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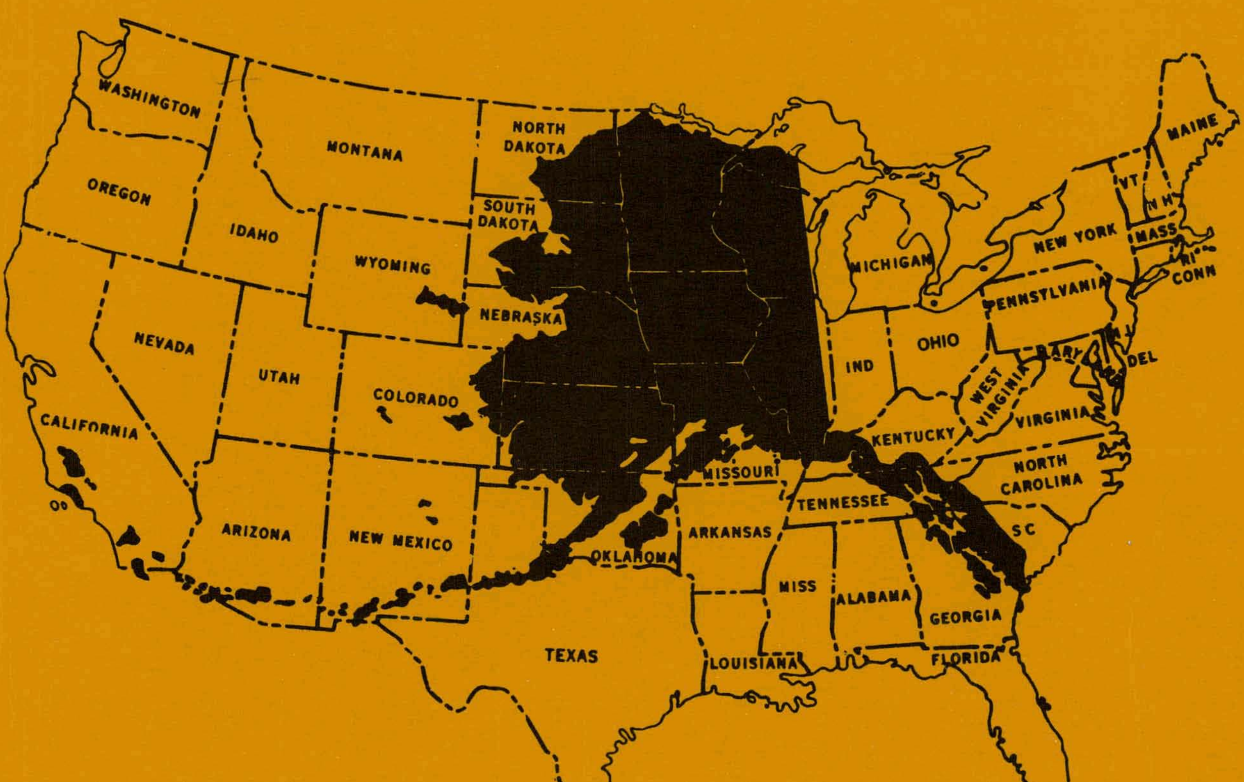
ALASKA REGIONAL ENERGY RESOURCES PLANNING PROJECT

PHASE 2

COAL, HYDROELECTRIC AND ENERGY ALTERNATIVES

VOLUME I
BELUGA COAL DISTRICT ANALYSIS



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DISCLAIMER

ALASKA REGIONAL ENERGY RESOURCES PLANNING PROJECT

PHASE 2: COAL, HYDROELECTRIC AND ENERGY ALTERNATIVES

VOLUME I BELUGA COAL DISTRICT ANALYSIS

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ALASKA REGIONAL ENERGY RESOURCES
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PHASE 2

COAL, HYDROELECTRIC AND ENERGY ALTERNATIVES

CONTENTS

VOLUME I

BELUGA COAL DISTRICT ANALYSIS

4 LAND TENURE

LIST OF FIGURES

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

FOREWORD

This second phase of the Alaska Regional Energy Resources Planning Project represents an in-depth look at the Beluga Coal District, hydroelectric development and the applicability of alternative energy systems. Specifically, this phase of the project will deal with the possible development of the Beluga Coal Fields, the construction and operation of hydroelectric facilities in Alaska as well as various alternative small scale energy systems such as geothermal, wind, fuel cells, small hydroelectric facilities and thermal application of energy conversion.

Since the beginning of this project in 1977, many important developments have occurred in the field of energy. The impact of the passage of the Clean Air Act amendments has yet to be felt, and changes in offshore federal lease sale schedules have yet to make a final impact within the economy of either Alaska or the continental United States. In addition, there is still considerable debate as to the disposition of the oil from the Trans-Alaska Pipeline System (TAPS) as well as the likelihood of a Trans-Alaska or Trans-Canada natural gas pipeline. Therefore, the reader must recognize that information and data concerning Alaska's resources, operations and issues are continually being supplemented and modified by changes in regulations, technology, economic factors and resource availability.

Since this report is based to a great extent upon scientific, geological and engineering work done by others, the reader is urged to obtain the original documentation for greater detail. This report does not attempt to establish State, Federal or Native corporation policies. This report does provide information which will assist policy makers in making informed decisions.

ACKNOWLEDGEMENTS

This report has benefited from contributions and input supplied by staff members from several state and federal agencies, Native corporations, utilities, libraries, industrial corporations, national laboratories, and consultants. A number, but not all, of the energy experts who assisted us are listed by name in various chapters of the text. Without the help of the many people who contributed, this report would not have been possible. It is hoped that all who assisted will also find this report useful.

The authors wish to express thanks to the secretarial staff members who assisted in the preparation of this report, Brenda Hviding, Shelly Lynn, Paula Parker, Arlene Price, Peggy Skeers and Nancy Totten. The following individuals must be thanked for their support in research and numerous writing contributions necessary for the successful completion of the project: Carol Bennet, Steven Levi, Randall Montbriand, and especially Kyle Weaver.

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Also, funding from the Department of Energy (formerly Energy Research and Development Administration) is acknowledged and appreciated. The continuing assistance of Dr. Paul Gerhardt, Regional Impacts Division, in the direction of the early stages of this project as well as his interest in the progress of this study was very helpful.

CHAPTER 1

INTRODUCTION

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INTRODUCTION

Prior to the development of any coal field, all facets of the project must be considered. The first of these is the human factor. Development of any kind will create some cultural dislocation. The entry of large scale industry into any district of Alaska poses potential conflicts. The development may result in a replacement of social values as well as an alteration of the lifestyle of the residents. Many of these problems can be resolved long before any construction work commences. Efforts to mitigate potential trouble spots should be coordinated with state and local agencies. Inevitably changes will occur, but with the proper planning framework, a smooth transition can occur.

Another critical feature of case development is the effect of construction on the environment. No construction project, especially one the size of the proposed Beluga Coal Field development, can be undertaken or completed without damage to the ecosystem. However, thoughtful safeguards will allow environmental disruption to be minimized.

Land tenure is yet another matter of concern. Not all lands are available for development. The land in the Beluga Coal Fields and the access routes are not all of the same status. Prior to any development it will be essential to identify who holds the real property and mineral rights of all lands to be used. Land use rights must be otbained and zoning restrictions observed.

Once land status uncertainties have been resolved, technological decisions remain. Numerous options in processing, transportation, and end use will necessarily be examined if the Beluga Coal Field is to be developed. Each option would of course, have different economic, social, and environmental impacts.

Transportation of coal is also a major concern. A variety of alternatives are available, including truck, barge, rail, slurry pipeline, transmission lines and combinations of these methods. The construction of compatible facilities will be required at least at the point of destination.

Once all other questions have been resolved, the permitting procedures may begin. For virtually all aspects of the development of a coal field there are permits which must be obtained from Federal, State and local agencies. No major construction, conversion or transportation of coal or any of its forms or byproducts can occur without a complete array of permits.

It is the purpose of this volume to deal with the problems and procedures inherent in the development of a coal field. With the proper planning and necessary safeguards, coal field development can be a benefit to the community and an additional source of energy for Alaska.

CHAPTER 2

SOCIAL EFFECTS AND MANAGERIAL ALTERNATIVES

CHAPTER 2

SOCIAL EFFECTS AND MANAGERIAL ALTERNATIVES

DEVELOPMENT SCENARIOS

INTRODUCTION

The extent to which coal will be mined in the Beluga area during the next 20 years cannot be predicted with any accuracy at the present time. Possibilities range from no mining at all to large-scale operations of 30 million tons per year. Numerous contingencies will affect the eventual development outcomes, including governmental requirements that utilities substitute coal for natural gas for electricity generation (unless Alaska is exempted from this requirement), the market demand for coal in the United States and around the world, the rate of industrial growth in the Cook Inlet region, and the responses of native villages and corporations to economic development in their region.

To take account of this wide range of possible future trends at Beluga, this report examines three alternative development scenarios: 1) a relatively low level of coal mining to supply fuel for additional electric generating facilities at Beluga; 2) moderate-scale mining operations for export, but no on-site use by generating facilities; and 3) a combination of both these conditions. These are the three situations that are thought most likely to occur at Beluga, and they represent considerably different levels of coal mining development.

In addition to these three possibilities, there has been considerable speculation about various forms of industrial development in the Cook Inlet region that would require coal for either process heat generation or electricity generation, or both. These possibilities include a petrochemical plant, an LGN plant, and an aluminum smelter. However, none of these projects is definite at this time. Therefore, their potential effects on coal development at Beluga cannot be estimated with any certainty. At one extreme, if a single plant were constructed on the Kenai Peninsula, and if coal were already being mined at Beluga, no more than an additional 20 to 30 miners would be required. At the other extreme, if several plants were constructed at Beluga, the construction and operating work forces, plus the associated secondary economic growth and influx of dependents, might push the population of the community at Beluga to 3000-4000 people. Consequently, this analysis does not specifically take into account the possibility of coal-dependent industrial growth in the Cook Inlet region. If and when such plans become more definite, however, their likely social and economic effects on Beluga could be incorporated into the scenarios analyzed here.

BACKGROUND DATA

The data used in constructing the scenarios for this report were obtained from a variety of sources, through personal interviews. These sources were:

- Placer Amex, Inc.
- Chugach Electric Association
- Pacific Northwest Laboratory
- Alaska Division of Energy and Power Development
- Alaska Division of Community Planning
- Alaska Division of Community and Rural Development
- Alaska Department of Transportation and Public Facilities
- Kenai Peninsula Borough Planning Department
- Cook Inlet Region, Inc.
- Tyonek Native Corporation
- Tyonek Village Council

Considerable information relevant to future development possibilities at Beluga resulted from these interviews, the most significant of which was that:

- The Beluga Coal Company (a wholly owned subsidiary of Placer Amex, Inc.) would like to begin mining development in the Beluga area within the next two or three years if possible, but it cannot initiate any projects there until it has a firm market for the coal. At the present time that market does not exist.

- If mining is begun at Beluga, it will likely be limited to the Capps coal field for the immediate future, since it is the most accessible of the three deposits for which Placer Amex, Inc. holds leases. The land on which the Capps field is located will be owned by Cook Inlet Region, Inc., so that it would receive the royalties from all mining activities in that field. These operations would be strip-mining with heavy equipment, since the coal lies quite close to the surface. It is subbituminous coal with a moderate heat value of 7500 Btus per pound, low sulfur content (0.2 percent), but a high ash-moisture content (about 35%) which makes it expensive to transport.
- Chugach Electric Association has no plans at this time to construct any coal-fired electric generating plants at Beluga. The company estimates that the Beluga gas field contains enough natural gas to meet all its needs until at least 2020, even with an annual demand growth rate of 13%-15% (which has been the case recently but which is not expected to continue indefinitely). Any future electric generating units the company installs at its Beluga plant will be convertible to coal if necessary, but the company will not burn any coal unless required to by governmental mandate. Such legislation is presently under consideration by the U.S. Congress and is likely to become law, but the statute might provide exceptions for situations such as Beluga where ample natural gas supplies are available. If such a requirement were imposed on Chugach Electric Association, however, it would undoubtedly install a minimum of two coal-fired generators, so the case of a single generator need not be considered.
- Chugach Electric Association is not presently contemplating constructing an underwater electric power cable across Cook Inlet to the Kenai Peninsula. There is considerable disagreement among experts at the present time concerning the engineering feasibility of such a project.
- The Alaska State Department of Transportation and Public Facilities has laid out a route for a road from Knik to Beluga, but it presently has neither plans nor funds to construct that road. Moreover, it will not

consider building the road unless there is extensive development in the Beluga area to justify its expense. In other words, the road will depend on prior development at Beluga, and would be constructed by the state as a means of promoting growth on the west side of Cook Inlet.

- Chugach Electric Association believes that if coal-fired generating plants were constructed at Beluga, a permanent settlement should also be built somewhere in that area. It would not consider rotating a labor force of several hundred people back and forth between a temporary work camp and Anchorage. The company would not assume responsibility for providing any of the infrastructure necessary for such a community, however, for it sees that as the responsibility of the state.
- Cook Inlet Region, Inc. favors the creation of a moderately large, permanent community somewhere in the Beluga area that would presumably attract several industries because of the availability of coal and electricity. It wants to participate in promoting this development, but also assumes that the state has the primary responsibility for providing the infrastructure for the new community.
- The Kenai Peninsula Borough government has governmental jurisdiction over the land where a town would most likely be built near the Beluga coal field. Members of the Borough Planning Department believe, however, that the borough has no intention of actively encouraging or facilitating such a venture. Their view is that this would be a private activity of the companies and individuals involved, and that the role of the borough government would be limited to reviewing requests made by the settlement for zoning, platting, schools, and solid waste disposal. The community itself would have to decide if and how it wished to obtain any other public services or facilities.
- The village of Tyonek might likely seek to minimize contacts between itself and a town in the Beluga area. Since a road already exists between Tyonek and the proposed town site, however, such contact would probably be difficult to avoid.

Several conclusions were drawn from these data and used as a basis for constructing the scenarios for this report:

- There is a distinct possibility that no development of the Beluga coal field will occur before 1990, if at all.
- Any such development would depend on at least one of three conditions occurring:
    1. a governmental order to Chugach Electric Association to use coal rather than natural gas for generating electricity, either in place of its present gas-fired turbines or in any additional generating units.
    2. construction of one or more industrial plants in the Cook Inlet region that require large amounts of coal for process heat or large amounts of electricity, although in the latter case Chugach Electric Association would likely produce as much of that electricity as possible with natural gas unless required by the government to burn coal.
    3. establishment by the Beluga Coal Company or by other coal lessees of external (outside Alaska) markets for at least six million tons of coal per year.
- If moderate levels of development did occur in the Beluga coal field, the labor force would most likely be housed in what might be termed a permanent work camp. Workers would remain there for periods of several months to a few years, with occasional trips to Anchorage or elsewhere. They would not be rotated back and forth on a weekly basis as is now done with the crews of the oil platforms in upper Cook Inlet. Some of the workers would bring spouses to the work camp, but virtually all of these people would also be employed in some capacity at the camp, since there would be little for a nonemployed person to do there. There would probably be few school-age children at the camp because it would have limited or no school facilities, and Tyonek would probably resist

any significant influx of nonnative students into its school. Hence the number of nonemployed persons at the camp would be limited to a relatively small number of spouses and children.

- If a high level of development should occur at the Beluga coal field, however, a more complete community would probably have to be created there. It would attract a secondary labor force composed of both persons directly supporting the primary labor force, and persons employed in other activites stimulated by the needs of the growing town. It would also include a sizable number of nonemployed dependents. Such a community could be supported by air and water transportation, but demographic and economic growth at Beluga would be greatly spurred by the construction of a road from Anchorage. An alternative to creating a full community would be to merely enlarge the size of the work camp, but that possibility was judged to be relatively remote and hence is not considered in this report.

- At the present time, only Placer Amex, Inc. has assumed any responsibility for planning a townsite at Beluga. The Kenai Borough government is likely to play only a passive role of responding to whatever might occur at Beluga. Chugach Electric Association and Cook Inlet Region, Inc. are both business concerns that do not consider community organization to be their responsibility. And state agencies are just beginning to establish policies concerning economic and community development in the Beluga area.

FIRST SCENARIO: COAL-FIRED GENERATING PLANTS

If the federal government should require Chugach Electric Association to burn coal in the future, either in place of its present gas-fired turbines or in any new generators it constructed, it would probably build a plant with at least two 200-megawatt coal-fired generators at Beluga. Since there is no way of knowing when such an edict might be issued, this scenario assumes the most demanding case of issuance in 1979. Construction of the first generator might then begin in 1980, using a semi-modular form of construction. On that schedule, the generator would be completed by 1983, with limited mining beginning that year and full-scale mining and generating operations beginning in 1984. This generator would require approximately 730,000 tons of coal per year. Construction of a second generator would begin in 1982 and be completed by 1985. Full-scale operation of this generator, which would require another 730,000 tons of coal per year, would begin in 1986.

Estimates of the labor force needed to construct the two generators are quite tentative since no previous construction experience is directly comparable to this plan for semi-modular assembly. The construction labor force figures used in this scenario are derived from estimates made by the Chugach Electric Association and Burns and Roe Co., and from a recent study of construction manpower requirements by Argonne National Laboratory.[(1)] (The latter figures are scaled down to take account of the planned semi-modular mode of construction.) The labor force for the first year (1980) is composed of 100 construction workers to prepare the plant site and 50 workers to build the work camp. The labor force needed to construct the second generator is assumed to be only two-thirds the size of that required for the first generator, since many of the plant facilities for both generators would be installed with the first one. Figures for the number of workers needed to operate the generators were estimated from the Argonne study, although this figure can vary widely from plant to plant depending on the nature of the equipment used.

Estimates of the labor force requirements for coal mining in this scenario are based on figures provided by Placer Amex Inc., on the current experience of the Nenana coal field, and on the Argonne study. The base figure of 60 persons needed to mine 730,000 tons per year is composed of 35 production workers, 13 maintenance workers, and 12 supervisory personnel.

In addition to the primary labor force, a relatively small support staff would be needed to operate the work camp. A coefficient of 1.3 was used to estimate the size of this support staff (0.3 support persons for each primary worker). No secondary economic activity is assumed to occur at the camp.

It is possible that some residents of Tyonek might join either the primary or support labor forces at Beluga, thus reducing somewhat the number of outside workers required. However, since there are only 60 men over age 17 in Tyonek, almost all of whom are presently engaged in some kind of occupation, the number of people who might do this is too small to significantly affect the scenario.

Because of the isolation of the Beluga area, the scenario assumes that none of the construction workers would bring any dependents with them who were not also employed there. All those persons would be counted as part of the labor force, not as nonemployed dependents. A few mining, operating, and support workers might bring nonemployed dependents with them, but for the reasons mentioned above this number would be rather small. The multiplier used to estimate the number of nonemployed dependents in this scenario was therefore only 1.2 (0.2 dependents for each mining, operating, and support worker). Since the standard multiplier used in estimating the number of nonemployed dependents who will accompany each operating (nonconstruction) worker is 2.2, the scenario is assuming only one-sixth the usual number of dependents at Beluga because of its work-camp nature.

The population estimates for this first scenario are given in Table 2-1. Initial construction activities in 1980 would create a total population of about 200 persons; this figure would increase to over 500 in 1982 and 1983; it would level off at 320 beginning in 1986 when the construction phase was completed. Since the scenario does not assume any secondary economic growth, the Beluga coal development population should remain relatively stable after 1985 unless there were further expansion of either the coal mining or electricity generating activities.

The permanent work camp that would be established at the Beluga coal field under this scenario would contain all housing, service, and recreational facilities needed by the labor force and their dependents. These would likely all be owned and operated by either Placer Amex, Inc. or Chugach Electric Association. There would be no independent economic enterprises, and most public services--from water and sewerage to retail merchandising and

TABLE 2-1. Population Growth with the First Scenario for Beluga Coal Field Development

Year	Construction Workers	Mining Workers	Operating Workers	Support Workers	Secondary Workers	Nonemployed Dependents	Total Population
1980	150	--	--	50	--	--	200
1981	300	--	--	90	--	--	390
1982	400	--	--	120	--	--	520
1983	350	30	--	120	--	--	500
1984	200	60	90	100	--	50	500
1985	100	60	90	80	--	50	380
1986-on	--	90	120	60	--	50	320

governmental administration--would be provided by the parent companies or the support staff. Kenai Peninsula Borough would have to approve the land use plans for the work camp but would not otherwise become involved in its operation unless the people there applied for incorporation as a first-class or second-class city. The North Kenai Recreation Service Area (a special service administration that is responsible to the borough government but functions relatively autonomously) does include the Beluga area, and hence it might be drawn upon to provide revenues for establishing some outdoor recreational facilities accessible to Beluga. Alaska state troopers would provide police services to the work camp when needed. All serious medical cases would have to be air evacuated to Anchorage. Finally, various state agencies might provide some planning and other support services to the settlement, although these would probably be minimal because of its designation as a work camp rather than a normal community.

SECOND SCENARIO: COAL EXPORTING

In this case, we assume that Chugach Electric Association does not construct any coal-fired generators at Beluga, but that by 1990 Beluga Coal Company has established sufficient markets for its coal to allow it to produce at least six million tons per year--the minimum amount necessary for cost-effective exporting. To export coal it would be necessary to construct docking and loading facilities at Beluga, which would occur in 1989. A rough estimate of 200 construction workers was made for this effort, plus 40 workers to construct the work camp facilities and 60 persons to operate the camp. None of these people is assumed to bring any nonemployed dependents during the first year. Mining would start in 1990 and would require a labor force of approximately 180 miners (based on the Argonne study), 30 workers to operate the docking and loading facilities and 60 support personnel. As in the first scenario, there would be no secondary economic growth and only a few nonemployed dependents (again estimated with a coefficient of 1.2).

The population estimates for this second scenario are given in Table 2-2. The total population of 300-320 should remain fairly stable unless the volume of coal being mined and exported were considerably increased in the future.

TABLE 2-2. Population Growth with the Second Scenario for Beluga Coal Field Development

Year	Construction Workers	Mining Workers	Operating Workers	Support Workers	Secondary Workers	Nonemployed Dependents	Total Population
1989	240	--	--	60	--	--	300
1990-on	--	180	30	60	--	50	320

The total population figures for the second scenario are identical to those for the first scenario after its construction phase (from 1986 on). Hence the permanent work camp envisioned in the two scenarios would be the same, except that in the second scenario it would not be established until 1989 and it would not have to accommodate a temporary "bulge" of 500 persons during the construction phase. Consequently, a single analysis will cover both scenarios except for the differing time frames and the short-term bulge of construction workers in the first scenario.

THIRD SCENARIO: GENERATING PLANTS AND COAL EXPORTING

This third scenario is simply a combination of the first two. It assumes that two coal-fired generating plants are constructed at Beluga between 1980 and 1985, and that Beluga Coal Company begins exporting six million tons of coal in 1990. Through 1988, therefore, it is identical to the first scenario in both its total population size and its work camp settlement. The population would begin to increase in 1989, however, with the arrival of the construction workers to build the docking and loading facilities. Then in 1990 the number of miners employed at the site would greatly expand, together with a corresponding increase in operating workers.

At this point, the work camp would begin to evolve into a more normal type of community because of its growing size and diversity. Secondary economic growth would develop in the area, thus the camp support staff could be cut in half in 1990 and eliminated in 1991 as support activities were taken over by private businesses. To estimate the size of the labor force employed in these secondary economic activities, a multiplier of 1.5 was used in 1990 and 2.0 in 1991. The latter figure--representing one secondary worker for each primary worker--is somewhat higher than the overall Alaska figure of 1.46.[2] since this would be a case of creating an entirely new community rather than just expanding an already existing one. However, this multiplier is still considerably lower than comparable figures for other parts of the United States (which commonly range between 2.5 and 3.5).[3]

With the availability of more housing and community services at Beluga, additional nonemployed dependents would also begin to arrive. Because of Beluga's isolated location, however, this growth would probably not be as great as in most other communities. Hence a multiplier of 1.4 was used to estimate the number of dependents in 1990 and 1.8 in 1991 (compared to the standard figure of 2.2 for Alaska as a whole as well as the rest of the country).

The population estimates for this third scenario are given in Table 2-3. The total population of this new community would jump to approximately 700 in 1989 and to over 1300 in 1991. After that time it is virtually impossible to make meaningful population estimates, since any of three different conditions could occur: (1) with no further major economic development, the population could stabilize at around 1300 people; (2) secondary economic growth could continue at Beluga because of the availability of coal, electricity, and land, thus increasing the community's population to 2000 or more within a few years; or (3) industrial growth in the Cook Inlet region or expanding export markets for coal could lead to rapid increases in the amount of coal being mined and electricity being produced, which could eventually increase Beluga's population to several thousand people. Consequently, the entries in Table 2-3 for 1992 and subsequent years are merely question marks.

TABLE 2-3. Population Growth with the Third Scenario for Beluga Coal Field Development

Year	Construction Workers	Mining Workers	Operating Workers	Support Workers	Secondary Workers	Nonemployed Dependents	Total Population
1980	150	--	--	50	--	--	200
1981	300	--	--	90	--	--	390
1982	400	--	--	120	--	--	520
1983	350	30	--	120	--	--	500
1984	200	60	90	100	--	50	500
1985	100	60	90	80	--	50	380
1986	--	90	120	60	--	50	320
1987	--	90	120	60	--	50	320
1988	--	90	120	60	--	50	320
1989	240	90	120	120	--	130	700
1990	--	220	150	60	210	260	900
1991	--	220	150	--	370	590	1330
1992-on	?	?	?	--	?	?	?

As long as the Beluga settlement remained a work camp with limited facilities and services, it would not likely attract a heavy flow of visits from the residents of Tyonek. Since a road presently runs directly from Tyonek to the proposed town site at Congahbuna Lake, however, it would be impossible to prevent interaction between the two settlements. And if the Beluga settlement evolved into a more complete community, this could pose serious problems for Tyonek if it desired to preserve its native culture. The consequences of this interaction between the two communities could be both beneficial and harmful for Tyonek, as will be examined in detail in the section on Psychosocial Prospects for Tyonek.

KEY FACTORS AFFECTING BELUGA DEVELOPMENT

A wide variety of interrelated factors could influence whether or not development occurs at Beluga, and if so, in what form and at what rate. A few of these factors appear to be especially critical, since they could markedly affect what happens at Beluga in the future. All of them are incorporated into the scenarios as fixed assumptions, but in reality they are dynamic variables that will require more detailed examination in future studies of energy development in the Cook Inlet region. These key development factors are:

1. if and when the federal government should require electric utilities to burn coal rather than natural gas or oil, whether this requirement is partial or total, the time limit for its implementation, and whether any allowances are made for special circumstances such as Beluga where adequate natural gas reserves are available for long-term use. Under the National Energy Act, provisions are made for exceptions to switching requirements. Regulations for general application of these provisions and specific decisions regarding conditions in Alaska have not yet been handed down.

2. the amount and rate of future industrial and other economic growth in Anchorage and the Kenai Peninsula that would require additional coal or electricity for manufacturing processes

3. the amount and rate of population growth in Anchorage and the Kenai Peninsula that would increase the demand for electricity

4. expansion of markets for coal in the United States (especially the West Coast states) or in other countries (especially Japan)

5. whether or not an underwater power cable were laid across Cook Inlet from Beluga to Kenai and the amount of additional demand for electricity stimulated by the cable

6. whether or not a road were constructed from Knik to Beluga (construction of a causeway across the Knik Arm would shorten the road distance from Anchorage to Beluga but is not necessary since it is presently possible to drive from Anchorage to Knik)

7. if and when any industries should decide to locate plants in the Beluga area to take advantage of the availability of coal and electricity, as well as the energy requirements of those plants and the sizes of their labor forces

8. the rate and nature of secondary economic growth that would occur in the Beluga area if a permanent work camp or community were established there

9. policies and actions of the Cook Inlet Region, Inc. to promote economic development in the Beluga area

10. policies and actions of the Kenai Peninsula Borough Assembly concerning development in the Beluga area, especially in regard to land use and schools

11. policies and actions of the Tyonek Village Council and the Tyonek Native Corporation to either resist or facilitate population and economic growth in the Beluga area and the creation of a town at Beluga

12. policies and actions of the state of Alaska to restrict or promote population and economic growth in the Beluga area.

Most of these factors are outside the direct control of the Alaska State government. They will be largely determined by decisions of the U.S. government, private businesses and organizations, and individuals. Nevertheless, the government of Alaska could play a decisive role in shaping the future of Beluga by adopting a definite policy regarding development in the Beluga area, and by establishing programs to carry out that policy. At one end of the policy spectrum, the state could decide to vigorously promte development in the Beluga area. Programs to support that policy might include constructing the road from Knik to Beluga prior to the time it was urgently needed, aiding coal lessees to locate export coal markets, providing inducements or requirements for Chugach Electric Association to switch from natural gas to coal, encouraging other industries to locate there, providing (through loans or grants) the initial capital needed to construct housing and community facilities in the Beluga area prior to the community's becoming financially self-sustaining, and working with the Village of Tyonek to ensure that its autonomy and cultural heritage were protected as fully as possible. At the other end of the policy spectrum, the state could decide to oppose all development in the Beluga area, although this is relatively unlikely considering the support it has already given to the Beluga Interagency Task Force.

In reality, the exact nature of the state's policy toward Beluga development will probably evolve gradually over the next several years through a process of negotiation among all the involved parties. A central concern throughout this negotiation process will be assigning responsibility for managing the various economic and social impacts and needs associated with coal development in the Beluga area.

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REGIONAL SOCIOECONOMIC Impacts

INTRODUCTION

The regional impact area surrounding a development activity is generally defined as that area that is likely to include most of the significant impacts associated with the project. The region that will experience most of the socioeconomic impacts from coal development at Beluga is limited to Anchorage and the Kenai Peninsula Borough in South Central Alaska. The analysis in this chapter excludes the immediate Beluga and Tyonek areas, however, since the impacts on those areas are examined in greater detail in subsequent chapters.

The principal conclusion that emerges from the analysis reported in this chapter is that the socioeconomic impacts of Beluga coal development on Anchorage and the Kenai Peninsula should be quite limited in nature. Several factors contribute to this conclusion, the most crucial of which are the isolated location of the Beluga coal field and the relatively small scale (in regional terms) of the development anticipated in all three of the scenarios sketched in the previous chapter.

Notwithstanding the paucity of data on which to base an assessment of potential regional socioeconomic impacts, three broad categories of impacts will be analyzed: 1) impacts associated with the regional labor force; 2) impacts associated with the market for coal and its by-products; and 3) impacts associated with the generation and distribution of revenues associated with the development, including secondary regional economic impacts.

The Alaskan economy has recently experienced extremely rapid growth, spurred in part by the Trans-Alaska Oil Pipeline and other energy development activities. This social and economic growth will undoubtedly continue in the future, regardless of what happens at Beluga. Consequently, it is quite difficult to forecast the regional socioeconomic impacts that might be caused by Beluga coal development, apart from the more general effects of rapid economic growth in the region. The analysis reported in this chapter must therefore be expressed in rather general terms with a considerable margin of uncertainty. The analysis uses the three development scenarios from the previous chapter, as well as existing socioeconomic conditions in the impact region, as points of departure.

IMPACTS ASSOCIATED WITH THE WORKFORCE

The three scenarios estimate the size of the workforce, secondary employment, and nonemployed dependents associated with the construction and operation of a coal-fired generating facility, a coal mining and exporting operation, and a combination of these two. The maximum construction work force requirement in any one year under any of these scenarios is 400. These workers would be drawn primarily from the large unemployed construction labor force pool (union labor) in Anchorage. Some of them would also be drawn from the appropriate local unions that cover the Kenai Peninsula area. A few workers might be hired from the native village of Tyonek. Although the size of the unemployed labor force pool is influenced by seasonal factors, as discussed below, more than enough construction workers should be available within the region to meet the construction work force needs of each of the development scenarios.

As provided by the Alaska Department of Labor, the preliminary estimate for 1977 mean annual number of unemployed workers in the civilian labor force in Anchorage, adjusted to the current population survey of the U.S. Bureau of the Census, is 5490, representing an unemployment rate of 6.5%. Approximately 80% of these unemployed filed for unemployment insurance. Of this group, about half listed contract construction as their previous occupation during 1977, although there is seasonal variation in this figure. Assuming that the 20% uninsured workers are distributed similarly and that 45% of the total unemployed were contract construction workers, then approximately 2500 unemployed contract construction workers were available in Anchorage during 1977. Given estimated employment in contract construction of 7600, this suggests a local unemployment rate for contract construction of 25%, or about four times the overall unemployment rate. Moreover, the total number of unemployed workers across all industries is projected to increase by about 2000 over the next five years. Clearly, there should be no need to bring in workers from outside the Anchorage-Kenai area to meet the employment requirements for Beluga coal development, unless other major construction projects such as the natural gas pipeline or the Susitna Dam) were drawing on the local labor force at the same time.

Since all coal mining associated with these development scenarios is surface strip mining, it would probably not be necessary to go far afield to find workers with special mining skills. The skills required for this type of operation are similar to many construction skills, such as operating bulldozers and scrapers, and could be adequately met by available construction workers with only a minimal amount of training. The addition of a coal mining work force to the required construction work force would not raise the total labor force requirement above the single-year figure of 400 workers. No other skill or industry category would place a demand on the labor force equalling the requirement for construction. Locally available unemployed workers would be more than adequate to meet the projected needs for operational and other secondary workers under the three scenarios.

The ready availability of local workers for future Beluga coal development has several implications for potential socioeconomic impacts. These projects should not induce any significant in-migration of workers from ouside the Anchorage-Kenai area. Although there might be some tendency for Anchorage workers to transfer to Kenai labor union locals in the belief that this would enhance their employment opportunities in the Beluga area, the magnitude of the potential labor force demand is small relative to the available labor pool. This means that there would be little job switching and little excess migration into the area in response to news of job opportunities, assuming that a large wage differential does not exist. Excess migration of workers responding to news of employment opportunities has been a serious problem on past development projects in Alaska, often resulting in increased levels of local unemployment. Thus, the main regional labor force impacts of

Beluga coal field development would be positive in nature. There would be a modest decline in the rate of regional unemployment for the duration of the project, with a commensurate increase in wage income available for reinvestment in the region and a reduction in the number of workers receiving unemployment insurance payments.

These effects would be further minimized to the extent that local residents of Tyonek were hired for construction or mining jobs. Even though there are some unemployed males with the requisite skills in Tyonek, few are union members, which puts them at a competitive disadvantage for this type of employment. However, any employment of Tyonek residents that did occur would reduce local unemployment and provide valuable skill training, both of which would directly benefit the Tyonek community.

IMPACTS ASSOCIATED WITH THE MARKET FOR COAL

The third scenario assumes the construction of two electric generators along with the annual production of six million tons of coal for export. The major market for the export coal would almost certainly be outside Alaska, so that regional market impacts would be minimal. If Chugach Electric Association merely substitutes coal for gas in the production of electricity at Beluga, the regional market impacts attributable to coal development per se would be negligible, but there could be a significant increase in the price of electricity. On the other hand, if the availability of coal at Beluga results in significantly altered energy costs and supply reliability, the impacts of Beluga coal development on the regional economy would be substantially greater. Chugach Electric, however, will not voluntarily switch from gas to coal. Natural gas supplies, as a by-product of oil development, are in abundant supply, sufficient to meet regional needs beyond the year 2000. It is unlikely that heavy industrial users of electricity, such as the aluminum industry, would ever be placed on interrupted service solely because of insufficient supply of the primary energy source, be it gas or coal. In addition, the cost of gas (at controlled prices) is substantially lower than any projected price of coal. Thus, the substitution of coal for gas is expected to make the regional cost of electricity more than at present, and this relative cost differential would likely continue into the foreseeable future.

Other regional use of coal as a primary energy source could attract new industry into the region in situations where gas was not economically substitutable for coal. An analysis of potential secondary coal-based industrial development of this sort is beyond the scope of this report but would have to be made in order to forecast properly the full potential for regional socioeconomic impacts implied by this initial development activity. To the extent that these secondary or derived developments should occur within the local impact area, socioeconomic impacts on Tyonek would be even more severe than those likely to be associated with the three scenarios. The construction of a road from Anchorage to Beluga would be a major factor precipitating these kinds of impacts.

IMPACTS ASSOCIATED WITH PROJECT REVENUES

The development of the Beluga coal resources and the production of electricity from coal would significantly add to the Kenai Borough's tax base. Specifically, Tax Code Area (TCA) number 54, which contains Tyonek and the Beluga coal fields, would become the source of further revenues. These would be in addition to the substantial existing revenues obtained from oil and gas properties situated in TCA 54. It is difficult to estimate the amount of new revenues that would be generated under each of the three development scenarios. Presumably, the assessed value of the coal lands around Beluga would increase, resulting in additional property tax revenues accruing to the Borough and the state. Cook Inlet Region, Inc. owns lease holdings on the Capps coal field and would be the recipient of royalties from the development of these coal resources. Further revenues could be generated from severance taxes and sales taxes to the extent they are levied on coal production.

The problem of estimating regional economic impacts associated with these revenues is limited to ascertaining the magnitude of future income flow in the region, though this is an important factor. The more serious problem involves the distribution of these revenues within the Borough. While the overall impact of increased regional revenues could be interpreted as beneficial, inequitable distribution of these benefits to villages, towns and cities causes adverse social impacts. This problem is characteristic of most large-scale development activities, especially energy development. The people who suffer most of the primary impacts, in this case the Tyonek natives, tend not to receive benefits adequate to compensate for the negative effects.

Public revenues are typically redistributed through the provision of public services. The Kenai Borough presently provides three main services: education, solid waste disposal, and planning (zoning and subdivision). The availability of these services throughout the Borough is at least in part a function of the ability and willingness of the Borough to distribute sufficient funds for their support. To the extent that the Borough can effectively and equitably deal with the issue of revenue redistribution, the region could be made more attractive to business and industry. In this way, coal development in Beluga could encourage growth in the region beyond that which would be expected in its absence, though the separation of these effects is extremely difficult.

CONCLUSIONS: REGIONAL SOCIOECONOMIC IMPACTS

With the present rate of rapid growth in the Anchorage-Kenai region as a baseline, coal development at Beluga should have only a few small socioeconomic impacts on the region. These would result from reductions in regional unemployment, provision of a new regional energy source, and the generation of new economic revenues in the region. Although a reduction in unemployment would be positive for the region, the magnitude of this effect would not be great. As a new regional source of energy, coal would likely be more costly than gas at its present price. Requiring Chugach Electric Association to convert to coal would represent a financial burden to its customers because of the higher prices it would be forced to charge. Regionally, this would provide a disincentive to industrial development. The greatest potential impacts are associated with the generation of additional revenues to the region. These could serve both to reduce absolute tax levels and to redress existing or created regional fiscal inequities.

SETTLEMENT REQUIREMENTS

SETTLEMENT SITES

Existing Settlements

Tyonek is a village of some 270 Tanaina Athabascans located on the west side of Cook Inlet about 40 air miles west-southwest of Anchorage. The village was originally located south of its present site, but was relocated in the 1950s to higher ground. The settlement includes a store, bank, gas station, and 66 housing units and is served by a water system and electricity from Chugach Electric Association. Most of the housing and community facilities are located on about 90 acres of land.

The Tyonek Timber Company camp is located about 3 miles south of Tyonek Village on former Moquawkie reservation land. Kodiak Lumber Company is sole owner of the chip mill operation, which processes timber received from a sale on the west side of Cook Inlet. The chip mill operation has been temporarily scaled-down because of a weakening in the Japanese market and shutdown of the timber salvage sale.(1) There are currently 20 people at the camp. When the mill was in full operation, it supported a community of about 200 residents that included about 30 school-aged children.

In addition to these settlement sites, there are several oil- and gas-related facilities on the west side of Cook Inlet at Drift River, Trading Bay, and Granite Point. Marathon Oil Company's Trading Bay facility has a large dormitory building to house workers.

Three-Mile Creek Subdivison, located north of Tyonek on the coast, consists of privately owned recreational lots and covers about one-half square mile of land area. Some of the lots have cabins and trailers. In addition, fishing and hunting cabins are scattered throughout the study area, especially along the coast.

Site Characteristics and Land Requirements

The land requirements for a new settlement will vary, depending on whether a work camp or permanent new community is planned.

There is very little data to substantiate the amount of land necessary to support commercial and residential development in areas such as Beluga. A village or town will typically have a small amount of commercial development to supply the local population with essential goods. Anchorage will still be likely to supply the majority of household goods and specialty items. Commercial development would tend to remain relatively small in a work camp, but would expand in the case of a permanent community to reflect other Alaskan towns.

Land needed for residential development will vary, according to preference and availability. The work camp described in scenarios 1 and 2 would tend to be compact and dense since industry-provided housing will have double occupancy. If the work camp is relatively compact, up to 8 to 10 units per acre would be accommodated. A permanent community would be less dense. Workers with families will tend to seek space and privacy and will be more likely to build single-family, detached homes. The density of subdivisions for single-family residences could range from two to six units per acre, depending on both the type of sewer and water system and the Kenai Peninsula Borough's subdivision standards.[a]

A 500-person work camp, with dormitory housing, a kitchen-dining annex, and a recreation annex may require about 40 acres of land. A permanent community for 1500 people, however, would likely require from 600 to 1200 acres, depending on density and design. The permanent community might include a school, recreation complex and park, clinic, and retail commercial area, in addition to both single- and multi-family housing.

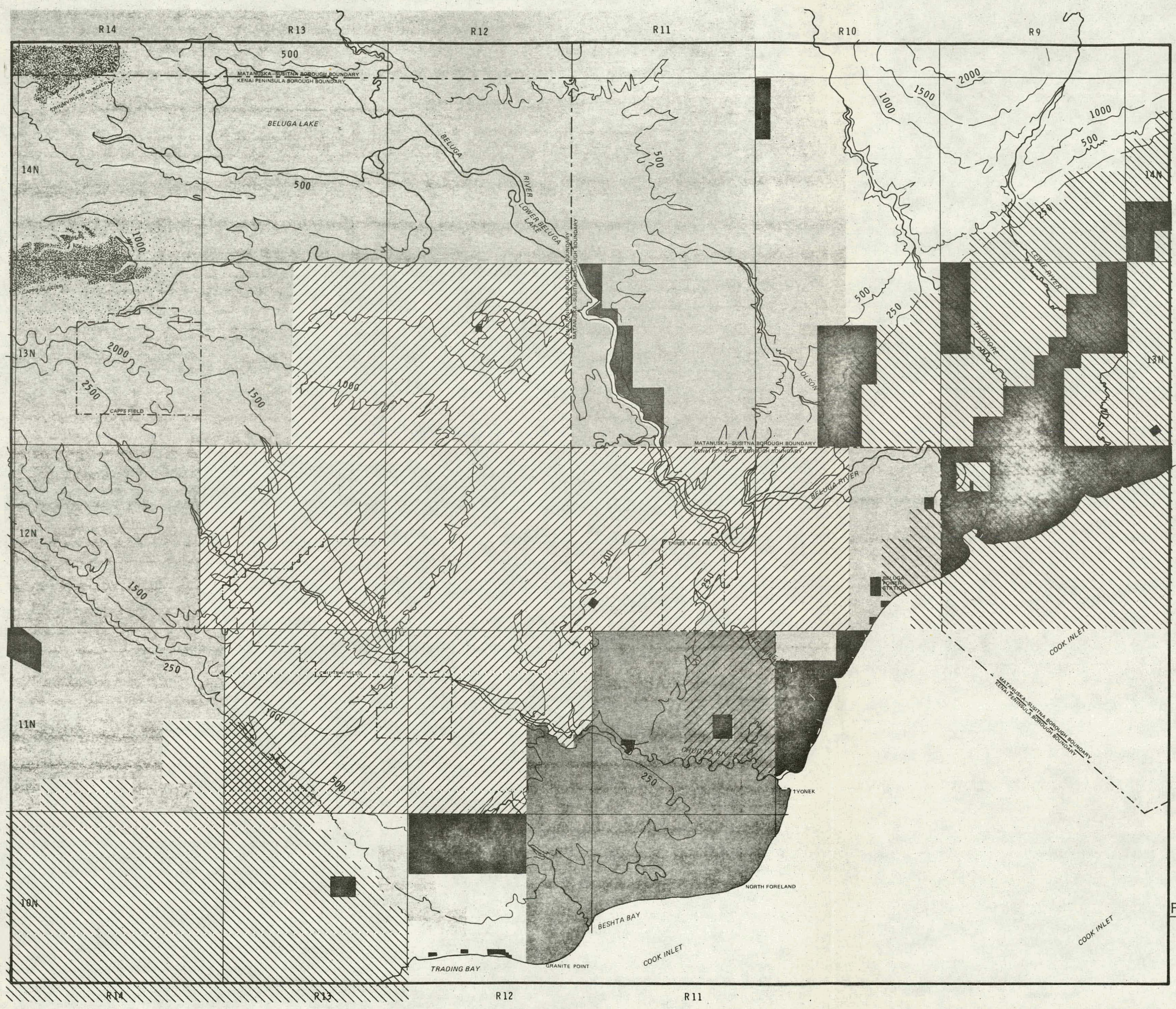
(a) The Kenai Peninsula Borough Subdivision ordinance allows a lot size of 6000 square feet for single-family residences served by public water and sewer. A 20,000-square-foot minimum is placed on a lot that has on-lot systems for both sewer and water.

