible size markings. Their sizes are estimated to be 15 KVA each. The other transformer sizes are shown on the drawing. The overhead line size was identified by Leonard Lowell & Associates in his report of 1977 to be No. 2 AWG. This was not verified. Loads through the various transformers were not determined. The primary fuse sizes were not verified.

A. Controls:

The system has three control points: (1) The hydro generator circuit breaker, (2) a main circuit breaker at the diesel power plant, and (3) a remote operated sectionalizing switch which separates the cold storage plant, the diesel power plant and cannery from the remainder of the system. The circuit breakers are both locally operated. The sectionalizing switch is operated from the diesel power plant. The controls were not verified for safety interlocks preventing connection of the two buses with the sectionalizing switch.

4. System Controls

The main operations center is located in the diesel power plant. The only remote instrumentation monitored is the ampere output of the hydro generator. The only remote control is for the sectionalizing switch. The generator loads are monitored via the demand needle on the KW/KWH meters. There are no kilowatt, var, or power factor meters.

It is recommended that kilowatt and var or power factor meters be permanently installed with each generator to aid in operating the generation systems more efficiently. It is further recommended that these indications plus the ampere and voltage indications from the hydro plant be remoted to the diesel plant. The remote indications and controls for the hydro plant should also include a general alarm, and voltage and speed controls.

5. Buildings

A. Hydro Generator Plant:

This building is a wood frame structure on a concrete slab. It appears to be structurally sound with a good exterior appearance. The interior is unfinished and difficult to maintain. The building needs a general upgrade.

B. Diesel Generator Plant:

This building is a metal building on a concrete slab. The overall appearance is good. Although the generator plant space is minimal, it is adequate.

6. References

A. Report by Leonard Lowell & Associates, dated 1977.

B. Report by Mr. Thomas Whitmarsh, Chief Engineer for Pelican Utility Company, dated August 1980.

C. Report by Mr. Thomas Whitmarsh, dated January 1981.

D. Report by Robert W. Retherford Associates, dated 1977.

Benjamin C. Haight, P.E.
January 22, 1982

NAMEPLATE DATE

1. Hydro Generator:

    General Electric
    No. 607224 P.F. 1.0
    Type ATB 10-500-760/735
    Form C 500 KW
    2300 Volt 125 AMP 760/735 RPM

2. Diesel Generator No. 1

    Caterpillar D333A
    1800 RPM 480 Volt 150 AMP
    100 KW

3. Diesel Generator No. 2

    Caterpillar D333A
    1800 RPM 480 Volt 150 AMP
    100 KW

4. Diesel Generator No. 3

    Caterpillar D343
    1800 RPM 460 Volt 447 AMP
    285 KW STANDBY
    Gen. Frame No. 449

5. Diesel Generator No. 4

    Caterpillar 3408
    1800 RPM 480 Volt 412 AMP
    275 KW 105°C TEMP RISE

6. Hydro Generator Governor

    Woodward
    Type VR FOOT POUNDS 2,000
    No. 4793

7. Hydro Voltage Regulator No. 1

    General Electric
    Diactor
    N.P. 76964-B

8. Hydro Voltage Regulator No. 2

    Basler

9. Hydro Undervoltage Device

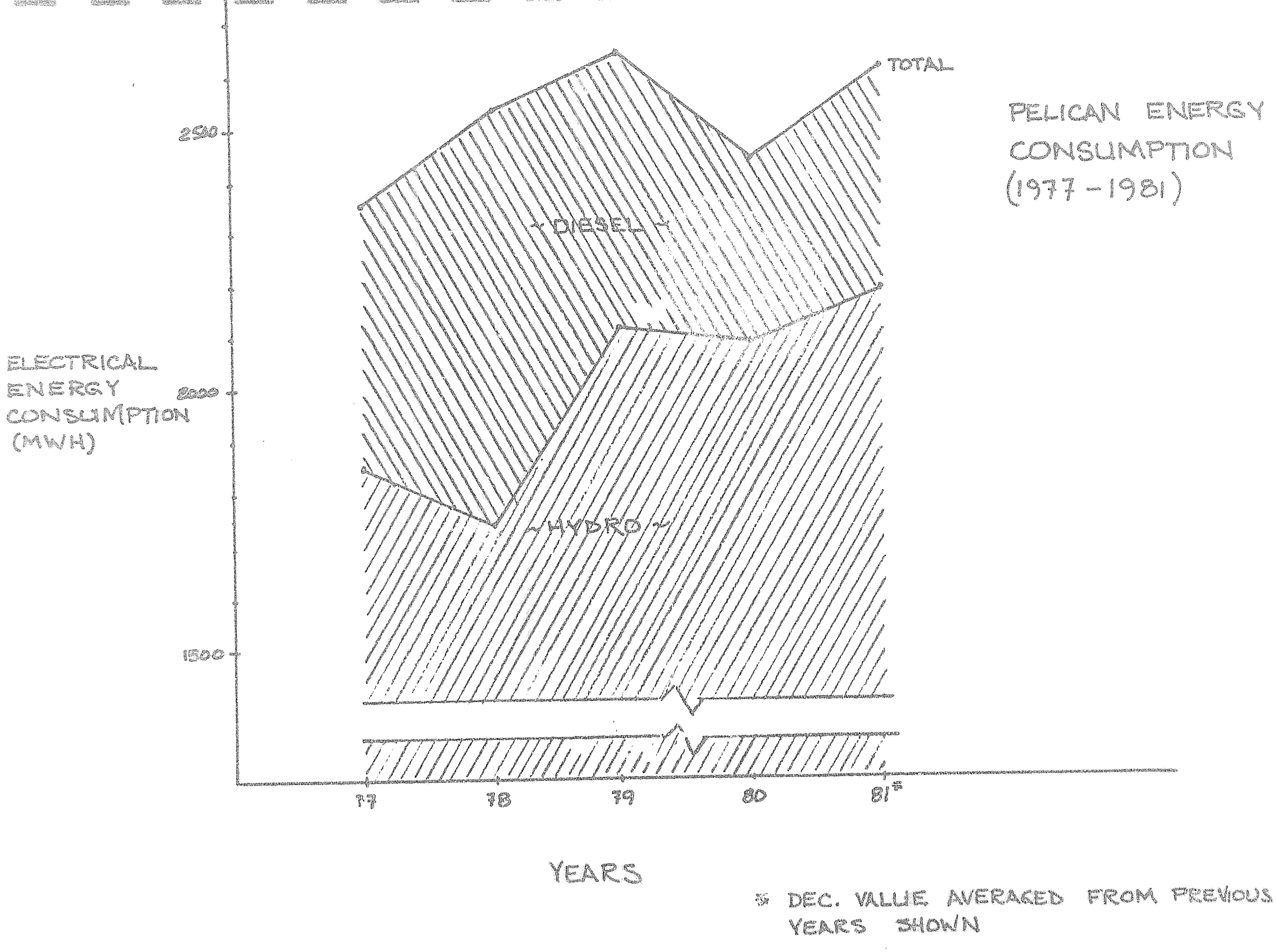
General Electric
Type PG-7 CAT 6300140 G38
230 Volt

10. Diesel Generators Power Relay

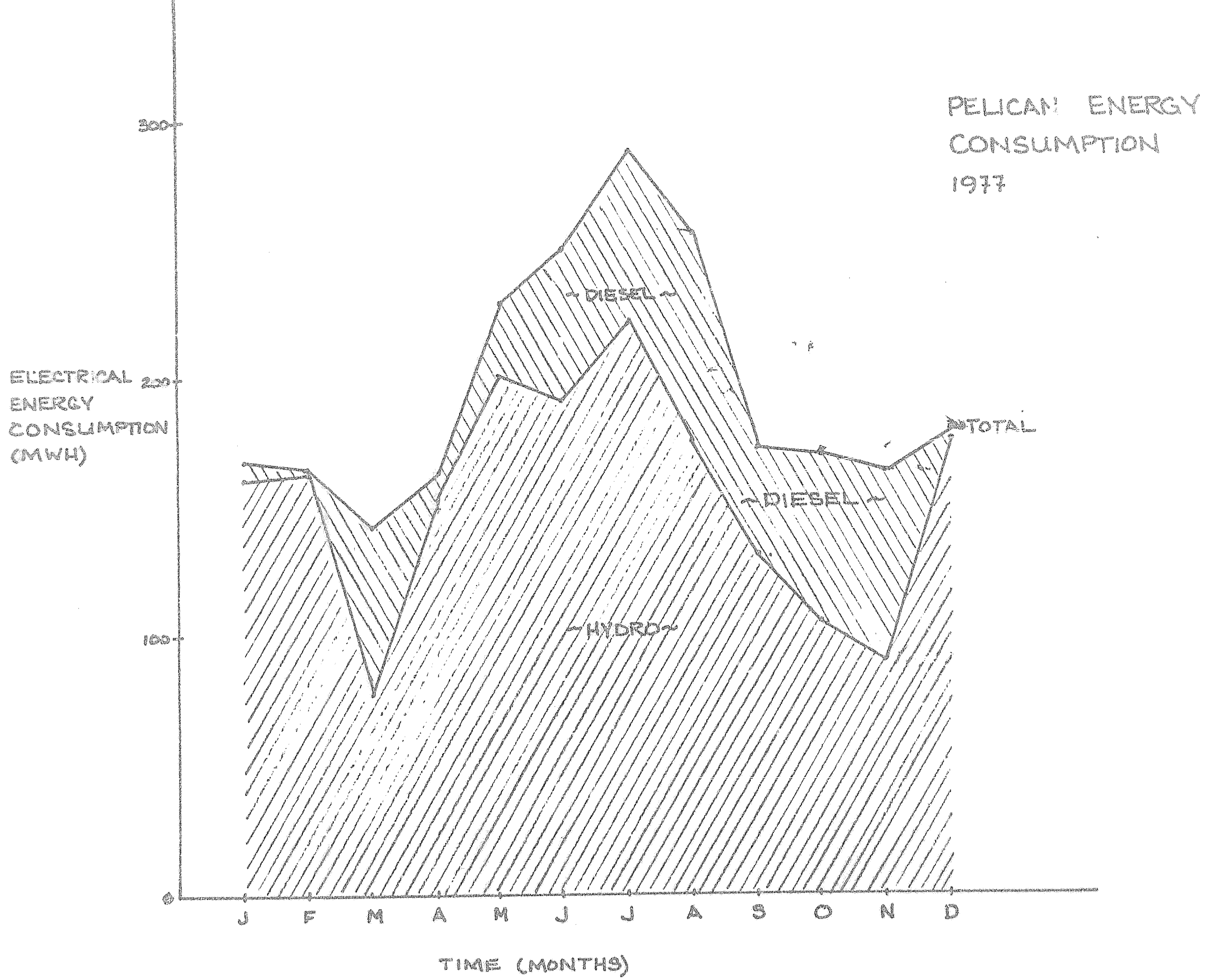
General Electric
Type 1CW Model 121CW5242A
Pick up 25/100