A number of factors affect the choice of settlement site, including slope, drainage, soils conditions, land ownership, and access to transportation facilities. Land ownership is shown in Figure 2-1. The major landholders in the Beluga study area are the state (mental health lands), Cook Inlet Region, Inc., Tyonek Village Corporation, and the Kenai Peninsula Borough. A new settlement could potentially be located on any of these lands where slopes and drainage characteristics are not a limiting factor.

For purposes of this analysis, several assumptions were made regarding site suitability for development:

- A new community should not be located in an area with poor drainage or with slopes greater than 10%.
- Based on an analysis of slope only, there appear to be some potential settlement sites on State Mental Health lands to the north and northwest of the reservation, and northeast of Capps Field on land owned by Cook Inlet Region, Inc. (south of Beluga Lake, north of Chichantna River, and west of Beluga River).
- A new settlement is not likely to be located on the lands owned by the Tyonek Village Corporation (former Moquawkie Reservation lands) (see Chapter 4 of this report).
- Coastal lands northeast of the reservation may be unsuitable for building and road construction because of soil and drainage characteristics.[2]
- Land along Trading Bay, to the north and east of the McArthur River, appears to be unsuitable for development because of soil type and poor drainage.
- Lands west of the reservation (Township 11N, Range 12W) appear to offer the best potential for community development.

Beluga Coal Company, owned by Placer Amex Inc., has suggested an area near Congahbuna Lake to the west of the Tyonek Reservation as a possible settlement site.[3] This area has slopes of less than 10% and includes two large land parcels, owned by the Kenai Peninsula Borough and Cook Inlet



KENAI PENINSULA BOROUGH LAND

MATANUSKA–SUSITNA BOROUGH LAND

WILDLIFE REFUGE (Trading Bay and Susitna)

FORMER STATE MENTAL HEALTH LAND

STATE GENERAL GRANT LAND
Those lands not indicated as Former Mental Health, Tyonek Native Corporation, or U. S. Survey are General Grant Lands

TYONEK NATIVE CORPORATION OWNED AND SELECTED

COOK INLET REGION, INC. SELECTIONS

PRIVATE LANDS

0 1.5 3 6 miles

Source:
1. State of Alaska, Department of Commerce and Economic Development, Division of Energy and Power Development
2. Beluga Coal Company
3. CH2M HILL, Consulting Engineers

The land status designations shown on this map reflect the best available information at this time and should be confirmed.

September 1978

FIGURE 2-1. Land Status: Surface Estate. Central Beluga Coal District

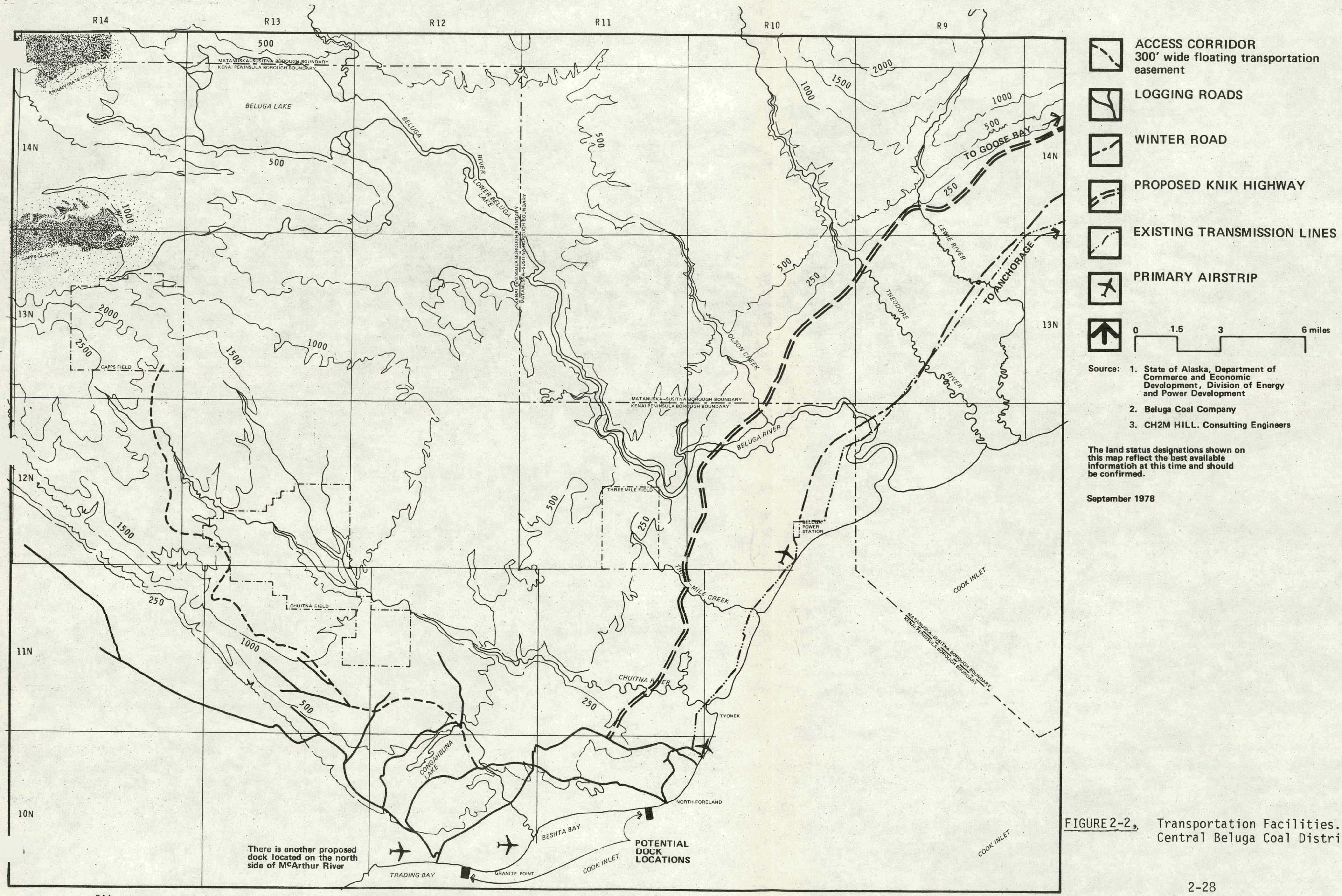


FIGURE 2-2, Transportation Facilities. Central Beluga Coal District

Region, Inc. These two ownerships are shown in Figure 2-1. The borough-owned land covers about an 8-square-mile area (about 5000 acres). The Cook Inlet Region Inc. land is just to the west and south of the borough parcel and includes about 2800 acres of land. The distance from Congahbuna Lake to the village of Tyonek is about 10 miles.

The lake area offers an attractive site for a new community. There are views to the Inlet and the lake can be used for recreation and float-plane landing. The area is served by existing logging roads and has easy access to the Cook Inlet Region, Inc. transportation corridor to Capps Field. Poor drainage may present some problems for development on the west side of Congahbuna Lake. Drainage characteristics appear to be more suitable to the east side.

Figure 2-3 shows a conceptual layout for a community at Congahbuna Lake developed for Beluga Coal Company. The lake has also been suggested as the possible site for a power plant, with lake water serving as cooling water for the power plant, which, in turn, might increase the lake's fishery potential.[3]

HOUSING

Existing Conditions

Three primary settlement sites exist within the study area, including the village of Tyonek, the Tyonek Timber Camp, and Marathon Oil Company's Trading Bay facility.

The major housing concentration is at Tyonek Village, which has 66 housing units (60 woodframe; 6 mobile homes). Many of the wood-frame houses are in need of rehabilitation. They are poorly insulated and energy inefficient.

Twenty-seven HUD-financed houses are planned for construction this year. This will satisfy the immediate need for additional housing, but many young people in the village will still want the opportunity to have their own house. In addition, teacher housing is in short supply; six units are needed.

All village housing is owned by the Tyonek Village IRA Council. The Kenai Peninsula Borough School Distric

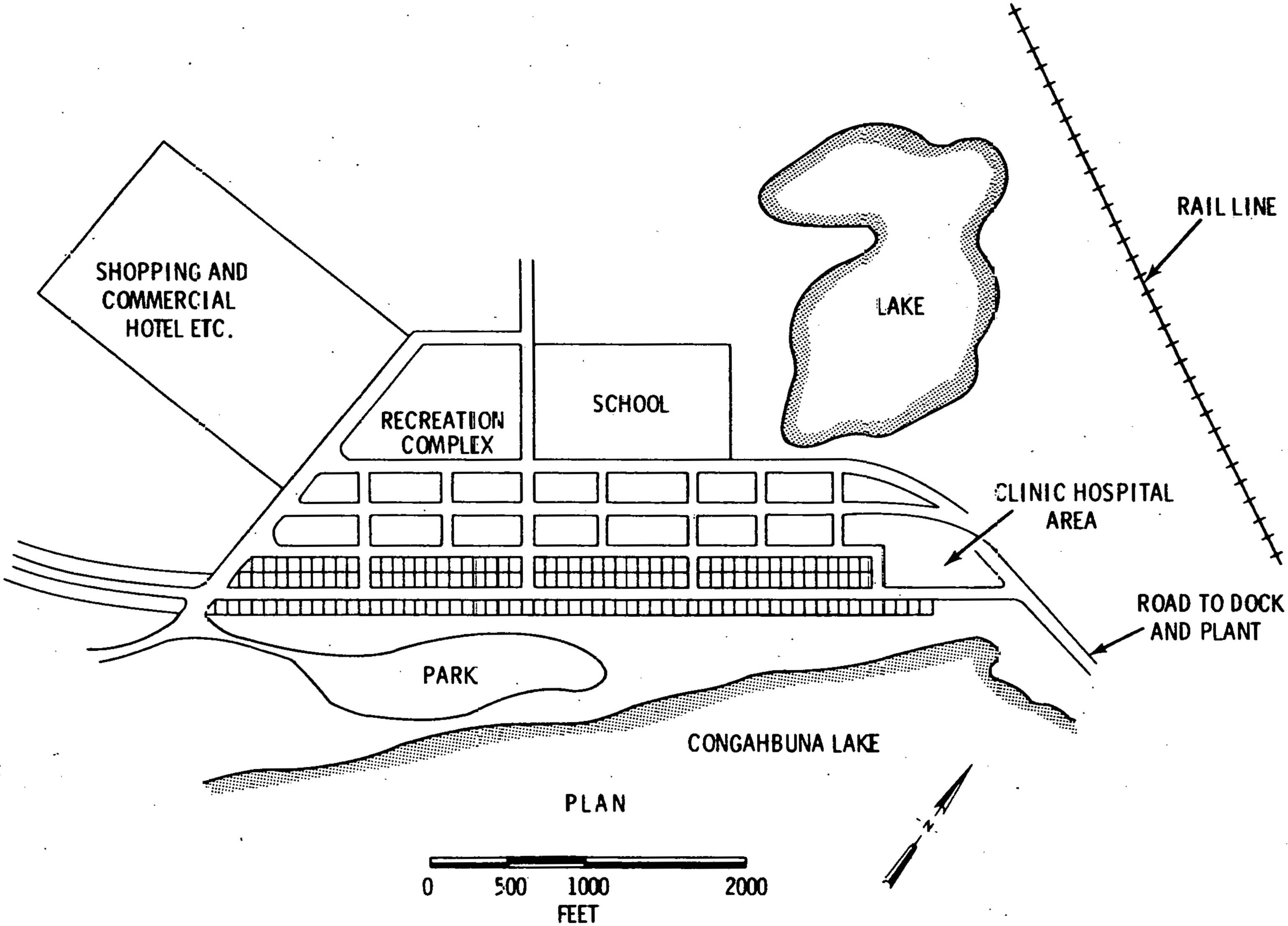


FIGURE 2-3. Conceptual Residential Layout

All village housing is owned by the Tyonek Village IRA Council. The Kenai Peninsula Borough School District might be able to subsidize teacher housing since the district has responsibility for education within the borough. Once built, a program for managing the housing units would need to be established.

Village houses are heated by electricity, which is provided without charge through an agreement with Chugach Electric. The contract for the electricity was signed in 1972 and is scheduled to expire when the village has used a total of 50 million kVh. At current rates of use (under 5 million kVh per year), this is likely to occur between 1982 and 1984.

The costs of heating with electricity are higher than those associated with oil heat, and village residents may find it difficult to pay for the electricity when the contract with Chugach Electric expires. The new housing units will have oil-fired, forced-air heating systems, with fuel purchased from Tyonek Timber. The older units can be converted from electric to oil heat, but at a cost of at least $2000 per unit.

Housing is also located about 2 miles from the village at Tyonek Timber Camp. The camp has six 20-person bunkhouses, five 3-bedroom modular homes, about 12 trailers, and six duplexes. This number of units is capable of housing about 200 individuals.

Marathon Oil Company has one dormitory building with a capacity of about 60 people at their Trading Bay facility. There are several trailers at Granite Point, and both trailers and cabins at the Three-Mile Creek recreational subdivision. In addition, small shacks and shelters are scattered along the coast at private fish sites.

Housing Requirements

The coal development scenarios presented at the beginning of the chapter suggest two possible types of settlement: a perment work camp and a small community.

The first and second coal development scenarios described would establish a permanent work camp at Beluga. In the first scenario for coal-fired generating plants, the first-year (1980) labor force is composed of 100 construction workers to prepare the plant site and 50 workers to build the permanent work camp. About 50 support workers are projected to be needed initially. The total first-year population is projected to be 200, rising to 500 in 1983-84, and declining to 320 from 1986 on.

Because the Beluga area is isolated from other development, this scenario assumes that none of the construction workers would bring any dependents who would not also be employed. The mining, operating, and support workers might bring nonemployed dependents with them, but very few are expected.

The primary means of housing for construction workers and support personnel is typically mobile homes, modular houses, or prefabricated, dormitory-like sleeping structures in a permanent work camp. The permanent work camp would contain all housing, service, and recreation facilities needed by the labor force. Based on the design of much construction camp housing, we have assumed an overall average of two persons per housing unit. Some units with single occupancy may be built for executive quarters, but most workers are likely to be housed in double occupancy rooms. The number of housing units projected for the work camp is based on two persons per unit for construction workers and a small number of four-person families among the permanent workers. Estimates of projected housing demands are presented in Table 2-4.

TABLE 2-4. Projected Housing Demand for the First Scenario

Year	Population	Dormitory Units	3-4 Bedroom Family Units
1980	200	100	
1981	390	195	
1982	520	260	
1983	500	250	
1984	500	220	15
1985	380	160	15
1986-on	320	130	15

The total population in the second scenario (coal exporting) is the same as in the first development scenario beginning in 1989. The permanent work camps are expected to be similar, except that in the second scenario the temporary "bulge" of 500 persons would not have to be accommodated. The estimate of units needed would be about 160 from 1989 on.

Portable ATCO-design prefabricated structures have often been used for construction camp housing in Alaska. These are typically single-story structures with segmented, 2-person sleeping rooms off a main hallway that connects to lavatories. These dormitory-like complexes can range in size from a 4- to a 400-person unit. This type of sleeping structure was typical of pipeline construction camps.

Families can be accommodated in prefabricated 2- and 3-bedroom modular homes or mobile homes. This is typical for family housing at many lumber camps and was used at Valdez during pipeline construction.

A prefabricated kitchen annex and recreational annex are likely to be included as part of the construction camp. Most buildings will be wood-frame on a steel chassis with steel roof and siding with baked enamel finish.

The construction materials can either be barged to the site or transported by airplane. Barging may require a temporary dock and roadway from the dock to the camp site. Barges can also be off-loaded onto the beach. For construction camp development at Beluga, materials could be trucked from Anchorage to Kenai and then barged across Cook Inlet to Trading Bay or the Tyonek Timber dock. Materials could also be barged directly from Anchorage or Seattle. A rough cost estimate (in 1978 dollars) for work-camp housing is $250,000 for a 52-person sleeping complex and $700,000 for a 500-person kitchen-dining facility.

The third scenario, which combines generating plants with coal export, is identical to the work-camp scenarios through 1988 in terms of total population and size of the work-camp settlement. The population begins to increase in 1989 as construction workers arrive to begin work on the docking and loading facilities. Mining and operating workers increase rapidly in 1990. By 1990, the "permanent work camp" will develop into a community, with ancillary businesses, services, and facilities.

For the purpose of projecting housing demand, we have assumed that the construction workers will all live in two-person units (as in the previous scenarios). A few nonemployed dependents would accompany mining, operating, and support workers through 1988, as in the first two scenarios. After 1988, there would be a diversity of household sizes, including single persons, couples, and families with children.

To project the demand for permanent housing, we have estimated a possible mix of housing types based on the nonconstruction worker population and on what construction companies are likely to build. After 1989, demand for dormitory housing will cease. In 1990, we have assumed a demand for about 100 3- to 4-bedroom houses, 225 2-bedroom units, and 50 1-bedroom units. The number of families with children is expected to increase in 1991, requiring additional 3- to 4-bedroom housing units. Projected housing demand by type of unit is shown in Table 2-5.

TABLE 2-5. Projected Housing Demand for the Third Scenario

	Population			Housing Units				
Year	Construction Workers	Other Workers & Dependents	Total	Dormitory Units	3- to 4-Bedroom Units	2-Bedroom Units	1-Bedroom Units	Total
1980	150	50	200	100				100
1981	300	90	390	195				195
1982	400	120	520	260				260
1983	350	150	500	250				250
1984	200	300	500	220	15			235
1985	100	280	380	160	15			175
1986	--	320	320	130	15			145
1987	--	320	320	130	15			145
1988	00	320	320	130	15			145
1989	240	460	700	120	50	225	35	430
1990	--	900	900	0	100	225	50	375
1991 on	--	1330	1330	0	200	225	50	475

SCHOOLS

Existing Conditions

Bob Bartlett School serves grades K through 12 and is financed and managed by the Kenai Peninsula Borough School District. Located at the village of Tyonek, it is the only school serving the Beluga area. The school has four regular classrooms, a home-economics suite, and a portable classroom, for a total capacity of 240 students.[4]

Enrollment history and school district projections are presented in Table 3-3. The total 1976-1977 enrollment was 108, with 75 in grades K-8, and 33 in grades 9-12. As of May 1978, 98 students were enrolled and 7 teachers (5 regular and 2 cultural resource teachers) were employed. The Borough's 1977 school-construction report indicates that no facilities other than a new home-economics suite need to be provided during the 5-year period ending in 1982.

When the Tyonek Timber Company mill was in full operation, approximately 20 children were bussed from the camp to the village to attend the school.

TABLE 2-6. Pupil Enrollment and Projections Bob Bartlet School, Tyonek[a]

School Year	K-8	9-12	Total
1972-73	76	21	97
1973-74	65	22	87
1974-75	73	18	91
1975-76	87	28	115
1976-77	75	33	108
1977-78	82	34	116
1978-79	90	34	124
1979-80	95	37	132
1980-81	103	38	141
1981-82	110	41	151

[a] Kenai Peninsula Borough School District, Enrollment Projections and School Construction Report, April 1977.

School Requirements

The permanent work-camp situations described in scenarios 1 and 2 (see Chapter 1) are expected to include few, if any, school-aged children. The possibility of a limited number of school-aged children should be anticipated, however, and ways to provide for their educational needs should be considered.

At its maximum level of operation, the Tyonek lumber camp had a ratio of about 0.10 school children per adult. If this ratio is applied to the mining, operation, and support workers in scenarios 1 and 2, a possible school population of 30 students for the work-camp situation is derived.

Even in the third coal development scenario, where a permanent community is anticipated, a lower than average pupil-per-household ratio should be used to estimate numbers of school children. Few school-aged children are likely to arrive until 1989, when the number of nonemployed dependents would begin increasing and secondary workers would begin arriving to provide services. Total housing (nondormitory) units are expected to reach 310 in 1989, 375 in 1990, and 475 from 1991 on.

The current pupil-per-household ratio in the Kenai Borough is 0.74, but the isolated nature of the Beluga settlement is expected to discourage families with school children from moving to the new settlement. A gradually increasing pupil-per-household ratio has been used instead to estimate numbers of school-aged children.[a][5] For 1989, a ratio of 0.3 yields approximately 90 pupils; for 1990, a ratio of 0.4 yields 150 pupils; from 1991 on, a ratio of 0.6 yields 285 pupils. Assuming a class size of 20 pupils with one teacher per class, 5 to 14 classrooms and teachers would be required to serve their needs.[b][6]

The educational needs of school-aged children in the Kenai Peninsula can be met in a variety of ways, depending on the number and location of the pupils to be served. The school board of the Kenai Borough School District is responsible for making final decisions on such matters. Several options are listed below:

- New pupils could be accommodated at the existing school at Tyonek.
- A school could be constructed at a new settlement site.
- Portable classrooms could be used to handle a temporary peak in school enrollment during construction periods.
- Pupils could be enrolled in correspondence classes through the school district.

The Bob Bartlet School facility has the potential to serve another 100 pupils given its current capacity and enrollment trends. For students to attend the Tyonek School, however, roads and bus transportation must be established from the new settlement to Tyonek. If a new school were built at the settlement site, it would probably be a prefabricated structure similar to the ATCO-designed dormitory housing.

The decision of whether to send children to the existing school at Tyonek or to construct a new school will be based on a number of factors. The number of school children associated with a work camp would probably not justify the cost of new school construction, although a school might be built to serve the combined needs of the lumber camp and the coal development work camp. On the other hand, a full-scale community in the Beluga area (scenario 3) would almost certainly require a new school facility. Another important consideration is the attitude of Tyonek villagers toward use of their school by nonnatives. Issues related to this concern are discussed in the sections which follow.

Correspondence courses are an alternative that should be explored if only a few children are associated with a work-camp situation. The Kenai Borough School District currently has one of the largest correspondence programs in the state, with over 100 students participating.

POLICE, FIRE, AND EMERGENCY MEDICAL SERVICES

Police Services

Police services in the Beluga area are provided by the Alaska State Troopers through a resident constable. The constable serves the area from the Beluga power station south to Trading Bay, including the oil and gas facilities at Trading Bay and Granite Point and the lumber mill camp near Tyonek. A four-wheel drive vehicle is used by the constable to patrol the area and an airplane is available to fly the area if the need arises.

The constable at Tyonek has the time and ability to handle an additional number of complaints and other police activity, but the point at which population increases will require the state troopers to add another policeman is difficult to estimate.

A need for additional police officers in the Beluga area will definitely be generated by the combined activity of the village, the Tyonek lumber camp, and any settlement associated with coal field development. In most cases, the state troopers wait to add staff until the new position can be justified by increasing population numbers. During construction of the Alaska pipeline, however, police service needs were anticipated and additional troopers were assigned to affected areas in advance of actual population increases.

In a work-camp situation, the troopers encourage private companies to hire their own staff for internal security. The troopers are then available to provide emergency assistance. The temporary assignment of additional troopers to the area is another option, especially if camp activity is short-term or seasonal. In the Beluga area, this would involve assigning staff from the Soldotna regional office of the state troopers.

A permanent community of 700 to 1400 residents in the Beluga area is likely to require a full-time police officer just to serve local community needs. The city of Seldovia, with a population of 600 and no road access to the other Kenai Peninsula cities, has one police officer and police car. The Kenai Peninsula cities of Kenai and Soldotna maintain a ratio of about two police officers per 1000 residents.(6)

The method of providing police services to a new community in the Beluga area will depend somewhat on whether the community incorporates as a city. A rough estimate of police manpower requirements can be obtained by applying a ratio of 1.5 policemen per 1000 residents to the projected population under coal development scenario 3.[7] These estimates are shown in Table 2-7.

TABLE 2-7. Police Service Projections for the Third Scenario

Year	Population	Police Officers
1980	200	0.3
1981	390	0.6
1982	520	0.8
1983	500	0.8
1984	500	0.8
1985	380	0.6
1986	320	0.5
1987	320	0.5
1988	320	0.5
1989	700	1.0
1990	900	1.4
1991	1330	2.0

If the new community does not incorporate, the present constable can probably handle the increased work load until 1989. During the years 1982-84, however, he may require some staff assistance from the Soldotna office of the state troopers.

Fire Protection

No publicly provided fire protection services are currently available in the Beluga area except through the U.S. Department of Interior, Bureau of Land Management. However, a work camp would typically have its own fire-fighting equipment on hand. A permanent community of 1400 residents would require some fire-fighting capability and equipment of its own.

Estimates of staff and equipment needs can be based on the experience of other Kenai Peninsula towns. The city of Seldovia, with 600 residents, has 24 volunteer firemen, 2 pumper trucks, and a jeep pumper. Soldotna, with about 2500 residents has 3 paid staff, 20 volunteers, 2 pumper trucks, and 2 tankers. Fire services may also be provided through a borough service area. An example is the Nikiski fire service area, which serves a 33-square-mile area, including the unincorporated residential and industrial area north of the city of Kenai on the east side of Cook Inlet. The service area has 2 fire stations, a paid staff of 19, 20 volunteers, and trained emergency medical technicians. One pumper and tanker are located at each station.

Fire protection needs for cities of all sizes are based upon the water flow in gallons per minute that may be required. According to the National Fire Protection Association, one pumper truck (plus supporting units) is required, in general, for each 500 gallons per minute (gpm).[7] Required water flow by community population size is presented in Table 2-8.

TABLE 2-8. Water Flow Requirements for Fire Protection

Population	In Gallons Per Minute	In Million Gallons Per Day	Pumper Trucks	Water Flow Duration In Hours
1000	1000	1.44	2.0	4
1500	1250	1.80	2.5	5
2000	1500	2.16	3.0	6
3000	1750	2.52	3.5	7

Health Care and Emergency Medical Services

The state troopers are responsible for supervising rescue operations for emergency situations in the Beluga area. Medical evacuations are usually accomplished by private charter plane. The RCC (U.S. Air Force) also handles some emergency evacuations.

Health care services are available to the residents of Tyonek through a medical center located in the village. The facility handles both medical and dental work and is staffed by a resident, licensed practical nurse. Emergency medical care is received at the ANS hospital in Anchorage.[8] The clinic also has a community health aide (and alternate) provided through the U.S. Public Health Service. The health aide may provide services to nonnatives on an emergency basis only. Nonnatives are billed for the service.[9]

The Kenai Borough's Central Hospital service area encompasses over 1000 square miles of land on both the east and west side of Cook Inlet. On the west side of Cook Inlet, the service area extends from Beluga River to Drift River, including the study area. A 32-bed hospital is located at Soldotna.

The health care needs of a work camp of 300 to 500 workers could be met in several ways. The camp could train or hire its own paramedics or obtain the services of a resident nurse or doctor. Tyonek Timber Company, for example, has its own paramedics at the lumber camp. Emergency medical situations could be handled by air evacuation to either the Soldotna hospital or a hospital in Anchorage. A small clinic could also be built at the work-camp site. Prefabricated first-aid units are available and can be barged to the site. A 14-bed, 58-foot by 56-foot unit costs about $125,000 in 1978 dollars.

A permanent community of 1000 or more without road access should have its own resident doctor, nurse, and clinic. Needs for hospital and clinic facilities and staff are usually based on the expected number of patients, but, a rule-of-thumb "bed multiplier" is 4.0 to 4.5 beds per 1000 population.[7]

RECREATION NEEDS AND OPPORTUNITIES

For either a work camp or a community, adequate opportunities for both indoor and outdoor recreation must be provided. Libraries, parks, community centers, restaurants, bars, and shops all help to meet recreational needs. Some problems were encountered during pipeline construction in those camps that did not provide adequate recreation opportunities. Studies of energy development communities elsewhere in the United States have also demonstrated that a lack of recreation facilities and services can contribute to stress and mental health problems, especially for nonemployed dependents. In addition, worker productivity may decline if opportunities for rest and relaxation are absent.(10)

Recreation needs in a work-camp setting can be met in several ways. Work schedules might be arranged on a "three-weeks-on, one-week-off" basis, with transportation provided to Anchorage (or elsewhere) during the off-period. The camp operators could also provide a recreation annex onsite, including indoor exercise facilities, informal meeting space, reading materials, and a bar.

Business opportunities will generate restaurants and other retail establishments in a permanent small city. In addition, residents will want to develop a range of facilities, including libraries and parks. Requirements for park and library space will vary depending on the expectations and desires of community residents. General standards for small rural communities indicate that a library facility for a population of 1000 should have a minimum of 6000 square feet, 10 patron seats, and 3000 to 4000 volumes. The facility should be open at least 20 hours per week at fixed times.(7) Bookmobiles (in this case, airplanes) may also be used to provide library services to an isolated area. If a school is built to serve the community, the school library might also be designed to serve the adult population.

The need for parks will be influenced by the character of the land surrounding the settlement site and the opportunities it offers for outdoor recreation--hiking, picnicking, and so forth. In any case, park space within the city for children is undesirable. Community-based park facilities are generally of three types: playgrounds (about 3 acres), neighborhood parks (about 10 acres), and community parks (about 60 acres). A new community in the Beluga area of 700 to 1400 residents could require a total of about 4 acres of park space. Parks might include play apparatus, a baseball diamond, and tennis courts.(7)

WATER AND WASTEWATER SYSTEMS

Existing Systems

Existing water sources for the village of Tyonek, the Tyonek Timber Company and the Trading Bay are described below.

Village of Tyonek

The existing water source for the village is a nearby lake.[a] The former ground water supply was abandoned because of its high iron content (with manganese).

The water system, which includes an infiltration gallery and pump house, was installed by the village in 1976. The lake water is chlorinated, stored in a tank, and filtered with activated carbon before being delivered to the underground distribution system, which was completed in 1972 under an EDA contract. A previous groundwater well was developed in 1964 by the U.S. Public Health Service, but is used only for public water supply. Each house and the school is served by the distribution system. The 27 new housing units planned for the village by Cook Inlet Housing Authority will be connected to the distribution system.

Several water system problems were identified in a recent Public Health Service survey:[11]

- The chlorinator is not working properly.
- The activated carbon supply needs to be replenished.
- The lake level is very low, primarily because of extensive winter pumping to keep waterlines from freezing.

The report also identified other potential water sources, including Second Lake, Chuitna River, and Bunka Lake. Water quality tests indicate

[a] Water quality, prior to treatment, has the following characteristics:

Fe (Iron)	0.2 mg/ℓ
Hardness	9.0 mg/ℓ as $CaCO_3$
Total Dissolved Solids	10.0 mg/ℓ

that both Rainbow and Second Lakes are low in iron and should be good water sources. The Public Health Service is investigating future water-source development.

The primary method of wastewater disposal is septic tanks with subsurface leach fields; some cesspools are also used. The septic tanks were installed in 1965, have a capacity of 200 to 400 gallons, and are constructed of low-grade steel. Some of the tanks are rusting.[11]

The soils have a gravel base, making them good for subsurface disposal. The problems that have developed with the onsite systems are probably a result of the small size of the tanks and inadequate maintenance.

An unfenced sanitary landfill is located 4.2 miles from the village. The Kenai Peninsula Borough is in the process of establishing a new landfill for the village, but it may be a year before all approvals are obtained.

Tyonek Timber Camp

Water is supplied from three wells, which have been adequate to support 200 people to date; no water shortages have occurred. The water contains an excessive amount of iron and barely meets water quality standards. However, no bacteria problems exist.

Water is distributed through an underground system that requires standard maintenance. No winter freezing problems have been encountered.

Septic tanks with perforated-pipe drainfields are used for waste disposal. The systems have required normal maintenance; no special problems have developed. The soils (consisting of a gravel base, covered with a few feet of sandy loam and some clay) are good for subsurface disposal.

Trading Bay

Water is supplied from wells at Marathon Oil Company's Trading Bay facility and no shortages have occurred. Septic tanks with drain fields have also been used with very few problems.

Requirements

To project water demand and system requirements for communities associated with Beluga coal-field development, we have assumed a demand of 70 gallons per capita, per day (gpcd) for a resident work camp[a] and 90 gpcd for a permanent community. We have also assumed that 100% of the total water supplied becomes sewage.

The first coal development scenario (generating plants only) estimates an initial population of 200 in 1980, or a water demand of 14,000 gallons per day (gpd), that must be supplied, treated, and disposed of. In the peak year (1982), a 36,400-gpd capacity is required. This demand declines in 1985, and the system requirements from 1986 on should be capable of handling about 23,400 gpd.

In the case of coal export only (scenario 2), water demand is likely to remain fairly constant, ranging from 21,000 gpd in the first year to 23,400 gpd from 1990 on.

Water demand for the third scenario is initially quite similar to scenarios 1 and 2. Water supply, treatment, and disposal systems must accommodate 21,000 gpd in 1980, rising to about 36,000 gpd in 1982-84, and then declining to about 23,000 gpd in 1988. Estimates for 1991 and after assume a permanent community with a 90-gpd demand, or a total daily demand of about 120,000 gallons.

Water Availability

Water to meet the demands of a work camp or permanent settlement can be supplied from either surface water or ground water sources. Potential surface water supply sources in the Beluga area include the Beluga River, with an average flow of 2400 cubic feet per second (cfs), and the Chuitna River (about 5 miles northwest of Tyonek), with a minimum flow of 60 cfs. Water quality data indicate that Chuitna River water would be acceptable for drinking with minimal treatment.[b]

(a) Based on the experience at Alyeska pipeline construction camps.
(b) USGS surface flow and well records for several locations in the Beluga area are contained in the Appendix.

System Alternatives

The alternatives available for meeting the water supply and wastewater disposal needs of new settlements include onsite systems, new community systems, and expansion of existing systems.

Onsite Systems

Onsite systems (wells and septic tanks) will function well if good soils and adequate separation (about 4 feet) are available between the leaching bed and the water table. In general, areas suitable for subsurface disposal systems have gravel and other permeable soils.

Onsite systems are best used where residential lot sizes are 20,000 to 40,000 square feet. When both individual wells and septic tanks are employed, the minimum lot size should be 40,000 square feet; when water is supplied through a community system, but waste disposal is onsite, a 20,000-square-foot minimum lot size is desirable.[12]

Multifamily residences (including work camp dormitories and bunkhouses) are less suited than single-family residences for onsite waste disposal. Large quantities of wastewater must be disposed of, requiring large septic tanks and leach fields.

Community Water and Sewer Systems

If onsite disposal is not possible, either because of adverse soil conditions or living unit configuration, community water and sewer systems must be developed.

A water treatment plant may be required, especially in the case of a permanent community. The length of water transmission mains will vary, based on the plant location in relation to the supply source. Small, outlying communities of low density are likely to have deep-well systems located adjacent to treatment plants and distribution points and, thus, do not require transmission mains.

Water-saving fixtures should be a part of the community water system, and their use should be encouraged. They will help to decrease the total water demand of a new settlement.

For sewage treatment, the system should be as simple as regulatory agencies will allow, while still maintaining adequate effluent discharge quality and receiving water quality. Types of sewage treatment systems, in order of preference, are listed below:[a]

1. facultative lagoon (requires the greatest land area of the alternatives)
2. aerated lagoon
3. mechanical systems (biological: activated sludge, RBS, ABF; or physical/chemical).

Discharge of sewage to a stream will require approval from EPA and the Alaska Department of Environmental Conservation. Discharge to Cook Inlet is another possibility if the new community is located close to the Inlet. This would not be feasible for a community in the Congahbuna Lake area because the distance to the Inlet is too great to make it economically feasible.

For solid waste disposal, the sanitary landfill method tends to work best, especially for a publicly used and operated system. In most cases, incineration is uneconomical when compared with sanitary landfill disposal. If the flow of solid waste can be carefully controlled (as in an industry-operated work camp), an incinerator might be an economical alternative.

Expansion of Existing Systems

A new community in the Beluga area is unlikely to be able to use existing water systems to serve its needs. For example, the present Tyonek water supply system is too remote to be used by a community next to Congahbuna Lake.

(a) For a brief description of each of these system types, see Appendix.

TRANSPORTATION AND POWER

Existing Systems

Existing road, air, and shipping transportation facilities as well as power supplies are described below.

Roads

Most of the road system in the Beluga area has been developed by Tyonek Timber Company in the form of logging roads that connect Granite Point, Tyonek, Nicolai Creek, Kaloa, North Foreland, and Beluga. There are about 100 miles of primary and secondary roads. These roads are in good condition, especially the main roads (see Figure 2-3).

The main logging road extends approximately 16 miles northwest of Congahbuna Lake to within 8 miles of Capps Coal Field. Most roads are sand, overlain with gravel, and require no special maintenance. The roads are retopped following breakup.

Road rights-of-way (100 feet wide) are established along the section lines of all state land (or land acquired from the state). All other land has a 66-foot right-of-way along section lines. Some legal questions have been raised about how this right-of-way provision applies to land "reserved for public use." No rights-of-way are associated with the network of logging roads. Access was permitted as part of the state's timber sale contract with Tyonek Timber Company.

Beluga and Anchorage are not connected by a year-round road; however a winter road has been used in the past when the Susitna River was frozen. The road was originally constructed to carry large, heavy equipment to the area, but it has not been used for the last two winters.[a]

The Alaska Department of Transportation and Public Facilities has studied the Beluga area and developed plans for river crossings and roadways. A proposed highway would run from the Moquawkie Reservation to Goose Bay (about 65 miles), crossing the Susitna and Beluga Rivers. An existing road

[a] During the 1975-1976 winter, the Susitna River did not freeze over.

already connects Goose Bay to Knik (10 miles), Knik to Wasilla (19 miles), and Wasilla to Anchorage (47 miles). The approximate location of the road is shown in Figure 2-2.

The proposed highway is not likely to be constructed in the near future, primarily because the economic benefits to be derived from it do not justify the construction costs. The river crossing alone would cost an estimated $250 million (1978 dollars). This may be compared with an annual state highway budget of a little over $100 million. The proposed highway may become more attractive as additional projects for resource and industrial development in the Beluga area (aluminum smelter, coal generating plants, etc.) are proposed or become feasible.

Airport Facilities

Four primary airstrips are located in the Beluga area: at the Beluga power plantsite, Tyonek Village, Kaloa, and Granite Point. Characteristics of these four strips are described briefly:[a]

- Beluga: 5000 feet, gravel surface, landing lights, good condition
- Tyonek: 3500 feet, gravel surface, landing lights, good condition
- Kaloa: 5000 feet, gravel surface, landing lights, good condition
- Granite Point: 3500 feet, gravel surface, poorly maintained.

Other airstrips in the area include a poorly maintained 3500-foot City Services Oil Co. field, 8 to 10 miles west of Beluga; a 1700-foot airstrip in good condition at North Foreland that will handle a Sky Van; and several light aircraft strips, including two 900-foot strips at Capps Field.[3]

All airfields in the Tyonek-Beluga area are privately owned and maintained. Use of the airstrips requires permission of the owners.

[a] Airstrip length requirements vary by type of aircraft. Both the Sky Van and Titan need about 2000 feet of runway. A C-130 requires close to 5000 feet. (A Titan will hold 10 people, or can be converted to cargo only up to 3500 pounds. A Sky Van will hold 10 to 12 people or 3000 to 3500 pounds of cargo. A C-130 is a large, 4-engine, turbo-prop plane, much larger than the Titan and Sky Van.)

Dock Facilities

A 1466-foot dock at North Foreland is the only dock located in the Beluga area. Owned by Tyonek Timber Company, it has 685 feet of berthing space and a water depth of 36 feet at mean low water. The largest ship to dock at North Foreland was 607 feet long and 45,000 metric tons. The dock would need to extend about 3700 feet from shore to reach a 60-foot depth. The dock is used from April to November, depending on shipping schedules. No unusual maintenance has been required to date with respect to ice or current problems.

Power

Chugach Electric Association operates a large, gas-fired generating plant at Beluga with a present capacity of 297.7 megawatts (MW) and a planned capacity in 1979 of 362.1 MW.[1] Chugach Electric supplies power to Three-Mile Creek Subdivision, the village of Tyonek, the Tyonek Timber Company, and others. Transmission line location is shown in Figure 2-3.

The village of Tyonek constructed a 10 MW generating plant some years ago to be run with gas from two prospective wells. When these wells failed to produce, the generating plant was sold to Chugach Electric Association in 1972 for $447,500, a contract was negotiated to supply Tyonek with 50 million kilowatt hours (kWh). Tyonek has used somewhat less than 5 million kWh per year since 1972.

Requirements

Future power and transportation requirements are discussed in the following sections.

Power

Power for a work camp in the Beluga area could be supplied from the existing Beluga generating station, especially during the initial construction phase of coal field development. If coal-fired generating plants are constructed in the Beluga area (scenario 1), these could eventually supply the work camp with electricity. Standby generators should also be available in case of a power or transmission line failure.

A permanent community of 1300 people or more (as projected in scenario 3) could eventually be supplied with power from a coal-fired generating station, depending to some extent on its distance from the community. Power would probably be available from the Beluga generating station during the initial phases of community development.

A peak demand of 2.0 to 2.5 kW per household can be used to estimate minimal power requirements for a small, isolated residential community.[a] For the community described in scenario 3, a 1500-kW-demand load should be anticipated. This would be adequate to serve residences, small businesses, and a school but would not supply the power needs of any heavy industry in the area. The potential 1500 kW demand is an almost insignificant percentage of the Beluga generating station's eventual 400-megawatt capability.

Airport Facilities

A 3500-foot airstrip can support a work camp of 200 to 500 people if barging is also relied on to bring in construction material, equipment, and other bulky goods. Currently, all people, and most goods, are transported to the Beluga area by air. Some goods are also shipped by small barges.

A permanent community of 1300 people or more will likely require at least a 5000-foot airstrip with adequate lighting and a building for travelers and cargo.

Dock Facilities

Dock facilities will be required to export coal from the Beluga area. Coal transport ships must have a water depth of 65 feet at low tide in which to maneuver and take on cargo.[3] A barging operation requires less depth; a loaded barge draws from 18 to 30 feet, depending on its size.[13]

Placer Amex, Inc. investigated a number of potential harbor sites for dock facilities on the west side of Cook Inlet between West Foreland and North Foreland. The three potential harbor sites that were identified are shown in Figure 2-2.[3]

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[a] CH2M HILL estimate.

One site is adjacent to the Tyonek Timber Company dock at North Foreland; access to the dock would be through Tyonek village lands. The other two sites are adjacent to state-owned lands at Granite Point and Trading Bay.

The shortest distance to 65-foot depths is at North Foreland (about 3700 feet from shore). The distance at Granite Point is over 8000 feet and over 12,000 feet at Trading Bay. These lengths assume that berthing must be available on a 24-hour basis (i.e., including the period of lower low water). If berthing space is required only part of the day, shorter dock lengths are possible.

A road or rail connection must be constructed from the dock to the new community and to Capps Field. It would be easier to build and supply a settlement in the Beluga area if it were located fairly close to the dock. Construction materials, equipment, and other supplies could be barged or shipped in and then trucked a short distance to the site. The Granite Point dock location is about 4 miles overland from the proposed community site at Congahbuna Lake. This configuration of dock and community site would avoid the need to cross Tyonek village lands.

Dock siting and construction require a permit from the Corps of Engineers. The permit is subject to public notice and review before it can be issued. Although the Corps has indicated that the permit should present few problems, it could be the subject of considerable controversy if road access is required across Tyonek lands to connect the new community and dock.

Overland Transportation

Of primary concern for coal development in the Beluga area is transporting the coal overland from Capps Field to either a coal-fired generating facility or a dock for export. Gravel surface roads are preferable since they are fairly stable, can handle heavy traffic, and are easy to maintain, especially given the frost heave problems. A road from Capps Field must be designed for at least 150-ton haul trucks.[3]

The quantity of coal required to supply coal-fired generating plants does not justify a rail connection. Rail becomes a feasible alternative when over 2 million tons of coal must be transported.[3] The two methods of transporting coal, railroad and truck, are not mutually exclusive. A truck-haul system may be used initially until the market has built up sufficiently to warrant railroad construction.

A third overland transportation method for coal is the slurry pipeline. Slurry may be a mixture of coal and either oil or water. The capital costs associated with a pipeline are much lower than with railroad construction. Costs are increased somewhat by other factors, however, such as storage and use of oil to mix with the coal. The coal must be crushed more finely than is necessary for truck and rail transport. The more finely the coal is ground, the more fly dust is produced and lost.

Loading would be simplified with a pipeline, since extending a pipe out to a large ship is simpler than constructing a dock. A catenary (a metal trestle), built to withstand the ice conditions and currents would suffice for a pipeline. A platform or T-section would be anchored at the end of the pipeline, so a ship can berth. A road would still be needed along the pipeline for maintenance and personnel transport, but less road maintenance would be required for this than with the truck-haul system.