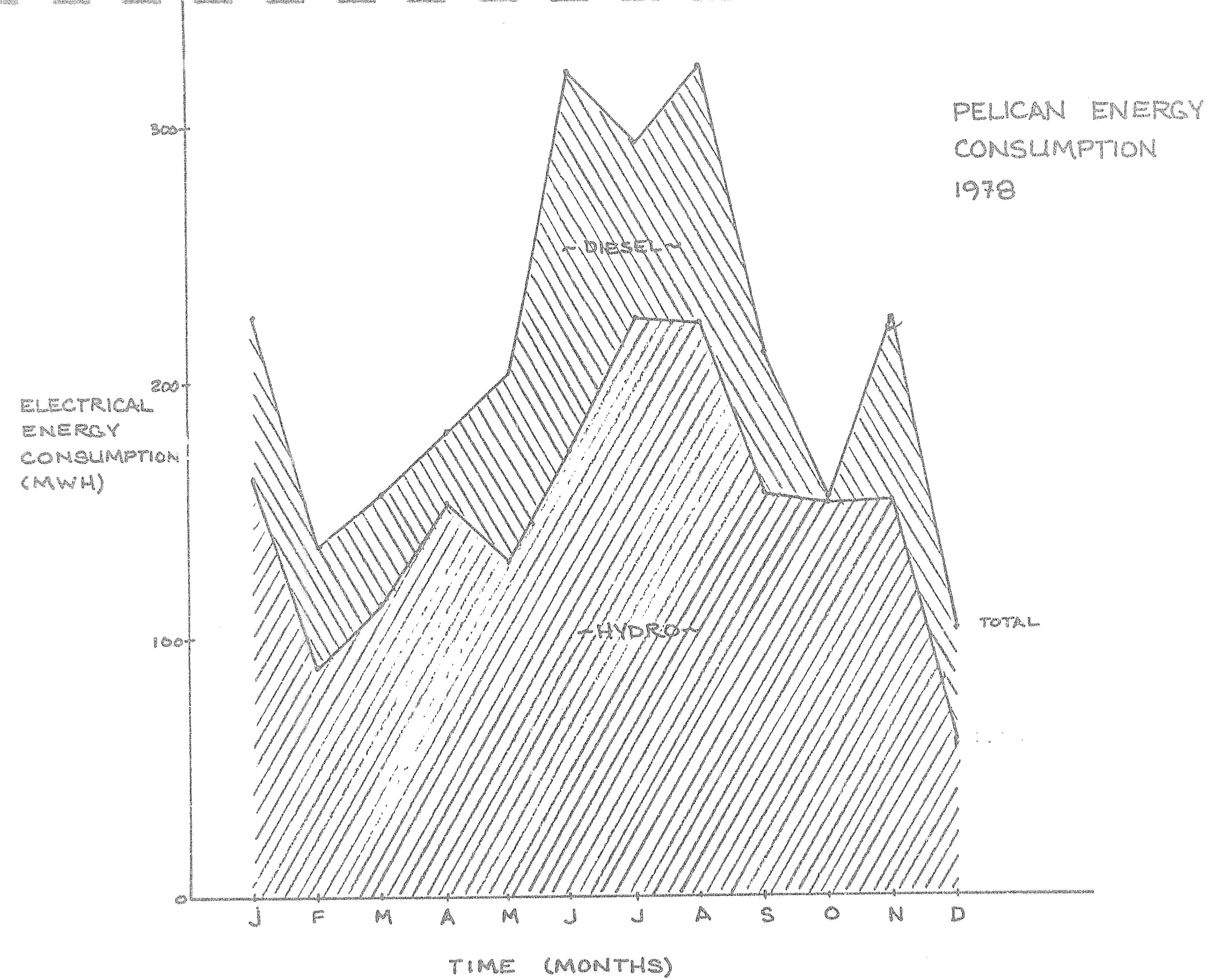
11. Kilowatt/Kilowatthour Meters

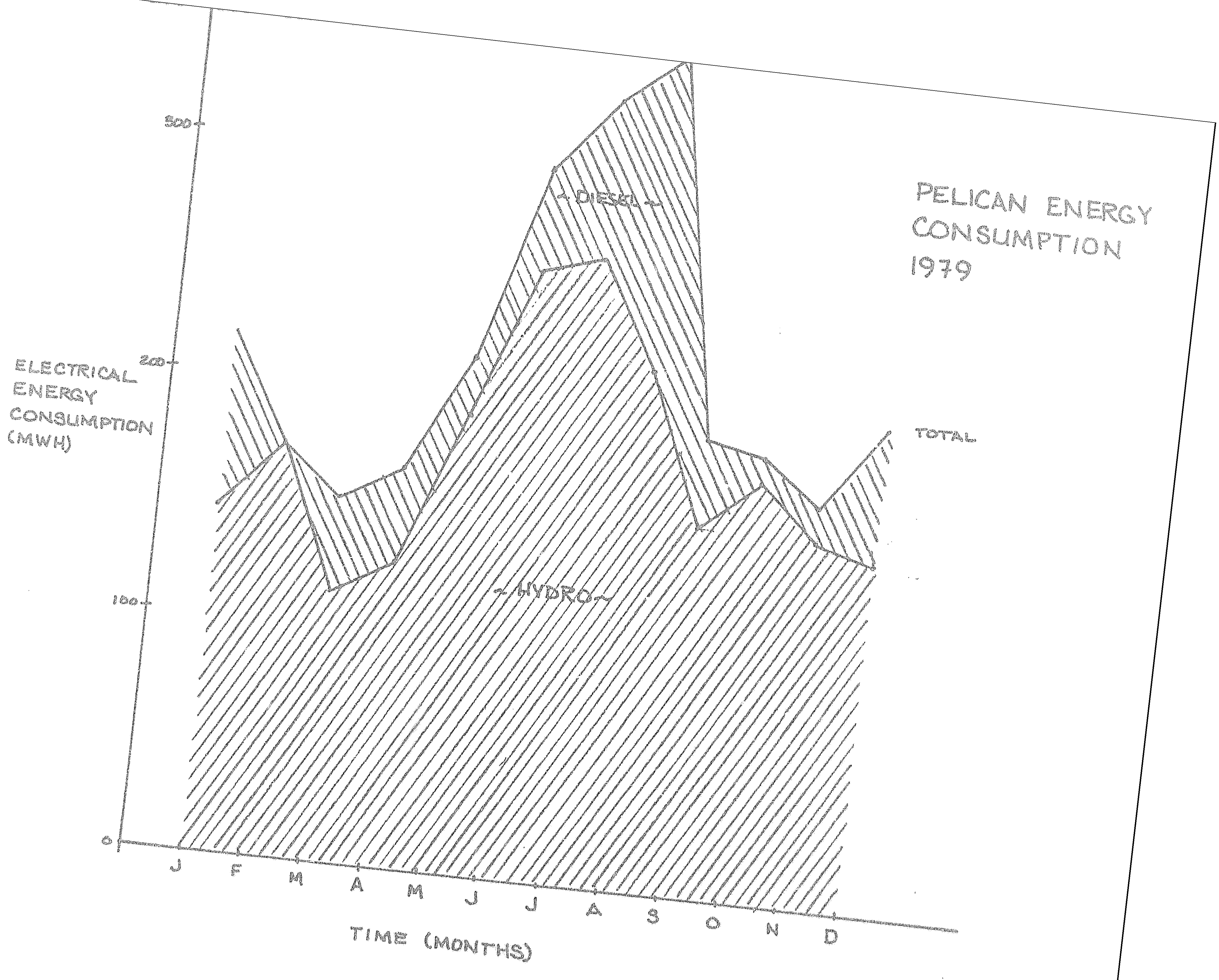
General Electric
Type DSMW-53
15 min Interval

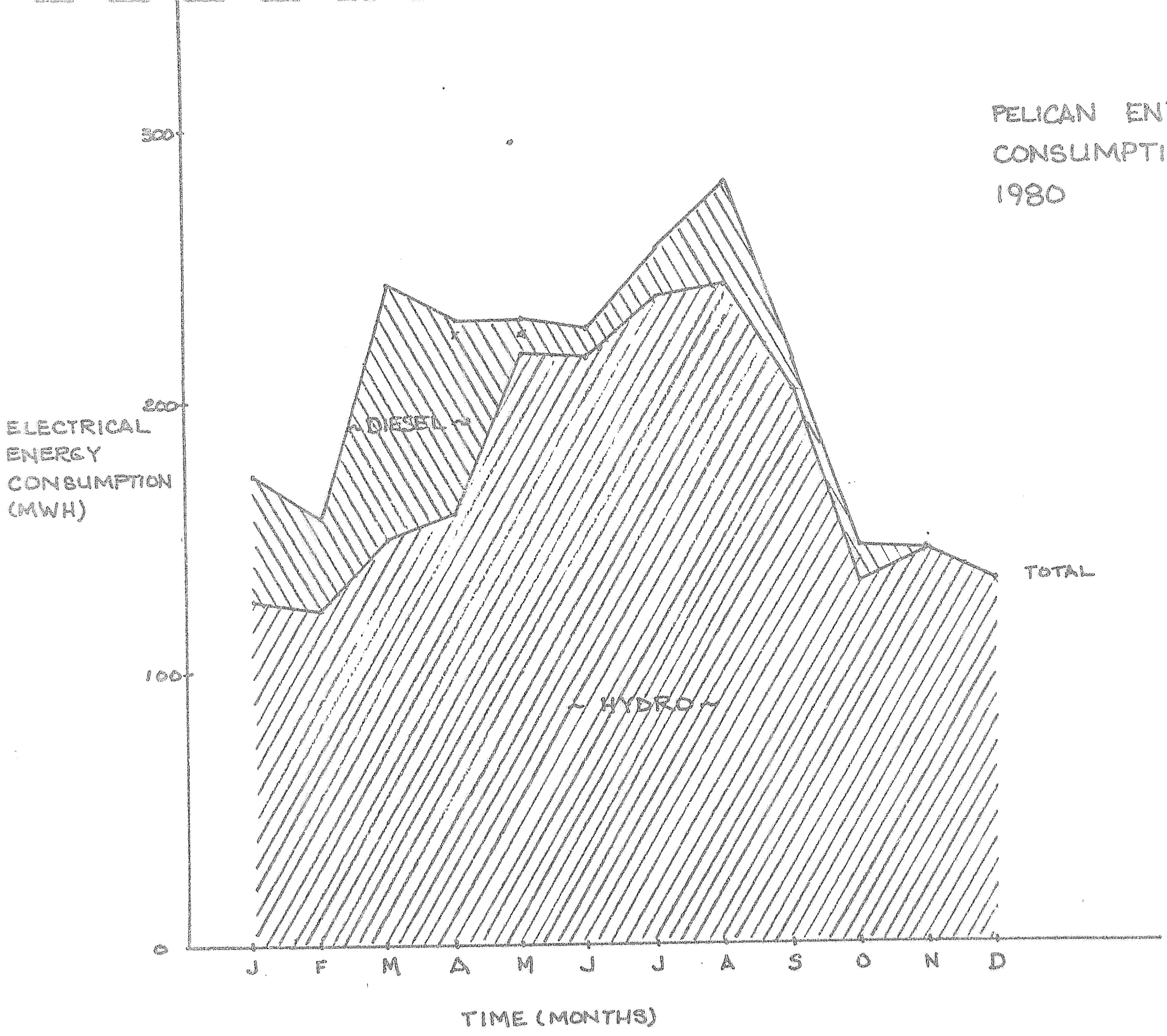


TOTAL
PELICAN ENERGY CONSUMPTION (1977-1981)
DIESEL
HYDRO
ELECTRICAL ENERGY CONSUMPTION (MWH)
2500
2000
1500
77
78
79
80
81*
YEARS
* DEC. VALUE AVERAGED FROM PREVIOUS YEARS SHOWN


PELICAN ENERGY
CONSUMPTION
1977
ELECTRICAL
ENERGY
CONSUMPTION
(MWH)
300
200
100
0
DIESEL
DIESEL
HYDRO
TOTAL
J
F
M
A
M
J
J
A
S
O
N
D
TIME (MONTHS)


PELICAN ENERGY CONSUMPTION 1978
ELECTRICAL ENERGY CONSUMPTION (MWH)
300
200
100
0
DIESEL
HYDRO
TOTAL
J F M A M J J A S O N D
TIME (MONTHS)


PELICAN ENERGY CONSUMPTION 1979
ELECTRICAL ENERGY CONSUMPTION (MWH)
300
200
100
0
DIESEL
HYDRO
TOTAL
J F M A M J J A S O N D
TIME (MONTHS)


PELICAN ENERGY
CONSUMPTION
1980
ELECTRICAL
ENERGY
CONSUMPTION
(MWH)
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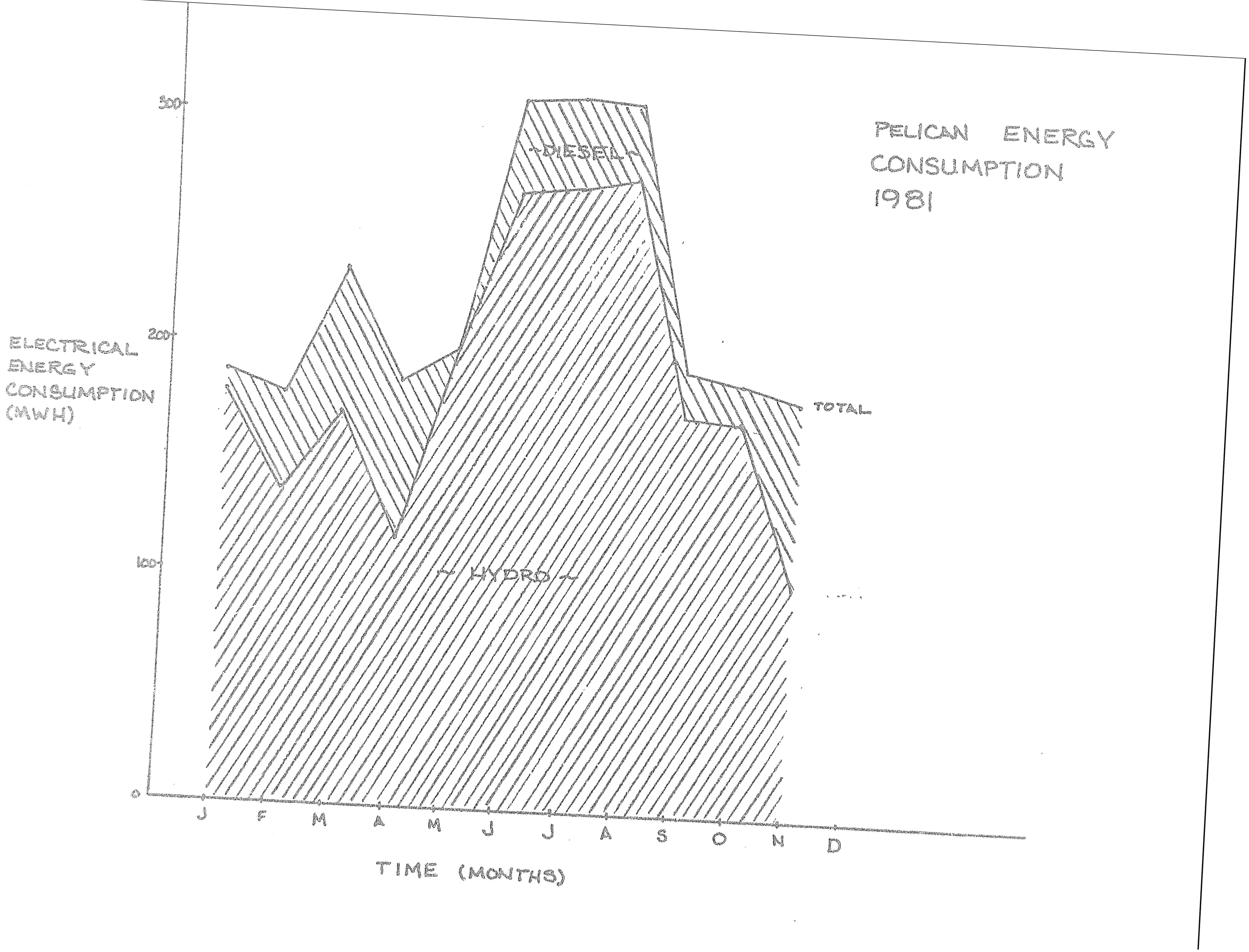
TIME (MONTHS)



PELICAN ENERGY CONSUMPTION 1981
ELECTRICAL ENERGY CONSUMPTION (MWH)
300
200
100
0
DIESEL
HYDRO
TOTAL
J
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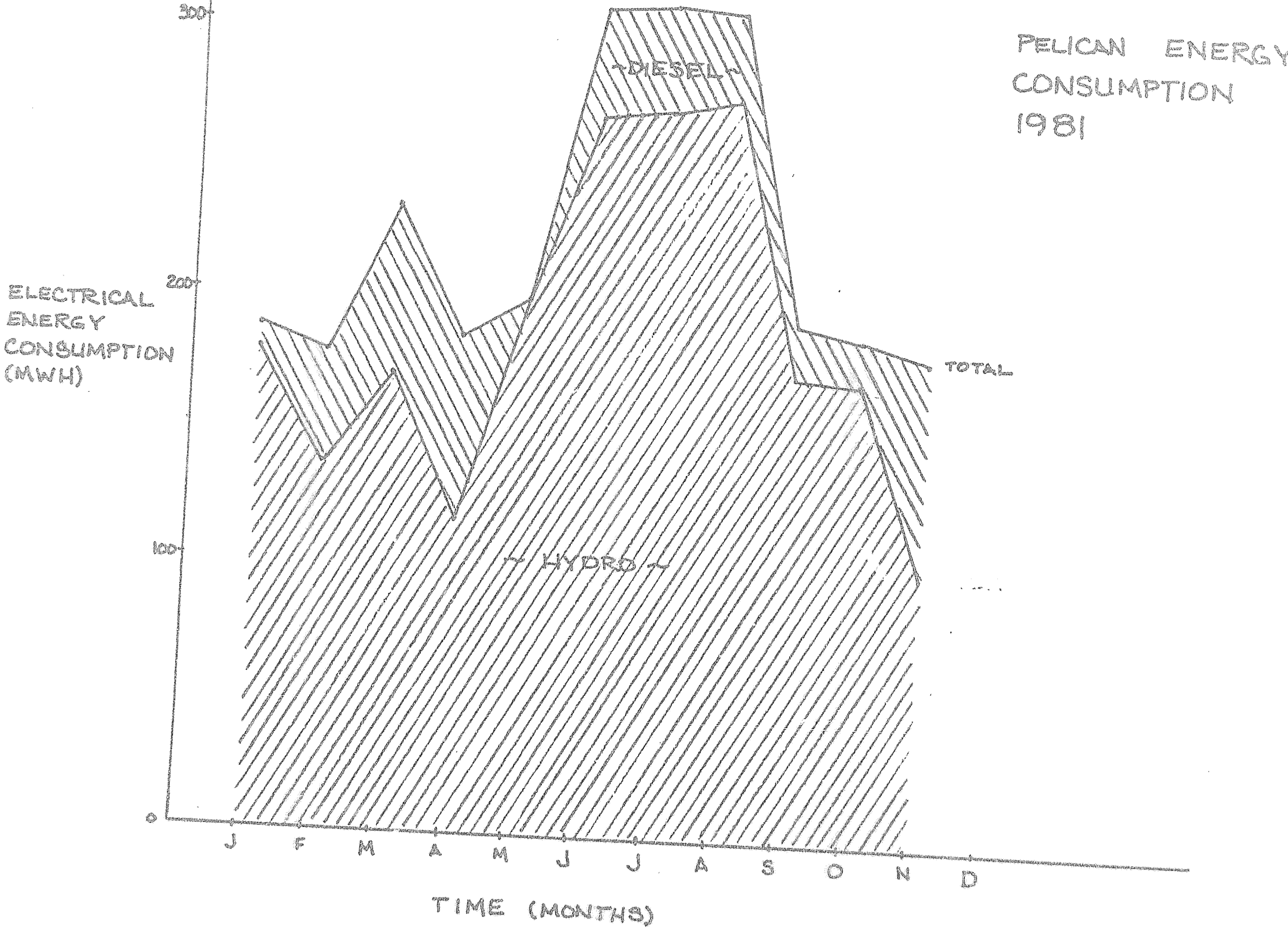
TIME (MONTHS)


PELICAN ENERGY CONSUMPTION 1981
ELECTRICAL ENERGY CONSUMPTION (MWH)
300
200
100
0
DIESEL
HYDRO
TOTAL
J F M A M J J A S O N D
TIME (MONTHS)

APPENDIX I

REVIEW COMMENTS ON DRAFT REPORT

APPENDIX I

REVIEW COMMENTS ON DRAFT REPORT

The following items, listed below, contain comments which were incorporated into the final report.