The amount of road construction required to support a work camp or full-scale permanent community will depend on site design and living configurations. A work camp with bunkhouses would require a minimum road network. A full-scale community might require anywhere from 6 to 20 miles of local streets. The city of Seldovia (population 600) maintains 6 miles of community streets; Homer (population 1800) has 8 miles of local streets; Soldotna (population 2600) has 27 miles of city-maintained roads.[5]

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PSYCHOSOCIAL PROSPECTS FOR TYONEK

OVERVIEW

The development of coal in the Beluga field is likely to have extensive impacts on the residents of the native village of Tyonek. Both negative and positive consequences may occur. Unlike many native villages in Alaska, Tyonek has previously experienced the impacts of development through: (1) royalties obtained from gas and oil leases in 1964, and (2) the construction and development of a large lumber chip mill just outside village boundaries. Like all native villages, Tyonek also faces the complicated and sometimes confusing conditions created by the Alaska Native Claims Settlement Act of 1971 (ANCSA). Past and current experiences with economic development have made Tyonek residents more sensitive to their consequences than most native Alaskans. They view development of the Beluga coal field with apprehension, skepticism, and caution because its impacts may forever change their village life style, quality of life, and life satisfaction.

This section of the report focuses on the concerns of the village residents. It examines the potential impacts of development on their community and life style and includes recommendations for minimizing negative social and individual impacts on village residents. Throughout this section emphasis is placed on the unique cultural orientation of Tyonek residents and on problems faced because of accelerated contact with the values, beliefs, and life styles of nonnatives and outsiders.

The scenarios presented and discussed earlier in this report suggest various levels of coal development. Elements such as the presence of a mining camp and the population size would vary as a function of the level of development. Any one of the scenarios would affect the quality of life and lifestyle of the Tyonek people, although the full-scale development depicted in the third scenario would have the greatest effects on the Tyonek village. To anticipate those maximum impacts, this section focuses entirely on that scenario, which includes the development of a new community of approximately 1300 people at Beluga.

A HISTORICAL PERSPECTIVE ON THE VILLAGE OF TYONEK

No one is certain when the first residents settled in the area now known as Tyonek. As late as 1880, Ivan Petroff, a Russian territorial governor, noted that the area around Tyonek contained "2 whites, 6 creoles and 109 natives." The native population has steadily increased to the present-day level of 271.

The native residents are related to the Athabascan-speaking clans and tribes that inhabit the central interior of Alaska and certain provinces of Canada. Many of the early folkways and mores of the Cook Inlet natives were heavily influenced by various Eskimo groups and Northwest Coastal tribes. Anthropologists noted that the Alaskan Athabascans displayed a "lack of precisely definable cultural base".(1) The tribes and clans have always been hunters and fishermen; as a consequence, they experienced a great deal of mobility and mingling with members of other villages. These factors have led many historians and anthropologists to believe that the Athabascan groups were highly adaptive, resourceful, and susceptible to external influences.

While the residents of the northwest shore of the Cook Inlet are often referred to as Tyoneks, they are actually of the Moquawkie tribe and of the Tanaina component of the Athabascan linguistic group. Through the years, outsiders have referred to the area as Moquawkie (many maps still show it as the Moquawkie Indian Reservation), Tyonek, and in rare instances, Beluga. Today, the native residents are identified as Tyonek.

Vestiges of traditional life style are still apparent in present-day Tyonek. Fishing and hunting are highly valued among villagers and the catches form the mainstay of the typical diet. Family networks are extended to include all relatives, however far removed. As one resident pointed out, "In one way we are probably all related." Tenets of the Russian Orthodox Church dominate religious beliefs and values and have a strong, bonding influence on everyday behavior. But while the tenets of Christianity guide behavior, values generally attributable to American Indian and Alaska Native groups are apparent. Tyonek residents value generosity, sharing, cooperation, humility, and a present-time orientation. In general, the villagers believe in living in harmony with nature and using only what is necessary. In this regard, every part of something (such as a moose, fish, or tree) has a functional use and should not be wasted. Moreover, most Tyoneks believe that the old traditional ways are functional and should not be changed simply because something new might be better.

Up to 1963, few major changes occurred in the Tyonek region. Daily living patterns centered around routine subsistence tasks. The quality of life was well below modern standards; many considered it close to poverty level because of substandard housing and diet and lack of basic utilities. However, the discovery of oil and gas reserves in the region and around the boundaries of the community had a dramatic impact on the Tyonek life style and quality of life. In 1964, the Tyonek community, with the assistance of the Bureau of Indian Affairs (BIA) and a few beneficient attorneys, gained about $12 million from oil and gas leases. In addition to undertaking many profitable ventures, the Tyonek Village Council approved a program that included improvements to roads, the airstrip, and community buildings, and increased opportunities for youth. More importantly, 59 new homes were constructed, one for each family residing in the village.

Some of the lease money was also invested, primarily in the Anchorage area. The Tyonek Management Corporation was established to plan and oversee those investments. Buildings were purchased and leased, and a construction campaign was initiated that resulted in office buildings and homes for Tyonek natives living in Anchorage. About 302 enrolled members of the village share in the profits from the investments.

Money generated from the 1964 oil and gas leases had a dramatic impact on the quality of life and life style of Tyonek residents. Many claim that their diets have improved, resulting in better overall physical health. Educational opportunities have been expanded with the construction of a new school. Employment opportunities and skill training have advanced, particularly in the construction fields. But wealth also brought the Tyoneks into closer contact with outsiders, largely through individual purchases of television sets, home entertainment equipment, and motor vehicles. Most villagers welcomed the sudden change and adapted to it with ease, but some did not and resented the intrusions and distractions created by the wealth. Through all these changes, however, the village remained a reservation and the Village Council retained the right to control access by outsiders and developments on reservation lands.

The second major impact on the Tyoneks came about seven years after the oil and gas lease. In 1971, the Alaska Native Claims Settlement Act went into effect. Through ANCSA, some 79,000 Aleuts, Eskimos, and Indians in Alaska were given about 40 million acres of land and close to $962,500,000. Tyonek natives shared in the settlement through their choice to become part of the Cook Inlet Region Corporation, one of 12 native regional corporations established as a result of ANCSA. Within five years after ANCSA went into effect, each regional corporation was required to distribute 10% of the monies derived from ANCSA to shareholders. Tyonek residents participated in this settlement and received an average payment of about $400 each.

While ANCSA meant income to Tyonek residents, problems emerged that seemed to outweigh the small amount of money received. Questions concerning jurisdiction, land use, water rights, and enforcement of village ordinances soon plagued the Tyonek Village Council, otherwise referred to as the Indian Reorganization Act (IRA) Council. Many village residents today feel that outsiders have abused visiting privileges, have contributed to the disruption of hunting and fishing patterns and, in general, have negatively affected the life style. In effect, ANCSA has led to the dissolution of the reservation status, has created complicated institutional arrangements, and is threatening traditional life styles among the Tyoneks.

The third major impact on the village of Tyonek occurred in 1975. At that time Tyonek Timber Company (TTC), a subsidiary of Kodiak Lumber Mills (KLM) began operations. TTC basically reduces wood to chips, which are eventually marketed for newsprint and paper products. The main processing plant is located just south of the present Tyonek village and occupies land once "owned" by the Tyoneks. From time to time, TTC employs Tyonek residents, but the bulk of the employees are transient nonnatives.

KLM and the accompanying housing settlement was the first "outside" venture to locate near Tyonek. While TTC means jobs for Tyonek residents, it also presents some problems:

1. Job opportunities for Tyonek residents are seasonal and skill-dependent, i.e., many jobs require specialized skills.
2. Work schedules are oriented around a nonnative way of life. Workers are required to put in eight hours a day, five days a week. Many Tyonek residents are not accustomed to this schedule and find it too constraining Although some residents want to work at KLM, their first priority is fishing. When the season starts, many would rather be in their boats and at their sites casting nets than operating heavy equipment.
3. The presence of outsiders who have a different cultural life style is viewed with suspicion and concern. Some villagers feel that the TTC workers have contributed to the increase of alcoholism and drug abuse in Tyonek. Others feel that teachers are more responsive to the educational needs and life orientations of the nonnative students attending the Tyonek school than they are to those of the native students. There have been a few isolated instances of hostility and overt conflict with TTC workers which have tended to heighten suspicions and concerns. Overall, many villagers feel they have little to gain from TTC's present operation.

By way of review, village life at Tyonek has been dramatically affected and altered by three major events. Within the past 14 years, Tyonek revenues have increased owing to gas and oil leases, ANCSA, and employment opportunities at the lumber chip mill. Nonetheless, the three events have created problems in life style, organization and management of the land, and individual preferences for improved standards of living. Tyonek residents have coped reasonably well with the changes evoked by the three events. However, many problems have been introduced that are creating adjustment and adaptation difficulties. By nature of their cultural tradition, Tyonek natives have had to adjust and adapt to many circumstances, for the changes introduced in the past decade and a half have posed problems never before faced by the Tyonek people.

PRESENT LIFE STYLE

At present, slightly more than 270 people live in the Tyonek village. Most, if not all, live in the houses constructed during the mid-sixties. Most families have established a moderate standard of living: trucks, cars, television sets, and citizens band two-way radios are commonplace. It is apparent that the diffusion of technology and contact with the outside world are influencing their life style.

For the most part, five major families tend to dominate village life and decisions made by the IRA Council. This does not imply, however, that other families are excluded from participation in community activities and the decision-making process. Rudiments of traditional decision-making procedures are clearly evident in the efforts by the IRA Council to involve everyone in current and future ventures affecting the village as a whole. Participatory management seems to be the main organizational style of village government.

At present, women hold key leadership roles in the village: the president and vice-president of the Village Council are women, as is the president of Tyonek Native Corporation in Anchorage. As a result, some outsiders consider the Tyoneks to be matriarchal (i.e., women control decision-making patterns). However, the present administrative arrangement is unique in the long history of the Tyoneks. Instead of Tyonek social organization being matriarchal or patriarchal, it is probably more a system of shared responsibility in which males and females are joint participants in decision making. Kinship is typically traced through the lines of the father (patrilineality); but otherwise neither sex appears to exert more decision-making influence than the other.

At one time, the Village Council prohibited outsiders from living in the village. In fact, at one point during the late sixties, visitors were not permitted in Tyonek unless they had been invited. This policy is still nominally in effect, but it is not enforced as rigorously as in the past. Moreover, a few nonnatives married to native residents are now living in the village. Ordinarily, nonnatives were supposed to appear before the Council to make their resident requests known. In addition, such individuals had to state their intentions; i.e., what they planned to do, where they would work, etc. The Village Council has also become somewhat lax in enforcing this policy, although there is talk that it will be reaffirmed in the near future. This reaffirmation is closely aligned with the sentiments of a few villagers who feel that ouside influences are becoming too disruptive and are having a negative effect, especially on youth.

Employment opportunities in the village are limited. Apart from the seasonal employees and the lumber chip mill, the major employer is the Village Council itself. Positions are varied and include secretarial/clerical work, heavy equipment maintenance and operation, and unskilled labor such as painting, janitorial service, etc. Apart from those who work in the native store, and occasionally on offshore oil rigs and at the Beluga power station, most natives are subsistence fishermen. Fishing seems to be the main interest, as it has always been. Many look forward with great enthusiasm and anticipation to the fishing season. Although it is not entirely true, it often appears as if all nonfishing-related village activities cease during the season and everyone seems to participate in the fishing activity.

In July 1978, 44 village males were unemployed although able to work if jobs had been available. In addition, 40 individuals were receiving some form of state welfare assistance, 10 of whom were participating in the food stamp program. While the unemployment rate is consistent with other native villages, participation in the welfare program was slightly less than the average for the region.

Tyonek residents have more contact with urban life and the nonnative world than do typical Alaska natives. Their close proximity to Anchorage (about 88 air kilometers) affords them line-of-sight television and commercial radio reception and easy air access (round-trip air charter fare ranges from $30 to $60) to the city. Through the media and visits to the city, many Tyonek residents are keenly aware of the impacts of industrial and land development and of population expansion on people and communities. Many recognize that idleness and boredom stemming from unemployment can lead to socially disruptive behavior such as vandalism, alcoholism, and drug abuse. Similarly, the role models provided youth by the unemployed and their exposure to the electronic media are potentially disruptive and considered counter to the preferred village pattern of living.

The present living standards of Tyonek are perhaps changing more rapidly now than ever before. While Tyonek received an earlier start than most Alaska native villages, its attempts to adjust to and cope with social change differ little from those of Alaska natives in general. The preferred life style is to retain the cultural traditions within a typical slow-paced rural environment. Tyonek's future is tenuous, however, like that of many Alaska native villages; it hinges on the potential impacts of coal and industrial development in the region.

EFFECTS OF COAL DEVELOPMENT ON COMMUNITY LIFE STYLE

Life in Tyonek would indeed be changed by coal development in the Beluga coal fields. Everyone in the village would be affected by it. Coal development would mean more jobs and overall economic growth for the village as a whole. It would also mean accelerated contact with outsiders and an introduction to new life styles.

Coal development would also produce population increases in the northwestern area of Cook Inlet. As many as five times the current population of Tyonek could settle in that area temporarily or permanently. Along with these people would come support services and other economic activities. Children from the community might attend the school at Tyonek, and because of their numbers could relegate the Tyonek youth to minority status. Overall, the changes induced by this population expansion could have extensive and very disruptive effects on Tyonek.

At a broad social level of analysis, development implies that two distinctly different cultures would come together rapidly. Although Tyonek residents have had considerable contact with the dominant American lifestyle, this contact would be greatly expanded by coal development. Under those circumstances, a variety of interpersonal and intergroup conflicts would likely surface. The contact generated by employment, the proximity of the mining camp to Tyonek, and the presence of nonnative children in Tyonek schools could intensify salient and subtle cultural differences between the two groups. The values, beliefs and customs of both parties would be challenged and could become points of controversy.

Coal development would also mean that, for the first time in their long history, Tyonek residents would be in the minority in their own region. Minority status usually is often a breeding ground for racism and discrimination. Status and cultural differences therefore can be factors in intensifying unfriendly and perhaps hostile relationships.

With the potential for social conflict comes a potential for social deviancy such as vandalism, larceny, alcoholism, and drug abuse. All of these forms of deviancy contribute to one another and in many cases can be emphasized by prevailing differences of opinions, intergroup relations, and feelings of inferiority, especially on the part of the group relegated to a minority status. Intergroup conflict can also affect employment, job productivity, learning in the classroom, and can disrupt a community's total way of life. At present, however, Tyonek is faced with only limited forms of alcoholism and drug abuse. Relationships between village residents and TTC employees and their families appear amiable. Tyonek residents have had only limited experience with the sort of problems generated by rapid economic and community development. Long-term development of the Beluga coal fields could therefore set in motion an irreversible change process in which the negative outcomes might far outweigh the economic benefits to Tyonek residents.

COMMUNITY PERCEPTION TOWARDS DEVELOPMENT

In contrast to the Kenai Peninsula area on the eastern shore of Cook Inlet, the northwestern shore is relatively isolated and, as yet, undeveloped. The power station at Beluga, the TTC lumber chip mill, the Granite Point Oil Facility, and the village at Tyonek make up the bulk of the activity and are the primary populated areas. At the same time, the area is ripe for extensive industrial development, especially if a plentiful supply of coal were readily available. How do Tyonek village residents feel about this present and potential development? What are their preferences? Can they hope to maintain their present life style in the face of population expansion? What are their major concerns? In their opinions, who is responsible for preventing the negative consequences associated with development?

Tyonek residents have had experience with developmental efforts. Through the media and visits to other communities outside the region, residents have acquired a sense of what the effects of development would be on the land and their community. To assess community feelings towards the questions listed above, interviews were conducted with a small representative sample of Tyonek residents. The results are summarized below.

All of the respondents expressed concern about the effects that coal development would have on their way of life, their culture, and the land on which they live. They recognize that development is inevitable. Some prefer that it not occur at all; a few acknowledge the economic benefits and hope that development will occur in an orderly, nondisruptive manner. All of the elderly respondents questioned are against development occurring within the village and especially in outlying areas. One elderly male best summarized this feeling when he said: "We want to live our life the way we have lived it. We don't want to be impacted in a sudden manner by something that's different to our way of life." One woman expressed concern for her children and grandchildren and saw more negative consequences than positive benefits emerging from coal development. She was especially concerned about "the abuse of alcohol and dope" and the effect these elements would have on the community as a whole.

Most people acknowledged the opportunity for employment and training, but some definite concerns were raised. "It will be all right," said one young male respondent, "if the coal company gives us training. But after the coal is gone what good are our skills? There's nothing else to mine in the area and I want to live here, not in Anchorage or some place else." Another male focused on the job requirements when he said, "I can do the work but I don't like to punch a clock and have the union tell me what to do. I know fishing and that's what I like to do. You can't fish all the time so I can use the job [at the coal field]. When it's time to fish I want time off to do that and still have a job to go back to. The union and coal company won't permit that." In general, the respondents felt that jobs were probably the only positive benefit associated with development.

Many respondents raised questions about jurisdiction and use of present facilities at Tyonek. Since Tyonek has the only school in the region, many expressed concern over student enrollments, classroom space, student/teacher ratios, and curriculum content. Of particular concern was the possibility of the school losing federal monies for education. Villagers believe that increases in nonnative student enrollment would lead to decreases in federal support for educational programs earmarked for native students. "Who would pay for the additional teachers, secretaries, additional classroom space, and facilities?" asked a mother of four children. She continued, "We built that school with our own money and assistance from the BIA [Bureau of Indian Affairs]. Those developers and Kenai Borough can't expect us to foot the bill for something we don't want in the first place." Another respondent added, "Right now we get along with the nonnative children in the school. Pretty soon there will be more nonnatives [in the school] and our kinds will be left out. A few of the elderly are teaching the children the native language, native crafts such as making moccasins and weaving baskets, including legends and stories about our history. What good will this be? Our culture is very important to us and we want to keep it. The school is the best way to teach our children the things they should know about our history, the language, and our way of life. We want to keep this."

Preservation of culture, intensification of external influences, and pressures to change are serious matters of discussion in Tyonek. Equally important are concerns over maintenance of cultural identity, a personal sense of worth, and the way of life. Problems have arisen over the matter of jurisdiction, since with the advent of ANCSA, traditional Tyonek forms of government and control have been challenged. Said one respondent, "Look, there was a time when the Village Council had complete control over use and occupancy of the land. Now, Kenai [Borough] wants to tax us, build public roads through our village, and bring in new laws. Now, who's going to enforce them? There is a constable for this whole area and he can't enforce anything. People come and go. Pilots bring in booze and dope. Hunters shoot moose and leave it lying in the village dump. Now, we'll have 3000 mining people around here and they'll probably take over the whole damn place. I'm 150% against development around here. Our life will be ruined and the land destroyed, all for coal that isn't very good anyway."

Tyonek residents have strong feelings about the land and wildlife. Like their ancestors, they want the area to stay pretty much the same as it has always been. Many feel that they have lost the opportunity to exert control over land use through ANCSA, some are bitter and wish they had not made the choice, others reluctantly accept their situation, and some prefer to go along with development without comment. Nonetheless, the deep-rooted feelings for the community and its way of life are strongly entrenched. One young student best summarized these feelings when she stated: "There is a certain warmth and sense of belonging here. When away at school, I look forward to coming home to be with the people and live with the land. When I finish school, I want to live here and provide a service. But, if coal development comes and change happens, I'm afraid our people will be faced with their greatest challenge."

The Tyonek community is apprehensive, even fearful, of the consequences of growth and development in the region. They have experienced the effects of progress and know that large-scale development can be overpowering. They recognize the negative impact of alcoholism, drug abuse, and other forms of deviancy, but feel that as long as they have some jurisdiction, reasonable controls can be maintained. However, the location of a mining camp some 10 to 15 kilometers from their village would present jurisdictional problems and would challenge the authority of the IRA Council to govern and to regulate. Current IRA Council members are exploring the nature and extent of their powers in an attempt to define, once and for all, how much control they do have. Tyonek residents are not bitter over past experiences with development. Instead, those experiences have made most residents cautious and somewhat pessimistic toward future development.

Currently, Tyonek residents have a sense of freedom of expression and movement. Apart from difficulties and problems associated with ANCSA, the the Tyonek do not feel subordinated or restrained in terms of mobility. In some ways they are fairly autonomous and value the sense of freedom that comes with living in a somewhat isolated environment. Should development occur, however, their autonomy would be challenged. Their energy would have to be redirected to protect their autonomy and to avoid feelings of powerlessness.

The presence of an outside community with a population five times greater than that of the native people would directly challenge traditional authority and group norms. Under similar situations, especially when communities are quickly and abruptly relegated to a minority status, feelings of alienation and powerlessness have tended to increase. Along with experiencing such feelings, individuals may find life meaningless. People in this situation not only attribute similar characteristics to those about them, but also become confused about norms and values. Insight, clarity, practicality, and thought processes in turn can be distorted. Taken together these physiological and sociological phenomena can lead to low levels of personal involvement in family and community responsibilities, lack of personal support, high levels of aggression, and premature speculation about remedial recourses of action.

It is probable that many residents could effectively adapt to the changing conditions brought on by development. Nonetheless, they would experience some psychological and cultural loss. The pace of daily living could change, values and beliefs could be altered to accommodate changes, and a bit of the cultural heritage could disappear. As long as the residents remain at Tyonek during the development process, there is every reason to speculate that, even in a small way, everyone will be negatively affected. The anticipated psychological and sociological problems, therefore, demand that preventive and corrective mental health efforts be undertaken.

The Tyonek people are proud of their life style, their village, and the environs, and they want to protect it. Just as federal and state governments seek to protect flora and fauna through environmental impact statements, village residents feel that their cultural life style should be equally considered and protected under the same guidelines.

SUMMARY : PSYCHOSOCIAL PROSPECTS FOR TYONEK

Development of the Beluga coal fields--especially under scenario 3--would likely have serious effects on the cultural life style of the residents of Tyonek. Increases in population could place Tyonek residents at a distinct disadvantage in maintaining their preferred standard of living and cultural heritage. Indeed, they could become a minority in their own region. Distinct social problems could emerge that would affect education, traditional subsistence efforts, community feelings, and beliefs and attitudes, and that could permanently alter the current way of life. Development could mean jobs for a few Tyonek residents, and with those jobs, increases in economic opportunities. Nonetheless, such gains might be overshadowed by the potential negative impacts associated with large-scale development in remote, rural areas of Alaska. Preventative measures could be taken before development begins, including establishing a standing committee composed of developers, planners, and Tyonek residents.

REFERENCE: PSYCHOSOCIAL PROSPECTS FOR TYONEK

1. Spencer, R. F., et al. The Native Americans. New York, Harper and Row. 1965,155.

DECISION MAKING FRAMEWORK

GOVERNMENTAL JURISDICTION AND POWERS

This chapter describes the governmental and private agencies with major jurisdiction in the Beluga area and suggests possible ways to influence coal-field development. The principal agencies[a] that will be involved in any future Beluga coal development project are:

- Tyonek Village Council
- Tyonek Native Corporation
- Cook Inlet Regional Corporation
- Kenai Peninsula Borough
- State of Alaska

Tyonek Village Council

The Tyonek Village Council is the federally chartered local "government" that manages Tyonek's public affairs. The council acts as spokesperson for the community-at-large, controls local use of village public lands and buildings, and has responsibility for public services within the community.

The Tyonek Village Council, at this writing, believes it can control access to lands encompassed by the former Tyonek reservation. When the federal reserve was abolished by the Alaska Native Claims Settlement Act, the village council's authority over the reserve lands was terminated. This did not, however, negate the role of the council in speaking for the village nor the importance of the views of Tyonek residents toward development at Beluga.

Tyonek Native Corporation

The Tyonek Native Corporation owns surface title to the site of the former Moquawkie Indian Reservation as well as other lands within the area.

(a) The role of Federal agencies will not be discussed except for those programs administered at the State level.

As a major landowner, the Tyonek Native Corporation's policies toward industrial development and use of corporation lands may affect transportation routes, location of community and industrial facilities, and location of transshipment or power plant facilities.

Cook Inlet Region, Incorporated (CIRI)

As a result of an exchange of land between the federal government, the state of Alaska, and the Cook Inlet Region, Inc., CIRI will become a major landholder in the Tyonek area. In addition to holding the subsurface rights to most of the land selected by the Tyonek Village Corporation, CIRI selected the surface and subsurface rights to major portions of the land surrounding and including the private coal leases within Capps Field. CIRI was also granted a 300-foot right-of-way to connect its holdings in the Capps coal field area to land along the coast.

As a further condition of the land trade, CIRI took over the ownership of leased lands within Capps Field. Future lease revenues will accrue to the corporation, and any lease renewals or extensions must be negotiated with CIRI.

Because of its land ownership, CIRI will have a major role in determining the development of coal deposits and access to those deposits.

Kenai Peninsula Borough

The Kenai Peninsula Borough (KPB) is the only local, general government in the project area. As a borough of the second class, KPB is charged with providing education, planning, and tax assessment in the area. In addition, KPB has taken over responsibility for the provision and management of public solid waste disposal sites throughout the borough.

Under its planning authority, the borough is charged with land-use planning, zoning, and platting. No borough land-use plan now exists for the area surrounding Tyonek. The project area is zoned "rural," which allows any use except some specific activities that are noxious or harmful to public health. Subdivision of private land must be approved by the borough, but the subdivision ordinance has few requirements for subdivision improvements in rural areas.

The borough also owns land that contains one portion of Congahbuna Lake and part of the proposed site for a permanent community. As such, the borough may have some ability to influence the nature of community development through land leasing agreements.

Although a proposed land-management system ordinance is under KPB Assembly review, the borough has not yet developed policies regarding lease of borough land for industrial or community development. The borough would consider the implications of the project after receipt of a land-lease application.

Two borough service areas encompass the project site: the North Peninsula Recreation Area and the Central Hospital Service Area. Neither of these service areas provides facilities in Tyonek or the Beluga area, although the North Kenai Recreation Area is considering extending some form of outdoor recreation programs to Tyonek.

The Kenai Peninsula Borough is initiating a coastal zone management policy study and a study of ports and harbor needs in relation to energy facility development. The coastal zone management policy study will recommend a set of policies for the management of coastal resources. This document, designed for extensive public review, will be used by the KPB as a basis for their own coastal management program. The question of coal development at Beluga will not be specifically considered, and energy facility siting will be included only in a general discussion of policies.

The port and harbors study will focus on the harbor resources and facility needs related to energy development in the KPB. As such, it will consider the possibility of development at Beluga, but will recommend policies only in relation to the location and provision of port facilities.

The KPB is a participant in the Cook Inlet Air Resources Management District, a three-borough organization responsible for air-quality monitoring and enforcement in cooperation with the Department of Environmental Conservation (DEC). DEC retains the authority to set air quality standards, grant air emissions permits, and regulate surface air emissions.

In summary, the Kenai Peninsula Borough is unlikely to begin developing a policy for development at Beluga until industry approaches the borough with a land-lease or subdivision application.

State of Alaska

The state of Alaska, through its various departments, has broad authority to mitigate the environmental and, to some extent, the socioeconomic impacts of coal development. Two inter-agency organizations, the Beluga Interagency Task Force and the Coastal Zone Regional Planning Team, could also provide a means for state intervention in energy development at Beluga.

The principal state agencies with program interest or responsibility are:

- Office of the Governor, Division of Policy Development and Planning (DPDP)
- Department of Commerce and Economic Development (DCED)
- Department of Community and Regional Affairs (DCRA)
- Department of Environmental Conservation (DEC)
- Department of Fish and Game (DF&G)
- Department of Natural Resources (DNR)

Although it would not have a major regulatory role, the Department of Labor would have a voice in the setting of policy concerning labor needs, local hire, and in the inspection of construction-camp housing.

The Coastal Zone Regional Planning Team, headed by DPDP, includes the Departments of Fish and Game, Community and Regional Affairs, Natural Resources, Environmental Conservation, and Commerce and Economic Development. The team is charged with preparing a regional resource management program for the Cook Inlet Region for submission to the State Coastal Policy Council. At present, the planning team is developing criteria for identifying uses of state concern and areas meriting special attention. It is studying whether these uses and areas should be specifically identified and located or defined more generally. As a result, the extent to which Beluga-area development will be addressed under the regional resource management program is unclear. However, its progress to date and its December 1978 report deadline suggest that recommendations and policies on development at Beluga will be limited and fairly general.

The Beluga Interagency Task Force, chaired by DCED's Division of Economic Enterprise, includes the Department of Environmental Conservation, Community and Regional Affairs, Fish and Game, Labor (in a research and information capacity), Natural Resources, and the Governor's Division of Policy Development and Planning--in addition to DCED's own Division of Energy and Power Development. The task force is charged with providing a coordinated state response to industry proposals on energy development in the Beluga area.

Office of the Governor, Division of Policy Development and Planning (DPDP)

DPDP's role in the Beluga project will primarily be one of agency coordination and policy formulation. As a policy spokesman for the Office of the Governor, DPDP can encourage line agencies to adopt programs in support of a state policy position. DPDP chairs the interagency Cook Inlet Regional Planning Team, which may address the siting of an energy facility at Beluga in the regional resource management plan in progress.

Department of Commerce and Economic Development (DCED)

DCED's Division of Economic Enterprise (DEE) also has a coordination and policy role in the Beluga project. As head of the Beluga Interagency Task Force, DEE is primarily responsible for coordinating state agency information-sharing and policy development.

In the latter stages of Beluga development, DCED's role as a regulator of private and public commerce, especially through various licensing authorities and the regulative powers of the Alaska Public Utilities Commission, may allow it to influence aspects of Beluga development.

Department of Community and Regional Affairs (DCRA)

DCRA's primary responsibilities regarding the Beluga project would involve analyzing the public costs and benefits of establishing a new community, including an evaluation of its effects on the provision of public facilities and services. DCRA's ability to provide technical assistance and program funds for local planning and management efforts could be used to affect the nature and extent of new community development. In addition, DCRA's participation on the coastal zone regional planning team and the Beluga Interagency Task Force gives it a direct voice in formulating overall state policy on the Beluga project.

Department of Environmental Conservation (DEC)

The Department of Environmental Conservation regulates the environmental effects of industrial development, construction, handling of petroleum products, and the disposal of solid waste and wastewater. In general, any activity that affects air and water quality or involves the (potential) spillage of petroleum products or noxious substances falls within the scope of DEC regulations. Of importance for the Beluga project is DEC's administration of permits related to air quality, wastewater discharge, and solid waste disposal. DEC's regulation of activities affecting air quality includes identifying air quality districts and emissions standards under the *Federal Clean Air Act*.

Department of Fish and Game (DF&G)

The Department of Fish and Game has primary responsibility for the management of fish and game populations and the protection of their habitats. Any activity that could potentially disrupt an anadromous fish stream or affect an established game refuge or critical habitat area must be reviewed and approved by the department.

Department of Natural Resources (DNR)

The Department of Natural Resources has a potentially important role to play in developing policy concerning Beluga coal-field development. DNR regulates the use and disposal of state land and tidelands, including temporary access and rights-of-way across state land, and the appropriation and use of surface and ground water. The use of surface materials located on state land (such as rock and gravel) also falls within DNR's jurisdiction.

DNR's responsibility for classifying and managing state lands affords the state a useful tool for dealing with activities on state land. DNR may also include performance stipulations in its land leases and permits.

DNR is preparing a land management plan for state lands within the Kenai Peninsula Borough. This plan will identify land and resource entities, develop resource management objectives and implementation recommendations, and set guidelines for management and disposal of state lands. This management plan will be coordinated with ohter state, borough, and private sector planning efforts and will involve extensive local review and input. Land management options and policy alternatives are scheduled for public presentation and review in November 1978.

The department will also have responsibility for administering and enforcing federal regulations on surface mining and land reclamation. The procedures for administering the surface-mining regulations will be established by DNR.

OPPORTUNITIES FOR INVOLVEMENT

A number of opportunities will arise for government and private interests to influence Beluga coal-field development. Potential areas of involvement include:

- environmental concerns
- land management
- creation of a new settlement
- provision of community services and facilities

Environmental Concerns

Some environmental issues can be considered in advance of the review of a specific project proposal. These general environmental issues include air quality, water resources, fish and game populations and habitat, and surface reclamation and revegetation.

Air Quality

Air-quality issues involve the overall effect of industrial activity on air quality in the Beluga area and the surrounding region.

The responsibility for air-quality control lies with the State Department of Environmental Conservation. DEC's authority stems in part from its role in implementing the regulations of two federal programs--the *Clean Air Act* and the *National Pollution Discharge Elimination System.*

The provisions of these programs do more than give DEC authority for the review and permitting of new sources of air emissions. The *Clean Air Act* also requires any proposed new point-source developer to supply DEC with sufficient background data on ambient air quality at the project site. This allows DEC to adequately review the effects of the project and the proposed emissions control technology. This background information must include meteorologic data, measurement of a variety of pollutants, and analysis of area topography. DEC has indicated that a 1-year monitoring program would be required in the Beluga area before a coal-fired generating plant could be approved. DEC determines the nature of the monitoring program to be undertaken by the applicant, based on the expected project emissions. Consequently, the applicant must inform DEC of overall project plans prior to initiating the monitoring.

The proposed Tuxedni wilderness area, located about 50 miles south of the Beluga area, has been designated as a Class I air-quality-control area under the *Federal Clean Air Act*. Under current regulations, new sources of air emissions in the surrounding region must not have significant effect on the ambient air quality of a neighboring Class I area. In addition to ensuring that any development at Beluga will meet the discharge limitations for a "Class II" area, DEC must determine that coal-related facilities will not exceed the deterioration standards established for the proposed Tuxedni wilderness area nor adversely affect air quality in the Anchorage bowl. Air-quality standards could become a major obstacle to the development of coal-fired generating plants.

While DEC cannot change the air-quality standards and deterioration limits established in the *Federal Clean Air Act*, it does have the authority to determine the methods or processes of pollution control. This allows DEC to influence the design and operation of a facility and its process of development.

Water Resources

Water-resource issues involve the allocation and use of water for industrial and community purposes in relationship to existing water supply and other area water requirements. Also involved is the effect of industrial activity on water quality, both during the construction period and over the life of the operation.

Three state agencies regulate water use. The Department of Natural Resources is responsible for arranging the appropriation of water rights for ground and surface water located within state-, local-, and privately-owned lands. DEC is responsible for approving the discharge of pollutants into water and any discharge of wastewater. The Department of Fish and Game, under its authority to protect anadromous fish populations, reviews and approves activities that could affect the nature of an anadromous fish stream.

The Department of Natural Resources's (DNR) program of permitting the appropriation of water rights is based on the legal principle of prior appropriation; in effect, it is a first-come, first-served system. Because of its backlog of applications and limited staff, DNR has not given much attention to determining the effects of a new appropriation on ground water regimes or to forecasting future water requirements. DNR has the authority to regulate the taking of surface and ground water from private lands. Attaching conditions to a permit for the industrial use of water is one method of intervening in industrial development.

DEC permits and monitors wastewater discharges and the design and construction of public wastewater systems. The agency plays an important role in the granting of Environmental Protection Agency NPDES wastewater discharge permits, since permits must be certified by DEC prior to approval by EPA. In those cases where an EPA permit is not required, the developer must obtain a DEC wastewater-disposal permit to discharge wastewater or pollutants into waters or onto land. This permit authority allows DEC to influence the planning and design of industrial water treatment and liquid waste discharge systems. The wastewater discharge permit application requires information on the proposed facility; the nature of the discharge, treatment, and planned disposal methods; and proposed sites.

The Department of Fish and Game's authority to protect anadromous fish streams enables some public intervention into those industrial activities that occur near streams or require crossing fish streams. Directed primarily at the protection of habitat, any activity that could affect the natural flow or bed of any anadromous water, including the use of equipment in or crossing such waters, must be approved by DF&G prior to the initiation of that activity. This includes all stream crossings by heavy equipment and the construction of bridges and culverts. Through its authority to regulate activites that could affect the flow of water in anadromous streams, DF&G could require the submission of an overall plan for water use and for the management of surface and ground water flow at the mine site.

Fish and Game

Fish and game issues related to Beluga area development include the protection and enhancement of habitat and identification of critical habitat areas. The effects of industrial and residential development on the Susitna Flats and Trading Bay State Game Refuges, and the protection of fisheries resources in the Chuitna and Beluga river drainage systems are also major concerns.

The Department of Fish and Game has identified the need for more background information on fish and game populations and use of the Beluga area by wildlife. In addition, more information on industry plans and activities is required in order to assess the potential impacts on habitat. A memo submitted to the Beluga Task Force by DF&G listed the major issues to be addressed in reviewing any project proposal: the formation of acid mine waters, the disposal of mine waters, site restoration, anadromous stream protection, effect on water table, disturbance of waterfowl population, effect of dock construction on tideland morphology and fish migration, and the potential linkage of the Beluga area to a regional road system.

An applicant for DF&G's "Waterway/Waterbody Use Request" must submit a plan for fish and game protection; a project schedule; an outline of materials, equipment, and activity proposed in the project; and a description of the project site. Most of DF&G's concerns about Beluga coal development could be addressed during the permit process if an overview of the entire project's effects on fish and game resources and full plans for the protection of fish and game are included with the permit application. DF&G can probably require such a broad overview under state statute [AS 16.05.870(c)].

Proposed activity or development within a state game refuge must be approved by DF&G before a project is initiated. However, activity that will take place within the boundaries of the Trading Bay State Game Refuge will most likely be located on land owned by the Cook Inlet Regional Corporation. Under the statute that establishes the Trading Bay refuge, lands owned by Cook Inlet Region, Inc. are specifically excluded from refuge protection [AS 16.20.038(j)].

Surface Revegetation/Reclamation

In response to enactment of the federal *Surface Mining Control and Reclamation Act of 1977*,[a] the Department of Natural Resources has been designated as the state agency that will administer and enforce regulations governing surface mining and reclamation.

Under provisions of the federal act, state regulations must be at least as stringent as the federal regulations. The federal government has published a set of interim surface mining and reclamation regulations that have been adopted by the state with minor modifications. These interim federal regulations will be replaced by final regulations in early 1979; these final regulations will then be adopted as the state regulatory program.

(a) PL 95-87.

Surface and subsurface coal mining operations with surface impacts must comply with provisions of the act. The regulatory provisions include requirements for surface contouring, reclamation, revegetation, reestablishment or replacement of ground water tables and surface and subsurface water flows, as well as treatment and disposal of acid, toxic, or harmful wastes or products. In addition to performance standards for reclamation, the regulations also describe standards for industry operations such as preparation of sites for mining and storage of materials, blasting, and drainage diversions.

Before activity can be initiated at a surface-mining site, plans for the eventual use and reclamation of the area must be reviewed and approved by the state regulatory agency. This includes approval of postmining land uses as well as projection of the highest and best future use of that land. The scope of the surface-mining regulations apparently includes any area where activities attendant to the coal-mining operation disturb the natural land surface. This would cover such activities as road construction and coal transport, remote storage areas, processing areas, transfer and shipment sites, and other areas that are used in relation to surface mining, processing, and shipment activities. The broad scope of the regulations will enable DNR and other state and local agencies (through permit application review procedures) to shape the conversion and future use of coal development areas.

<u>Land-Management Issues</u>

Some land-management issues have already arisen from the complex land ownership patterns in the Beluga area and differences in the objectives of the various land owners. (See Figure 2-1).

Prior to passage of the *Alaska Native Claims Settlement Act* (ANCSA) in 1971, the Tyonek Village Council controlled the use of all village lands within the Tyonek reservation. However, that reservation was abolished by the act, with ownership of the reservation eventually passing to the corporations established under the act. The Tyonek Village Council maintains that it still has the right to control the use and disposal of its former trust lands and any lands that it owns now or will receive title to from the

Tyonek Native Corporation. The Council's desire to control the land surrounding the community reflects its objective of minimizing outside influences on village life and community services.

The Tyonek Village Council's position has been reinforced by the recent initiation of a HUD housing project in the village. The project consultant convinced HUD that the Council was the authorized land-management authority in the area, and the Kenai Peninsula Borough's subdivision review process was bypassed. The Council believes that borough planning, zoning, and subdivision authority does not apply to their land.

Established as a profit-making corporation under the *Native Claims Settlement Act*, the Tyonek Native Corporation (TNC) holds title to the surface estate of the land over which the Council claims jurisdiction. TNC has indicated it will defer to the opinions of the council on local land-management questions. Hence, regardless of its legal authority, the Council will have an effective voice in controlling the surface use of surrounding lands.

Section 14(c)(3) of ANCSA provides that 1280 acres is to be conveyed to the state by the Tyonek Native Corporation to be held in trust for future community expansion. Under Alaska Statutes (AS 44.47.150), the state as trustee cannot transfer the land, or any interest in the land, without a resolution to that effect from the villate.

TNC's surface ownership of the former reservation lands is complemented by ownership of the subsurface estate by the Cook Inlet Region, Inc. (CIRI). Therefore, each of these two corporations has some ability to regulate the other's use of land. Any disposals of land by TNC must be reviewed by CIRI; conversely, the disposal of subsurface rights by CIRI may be vetoed by TNC under provision of ANCSA 14(j). CIRI presently favors development in the Beluga area more than does the TNC or the Council.

Another major land-use issue concerns the public role in managing land use and development. The ability of state agencies to guide land use in the Beluga area is limited by the existence of large, privately-owned tracts.

The state can influence land use through the classification and disposal of the remaining state land, most of which was acquired under the *Mental Health Enabling Act*. Under the provisions of recently adopted state legislation (H.B. 720 and S.B. 159), land acquired under this act will become *general grant lands*, thereby facilitating the state's disposing of that land. H.B. 720 includes broad policy guidelines concerning the management of state lands for public use and their disposal for private use that could influence state land management in the Beluga area. The granting of an unspecified easement across state lands to the Cook Inlet Region, Inc. under terms of the State-Native corporation land trade has eliminated a major means of public intervention in the coal-field development process. On the other hand, the use and disposal of state tidelands for industrial or public use could be an important means of guiding the location of port and transshipment facilities.

The Kenai Peninsula Borough has general authority to regulate land use in the Beluga area through its mandatory planning, zoning, and platting responsibilities; but no zoning review or land-use permits other than subdivision review are required by the borough for development in the Beluga area. This situation could change once more specific proposals are presented by industry, especially if borough-owned land is included in, or affected by, a development proposal.

Creation of a New Settlement

Under state statute, a *development city* may be established to insure a cooperative relationship between state agencies and private industry in the creation of a new community and the provision of services and facilities.[a] A development city may be created either by act of the legislature or through an action of the state's Local Boundary Commission, following petition by an industrial developer to the Department of Community and Regional Affairs. This petition must be reviewed by the Department of Community and Regional

[a] This analysis is based on AS 29.18.220-460.

Affairs to determine if the development project is likely to occur, and if the industry proposal for community development appears to be in the public interest.

In the case of the Kenai Peninsula Borough, the creation of a development city could proceed in two ways. The Local Boundary Commission might find that a special service area could be created within the borough for the purpose of guiding and supporting community development. The Borough Assembly, in turn, could agree to approach the proposed project as a development city by creating a special service district at the site. In this case, the borough would present the Local Boundary Commission with a *contractual* agreement outlining the responsibilities of both the developer and the borough to provide for community services, facilities, and the implementation of the development project.

Alternatively, the Borough Assembly could decline to establish a special service district, instead requesting the Local Boundary Commission to create a development city that would function independently from the borough. In this case, an appointed city council would proceed with preliminary comprehensive planning for the community. Included in the planning process would be economic and population projections, a capital improvements program, an environmental assessment, and a land-use plan.

Designation of a community as a development city has a number of benefits in terms of program funding. First, state agencies are specifically directed to give priority to a development city in allocating program funds. Second, a development city is granted housing and urban renewal authority for a period of some 15 years and planning powers during a 5-year development period. Third, a development city is granted the right to select 10% of the unappropriated state land within its boundaries. (In the case of the Beluga area, however, the city would probably not be located near available state land.) Fourth, the development city is eligible to receive funds under the state shared-revenue program, based upon a projected population figure. Finally, the city council is granted broad powers to enter into agreements and raise and spend funds without voter approval, including issuing revenue bonds, during the development period.

When industry proposals for a new community in the Beluga area are more definite, the applicability of the development city's legislation to that community should be analyzed in greater depth.

Provision of Community Services and Facilities

The best mechanism for providing public services, as well as the role of state agencies in public service delivery, will depend largely on the legal status of the new settlement. This community might be a work camp or company town, an unincorporated community within the borough, a special service area, or a development city. As the community grows, it might incorporate as a home-rule, first-class, or second-class city, as provided in state statute.

State agencies would be required to provide some services, whether or not a community is incorporated. State support of local public services could vary from the actual provision of services to the financial support of programs administered by a local government. If the community remains unincorporated, planning and coordination of public service delivery could be accomplished at the state level, through either a task-force approach or direct policy direction from the office of the governor.

The community itself would be responsible for planning and coordinating state agency programs if it were designated as a development city or special borough service area. In both cases, a property-tax base would be available to help support public service provision. State agencies are also specifically directed under state legislation to give priority in the allocation of program funds to a development city or to a specially identified borough service area.

Education

The major issue in the provision of education services is the potential impact on the Tyonek school, in light of that community's desire to maintain a strong role in the local school program and its opposition to use of the school by large numbers of students from outside the village.