- 10 March 1982 letter from State of Alaska Department of Natural Resources
- 25 March 1982 letter from Calvin Philbin
- 24 February 1982 submittal from Tom Whitmarsh
- 9 March 1982 letter from Pelican Utility Company
- 3 March 1982 review of draft report from Alaska Power Authority
- 4 March 1982 letter from U.S. Department of Fish and Wildlife
- 16 March 1982 letter from Department of Energy, Alaska Power Authority
- 16 March 1982 letter from Alaska Fish and Game

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF [redacted] LAND AND WATER MANAGEMENT

JAY S. HAMMOND, GOVERNOR

555 Cordova
Pouch 7-005
Anchorage, AK 99501
(907) 276-2653

March 10, 1982

RECEIVED

ALASKA POWER AUTHORITY

Eric P. Yould
Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

I have reviewed "A Report to Alaska Power Authority On Pelican Power Alternatives, Phase I - Reconnaissance Assessment." The Water Management Section has management responsibility for water quantity and dam safety. I offer the following comments in those areas.

Water Quantity

The Pelican Utility Company has water right certificate 43665 for 60 cfs associated with this facility. If more water than this is required after the modification, an Application for Water Right must be filed with this Division for the additional quantity needed.

Dam Safety

Page 6-3 of the report indicates that total failure of the dam is envisioned during an exceptionally high flow, but no downstream loss of life or property would be expected. This is in partial disagreement with the Phase I Inspection Report of the Pelican Cove Creek Dam by the U.S. Army Corps of Engineers. Page 6 of this report states that this dam has a downstream hazard category of 2(significant) based on the potential loss of life downstream of the dam. Because of this hazard the Corps of Engineers has identified, and becuase of the impending dam failure, the dam should either be destroyed or modified as soon as possible.

As mentioned on page 13-2 of the report to the Alaska Power Authority, and according to 11 AAC 93.160, no work on the restoration or demolition of this dam may begin until filing an Application to Construct or Modify a Dam and receiving approval from this Division. Therefore, I would like to be kept informed as plans continue.

Thank you for the opportunity to review this report.

Sincerely,

J.W. SEDWICK
Director

Paul Janke

BY: PAUL JANKE, P.E., Civil Engineer
Water Management Section

pc: Leila Wise, DNR

March 25, 1982

Harvey:

As we discussed Scenario No. 1 will remain the same, which is a recap of 1981 power sales. Add 5% for line loss if you want actual power generated.

Also, please remember to take out Gross Sales and Gross Revenues in the Business Trends section of my original questionnaire response.

Thanks.

Sincerely,

Cavin W. Philbin

CWP/ak

cc: Jim Ferguson

LOCATIONS

PELICAN
UTILITY COMPANY

GENERAL OFFICES 653 N.E. NORTHLAKE WAY, SEATTLE, WASHINGTON 98105 · PHONE (206) 632-8000
GENERAL OFFICES MAILING ADDRESS: P.O. BOX 5538, SEATTLE, WASHINGTON 98105

March 25, 1982

Mr. Harvey Hutchinson
Engineering Science
242 S. Main Street
Alpine, Utah 84003

Re: Electric Load Forecast Revision for Phase II of Pelican Hydro Study

Dear Harvey:

Enclosed are load revisions for Scenario No. 2 of my original questionnaire response to you dated January 8, 1982. We have had a chance to look more closely into the power required to store an additional 2 million pounds of product and run a secondary boxing operation at Pelican. The annual total on Scenario No. 2's power consumption increased from 2,541,000 KWHs to 2,945,000 KWHs.

The methodology for applying this increase remained the same. I have also rewritten the paragraph on plant expansion as follows:

B. Additional plant and community expansion potential when certain Sand Point and Seattle processing activities are shifted to Pelican.

Plant Expansion. Additional storage capacity will have to be added to the Pelican facility to store product from Sand Point, Port Alexander and Pelican throughout the year. Pelican is presently able to store roughly two million pounds of product and if the Sand Point and Port Alexander facilities utilized the Pelican location to store products, it is estimated that Pelican would need space for over 4 million pounds during the months of August, September and October, providing the three plants produce on a scale comparative to 1981 season poundage. This assumes salmon roe, opilio crab and roe herring are sold FOB plant and 1981 levels of salmon are canned. This also assumes utilizing Pelican totally for storage and secondary processing. To store two million pounds in a new, fully insulated facility would require a 38HP compressor running 70% of the time which would use about 175,000 KWHs per year. Fans and a condenser pump would be rated at a total of 10HP which, running continuously, would use another 65,000 KWHs for a total cold storage usage of 240,000 KWHs consumed annually. Lighting and office heat for the cold storage would amount to another 50,000 KWHs per year.

PELICAN

It is estimated that boxing product in Pelican would require increased heat, lighting and small motor use demanding 100,000 KWHs per year. Bunkhouse power demand would increase 15%, or 45,000 KWHs per year.

Pelican Cold Storage Company is also planning on adopting conservation measures as part of an on-going program to cut back power use. The cold storage could save a large amount of power by re-insulating the facility and decreasing infiltration through doors and other openings.

Other energy savings realized through cutting down on electricity use would be negated by increased dependence on electrical power instead of diesel powered machinery as fuel prices increase faster than electric rates.

The domestic load would be expected to increase by 30,000 KWHs (two to three homes) as a result of Pelican's expansion. There would be no effect on the harbor's or commercial users' power use as a result of the expansion.

Based on these figures, Pelican could expect an additional 435,000 KWHs to be consumed if a boxing operation were undertaken, not taking into account energy savings. Based on 1981 storage amounts from the three plants and estimated product life in storage at Pelican, the 435,000 KWHs were spread over the six bi-monthly billing periods in the following percentiles, (see Scenario No. 2 power consumption estimates):

December/January	-	15%
February/March	-	10%
April/May	-	10%
June/July	-	15%
August/September	-	30%
October/November	-	20%

Sincerely,

Cavin W. Philbin
General Manager

CWP/ak

cc: Jim Ferguson. Cal Boord, Tom Whitmarsh, Jerry Larson, APA

SCENARIO # 2 - AMPLIFY HYDRO SYSTEM TO FULLY ACCOMMODATE POTENTIAL PLANT AND COMMUNITY EXPANSION WITH HYDRO POWER

Month	Water Consumption (000's omitted) Industrial(1)	Domestic(2)	Total	Power Consumption - KWHs (000's omitt Industrial	Marina	Domestic	Total	
J	7,920	1,468	9,388	269	25	66	360	Dec/Jan
F	7,920	1,468	9,388					
M	1,100	667	1,767	417	25	62	504	Feb/Mar
A	1,100	667	1,767					
M	33,000	667	33,667	333	8	61	402	Apr/May
J	33,000	667	33,667					
J	33,000	667	33,667	362	6	64	432	June/Ju
A	33,000	667	33,667					
S	1,100	667	1,767	694	14	70	778	Aug/Sep
O	1,100	1,468	2,568					
N	7,920	1,468	9,388	369	6	94	469	Oct/Nov
D	7,920	1,468	9,388					
	Annual Total:		180,089			Annual Total:	2,945	

(1) Industrial water use increases est. 10% over Scenario #1.
(2) Domestic water use increases est. 3% over Scenario #1.

Month	Boat Days @ Marina Scenario #1	Scenario #2	Employees Scenario #1	Scenario #2	Residents (1) Scenario #1	Scenario #2	# Homes (1) Scenario #1	Scenar #2
J		No appreciable change	50	60	175	180		
F	4,500		50	60	175	180		
M			60	70	175	180		
A	1,830		65	75	175	180		
M			90	100	200	205		
J			110	120	200	205	75	78
J	7,360		120	130	200	205		
A			120	140	200	205		
S	3,720		40	80	175	180		
O			40	80	175	180		
N	3,050		40	60	175	180		
D			50	60	175	180		

(1) Increases in residents and homes only reflect change in processing strategies and do n account for an estimated 5% increase in population over the next 5 years due to a natu influx of people.

COMMENTS ON " A REPORT TO ALASKA POWER AUTHORITY ON PELICAN POWER ALTERNATIVES: PHASE I - RECONNAISSANCE ASSESSMENT" (JANUARY 1982)

RECEIVED
MAR 2 1982
ALASKA POWER AUTHORITY

Page 4-4 There is some climate data available. Betty Clauson keeps records for the National Weather Service.

Page 5-5 Fidelity Exciter 1450 RPM instead of 145 RPM.

Page 5-7 The fourth Cat is a 3408 per B.C. Haight report.

Page 6-6 Second paragraph: No rocks ever found in bottom of turbine case although steel H sections which rust off on inside of penstock are found there. All the blade damage is due to sticks being jammed against them. A much better trash rack system is required. The present rack can plug in as little as three hours during high run-off periods.