Education at Tyonek is provided by the Kenai Peninsula Borough, which is responsible both for the provision of facilities and the educational program. Program decisions are made by the KPB School Board, with input from local residents. The borough school board would need to determine whether the Tyonek school will be used by all Beluga-area residents or whether additional education facilities should be provided outside of the village. The needs and wishes of area residents would be considered in light of the availability of program funds and district-wide capital improvement plans and program commitments.

The Kenai Peninsula Borough receives support from the State Department of Education in the form of capital construction funds and funds for program operation, based on school attendance levels. The principal mechanism for obtaining additional funds is the borough property tax. Tax revenues are used to repay construction bonds as well as to meet operating expenses.

The village of Tyonek, however, participates directly in the federal Johnson-O'Malley (JOM) program, which funds supplementary educational programs for native Americans. JOM program funds are currently used to retain two local residents as cultural instructors. The Tyonek Village Council administers the JOM grant, under the guidance of a JOM committee composed of parents of the students in the program.

The Tyonek Village Council is concerned that an increase in the number of nonnative students would adversely affect their standing in the JOM program. JOM program allocations, however, are based on the *number* of native students in the program and are not related to the proportion of native students in the total enrollment.

According to the state attorney general, a development city created in the Beluga area could not independently receive or expend program or capital funds for education from the Department of Education.

<u>Public Safety</u>

Fire protection, police protection, emergency medical services, and justice services in the Beluga area could become the program responsibility of either the state or the new community. The industry itself would have major responsibility for providing fire protection and emergency medical services initially. Training of residents in emergency medical techniques could later be requested from the state's Departments of Public Safety and Health and Social Services. Although industry would probably provide fire equipment for protection of industry facilities that would also be satisfactory for community needs, forming a volunteer fire department might be desirable. This would make the community eligible for technical assistance from the state fire marshall as well as funds from the state shared-revenue program. Both of these sources could be used to increase the volunteer department's capacity to respond to residential fires. Police protection would be provided by the state troopers if the area remained unincorporated.

If either a special borough service area or incorporated city were created, the primary responsibility for the provision of public safety facilities and services would shift to the community. The city would work directly with the Department of Public Safety, the Criminal Justice Planning Agency, the fire marshall, and state court system.

Public Utilities

Provision of public utilities to a new community in the Beluga area would present a number of opportunities for state involvement in the development process. These public utilities would include community water and sewer systems, solid waste disposal, and power.

Under recently adopted regulations, plans for new or expanded community water systems must meet certain standards and have plans approved by the Department of Environmental Conservation. DEC also approves plans for community sewer systems. DEC administers water system and sewer system construction grant programs that may provide up to 50% of planning and construction project costs not funded by the federal government. Under this program, DEC also sets the priorities for EPA-funded projects within Alaska. Construction funding programs available through the federal Economic Development Administration (EDA) include two programs for funding economic development projects. Under the provision of the "section 304" grant program, EDA would fund projects requested and prioritized by the governor's office.

The industrial developer might provide a major portion of the initial capital facilities for utilities; the state and industry could cooperate in the funding of facilities; or the public could carry the entire cost of the utilities. A city or service area would support utility construction and operation by issuing revenue or general obligation bonds. Industry purchase of local bonds is also a possibility.

One means of exerting state influence over privately operated utilities is through the Alaska Public Utilities Commission's requirements for a certificate of public convenience and necessity. This permit is required of any organization, other than a municipality, that wishes to operate a public utility, including electric power, communications, gas, water, sewer, or refuse utilities. The Alaska Public Utilities Commission has broad authority to review the nature of the proposed utility system and its ability to serve public needs adequately.

Housing

For a work camp in the Beluga area, employee housing would probably be built by Placer Amex, Inc. (the coal-field developer) or Chugach Electric Association (if it chooses to develop coal-fired generating plants).

The state's Department of Labor administers health and safety standards for construction-camp housing under Alaska's Industrial Housing Code. The Department's Safety Compliance Section inspects housing only after construction to check for compliance with state and federal standards. However, the Voluntary Compliance Section is available to review housing plans in advance of construction at the developer's request. The state standards require a minimum of 400 cubic feet per person. The state regulations do not require the developer to remove the structures when industrial activity terminates, although this can be stipulated as a condition of other state or local permit approvals.

In the case of full-scale community development, housing can be provided through the private market, with or without a government subsidy, or through a housing authority. The permanent community described in coal development scenario 3 would probably require a combination of industry-provided housing for construction workers and privately financed family residences to accommodate permanent residents.

There are two basic home-ownership alternatives for permanent residential development:

- conventional, single-family dwellings (individually financed and insured) located on individual lots in a residential subdivision
- individual family cooperative shares in a residential complex or planned unit development, using common project financing, utilities, open space, and insurance services.

The construction of rental units (apartments) is also a possibility.

Financing for permanent housing may be obtained through a variety of programs. The Farmers Home Administration (FmHA) housing finance program funds construction of both single-family housing and rental housing. The programs are designed for low- and moderate-income families; the effective income ceiling for Alaska is about $25,000 per family. In 1977, the state's total allocation for FmHA rental-housing-construction assistance was $3 million.

The FmHA area office in Soldotna serves the Kenai Peninsula Borough, Kodiak, and the Aleutian Chain. Currently, 90% of the office's home-loan activity is concentrated in the Kenai-Soldotna area. In the 1976-77 fiscal year, the Soldotna office of the FmHA lent a record $6.2 million for 128 single-family dwellings and $2.1 million for rental-unit projects in Kenai.

FmHA will fund individual home construction involving on-lot systems if the property is owned by the prospective resident. However, on-lot systems are not encouraged. Larger developments would be required by FmHA to include community or package water and sewer systems or, at a minimum, sewer systems with evidence of good water available on a lot-by-lot basis.

The U.S. Department of Housing and Urban Development offers a range of programs to assist in the development of new housing. Included in its programs are mortgage and loan insurance assistance to low- and moderate-income families through the Federal Housing Administration (FHA) for single-family homes, including mobile homes. FHA also insures mortgages made by private lending institutions to finance the construction of multifamily rental housing by either private or public developers. The project must contain at least eight dwelling units. Application for funds under this program can be submitted by investors, builders, developers, and any others who meet the FHA requirements if the housing project is located in an area approved by the FHA for rental housing and if market conditions indicate a need for such housing.

Some housing construction may also be possible under the jurisdiction of the Cook Inlet Housing Authority (CIHA). It is one of 13 regional housing authorities created by a special act of the state legislature to meet moderate- and low-income housing needs. Encompassing the Beluga coal district, CIHA has worked with the Tyonek Native Corporation to finance new housing in the village.

Community Transportation

Future decisions by industry on the volume of coal to be mined will set the overall requirements for surface transportation in the Beluga area. Once that information is available to the state, community public transportation needs can be assessed. The primary state agencies involved will be the Departments of Community and Regional Affairs, Natural Resources, and Transportation and Public Facilities.

In addition to broad responsibility for planning regional road, marine, and air transportation systems, the State Department of Transportation and Public Facilities (DOT/PF) is responsible for the construction of state roads and federally assisted road and highway projects. Local transportation facilities, such as boat harbors, airports, and streets are also eligible for DOT/PF funding. Programs range from grant assistance for locally constructed projects to actual state project construction, including state airport construction and improvement projects, state boat harbor construction and grants to eligible municipalities. Responsibility for maintenance may be assumed by the state or may be delegated to local government.

DOT/PF grant funds are usually dispersed to a home-rule city, first-class city, or a borough. A new community in the Beluga area could apply directly to DOT/PF if it were incorporated or designated as a development city. Otherwise, DOT/PF would work through the Kenai Peninsula Borough to set project priorities and funding levels for local projects.

RECOMMENDATIONS

RECOMMENDED RESEARCH

As an outgrowth of the research reported in this report, the authors have become aware of a number of pressing topics associated with energy and economic development in the Beluga area that we believe should receive further study in the near future. This section briefly describes these proposed research topics.

All such future research should be addressed in order to:

1. clarify and emphasize the processes of change and adjustment associated with energy and economic development that are unique to Alaska;
2. resolve the problem of distinguishing development impacts from baseline trends that will occur in any case because of the overall economic and social growth occurring in Alaska;
3. give special attention to the interests and problems of Alaskan natives;
4. examine the distribution of economic and social costs and benefits throughout the impact region;
5. suggest clear policy implications of the development and its impacts for both the Kenai Peninsula Borough and the state of Alaska.

All research and planning efforts concerning the Beluga area should be approached from an interdisciplinary perspective, with social scientists, physical scientists, planners, public officials, engineers, and representatives of native organizations working together as a team. All of this work should be coordinated by a central body to prevent wasteful duplication and to facilitate open communication among all involved parties. And this work should be initiated well in advance of the actual beginning of development activities, to ensure that adequate preparatory steps are taken before rather than after impacts begin occurring.

Alaska Energy Worker Profile

Research has been conducted on the characteristics of construction workers in the Great Plains area, but the people who work on energy development projects in Alaska may be different in many respects. We therefore propose that a study be conducted to determine the characteristics and actions of workers who both seek and obtain employment on energy projects in Alaska. Such information would be of great value in forecasting the planning for the socioeconomic impacts that might result from a future project such as Beluga coal-field development. This study should gather the following kinds of information about the workers:

1. age, sex, race, education, marital status, number and ages of dependents, income, and similar personal characteristics;

2. previous employment, migration history, labor union status, range of occupational skills, and other occupational background data;

3. current employment status, job activities and responsibilities, job satisfaction, spouse employment, and other current occupational data;

4. residential location and housing preferences, satisfaction with the area and the community, and similar social orientations;

5. job preferences, anticipated tenure on current job, future job plans, desire to remain in Alaska, and related future plans.

This research might also explore the role of local labor unions in finding and recruiting energy workers in Alaska. These union policies and practices will significantly influence who works on energy development projects, where they come from, where they will live, how they will differ from local residents, regional employment levels, and future economic growth in the region.

Energy Development Monitoring

Assessments of anticipated future impacts of energy development projects are forecasts based on judgments and estimates, and hence are subject to considerable error. If and when these projects are initiated, it is vital that they be closely monitored to identify and measure their actual impacts so that appropriate impact management strategies can be implemented as needed. In addition, such monitoring provides much valuable data for improving future impact assessments. Consequently, as soon as a decision is made to move ahead with coal development at Beluga, an impact monitoring program should immediately be implemented. This program would collect data on an ongoing basis on both local and regional socioeconomic impacts of the project, with particular attention to the native village of Tyonek. Especially crucial in this endeavor would be identifying the distribution of costs and benefits associated with the project, to determine what people were bearing what kinds of costs from the project, and what people were reaping what kinds of benefits.

Meanwhile, prior to the initiation of any energy development projects, a considerable amount of preparatory work needs to be done, so that a monitoring program can be implemented quickly whenever necessary. This preparatory research would include collecting and standardizing current baseline data within uniform geographical boundaries, identifying key impact indicators and devising measures of them, and selecting appropriate levels and units of analysis for impact monitoring.

New Community Planning

With extensive development of the Beluga coal field, as depicted in our scenario 3, a new permanent community would almost certainly be established in that area. To minimize the problems that could occur in this process, and to ensure that the new community met the needs of its inhabitants, considerable contingency physical and social planning for the community should be conducted well in advance of actual coal-field development. This planning should cover such topics as the following:

1. selection of a suitable town site;
2. comprehensive land-use planning for this site and the surrounding area;
3. ground and surface water availability and soil conditions suitable for waste disposal;
4. desirability of applying the development city statute (AS 29.18.220-460) to the community;
5. design and financing of community public buildings and recreational facilities;
6. provision of adequate housing accommodations;
7. development and financing of public services, especially during the first years of the community's existence;
8. organization of a community government;
9. transportation facilities between the community and Anchorage;
10. economic and political relationships between the community and Anchorage, the Kenai Peninsula Borough, and the State of Alaska.

Area Development Assessment

Large-scale coal mining in the Beluga area could induce various industries to locate there to utilize the coal. If this should occur, the entire Beluga area would experience rapid and intensive economic and social growth, leading to numerous socioeconomic and other impacts and problems. An adequate impact assessment, performed well in advance of any such growth, could provide the information necessary to plan for and manage these impacts, however. We therefore suggest that an impact assessment be performed now on the potential consequences of extensive industrial development in the Beluga area. This assessment should cover such topics as:

1. alternative land-use plans for the entire area;
2. necessary and feasible transportation facilities between the area and Anchorage;

3. responsibilities of the Kenai Peninsula Borough and the state of Alaska for coordinating and regulating development in the area;
4. potential accrual of tax revenues to the borough and the state;
5. potential lease royalties to Cook Inlet Region, Inc.;
6. effects of development on the water resources, soil conditions, wildlife and fish habitats, and other environmental conditions;
7. labor force availability and the need to attract additional workers from outside the Cook Inlet region;
8. effects of development on the regional economy, including stimulation of secondary economic growth;
9. possible population growth in the region resulting directly or indirectly from development in the Beluga area;
10. consequences of such development for the native village of Tyonek.

Tyonek Ethnographic Profile

The sociocultural and historical characteristics of the Tyonek natives differ markedly from those of nonnative people in Alaska, and the Tyoneks are also culturally distinct from other Alaskan native peoples such as Eskimos, Aleuts, and southeastern Alaska tribal communities. If conflicts over development on or near native lands are to be avoided or minimized, it is vital that those who initiate and manage this development understand the Tyonek value and belief systems, normative standards, conflict resolution procedures, and similar cultural traits. Without such understanding among developers, planners, and public officials, even minor disputes with the Tyonek people could easily flare into major confrontations.

At the present time, very little is known about the Tyonek culture. We therefore recommend that a carefully researched ethnographic profile of the Tyonek people and their culture should be compiled in advance of any development project in the area. Compiling this profile would require considerable effort and time, since the Tyoneks are very hesitant to talk openly with outsiders. Nevertheless, this profile--in conjunction with the energy worker profile--could provide a basis for establishing effective interaction and communication processes with the Tyonek people. The result would be a more cooperative and beneficial climate for everyone involved, natives and developers.

Tyonek Impact Prevention

When energy development projects are located near native villages such as Tyonek, the residents of these villages are very likely to experience severe social, cultural, and psychological impacts that they cannot handle. The consequences of these pressures can range from alcohol and drug abuse or other forms of personal deviance to the disappearance of native cultural traditions or destruction of the entire village.

Two lines of action are required to prevent these impacts from occurring, both of which call for extensive research and planning in advance of any development projects. The first approach focuses on the village as a whole. It involves devising strategies and procedures that the village can use to minimize the extent to which the development project impinges on village life, thereby limiting the nature and intensity of the impacts experienced. The second approach is aimed at individuals who are seriously affected by disruptions of native cultural patterns. Common symptoms of such personal problems are alcohol and drug abuse and mental illness, so that the aim in this case is to establish programs to prevent such problems from developing by helping individuals to cope with the stresses they are experiencing. Tyonek is already experiencing a serious alcohol problem, yet very little is presently known about how to organize and operate alcohol and drug prevention programs in native villages. The goal of research on both these approaches to impact prevention would be to provide native villages such as Tyonek with opportunities for exercising self-determination in preserving their traditional culture and lifestyle.

POSSIBLE STEPS TO PREVENT UNACCEPTABLE IMPACTS

General Guidelines

Interpersonal and intergroup conflict between Tyonek residents and coal field developers can be minimized or prevented. In addition, the preferred life style of Tyonek residents can be maintained in the presence of a minimum of influence and impact by the development. If change is to occur in Tyonek, the decision should emanate from the village residents and not from an outside development firm.

An effective procedure for minimizing social impacts and social conflicts would be to establish an active collaborative arrangement between the two groups. A standing committee of community representatives could be formed to meet at least monthly to review, discuss, and recommend various courses of action. Committee members would be responsible for processing information and preparing relevant materials, distributing materials to their respective constituents, soliciting and consolidating feedback from community members at all levels, and promoting a consensus concerning steps to take on matters requiring action.

Needs and concerns of both communities could be channeled through the committee. In some cases, the committee might find it necessary to form subcommittees to address particular community concerns or issues. Equal representation at all levels would be essential if the communities were to achieve reasonable policy decisions. The formation of a permanent collaborative working committee would be a simple but reasonable approach to maintaining open channels of communication between the two communities.

It must be emphasized that the Tyoneks are the native residents of the region. Their cultural heritage, life style, and desire to retain their way of life must be respected and acknowledged by outside developers. The Tyonek residents have a right to exert some controls on the impact that coal development may have on the village. Whether outsiders intend to reside in the region permanently is not important; what is important is the fact that Tyonek residents are the permanent residents.

Coal developers must be aware of the impact of their presence and of the long-term effects on the community produced by the entire coal mining operation. In planning, coal developers should give direct and immediate attention to several considerations:

1. recognition of the differences in cultural backgrounds of community residents. If developers anticipate training and hiring Tyonek residents, steps should be taken to accommodate cultural and life-style orientations. For example, instead of requiring Tyoneks to "punch a clock" or work "from 9 to 5," developers could institute flexible time schedules.

2. preparation of formalized and rigid controls to regulate the sale and consumption of alcoholic beverages. Tyonek has an ordinance that forbids the sale and consumption of alcohol within the village boundaries. Alcohol consumption and the potential for alcoholism is a major concern of the IRA Council. Future developers should be aware of this concern and should take steps to regulate and control alcohol consumption within their own communities.

3. recognition of the differences between the Tyonek life style and that of the typical outsider. To understand, appreciate, and be in a position to respond positively to Tyonek interests, developers should make efforts to inform incoming residents and workers of the differences in life styles. This could be accomplished through a short series of preentry workshops in which the values, beliefs, preferences, and life styles of the Tyonek are explained in detail. Tyonek representatives could be extremely helpful in preparing instructional materials.

4. assessment of the impact that coal development in the Beluga region could have on migratory patterns of indigenous fauna. Some Tyonek residents are subsistence hunters who rely heavily on seasonal wildlife migratory patterns. The impact of the entire coal development operation on wildlife should be assessed, not only for the sake of the wildlife itself but for its effect on subsistence hunting.

5. assessment by the Kenai Borough in collaboration with Tyonek representatives of the impact and added burden of additional students attending the Tyonek school. Specific efforts should be made to hire more native teachers, counselors, and administrators to ensure that the particular cultural and educational needs of Tyonek youth will be met.

6. assessment by Kenai Borough and state law enforcement agencies, in collaboration with Tyonek representatives and developers of law enforcement issues and policy. Jurisdictional matters should be clarified and confirmed. Use of Tyonek residents as potential law enforcement agents should be encouraged.

7. review and assessment of land use and right-of-way issues. At present, roads connect Tyonek with the TTC operation and the area around the coal fields. In addition, several lakes on Tyonek land could be used for recreational purposes. Use of the roads for travel through Tyonek, and of the lakes and the land in general should be discussed with Tyonek representatives. Village boundaries should be made clear to developers and outsiders and the desires of the Tyonek residents should be acknowledged and followed.

8. recognition of the Tyonek residents' long-standing traditional fishing sites. As indicated previously, many of the Tyonek are subsistence fishermen. Developers and outsiders should be aware of the location of fishing sites and their use should be of primary concern in planning discussions with Tyonek representatives.

9. monitoring and evaluation of the process of coal development and its subsequent effects on the Tyonek natives by a third party. Data could be collected to determine the impacts on quality of life, life satisfaction, impacts on overall standards of living, and the success or failure of collaborative efforts.

Implementation Suggestions

These recommendations are offered for discussion purposes. They primarily suggest ways to plan for coal-field development so that adverse effects are minimized.

State Policy Development

An essential first step in the planning effort is formulating an overall state policy toward Beluga coal-field development and the provision of related services and facilities. One of the policy questions to be addressed is whether the state wishes to encourage and subsidize the development of a permanent, full-scale community in the Beluga area. A related question is whether the success of the coal development project depends on developing such a community.

The infrastructure needs and public service costs of alternative community types (work camp, company town, full-scale community) should be assessed, along with the possible relationship of a new community to Tyonek and the Kenai Peninsula Borough. Tyonek wants to minimize impacts on its facilities and potential disruption of village life. The borough, on the other hand, has expressed little interest in actively influencing or guiding development in the area. Together, these two positions indicate that most program responsibility for providing community infrastructure and support would rest with the state.

The Beluga Task Force should analyze these issues and develop policy options for review by the governor's office. The ability of each state agency to support community development through ongoing programs must be delineated and a possible plan of action developed. Policy development should include a detailed investigation of the desirability of applying the Development Cities legislation to the Beluga project.

The task force should not initiate a detailed analysis of community development needs until it appears likely that Placer Amex, Inc. will proceed with coal development. As noted early in the chapter, this will depend on Chugach Electric Association's interest in developing coal-fired generating plants, or Placer Amex's ability to develop an export market for the coal. In the interim, the three scenarios and possible areas of intervention presented in this report can guide the task force in assessing some of the key policy issues.

The membership of the Beluga Task Force, with one exception, encompasses the state agencies most closely linked to the policy issues. The Department of Transportation and Public Facilities, which has responsibility for transportation systems and planning, might also be included because questions of long-term policy related to transportation are important components of new community development in the Beluga area. Representatives from the Kenai Peninsula Borough, the Cook Inlet Region, Inc., and the Tyonek Native Corporation should be invited to participate in at least some of the task force meetings and, possibly, as permanent members of the task force.

Land-Use Planning

The Kenai Peninsula Borough should develop land use policies to guide development on private lands in the Beluga area. These land-use policies should include criteria or performance standards for siting both industrial and residential uses. Guidelines for the lease and sale of borough-owned land should also be developed, especially since portions of borough land have been identified as possible sites for the proposed community. It is crucial that policies and standards be adopted by the Borough Assembly before coal-field development begins.

This planning effort could be coordinated with the borough's port and harbor study and development of the district coastal management program. Background information and policy suggestions will be available from the Cook Inlet Coastal Zone Regional Planning Study and the ongoing South Central Water Resources Study. Because of the regional and statewide implications of industrial development in the Beluga area, it would be appropriate for the state to assist in funding this planning effort.

Town Site Planning

If a full-scale community is to be developed in the Beluga area, detailed physical and social planning must be accomplished for the town site. This plan should be a cooperative effort involving the coal-field developer, the Kenai Borough, and state agencies. Placer Amex, Inc. might be willing to help fund the planning work, possibly in conjunction with Chugach Electric Association. The Kenai Peninsula Borough Planning Department might administer the actual planning study, which could be accomplished in-house or by a private consultant.

Several considerations should be incorporated into town-site planning and construction:

- Community development should be staged because expected population levels may change if coal-field development does not proceed as predicted.
- Utilities (water, sewer, power) could be provided initially by industry, with eventual transfer to a public body as the community grows and revenue sources develop.
- Transportation facilities such as roads, docks, and airports should be built to serve the combined needs of the mining operation and the new community.
- Housing units should be clustered, rather than dispersed over a large area, to save costs on the provision of water, sewer, and other utilities.
- Industries should be required, through contract stipulations, to remove temporary work-camp housing, and to convert it to other community uses following the construction period.
- Potential or typical residents of the new community should be surveyed about their preferences and expectations for housing, recreational opportunities, and shopping facilities. This information should be distributed to local builders.

- The community site should be located at a sufficient distance from the village of Tyonek to minimize interchange and possible disruption to village life.

Employment and Job Training

Coal-field development could benefit the local economy by providing new jobs for Tyonek and other Kenai Peninsula Borough residents. Industry hiring practices should be carefully monitored to ensure that qualified local workers are hired for both permanent and temporary jobs. Local job training programs should be established with financial and technical support from the coal-field developer.

Financing Community Services

The coal-field developer should be required to bear most of the costs of establishing and operating a work camp since its purpose would be to facilitate coal-field development. A full-scale community, on the other hand, would serve many purposes. Its financial support should therefore come from a combination of local, state, and private sources.

While coal-field development would eventually contribute financially to service provision through the property tax, capital improvements are likely to be required before these new tax revenues become available. This problem with the timing of property tax revenues can be alleviated through the prepayment of industry taxes. Several states, including Oregon and Montana, have passed legislation to allow for the prepayment of taxes. In exchange for the tax prepayment, the industrial developer is usually offered a reduction in future taxes directly or, indirectly, through a reduced tax assessment. The reduction should never exceed the total amount of the prepayment plus interest.

In another example, Skagit County in Washington State recently executed a tax prepayment agreement with Puget Sound Power and Light Company as a condition of a zone change agreement for a proposed nuclear power plant. The agreement provides for *construction impact payments* to the school district and for law enforcement. The school impact payments are designed to cover whatever additional maintenance, operation, and capital costs the school district incurs as a result of enrollments during project construction. The developer also agrees to pay the cost of portable classrooms, if they are required, and any law enforcement staff and equipment costs incurred as a result of the construction-period population influx. Tax prepayment agreements should be investigated as a possibility for Beluga-area development.

SUMMARY

Plans are under way to mine the Beluga coal fields on the west side of Cook Inlet. The coal will be strip-mined for export, or to supply local electric generating plants, or both. Over the next 20 years, this coal development activity is likely to generate social and economic impacts at the local, regional, and state levels. The purpose of this study is to assess the potential social and economic effects of coal development, including employment and population growth, regional impacts, and the facility and service needs of a new settlement in the Beluga area. Of special concern is identifying the role of various governmental agencies in the development process. Potential effects on the natural environment are not examined in detail since they are expected to be controlled to acceptable levels through existing federal and state laws.

This report examines three possible levels of coal-field development and the settlement requirements associated with each. Scenario 1 postulates a low level of coal mining to supply local generating facilities. Initial construction activities in 1980 would create a total population of about 200 persons, increasing to over 500 in 1982 and 1983, and leveling off at 320 in 1986, when the construction phase would be complete. Scenario 2 assumes that mining would begin in 1990 to supply coal for an export market. A population of 300 to 320 would be associated with this mining activity and would remain fairly stable over the years unless the volume of coal being mined and exported were considerably increased. Both scenarios 1 and 2 would require a permanent work camp to house construction, mining, operating, and support workers and any nonemployed dependents.

Scenario 3 assumes that two coal-fired generating plants would be constructed in the Beluga area between 1980 and 1985, and that six million tons of coal would be exported, beginning in 1990. A work camp would serve workers until about 1989, when it would begin to evolve into a full-scale community, with a diversity of housing types and services. By 1991, a population of over 1300 residents might be reached.

The most probable regional impacts associated with Beluga coal-field development will include effects on the regional labor force, the market for coal, and the generation and distribution of revenues. The main regional labor force impacts will be positive in nature. The rate of regional unemployment is likely to decline slightly for the duration of the project, with an increase in wage income available for reinvestment in the region and a reduction in the number of individuals receiving unemployment insurance payments. Coal development is not expected to induce any significant in-migration of workers from outside the Anchorage-Kenai Peninsula Borough region.

The development of the Beluga coal resources and the production of electricity from coal would add to the Kenai Peninsula Borough's tax base. The assessed value of coal lands around Beluga would likely increase and, in addition, Cook Inlet Region, Inc. would be the recipient of royalties from coal leases.

The land requirements for a new settlement in the Beluga area will vary, depending on whether a work camp or full-scale community is planned. A 500-person work camp, with dormitory housing, a kitchen-dining hall, and recreation facilities may require about 40 acres of land. A permanent community for about 1500 people would likely require from 600 to 1200 acres, depending on density and design. It would need to include a school, recreation center and park, clinic, police-fire station, city hall, and retail commercial area, in addition to both single- and multi-family housing.

A number of factors will affect the choice of settlement site, including slope, drainage, soils conditions, land ownership, and access to transportation facilities. Placer Amex Inc. has suggested an area near Congahbuna Lake, to the west of the former Moquawkie Reservation, as a likely settlement site.

Housing requirements for a work camp would probably be met by prefabricated structures, primarily dormitory units for single workers and a small number of two- and three-bedroom houses or mobile homes for families. A full-scale community would also require dormitory housing initially, until the construction period is completed. Housing demand would then shift to a mixture of one-, two-, and three-bedroom units, including mobile homes. The total required housing units under scenario 3 is expected to be about 475 from the year 1991 on.

Classrooms and teachers will be provided by the Kenai Peninsula Borough School District for any school-age children who live in the project area. Few children are likely to live in a work-camp setting, but a full-scale community is expected to attract many families. A community with a population of 1300 residents could require school facilities for over 280 pupils.

Other services and facilities required by a new settlement include police and fire protection, recreational services, parks, libraries, medical care, water and sewer systems, roads, and electric power. The role of state and local agencies in providing these services and facilities will depend to a large extent upon the legal status of the new settlement. State support of local public services could range from actual provision to financial support of programs administered by a local government. A *Development City* could be established under existing state statute, increasing the settlement's eligibility for financial assistance from state agencies.

Life in the village of Tyonek could be disrupted by coal development and any associated new settlement in the area. Tyonek residents may become a minority in their own region and have difficulty maintaining their preferred lifestyle. Social problems can emerge that would affect education, traditional subsistence efforts, and community beliefs and attitudes. However, preventive measures can be taken to minimize adverse impacts by assisting coal developers and new workers to understand the needs and priorities of Tyonek residents.

Governmental and private agencies with interests in the Beluga area include the Tyonek Village Council, the Tyonek Native Corporation, Cook Inlet Region Inc., the Kenai Peninsula Borough, and the State of Alaska. All of these organizations are likely to become involved in various aspects of coal-field development.

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APPENDIX 2-A

TYONEK HOUSE-TO-HOUSE SURVEY*

Total number of dwellings in Tyonek - 57 hourse and 9 trailers

Total number of dwellings surveyed - 52

Sewage Systems	No. of Houses	Percent
No sewage problems in past few years	13	25
Leaching problems	20	38
New seepage pit or septic tank within past 3 years	15	29
Septic tank pumped within last 2 years	11	21
Pipes breaking or seepage pit or septic tank freezing	7	13
Water System		
Like the water	26	50
Dislike water because of:	22	42
Swampy taste or smell	(8)	(15)
Cl_2 taste or smell	(4)	(8)
Iron taste or smell	(8)	(15)
Sulfur smell	(1)	(2)
"Bad" smell	(2)	(4)
Do not drink the water but use for washing clothes and bathing purposes	6	12

NOTE: Some houses had multiple sewage and multiple water problems. Above columns may add up to more than 52 houses or more than 100 percent.

*23 May 1978.

APPENDIX 2-B

COMMUNITY SEWAGE TREATMENT SYSTEMS

1) Facultative Lagoon. This system could only be used if ample land is available (requires the most land).

   A facultative pond is a way of treatment using bacteria that have the ability to survive with or without oxygen to break down the organic load.

2) Aerated Lagoon. An aerated lagoon is a basin in which wastewater contents are kept in suspension and to which oxygen is supplied, to provide a primarily aerobic environment for the microorganisms. (Similar to activated-sludge system, without sludge recycle.)

3) Mechanical Systems

   Biological

   Activated sludge. Uses a concentrated mass of microorganisms capable of aerobically stabilizing a waste in conjunction with diffusion or mechanical aeration to maintain the aerobic environment.

   RBS. A fixed film reactor, in which media are continuously rotated through wastewater. Biological degradation occurs through both aerobic and anaerobic processes. A low operating cost system for small installations.

   ABF. A fixed film reactor, in which wastewater is circulated over solid media (wood, plastic, rock); it is often used in conjunction with aeration (see activated sludge).

   Physical/Chemical

   Chemicals are used to enhance physical reactions (i.e., lime, ferric chloride, alum). This system requires high maintenance.

APPENDIX 2-C

USGS SURFACE FLOW AND WELL RECORDS FOR THE BELUGA AREA

Location	Flow Well Records (Permit)	Type (In Permit)
T13N, R10W		
Section 13	50 gpm	
24	50 gpm	
25	75 gpm	
27	40 gpm, 50 gpm, 500 gpm (144,000 gpd)	Ground water
34	27 gpm, 10 gpm (28,400 gpd)	Ground water
35	8 gpm	
T12N, R10W		
Section 4a	60 gpm (2,000 gpd)	Surface
4b	25 gpm (1,000 gpd)	Surface
8	25 gpm	
9	5,000 gpd	Surface
T12N, R11W		
Section 8	12 gpm, 16 gpm, 16 gpm	
T11N, R11W		
Section 1	22 gpm	

CHAPTER 3

BELUGA COAL FIELD LICENSES AND PERMITS

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INTRODUCTION

In March, 1978, the State of Alaska Department of Commerce and Economic Development, in cooperation with the State of Alaska Department of Environmental Conservation, published the first compilation of the approvals required for development activities within the State of Alaska. This compilation, the State of Alaska Directory of Permits, (Directory) was an inventory of all State and Federal agencies which have a regulatory interest in business or industrial development. The resulting document is particularly appropriate for examination of the various agencies' requirements and restrictions pertaining to coal field development.

The Directory is one component of a larger program whose purpose is the completion of a Developer's Procedures Manual. In brief, this Manual would be similar to an operations manual for developers. It will be designed as a permit procedure for industrial or commercial development within the State of Alaska.

The concept of a permitting procedures manual is not new. The need for such a publication has been recognized for a long time. The last attempt at the creation of such a manual was made by the Division of Policy Development and Planning, Office of the Governor, in 1975. This project however, was limited in scope, and covered only State land-related permits. The information given was general and no account was made of the Federal permit requirements.

The Department of Commerce and Economic Development has been interested in the procedures manual idea for a substantial period of time. The impetus for the creation of a Developer's Procedures Manual came when the Department of Commerce and Economic Development staff began to work with the U.S. Borax Corporation on the requirements for opening their molybdenum mine near Ketchikan. At this point it became apparent that a comprehensive manual was necessary. Early work showed there was a gap in understanding between staff and the U.S. Borax people as to the permitting process. Discussions with other State agencies showed that this was the case throughout the bureaucracy. The department then decided to begin an in-depth analysis of the permitting procedures within the State with the ultimate goal being to create a comprehensive Developer's Procedures Manual.

The Directory includes a description of the various approvals required and included specific information on plan reviews, permits, licenses, certifications, authorizations, leases, regulations and inspections. Some examples of development activity which would require a permit are as follows:

1. Removal or harvesting of major vegetation;
2. Grading, removing, dredging, mining, or EXTRACTION of any minerals;
3. Construction, reconstruction, demolition, or alteration of any structure;
4. Discharge or disposal of solid, liquid, gaseous or thermal waste or any dredged material;
5. Placement or erection of any solid material or structure on land, in water, or under water;
6. Change in density or intensity of the use of land; or
7. Changes in intensity of use of water or altered access to, or course of, water.

Through the issuing of development permits, the State of Alaska is an influential partner in the timetable of any development including the Beluga Coal Field. (See Chapter 2, Social Effects and Management Alternatives). However, as stated in the introduction to the Directory,

> "While each individual permit may serve a valid purpose, the combination of many permits applicable to any given project, and conflicting procedures and regulations can act as a serious obstacle to good development. (The Directory) will hopefully lead to efforts to ameliorate the present situation."

At the present time the Directory should not be considered the final authority on coal field development permits in the State of Alaska. Because of time constraints and ever changing procedures and regulations, (both State and Federal), some permits could not be included. The permit descriptions are intended to provide basic information, but for the most up-to-date requirements and procedures all interested persons should contract the appropriate agency before beginning any development activity. (A selected collection of State Permits may be found in Appendix I.)

In regard to the Beluga Coal Field development, a permit scenario was prepared by the State of Alaska Division of Economic Enterprise. Although this document is not in its final form, a draft copy of the outline is included to illustrate the stages of development as they are affected by permit regulations. The final version of this paper will be completed by the State of Alaska Department of Commerce and Economic Development, Division of Economic Enterprise. The final report will include the new coal mining regulations which are presently being revised by the State of Alaska Department of Natural Resources.

This chapter will review permits and approvals necessary for the initial development of the Beluga Coal Field. Development of this coal field and the recovery of the coal resources will be significantly impacted by the State of Alaska's attempt to streamline the process of issuing permits to qualified developers.

LOCATION

Beluga Coal Field is approximately 40 miles to the west of Anchorage and is situated south of the Bruin Bay-Castle Mountain fault zone and has been extensively explored by private industry since 1969. From two to nine exploration or mobile drills have been active in the area each year. The measured reserves amount to several tons of coal available for surface mining. Unfortunately, the lease reserve figures are still held as confidential. Beluga Coal Field was originally leased to Placer Amex by the State of Alaska but the land is presently or soon will be partially under State and partially under Native ownership. The area covered by the original lease to Placer Amex is still being honored by the new land owners.

On Native lands, the regional corporation has subsurface rights. The village has surface rights within their local ownership area. In this case, the Tyonek Native Corporation has surface rights and Cook Inlet Region, Inc. (CIRI) has subsurface as well as some surface rights. However, the Bureau of Land Management (BLM) has interim management authority over Native lands between the time that the Natives select the lands and the time the Natives receive interim conveyance. For that reason persons working on Native land should seek approval and assistance from CIRI, the Native corporation, the village corporation and BLM.

Companies wishing to mine coal on State-owned lands are required to obtain a Coal Prospecting Permit from the Department of Natural Resources (DNR). These permits are issued only after approval of the company's plan of operations, which describes the land to be prospected, the equipment to be used, time frames for the operation, and other information as required by the Department of Natural Resources. Coal mining leases may be issued if coal in commercial quantities is discovered. A mining plan approved by DNR is required before commencement of operations. A State Land Lease which provides for right-of-way and easements may be obtained after approval of a development plan. Use of the tidelands requires a State Tidelands Lease or Permit.

The Kenai Borough government has legal jurisdiction over the land where a town might be built in the Beluga Coal field. Their involvement would include reviewing plans for subdivision, zoning, schools, and solid waste disposal. Roads, railroad, and communication lines may need approval from the Matanuska-Susitna Borough, as well as the Kenai Borough, if they pass through both of these.

MINING OPERATION

Because of the way the coal occurs at Beluga, strip mining is the only possible method for removal of much of the coal. The Federal government, Office of Surface Mining, Reclamation and Enforcement, now has Strip Mining Regulations which will set guidelines on how the operations will proceed. (The DNR State Mining Manager should be contacted for State guidelines.) An Environmental Impact Statement or environmental assessment may be required as well as plans for provisions for compliance with State and Federal water and air quality regulations. Measures to protect anadromous fish streams are mandatory and diversion or withdrawals from all State waters requires a Water Use Permit from DNR. Provisions for the use of materials such as timber or gravel from State lands should be included in the development plan submitted for approval of the mining plan. Timber and other materials would have to be purchased from the State through a material or timber sales contract. A Tidelands Permit would be required for activities on the tidelands and a Miscellaneous Land Use Permit will be required for the use of explosives, waste dumps, and other miscellaneous uses. The Mining Safety and Health Administration (MSHA) has regulations regarding safety of operation and equipment.

Provisions for reclamation are an important part of the application for a mining permit. Inspection and approval of a plan of reclamation at the end of operations are required by the U.S. Department of the Interior as well as the State Department of Natural Resources (DNR).

The site should be examined for archeological artifacts and any excavation of this type on State lands will require a field archeology permit from the Department of Natural Resources. Results of an antiquities survey will be a necessary subject of discussion in the environmental assessment or Environmental Impact Statement.

OVERLAND ROUTE

Overland access for heavy construction equipment will be a necessary prerequisite for the commencement of operations. Equipment could be barged to Granite Point, and driven from there to the mine site. Another possibility would be a link with an extension of the Alaska Highway System, or an extension of the Alaska Railroad System. Other small roads, and rail transport systems will also be needed. A direct overland route to marine terminal facilities is the most likely form of transportation.

Requirements for both the railroad and highway are virtually the same. The railroad will require approval from the Alaska Railroad System if it is an extension of the present railroad system. The road will need approval from the Alaska Department of Transportation.

Both a railroad extension or a highway extension will require easements or rights-of-way from the various land owners along the route. If a bridge or an improper crossing utilizing culverts is required, the Corps of Engineers, U.S. Coast Guard (USCG), and the Alaska State Departments of Fish and Game and of Environmental Conservation should be contacted. Gravel resource extraction will require a permit from the owners of the land where the gravel is located. Labor and equipment safety standards by MSHA must also be met during any construction phase.

Burning of certain materials or burning during the fire season will require permits from the Department of Natural Resources as well as the Department of Environmental Conservation (DEC). If pesticides are applied aerially a Department of Environmental Conservation Pesticide permit will also be required. Oiling of roads on State land will require a Department of Environmental Conservation Surface Oiling Permit. The Department of Environmental Conservation's approval will also be required for the disposal of overburden or other spoil materials. Specific plans and methods of operation should be discussed with the Department of Environmental Conservation to determine what requirements must be met.

PLANE LANDING STRIP

A landing area exists at Tyonek and an agreement may be negotiated with the village in order to use the strip. It has been proposed, however, that a new landing area be built specifically for Beluga Coal Field operations.

The Federal Aviation Administration (FAA) will require a Notice of Intent to Establish a Landing Strip, and material sources (such as gravel) must be obtained from owners of the material site. FAA also requires an Airport Operation Certificate for airports serving CAB certified, scheduled air carriers. A Special Land Use Permit from the Department of Natural Resources will be required if the land to be used for the strip is not covered by the main lease. MSHA safety requirements must also be followed.

PRESERVATION OF STREAMS

Preservation of the natural quality and life of streams is an important consideration and has been broken out as a specific activity for this reason. All phases of development in or near natural water systems must provide for minimizing or alleviation of the potential effects of damage that mining operations as well as roads and railroads could have on the stream and the flora therein. Effects of physical disturbance or discharge of pollutants must be controlled or minimized as much as possible. The development plan and environmental statement should address these specific concerns.

CONSTRUCTION CAMP

The basic construction camp will require facilities for housing, cooking as well as a fresh water source and a temporary means for waste disposal. Structures will need DEC and Department of Health and Social Services (DHSS) approval while water use and discharge must be in compliance with DEC, DNR, and EPA regulations. A Food Service Permit will be required from DHSS for any food services offered and DEC must approve of any solid waste handling and disposal methods. Construction personnel should also be aware of any particular requirements established by local authorities for construction camp or its associated facilities.

The construction plans and specifications for all buildings, i.e., commercial, industrial, business, institutional, and other public buildings or residential buildings containing four or more dwelling units, must be submitted to the State Fire Marshall (Department of Public Safety) for examination and approval prior to starting construction.

DOCK

One reason that mining the Beluga Coal Field might be economically feasible is because of its proximity to tidelands and marine transportation corridors. A corridor to transport the coal over State land to the shoreline will be needed. (A Tidelands Permit of Lease will be necessary and a Corps of Engineers permit will be required for all approaches over tidelands as well as disposal of dredge spoils and for all structures in navigable waters.

A dock to handle vessels carrying loads of up to 100,000 tons will be required. The tidal conditions of Cook Inlet are such that there is a need for a high pier or causeway extending out to a dock to form an onshore storage and handling facility. The pier would have to be equipped with a conveyor belt or some other form of continuous loading system.

Fuel storage and general freight handling facilities would help to make this a full service dock. If the facility handles fuel or any materials classified as hazardous or involves ship ballast off-loading pipes, storage tanks or cleaning facilities, permits and approvals from USCG and DEC will be required.

A Spill Control and Counter Measure plan (SPCC) must also be written and stamped by a professional engineer, in order to meet with EPA regulations.

GENERATING POWER PLANT

A generating power plant may be required to operate the mine and coal treatment plant. U.S. Department of Energy Construction Orders concerning coal as a fuel source and Environmental Protection Agency air quality standards will have to be considered carefully prior to any operation. Discharge of cooling water from any power plant will also require a permit from EPA and any storage of fuel on the premises will require a permit from EPA as well as a SPCC stamped by a professional engineer in order to meet with SPCC regulations.

POWERLINES

Overland powerlines will require easements from various landowners. The FAA requires notice of proposed powerlines routed anywhere near airports. A permit will also be required by the Corps of Engineers for overhead powerlines which cross any navigable waters. It would also be advisable to contact the Alaska Power Authority prior to establishment of any powerlines.

KENAI PENINSULA BOROUGH

The Kenai Peninsula Borough constitutes the only local government in the project area. As a borough of the second class, the Kenai Peninsula Borough (KPB) is charged with providing education planning and tax assessment in the area. In addition the borough has taken over responsibilities for provision and management of public solid waste disposal sites borough-wide.

Under its planning authority, the Borough was charged with land use planning, zoning and platting. No borough land-use plan now exists for the areas surrounding Tyonek. The project areas are rural which allows any use except some specific activities that are noxious or harmful to public health. Subdivisions of private land must be approved by the Borough but the subdivision ordinance has few requirements for subdivision improvements in rural areas.

The Borough also owns land which contains one portion of Congahbuna Lake and part of the proposed site for a permanent community. As such the Borough would have some ability to condition the nature of community development through land leasing agreements.

Although proposed land management system ordinances require KPB Assembly Review, the Borough has not yet developed policies regarding lease of borough land for industrial or community development. The Borough would consider the implications of the project after receipt of a Land Use Application.

Two borough service areas encompass the project sites: the North Peninsula Recreation Area and the Central Hospital Service Area. Neither of these service areas provides facilities in Tyonek or the Beluga area although the North Kenai Recreation Area is considering extending some form of outdoor recreation programs to Tyonek. The Kenai Peninsula Borough is initiating a study of coastal zone management policy and a study of port and harbor needs in relation to energy facility development. The Coastal Zone Management Policy study will result in a document containing the recommendations of consultants for a set of policies for the management of coastal resources. This document, designed for extensive public review, will be used by KPB as a basis for their own coastal management program. The question of coal development at Beluga will not be specifically considered and energy facility siting will be included only in a general discussion of policies.

The Port and Harbors Study will focus on the harbor resources and facility needs related to energy development in the KPB. As such, it will consider the possibility of development at Beluga but will recommend policies only in relation to the location and provision of port facilities.

The KPB is a participant in the Cook Inlet Air Resources Management District, a three-borough organization responsible for air quality monitoring and enforcement in cooperation with the Department of Environmental Conservation (DEC). DEC retains the authority to set air emmissions standards.

In summary, the Kenai Peninsula Borough is unlikely to begin to develop a policy toward development at Beluga until industry approaches the Borough with a land lease or subdivision application. It should be noted that building permits are not required in the unincorporated areas of the Kenai Peninsula Borough. However, all commercial businesses, including rental housing will be subject to a borough sales tax and a sales tax permit must be obtained on each individual enterprise. Furthermore, a Coastal Zone Management plan for the Cook Inlet is presently in the works and expected to be completed and in effect by 1981. Coastal Zone Management (CZM) Permit and Planning Requirements will be required, although the nature of such requirements cannot be ascertained at this point and time.

MANTANUSKA SUSITNA BOROUGH

Beginning in 1977, the Matanuska Susitna Borough established two programs: the six-year capital improvement program and the ten-year land acquisition program. The purpose behind these programs was the establishment of facilities which would help create centers of community life in conjunction with the regional development concept. It is anticipated that by acquiring sites within a ten-year period the Borough will be able to centralize school and community facilities.

Matanuska Susitna Borough is in the process of developing the four following innovations:

1. The creation of district development plans which have legal status as a device for the regulation of land use community facilities and transportation systems.

2. The formation of district councils which will give communities within a district a greater voice in long range planning for the area in which they are living as well as a role in the level of services to be delivered by the government entity for that particular district.

3. The development and use of land development regulations which will insure a coordinated and homogenous development of activities permitted under district development plans. These regulations would specifically address problems in the borough such as strip commercial development, access to highways, parking and sign regulation, environmental protection and buffering of incompatable land uses.

4. Development of a ten year site acquisition program for schools, parks and community facilities which will establish centralized places where a sense of community can be created to off-set the costly disadvantages of sprawl which is rapidly occurring throughout other sections of the Borough.

REFERENCES

Matanuska-Susitna Borough. Comprehensive Planning Program Directions, September, 1978.

Paulick, Karen. Beluga Coal Development--Permits Senario. State of Alaska Division of Economic Enterprise, August, 1978.

State of Alaska Department of Commerce and Economic Development and Department of Environmental Conservation. Directory of Permits, March 1978.

Kenai Peninsula Borough Handout.

APPENDIX 3-A
SELECTED STATE PERMITS

PERMIT TO DRILL OR DEEPEN

DESCRIPTION

Anyone planning to drill or deepen any well for oil or gas or for stratigraphic information on lands or waters of the State of Alaska must obtain a permit from the Division of Oil and Gas Conservation, Department of Natural Resources (DNR). Also, any wells drilled for other purposes may be subject to a permit if the Oil and Gas Conservation Committee finds there is sufficient likelihood of an unexpected encounter of oil, gas or other hazardous substances in any specific area of the State.

The statutory responsibility of the Division is to regulate oil and gas drilling and producing operations to prevent the waste of oil and gas and to protect the correlative rights of lease and royalty owners. Regulation of drilling activities is controlled by the issuance of the permit to drill or deepen. The issuance of a permit and subsequent acitivity on that well are subject to either statewide regulations or special conservation orders which govern location, drilling procedures, abandonment or production practices. Administration and enforcement of these rules and regulations require many approvals by the Division personnel, both verbal and in writing. However, no additional permits are required by this division.

REQUIREMENTS

An application for a drilling permit must be filed on form 10-401, "Permit to Drill or Deepen," together with an application fee of $100.00. Also accompanying the application must be a survey plat showing the precise location of the operation. The application shall include or have attached the following information:

1. The proposed bottomhole location.

2. The proposed casing program including the size, weight, grade, and depth at which each string is to be set.

3. The minimum amount of cement to be used for each casing string.

4. The blowout prevention program to be employed.

5. Any other proposed program information as required by the committee.

In addition to the above, the Oil and Gas Conservation Commission may require a directional survey, samples of drill cutting, core chips and mud logs on the well. Prior to the issuance of any drilling permit, the operator of a well is required to provide a bond to the Oil and Gas Conservation Commission of not less than $50,000.00 for each onshore well near roadways and $100,000.00 for each offshore or remote location well. The purpose of the bond is to assure that funds are available for safely plugging the well and for the repair of wells causing waste or pollution.

Public notices and/or hearings are not required prior to the issuance of a drilling permit unless exceptions to spacing regulations are requested and there are affected parties involved. Other exceptions are for downhole commingling, classification of fields and pools, and implementation of field and pool regulations, or applications for additional recovery. If there are objections to the proposed activities or the Commission feels it is necessary, a public hearing will be held as provided by 11 AAC 22.540. Following the hearing or a ten day period without objections, the Commission may take final action on the application.

A drilling permit is valid for 24 months.

Final processing and issuance of a drilling permit is made only after the plan of operations is approved by the Division of Minerals and Energy Management (DMEM). DMEM coordinates approvals from the Department of Fish and Game, the Department of Environmental Conservation and the Division of Oil and Gas Conservation prior to approving the plan of operations.

An operator may be required to obtain permits from other agencies for the preparation of a site and the placement of a rig before drilling commences. Gravel and land use permits must be approved by DMEM and the Division of Land and Water Management. Often permits for work in navigable water must be obtained from the U.S. Department of the Army, Corps of Engineers. Permits to discharge wastewater and dispose of materials must be obtained from the U.S. Envrionmental Protection Agency and the Alaska Department of Environmental Conservation. The Alaska Department of Fish and Game must approve work in designated anadromous fish streams.

AUTHORITY

AS 31.05.010. Application.
AS 31.05.020. Waste Prohibited.
AS 31.05.030. Powers and Duties of the Department.
AS 31.05.040. Rules and Regulations of the Department.
AS 31.05.050. Notice.
AS 31.05.060. Action by Department.
AS 31.05.090. Permits and Fees to Drill Wells.
AS 31.05.100. Establishment of Drilling Units for Pools.
AS 31.05.110. Unitization and Unitized Operations Approvals and Integration of Interest by Agreement.
11 AAC 22.005-570. Division of Oil and Gas Conservation.

CONTACT

Oil and Gas Conservation Committee
Division of Oil and Gas Conservation
Department of Natural Resources
3001 Porcupine Drive
Anchorage, Alaska 99501 Telephone: 279-1433

UPLAND LOCATABLE MINERAL RIGHTS

DESCRIPTION

To obtain the rights to locatable minerals on State uplands one must stake a prospecting site or mining claim and file a "location notice" with the District Recorders Office in the area in which the site or claim is located and with the Division of Minerals and Energy Management (DMEM), the Department of Natural Resources (DNR).

REQUIREMENTS

Location Notice forms may be obtained from a stationery store. The applicant must include (1) the name of the claim, (2) the date of discovery and the date of posting the notice, and (3) a sketch map of the claim which identifies the location of the claim clearly. The claimant should check the status of the area he wishes to stake to be sure that it is open to staking. Status plats and other information are maintained at the public information office of the Southcentral District Office of the Division of Land and Water Management, 3327 Fairbanks Street in Anchorage for use in making this determination. Copies of the mining laws and regulations and other mining information may be obtained from this office.

No filing fee is required by DMEM at this time.

The mineral rights become effective when a location notice of the claim is filed and remain in effect for at least a twelve-month period, expiring September first. By filing a statement of annual labor by September first, the mineral rights may be extended an additional year. If the statement of annual labor is not filed, the claimant forfeits his rights and may not reestablish the claim for at least one year.

Prior to commencement of operations, the claimant must obtain a Miscellaneous Land Use Permit from the DMEM.

AUTHORITY

AS 38.05.020. Authority and Duties of the Commissioner.
AS 38.05.195. Mining Claims.
AS 38.05.245. Prospecting Sites.
11 AAC 82. Mineral Leasing Procedure.
11 AAC 86. Mining Rights.
11 AAC 88. Practice and Procedure.

CONTACTS

Division of Mineral and Energy Management
Department of Natural Resources
323 E. Fourth Avenue
Anchorage, Alaska 99501 — Telephone: 274-8542

District Offices:

Southeastern District Office
Division of Lands
Pouch M
Juneau, Alaska 99811 — Telephone: 465-2415

Southcentral District Office
Division of Lands
3327 Fairbanks Street
Anchorage, Alaska 99503 — Telephone: 279-7696

Northcentral District Office
Division of Lands
4420 Airport Way
Fairbanks, Alaska 99701 — Telephone: 479-2243

OFFSHORE LOCATABLE MINERAL PROSPECTING PERMIT AND COAL PROSPECTING PERMIT

DESCRIPTION

A prospecting permit is required for persons proposing to prospect for coal and/or offshore locatable minerals on State land. Permits are issued by the Division of Mineral and Energy Management (DMEM), the Department of Natural Resources.

REQUIREMENTS

Application must be submitted on forms provided by DMEM and must include the legal description of the area where the prospecting will be done. Form DL-174 is used when applying for Offshore Locatable Mineral Prospecting Permits; Form DL-70 is used when applying for Coal Prospecting Permits. The applicant should check the status of the land prior to filing the application to be sure of its availability. Status plats and other information are maintained at the public information office of the

Southcentral District Office of the Division of Land and Water Management, 3327 Fairbanks Street in Anchorage for use in making this determination. Copies of the coal and mining rights law may be obtained from the same office.

A $20.00 filing fee is required for each application. Public notice and public hearings are not required.

Prior to commencement of operations the applicant must file a plan of operations with and receive the approval of DMEM.

The Offshore Locatable Mineral Prospecting Permit is issued for a single ten-year period; it is not renewable. If minerals or coal are discovered, the permit may be converted to a lease issued for an indeterminant period. To obtain the lease, the applicant must file a $20.00 fee and geologic evidence with DMEM. A lease form subsequently provided by DMEM also must be completed. Form DL-94 is used for mineral leases; Form DL-71 is used for coal leases. Coal Prospecting Permits are issued for a two-year period and may be renewed once for an additional two years.

AUTHORITY

AS 38.05.020. Authority and Duties of the Commissioner.
AS 38.05.145. Leasing Procedure.
11 AAC 82. Mineral Leasing Procedure.
11 AAC 84. Other Leasable Minerals.
11 AAC 86. Mining Rights.
11 AAC 88. Practice and Procedure.

CONTACT

Mineral Leasing Section
Division of Minerals and Energy Management
Department of Natural Resources
323 East Fourth Avenue
Anchorage, Alaska 99501 Telephone: 274-3542

SOLID WASTE DISPOSAL PERMIT

DESCRIPTION

No person may establish, modify or operate a solid waste disposal facility in the State of Alaska without a Solid Waste Disposal Permit from the Department of Environmental Conservation (DEC), except for the following:

1. A single-family or duplex residence which generates solid waste and disposes of it on premises.
2. A farm on which solid waste generated from the operation of that farm is disposed.
3. Incinerator facilities having a total rated capacity of less than 200 pounds of solid waste per hour.

Definitions pertaining to this permit include:

1. "Solid Waste Disposal Facility" means an intermediate disposal facility, transfer station, landfill, incinerator, composting plant, recycling or reclamation facility or any site utilized for the reduction, consolidation, conversion, processing or disposal of solid waste.
2. "Solid Waste" means all unwanted or discarded solid or semi-solid material whether putrescible or nonputrescible, originating from any source, including but not limited to garbage, paper, wood, metal, glass, plastic, rubber, cloth, ashes, litter and street sweepings; dewatered sewage sludge, dead animals, offal, junked vehicles and equipment, material and debris resulting from construction or demolition projects; abandoned and decaying structures; hazardous wastes, mine wastes, gravel pit and quarry spoils; and overburden except that originating from the construction of single buildings.

REQUIREMENTS

An applicant is required to submit two completed "Solid Waste Disposal-Solid Waste Management Permit" application forms (no form number available) showing:

1. Detailed plans and specifications for the facility.

2. Certification of compliance with local ordinances and zoning requirements.

3. A report detailing the proposed method of operation, population and area to be served, the characteristics, quantity and source of material to be processed, the use and distribution of processed materials, method of residue disposal, emergency operating procedures, the type and amount of equipment to be provided, and the proposed ultimate land use.

No application fee is required.

Applications should be submitted at least 60 days prior to the commencement of operations. Upon the receipt of an application DEC will publish a public notice in two consecutive editions of a newspaper in the area of the proposed activities. Public comments are accepted up to 30 days following the final notice. Public hearings are not mandatory unless dictated by public comment. At the end of the 30-day public notice period, DEC may act on the application. Solid Waste applications are sent to the Alaska Departments of Fish and Game, Health and Social Services, Commerce and Economic Development and Natural Resources for their review and comment.

Permit renewal is only on request by the permittee and must be submitted 30 days prior to the permit's expiration. The application procedures for permit renewal are the same as those required for the initial application, except that public notice is not required.

Solid Waste Permits may be issued for a period not to exceed 5 years. Permits may not be transferred without written consent of DEC.

AUTHORITY

AS 46.03.020. Powers of the Department.
AS 46.03.100. Waste Disposal Permit.
18 AAC 15. Administrative Procedures.
18 AAC 60. Solid Waste Management.

CONTACTS

Permit Coordinator
Department of Natural Conservation
Pouch O
Juneau, Alaska 99811 Telephone: 465-2670

Regional Offices:

Regional Environmental Supervisor
Southeast Regional Office
Department of Environmental Conservation
Pouch OA
Juneau, Alaska 99811 Telephone: 364-2148

Regional Environmental Supervisor
Southcentral Regional Office
Department of Environmental Conservation
MacKay Building, 12th Floor
338 Denali Street
Anchorage, Alaska 99501 Telephone: 274-5527

Regional Environmental Supervisor
Northern Regional Office
Department of Environmental Conservation
P. O. Box 1601
Fairbanks, Alaska 99707 Telephone: 452-1714

Regional Environmental Supervisor
Prince William Sound Regional Office
Department of Environmental Conservation
Pouch E
Valdez, Alaska 99686 Telephone: 835-4698

TIDELANDS PERMIT

DESCRIPTION

Persons proposing to utilize State-owned tidelands and submerged lands for any temporary, short term use must first obtain a Tidelands Permit from the Director, Division of Land and Water Management, Department of Natural Resources.

Definitions pertaining to this permit are:

> "Tidelands" means those lands which are periodically covered by tidal waters between the elevation of mean high and mean low tides.
>
> "Submerged lands" means those lands covered by tidal waters between the line of mean low water and seaward to a distance of three geographical miles or as may hereafter be properly claimed by the State.

REQUIREMENTS

Applications are to be filed with the Division of Land and Water Management on Form 10-107 and must include information on the purpose of the proposed project, the method of construction, and the dates of the construction period. A preliminary plat and a non-refundable $20.00 filing fee must accompany the application.

Before the application is approved, the director must advise each of the abutting upland property owners of the project by registered mail and allow them 20 days from receipt of the notice for comments. Also, the department must receive from the applicant a letter of non-objection to the proposed use of the tidelands or submerged lands from the Commissioner of the Alaska Department of Fish and Game. Public notices and hearings are not required. Final action is taken by the Director within 60 days of receipt of the application.

The permit does not grant the right to remove materials from the tidelands or submerged lands; nor does it grant the right to prospect for or extract minerals from tidelands or submerged lands. Each permit is issued for a duration determined by the Director but not to exceed five years. Renewals must be applied for in writing between 30 and 60 days prior to expiration of the original permit. An application for renewal must contain certification as to the character and value of all improvements existing on the land and reasons for a renewal.

Projects conducted on tidelands and submerged lands may also require a permit issued by the U.S. Department of the Army, Corps of Engineers.

AUTHORITY

AS 38.05.035. Powers and Duties of the Director.
AS 38.05.330. Permits.
11 AAC 62.710-800. Tide and Submerged Lands.

CONTACTS

Director
Division of Land and Water Management
Department of Natural Resources
323 E. Fourth Avenue
Anchorage, Alaska 99501 — Telephone: 279-5577

District Offices:

Southeastern District Office
Division of Land
Pouch M
Juneau, Alaska 99811 — Telephone: 465-2415

Southcentral District Office
Division of Lands
3327 Fairbanks Street
Anchorage, Alaska 99503 — Telephone: 279-7697

Northcentral District Office
Division of Lands
4420 Airport Way
Fairbanks, Alaska 99701 — Telephone: 479-2243

DEVELOPMENT WORK ON COAL DEPOSITS

DESCRIPTION

No person may initiate development work on coal deposits located on State lands without the advance approval of the plan of operations by the State Geologist of the Division of Geological Surveys, Department of Natural Resources (DNR).

REQUIREMENTS

A letter of application must include a preliminary plan of operation. The plan shall consist of a map with a scale of 1 inch to 400 feet and such other maps that are necessary to show clearly the intent of the lessee as to future mining, ventilating, and development of the mine. No application fee is required. No public notice or public hearings are required.

The permit is issued for a duration prescribed by the geologist.

A coal mining permit and/or lease may be required by the Division of Mineral and Energy Management, DNR.

AUTHORITY

AS 27.20.005. Purposes.
AS 27.20.010. Rules and Regulations.
11 AAC 46.010. Advance Approval.

CONTACT

State Geologist
Division of Geological and Geophysical Surveys
Department of Natural Resources
3001 Porcupine Drive
Anchorage, Alaska 99504 Telephone: 279-1437

CHAPTER 4

LAND TENURE

CHAPTER 4
LAND TENURE

INTRODUCTION

In order to predict the direction that future development in the Beluga Coal District may take and what the land-related barriers to that development may be, it is necessary to look at the area's land status, land tenure, and restrictions on land use. To do this, it is essential to identify who holds the real property and mineral rights. This includes the ownership of the surface and subsurface as well as who controls other lesser rights and interests in the land such as coal prospecting permits, oil and gas leases, coal leases, and easements. The land use controls, classifications, and zoning restrictions imposed by government agencies are also central to an understanding of the land situation in the Beluga Coal District.

Normally, land status and land tenure are displayed graphically by the use of maps. Figure 2-1 shows the land status, surface estate, as of September 1978. However, the enactment of the Alaska Native Claims Settlement Act has caused a very complex land tenure situation to exist in Alaska, particularly in the Beluga Coal District, and this map alone does not tell the whole story.

This chapter will attempt to clarify the major land tenure issues in the Beluga Coal District. Discussed are the major land holdings and the characteristics of different classes of holdings by the State, the Kenai Peninsula and Matanuska-Susitna Boroughs, the Native and non-Native private land owners. Because transportation is so important to energy resource development, the types of existing routes and proposed routes and sites that would be available have been addressed in detail. Several recommendations follow. The recommendations are neither exhaustive nor comprehensive, but result from obvious conclusions reached by the researchers, especially where inherent characteristics in various land ownerships and interests defined the problem and led to fairly straightforward recommendations.

The Central Beluga Coal District surrounds the Athabascan Indian Village of Tyonek and the former Moquawkie Indian Reserve and lies generally between the Beluga River on the east, the Chakachatna River on the west, Beluga Lake on the north and Cook Inlet on the south (see legal description on page 7-2).

The three words that best describe the land ownership situation in the Beluga Coal District are "volatile," "exchange," and "litigation." "Volatile" because change is so explosive in land ownership patterns that State, Native and Borough land ownership is likely to shift quickly and unpredictably. "Exchange" because the area is so heavily affected by two pending Native land exchanges. "Litigation" because the State, Natives and the two Boroughs are all involved in lawsuits affecting land rights in the area.

The major landowner trading "out" of the area is the State of Alaska. Native Corporations are trading "in" to the area. Cook Inlet Region, Inc. is in the process of acquiring a large block (311,040 acres) of coal-rich lands from the State, and the Tyonek Native Corporation, in addition to selecting land set aside for it under ANCSA, has the option of acquiring in trade with the State, one township (23,040 acres) of land near their village for land they selected from the Kenai National Moose Range across Cook Inlet. Both the Matanuska-Susitna Borough and the Kenai Peninsula Borough have selected land in the area as part of their ten percent municipal land entitlement to State lands within their boundary, an issue that is presently before the Courts in Alaska.

The following chapter is intended to give a rough overview of land tenure in regard to the Beluga coal fields. This chapter was written using June, 1978 as a base year. But, considering the state of flux, any further pursuit of information on land tenure should appropriately be addressed to the Alaska Division of Lands.

MAJOR LAND HOLDINGS

STATE LANDS

With the important exception of the former Moquawkie Indian Reserve, almost the entire area of the Beluga Coal District is patented State land with less than one township State Tentatively Approved land. Much of the State Patented and Tentatively Approved land is Mental Health Land. Other significant State land holdings in the area are the tidelands along the coastline and the submerged lands of the navigable tidal waters of Upper Cook Inlet. The bed of Upper Cook Inlet, generally defined as north of Kalgin Island, is predominately State land. The beds of the navigable lakes and streams, such as Beluga Lake and River, are also State lands.

During the 1950's, shortly before Statehood, Federal lands in the Beluga Area were transferred to Alaska under the authority of three Congressional Acts: The 1953 Submerged Lands Act, the 1956 Mental Health Enabling Act and the 1958 Alaska Statehood Act. Table 4-1 gives and overview of State land entitlements, their authority and acreages, and Table 4-2 the State Land Status in the Beluga Coal District.

Congress approved Public Law 31, Chapter 65, the Submerged Lands Act, in 1953. This law confirmed and established the titles to lands beneath navigable water within state boundaries and to the natural resources within such lands and water to the states. It also provided for the use and control of waterway bottoms and resources and confirmed the jurisdiction and control of the U.S. over the natural resources of the sea bed of the Continental Shelf seaward of State boundaries. This Act did not substantially affect Alaska's land holdings until Statehood early in 1959.

In 1956, the Mental Health Enabling Act, Public Law 830, titled "Grants to Alaska for Mental Health", authorized the territory of Alaska to select one million acres of land for the purpose of improving mental health conditions in Alaska. The potential revenue obtained from the development

TABLE 4-1

ALASKA LAND ACQUISITION

CATEGORY	ACREAGE	AUTHORITY IN 1958 STATEHOOD ACT	REMARKS
Community development & expansion (U.S. forest lands)	400,000	Sec. 6(a)	Grant
Community development & expansion (other public lands)	400,000	Sec. 6(a)	Grant
General land grant	102,550,000	Sec. 6(b)	Grant
School (1915 Act) (Sec. 16 & 36 of Surveyed townships)	?	Sec. 6(k)	Reconfirmed
University (1929 Act) (Sec. 33 of Tanana Valley townships)	?	Sec. 6(k)	Reconfirmed
University (1929 Act)	100,000	Sec. 6(k)	Reconfirmed
Mental Health (1956 Act)	1,000,000	Sec. 6(k)	Reconfirmed
Submerged Lands (1953Act) (Tidelands, submerged lands & shorelands)	?	Sec. 6 (m)	Reconfirmed
Miscellaneous Lands	?		

TABLE 4-2

STATE LAND STATUS

Beluga Coal District

T.11N.-T.15N. and R.9W.-R.14N.,S.M.

U.S. TO STATE OF ALASKA PATENT NUMBER	TYPE	LEGAL DESCRIPTION	DATE OF PATENT
50-66-0318	GS 401	T.13N., R.9W.	
50-66-0314	MH 57	T.13N., R.10W.	
50-66-0214	GS 402	T.13N., R.10W.	
50-66-0318	GS 401	T.13N., R.9W.	
50-66-0314	MH 57	T.13N., R.10W.	
50-66-0314	GS 402	T.13N., R.10W	
50-66-0315	MH-61 CRA	T.13N., R.11W.	
50-66-0289	MH-61 CRA	T.13N., R.11W.	
50-66-0322	CRA MH 63	T.13N., R.12W.	
50-67-0234	CRA MH 58	T.12N., R.12W.	
	TA GS 396	T.12N., R.11W.	
	TA MH-70	T.12N., R.11W.	
50-66-0212	GS 215	T.15N., R.9W.	
50-66-0144	GS 412	T.14N., R.14W.	
50-66-0376	CRA MH 69	T.14N., R.13W.	
50-66-0133	GS 411	T.14N., R.13W.	
50-66-0142	GS 403	T.13N., R.14W.	
50-66-0375	CRA MH 65	T.13N., R.13W.	
50-67-0212	MH 59 CRA	T.12N., R.13W.	
50-67-0203	GS 397	T.12N., R.14W.	
50-66-0134	GS 1217	T.15N., R.14W.	
50-66-0013	GS 416	T.15N., R.13W.	
55-66-0336	GS 414	T.15N., R.12W.	
50-66-0332	GS 284	T.15N., R.11W.	
50-66-0310	GS 235	T.15N., R.10W.	
50-66-0317	GS 396 (3 Mile Creek)	T.12N., R.10W.	
50-66-0293	GS 407	T.14N., R.10W.	
50-66-0346	GS 409	T.14N., R.11W.	
50-66-0316	MH 67 CRA	T.14N., R.12W.	
50-66-0319	GS 103	T.14N., R.9W.	

TA - Tentatively Approved
GS - General Selection
MH - Mental Health
CRA - subject to Civil Rights Act. For a period of time all federal patents were granted subject to the Civil Rights Act, but no longer are.

of the Mental Health Lands was to be an economic base on which to meet the needs of the Mental Health Program. Alaska had ten years from 1956 in which to select the lands under this entitlement. Table 4-3 lists the general locations of Mental Health Lands in the Beluga Coal District.

The third Federal law was the Alaska Statehood Act of 1958 which enabled the newly-formed State to select 103.5 million acres of Federal lands throughout Alaska. The type of lands the new State was authorized to select under the Statehood Act were General Grant Lands from the huge public domain, Community Grant Lands from the National Forests and other public lands near existing communities and in addition confirmed previously granted lands to the territory as State lands, including School, University and Mental Health Lands and various miscellaneous parcels. Submerged lands and the beds of navigable waters were also granted at Statehood pursuant to the Submerged Lands Act. In the Beluga District, although much of the uplands were selected under the general grant land authority, the heart of the district was acquired under the Mental Health Enabling Act. The State was allowed 25 years to select General Grant Lands, a period which expires in 1984.

Tentatively Approved Lands

After the State Division of Lands identified and selected lands they wanted (called State Selections), the Federal Bureau of Land Management determined the correctness and appropriateness of the requested selections. "Tentative Approval" (T.A.) followed. Under Tentative Approval, the jurisdiction of the lands for administrative purposes was transferred to the State. Tentative approval is not similar to Interim Conveyance (I.C.) for Native selected lands, in that Interim Conveyance actually passes legal title to the Native Corporations, whereas Tentative Approval grants equitable title. Equitable title means that a right to the land exists, but is short of full title (equitable title is similar to "color of title").

TABLE 4-3

MENTAL HEALTH LANDS

BELUGA COAL DISTRICT

Legal Description	Acreage	U.S. Patent No.	Mental Health No.
T.12N., R.11W., S.M. Tract A Sec's. 6, 5, 4, 3, 7, 8, 9, 10, 18, 17, 16, 15, 22, 21, 20, 19, 29, 28, 27,	9,885.71	(No Patent- Tentatively Approved)	
T.12N., R.12W., S.M. Tract A Sec. 1-24, 27-34	19,192.31	50-67-0234 CRA	MH-58
T.12N., R.13W., S.M. Sec 1-36	20,040	50-67-0212 CRA	MH-59
T.13N., R.10W., S.M. Sec's. 4-9, 16-21, 28-33	11,488.32	50-66-0314 CRA	MH-57
T.13N., R.11W., S.M. Tract A	22,849.08	50-66-0315	MH-61
USS 3964 #1 & 2	159.24	50-67-0289	MH-61
T.13N., R.12W., S.M. Sec. 1-36	23,040	50-66-0322 CRA	MH-63
T.13N., R.13W., S.M. Sec. 1-36	23,040	50-66-0375 CRA	MH-65
T.14N., R.12W., R.M. Sec. 1-36	22,939.96	50-66-0316 CRA	MH-67
T.14N., R.13W., S.M. Tract A Sec. 1-3 10-12 13-15 22-24 25-27 34-36	11,520	50-66-0376 CRA	MH-69
TOTAL	167,154.62 Acres		

Source: State of Alaska Status Plats.

State Selected and State Tentatively Approved lands were available for selections from lands surrounding the villages by Native Village Corporations under ANCSA, (but not to Regional Corporations, except the regions receive the subsurface estate of all Village lands). Since most of the State lands in the Beluga District are State patented lands; only a small amount of State land was available for selection by the Natives. Lands north of the Moquawkie Indian Reserve in T.12N., R.11W. have been selected by the Tyonek Native Corporation because they contain some Tentatively Approved State land, some of which is Mental Health land. If the selection is approved by the Bureau of Land Management, and the issue is in court, the surface estate will be conveyed to the Tyonek Native Corporation and the subsurface estate will be conveyed to Cook Inlet Region.

Patented Lands

In order for the Tentatively Approved lands to become patented, the Federal government was required to survey the lands. The patent is a title document, similar to a deed, which conveys the first title of government land to others. Within the patents granted to the State, several rights were reserved (held) by the Federal government; among these are rights-of-way for construction of railroads, telegraph and telephone lines, ditches and canals. Patented lands, as conveyed, are subject to any already vested and accrued water rights for mining, agriculture, or manufacturing.

Patents granted to the State, private persons and Native allotees, after the passage of the Alaska Native Claims Settlement Act, will still contain these standard reservations by the Federal government. Patents granted to Native village and regional corporations throughout most of the State will, however, not include these reservations. This change was affected through the determination that ANCSA was not a public land law, but a settlement of aboriginal claims, and as such, reservations by the Federal government were no longer appropriate. There does remain a question as to what will be conveyed to the Native Corporations in the Cook Inlet Region as a result of the agreement to exchange State, Federal and Native Lands.

Mental Health Lands

Under Congressional legislation passed when Alaska was a territory and reaffirmed in the Statehood Act, the State is entitled to select 1,000,000 acres of land to support Mental Health Programs. Prior to July 1, 1978 lands selected for this purpose were administered by the State with disposal of these lands only being made after approval by the Mental Health Board.

On July 1, 1978 legislation became effective which abolished the Mental Health Land trust and which created in its place a monetary trust that would support the mental health programs in the future. By this legislation, all former Mental Health lands patented or approved for patent to the state were redesignated as General Grant lands. This redesignation allows these lands to be more easily administered or disposed of by the state in conveying out its land management function. This former Mental Health Land is now also available to municipalities for selection under the terms of AS 29.18, the Municipal Entitlement Act. The redesignation of Mental Health lands to General Grant lands does not effect the validity of any deed, contract, sale, lease, easement, right-of-way, permit, mineral lease disposal or other conveyance of the land.

Water Way Bottoms

Under the authority of Section 6(m) of the Alaska Statehood Act, the Submerged Lands Act of 1953, and other court decisions, the State holds title to land under navigable and tidal waters within the State. Title to these lands was vested upon admission as a State to the United States on January 3, 1959.

Navigable Waterways

Identification of navigable streams in the areas of Native village land withdrawals has been made by the State of Alaska Division of Lands. The identification was limited to the confines of village land withdrawals and in some cases may be incomplete.

The Chuitna River is the only water body considered for navigability by the Bureau of Land Management on lands selected by the Tyonek Native Corporation. It has been determined that the Chuitna River is not a navigable river by reason of travel, trade and commerce, according to recommendations issued December 24, 1975 by the BLM which allowed a 30 day notice period to submit comments. No comments were received on the determination of non-navigability of the Chuitna River.

According to the State, navigable rivers are located within the Cook Inlet Land Exchange, Beluga Pool, part of the Tyonek Native Corporation Village Withdrawal area. Title to land beneath the navigable streams is to remain with the State. The State's determination of the navigable waters in the area is listed in Table 4-4.

What makes a stream or lake navigable is defined somewhat differently by the State and Federal governments. The Federal government's focus is on trade and commercial activity. The State considers activities such as float plane docking, dog sled routes on the ice during the winter, and vessel passability, as appropriate criteria for determination of navigability. The Corps of Engineers & Bureau of Land Management determine navigability of Alaskan waters for the Federal government.

In his 24 Issue policy document on the Native Land Claims Settlement dated March, 1978, the Secretary of Interior's policy regarding the disposition of lands under navigable waters includes the following:

- Ownership to submerged lands beneath navigable streams will be conveyed on a section by section basis. Sections with lands under navigable streams not selected will remain in Federal, or if applicable, State ownership.

- The process of determining navigability of Alaskan streams and identification of inland waters is to continue. Criteria for navigability is to be mutually established between the State, Native groups and the Bureau of Land Management. Conflicts in opinion will be brought before the Federal Regional Solicitor for review and possible litigation.

TABLE 4-4

STATE DETERMINATION OF NAVIGABLE WATERS

BELUGA COAL DISTRICT*

River	Location
Theodore River	T.13N., R.9W., S.M.
Lewis River	T.13N., R.9W., S.M.
Middle River	T.10N., R.13W., S.M.
Chuitna River	T.12N., R.11W., S.M.
Three Mile Creek	T.12N., R.10W., S.M. Sec. 8 & 9
Congahbuna Lake	T.11N., R.12W., S.M.
Beluga River	T.13N., R.9, 10 & 11W., S.M.
Chakachatna River	T.13N., R.16W., S.M.
Nikolai Creek	T.11N., R.12W., S.M.
Coastal Waters	T.11-13N., R.8-12W., S.M.

*Since determinations of navigable waters were made only within the confines of the Tyonek Village withdrawal lands, other areas of these streams or lakes may also be determined navigable.

Source: State of Alaska, Department of Natural Resources, Division of Lands, Water Delineation Maps.

Since there is no consensus on what determines navigability, Federal courts will decide finally whether a particular stream or lake is indeed navigable or non-navigable.

According to the Alaska Administrative Code (11 AAC 83.625), lands underneath navigable streams and lakes are called "shorelands." These are lands belonging to the State which are covered by non-tidal waters up to the ordinary high water mark, deemed navigable under U.S. laws. Shorelands don't include tidelands or submerged lands as the latter are covered periodically by tidal action. Tidelands, submerged lands and shorelands are all types of lands beneath navigable waters. Tidelands and submerged lands are beneath coastal waters; shorelands are beneath inland waters.

Tidelands

Tidelands are lands which are periodically covered by tidal waters between the elevation of mean high and mean low tides. The State also has title to the "submerged lands" which are those covered by tidal waters between the mean low water line (zero elevation) seaward three geographical/or nautical miles (3.45 statute miles).

The State cannot sell its tide, submerged and shore lands (AS 38.05.045).

In granting any permit or easement to tide or submerged lands, the upland owner has the first preference to the use of the land. If the projected use of the permit involves a hydroelectric project or uses equipment which might divert, obstruct or pollute the flow of a river or stream, the applicant must obtain prior approval from the Department of Fish and Game. The same approval is required if any of the waters or materials from rivers, lakes, or streams are utilized.

Leases are required for any project involving substantial development of semi-permanent or permanent structures on State owned tide and submerged lands. Typical uses for which leases are required include construction of piers, wharves, causeways, boat marinas, fill for expansion of commercial activities and log storage of a permanent nature.

In the event the use of the permit involves navigable water or in any way interferes with navigation, permission must be obtained from the Corps of Engineers. For example, when a right-of-way application or permit filed by the Department of Transportation for a portion of road from Chuitna to Goose Bay, the Corps was necessarily consulted. Before the permit was approved, the Corps expressed its preliminary consent by filing a letter of non-objection (LTR) in the case of each potential crossing of a stream or river.

STATE LAND CLASSIFICATIONS

The State land classification system which is currently being revised is similar to zoning, in that there are different classification categories which reflect the capabilities and different potential uses of the land. Unlike zoning, however, the classification system applies to State-owned land only. Also unlike zoning, the present state classification system contains no provisions to guarantee that once title to State-owned land is passed, it will continue to be used for the classified purpose. The classification system is presently undergoing revision within the Division of Lands. (State Division of Lands, CZM Report, December 31, 1977. For more information, contact Planning & Classification Section of the State Division of Lands for details.)

In the Beluga Coal District, the following land classifications exist:

- Resource Management Lands
- Industrial Lands
- Reserved Use Lands
- Material Lands

The Beluga Land Classifications are described and are tabulated in following sections to show ownership rights and the extent of development.

The primary reference in the Alaska Statutes to State Land Classification is found in AS 38.05.300, which provides for the Director of the State Division of Lands to make a preliminary classification for the surface use of all lands in the areas he considers necessary and proper for future development. The classification together with the land-use plan is then transmitted to the Commissioner of Natural Resources for approval, modification, or rejection. This does not prevent reclassification of lands where the public interest warrants reclassification nor does it preclude multiple uses of lands when the different uses are compatible. A major restriction on the classification of State lands is contained in the above referenced statute, which states,

> "No State land, water or land and water areas shall, except by act of the State Legislature, be closed to multiple purpose use if the area involved contains more than 640 acres."

Resource Management Lands

Resource management lands contain an association of surface and/or sub-surface resources which are especially suited to multiple use management.

In the Beluga Coal District, Resource Management Lands are being used in several ways: oil and gas leasing, coal prospecting and leasing, a timber sale and mining permits, with some uses overlapping on the same lands. Approximately half of the Beluga District is under resource management classifications.

Industrial Lands

Industrial lands are those which, because of location, physical features or adjacent developments, may best be utilized for industrial purposes. According to the State Administrative Code, these lands may be disposed of by lease or sale (11 AAC 52.070).

There are currently several sites of varying sizes which are classified as industrial sites in the Beluga District. These include the Kodiak Lumber docking facility at North Forelands; the Chugach Electric Power Plant near Tyonek, and several other sites are operated by Texaco and Atlantic Richfield. See Table 4-5 for list of industrial sites.

Lands leased from the State for commercial or industrial purposes can only be used for the purposes designated and are subject to local building and zoning codes, which in the Beluga District largely involves the Kenai Peninsula Borough, although the Matanuska Borough has jurisdiction generally north of Beluga Lake and east of the Susitna Flats.

Reserved Use Lands

Reserved use lands are those which have been transferred, assigned, or designated for present or for future public use by a governmental or quasi-governmental agency, or for future development of new townsites, or for future expansion of existing townsites. Reserved use lands are available for leasing and may be utilized under an Inter-Agency Land Management Transfer. Lands transferred to a qualified agency may be utilized by sublease or any other manner providing such utilization is consistent with the function of the agency and the provisions of the Land Act.

See Table 4-6 for the list of applications or requests on file at the Division of Lands for Reserve Use Classifications in the Beluga Coal District.

Material Lands

The State of Alaska is authorized by Alaska Statute 38.05.110 to sell sand, rock, gravel, pumice, clay and other materials located on state-owned tidelands and uplands. Material sales are administered by the Department of Natural Resources, Division of Land and Water Management under the regulatory authority of 11 AAC 76.

TABLE 4-5

INDUSTRIAL SITES

BELUGA COAL DISTRICT

JUNE 1978

SITE NUMBER	TOWNSHIP LOCATION & SIZE	DESCRIPTION	DATE CLASSIFIED
C170	T.11N., R.12W., S.M. Sec. 28, 255.87 ac.	Tidelands	12-13-61
C1313	T.11N., R.12W., S.M. Sec. 27, 248.64 ac.	O & G Support Facilities	9-30-65
C1336	T.11N., R.12W., S.M. Sec. 28, 351.45 ac.	O & G Support Facilities	12-27-65
C1336	T.13N., R.10W., S.M. Sec. 27, 80 ac.	Chugach Electric Power Plant	4-8-66
C1369	T.11N., R.12W., S.M. Sec. 28, 126 ac.	O & G Support Facilities (tidelands)	4-13-66
C1483	T.11N., R.12W., S.M. Sec. 29, 397 ac., & Sec. 30, 6 ac.	O & G Support Facilities	2-21-68
C1487	T.11N., R.11W., S.M. Sec. 28 & 33, 36.82 ac.	Ship Docking Facility O & G Support Facilities (tidelands)	2-6-68
C1906	T.11N., R.11W., S.M. ATS 931, 44.86 ac.	Ship Docking Facility Kodiak Lumber Company	5-28-74

Source: State of Alaska, Department of Natural Resources Status Plats. For complete legal descriptions, including aliquot part descriptions, contact Alaska Division of Lands.

TABLE 4-6

RESERVED USE LANDS

BELUGA COAL DISTRICT

JUNE 1978

ADL APPLICATION #	LOCATION & SIZE (Acreage)	DESCRIPTION	DATE OF CLASSIFICATION
C1 647	T.13N., R.10W., S.M. Sec. (corners) 1-4, 15 acres	Beluga River access barge landing site	12-4-73
26336	T.12N., R.11W., S.M. Sec. 26 & 28, 26 acres	Chuit River access site	2-17-65
26338	T.11N., R.14W., S.M. Sec. 6, 30 acres	West Creek access site	2-17-65
26469	T.11N., R.13W., S.M. Sec. 14, 7 acres	Nikolai Creek access site	2-17-65
26919	T.11N., R.13W., S.M. Sec. 22, 640 acres	Nikolai Creek Rec. & Waterfowl Area	3-25-65
26922	T.14N., R.9W., S.M. Sec. 36 & 31, 640 acres	Skoog Lake & Ivan River	3-25-65
45327	T.12N., R.10W., S.M. Sec. 20 (U.S.S. 4679)	barge landing site	5-2-69
54956	T.14N., R.11W., S.M. Sec. 32	Dept. of Fish & Game request	7-21-71
57066	T.11N., R.12W., S.M. Sec. 3, 4, 5, 6, 7, 8, 9, & 10	Future State Subdivision	4-17-72
	T.12N., R.12W., S.M. Sec. 33 & 34		
59720	T.12N., R.10W., S.M. Sec. 7, 5.2 acres	Dept. of Fish & Game request	2-2-73

Source: State of Alaska, Department of Natural Resources. For complete Legal Descriptions, including Aliquot part descriptions, contact Alaska Division of Lands.

General authority for the sale of materials from the state lands requires the Director of the Division of Lands to recommend areas and terms of material sales to the Commissioner of Natural Resources. The Director's authority has been delegated departmentally to the Director of Land and Water Management.

The statutory requirements for public notice and review (AS 38.05.305 and AS 38.05.345) are the same for competitive material sales (sales of more than $5,000 worth of materials) as they are for tideland leases. Likewise, the statute dealing with navigable or public waterways (AS 38.05.127) as discussed under tideland leases applies to material sales.

Before a public hearing on the sale in conjunction with sections 305 and 345, or in any case no less than 21 days before the sale, the State Director of Land & Water Management must make available to the public a written decision in which are set out the facts and the applicable law upon which the determination that the sale will serve the best interests of the State is based (AS 38.05.035(a)(14)).

Under AS 38.05.115(a), not more than $5,000 worth of materials may be sold by nonadvertised, negotiated sale to the same purchaser within a one-year period. Also affecting Material Sales are the classification regulations, which are covered in a separate section of this chapter.

All materials to which Alaska may hold fee title or to which Alaska may become entitled may be sold (11 AAC 76.400).

Under 11 AAC 76.415, prior to the offering of any materials for sale, the lands upon which the materials are located must be classified or, if they are already classified, the classification must be reviewed by the Director of the Division of Lands.

Minimum qualifications for a material sale applicant are provided for in 11 AAC 76.420. Specifically, an applicant must:

1. be a citizen of the U.S. and at least 19 years of age; or
2. have filed a declaration of intent to become a citizen and be at least 19 years of age; or
3. be a group, association or corporation authorized to conduct business in Alaska; or
4. be acting as an agent qualified by filing, prior to the time set for the auction, a proper power of attorney or letter of authorization.

The regulations generally provide for the procedures to be followed in material sales rather than spelling out environmental, social or other criteria which should be used to determine whether a particular sale is in the best interests of the State.

11 AAC 76.465 gives the Director discretionary authority to require a personal or corporate surety bond of the materials purchaser. Under 11 AAC 76.515 the sales contract may be assigned, but only if approved by the Director.

11 AAC 76.530 requires the purchaser of materials from the State to comply with all regulations or ordinances in effect governing sanitation and sanitation practices. 11 AAC 76.535 requires the purchaser to take all reasonable precautions to prevent and suppress uncontrolled brush, grass or forest fires on the lands from which the materials are to be extracted.

Departmental policy regarding material sales can be found in the material sales contract form, which contains a number of restrictive operating requirements, including:

> Road construction or operations in connection with this contract shall be conducted so as to avoid damage to streams, lakes or other water areas and lands adjacent thereto. Vegetation and materials

shall not be deposited into any stream or other water area. Locations and/or improvements necessary for stream crossing for haul roads shall be approved in advance by the state. All roads to be abandoned shall be treated with such measures as necessary to prevent erosion. Any damages resulting from failure to perform these requirements shall be repaired by the purchaser to the satisfaction of the state.

The purchaser shall take all necessary precautions for the prevention of wildfires and shall be responsible for the suppression and bear the suppression costs of any and all destructive or uncontrolled fires occurring within or without the contract area resulting from any and all operations involved in the removal of the material.