Page 6-6 Replacing the flume to the down stream end of the tunnel with pipe is a good idea, but it would be very difficult to build a wood stave pipe through the tunnel. This section should be metal pipe. Was a check made of using aluminum culvert instead of wood stave pipe? During this winter, 1981-82, many more small leaks have occurred in in the flume just up stream from the penstock. This section was built in 1974 and the freezing of water in the joints is opening it up. Substantial amounts of water are leaking. So pipe replacing the entire flume should be strongly considered. (Better trash rack at dam would then be required).

Page 6-7 Wall thickness of turbine: Holes drilled and tapped in top of case for grease fitting access showed about ½" wall thickness.

Page 10-1 Cal Boord, not Cavin Philbin, is General Manager.

Page 10-2 I do not believe there is ten feet of additional head in the tail-race. There might be ten feet total head increase if the tailrace was lowered and the flume was replaced with pipe all the way to the dam.

For additional head, another alternative is to install an entirely new dam in the notch 100 feet down stream from the present dam. This dam could easily be 50 feet higher than the existing dam and would eliminate the need for 100 feet of wood stave pipe and repairing the present dam including the wing walls. The $322,550 savings on repair could go toward the new dam. The higher dam would require an environmental impact statement however.

Page 11-1 Expansion requirements: I believe the estimates for KWH for a larger cold storage and packing operation are too low. In mid winter 1981 with no fish being frozen, the electrical load from the engine room and fishhouse is averaging about 1960 KEH per day or over 700,000 KWH over a year. It seems reasonable to use this figure as a baseload for a two million pound cold storage. If the cold storage was upped to four million pounds it would likely double the power requirements because most of the load is compressors and pumps for refrigeration.

Also the estimate for the increase in domestic load was only 15,000 KWH per year. This might be equivalent to about two new houses. It seems reasonable to me that the additional steady work available with a packaging operation would result in considerably more town growth than this. 75,000 to 150,000 KWH might be a more reasonable estimate. So the additional power usage could easily run 600,000 KWH higher than the estimates in the report.

Page 11-2 Fossil fuel: The all diesel plan indicates no capital works are required, but this is incorrect. At the present time we do not have adequate capacity with diesel power to operate the plant at peak load in the summer high load period. This is with all engines running at peak output and no back-up for maintenance down time. At least one additional Cat of 3408 size or larger would be required for an all diesel operation.

Page 11-3 Heat recovery: Might be possible from refrigeration compressors regardless of power source.

Page 11-4 Alternative #2: Diesel power is called reliable; however, in my experience with the Pelican and Sand Point plants, numerous breakdowns and rebuilds require extra engines for standby and considerable maintenance expense.

Page 12-3 Typo: 500 KW turbine not 50 KW turbine.

Page 12-3 Estimates based on same flows as used by present turbine do not come close to utilizing the available water resource. During the last six years, during the spring, most of the summer, and the fall large amounts of water flow over the dam to waste. This water could be used to generate more power if turbine capacity was available. Even this summer when the turbine was finally able to run at full capacity, 500 KVA, there was lots of excess water. If our present turbine is only operating at 50% efficiency and the efficiency could be raised to 75 % with new turbines, than the same amount of water would be required for a 250 KW and 500 KW generator as is required for the present inefficient 500 KW generator. This does not allow for the 10 % increase in power available due to higher head or the fact that much more water is available for seven months of the year. Possibly a 750 KW and a 250 KW generator would more fully utilize the power available.

USKH letter to Alaska Power Authority, December 23, 1981.

Page 2 Third paragraph: Low water in summer during last six years has only been in last two weeks of August and sometimes not even then. However, we often need diesel suppliment power from late November to mid April.

Page 3 Third paragraph: Only one man checks flume and dam daily, and it takes about 15 minutes. The safety problem with ice in winter is very real and getting worse.

Page 5 Fifth paragraph: Only one cave in in tunnel noted in last four years. The tunnel is larger inside than the flume so some blockage does not make that much difference.

Pelican Cold Storage Questionnaire

Assumption of the same amount of diesel burned in 1982 as in 1981 is already incorrect as the 1981 winter was very mild and the hydro was used extensively. 1980 was also a mild winter and production was downa as well, requiring less power. So, the last two years have seen lower than normal diesel usage.

Assumptions on additional power required for a secondary processing operation are probably way too low. The domestic load increase is also too low.

USKH letter from B.C. Haight, January 21, 1982

Hydro Electric Generator

A. Generator: The Babbit bearing was new two years ago. The down time cost for sending the generator out for rebuild could easily exceed the cost of a rewind. If the job could be done in Pelican it probably should be.

B. Excitation: G. E. guarranteed the new exciter when they worked on it last summer. It still has the same arcing problem, so they will be coming to Pelican to trouble-shoot it when there is enough water to run the turbine again. This will probably not be before April.

Distribution System : While poles and cross arms are being replaced when time there are at least ten questionable poles and we are only changing one or two a year.

Most of the distribution transformers are 25 KVA. A peaking AMP probe has been installed on most of them to check for overloads. only the one by the bunkhouse is marginally overloaded and that load will be split this spring.

A. Controls: There is no safety interlock preventing connection of the two buses with the sectionalizing switch.

Tom Whitmarsh
February 24, 1982

Pelican
9803

LOCATIONS

PELICAN
UTILITY COMPANY

GENERAL OFFICES: 653 N.E. NORTHLAKE WAY, SEATTLE, WASHINGTON 98105 • PHONE (206) 632-8000
GENERAL OFFICES MAILING ADDRESS: P.O. BOX 5538, SEATTLE, WASHINGTON 98105

March 9, 1982

Mr. Jerry Larson
Alaska Power Authority
334 West 5th Avenue
Anchorage, AK 99500

Dear Jerry:

Enclosed for your information are recommendations from our company for the second phase of the study involving Pelican's power alternatives.

Of prime importance to the company is to have a survey done of the entire water system. One particular area that needs surveying is the dam. The survey drawings should include determining the dimensions, amount of voids in the rock, abutment conditions and information needed for a grouting engineer to step in and grout the dam. Included in the dam survey should be cost figures, drawings and additional power gained as a result of increasing the height of the dam. In addition, it is important that the survey team document their investigation and analysis of building a new dam downstream adjacent to the notch where the tunnel is located. The documentation should be supported with engineering feasibility and costs, comparing them to the costs associated with grouting the dam. Loss of Head

Replacing the wood stave pipe in the tunnel should be looked at more closely to determine if it wouldn't be more practical and less costly to install a metal pipe instead of a wood stave pipe.

A detailed feasibility and cost analysis of replacing the flume upstream from the penstock should be done, particularly to determine if installing a metal pipe is a better solution than wood.

The penstock will have to be replaced in the near future. When this is done, the collection box will have to be upgraded also. What would be a sound means of handing the trash collection upstream from the collection box at the time of this upgrading? It would be beneficial for the survey team to analyze the trash removal, collection box and penstock replacement, remembering that at some time in the future there will be two turbines instead of one.

Finally, the survey investigation should look at whether 10 feet of additional

PELICAN

head would be derived from lowering the tailrace. Tides should be taken into account with measurements and costs associated with lowering the tailrace.

The final economic analysis should offer Pelican Utility Company an idea of what a final cost per installed KW would be after the proposed upgrading and as a result, the cost per KWH generated by the hydro system. Please include savings from not relying on diesel power which, except for standby power, will eliminate diesel fuel and maintenance costs.

In addition, we are aware that there are discrepancies in the additional power figures required for plant expansion included in phase 1 of the study. We plan on rectifying these discrepancies before the end of the second phase of this study.

Sincerely,

Cavin W. Philbin
General Manager

CWP/ak

cc: Jim Ferguson
Cal Boord
Tom Whitmarsh
Pat Creegan, USKH-Engineering Science, 600 Bancroft Way, Berkeley, CA 94710
Harvey Hutchinson, USKH-Engineering Science, 242 S. Main Street, Alpine, Utah 84003

ALASKA POWER AUTHORITY
334 West 5th Avenue,
2nd Floor
Anchorage, Alaska 99501

(907) 276-0001
(907) 277-7641

LETTER OF TRANSMITTAL

DATE: 3-2-82 JOB NO: PELICAN

ATTN: HARVEY Hutchinson

TO:
ENGINEERING SCIENCE
194 EAST PARADISE Lane
Alpine, UTAH 84003

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ CHANGES IN ROUGH DRAFT

COPIES	DATE	NO	DESCRIPTION
	3-2-82		Pelican HyDRO, misc pages FROM
			Rough DRAFT TO BE corrected.

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ______ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit ______ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return ______ corrected prints

☒ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19 ______ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS HARVEY - I will FORWARD Any And All Letters Received FOR comments, AS soon AS They ARRIVE. Give me A call IF you Need FURTHER clarification on Any items.

COPY TO ______

SIGNED Terry Lawson

If enclosures are not as noted, kindly notify us at once.

2,500,000 kW (2,500 MW) of electricity to the community and storage company annually. The community is small, but ~~its far-reaching effect~~ served about 1,500 fishing vessels in 1980 and is critical to the fishing industry in that area.

Pelican Potential for the Future

With storage and a small diversion on Phonogaph Creek there is a potential of about 1.1 MW of additional hydro-electric capability. The feasibility of that additional power is dependent of whether the cold storage and secondary processing is expanded. The expansion of the fish processing plant, which is presently being investigated (Scenario #2, Section 8) by the Pelican Cold Storage Company, calls for only about .66 MW in total production.

THE PROBLEM

The APA has employed the services of USKH-ES to perform a reconnaissance-level study, as outlined in Section 3, on the power facilities at Pelican, Alaska for the purpose of leading to a feasibility study of a suitable alternative to meet the power needs presently and in the future. The requirements are outlined in the APA register 1981 3AAC 94.055, Sec. 4 as amended.

The penstock is a 36" Ø nominal circular wood stave pipe with steel reinforcing hoops. It is 326 feet long, running on a straight alignment and about a 19 percent grade.

The only way the dam can pass design flood is by overtapping the wing wall. This would take out the flume in that section. In addition, the tunnel has experienced roof spalling from time to time and rocks have actually passed the rock box and entered the turbine causing serious blade damage to the impeller. To eliminate these problems, under Alternative #1, it is recommended that the flume be replaced from the dam to the downstream end of the tunnel with a 5' Ø wood-stave pipe, properly anchored and with a timber roof protecting it from being carried away in flood. Under Alternative #3 it is recommended to replace the flume all the way from the dam to the penstock forebay in order to take advantage of full head in the reservoir and elimnate the need for the bar screen and overflow structure.