Before construction of any main haul, secondary or spur roads across State lands, the purchaser shall obtain written approval of the location and construction standards of such roads from the State.

The sales contract form also requires that any improvements or transportation facilities, including crushers, mixing plants, buildings, bridges and/or roads constructed by the purchaser in connection with the sale and within the sale area be in accordance with plans approved by the State.

The contract shall be terminated or suspended if the purchaser does not comply with all laws and regulations applicable to the contract, including the State Department of Fish and Game regulations pertaining to the protection of wildlife and wildlife habitat.

Although not a matter of formal written policy, material sales are evaluated using basically the same criteria used for permits and leases: compatibility with existing or proposed uses, suitability of the site, conformance with local zoning, possible resource conflicts, the environmental and social impact of the sale, and the probable future benefit or harm.

Material sales proposals are subjected to interagency review which is similar to that given permits -- at the minimum the proposed sale is reviewed by the Department of Fish and Game, the Department of Environmental Conservation and any affected municipality or Native corporation. For any sale which might affect navigability, concurrence from the U.S. Army Corps of Engineers is obtained. Exceptions are negotiated material sales located in an established quarry which has already been subjected to a review and decision process. Interagency review in this case would be requested only if a significant factor relating to the original decision had been altered.

For material sales on the tidelands, upland and adjacent owners are contacted for comment. See Table 4-7 for Material Sales in the Beluga Coal District.

On Cook Inlet Region, Inc. Land Exchange lands, sand and gravel are to be conveyed as the <u>surface</u> estate which means that CIRI will have the rights of the sand and gravel on all exchange lands except those where the surface estate is conveyed to the Kenai Peninsula Borough or Matanuska Susitna Borough.

On Tyonek Native Corporation Lands, gravel is also considered surface estate, for the present at least. The results of a lawsuit in Federal District Court concerning whether sand and gravel is of the surface or subsurface estate resulted in a decision by Judge von der Heydt in Anchorage which is being appealed. The results of that litigation would finally determine whether Cook Inlet Region, Inc. or Tyonek Native Corporation would have jurisdiction over the management of these materials. Judge von der Heydt found that on village lands such as the Tyonek's former Moquawkie Indian Reserve and Village selected State Tentatively Approved Lands north of the reserve, gravel is of the <u>surface</u>

TABLE 4-7

MATERIAL SALES

BELUGA COAL DISTRICT

JUNE 1978

ALASKA DIVISION OF LANDS NUMBER	LOCATION & SIZE	DESCRIPTION	EXPIRATION DATE
81259	T.13N., R.10W., S.M. Sec. 12, 40 acres	Pit run borrow	12-31-78
81332	T.13N., R.9W., S.M. Sec. 6, 10 acres	Gravel	8-21-79

Source: State of Alaska, Department of Natural Resources Status Plats. For complete legal descriptions, including aliquot part descriptions, contact Alaska Division of Lands.

estate. On Regional deficiency lands, (none of which occur in the Beluga area), gravel would be of the <u>subsurface</u> estate.

Water Rights

Availability of water and regulations concerning its use are two important factors in coal production due to the large quantities of water required for washing the coal in the recovery process.

Federal and State regulations cover specific areas of water ownership and use. Federal District Court Judge von der Heydt's decision on easements addresses as well the ownership of lands beneath navigable waters as well as water rights in Alaska. The Submerged Lands Act confers to the State "... Title to and ownership of the lands beneath the navigable waters within the boundaries of the respective States, and the natural resources within such lands and waters, 43 U.S.C. Sec. 1311(a)(1)." The Act further states "nothing in this chapter shall be construed as affecting ... the laws of the State which lies wholly or in part westward of the 98th Meridian, relating to ownership and control of ground and surface waters; and the appropriation, use, and distribution of such waters shall continue to be in accordance with the laws of such States, 43 U.S.C. 1311(e)." Under Federal law, ownership and control of the land under navigable waters is confirmed in the State. See also AS 44.03.020. The ownership of ground and surface waters is to be determined according to State law. Under the Alaska Constitution and State Law, the ownership of such waterways is placed in the people of the State (Alaska Constitution, Article VIII, Sec. 3 and A.S. 46.15.030). Accordingly the State owns or controls the land beneath navigable waters and the water itself on non-navigable rivers and streams.

The taking of water from surface and subsurface sources on State, Federal and private lands is allowed for purposes defined as "beneficial use ... [for] the appropriator, other persons or the public." Title 46 of the Alaska Statutes, the Water Use Act, identifies policies governing water appropriation and grants the Department of Natural Resources the authority to prescribe procedures and regulations concerning diverting, impounding, withdrawing and/or distributing water. Appropriation may be made for use "reasonable and consistent with the public interest, including, but not limited to, domestic, agricultural, irrigation, industrial, manufacturing, mining, power, public, sanitary, fish and wildlife, and recreation uses." (AS 46.15.010)

Application for water appropriation permits is made to the Department of Natural Resources. Additional review is accomplished by the Department of Environmental Conservation and the Department of Fish and Game, Public Notice and Review, and by affected permit holders and previous applicants.

Although some use categories are presently exempt from the Water Use Act (less than 1,000 gallons per day/domestic and certain remote location uses), some serious appropriation problems have developed. In the first case, typified by the situation in some areas on the Kenai Peninsula, long time domestic users who did not obtain permits are discovering their water resources being drawn down by nearby industrial users who have appropriation permits, and thus established rights to the water. Domestic users are finding that they have no rights whatsoever to water they have depended on for years. In the second case, major remote industrial users, not subject to review by State and local agencies, could have significantly adverse effects on an area in both economic and environmental concerns. Proposed changes to the regulations include provisions to delete these exemptions.

The statutes list two additional criteria which must be met before permit issuance. These cover prior user rights and diversion or construction methods. Other considerations for determining the public interest requirement are also listed: (1) the benefit to the applicant; (2) the effect of the economic activity resulting from the proposed appropriation; (3) the effect on fish and game resources and on public recreation opportunities; (4) the effect on public health; (5) potential loss of water supplies identified for future use by the district or regional planning; (6) harm to other persons resulting from the proposed appropriation; (7) the intent and ability of the applicant to complete the appropriation; and, (8) the effect upon access to navigable or public waters (AS 46.15.080).

Upon completion of construction of the works and commencement of use, the permit holder may obtain a Certificate of Appropriation. Current Water Rights Certificates for this area are listed in Table 4-8.

State Game Refuges

This category, distinct and separate from Resource Management Lands, was established by legislative definition to provide for specialized management requirements and because of the large size of the subject areas.

Two large game refuges, Susitna Flats and Trading Bay, bracket the Beluga Coal District. The largest, the 240,000 acre Susitna Flats State Game Refuge, established by the State Legislature in 1976, covers the extensive mud flats and the lowlands of the Susitna River Delta. It also includes the mouth of the Beluga River. Most of this refuge lies east of the Beluga Coal District in the Matanuska-Susitna Borough, with a few sections in the Kenai Peninsula Borough. Approximately 88,900 acres lie in the Belgua District, in the following locations in the Seward Meridian: T.13N., R.9W.; T.13N., R.10W.; T.14N., R.9W.; T.14N., R.10N.; and in T.15N., R.9W.

The refuge has previously been administered on a cooperative basis by the State Department of Natural Resources, the State Department of Fish and Game and the Matanuska-Susitna Borough. Upon passage of the State Law creating the game refuge, AS 16.20.036, the Department of Fish and Game assumed responsibility for management.

A railroad or highway connecting the Anchorage/Wasilla/Willow areas to the Beluga Coal District would pass through the Northern segment of this refuge, a condition that is not strictly prohibited in the enabling legislation, but which nonetheless would be highly sensitive, requiring public hearings as well as the formal approvals of State agencies. The State Department of Fish and Game suggests the desirability of impact

TABLE 4-8

WATER RIGHTS

BELUGA COAL DISTRICT

JUNE 1978

DIVISION OF LANDS APPLICATION #	LOCATION	DESCRIPTION	PRIORITY DATE
WR 44838	T.12N., R.10W., S.M. Sec. 4, U.S.S. 4541	Certificate #741 Louis Kozisek Anchorage, Alaska 1,000 gal. per day/ domestic	1951
WR 45467	T.12N., R.10W., S.M. Sec. 9, U.S.S. 2345	Certificate #742 Louis Kozisek Anchorage, Alaska 5,000 gal. per day/ domestic	1956
WR 45765	T.12N., R.10W., S.M. U.S.S. 3072	Certificate #739 Earl Roberts Anchorage, Alaska 5,000 gal. per day/ domestic & commercial at fish camp	1940

Source: State of Alaska, Department of Natural Resources Status Plats. For complete descriptions, including aliquot part descriptions, contact Alaska Division of Lands.

studies and a consideration of alternate routes, or possible transportation corridors. Such construction is therefore possible, subject to compatibility with multiple land use legislation and submission of plans and specifications as identified in Alaska Statute 16.20.50 and 16.20.060. Within the Susitna Flats Game Refuge, there are lands which are currently under oil and gas lease, and lands which are under mining permits and coal prospecting permits. There is also a permit for a 150 foot wide right-of-way for an electric transmission line, as well as rights-of-way for several oil companies which provide access to their current oil and gas leases.

The Tentatively Approved lands selected by the Matanuska-Susitna Borough that are located within the Susitna Flats Game Refuge may be relinquished by the Borough. Access to the several private parcels of land within the refuge are provided by transportation corridors determined by mutual agreement with the Department of Natural Resources, Department of Fish and Game, and the owner. The holders of Set Net Site Leases which are numerous in the tidelands and offshore areas are also assured access. However, the access rights of the numerous squatters who have duck shacks on the Susitna Flats in the Refuge is unknown.

The Trading Bay State Game Refuge established in 1976 by Alaska Statute 16.20.038, has essentially the same provisions as the Susitna Refuge with one difference. Existing rights-of-way in lands for roads and railroads and pipelines are excluded from the lands of the Trading Bay State Game Refuge. When permits or applications for such rights-of-ways expire, the land on which they are located will become part of the refuge. Only a small portion of this 168,000 acre refuge lies in the central Beluga Coal District: in T.11N., R.13W.; T.11N., R.14W.; a few sections in T.12N., R.13W.; and a few sections in T.12N., R.14W.

Figure 4-1 shows the relative relationship of the Beluga Coal District to the seven State game refuges on Upper Cook Inlet, including Turnagain Arm and Knik Arm.

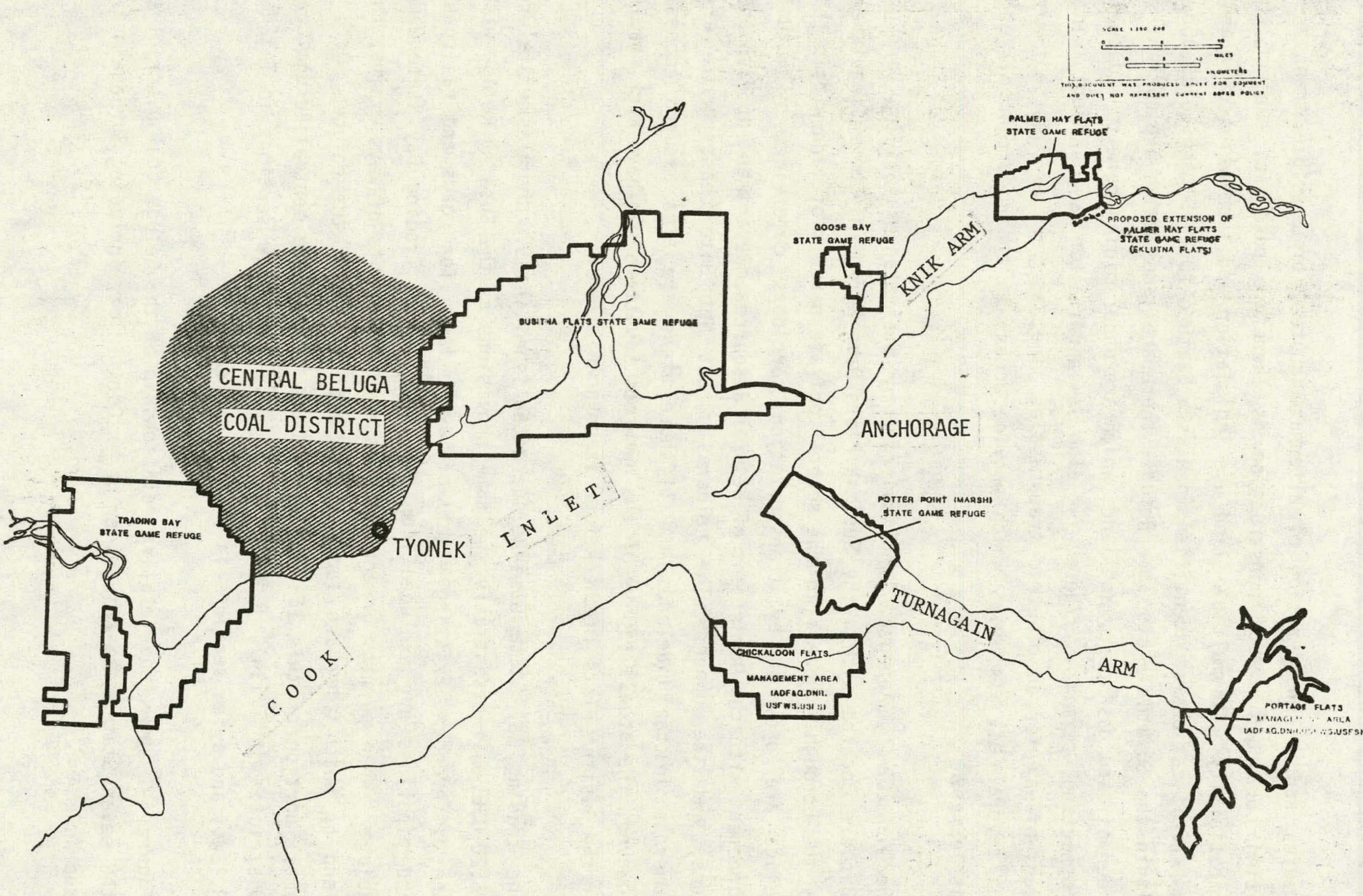


Figure 4-1 - State Game Refuges - Upper Cook Inlet, Southcentral Region

Refuge lands have been open for selection by Native Corporations and municipalities. Any lands received by the Natives in the Cook Inlet Land Exchange will be excluded from the Refuges. A small portion of the Susitna Refuge is part of the Beluga Pool of the Cook Inlet Exchange, as follows: T.13N., R.10W., S.M. Sections 13, 23, 24, 25, 26, and 36.

Timber Sale

A large portion of the Beluga area is composed of a timber sale which is operated by Kodiak Lumber Mills. This sale, #60524, consists of 233,000 acres. Kodiak Lumber Mill's ten year contract, effective through August, 1983, is for 6 million board feet of beetle-infested spruce trees.

Timber sales are regulated and administered by the Department of Natural Resources (11 AAC 76 and AS 38.05.110). Procedures for timber sales are managed by the Division of Land and Water Management (AS 38.05.120). Evaluation criteria include the following: (1) compatibility with existing or proposed uses; (2) suitability of the site; (3) conformance with zoning; (4) possible resource conflicts; (5) environmental and social impact; (6) future resultant benefits or damage. Special contract provisions may cover road construction, logging methods, silvacultural practices, reforestation, fire control, slash disposal and protection of improvements, watersheds and recreational values (11 AAC 76.110).

Review of proposals is also conducted by the Department of Fish and Game, the Department of Environmental Conservation and any affected municipality and/or Native village or corporation. Public notice and review regulations for timber sales of more than 500 million board feet are the same as for tideland leases.

NATIVE LANDS

There are five classes of Native land rights in the Beluga Coal District: (1) Native allotments; (2) IRA Tribal Council lands; (3) other Native lands subject to reconveyance under Section 14(c) of ANCSA including the IRA Council; (4) Tyonek Native Corporation lands,* and (5) Cook Inlet Region, Inc. lands.

The largest Native landholder in the Beluga District will be Cook Inlet Region, Inc. (CIRI). CIRI will eventually own 13.5 townships of Beluga Coal District Lands, both the surface and the subsurface estate, plus the subsurface estate of lands which the Tyonek Native Corporation will receive.

There may be other Native holdings or land ownership in the area, such as set net site leases or other private interests in land, but the five above classes are almost exclusively held by Natives under special legislation.

Native Allotments

Sometimes thought of as the Homestead Act for Alaska Natives, the Native Allotment Act of May 17, 1906, as amended August 2, 1956, authorized the Secretary of Interior to allot land to any Indian, Aleut, or Eskimo of full or mixed blood who resides in and is a Native of Alaska and who is the head of a family or is 21 years of age. A land area not to exceed 160 acres of vacant, unappropriated and unreserved non-mineral land in Alaska, or subject to the provisions of the Act of March 8, 1922, certain vacant, unappropriated and unreserved public land in Alaska that may be valuable for coal, oil or gas deposits or under certain conditions of National Forest Lands in Alaska was made available if various conditions were met.

* Includes surface estate of the former Moquawkie Indian Reserve, some Tentatively Approved State Land, including Mental Health Lands and General Grant, all selected to meet the entitlement under ANCSA, and one township of State land near the Village, which is available should the Village Corporation desire to exchange their Kenai National Moose Range Selection across Cook Inlet for State lands near their village.

The application must have been on file with the Department of Interior (either the Bureau of Indian Affairs or the Bureau of Land Management) before December 18, 1971, the date Alaska Native Claims Settlement Act was enacted. Proof of use and occupancy must have been filed with the application, or must have been filed within six years of filing the

application, and the use and occupancy must have been substantial and continuous for a period of five years, except seasonal use customary to the normal way of livelihood was acceptable. Casual or intermittent use was not acceptable. Use must have been for the exclusive use of the Native applicant and his or her immediate family -- it could not be partial use in connection with a group, communal or village use, and must have been sufficiently obvious that others were aware that the land was being used by the applicant. No allotment could be given to mineral lands, except if the land was valuable only for coal, oil and/or gas, an allotment could be made, but the mineral rights to the coal, oil and/or gas were reserved to the United States.

The title to a Native Allotment would be under a restricted title, that is, the land cannot be mortgaged, leased, sold, or deeded away without the approval of the Secretary of Interior or someone designated by him. The allotee or his heirs may deed the allotted land to another with the approval of the Secretary of Interior and the purchaser will then receive an unrestricted or fee title unless the purchaser is a Native whom the Secretary of interior determines should continue to have a restricted title.

So long as title to a Native allotment is held in a restricted status, the land is not taxable by the State of Alaska or local authorities, such as the Kenai Peninsula and Matanuska-Susitna Borough. The lands would become subject to taxation upon removal of restrictions. Income from developing or leasing allotted land is probably not taxable, although there is no clear ruling on this point, so long as the title remains in a restricted status. But, it becomes taxable if restrictions are removed.

There are eight Native Allotments in the Beluga Coal District. Three have been patented, one has an amended certificate, and four are still in the application stage and have not been finally adjudicated by the Bureau of Land Management; see Table 4-9. Should all of the Native allotments in the area be approved, a total of 1120.68 acres would be owned by Native allottees.

Native Corporations

Of the three Native corporations which will own land in the immediate vicinity of Tyonek and the Beluga Coal District, all three corporations have their principal corporate offices located in Anchorage, and all three employ business managers. The three Native Corporations are:

- The Native Village of Tyonek, Inc., the Federally chartered IRA Tribal Council which is elected by the village and governs the village.
- The Tyonek Native Corporation, the for-profit village corporation which manages the money and land resulting from the Alaska Native Claims Settlement Act (ANCSA), for shareholders enrolled to the village at Tyonek.
- Cook Inlet Region, Inc., one of the 12 for-profit landed regional corporations which manage the money and land resulting from ANCSA for their at-large and village shareholders, including individual Natives enrolled to the village of Tyonek.

Under the Federal Charter, the Tyonek Tribal Council has the power to organize a police force, a fire department and provide just about any other municipal services common to a community incorporated under the laws of the State of Alaska (See Appendix A). The Council does not, however, exercise all of its powers. The Village Council determines what roads will be built, where new housing will be developed and makes other decisions generally affecting the health, safety and welfare of village residents.

The Village Council also manages the assets with the assistance of the General manager, including the substantial real property, that resulted from the Department of Interior's lease of oil and gas lands on the Moquawkie Indian Reserve. The Village Council realized about $14 million

TABLE 4-9

NATIVE ALLOTMENTS

IN SHORELINE TOWNSHIPS

BELUGA COAL DISTRICT

APPLICATION #	LOCATION & SIZE	CERTIFICATE # & DATE	DATE OCCUPIED
AA 6459	T.12N., R.11W., S.M. M & B, 160 ac.	Apln 8-23-71	1949
AA 7268	T.12N., R.11W., S.M. 160 ac.	Apln 3-20-72	7/1946
AA 7324	T.12N., R.11W., S.M. 160 ac.	Apln 3-23-72	5/1953
AA 7788	T.12N., R.11W., S.M. 160 ac.	Apln 4-20-72	6/1957
A 053444	T.13N., R.11W., S.M. M & B, 160 ac.	Amdt Cert 11-17-64	11-16-34
A 055082	T.12N., R.11W., S.M. U.S.S. 4547, 119.39 ac.	50-75-0138/3-14-75	11-16-40
A 055680	T.12N., R.11W., S.M. U.S.S. 4546, 160 ac.	50-66-0608/6-20-66	9-15-41
A 057450	T.12N., R10W., S.M. M & B, 41.29 ac.	50-75-0184/6-5-75	2-15-57
	Total acreage 1120.68		

Source: BLM Status Plats, June 1978. For complete descriptions, including aliquot part descriptions, contact Alaska Division of Lands.

from the lease sale and as a result has made various investments to benefit their membership. For example, the Tyonek Native Village, Inc. owns two-thirds interest in Central Alaska Utilities and three office buildings in Anchorage, including the Kaloa Bldg. at 16th & C Street; the Williams Bldg. on East 4th Avenue, near Juneau Street; and Builders Millwork and Supply Company Bldg. on Tudor Road. Homes for the Tribal membership were constructed both at Tyonek and purchased for tribal members outside the Reserve. The village store and airfield were built and are maintained from the lease sale proceeds. Other improvements to tribal lands were made so villagers could enjoy a better way of life. All of these improvements were a result of the U.S. Department of the Interior's lease of oil and gas on the Moquawkie Indian Reserve.

The Village Council has been considering incorporation as a city under the laws of the State of Alaska. One reason stems from an interest in retaining control of village lands and lands destined for village expansion under a provision of the Settlement Act. Under ANCSA, it is necessary for the other village corporation, the Tyonek Native Corporation, to convey "the remaining improved land on which the Native Village is located and as much additional land as is necessary for community expansion, an appropriate rights-of-way for public use, and land for other foreseeable community needs" to the appropriate municipal corporation where one exists or otherwise to the State in trust for any municipal corporation established in the Native Village in the future. In either case, according to ANCSA, in Sec. 14(c)(3), the amount of land to be transferred to the municipal corporation or in trust shall be no less than 1,280 acres, an area equivalent to two (2) square miles. The Alaska State Legislature, in Alaska Statutes 44.47.15(g), defined the term "municipal corporation" with respect to lands conveyed in trust under ANCSA as including only first and second class cities incorporated under the laws of the State. This law apparently precludes the Kenai Peninsula Borough or the IRA Tribal Council from being a recipient of trust lands for the village of Tyonek.

Tyonek Native Corporation will be receiving title to the lands for the future city. If Tyonek were an incorporated city under State law, it would reconvey title to the City (their own tribal members) rather than to the State to be held in trust for them.

The Tyonek Airfield, one of several private airfields in the Beluga Coal District (see Figure 4-2), was constructed with 1965 oil and gas lease money. The field is maintained by the Village Council and has been found to be a costly public improvement. At one time, the Village Council attempted to transfer the airfield to the State Division of Aviation (now the State Department of Transportation and Public Facilities) in an effort to ease their financial burden. At that time, the offer to give the airfield to the State was not accepted. The Village Council has retained the right to refuse landing privileges to unwelcome aircraft. The Tribal Council established landing fees but it was difficult to administer the fee program. The village residents prefer to have control over who visits their community and because of their outright ownership of the airfield they have had some control. However, the villagers do not like the costs associated with ownership.

The surface estate of the existing Tyonek airport, airway beacons, and other navigational aids, together with such additional acreage and/or easements as are necessary to provide related services and to insure safe approaches to the airport runways must be reconveyed to the Federal, State or Municipal government according to the requirements in Section 14(c)(4) of ANCSA.

Tyonek Native Corporation

The Tyonek Native Corporation was organized as a result of the passage of the Alaska Native Claims Settlement Act by Congress and represents the 303 Native people enrolled to the village of Tyonek. The Tyonek Village entitlement according to Section 14(a) of ANCSA is 115,200 acres - substantially larger than the 69,120 acres most villages receive. The

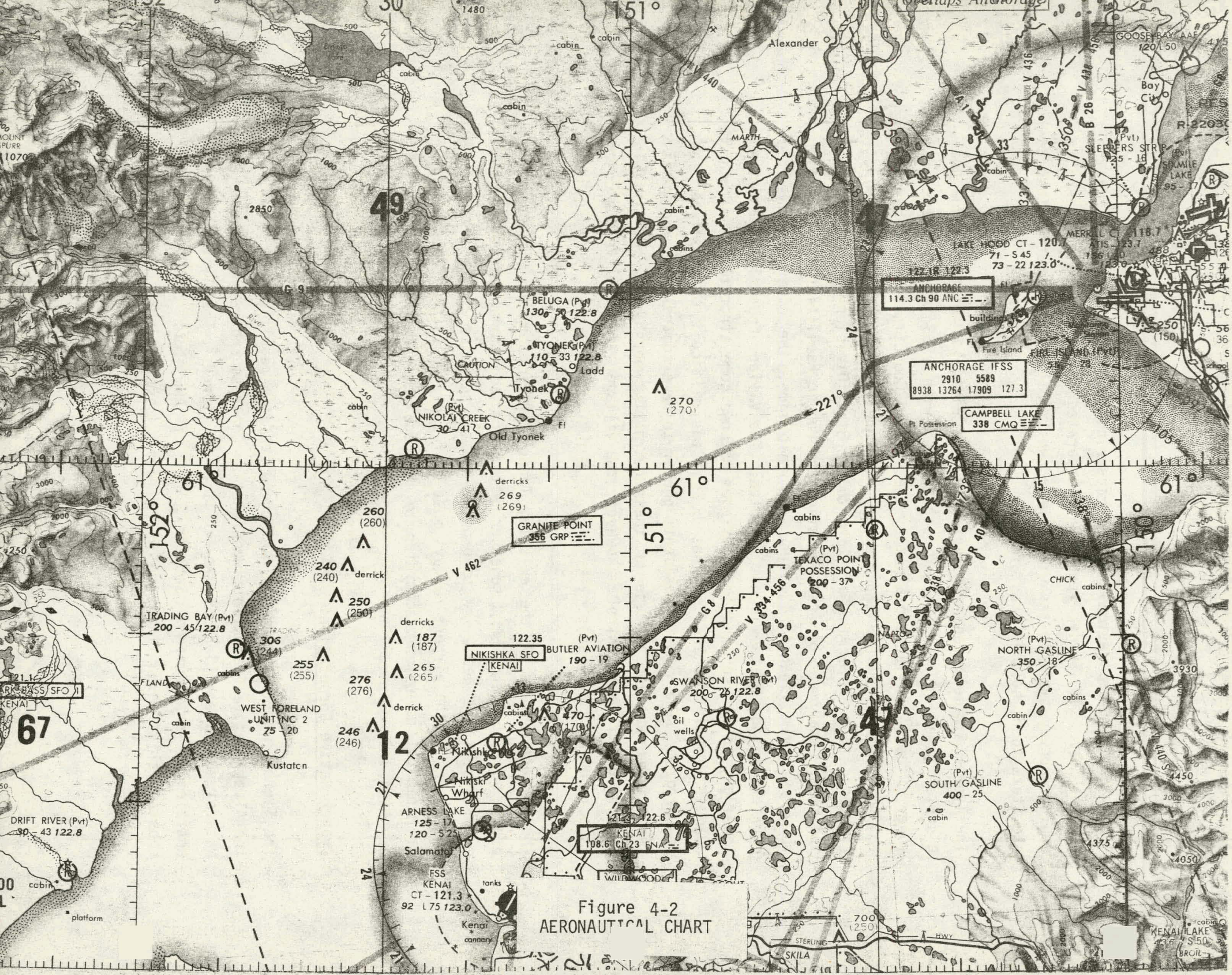


Figure 4-2
AERONAUTICAL CHART

size of Tyonek's entitlement is based on the fairly large Native population which the village had on the 1970 census enumeration date. Villages with a population between 200 and 399 were entitled to 115,200 acres.

The lands patented to Tyonek Native Corporation will be limited to just the surface estate of the lands - in accordance with Section 14(a) and (b) of ANCSA. Patent to the subsurface estate will be made to Cook Inlet Region, Inc. according to Section 14(f) of ANCSA. Cook Inlet Region, Inc. is the regional corporation in which Tyonek Village lands are located. The Region will not receive the subsurface estate of the Kenai National Moose Range lands which the Tyonek Native Corporation selected. Section 14(f) provides that in lieu rights will be made for such unavailable National Wildlife Refuge System subsurface.

A stipulation of the regional corporation patent to the subsurface estate is that the right to explore, develop or remove minerals from the subsurface estate in the lands within the boundary of Tyonek Village, are subject to the consent of the Village. Essentially this provision gives Tyonek a "veto power" over unwanted development by Cook Inlet Region. Village approval was given by Tyonek Native Corporation (TNC) recently under this provision, as follows:

> On July 13, 1977, Cook Inlet Region, Inc. entered into a lease agreement with Simasko Production Company for exploring and developing potential oil and natural gas in an area on the former Moquawkie Indian Reservation. Prior to entering the land this past winter, Simasko also executed an agreement with the Tyonek Native Corporation which allows Simasko access to CIRI subsurface interests. Simasko will begin drilling for the first of two wells required by this contract in early 1978. If the indications for further exploration and development are favorable, four wells will eventually be drilled.

Because there are not sufficient lands available for selection to meet the village entitlement from among lands surrounding the village, the Secretary of Interior set aside "deficiency lands" from nearby unreserved, vacant and unappropriated public lands. Thus, much of the Tyonek Village's land selected under ANCSA is not adjacent to the village site.

Adjacent selectable lands consisted of the Moquawkie Indian Reservation (the Tyonek Village Indian Reserve) and State tentatively approved lands. Several miles across Cook Inlet from the village, lands within the Kenai National Moose Range were also selected. Although these lands are located across the Inlet, they are within the village land withdrawals, and are not deficiency land selections.

Deficiency selections were made south of the village along the West Coast of Cook Inlet and from lands in the Upper Susitna River area, where the Susitna Hydroelectric Project is planned.

According the ANCSA Section 22(g), if a patent is issued to the Tyonek Native Corporation for land in the Kenai National Moose Range, the patent shall reserve to the United States the right of first refusal if the land is ever sold. Notwithstanding any other provision of ANCSA, every patent issued by the Secretary of the Interior pursuant to ANCSA, which covers lands lying within the boundaries of the Kenai National Moose Range, shall contain a provision that such lands remain subject to the laws and regulations governing use and development of the wildlife refuge.

Native Village of Tyonek, Inc.

Tyonek, which is located within the Kenai Peninsula Borough on the former Moquawkie Indian Reserve is not incorporated as a city under the laws of the State of Alaska. However, it is a Federally chartered Native village, governed by an IRA (Indian Reorganization Act) Tribal Council. The Tribal Council -- also called the Village Council -- is the political arm of Tyonek and which, prior to December 18, 1971 (the date ANCSA was enacted) controlled the lands within the former Moquawkie Indian Reserve under a trust relationship with the U.S. Department of Interior, Bureau of Indian Affairs. On December 18, 1971, this Reserve was abolished by Section 19 of ANCSA, and the lands came under the jurisdiction of the U.S. Department of Interior, Bureau of Land Management. The Tyonek Native Corporation succeeded to the rights of the surface estate of the Reserve under terms of ANCSA that had been enjoyed by the Village Council. The Village Council will own lands under reconveyance provisions of Section 14(c) of ANCSA. The council also is responsible for management of substantial business interests for the tribal membership.

The official title of the IRA Tribal Council for Tyonek is "Village Council of the Native Village of Tyonek, Inc." The Council has nine members composed of three officers and six council members. Members are elected annually with staggered terms of office.

Because the village of Tyonek was located on the Moquawkie Indian Reservation, Section 19(b) of ANCSA came into play. This section of the Settlement Act provides for an election of its members to decide whether to retain the Indian Reserve and receive the surface and subsurface estate to the reserve or to opt for benefits of ANCSA. Tyonek Native Corporation voted for the provisions of ANCSA. Had they taken the former reserve, the village would have received fee simple title (both surface and subsurface estates) to 26,918.56 acres of land compared to the 115,200 acres of surface lands they are to receive under their ANCSA entitlement.

Native Lands Subject to Reconveyance

Following are the conditions in ANCSA under which lands conveyed to Tyonek Native Corporation are to be reconveyed to others:

1. The Tyonek Native Corporation, upon receipt of patent to land which is occupied as a primary place of residence, a primary place of business, or as a subsistence camp site, must reconvey to any Native or non-Native occupant, without cost, title to the land they occupy;

2. Next, the Tyonek Native Corporation must convey to the occupant either without cost or upon payment of an amount not in excess of fair market value (determined as of the date of initial occupancy and without regard to any improvements thereon) title to the surface estate of any tract occupied by a non-profit organization;

3. Then the Tyonek Native Corporation shall convey to any municipal corporation in the Native Village or to the State in trust for any municipal corporation established in the Native Village in the future, title to the remaining surface estate of the improved land as is necessary for community expansion, an appropriate rights-of-way for public use, and their foreseeable community needs, provided that the amount of land to be transferred to the municipal corporation or in trust shall be no less than 1,280 acres;

4. The Tyonek Native Corporation shall convey to the Federal Government, State or to the appropriate municipal corporation title to the surface estate for existing airport sites, airway beacons, and other navigational aids, together with such additonal acreage and/or easements as are necessary to provide related services and to insure safe approaches to airport runways; and

5. For a period of ten years after the date of enactment of ANCSA (December 18, 1971), the Cook Inlet Region, Inc. shall be afforded the opportunity to review and render advice to Tyonek Native Corporation on all land sales, leases or other transactions prior to any final commitment. This last provision has been construed by some to mean that the regional corporation is not required to review or advise; only that the Village Corporation must afford the Regional Corporation that opportunity.

As of June 15, 1978, in Interim Conveyance 87, Tyonek Native Corporation received title to 26,917.56 acres, all of U.S. Survey 1965 (the former Moquawkie Indian Reserve) except for lands needed for U.S. Coast Guard navigation aid AA-14290.

Tyonek Native Corporation has remained adamant in its refusal to accept easements across their lands, particularly on the former Moquawkie Indian Reservation.

Cook Inlet Region, Inc. Lands

In most areas of the State, the mechanisms in the Alaska Native Claims Settlement Act for the selection of land entitlement by Native regional and village corporations worked reasonably well. Within the Cook Inlet Region, Inc. (CIRI) area, however, this was not the case and severe difficulties arose. The State of Alaska centered most of its early land selections under the Statehood Act in the area within the geographic boundaries of the Cook Inlet Region which includes Anchorage, the State's largest city with over one half the entire population of the State. The land selected by and patented to the State were the low lying plains and coastal areas where the Cook Inlet Native villages were located. Thus before the passage of ANCSA, most of the traditional lands surrounding the villages of the Region were granted to the State. There was little appropriate land for selection by CIRI and the village corporations within the region.

The leadership of CIRI refused to accept the mountains and glaciers the Secretary of Interior set aside for the region to select. After two years of negotiating with the Secretary of Interior, CIRI brought suit in Federal Court seeking to invalidate prior selections by the State of Alaska in an effort to make adequate land available to the corporation for selection. The Federal District Court ruled against the corporation so an appeal was lodged by the Region before the U.S. Court of Appeals.

In order to settle the lawsuit and the underlying problems of insufficient Federal land available for the Native selection in the Cook Inlet Region, a three party agreement was negotiated. In essence, the U.S. agreed to make other lands available to the State of Alaska in return for conveyance to the U.S. by the State of certain lands it had ownership of in designated areas of the Cook Inlet Region. Cook Inlet Region, Inc. would then choose a portion of its entitlement. The balance of CIRI's entitlement would come from other Federal lands throughout the State. The intention of the agreement was not only to end the lawsuit, but also to serve the additional purpose of allowing more rational land ownership patterns for all three parties.

On January 2, 1976, the United States Congress, in Public Law 92-204, directed the Secretary of Interior to ratify the agreement and the Alaska State Legislature ratified the agreement in March, 1976. Before the ratification by the State Legislature, however, a lawsuit was filed challenging the constitutionality of the State's participation in the conveyance to CIRI, based largely on the value of the Beluga coal lands.

This delayed the implementation of the exchange agreement. After losing in the Superior Court, the Alaska Supreme Court decided in favor of the land exchange in February 1977. However, this did not end the challenge as the plaintiffs appealed to the U.S. Supreme Court to hear their case. Finally, in July 1977, the U.S. Supreme Court issued an order refusing to hear the case, effectively removing the cloud of uncertainty from the agreement.

Prior to implementing the exchange agreement, Cook Inlet Region, Inc. went back to Congress seeking to remedy the 18 month delay resulting from the lawsuit challenging the land exchange. This remedial legislation was passed by the U.S. Congress in November 1977 and the Corporation is finally on the threshhold of implementing the land exchange and selecting the entitlement originally guaranteed by ANCSA.

Under the land exchange, CIRI is to obtain patent to the surface and subsurface estate of approximately 1.23 million acres of land. In addition, it receives a subsurface to another 1.15 million acres of land, the surface of which is either patented to the village corporations or is within the Kenai National Moose Range.

Village Corporations Associated with CIRI

Within the geographic boundaries of the Cook Inlet Region, Inc., which extend from Seldovia in the south, almost to Mt. McKinley in the north, there are eight village corporations: Alexander Creek, Chickaloon, Eklutna, Knik (called Knikatnu by the Villagers), Ninilchik, Salamatoff, Seldovia, and Tyonek. Six of these village corporations have been officially certified under provisions of ANCSA while the eligibility of

Alexander Creek and Salamatoff is being challenged in a U.S. Court of Appeals. Under the terms of ANCSA, the village corporations will receive patent to approximately 930,000 acres of surface lands, with the title to the subsurface estate remaining with Cook Inlet Region, Inc. The acreage received by the Village Corporations is based on the number of stockholders who traced their heritage back to a village and enrolled to a village corporation. Approximately 6,000 Eskimos, Indians, and Aleuts have enrolled to Cook Inlet Region, making it the fifth largest Native regional corporation. CIRI is the only regional corporation whose stockholders are for the most part residents of developed urban areas. Nearly half of their shareholders (about 2,800 individuals) live in Anchorage, about two-thirds (4,000 individuals) live within the Region, and about one-quarter of the total (1,460 indiviuals) live outside the State of Alaska.

Land Exchange Overview

Under the terms of the Cook Inlet Exchange, Cook Inlet Region, Inc. will receive an entitlement of approximately 63 townships (a township equals 23,040 acres) of land in numerous locations throughout the State. Within its regional boundaries, situated on both sides of Cook Inlet in South-central Alaska, Cook Inlet Region will receive lands from both the State of Alaska and the Federal Government.

Within their regional boundaries, Cook Inlet Region, Inc. will select 476,440 acres of land from six separate pools established by the State of Alaska. Cook Inlet Region's respective acreage entitlement from these pools is as follows:

1.	Kenai Pool	115,200 acres
2.	Beluga Pool	311,040 acres
3.	Knik-Willow Pool	4,480 acres
4.	Pt. McKenzie Pool	3,200 acres
5.	Kashwitna Pool	38,040 acres
6.	Chickaloon Pool	4,480 acres

By far the largest, the Beluga Pool (see Figure 4-3) was made available to the Region by the State of Alaska because of its very large coal resources. The west tier of townships and the north tier of townships is not included in this study of the Beluga Coal District.

Because of population pressures and inadequate lands for selection within the boundaries of Cook Inlet Region, Inc., the land exchange had to provide a mechanism for land selections outside the Region's boundaries. This mechanism also had to serve the goal of ensuring Cook Inlet Region, Inc.'s full entitlement as contemplated by ANCSA. Rights to land outside their regional boundaries include the Region's right to select approximately 545,000 acres of land, which will more than likely come from within a pool established within the boundaries of five other Native Regions: Ahtna, Bristol Bay, Calista, Chugach, and Doyon. Cook Inlet Region also has the right to select lands within the boundaries of the other six regional corporations with their consent.

Beluga Pool Selections

Cook Inlet Region, Inc. has selected all of the lands in the Beluga Pool and expects conveyance of all except T.14N., R.15W. The northern half of that township covering the central part of Capps Glacier was not State land and should not have been set aside initially in the State's Beluga Pool.

Because the Beluga Gas Field subsurface and the Nikolai Gas Field subsurface were both excluded in the exchange agreement, Cook Inlet Region expects to receive only the surface estate to the affected land located in T.12 & 13N., R.10W. (Beluga Gas Field) and T.11N., R.12W. (Nikolai Gas Field). Land selected by the Kenai Peninsula Borough in T.12N., R.10W. and land selected by the Matanuska-Susitna Borough in T.14N., R.10 & 11W.; T.15N., R.10W., and T16N., R.13W. are available to CIRI for the subsurface only. The surface estate will go to the two boroughs. Inasmuch as there is more subsurface estate available to CIRI from the Boroughs' lands than there is surface available, due to the gas fields' exclusion, there is an imbalance in CIRI's selections. In an effort to select their full entitlement of 311,040 acres, CIRI has selected somewhat more surface than

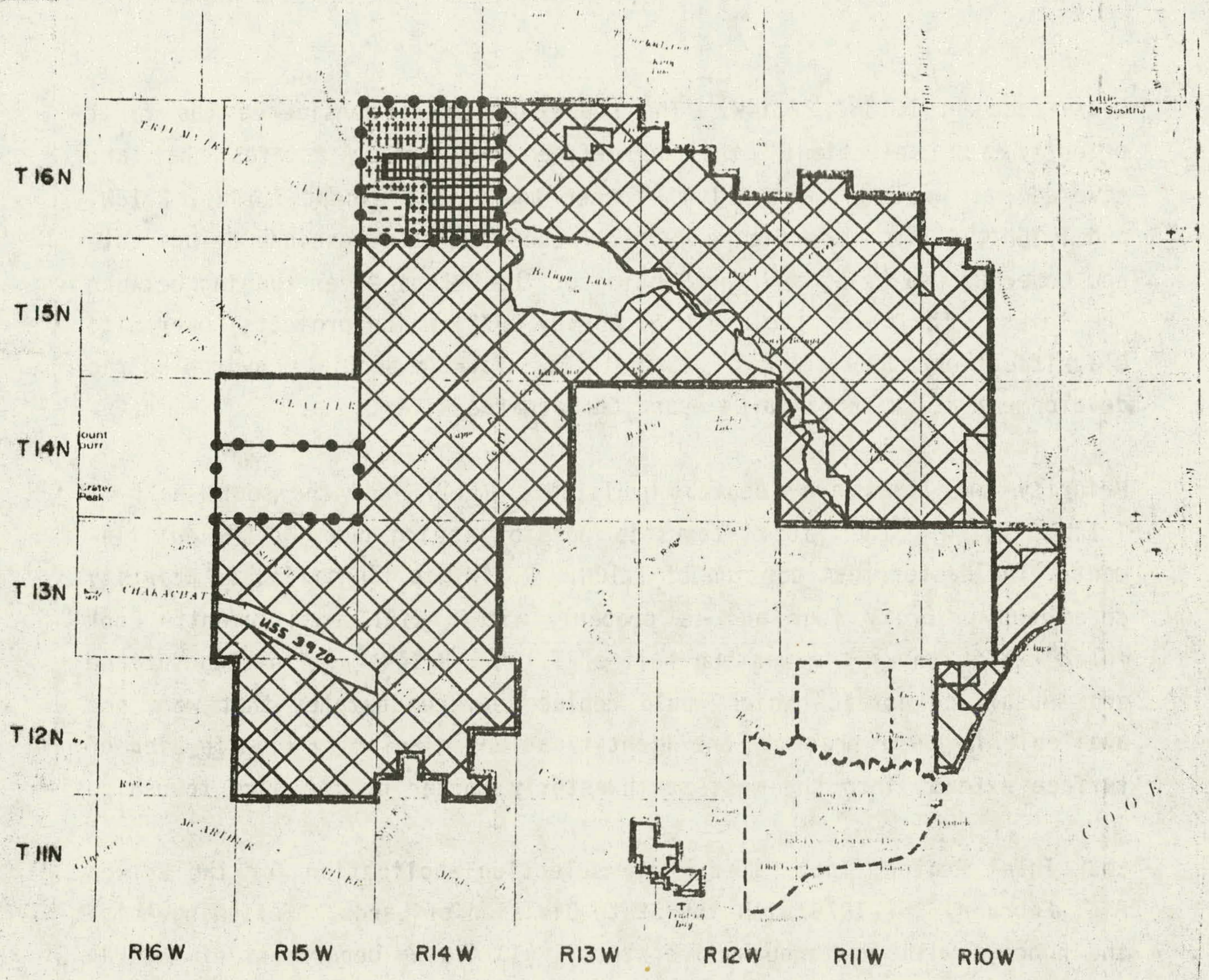


FIGURE 4-3

COOK INLET REGION, INC.
BELUGA POOL SELECTIONS
12/16/1977

Priority 1
Subsurface
Surface

Priority 2
Estimated within Entitlement

Priority 3 & 4
In-Lieu Subsurface and Surface

Priority 4
In-Lieu Surface

Excluded from Selections

Note: See Appendix G for September 7, 1978 legal notice of Division of Lands proposed conveyance of Beluga Pool Lands. Most Priority 1 lands had been conveyed as of June 10, 1980.

Source: Margie Sagerser, Land Manager, Cook Inlet Region, Inc., June 1978.

subsurface in T.16N., R.14W. The above lands are considered the first priority for selection: the subsurface and surface estates that are severed, as well as most all the other townships, except T.14N., R.15W. and T.16N., R.14W. (See Figure 4-3.) These selections exclude Beluga Lake and Lower Beluga Lake, and the Section of the Beluga River running between the lakes. They also exclude U.S. Survey 3970, which protects Power Site Classification 395 (April 22, 1948) for potential hydroelectric development at Chakachamna Lake and Chakachatna River.

Priority two lands are located in T.16N., R.14W. and the south half of T.14N., R.15W., the latter township possibly being over CIRI's entitlement. The easternmost portion of T.16N., R.14W. is identified as priority three and priority four and is probably within CIRI'sentitlement. Cook Inlet Region shows the western half of T.16N., R.14W. as "In-Lieu surface and subsurface estate" which would replace severed estates that were not available in their priority one identifications. Priority four In-Lieu of surface extends into the most southwesterly corner of the same township.

Cook Inlet Region, Inc. filed their selection application for the Beluga Pool February 16, 1978 with the State Division of Lands. Following this, the process will go through five steps: (1) Alaska Department of Natural Resources, Division of Lands, Planning and Classification Section will review the selections for third party rights, other interests and so fourth, (2) State Agencies review, (3) Public Notice persuant to AS 38.05.305 and 38.05.345 requirements, (4) the State conveys a Deed of Title to the United States Department of Interior, (5) Cook Inlet Region, Inc. receives conveyance from the United States under the terms of ANCSA. The Secretary of Interior has 60 days upon acceptance of the State Deed of Title to issue conveyance, without adjudication, to Cook Inlet Region.

Conveyance of the Beluga Pool Land to CIRI is subject to any lawful reservations of rights or conditions contained in the State conveyance as provided by the Terms and Conditions document (see Appendix 4-A). Patent to Cook Inlet Region, Inc. could follow as soon as the land survey is approved. Within two years after initial conveyance, the Secretary of Interior is authorized to identify and reserve any easement he could have lawfully reserved before conveyance. A revised conveyance is to be issued, reflecting such reservations, subject to the agreement of January 18, 1977 between the Secretary of Interior, Cook Inlet Region, Inc. and some of the associated villages in the Region. The Secretary of Interior may start to identify and reserve easements before the State Deed of Title has been received but to do so is not to affect the prompt issuance of conveyance to CIRI by the Secretary of Interior (Public Law 95-178, November 15, 1977).

Of course, all valid existing rights to coal prospecting permits (Table 4-10), coal leases (Table 4-11), oil and gas leases, mineral leases, etc. are protected under terms of the exchange. The State issued a Mineral Closing Order to stop any more prospecting permits from being issued within the Beluga Pool Area, and there has been a moratorium on the transfer of prospecting permits to lease.

However, in May 1978, the State Department of Natural Resources met with industry representatives in an effort to define what is meant by "mining plan" and "commercial quantities" as used in the coal prospecting permits so that the State could formalize those definitions. It is not known whether the Department of Natural Resources will take a hard or soft line relative to the conversion of coal prospecting permits to coal leases in the Beluga land exchange area. Most of the prospecting permits will expire this summer (1978).

The attitude of Cook Inlet Region, Inc. about rights-of-way across its lands, is quite different than that of Tyonek Native Corporation's. While the Tyonek Native Corporation is opposed to all rights-of-way and easements, the Region is not particularly concerned about them. They recognize that in order to remove the natural resources, such as the coal, easements must be made available.

TABLE 4-10
COAL PROSPECTING PERMITS
BELUGA COAL DISTRICT
EFFECTIVE DATE NOVEMBER 1, 1979

Date Issued	ADL	Description	Name	Total Acres
	55604 Terminated	T 12N, R11W SM Sec. 6: All T 12N, R12W All Sec. 1: All 11: All 12: All 13: All 14: All	Starkey Wilson	3,840±
10/1/72	58472 Terminated	T 12N, R11W SM Sec. 1: All 2: All 3: All 4: All 9: All 10: All 11: All 12: All	Locke Jacobs	5,120±
9/18/72	58473 Terminated	T 12N, R11W SM Sec. 13: All 14: All excl. USS 4546 15: All 16: All 21: All 22: All 23: All excl. USS 4546 24: All	Locke Jacobs	4,960

Date Issued	ADL	Description	Name	Total Acres
10/1/72	58475 Terminated	T 12N, R11W SM Sec. 5: All 7: All 8: All 17: All 18: All 19: All excl. USS 1865 20: All excl. USS 4547 24: All	Locke Jacobs	3,762.35±
10/6/72	58690 Terminated	T 12N, R11W SM Sec. 25: All excl. USS 1865 26: All excl. USS 1865 27: All excl. USS 1865 28: All excl. USS 1865 29: All excl. USS 1865	Locke Jacobs to American Metal Climax, Inc.	1,012.56±
7/1/75	67814 *	T 16N, R7W SM Sec. 6: All T 16N, R8W SM Sec. 1: All T 17N, R7W SM Sec. 31: All T 17N, R8W SM Sec. 24: All 25: All 26: All 36: All	Mobil Oil Corp.	4,437±

Date Issued	ADL	Description	Name	Total Acres
7/1/75	67815 *	T 17N, R8W SM Sec. 4: All 5: All 6: All T 18N, R8W SM Sec. 31: All	Mobil Oil Corp.	2,538±
7/1/75	67816 *	T 17N, R8W SM Sec. 9: All 10: All 14: All 15: All 16: All 22: All 23: All	Mobil Oil Corp.	4,480±
			TOTAL	30,150 A±

TERMINATED: The Permits were preceded or superseded by Cook Inlet Native Corporation claims. Pending land status resolution; these permits are considered suspended permit applications.

* Not within area mapped in figure.

Source: Alaska Division of Minerals and Energy Management, Alaska Department of Natural Resources. Contact: Robert Sanders, January 24, 1980.

TABLE 4-11
COAL LEASES
BELUGA COAL DISTRICT
(EFFECTIVE DATE NOVEMBER 1, 1979)

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
1/13/65**	Beluga	.05	25060	T 13N, R10W SM Sec. 7: W½SW¼	Albert E. Slone	80±
1/1/71	Beluga	.10	33795	T 12N, R13W SM Sec. 1: W½ 2: All 3: N½,SE¼ T 13N, R13W SM Sec. 34: All 35: All 36: All	Beluga Coal Co.	3,360±
4/18/72	Beluga	.10	36282	T 13N, R13W SM Sec. 22: SE¼,S½NE½, NE¼SW¼, S½SW¼ 23: All 24: All 25: All 26: All 27: All	Beluga Coal Co.	3,560±
5/10/72	Beluga	.10	36911	T 13N, R12W SM Sec. 19: All 20: All 21: All 28: All 29: All 30: All	Bass Trust Estate to Cloonan & Gibbs	3,833±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
5/10/72	Beluga	.10	36913	T 13N, R12W SM Sec. 14: All 15: All 22: All 23: All 24: All 26: All 27: All 34: All	Bass Trust Estate to Cloonan & Gibbs	5,120±
5/10/72	Beluga	.10	36914	T 13N, R12W SM Sec. 25: All 35: All 36: All T 12N, R12W SM Sec. 2: All 3: All 10: N½	Bass Trust Estate to Cloonan & Gibbs	3,520±
5/10/72	Beluga	.10	37002	T 13N, R12W SM Sec. 31: All 32: All 33: All T 12N, R13W SM Sec. 1: E½ T 12N, R12W SM Sec. 4: All 5: All 6: All 7: N½ 8: N½ 9: N½	Bass Trust Estate to Cloonan & Gibbs	5,058±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
11/13/72	Beluga	.10	37471	T 12N, R12W SM Sec. 7: S½ 8: SW¼ 17: W½ 18: All 19: N½ 20: NW¼ T 12N, $13W SM Sec. 12: E½ 13: E½.SW¼ 24: N½	Beluga Coal Co.	2,966±
4/18/72	Beluga	.10	56982	T 12N, R13W SM Sec. 3: SW¼ 4: N½,SE¼ 5: N½ 10: N½ 11: N½ 12: NW¼ T 13N, R13W SM Sec. 28: All 29: S½.NE¼,S½NW¼ 30: E½SE¼ 32: N½N½,SE¼NE¼, E½SE¼ 33: All	Beluga Coal Co.	3,960±
7/1/78	Beluga	.20	59502	T 12N, R12W SM Sec. 8: SE¼ 9: S½ 10: S½ 15: All 16: All 17: E½ 20: NE¼ 21: N½ 22: NW¼	Starkey Wilson Bass Trust Estate W. H. Hunt	3,040±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
5/1/79	Beluga	.35	62403*	T 23N, R14W SM Sec. 6: SW¼,S½NW¼ 7: S½,NW¼,W½NE¼ 18: All 19: All	Mobil Oil Corp.	2,080±
5/1/79	Beluga	.35	62404*	T 23N, R14W SM Sec. 30: All 31: All 32: W½,W½SE¼ T 22N, R14W SM Sec. 5: All 6: All 7: All 8: All 18: All	Mobil Oil Corp.	4,880±
5/1/79	Beluga	.35	62405*	T 22N, R14W SM Sec. 17: All 19: E½,NW¼,E½SW¼ 20: All 21: SW¼,W½NW¼ 28: N½NW¼ 29: All 30: NE¼,N½SE¼, SE¼SE¼	Mobil Oil Corp.	3,080±
5/1/79	Beluga	.35	62406*	T 22N, R14W SM Sec. 32: N½N½	Mobil Oil Corp.	160±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
5/1/79	Beluga	.35	62407*	T 21N, R13W SM Sec. 19: All 20: SW¼NW¼,SW¼, SW¼SE¼ 29: All 30: E½,E½NW¼, NW¼NW¼ 31: E½,SE¼NW¼ 32: All T 21N, R14W SM Sec. 24: E½,E½NW¼	Mobil Oil Corp.	3,360±
5/1/79	Beluga	.35	62408*	T 20N, R14W SM Sec. 12: E½NE¼,SW¼ 13: E½,NW¼,E½SW¼ T 20N, R13W SM Sec. 5: W½ 6: All 7: All 8: W½ 17: NW¼,W½SW¼ 18: All	Mobil Oil Corp.	3,600±
5/1/79	Beluga	.35	62409*	T 20N, R13W SM Sec. 19: All 30: All 31: All T 20N, R14W SM Sec. 23: E½SE¼ 24: All 25: All 26: E½NE¼,SE¼	Mobil Oil Corp.	3,520±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
5/1/79	Beluga	.35	62410*	T 20N, R14W SM Sec. 35: E½,E½SW¼ 36: N½NW¼,NE¼, E½SE¼ T 19N, R13W SM Sec. 35: E½,E½SW¼ 36: N½NW¼,NE¼, E½SE¼ T 19N, R14W SM Sec. 1: S½,SE¼NW¼,NE¼ 12: NE¼NE¼	Mobil Oil Corp.	2,400±
5/1/79	Beluga	.35	64560*	T 18N, R12W SM Sec. 6: All 7: NW¼	Meadowlark Farms	800±
5/1/79	Upper Beluga Lake	.35	64596*	T 19N, R13W SM Sec. 34: All 35: S½,NW¼ 36: S½ T 19N, R12W SM Sec. 31: SW¼	Meadowlark Farms	1,600±
5/1/79	Upper Beluga Lake	.35	64598*	T 18N, R13W SM Sec. 1: All 2: N½,SE¼,NE¼SW¼ 3: NE¼ 12: NE¼	Meadowlark Farms	1,480±
10/1/76	Beluga	.15	79816	T 13N, R11W SM Sec. 22: All 23: All 26: All 27: All 34: All 35: All	Beluga Coal Company	3,840±

Date Issued	Area	Royalty	ADL	Description	Name	Total Acres
3/1/76	Beluga	.15	309744 (formerly	T 13N, R10W SM Sec. 6: N½,SW¼ T 13N, R11W, SM Sec. 1: E½NW½,NE¼,S½ 12: All 13: N½,SW¼	Elton to Stabio	2,310.5±
					TOTAL	67,607.5±

* Not within area mapped in Figure.
** No rental paid since 1/13/73-1/13/74.

Source: Division of Minerals and Energy Management, Alaska Department of Natural Resources
Contact: Robert Sanders, January 27, 1980.

The revenues produced from development of Cook Inlet Region, Inc.'s subsurface estate, whether it be the subsurface of village lands or the subsurface involved in the land exchange, will be subject to Section 7(i) of ANCSA. This section mandates the sharing of 70 percent of the revenues received from the timber resources and subsurface estate patented to the regional corporations. Seventy percent will be divided annually by each regional corporation among the other eleven regional corporations according to the number of Natives in each region.

BOROUGH LANDS

The Beluga Coal District lies astride of the boundary separating the Kenai Peninsula Borough on the South from the Matanuska-Susitna Borough on the north. Although most of the district lies within the Kenai Peninsula Borough, there are important jurisdictional matters affecting both boroughs, particularly relating to land use, zoning, energy transmission and other transportation issues as well as taxing authority. Neither Borough has zoned any land in the Beluga Coal District, so presently the lands are designated "Unrestricted."

Both Boroughs are also land owners in the district where a portion of their entitlement of ten percent of the State land within their boundaries has been selected by the Boroughs.

OTHER PRIVATE (NON-NATIVE LANDS)

Private non-Native land ownership is minimal so far as the extent of acreage is concerned. Interests in the subsurface estate, on the other hand, have major privately held rights, for oil and gas leases and coal prospecting permits and leases. Affected Native lands acquired as a result of the Settlement Act are subject to any valid existing rights according to Section 14(g) of ANCSA. Appendix 4-B shows the U.S. Surveys in the Beluga Coal District and includes both Native and non-Native lands and, for the most part, describes lands acquired by townships and ranges.

LAND TENURE AND COAL DEVELOPMENT

ENERGY RESOURCES

Land tenure plays a major role in development and is critical to the coal development in the Beluga Coal District: the configuration of lands and ownership of the energy resources, the availability of transportation routes across the land for roads and railroads; energy transmission, including electric power transmission, oil and gas pipelines, coal slurry pipelines, airports and docks and water transport; permanent settlement sites; the ownership of the commodities needed for development, such as water and gravel, as well as which lands may limit development because of incompatible land use, ownership problems or other characteristics.

The State of Alaska and the Cook Inlet Region, Inc. are the two major owners of the energy resources of the area. Those resources are substantial. They include deposits of oil and gas, and coal onshore and offshore of Upper Cook Inlet, several undeveloped hydroelectric sites, and possibly uranium deposits. Oil and gas leases and coal prospecting leases and coal leases are held by several individuals and companies (Table 4-10, Table 4-11 and Figure 4-4). The leases are on State land -- some of which CIRI will be receiving under the land exchange. Section 14(g) of ANCSA protects valid existing rights to leases on land conveyed to the Natives as follows:

> All conveyances made pursuant to this Act shall be subject to valid existing rights. Where, prior to patent of any land or minerals under this Act, a lease, contract, permit, right-of-way, or easement (including a lease issued under section 6(g) of the Alaska Statehood Act) has been issued for the surface or minerals covered under such patent, the patent shall contain provisions making it subject to the lease, contract, permit, right-of-way, or easement, and the right of the lessee, contractee, permittee, or grantee to the complete enjoyment of all rights, privileges, and benefits thereby granted to him. Upon issuance of the patent, the patentee shall succeed and become entitled to any and all interests of the State or the United States as lessor, contractor, permitter, or grantor, in any such leases, contracts, permits, rights-of-way,

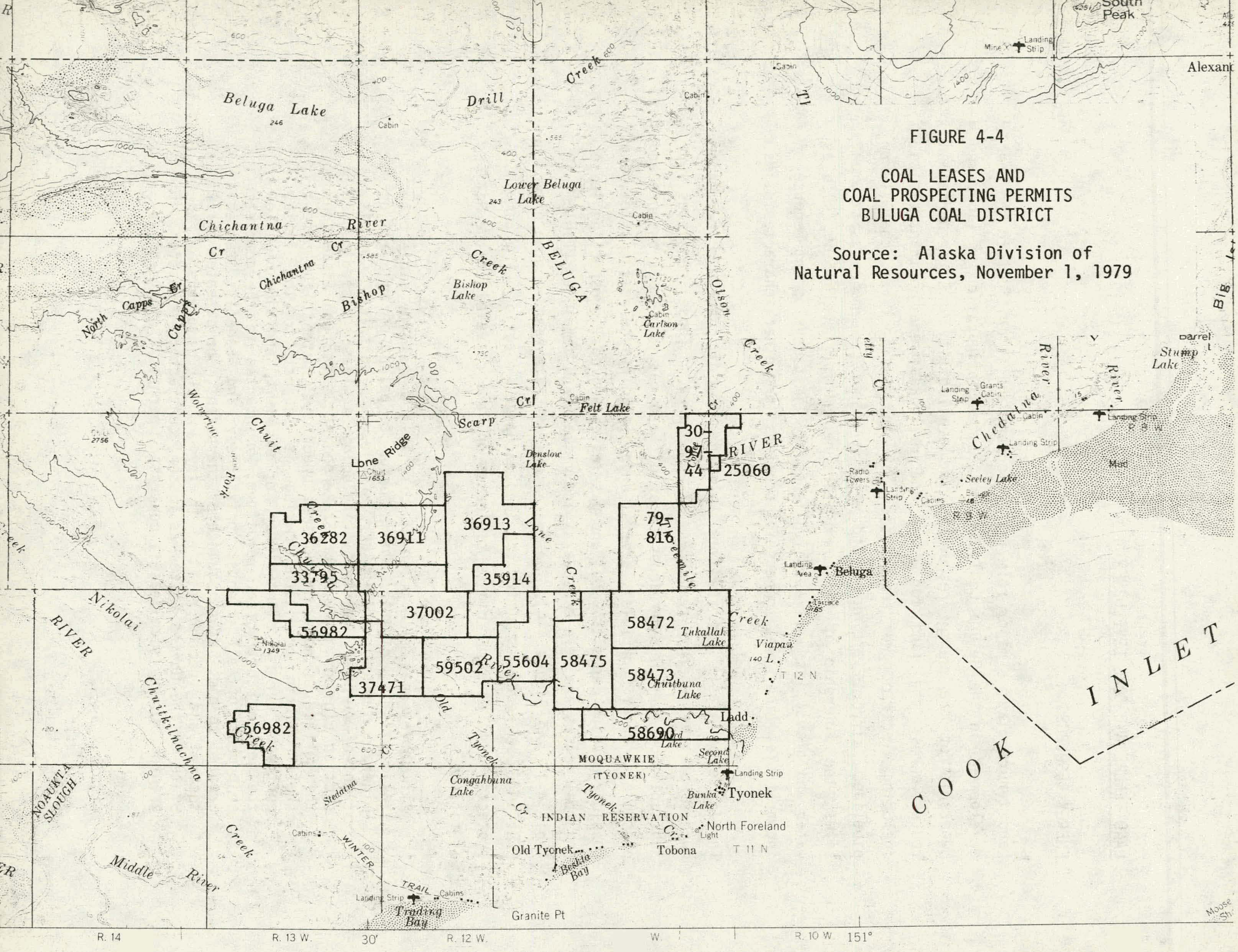


FIGURE 4-4

COAL LEASES AND
COAL PROSPECTING PERMITS
BULUGA COAL DISTRICT

Source: Alaska Division of
Natural Resources, November 1, 1979

> or easements covering the estate patented, and a lease issued under section 6(g) of the Alaska Statehood Act shall be treated for all purposes as though the patent had been issued to the State. The administration of such lease, contract, permit, right-of-way, or easement shall continue to be by the State or the United States, unless the agency responsible for administration waives administration. In the event that the patent does not cover all of the land embraced within any such lease, contract, permit, right-of-way, or easement, the patentee shall only be entitled to the proportionate amount of revenues reserved under such lease, contract, permit, right-of-way, or easement by the State or the United States which results from multiplying the total of such revenues by a fraction in which the numerator is the acreage of such lease, contract, permit, right-of-way, or easement which is included in the patent and the denominator is the total acreage contained in such lease, contract, permit, right-of-way, or easement.

Coal Prospecting Permits

A coal prospecting permit allows the permittee to determine the existence or workability of coal deposits in an unclaimed and undeveloped area. The permit is valid for two years and each permit may include up to 5,120 acres. If within the period of two years, the permittee shows that the land contains coal in commercial quantities and submits a satisfactory mining plan for coal recovery, the permittee can obtain a lease. A coal prospecting permit may be extended for a period of two years if the permittee can provide adequate reasons (regulated by the Department of Natural Resources).

The Mobil Oil Corporation holds coal prospecting permits for 11,455 acres in the northern Beluga area (Table 4-10 and Figure 4-4).

Coal Leases

There are 67,607.5 acres in the Beluga District presently subject to coal lease according to the State Division of Minerals and Energy Management (Table 4-11). The largest lessee in the area near Tyonek is the Beluga Coal Company. This joint venture by Starkey A. Wilson, Richard D. Bass, and W. Herbert Hunt leases 17,686 acres. The next major holder is Cloonan

& Gibbs, with 17,531 acres. On May 1, 1979, Mobil Oil Corporation and Meadowlark Farms required leases in the Beluga vicinity respectively totaling 23,080 and 3880 acres.

The lessee must pay a royalty to the State for the mining or extraction of coal in the lands covered by lease. The royalty rates are effective for a period of 20 years. The royalty cannot be less than 5¢ per 2,000 pounds (short ton). An annual rental cannot be less than 25¢ per acre for the first year, not less than 50¢ per acre for years 2 through 5, and not less than $1.00 per acre thereafter for the duration of the lease. The rental rate is to be revaluated at 20 year intervals.

Coal leases run for an undetermined period of time, conditional upon the continued development and/or operation of a mine. Coal lease contracts can be assignable, upon the approval of the Director of the Division of Lands, by the lessee subject to the laws and regulations applicable to the lease.

Coal leases are divided into leasing tracts of 40 acres each or multiples of 40 acres, and in a form which will permit the economical mining of coal in the tract. The maximum amount of state land that one party may hold under coal lease is limited to a total of 46,080 acres, with up to 5.120 acres of additional land (in multiples of 40 acres) if sufficient reason is shown to warrant the granting of the extra land.

Oil and Gas Leases

The Department of Natural Resources, through the Division of Lands, is authorized to lease subsurface oil and gas resources on a competitive and noncompetitive basis. All lands in the public domain are open for oil and/or gas exploration and development. The provisions of the Miscellaneous Land Use Permit apply to surface oil and gas related activity on State lands where no lease has been issued. In addition, the State, under provisions of the Alaska Land Act, reserves rights to all subsurface gas and oil resources on lands disposed for any other purpose.

"The legislature may preside for the leasing of, and the issuance of permits for exploration of, any part of the public domain or interest therein, subject to reasonable concurrent uses" (State of Alaska Constitution, Article VIII, Section 8).

"Subject to the provisions of this section, the legislature may provide for the sale or grant of state lands, or interests therein, and establish sales procedures. All sales or grants shall contain such reservations to the State of all resources as may be required by Congress or the State and shall provide for access to these resources" (State of Alaska Constitution, Article VIII, Section 9).

"Surface uses of land by a mineral claimant shall be limited to those necessary for the extraction or basic processing of the mineral deposits, or for both" (State of Alaska Constitution, Article VIII, Section 11).

"Leases and permits giving the exclusive right of exploration for these minerals for specific periods and areas, subject to reasonable concurrent exploration as to different classes of minerals, may be authorized by law" (State of Alaska Constitution, Article VIII, Section 12).

The Commissioner of Natural Resources is authorized under AS 38.05.027 to enter into cooperative resource management or development agreements with other State agencies, Federal agencies, villages, municipal governments and individuals.

"In addition, AS 38.05.285 requires that disposal and of State lands shall conform to the constitution and the principles of multiple purpose use consistant with public interest. AS 38.05.300 provides that no state land, water or land and water area shall, except by the act of the state legislature, be closed to multiple purpose use, if the area contains more than 640 acres" (U.S. Office of Coastal Zone Management Document Gas and Oil Leasing).

"Terms of leases are dependent on the kinds of lands leased (competitive or noncompetitive) and the status of oil and gas field production. The term for a competitive lease is 10 years at the Commissioner's [of Natural Resources] discretion and such leases continue as long as oil and gas is produced. Noncompetitive leases extend five years, or as long as oil and gas is produced in paying quantities (AS 38.05.180 (a))" (U.S. Office of Coastal Zone Management Document Gas and Oil Leasing).

TRANSPORTATION

LAND

In Alaska, a key to development of any resource is transportation. An important element is the land status which makes the development of transportation routes possible. Overland routes for roads, railroads, power transmission lines, and pipelines depend on rights-of-way and easements. Suitable air corridors and airport lands must be available as well as sealanes and adequate dock sites. All play a part in the complex problem of moving goods, supplies and workers to and from the mine site as well as moving coal from the mines in the Beluga Coal District to markets elsewhere. Appendix 4-C lists the Right of Way permits for this area.

EASEMENTS ACROSS NATIVE LANDS

One of the thorniest issues of land rights in the Beluga Coal District is that of easements across Native Lands. The Tyonek Native Corporation has adamantly refused to accept any easements across their former Moquawkie Indian Reserve and has also taken a very strong position relative to easements across lands they have selected north of the reservation. However the Interim Conveyance, I.C. 087, to their former Moquawkie Indian Reserve, contains several easements, at least temporarily set aside by the Federal government (see I.C. 087, Appendix E). Judge James A. von der Heydt, Federal District Court, in Anchorage has rendered a decision in Calista et. al. versus Andrus et. al. 435F.SUPP.664 (Decision Alaska 1977).

The present controversy arose over Native objections to Federal demands for numerous easements across the lands to be conveyed to them.

(See Volume 1, Chapter 3 of Alaska's Energy Resources, Findings and Analysis, for a discussion of the nature of the easement dispute.) The only lands in the Beluga District subject to the settlement of the Calista case are the former Moquawkie Indian Reservation and two-thirds of a township directly north of the Reservation.

On March 3, 1978, the Secretary of Interior released his 24-issue policy guidelines document on March 3, 1978 which presents the Federal position on easements. This document represents the working base from which the May 25, 1978 proposed U.S. Department of Interior, Bureau of Land Management rules on Easements across Native lands were made.

The following discussion summarizes the issues involved in the easement dispute and describes easements as provided in the interim conveyances prepared under present BLM policy.

Easements On and To the Marine Coastline

Interim conveyance documents cite a continuous 25 foot wide linear easement along the coastline for purposes of public access and recreation. The Secretary's 24-issue policy document suggests reducing the continuous easement to site easements along the coast as appropriate points to facilitate travel purposes only, such as beaching of water craft. Specific uses of periodic coastline easements would be clarified in revised interim conveyances. Also, a limited number of linear access easements perpendicular to the coast would be reserved to allow access to interior public lands.

Easements On and To Waterways (Rivers, Lakes and Streams)

The present Federal policy of reserving easements along recreational rivers and streams is to be, according to the 24-issues policy document, restricted to periodic points along "major" waterways. Major waterways are to be defined by the criteria of significant commercial or transportation use, or significant resource value (including recreation). The use of these site easements will be limited to activities related to travel along the waterway (e.g. beaching of boats and float planes). Some linear access easements to "major" waterways and to public lands beyond conveyed Native lands may be reserved.

Transportation and Utility Corridors and Statutory Easements

Interim Conveyances retain rights-of-way for ditches, canals, telephone and telegraph lines and railroads constructed by the authority of the Federal government. Easement corridors for energy, fuel, and natural resources transportation were also reserved and included the right of eminent domain. The Secretary has revised his policy and will now ask for no reservations for transportation or utility corridors nor easements future ditches, canals, telephone, telegraph and railroad lines unless they are justifiable, and site specific at the time of conveyance.

A tentative, unsurveyed routing of an Alaska Railroad extension to the Beluga District passes through lands which are a part of the Exchange Pool. The Terms and Conditions agreement of the Cook Inlet Exchange requires the State to convey its lands to the Federal government in the exchange as they were received, less valid, existing rights (such as leases, permits, etc.). In turn, the Federal government is to convey the lands to the Natives involved pursuant to the terms of the Exchange agreement. The lands involved in the Exchange is governed by the Land Exchange Agreement.

Native vs. Public Use

In determining whether a public easement is required over Native lands to assure access to public lands, the Secretary of Interior's policy is to not distinguish between Native use and public use. Both "Native" and "non-Native" use will be considered public use. Easements will be adopted only where there is a demonstrated need to cross Native lands, and where no reasonable alternate routing exists. Access easements would be subject to use restrictions.

Cut-off Date for Determining Present Use

December 18, 1976, or the date of selection, whichever is later, is the cut-off date used to determine whether sufficient use exists to warrent an easement across Native lands for access to other public lands and resources.

As a result of the Court's decision, the Secretary of Interior has proposed new rules concerning reservations of public easements on Alaska Native land selections. In the meantime, the Bureau of Land Management operates under an easement agreement they made with the Native Corporations whereby the Bureau of Land Management uses the old easement policy. The BLM plans to conform the interim conveyances and patents according to the new regulations. The new regulations were only recently proposed by the Secretary of Interior; written comments on his proposals to be received on or before June 26, 1978. The agreement with the Native Corporations says, in essence, that the United States of America will relinquish any easements the Court finds illegal and the Native Corporations are to donate any easements which were not reserved in the conveyance documents, but which the Court finds could have been reserved. So long as the Bureau of Land Management has the consent of the Native Corporation, to make conveyance subject to the easements in the current policy, the BLM may convey lands. New rule making by the Secretary of Interior could take years to resolve, with conforming Interim Conveyances or Patents to follow.

Cook Inlet Region, Inc. has not taken a stand opposing easements across their lands and are not expected to take a hard line opposing them. Under the terms and conditions of the land exchange, the Secretary of Interior has two years following conveyance in which to identify easements across Cook Inlet Region lands. (See Appendix 4-A for the Terms and Conditions segment which affects the Beluga Coal District.)

STATE HIGHWAY PROPOSAL

The most significant right-of-way in the Beluga Coal District is the State's Chuitna-Goose Bay Road Right-of-Way Permit (ADL Application No. 57588) for 200 feet on each side of the centerline. This is a proposed extension of the existing State Highway between Knik and Goose Bay. The application was filed by the State Department of Highways (now Department of Transportation and Public Facilities) in June 1972, six months after Congress approved the Alaska Native Claims Settlement Act. Although the State Division of Lands approved the application, there is no indication that the Tyonek Native Corporation approved it.

The proposed highway alignment starts at approximately the center of the former Moquawkie Indian Reservation, and runs northeast toward Goose Bay. It goes west of Chuitbuna Lake, crosses Three-mile Creek Subdivision, crosses the Beluga River in Section 8, T.13N., R.10W., S.M., crosses Olson Creek, crosses the north and south forks of Pretty Creek, crosses the Theodore River about four miles west of the Chugach Electric Association Power Transmission Line and continues northeast. The highway has not been surveyed in the field, but is identified by section lines and by a metes and bounds description.

No further action has been taken on the right-of-way permit application. To a considerable extent, action must await approval from the Natives once the Cook Inlet Land Exchange is accomplished since the highway would cross lands conveyed to the Natives.

ELECTRIC POWER TRANSMISSION LINES

Chugach Electric Association presently has electric power transmission lines running from the Beluga Gas Field northeast. They cross the Susitna River and Knik Arm and provide electric power service to the Anchorage area. However, additional electric power transmission lines will be needed if electricity is generated from coal on site. One proposal, suggested by Beluga Coal Company is a loop down the west coast of the Inlet to cross between West Forelands and East Forelands to tie into the existing transmission line at Nikiski at North Kenai.

COAL SLURRY PIPELINE

It would appear that construction of a slurry pipeline might face some right-of-way problems in the Beluga area. In western states, slurry pipelines are opposed by railroad companies who believe that business would be lost due to competition presented by the long-range economic advantages of large volume slurry pipelines. So far, railroads have been able to prevent construction by refusing to grant pipelines the right to cross railroad rights-of-way.

Legislation has been introduced in the U.S. Congress to allow slurry pipelines the right of eminent domain to condemn railway crossings where needed. Such legislation has not as yet been successful. Although no actual railroad exists in the Beluga District, the Federal government has reserved a right-of-way for railroads in the patents which transferred lands to State ownership. Whether or not this right-of-way constitutes a blanket easement across the lands, and consequently whether the Alaska Railroad can object on such grounds to a proposed slurry pipeline routing over the lands has not been addressed. (Reference Comparative Study of Coal and Nuclear Generating Options for the Pacific Northwest.)

OTHER COAL TRANSPORTATION

Routes for coal slurry pipelines, solid coal conveyor belts, or a short-haul railroad from the mine-mouth to the docks may be needed. Cook Inlet Region, Inc. as a provision of its land exchange with the State, has secured a 300 foot unspecified location easement running from the Capps Glacier Field in T.13N., R.14W., S.M. to the beach at the eastern edge of Trading Bay, T.11N., R12W., S.M. which could be used for these purposes.

Patents issued to the State, as well as to individuals under Federal public land laws for homesteads, small tracts, trade and manufacturing sites and so forth have reserved to the United States the following standard reservations:

1. A right-of-way thereon for ditches and canals constructed by the authority of the United States, as prescribed and directed by the act of August 30, 1890, 26 Stat. 391; 43 U.S.C. 945;

2. A right-of-way thereon for the construction of railroads, telegraph and telephone lines, as prescribed and directed by the act of March 12, 1914, 38 Stat. 305; 43 U.S.C. 975d;

The subsurface rights, under the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688. 704; 43 U.S.C. 1601, 1613 (Supp.V, 1975,)) belong to the Native corporations. In the case of the Beluga coal fields these rights belong to the Cook Inlet Native Association. However, pursuant to section 17(b) of the Alaska Native Claims Settlement Act, some public easements--easement identification letters (EIN) on the easements map in case file AA-6707-EE are reserved to the United States and subject to further regulation thereby.

ALASKA RAILROAD

It appears that the Alaska Railroad would have little difficulty in securing adequate rights-of-way for new line construction due to the blanket easement across most lands in Alaska and on most lands in the Beluga Coal District. A possible exception is the Moquawkie Reserve Lands just north of the former reserve (State tentatively approved land selected by Tyonek Native Corporation). The standard easement reservations have been imposed on their I.C. 087 but will undoubtedly be lifted by the Secretary of Interior after the new rule making has been approved.

TIMBER ROADS

Timber roads criss-cross the western part of the Moquawkie Indian Reserve and into the area to the west containing the 1973 State timber sale. The

State sold the timber to Kodiak Lumber Mills, Inc. in an effort to stop the spread of the spruce beetle infestation in the trees on the west side of Cook Inlet. The roads were built to allow removal of the trees which were chipped near the dock. The chips were transported by ship and exported. The status of the timber roads rights-of-way is unknown at this time.

SEISMIC TRAILS

Seismic trails also are visible in the area. These are usually seen as straight line brushed-out areas and were used for seismic studies to determine the oil and gas potential of the region. Presumably, no rights-of-way attach to these brush lines.

SECTION LINE EASEMENTS

Section line easements of 33 feet on each side of the section line for a total of 66 feet provide legal access to Federal lands. State lands have a 50 foot section line easement, 50 feet on each side of the section line. Although section line easements do not provide access that relates to the topography--they are, after all, straight line easements--they do, nonetheless, provide legal access across the land.

Under the authority of Revised Statutes No. 2477 enacted by Congress in 1866, the Federal government offered to the States and territories a general Federal grant of a public right-of-way over public lands "not reserved for public uses." Such public uses which might already have been reserved were national forests or national parks. The Territory of Alaska legislatively accepted the Federal grant on April 6, 1923. All section lines in the Territory were designated as public rights-of-way. The acceptance continued by legal statute until 1949 when it was repealed for a period of four years. On March 20, 1953, acceptance of the Federal grant was again re-enacted by legal statute. Informed legal opinions by the Alaska State Attorney General's office affirm that State owned (that is, patented) lands will not be affected by repeal of R.S. 2477 in the

1976 Federal Land Policy and Management Act (1976 Organic Act). The provision repeals the original Federal offer of the right-of-way grant along section lines to the states. However, insofar as the original Federal offer was legislatively accepted prior to passage of the 1976 act, existing rights-of-way are considered valid.

The present Alaska legal statute concerning right-of-way dedication between section lines is AS 19.10.010. This statute dedicates a strip of land 100 feet wide for highway use between each section of land owned by the State and 66 feet wide between all other sections of the State, specifically sections of federally owned lands. Since there are no Federal lands in the Beluga District, the 66 foot right-of-way does not apply. Nearly all the lands in the Beluga District are surveyed and patented State lands, except for a portion of one township. Thus, each section in the district is bounded by a 100 foot wide right-of-way.

An important question regarding the existing right-of-way between section lines is the possible and potential usage of the land for purposes other than highways, or in conjunction with highways. AS 19.25.010 provides the legal authority and required approvals for the use of utilities along the constructed highways rights-of-way. Specified in the statute is the following: "An electric transmission, telephone or telegraph line, pole line, railway, ditch, sewer, water, heat, or gas main, flume, or other structure which by law may be constructed, placed or maintained across or along a highway by a person or political subdivision may be maintained or constructed only in accordance with regulations prescribed by the department (Alaska Department of Transportation & Public Facilities)." There is presently considerable overlapping of authority of the rights-of-way. The Department of Transportation & Public Facilities and the Division of Lands, are currently establishing regulations which will disentangle the overlapping authority, clarify accepted uses and revise procedural matters.

Several court cases have fairly well established usage of the rights-of-way for public purposes. State policy, therefore, would most likely support uses which are deemed to be in the public interest. A potential conflict always exists as to the nature of the public interest.

HISTORIC TRAILS, SITES AND CEMETERIES

Historic trails in the area were identified in a 1973 inventory done by the State Department of Highways (now the State Department of Transportation and Public Facilities). Table 4-12 identifies the historic trails in the Beluga Coal District. The Highway Department claims legal access through prescriptive rights along these traditionally travelled ways.

Several Native historic sites and cemeteries have also been identified in the area, see Figure 4-5.

RECOMMENDATIONS FOR FUTURE LAND USE

Based on the initial study of land tenure, land status, land classifications and zoning in the Beluga Coal District, the following preliminary recommendations are submitted:

LAND STATUS

All land status, land tenure, classifications and zoning in the Beluga Coal District must be determined accurately by using correct maps and records. The work contained in this report was based in part on records that are inaccurate. Time constraints did not allow for additional research to rectify data inconsistencies.

PLANNED DEVELOPMENT

On resource management lands, it seems appropriate for the State to sell commercial stands of timber well in advance of surface mining efforts on the coal leases. This will assure maximum resource utilization for the timber as well as the coal. Thus the timber won't be "wasted" as a residue of surface mining land clearance.

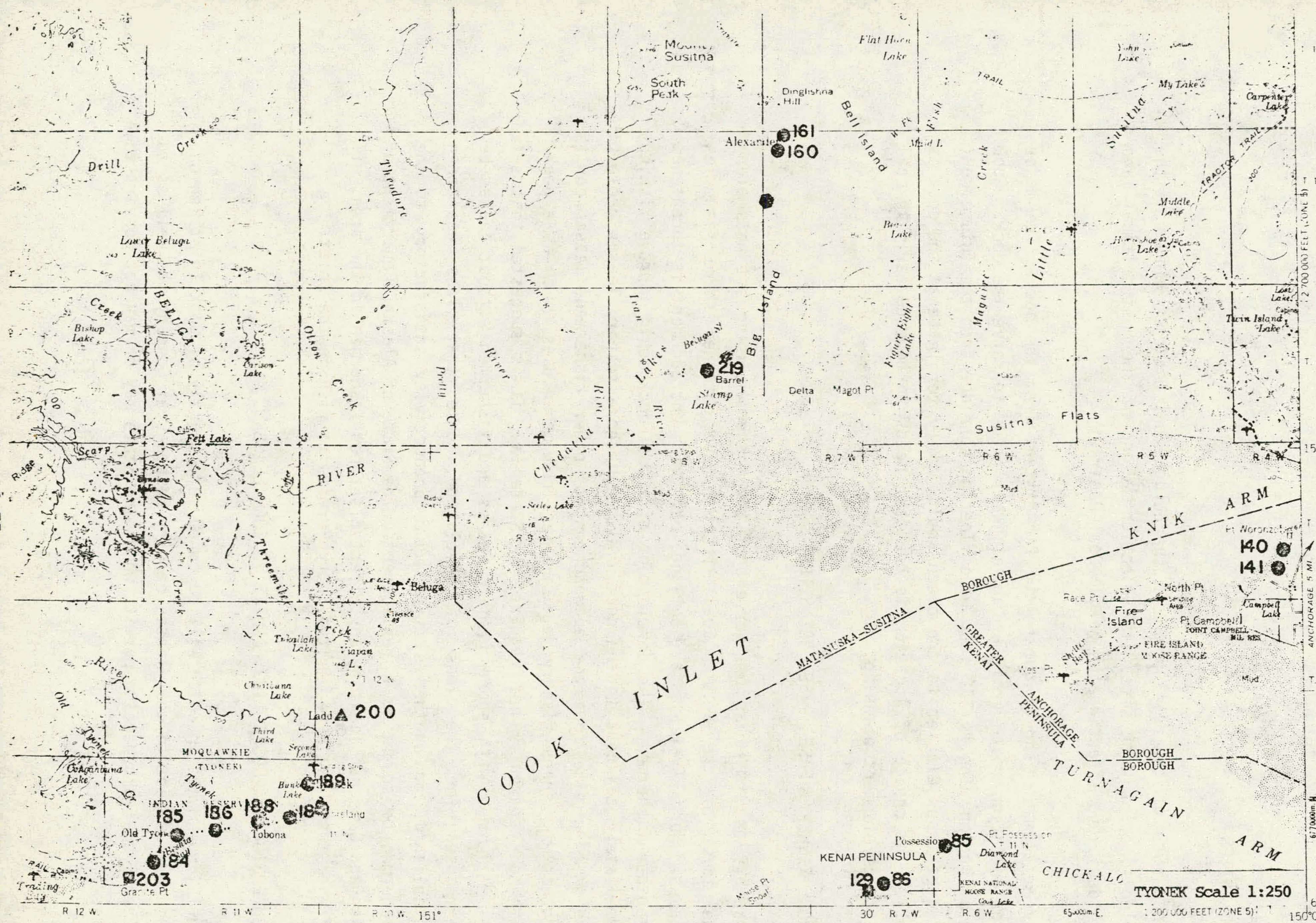
TABLE 4-12

EXISTING TRAIL SYSTEM

Beluga District

TRAIL NAME	QUADRANGLE & NUMBER	LOCATION	SOURCE	DESCRIPTION
None	Q70 - #1	T.13N.R.10W. SM	USGS Tyonek Quad	Trail begins at south shore of Beluga River and runs SW to radio towers, then north to cabins.
Susitna - Tyonek	Q70 - #2	T.11,12,13,14,15, 16,17N. R.7,8,9, 10,11W. SM	ARC Annual Report 1930 Part II, Page 61. & Fifty Years of Highways - Ak. Dept. Public Works, Div. of Highways 1960, pg. 29-30.	Trail begins at town of Susitna T.17N.R.7W. and runs in a SW direction for 46 miles to town of Tyonek T.11N.R11W.
Winter Trail	Q70 - #3	T.11N.R.12,13W. SM	USGS Tyonek Quad	Trail runs from Trading Bay to cabins on Nikolai Creek.
Mary's Lane	Q70 - #11	T.15,16N.R.9W. SM	Based on old mining claim map mining activity 1907. Man who mines in the area came to the Dept. of Highways provided on 7/3/73 and this information.	Looking down Lewis River from Mary's Lane, trail proceeds north along Lewis River to landing strip and mine.

Source: State of Alaska. Dept. of Highways. Alaska Existing Trail System. Pg. 246 & 249.



Native Historic Sites
Beluga Coal District
Figure 4-5

DOCK SITES

Since much of the development in the Beluga Coal District hinges on the selection of a dock site, its selection is one of the most critical land use decisions affecting the Belgua Coal District.