Under Alternative #1 both the bar screen and overflow structure and the rock box surge chamber (penstock forebay) are called to be redetailed and reconstructed. The latter is also recommended under Alternative #3, so as to efficiently prevent rocks from passing down the penstock.

The penstock is worn to an estimated 1/2" wall thickness in places and is called to be replaced. Because of construction logistics, redwood wood-stave pipe is selected over steel. It has a life of 35-40 years.

The area under the flume and penstock is in need of housekeeping to reduce rot potential. Threatening trees should be guyed back so as to preclude windfalls such as took out the penstock last November.

The braced timber bent support structure is in fair condition. Certain members, on a selected basis, should be replaced to give the system a new life. This relates to perhaps 10 percent of the members. The pile members are founded directly on natural ground and can be expected to have a longer life if supported up about 1' off the ground with concrete footings.

POWERHOUSE AND GENERATING FACILITIES

The 42-inch Ludlow Valve is old and has failed. The water hammer which cracked the bonnet was only one in a series of problems in the last three years. In 1980, this valve caused a two-month down time of the hydro-system, at a great loss of revenue.

The Leffel Turbine has an impeller that is producing perhaps 20 percent less energy than a new one with less down time, and more flexibility to operate efficiently over a greater range of flows. The water quality change caused by the lubrication prevents the company from using the water from their proposed fish hatchery. The wall thickness of the turbine casing is questionable. Certainly, erosion during the 75 years of use has cut into its designed safety factor. A major overhaul of this turbine would be necessary but may not extend its useful life significantly. The turbine was purchased because it was available, not because it was the best suited for the flow of the creek. To continue this equipment's life may not be the best decision in lieu of the spiraling cost of energy.

The generator needs to be at least rewound.

The switch gear needs to be replaced with new equipment because most of the components are old and not reliable during times of stress.

The powerhouse needs major repairs to the foundation, especially in the afterbay and tail race sections of the facility. These, as a minimum, would require repair of the walls and installation of new steel liner. For optimum improvements, it is recommended that the draft tubes be

SECTION 7

HISTORY OF PELICAN UTILITY COMPANY LOADS AND REVENUES

INTRODUCTION

Table 7.1 is drawn from information contained in Appendices C and H.

TABLE 7.1

LOAD AND REVENUE TRENDS

Fiscal[a] Year	Gross Sales Pelican C.S. Seafood	Gross Sales Pelican C.S. Pelican Store	KWH Produced	Gross Revenues From Water Sold Pelican U.	Gross Revenues From Power Sold Pelican U.
1977	$ 6,438,000	$683,000	2,350,000	$ 6,000	$ 75,000
1978	7,234,000	679,000	2,540,000	6,000	125,000
1979	9,888,000	923,000	2,650,000	6,000	140,000
1980	14,861,000	964,000	2,450,000	6,000[c]	144,000[b]
1981	13,658,000	712,000	2,625,000	11,000	210,000

(a) Pelican's FY is April 1 to March 31.
(b) Pelican Utility power rates increased 22% during FY 1980.
(c) Pelican Utility water rates increased about 40% during FY 1981.

SECTION 8

PLANNING SCENARIOS

There are two planning scenarios:

#1 - The industrial and urban power requirements of Pelican will remain more or less at present levels. ~~with the power supply to come from a refurbished hydroelectric system (present scheme) backed up by the standby diesel.~~

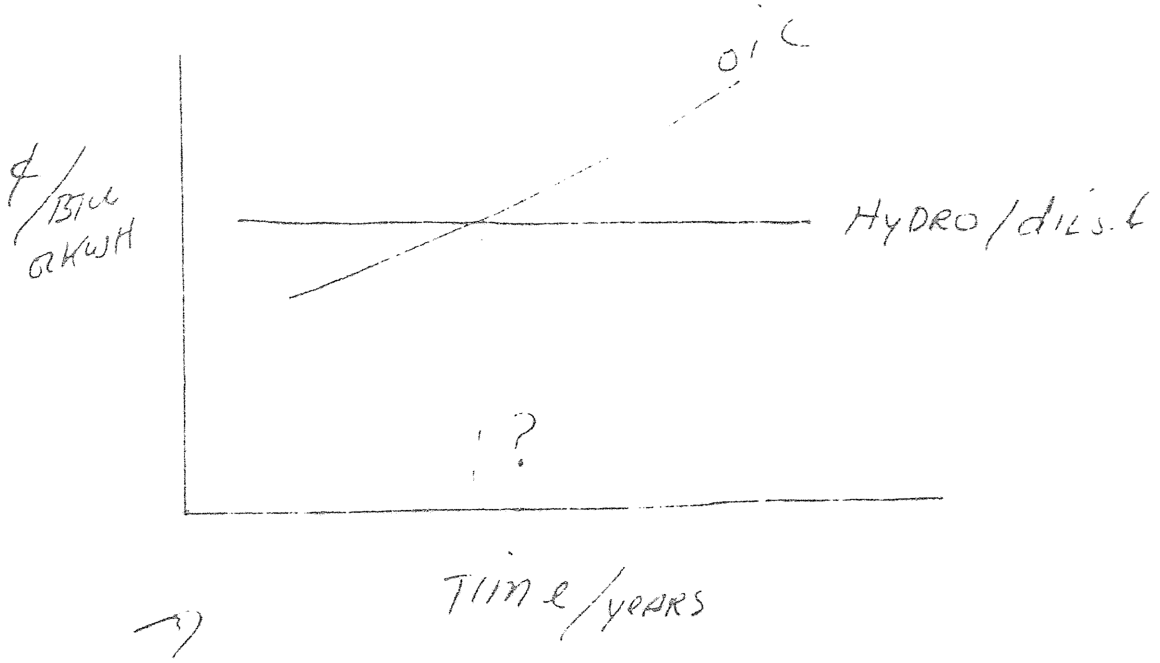
#2 - The industrial and urban power requirements of Pelican will increase 15% within the next few years. ~~with the power supply to come from a refurbished hydroelectric system (present scheme) upgraded to furnish additional power and better 12-month hydro reliability~~.

SEE - PAGE. 9-2

*

What is cost of ELEC? [illegible]

[illegible]



COST FOR SPACE HEATING

→ AT WHAT POINT IN TIME WOULD THIS MOST LIKELY OCCUR BASED ON APA ESCALATIONS? SHOW IN GRAPH FORM AS ABOVE.

TABLE 9.1 - Continued

Questionnaire No.	Water $	Electric $	Fuel $
	Utility Costs for 1981		
1	60.00	540	1950
2	134.40	458	950
3	--	--	--
4	--	372	1006
5	67.20	480	1380
6	72	577	1200

Even though only six questionnaires were received, they do contain some very valuable information. Out of the six questionnaires received, all said that they now use oil for heating and five use it for cooking. All said that if hydropower were cheaper than oil they would change to electrical heating. One user reported his costs over the last six years for electricity and fuel. That information is as follows.

Electrical Bill

Year	1976	1977	1978	1979	1980	1981	Increase
Cost($)	300	300	360	360	420	480	60%

Fuel Bill

Cost($)	700	700	750	1320	1825	1950	178%

This points to be beneficial effect that the hydro generation has had on the price of power. The hydropower costs stayed about the same during the period whereas the diesel costs increased almost 300 percent.

One questionnaire pointed out that power fluctuations have destroyed many radios, freezers, clocks and other major electrical items. This is borne out in other parts of the study and is caused by obsolete and worn equipment that needs replacing.

SECTION 10

WATER AND POWER DEMANDS

INTRODUCTION

The water and power demands shown in Tables 10.1 and 10.2 are derived from data presented in Appendix C. This is the response of Cavin Philbin, General Manager of the Pelican Cold Storage Company, to a questionnaire sent to the company. There is only about a 15 percent growth in power demand anticipated for Scenario #2 over Scenario #1.

They estimate that on an average year, 25 percent of their power has been generated at the diesel plant. This ~~jibes~~ correlates well with Lowell's report of 1977 and Haight's report (Appendix H) taken from the annual reports of the Pelican Utility Company:

Year	% Diesel Generation
1971	23.0
1972	24.9
1973	19.2
1974	36.9
1975	30.6
1977	21.3
1978	31.5
1979	20.4
1980	14.7
Mean	24.7

jibes is correct — correlates is incorrect — change to "agrees"

SECTION 11

ALTERNATIVES

ALTERNATIVES DISCARDED

Phonograph

The alternative of diverting water from Phonograph Creek by a dam at Phonograph Lake was studied in detail. The system would consist of a 10-foot dam at Phonograph Creek with about 1,700 acre-feet of storage which would be diverted into the head waters of Pelican Creek during low flow periods and piped to a new 1.2 MW powerhouse (Powerhouse #2) that would discharge into Pelican Lake. A pipeline would also collect the Pelican Creek water at the 750-foot elevation and convey it to Powerhouse #2. The hydro capacity of the Pelican Utility Company would be increased from .50 MW or .75 MW to 1.75 or 1.95 MW, respectively. After receiving the questionnaire response from the Pelican Cold Storage Company, it was determined that their expansion requirements were smaller than first anticipated. It was determined that this alternative is viable, but there is no present market for the power. When the town grows, this alternative is a good one to expand its present power supply, and is compatible with the continued operation of the proposed program.

Wind

The alternative of wind power was considered, but discarded as not being reliable.

Expand to 2-3 paragraphs of why this is not a viable alternative.

Solar

The solar alternative was considered and judged not feasible due to the generally prevailing cloud cover.

Geothermal

The alternative of geothermal was considered. The only sites that provided any possibilities were on Chichagof Island nearer to Hoonah. There was not enough information on those sites to determine whether they could be economically developed or not. Even so, the long transmission lines required for this alternative makes it infeasible.

Fossil Fuel

Of all the fossil fuel options, it is obvious that diesel generation would be the most competitive, since a plant exists at Pelican and there would be no capital works to construct. Diesel is presented as Alternative #2, under the options studied.

ALTERNATIVES STUDIED

Three alternatives were studied, each under load conditions of Scenario #1 and Scenario #2. The cost estimates for each alternative are included in Appendix E, and each is analyzed on the basis of the present worth of life cycle costs in Appendix F.

Alternatives #1 and #3 relate to upgrading the existing hydroelectric generating facilities, and have a zero environmetnal impact because they represent a continuation of the status quo. Alternative #2 features abandonment of hydroelectric power in favor of an all diesel supply. This has the negative environmental impact of mining a nonreplenishable reource. In addition to the adverse economics of Alternative #2, it would require the continuous annual consumption of 6,700 barrels and 7,700 barrels of diesel, respectively, under Scenarios #1 and #2.

Harvey - Do we have a typo or am I missing something

Diesel -
Electric - 30% - .3
Jacket water 30% - .6
Exhaust recovery 15% - .75
Balance not recoverable.

O&M cos
economic ana
Cold Storage
the hydro ar
large compon
was judged t
alternatives. ... differences
between alternatives, the O&M costs were deleted.

Heat recovery in this situation is only practical under Alternative #2, the all diesel option, because under Alternatives #1 and #3, hydro will be on line for such a high percentage of the time, with the diesels being idle. Accordingly, the capital costs? for a heat recovery system were not estimated. The allowance was made ~~for it~~ By computing differences in fuel costs between alternatives, however, by varying the assumed efficiency (load factor?) of the diesel plant from .5 (? .3?) under the hydro options to ~~.75~~ .6? under the all-diesel option. Total energy?

Alternative #1 (Base Case)

This alternative calls for:

1. Repairing Pelican Dam and reconstructing the wing wall, as recommended in Section 6.
2. Replacing first 189 feet of flume and tunnel conveyance from the dam with a 60" Ø wood stave pipe threaded through the tunnel.
3. Replacing the diversion valve at Pelican Dam with a 48" Ø remotely operated sluice gate.
4. Reconstructing both the screen diversion box and the rock box on the lower flume.
5. Replacing the penstock with a new 36" Ø wood stave pipe.
6. Housekeeping under the total flume and penstock support system.

The addition of waste heat recovery option will modify some of the $ figures for that alternative.

Can they use the waste heat? ie large building in close proximity to powerhouse?

7. Mal[illegible] sup[illegible] the[illegible]

8. Com[illegible] mac[illegible] kW[illegible] butterfly control valve; francis type turbine; Woodward governor; new generator and switch gear.

9. Refurbishing the afterbay.

The capital costs for Alternative #1 are estimated at $1.37 million; and the present worth of life cycle costs, including the standby diesel operation, are $3.19 million under load Scenario #1 and $5.11 million under load Scenario #2. The essential objectives of Alternative #1 are:

1. Restoration of the entire system to a new economic life.

and 2. Replacement of the worn out and obsolete machinery with a system that will operate an estimated 15 to 20 percent more efficiently.

Alternative #2 (All Diesel)

This alternative assumes abandonment of the Pelican Creek hydroelectric system in favor of relying 100 percent on the use of the existing diesel plant to furnish industrial and domestic power for Pelican. The scheme would be reliable and would involve no capital expenditure. The present worth of the life cycle costs for this alternative is very high, however, being $10.32 [MILLION] for load Scenario #1 and $11.86 million for load Scenario #2.

Alternative #3 (Improved Hydro)

This alternative is essentially the same in concept and has the same objectives as Alternative #1 (restored life to the existing plant, plus increased efficiency), but in addition, provides the following advantages:

1. Takes full advantage of the head in the reservoir by replacing the flume in its entirety with a 60" Ø wood stave pipe.

2. Further increases plant efficiency and makes better use of both high and low flows by installing two turbines (500 kW and 250 kW).

~~and~~ 3. Further increases power yields (by 10 percent) through increased use of available head. This is accomplished by extending the draft tube and constructing a new afterbay providing for tailwater at mean high water level.

The capital costs for this Alternative are $1.79 million and the present worth of its life cycle costs, including fuel costs for the standby diesel operation, are $2.4 million under load Scenario #1 and $4.41 million under load Scenario #2.

~~AFTERWORD~~ Summary

Under either Alternatives #1 or #3, the only shortcoming of the hydro system is the fact that it is essentially run-of-the-river and must rely to a degree on standby diesel power during low flow periods. The diesel power plant exists, however, and the investigation has indicated that the costs for storage, either at Pelican or through a trans-watershed diversion from Upper Phonograph Creek, simply can not be justified at this time. This is because the escalation of power requirements for Scenario #2 over Scenario #1 are really quite modest. The solution is to make optimum use of the naturally abundant watershed by increasing plant efficiency and taking full advantage of available head.

SECTION 12

RECOMMENDED ALTERNATIVE

INTRODUCTION

Alternatives #1, #2, and #3 (reference Section 11) were compared under Scenarios #1 and #2 (reference Section 8). The alternatives are engineering options which are the responsibility of the planners; while the scenarios are operations options, exclusively within the prerogative of the Pelican Cold Storage Company. The cost estimates for Alternatives #1 and #3 are presented in Appendix E (no capital costs are associated with Alternative #2). The present worth economic analyses for the six combinations are presented in Appendix F.

SUMMARY OF ECONOMIC ANALYSES

The economic analyses were made on the basis of the following criteria, dictated by the APA guidelines:

1. 1982 fuel costs at Pelican (from information furnished by the Pelican Cold Storage Company) are $1.18/gallon. These are escalated for 20 years at the rate of 2.6 percent per year, and then continue at a constant level ($0.218/kWh) for the balance of the study period.
2. Diesel generators have a 20-year life.
3. Hydroelectric facilities have a 50-year life; except that the runners are assumed to be replaced after 20 years and the wood-stave pipe after 35 years.

1286850

4. Replacement ... ate at the rate of ... p

5. The discou...

6. O&M costs ... ed the same under all ... included in the analys...

7. A ~~85~~ 80-year ... ~~amortization~~ [illegible] PERIOD FOR ECONOMIC ANALYSIS ~~period on~~

Table 12.1 rec...

SUM ... RY OF ... ALYSES

Alt. #	Description	Capital Cost million $	Present Worth million $	-- during 35-Year Study Period	P.W./kWh $
			Scenario #1		
1	Base plan	1.37	3.19	86.905	.037
2	All diesel	0	10.32	86.905	.119
3	Upgraded base plan	~~1.79~~ 2.1	2.49	86.905	.029
			Scenario #2		
1	Base plan	1.37	5.11	100.319	.051
2	All diesel	0	11.86	100.319	.118
3	Upgraded base plan	~~1.79~~ 2.1	4.41	100.319	.044

DISCUSSION AND RECOMMENDATION

Alternative #2 is presented to show the economic importance of preserving the hydroelectric plant. Neither

1. A plan of the system from Pelican diversion dam to the end of the tailrace.

2. Topography, axis profile and cross sections through the dam.

3. Profile and cross section through the flume.

4. Cross section of the tunnel.

5. Plan and cross sections of rock box at head of the penstock.

6. Structural sections through penstock support framing, including member sizes.

7. Floor plans, elevations and cross sections through powerhouse.

Alternative #3

In addition to the surveys specified for Alternative #1, Alternative #3 will require detailed topography of the tailrace channel from the existing afterbay to mean sea level.

FERC APPLICATION

If there is an increase of hydropower capacity (Alternative #3), it would be necessary to submit a request to the FERC for an Exemption from a Permit or License. The request for Exemption is not as detailed or complex as one for a Permit or License. The Phase II feasibility study agreement should satisfy the requirements for this exemption. No EIS is anticipated, since neither Alternative #1 or #3 modifies existing environmental impacts.

DAM RESTORATION APPLICATION

Application should be filed with the Stage Forest Land and Water Division Office (Dam Safety) for the restoration of Pelican Dam. The technical information required in that Application will be contained in the Phase II report.

TABLE D.1

COMPARISON OF GAGING STATIONS, 1977-1978
(cfs/sq mi)

Month	Black River (24.7 sq mi)	Hook Creek (4.48 sq mi)	Hook Creek (8 sq mi)	Tonelite Creek (14.5 sq mi)
Oct	25.2	31.3	26.6	34.1
Nov	6.15	13.7	15.0	12.3
Dec	3.15	8.1	5.41	7.83
Jan	5.14	1.21	.75	1.30
Feb	7.41	.75	.44	.70
Mar	5.06	4.22	2.83	2.48
Apr	10.2	8.35	5.65	6.97
May	15.1	17.5	10.9	13.2
Jun	10.5	8.86	6.26	7.17
Jul	6.92	5.13	3.49	4.54
Aug	4.49	2.66	1.70	2.79
Sep	7.65	5.09	2.76	4.4
Total	106.97	106.87	81.79	97.88
Mean	8.91	8.91	6.81	8.16

Upon analysis of Table D.1, Hook Creek (4.48 sq mi) was selected for correlation to Pelican Cove Creek. The statistics used are:

HOOK CREEK

Area: 4.48 sq mi total
3.82 sq mi above EL 750
0.66 sq mi below EL 750

Period of record: since August 1967
Historical peak: 1290 cfs max.
1.5 cfs min.
12 year average runoff: 20,810 AF/yr
or 85.5 in/yr
or 28.2 cfs

COST ESTIMATE
ALTERNATIVE #1

DESCRIPTION OF ITEM	UNIT	QUANTITY	UNIT PRICE	COST
DAM RESTORATION				
VISQUEEN FACING (UPSTREAM)	S.F.	6000	$2	$12000
VISQUEEN BALLASTING	C.Y.	250	$~~10~~ 20	5000 ~~2500~~
REMOVE SPILLWAY	L.S.	—	$5000	5000
REPLACE ROCK IN DAM	C.Y.	250	$20	5000
SEAL DOWNSTREAM FACE	S.F.	1950	$10	19500
SET GROUT PIPES	EA	5	~~$1000~~	~~5000~~
GROUT DAM	C.F.	18000	$~~12~~ 20	360,000 ~~216000~~
REPLACE WINGWALL	SF	510	$30	15300
REINFORCED CONC DECK	L.S.			7500
				429,300
FLUME RESTORATION				
NEW TRASH RACKS	L.S.	—	$4000	4000
REPLACE FLUME W/60"Ø WOODSTAVE PIPE THRU TUNNEL	LF	189	$250	47250
NEW 48"Ø SLUICE	L.S.	—	$12000	12000
SEAL TUNNEL PORTALS	L.S.	—	$2000	2000
UPGRADE DIVERSION BOX	L.S.	—	$10000	10000
RECONSTRUCT ROCK BOX @ PENSTOCK FOREBAY	L.S.	—	$20000	20000
MISC. FLUME REPAIRS	L.S.	—	$5000	5000
PENSTOCK				
NEW 36"Ø WOODSTAVE PENSTOCK	LF	326	$150	48900
DEMOLITION	L.S.	—	$5000	5000
FLUME & PENSTOCK SUBSTRUCTURE				
CLEANUP	L.S.	—	$5000	5000
MISC. REPAIRS	L.S.	—	$10000	10000
POWERHOUSE				
MODIFY & REPAIR	SF	600	$80	48000
(500 KW) NEW MACHINERY PACKAGE	L.S.	—	$400 000	400000
FREIGHT & INSTALLATION	LS	—	$200 000	200000
SUBTOTAL				1092450
CONTINGENCY @ 25% +				277550
TOTAL				1370000

Cost Estimate
Alternative #3

Description of Item	Unit	Quantity	Unit Price	Cost
Dam Restoration				
Per Alt #1	—	—	—	$429,300 (~~$275,300~~)
Flume Restoration				
Per Alt #1	—	—	—	100250
Replace flume from tunnel to surge chamber - Rock Box	L.F.	511	$400	204400
Penstock				
Per Alt. #1	—	—	—	53900
Flume & Penstock Substructure				
Per Alt #1	—	—	—	15000
Powerhouse				
Modify & Repair	SF	600	$80	48000
New Machinery Package	L.S.	—	$500000	500000
Freight & Installation	L.S.	—	$200000	200000
Extended Draft Tube	L.S.	—	$10000	10000
New Afterbay	L.S.	—	$25000	25000
Subtotal			~~1,585,8..~~	~~1,431,850~~
Contingency @ 25%				~~357,950~~
~~Subtotal~~				$1,789,800

~~MOB & DEMOB~~

Subtotal	1,585,850
MOB & DEMOB	100,000
	1,685,850
Contingency 25%	421,462
	$2,107,312
Use	$2,100,000

COST OF FUEL / KWH

1982 PRICE OF DIESEL @ PELICAN = $1.18 / GALLON

[illegible]

@ 12000 BTU / KWH GENERATED

~~BTU~~ 3412 /KWH?

AND $\frac{\text{FUEL OIL COST}}{1000\,000 \text{ BTU}} = \frac{(\$/\text{GAL})(7.09 \text{ GAL}/1000\,000 \text{ BTU})}{\text{EFFICIENCY}}$

$= \frac{(1.18)(7.09)}{.50^{*}} = \$.167/\text{KWH}$, FUEL COSTS

* ASSUMING NO HEAT RECOVERY

THIS WILL ESCALATE AT 2.6% / YEAR, PER APA GUIDELINES, FOR 20 YEARS AND THEN ESCALATION STOPS

DIESEL GENERATING REQUIREMENTS

SCENARIO #1 (CONSUMED) (AVG. LOSSES) (PRODUCED)

2 201 000 KWH/YR × 1.128 = 2 483 000 KWH/YR

OLD AVG HYDRO PRODUCTION = .75 OF TOTAL

NEW " " " $= \frac{.75}{.65} \times .75 = .87$ OF TOTAL

(IMPROVED EFFICIENCY → .65)

2483000 (1 − .87) = 322790 KWH/YR OF DIESEL PRODUCTION

P.W. OF ESCALATING ANNUAL AMOUNT FOR YEARS 1-20

A = .167 (322790) = 53906

REF ALT #2 → P.W. = A (19.204) = 53906 (19.204)

= 1035200

P.W. OF FIXED ANNUAL AMOUNT FOR YEARS 21-35

FUEL COST IN 20TH YR = 16.7 $(1.026)^{19}$ = 27.2¢/KWH

A = .272 (322790) = 87799

$PW = PW_{35} - PW_{20} = (87799)(21.487 - 14.887)$

= $579500

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P. O. Box 1287
Juneau, Alaska 99802

IN REPLY REFER TO:

March 4, 1982

RECEIVED

MAR 8 1982

ALASKA POWER AUTHORITY

Mr. Eric P. Yould, Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Re: Pelican Hydro Project

Dear Mr. Yould:

This responds to your letter of February 16, 1982, requesting our comments on the Pelican Power Alternative Phase I--Reconnaissance Assessment.

Pelican currently receives most of its power from an old hydroelectric facility at Pelican Cove Creek. This is supplemented by diesel generators which provide the community with 25 percent of its power. The recommended alternative would restore and upgrade the existing hydroelectric facility.

There are limited existing data on fish and wildlife resources for the project area. However, intertidal spawning of a small run of pink and possibly chum salmon has been reported at the mouth of Pelican Creek Cove. The project probably would have minor impacts on the fishery provided that pollutants such as sediment and petrochemical discharges are controlled during construction. However, we would suggest that you survey the fish and wildlife resources in the area so specific protective measures can be incorporated in the project plans.

We appreciate the opportunity to comment. Please keep us informed of any new developments on the project.

Sincerely yours,

[signature]

Field Supervisor

Department Of Energy
Alaska Power Administration
P.O. Box 50
Juneau, Alaska 99802

March 16, 1982

Mr. Eric Yould
Executive Director
Alaska Power Authority
334 West 5th Avenue, 2nd Floor
Anchorage, AK 99501

Dear Mr. Yould:

We have reviewed the USKH-Engineering Science report on Pelican Power Alternatives sent by your February 16 letter. The investigation seems to have been thorough for the reconnaissance level scope of effort and the recommendations accordingly well founded. We agree with those recommendations. Floyd Summers discussed our observations with Jerry Larsen by telephone March 5.

We suggest that the report could provide a little more narrative explanation about the cold storage plant and water system operation. Specifically, it appears there are high water requirements in November-February to prevent the water system from freezing, high power requirements in February and March for ice production for the beginning of halibut fishing, and high power requirements in August and September for ice production and flash freezing.

We don't have specific comments about the structural measures proposed. However, we note that corrective measures for the tunnel are not addressed. Information on estimated flow capacities for the flume, tunnel, and penstock would be helpful.

A feasibility study might include analysis of electric heat, and waste heat recovery from the freezing units. We acknowledge that electric heat is secondary to other electric needs, but would affect design of the generation system. Electric heat could include direct resistance and/or air or water source heat pumps. We have had an informal suggestion from a heat pump supplier familiar with Pelican that conditions may be favorable for those units.

Sincerely,

Robert J. Cross
Administrator

STATE OF ALASKA

DEPARTMENT OF FISH & GAME

JAY S. HAMMOND, Governor

State Office Building
P. O. Box 499
Sitka, Alaska 99835

PHONE: 747-5828

Habitat Division

RECEIVED

MAR 19 1982

ALASKA POWER AUTHORITY

March 16, 1982

Mr. Perrick T. Yould
Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

The Alaska Department of Fish and Game, as requested in your letter of February 16, 1982, has reviewed the draft Pelican Power Alternatives Phase I Reconnaissance Assessment. Our concerns relate primarily to the maintenance of anadromous fisheries values in Pelican Creek, anadromous stream #113-95-03. This systems supports primarily pink salmon and a few chum salmon which utilize that portion of the stream from about 50 feet to the east of the boardwalk through the intertidal area to salt water. We believe that the primary impacts of the project will be associated with construction activity and also with the alteration of flow levels for the lower portion of the stream. Specific comments preceded by page and paragraph number follow;

<u>Page 3-3, Number 6</u>: The deadlines required of the consultant are apparently not going to be met for this document. We hope that the deadlines noted will not interfere with the careful evaluation of this proposal.

<u>Page 4-4, Paragraph 1</u>: The statement is made that climatic conditions at Sitka are representative of those at Pelican. We do not believe this is an accurate statement. The rainfall, the winds, solar reception all vary tremendously in Southeast depending on slope aspect, altitude, and other factors.

<u>Page 4.5, Paragraph 2</u>: Similarly it does not seem reasonable to assume that ~~Creek~~ Hook Creek would be "ideal to use for correlation studies" to determine runoff for Pelican Creek. The U.S. Geological Survey should be contacted and their methods used to correlate stream flows discussed prior to making such a broad brush statement.

<u>Page 5-5, Paragraph 2</u>: The statement is made that several pieces of electrical equipment are obsolete and do not perform well. It would be appropriate to state which pieces are obsolete and why

they do not perform well.

Page 9-2, Paragraph 1: The statement is made that if electricity becomes cheaper the number of people in Pelican will change from oil for heating and cooking to electricity. It should be pointed out that this would increase the community dependency on electricity and would increase the community costs should the electricity not be reliable.

Page 9-2, Second Table: The percentage increase calculated for the fuel bill from 1976 to 1981 is listed as 78%. The change from 700 to 1,950 represents considerably more than a 78% increase. ✓

Page 9-2, Paragraph 3: A statement is made that power fluctuations have destroyed many electrical items in Pelican. We hope that the improvements under this study will reduce those impacts, as well as, reduce fluctuations in stream flow.

Page 11-2, Paragraph 5: The statement is made that alternatives 1 and 3 will have a zero environmental impact because they represent a continuation of the status quo. If the construction aspects of the project and the long term results of the project are that the flow regime down Pelican Creek is altered then this statement is inaccurate.

Page 11-3, Paragraph 1: A statement is made that the operation and management costs would be comparable for all alternatives. The evidence does not support this conclusion.

Page 11-5, Number 3: Apparently the construction of a new after bay under this option would provide for tail water release at the mean high water level. Obviously this option would remove anadromous fisheries habitat that currently exist. Implimenting this option would run counter to the statement that no environmental impacts would occur.

In summary because the project will result in the upgrading or modification of an existing facility, the impacts on anadromous fisheries habitat are less than would be the case otherwise. However, some impacts are expected to result from the project. If the project results in the augumentation of downstream flow at times of natural low flow, through waters that have been held up by the dam, then the net consequence of the project may be to improve anadromous fisheries habitat. However, if the flow regimes are altered in any matter which might negatively effect fish spawning, incubation, and rearing then the project may well have negative environmental impacts.

Also, the construction phase may be expected to result in altered flows and perhaps turbidity and sedimentation in the downstream areas.

Thank you for the opportunity to comment.

Sincerely,

Dave Hardy

Dave Hardy
Area Habitat Biologist
Sitka KK

cc: Rick Reed

DH:kk