Any settlements should not be too far distant from the dock. The major transportation route (rail and/or highway) needs to serve the dock. Cook Inlet Region, Inc.'s 300 foot wide floating corridor from the future coal mine at Capps Glacier to the beach would likely terminate at the dock as well. The choice of location is one that needs to be made early in coal field development planning.

SHORE FISHERY LEASE -- SET NET SITES

Possibly as little as ten percent of the fishermen using set nets along the coast of the Beluga Coal District have obtained shore fisheries leases. Normally leases are obtained only when encroachment is threatened by other fishermen. The development of a coal dock could improve fishing immediately adjacent to the dock. Although shore fishery leases protect the fishing site from the encroachment of other fishermen, leases don't protect the shore fishery lease holder from other uses, such as a dock. Although apparently not required by State law, it is suggested that set net fishermen with shore fishery leases and fishermen without leases be reimbursed for the loss of livelihood, once that loss has been established, or another site of equal productivity satisfactory to the fishermen be sought as a replacement. The State of Alaska, Department of Fish and Game can identify any affected set net fishermen in the area, all of whom must also have Limited Entry Permits to fish in the Inlet.

CONVERSION OF PROSPECTING PERMITS TO COAL LEASES

Coal lands owned or which will be owned very shortly by Cook Inlet Region, Inc. are subject to coal leases held by Beluga Coal Company, as well as to several coal prospecting permits which the State may or may not convert to lease.

The State, as the largest owner of coal lands in the district, is responsible for the management of all coal leases and prospecting permits including those on the State Mental Health Lands lying between the Tyonek Native Corporation Village Lands and Cook Inlet Region exchange lands. Numerous coal prospecting permits are also found on these Mental Health Lands. The moratorium on converting prospecting permits to coal leases has been responsible for halting the issuance of leases.

PROPOSED STATE HIGHWAY: CHUITNA TO GOOSE BAY

The proposed highway might best be part of a corridor that would include future electric power transmission lines, a proposed railroad link and the proposed highway, as well as provision for other utilities that are necessary. So far, the Tyonek people have made it clear that they do <u>not</u> want such a tie located on Tyonek Native Corporation Lands; at least they are unwilling to give their land away for such a road. The proposed highway might be realigned across borough lands to tie into the existing road north of the Chuitna River. Such a tie would allow existing roads to be used north of the Chuitna River on Tyonek Native Corporation Lands, but would not impose on the former Moquawkie Reserve where the Village is located.

FUTURE PERMANENT SETTLEMENTS

The coastline from Beluga south to Kustatan on West Forelands has seen numerous traditional Native Settlements over the past several hundered years. The status plats show that some of the best settlement locations are on lands selected by the Kenai Peninsula Borough. The area surrounding Congahbuna Lake is under a Reserved Use Classification for a future subdivision. To many observers, this is the area that is most appealing for a permanent settlement. Care should be taken to assure that any permanent settlement is not located on a prospectively "high value" coal production area.

TRADING BAY AND SUSITNA FLATS STATE GAME REFUGES

One of the first considerations to be resolved prior to the development of any facilitiles or structures is that that of transportation and utility corridors. In the Beluga coal field it will be necessary to make use of an easement to loop the electricity generated from coal from the future coal mines west along the coast, crossing the Cook Inlet between West and East Forelands, looping north to follow the general alignment of one or the other of the gas lines, crossing the mouth of Turnagain Arm, thence to Anchorage. Looping east from the future coal mine(s), power transmission would go through the Susitna Flats State Game Refuge following the general alignment of the existing power transmission lines serving Chugach Electric Association, running from the Beluga Gas Field (or north of there) to Anchorage. Taking the proper environmental safeguards, appropriate easements could be set aside for proper passages through the Trading Bay State Game Refuge and the Susitna Flat State Game Refuge.

FUTURE HYDROPOWER DEVELOPMENT

Potential hydropower development at Chakachamna Lake and Chakachatna River are presently protected by U.S. Survey 3970, and Power Site Classification 395. This is one of the lowest cost large scale potential hydropower sites in the Southcentral Region, with an index cost of 6.5 and an estimated installed capacity of 366 MW with a plant factor of 50 percent. It is appropriate that the development plans for the coal field take the future hydropower development (possibly in the 1990's) into account, particularly for transportation and power transmission line planning.

EXISTING WATER RIGHTS

The water rights of the existing settlements along the coast of the Beluga Coal District should be protected. The limited number of water rights holders shows that this has not yet been done by the local residents. In order to avoid future conflict with industrial developers, the local residents should assure their own water rights through the appropriate permitting procedures. Possibly the watershed serving the area should be identified and set aside. As it is in the North Kenai area, water could become a major topic of dispute between the local people and industrial developers.

NATIVE HISTORIC SITES AND CEMETERIES

Immediately following site selection for the dock, additional local road alignments, the permanent settlement site (if any), and especially development activities affecting the coastline, studies should be started to determine significant Native historic sites and burial grounds in the path of proposed development. It is likely that any site selected for its valuable location would also have been used in the past by Native people for similar reasons.

PERMITTING PROCEDURES

This report was written as the permit procedures existed in June 1978. However, because of the state of flux in this rapidly changing field, substantial changes may have taken place since the writing of this document. Further pursuit of information on the Land tenure of the Beluga coal fields should be coordinated with the Alaska Division of Lands. This office will have the most up-to-date information.

APPENDICES
CHAPTER 4

The following appendices should be used only for superficial reference in regard to the subject matter contained in this Chapter. Because of the rapidly changing status of land in the Beluga area, this information cannot be used as a legal representation of land status. All correspondence should be addressed to the Alaska Division of Lands.

APPENDIX 4-A

TERMS AND CONDITIONS OF THE COOK INLET LAND EXCHANGE

(SELECTED SEGMENTS AFFECTING THE BELUGA COAL DISTRICT)

STATE TO U.S. & U.S. TO CIRI

II. Upon consent by the State to be bound by the terms and conditions of this Document, which consent must be given, if at all, within 60 days of the commencement of the 1976 Session of the Alaska State Legislature, the State shall convey to the United States for reconveyance to CIRI the lands described in Appendix C of this Document. Said Lands shall be considered State lands until the United States accepts the State's Deed of Title. Upon acceptance of the State's Deed of Title, the Secretary shall withdraw the lands conveyed thereby, subject to valid existing rights, from all forms of appropriation under the Public Land Laws, including the mining and mineral leasing laws, and from selection under the Alaska Statehood Act, as amended; such withdrawal to expire upon reconveyance of said lands to CIRI.

APPENDIX C

(Reference: Paragraph II this Document)

I. If CIRI has on or before January 12, 1976, presented evidence satisfactory to the State that the villages of Knik, Chickaloon, Alexander Creek, Tyonek, Ninilchik and Salamatof have withdrawn selection applications for and relinquished all claims to land in the Lake Clark, Lake Kontrashibuna and Mulchatna River areas, the State shall convey:

Source: U.S. Department of Interior, State of Alaska, Department of Natural Resources, Cook Inlet Region, Inc. Terms and Conditions for Land Consolidation and Management in Cook Inlet Area, Submitted Dec. 10, 1975 and clarified Aug. 31, 1976 to the House Commission on Interior and Insular Affairs.

T. 16 N., R. 13 W.;

T. 16 N., R. 12 W.,

Sec. 7 all;

Secs. 16 - 22 all;

Secs. 25 -36 all;

T. 16 N., R. 11 W.,

Secs. 20 - 21 all;

Secs. 25 - 36 all;

T. 15 N., R. 14 W.;

T. 15 N., R. 13 W.;

T. 15 N., R. 12 W.;

T. 15 N., R. 11 W.;

T. 15 N., R. 10 W.,

Secs. 5 - 9 all;

Secs. 16 - 21 all;

Secs. 28 - 33 all;

T. 14 N., R. 15 W.;

T. 14 N., R. 14 W.;

T. 14 N., R. 13 W.,

Secs. 4 - 9 all;

Secs. 16 - 21 all;

Secs. 28 - 33 all;

T. 14 N., R. 11 W.;

T. 14 N., R. 10 W.,

Secs. 4 - 9 all;

Secs. 16 - 21 all;

Secs. 28 - 33 all;

T. 13 N., R. 15 W.;

T. 13 N., R. 14 W.;

T. 13 N., R. 10 W.,

Secs. 1 - 3 all;

Secs. 10 - 11 all;

Secs. 12 - 13 excluding lands east of the ordinary high water mark on the right bank of the Beluga River;

Secs. 14 - 15 all;

Secs. 22 - 27 all;

Secs. 34 - 36 all;

T. 12 N., R. 15 W.;

T. 12 N., R. 14 W.,

Secs. 1 - 22 all;

Secs. 27 - 28 all;

Sec. 30 all;

Secs. 34 - 35 all;

T. 12 N., R. 10 W.;

T. 11 N., R. 13 W.,

Sec. 12 all;

Sec. 13 E 1/2, NW 1/4, E 1/2 SW 1/4;

Sec. 24 NE 1/4 NE 1/4;

T. 11 N., R. 12 W.,

Sec. 18 all;

Sec. 19 N 1/2, N 1/2 SE 1/4;

Sec. 20 all.

(2) Provided, however, that the following described lands shall <u>not</u> be available for CIRI's selection of subsurface estate:

Seward Meridian, Alaska

(Beluga Gas Field)

T. 13 N., R. 10 W.,

Sec. 11 E 1/2;

Secs. 12 - 14 all;

Secs. 22 -27 all;

Sec. 33 E 1/2;

Secs. 34 - 36 all;

(B) (1) Thirteen and one-half townships of surface and subsurface estate from the Beluga Area Townships listed in these sub paragraphs B.1. and B.2. The identity of those lands shall be determined by CIRI within eighteen months following the implementation of this document by nomination of compact units no less that 1/4 township in size lying along township lines, provided that where constrained by selection pool boundaries or water bodies they may be smaller; provided, however, that if Tyonek Corporation desires to trade the surface estate it holds in the Kenai National Moose Range for State surface lands within the vicinity of its village lands but within CIRI's selection pool, it may obtain up to one township of such lands. If Tyonek Corporation does trade for CIRI's selection pool lands, CIRI shall select an equivalent acreage of other lands from within this selection pool:

Seward Meridian, Alaska

T. 16 N., R. 14 W.;

T. 12 N., R. 10 W.,

Secs. 2 - 5 all;

Secs. 8 - 10 all.

(Nicolai Creek Gas Field)

T. 11 N., R. 12 W.,

Sec. 16 SW 1/4;

Sec. 17 S 1/2;

Sec. 18 SE 1/4;

Sec. 19 E 1/2, E 1/2 W 1/2;

Sec. 20 all;

Sec. 21 W 1/2;

Sec. 28 W 1/2;

Secs. 29 - 32 all.

(3) The State shall provide a floating, public, 300 foot wide transportation easement from T. 13 N., R. 14 W., Seward Meridian, Alaska, to the shore of Cook Inlet in T. 11 N., R. 12 W., Seward Meridian, Alaska, said easement to be determined upon the ground at such future time as a need exists and there are adequate field data available upon which the State may finally plan and locate the corridor.

II. All Conveyances of lands made in accord with this Appendix C shall pass all of the State's right, title and interest in the lands, including the minerals therein, as if those conveyances were made pursuant to Section 22(f) of ANCSA, except that dedicated or platted section line easements and highway or other rights-of-way may be reserved to the State. Conveyances of surface estate pursuant to this Appendix C shall include sand and gravel as a matter of agreement.

APPENDIX 4-B

UNITED STATES SURVEYS

(PREDOMINANTLY PRIVATE LANDS)

BELUGA COAL DISTRICT

U.S. SURVEY NUMBER	LOCATION
4550	T.11N., R.12W., S.M. Sec. 29.
1880	T.11N., R.12W., S.M. Sec. 27.
4548	T.11N., R.12W., S.M. Sec. 27.
3895	T.11N., R.12W., S.M. Sec. 28.
4549	T.11N., R.12W., S.M. Sec. 28.
4678	T.11N., R.13W., S.M. Sec. 14 & 15.
4540	T.12N., R.10W., S.M. Sec. 4.
3072	T.12N., R.10W., S.M. Sec. 4.
4541	T.12N., R.10W., S.M. Sec. 4.
4545	T.12N., R.10W., S.M. Sec. 7.
4542	T.12N., R.10W., S.M. Sec. 17.
3411	T.12N., R.10W., S.M. Sec. 17 & 20.
4543	T.12N., R.10W., S.M. Sec. 17 & 20.
3270	T.12N., R.10W., S.M. Sec. 20.
4679	T.12N., R.10W., S.M. Sec. 20.

UNITED STATES SURVEYS

(PREDOMINANTLY PRIVATE LANDS)

BELUGA COAL DISTRICT

U.S. SURVEY NUMBER	LOCATION
2089	T.12N., R.10W., S.M. Sec. 30.
4544	T.12N., R.10W., S.M. Sec. 30.
364	T.12N., R.10W., S.M. Sec. 30.
1865	Moquawakie Indian Reservation
2345	T.12N., R.10W., S.M. 3M. Crk. Sub.
4547	T.12N., R.11W., S.M. Sec. 20.
4546	T.12N., R.11W., S.M. Sec. 14 & 23.
3956	T.13N., R.9W., S.M. Sec. 11.
3961	T.13N., R.9W., S.M. Sec. 7.
3959	T.13N., R.9W., S.M. Sec. 17.
3957	T.13N., R.9W., S.M. Sec. 16.
3901	T.13N., R.10W., S.M. Sec. 12.
3962	T.13N., R.10W., S.M. Sec. 35.
3596	T.13N., R.10W., S.M. Sec. 35.
3963	T.13N., R.10W., S.M. Sec. 35.

UNITED STATES SURVEYS

(PREDOMINANTLY PRIVATE LANDS)

BELUGA COAL DISTRICT

U.S. SURVEY NUMBER	LOCATION
3964	T.13N., R.11W., S.M. Sec. 30 & 31.
3954	T.14N., R.9W., S.M. Sec. 11.
3156	T.14N., R.9W., S.M. Sec. 34.
3955	T.14N., R.9W., S.M. Sec. 36.
3949	T.14N., R.12W., S.M. Sec. 15 & 16.
3953	T.15N., R.10W., S.M. Sec. 7.
3952	T.15N., R.11W., S.M. Sec. 27.
3948	T.15N., R.12W., S.M. Sec. 7, 8, 17 & 18.

APPENDIX 4-C

RIGHT-OF-WAY PERMITS BELUGA COAL DISTRICT

ADL Permit Number & Effective Date	Permittee	Size	Use	Legal Description (all Seward Meridan)
34776 9/27/67	Matanuska Electric Assoc. acting agent for Village of Tyonek, Box 6, Palmer, Alaska	27 acres- 100' width		T11N, R12W, Sec. 21, 22, 28 M & B
32183 1/16/68	Chugach Electric Assoc.	18.18 acres 50' width		T13N, R10W, Sec. 27, 34 M & B
37198 12/11/67	Chugach Electric Assoc.	10.3 acres - 200' width		T13N, R10W, Sec. 26 (M & B)
37819 5/12/70	Phillips Petroleum Co Box 1967 Houston, Texas	100' width		T10N. R8W; T10N, R9W; T11N, R9W, ATS#835 T.R.W.P.#14
56013	Marathon Oil CO. & Union Oil Co. of Calif Box 2380, Anchorage	50' width 132,500' length (152.09 acres)	gas pipelines	T9N, R14W, Sec.5, 17, 20, 29, 30, 32, 8; T10N, R14W, Sec. 10, 11, 12, 16, 1, 15, 33, 21, 32 T10N, R13W, Sec. 5, 6 T11N, R13W, Sec. 24, 25, 26, 27, 32, 33, 34 T11N, R12W, Sec. 19, 20, 21, 22
32178 1/16/68	Chugach Electric	84.85 acres 50'C/L M & B		T11N, R12W, Sec. 25, 26, 34, 35

Number	Permittee	Size	Use	Legal Description
32179 1/16/68	Chugach Electric	32.12 acres 50' C/L M & B		T11N, R13W, Sec. 25, 26, 34, 35
58502 9/18/22	Atlantic Richfield Co. Box 360, Anchorage, 99510	50' width, 1700' length	gas pipeline	T11N, R12W, Sec. 21, 28
28471	Chugach Electric	100' letter of non-objection for 150'	electric line transmission	passes through; T13N, R9W; T13N, R10W; T14N, R8W; T14N, R9W; T15N, R8W
38086	Texaco, Inc. Box 664, Anchorage	2.94 acres M & B	pipeline	T11N,R12W Sec. 28 S1/2, Sec. 29 S 1/2
34126	Shell Oil Co. 430-7th Avenue Anchorage, Ak.	12' width M & B		T11N, R12W; Sec. 19, 28, 29, 30 T11N, R13W, Sec. 14-17, 19, 23, 24, 22, 27, 28, 33, 20, 29, 30, 32 T10N, R13W, Sec. 5 T11N, R14W, Sec. 13, 24
33333	Cook Inlet Pipeline Co. 1822 W. Northern Lights Anchorage, Ak.	265.7 acres 25' width		T11N, R12W; T11N, R13W; T8N, R14W, and other townships outside Beluga Dist.

Number	Permittee	Size	Use	Legal Description
33081	Pan American Pet. Corp. Box 779 Anchorage	125.688 Acres	tidelands right of way	T11N, R12W; T11N, R11W;T10N,R12W; T9N, R12W; T8N, R12W
32181	Chugach Electric Assoc.	50' width 71.52 acres M & B	powerline	T12N, R11W, Sec. 13-18
32182	Chugach Electric Assoc.	77.58 acres M & B		T12N, R12W, Sec. 13-16 & 21, 28, 33
35684	Superior Oil Co. Box 1521, Houston, Tex	47.859 acres M & B		T12N, R11W, Sec. 3, 10, 15, 22, 16, 21
56285 (offshore)	Union Oil Co. of Calif. Marathon Oil Co. 909-W.9th Avenue, Anchorage	500' width, 111,400' length	gas pipeline	
33939	Chevron USA, Inc. P. O. Box 7643 San Francisco, CA 94120	159 acres 50' C/L	Surveyed, amended to include seismic trail and ADL 67290, ASLS 75-28 and ASLS 75-70	T13N, R9W, Sec. 1, 5, 6, 7,; T14N, R9W, Sec. 27, 33, 34, 32, 36, 35 T13N, R10W, Sec. 12, 26, 23, 14, 13 ASLS 75-70: T14N, R8W Sec. 18 T14N, R9W Sec. 2, 3, 10, 11, 12, 13, 15, 22, 27 ASLS 75-28: T14N, R9W, Sec. 7, 18, 17, 20, 29, 28, 33 T14N, R10W, Sec. 2, 11, 12

Number	Permittee	Size	Use	Legal Description
32180	Chugach Electric Assoc. P. O.Box 3518, Anchorage	42.42 acres		T12N, R10W, Sec. 4, 5, 7, 8, 18 M & B within
17152 7/31/62	The Superior Oil CO. Legal Dept. P.O. Box 152 Houston, Texas	121 acres	access road to well site(?)	T12N, R10W, Sec. 20; T12N, R11W, Sec. 7, 8, 18, 19, 20, 21, 22, 23, 24, 28 (excluding lands within Indian Allotment A-055082)
58034	Chugach Electric Asoc.	20' width 34,779' length (15.90 acres)	for electric distribution line	T12N,R10W, Sec. 4, 8, 9, 17 T13N, R10W, Sec. 19, 20, 27, 34
52466 1/12/71	Atlantic Richfield Co. Box 360, Anchorage	2.10 acres 25' width 9,260' length		T11N, R12W, Sec. 27 within N 1/2 Sec. 28 within N 1/2

RIGHT OF WAY APPLICATIONS IN THE BELUGA DISTRICT

ADL Application Number & Date	Applicant	Size	Use	Legal Description (all Seward Meridan)
61723 (7/6/73)	Division of Lands 323 E. 4th Ave Anchorage (changed from Phillips Pet. Co.) (7/27/73)	100' width 14,264.70' length 33 acres	run to well location	T13N, R10W, Sec. 18, 19 T13N, R11W, Sec. 24, 25, 26, 34, 35 T12N, R11W, Sec. 3
67900 (6/13/75)	Chugach Electric	38' width 110' length .096 acres	underground sewage disposal system	T13N, R10W, Sec. 26
67901 (6/13/75)	Chugach Electric	15' width 540' length .186 acres	Sewerline & Maintenance road	T13N, R10W, Sec. 26
64352	Amoco Production Co. P.O. Box 779 Anchorage, 99510	50' width 8300'length	gathering pipeline	
72135	Matanuska Telephone Assoc., Palmer	10' width	buried telephone cable facility	T12N, R10W; T13N, R10W; T12N, R11W

Number	Applicant	Size	Use	Legal Description (all Seward Meridan)
75004	Jack C. Garber Tyonek, Ak 99682	20' width 3000' length	public road	T12N, R10W, Sec. 17
75699	Francis H. Grant 2917 Jones Ave, Anchorage	15' width 1800' length	public road	T12N, R10W., Sec. 17

APPENDIX 4-D

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF INDIAN AFFAIRS

CORPORATE CHARTER

OF THE

NATIVE VILLAGE OF TYONEK ALASKA

RATIFIED NOVEMBER 27, 1939

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1940

CORPORATE CHARTER OF THE NATIVE VILLAGE OF TYONEK

A FEDERAL CORPORATION CHARTERED UNDER THE ACT OF JUNE 18, 1934, AS AMENDED BY THE ACT OF MAY 1, 1936

Whereas, a group of Indians having a common bond of living together in Tyonek, Territory of Alaska, seek to organize under sections 16 and 17 of the Act of June 18, 1934, and section 1 of the Act of May 1, 1936 by adoption of a constitution and by-laws and a charter approved by the Secretary of the Interior,

Now, therefore, I, Oscar L. Chapman, Assistant Secretary of the Interior, by virtue of the authority given to me by the above acts, do hereby submit this charter of incorporation to the group of Indians so organizing.

SECTION 1. *Purpose and Name.*—In order to enable the Village and its members to do various kinds of business for their good, the Village is hereby chartered as a corporation of the United States of America under the name of "Native Village of Tyonek."

SEC. 2. *Membership.*—The corporation shall be a membership corporation, consisting of all persons of the Village considered members under the rules of its Constitution.

SEC. 3. *Management.*—The corporation shall be managed by the governing body set up under the constitution.

SEC. 4. *Powers.*—The corporation shall have the power to do the following things:

To own, hold, manage and dispose of all Village property;
To make contracts;
To sue and be sued;
To borrow money from the revolving Indian Credit fund and to use it under a loan contract;
To enter into any business or activity that will better the condition of the Village and its members;
To do such other things as may be necessary to carry on the business and activities of the Village.

SEC. 5. *Limits to Powers.*—In using its powers the corporation must not do the following things:

Go against any law or the constitution and by-laws of the Village:
Sell or mortgage any land set aside as a reserve for the Village;
Make leases, permits or contracts covering any lands or waters set aside as a reserve for the Village without the approval of the Secretary of the Interior or his authorized representative.

SEC. 6. *Property of Members.*—Property owned by a member of the Village shall not be taken to pay the debts of the corporation without his consent.

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SEC. 7. *Records.*—The corporation shall keep correct records of its business and activities and give copies of these records when asked to do so to the representative of the Office of Indian Affairs serving the Village.

SEC. 8. *Changes in the Charter.*—Changes in the charter may be made by the Village and if approved by the Secretary of the Interior shall be in force when agreed to by a majority vote of those members voting in an election called by the Secretary of the Interior: *Provided*, That at least 30 percent of the voting membership votes. The charter itself shall continue in force for all time, unless taken away by act of Congress.

SEC. 9. *Adoption of Charter.*—This Charter shall be in force when it is agreed to by a majority vote of those members voting in an election called by the Secretary of the Interior: *Provided*, That at least 30 percent of the voting membership votes and provided that the Village has agreed to a constitution and by-laws approved by the Secretary of the Interior.

This Charter is hereby approved and submitted to the group of Indians having a common bond of residence in the Village of Tyonek, Alaska, to be voted on in an election called and held under the Instructions of the Secretary of the Interior. The Charter shall be deemed issued when a petition for a charter, signed by one-third of the adult Indians, has been received by an authorized representative of the Department of the Interior.

OSCAR L. CHAPMAN,
Assistant Secretary of the Interior.
[SEAL]

WASHINGTON, D. C., *May 23, 1939.*

CERTIFICATION

Pursuant to an order, approved May 23, 1939, by the Assistant Secretary of the Interior, the attached charter was submitted for ratification to the group of Indians having a common bond of residence in the neighborhood of Tyonek, Territory of Alaska, and was on November 27, 1939, duly ratified by a vote of 40 for and 0 against, in an election in which over 30 percent of those entitled to vote cast their ballots, in accordance with the Alaska Act of May 1, 1936 (49 Stat. 1250), and section 17 of the Act of June 18, 1934 (48 Stat. 984), as amended by the Act of June 15, 1935 (49 Stat. 378).

DICK MISHAKOFF,
Chairman, Election Board.
NICKEFOR ALEXAN,
Secretary, Election Board.

MAURICE W. CARMODY,
Government Representative.

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF INDIAN AFFAIRS

CONSTITUTION AND BY-LAWS

OF THE

NATIVE VILLAGE OF TYONEK ALASKA

RATIFIED NOVEMBER 27, 1939

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1940

CONSTITUTION AND BY-LAWS OF THE NATIVE VILLAGE OF TYONEK

We, a group of Indians having the common bond of living together in the Village of Tyonek, Territory of Alaska, in order to have better life and greater security, make for ourselves this Constitution and By-laws, by authority of the Act of Congress of June 18, 1934, as amended by the Acts of June 15, 1935 and May 1, 1936.

ARTICLE I—NAME

This organization shall be called the "Native Village of Tyonek."

ARTICLE II—MEMBERSHIP

SECTION 1. *First Members.*—All persons whose names are on the list of native residents, made according to the Instructions of the Secretary of the Interior for organization in Alaska, shall be members of the Village.

SEC. 2. *Children of Members.*—All children of any members shall be members of the Village.

SEC. 3. *Loss of Membership.*—Any member may willingly give up his membership, or his membership may be taken away for good reason by the Village, or if he moves away from the Village, intending not to return, he shall lose his membership.

SEC. 4. *New Membership.*—Any person who has lost his membership and any other native person may be made a member if he sets up a home in the Village.

SEC. 5. *Membership Rules.*—The Village may make rules to govern membership, either for the purpose of carrying out this Article or covering membership matters not taken care of in this Article.

ARTICLE III—GOVERNING BODY

SECTION 1. *Choice of Governing Body.*—At a general meeting following the acceptance of this Constitution, the Village membership shall decide what kind of governing body it wishes to set up to speak and act for the Village and to use the powers of the Village. If there is a governing body already set up in the Village, at the time this Constitution is accepted, the membership may decide to keep that governing body, or it may choose a new form of government.

SEC. 2. *Choice of Officers.*—The Village shall at the same time decide how members and officers of the governing body shall be chosen and how long they shall serve. The Village shall then choose the members to serve on the governing body and such officers as may be thought necessary.

SEC. 3. *Meetings of Membership and Governing Body.*—The Village shall decide when and how often there should be meetings of the whole Village membership as well as of the governing body; also it shall decide what notice shall be given for the calling of meetings and how many members must be present at such meetings in order to do business; and it may make any other rules necessary for the holding of meetings. A general meeting of the whole membership shall be held at least once a year.

SEC. 4. *Record and Report of Village Decisions.*—A record shall be made and kept of all the rules made under sections 1, 2, and 3 of this Article, which record shall be called the Record of Organization of the Native Village of Tyonek. Copies of this record shall be given to the teacher or other representative of the Office of Indian Affairs serving the Village. There shall be put in the record the names of all persons chosen to be officers of the Village.

ARTICLE IV—POWERS OF THE VILLAGE

SECTION 1. *Powers Held.*—The Village shall have the following powers:

To do all things for the common good which it has done or has had the right to do in the past and which are not against Federal law and such Territorial law as may apply.

To deal with the Federal and Territorial Governments on matters which interest the Village, to stop any giving or taking away of Village lands or other property without its consent, and to get legal aid, as set forth in the act of June 18, 1934.

To control the use by members or nonmembers of any reserve set aside by the Federal Government for the Village and to keep order in the reserve.

To guard and to foster native life, arts and possessions and native customs not against law.

SEC. 2. *Grant of More Power.*—The Village may have and use such other powers as may be given to it by the Federal or Territorial Government.

SEC. 3. *Use of Powers.*—The governing body shall put into use such of the powers of the Village as the Village may give to it at general meetings of the membership and shall make reports of its actions to the membership at general meetings.

SEC. 4. *Rule-making Power.*—The Village may make rules which are not against law to carry out the words of this Constitution.

ARTICLE V—RIGHTS OF MEMBERS

SECTION 1. *Right to Vote.*—All members of the Village 21 years of age or over shall have the right to vote in Village meetings and elections.

SEC. 2. *Right to Speak and Meet Freely.*—Members of the Village shall have the right to speak and meet together freely in a peaceable way.

SEC. 3. *Right to Share in Benefits.*—Members of the Village shall have equal chance to share in the benefits of the Village.

ARTICLE VI—CHANGES IN THE CONSTITUTION

Changes in this Constitution and By-laws may be made if the changes are approved by the Secretary of the Interior and by a majority vote of the Village members voting in an election called by the Secretary of the Interior at which at least 30 percent of the voting membership take part.

BY-LAWS OF THE NATIVE VILLAGE OF TYONEK

ARTICLE I—OFFICERS AND THEIR DUTIES

SECTION 1. *Village Records.*—The Village or the governing body shall choose one or more members who shall have the duty of keeping records of all actions and decisions of the Village and of the governing body and of giving copies of the records to the representative of the Office of Indian Affairs serving the Village.

SEC. 2. *Village Funds.*—The Village or the governing body shall choose one or more members who shall have the duty of caring for the Village funds and keeping records of all funds taken in and paid out and giving copies of the records to the representative of the Office of Indian Affairs.

SEC. 3. *Officers and Agents.*—The Village or the governing body may choose as many officers and agents as it may need to carry out its duties and shall state the length of service and the duties of each officer or agent when he is chosen.

ARTICLE II.—ADOPTION

This Constitution and By-laws shall be in effect when it is agreed to by a majority vote of the Village members voting in an election called for the purpose by the Secretary of the Interior: *Provided,* That at least 30 percent of the voting membership take part. The persons entitled to vote are all the adult native residents in the Village of Tyonek.

APPROVAL

This Constitution and By-laws is hereby approved by the Assistant Secretary of the Interior and submitted for acceptance or rejection by the group of Indians having a common bond of living together in the Village of Tyonek, Alaska, in an election called and held under the Instructions of the Secretary of the Interior.

All rules and regulations heretofore promulgated by the Interior Department or by the Office of Indian Affairs, so far as they may be incompatible with any of the provisions of the said constitution and by-laws will be inapplicable to the Village of Tyonek, Territory of Alaska, from and after the date of adoption of this constitution.

All officers and employees of the Interior Department are ordered to abide by the provisions of the said constitution and by-laws.

OSCAR L. CHAPMAN,
Assistant Secretary of the Interior.
[SEAL]

WASHINGTON, D. C., *May 23, 1939.*

CERTIFICATION OF ADOPTION

Pursuant to an order, approved May 23, 1939, by the Assistant Secretary of the Interior, the attached Constitution and By-laws was submitted for ratification to the group of Indians having a common bond of residence in the neighborhood of Tyonek, Territory of Alaska, and was on November 27, 1939, duly ratified by a vote of 40 for and 0 against, in an election in which over 30 percent of those entitled to vote cast their ballots, in accordance with section 16 of the Indian Reorganization Act of June 18, 1934 (48 Stat. 984), as amended by the Act of June 15, 1935 (49 Stat. 378).

DICK MISHAKOFF,
Chairman, Election Board.
NICKEFOR ALEXAN,
Secretary, Election Board.

MAURICE W. CARMODY,
Government Representative.

APPENDIX 4-E
INTERIM CONVEYANCE

WHEREAS

Tyonek Native Corporation

is entitled to a conveyance pursuant to sections 14(a) and 22(j) of the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 702, 715; 43 U.S.C. 1601, 1613(a), 1621(j) (Supp. V, 1975)) of the surface estate in the following described lands:

U.S. Survey 1865, excluding U.S. Coast Guard navigation aid AA-14290.

Containing approximately 26,917.56 acres.

NOW KNOW YE, that there is, therefore, granted by the UNITED STATES OF AMERICA, unto the above-named corporation the surface estate in the land above-described, TO HAVE AND TO HOLD the said estate with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said corporation, its successors and assigns, forever;

EXCEPTING AND RESERVING TO THE UNITED STATES from the lands so granted:

1. A right-of-way thereon for ditches and canals constructed by the authority of the United States, as prescribed and directed by the act of August 30, 1890, 26 Stat. 391; 43 U.S.C. 945;

2. A right-of-way thereon for the construction of railroads, telegraph, and telephone lines, as prescribed and directed by the act of March 12, 1914, 38 Stat. 305; 43 U.S.C. 975d;

3. The subsurface estate therein, and all rights, privileges immunities, and appurtenances, of whatsoever nature, accruing unto said estate pursuant to the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 704; 43 U.S.C. 1601, 1613(f) (Supp. V, 1975)); and

4. Pursuant to section 17(b) of the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 708; 43 U.S.C. 1601, 1616(b) (Supp. V, 1975)), the following public easements referenced by easement identification number (EIN) on the easement map in case file AA-6707-EE are reserved to the United States and subject to further regulation thereby:

    a. (EIN 1 C, D, D9, D1) A continuous linear easement twenty-five (25) feet in width upland of and parallel to the mean high tide line in order to provide access to and along the marine coastline and use of such shore for purposes such as beaching of watercraft or aircraft, travel along the shore, recreation, and other similar uses; provided that the twenty-five (25) foot marine coastline easement shall be reduced to a ten (10) foot width for any permanent fish camp which has at least one

Interim Conveyance No. 001

Date MAR 31 ...

permanent structure within twenty-five (25) feet of the mean high tide line and is in existence on the date of conveyance. The ten (10) foot easement is to run ten (10) feet upland of and parallel to the mean high tide line and shall be two hundred (200) feet in length, one hundred (100) feet on each side of the approximate center of the fish camp measured in directions generally parallel to the mean high tide line. Deviations from the waterline are permitted when specific conditions so require, e.g., impassable topography or waterfront obstruction. This easement is subject to the right of the owner of the servient estate to build upon such easement a facility for public or private purposes, such right to be exercised reasonably and without undue or unnecessary interference with or obstruction of the easement. When access along the marine coastline easement is to be obstructed, the owner of the servient estate will be obligated to convey to the United States an acceptable alternate access route, at no cost to the United States, prior to the creation of such obstruction.

b. (EIN 15 C) The right of the United States to enter upon the lands herein granted for cadastral, geodetic, or other survey purposes is reserved, together with the right to do all things necessary in connection therewith.

c. (EIN 16 C) Easements for the transportation of energy, fuel, and natural resources which are the property of the United States or which are intended for delivery to the United States or which are produced by the United States. These easements also include the right to build any related facilities necessary for the exercise of the right to transport energy, fuel, and natural resources, including those related facilities necessary during periods of planning, locating, constructing, operating, maintaining, or terminating transportation systems. The specific location of these easements shall be determined only after consultation with the owner of the servient estate. Whenever the use of such easement will require removal or relocation of any structure owned or authorized by the owner of the servient estate, such use shall not be initiated without the consent of the owner of such improvement; provided, however, that the United States may exercise the right of eminent domain if such consent is not given. Only those portions of these easements that are actually in use or that are expressly authorized on March 3, 1996, shall continue to be in force.

d. (EIN 22 C4) A one-quarter (1/4) acre easement for an existing stream gaging station in the NE¼ sec. 29, T. 12 N., R. 11 W., Seward Meridian, on the right bank of the Chuitna River.

THE GRANT OF THE ABOVE-DESCRIBED LANDS IS SUBJECT TO:

1. Issuance of a patent confirming the boundary description of the lands hereinabove granted after approval and filing by the

Interim Conveyance No. 087

Date MAR 31 1979

AA 07-A

Bureau of Land Management of the official plat of survey covering such lands;

2. Valid existing rights therein, if any, including but not limited to those created by any lease (including a lease issued under section 6(g) of the Alaska Statehood Act of July 7, 1958 (72 Stat. 339, 341; 48 U.S.C. Ch. 2, Sec. 6(g) (1970))), contract, permit, right-of-way, or easement and the right of the lessee, contractee, permittee, or grantee to the complete enjoyment of all rights, privileges, and benefits thereby granted to him;

3. Requirements of section 14(c) of the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 703; 43 U.S.C. 1601, 1613(c) (Supp. V, 1975)), that the grantee hereunder convey those portions, if any, of the lands hereinabove granted, as are prescribed in said section;

4. The terms and conditions of the agreement dated January 18, 1977, between the Secretary of the Interior, Cook Inlet Region, Inc., Tyonek Native Corporation and other Cook Inlet village corporations. A copy of the agreement is hereby attached to and made a part of this conveyance document; and

5. The following third-party interest, created and identified by the Bureau of Indian Affairs, as provided by section 14(g) of the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 704; 43 U.S.C. 1601, 1613(g) (Supp. V, 1975)):

   Right-of-way for underground gas pipeline

   (1) File No. 72-1 traversing selected lands in the former sections 22, 23, 25, 26 and 27, T. 11 N., R. 12 W., Seward Meridian.

IN WITNESS WHEREOF, the undersigned authorized officer of the Bureau of Land Management has, in the name of the United States, set his hand and caused the seal of the Bureau to be hereunto affixed on this 31st day of March, 1978 in Anchorage, Alaska.

UNITED STATES OF AMERICA

Robert L. [illegible]

Chief, Division of
Technical Services

Interim Conveyance No. 087

Date MAR 31 1978

INTERIM CONVEYANCE

WHEREAS

Cook Inlet Region, Inc.

is entitled to a conveyance pursuant to sections 14(f) and 22(j) of the Alaska Native Claims Settlement Act of December 18, 1971 (85 Stat. 688, 704, 715; 43 U.S.C. 1601, 1613(f), 1621(j) (Supp. V, 1975)) of the subsurface estate reserved to the United States in the hereinbelow identified interim conveyance of the surface estate in the following described lands:

INTERIM CONVEYANCE NO. 087

U.S. Survey 1865, excluding U.S. Coast Guard navigation aid AA-14290.

Containing approximately 26,917.56 acres.

NOW KNOW YE, that there is, therefore, granted by the UNITED STATES OF AMERICA, unto the above-named corporation the subsurface estate in the land above-described, TO HAVE AND TO HOLD the said estate with all of the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said corporation, its successors and assigns, forever.

THE GRANT OF THE ABOVE-DESCRIBED LANDS IS SUBJECT TO all the easements and rights-of-way reserved in the aforementioned conveyance of the surface estate, and to valid existing rights, if any, in the said subsurface estate, including but not limited to those created by any lease (including a lease issued under section 6(g) of the Alaska Statehood Act of July 7, 1958 (72 Stat. 339, 341; 48 U.S.C. ch. 2, sec. 6(g) (1970))), contract, permit, right-of-way, or easement, and the right of the lessee, contractee, permittee, or grantee to the complete enjoyment of all rights, privileges, and benefits thereby granted to him, and the grant of the lands is further subject to the terms and conditions of the agreement dated January 18, 1977, between the Secretary of the Interior, Cook Inlet Region, Inc., Tyonek Native Corporation, and other Cook Inlet village corporations. A copy of the agreement is hereby attached to and made a part of this conveyance document.

IN WITNESS WHEREOF, the undersigned authorized officer of the Bureau of Land Management has, in the name of the United States, set his hand and caused the seal of the Bureau to be hereunto affixed on this 31st day of March, 1978 in Anchorage, Alaska.

UNITED STATES OF AMERICA

Robert [signature]

Chief, Division of
Technical Services

Interim Conveyance No. 088

Date MAR 31 1978

DEPARTMENT OF NATURAL RESOURCES

PUBLIC NOTICE UNDER AS 38.05.345

Subject to the provisions of AS 38.05 and pursuant to the regulations promulgated thereunder, the Division of Lands through its Planning and Classification Section is proposing to classify as Reserved Use Lands the following [Selected] lands:

SUBSURFACE ESTATE
SEWARD MERIDIAN, ALASKA
BELUGA POOL

T12N.	R10W.,	Sec. 16	All;	1.03 acres±
		Sec. 17	All excl. USS 3411, USS 4543, USS 4542, Viapan Lake;	476 acres±
		Sec. 18	All excl. Viapan Lake;	503 acres±
		Sec. 19	All;	605 acres±
		Sec. 20	All excl. USS 3411;	216.42 acres±
		Sec. 30	All excl. USS 2089, USS 364;	363.08 acres±
		Sec. 31	All;	5 acres±
T14N.	R10W.,	Sec. 16	All;	640 acres±
		Sec. 21	All;	640 acres±
		Sec. 28	All;	640 acres±
		Sec. 33	All;	640 acres±
T.14N.	R.11W.,	Sec. 6	All east of the east (left) bank of the Beluga River;	360 acres±
		Sec.7	All east of the east (left) bank of the Beluga River;	140 acres±
		Sec. 8	That portion of the SW¼ east of the east (left) bank of the Beluga River	105 acres±
		Sec. 17	All east of the east (left) bank of the Beluga River;	355 acres±
		Sec. 20	All east of the east (left) bank of the Beluga River;	410 acres±
		Sec. 28	All east of the east (left) bank of the Beluga River;	560 acres±
		Sec. 29	All east of the east (left) bank of the Beluga River;	120 acres±
		Sec. 33	All east of the east (left) bank of the Beluga River;	125 acres±
T.15N.	R.10W.,		That portion of Tract "A" further described as	
		Sec. 6	W½;	289 acres±
		Sec. 7	W½;	281.5 acres+

T15N.	R.13W.,	Sec. 12	NE¼NE¼ excl. Beluga Lake;	30 acres ±
T16N.	R13W.	Sec. 10	All excl. Coal Creek Lake;	420 acres ±
		Sec. 11	All incl. USS 3969 Lot 1, USS 3967 Lots 1,7,8,9,10,11, excl. Coal Creek Lake;	427.91 acres ±
		Sec. 12	W½ excl. Coal Creek Lake;	305 acres ±
		Sec. 15	N½ excl. Coal Creek Lake;	290 acres ±
		Sec. 31	NE¼NE¼SW¼;	10 acres ±
		Sec. 35	NE¼NE¼NE¼	10 acres ±

SURFACE AND SUBSURFACE ESTATE
SEWARD MERIDIAN, ALASKA
BELUGA POOL

T.11N.	R.12W.,	Sec. 18	W½, NE¼;	480 acres ±
		Sec. 19	W½NW¼;	80 acres ±
T.11N.	R.13W.,	Sec. 12	all;	640 acres ±
		Sec. 13	E½, NW¼, E½SW¼;	560 acres ±
		Sec. 24	NE¼NE¼;	40 acres ±
T.12N.	R.10W.,	Sec. 5	all;	640 acres ±
		Sec. 6	all;	640 acres ±
		Sec. 7	all including USS 4545 excluding W½SW¼SW¼NE¼, E½SE¼SE¼NW¼ and Tukallah Lake and Three Mile River;	396 acres ±
T.12N.	R.14W.,	Sec. 1	all;	640 acres ±
		Sec. 2	all;	640 acres ±
		Sec. 3	all;	640 acres ±
		Sec. 4	all;	640 acres ±
		Sec. 5	all;	640 acres ±
		Sec. 6	all excl. Chakachatna River;	600 acres ±
		Sec. 7	all excl. Chakachatna River;	426 acres ±
		Sec. 8	all excl. Chakachatna River;	610 acres ±
		Sec. 9	all;	640 acres ±
		Sec. 10	all;	640 acres ±
		Sec. 11	all;	640 acres ±
		Sec. 12	all;	640 acres ±
		Sec. 13	all;	640 acres ±
		Sec. 14	all;	640 acres ±
		Sec. 15	all;	640 acres ±
		Sec. 16	all; excl. Chakachatna River;	610 acres ±
		Sec. 17	all excl. Chakachatna River;	460 acres ±
		Sec. 18	all excl. Chakachatna River;	605 acres ±
		Sec. 19	all excl. Chakachatna River;	603 acres ±
		Sec. 20	all excl. Chakachatna River;	460 acres ±

	Sec. 21	all excl. Chakachatna River;	630 acres ±
	Sec. 22	all;	640 acres ±
	Sec. 27	all;	640 acres ±
	Sec. 28	all excl. Chakachatna River;	630 acres ±
	Sec. 30	all;	601 acres ±
	Sec. 34	all;	640 acres ±
	Sec. 35	all;	640 acres ±
T.13N. R.10W.,		That portion of Tract "A" further described as follows:	
	Sec. 1	all excl. NE¼NW¼ and the Beluga River;	470 acres ±
	Sec. 2	all excl. Beluga River;	440 acres ±
	Sec. 3	all excl. Beluga River;	300 acres ±
	Sec. 10	all excl. Beluga River;	460 acres ±
	Sec. 11	W½;	320 acres ±
	Sec. 15	all;	640 acres ±
T.13N. R.14W.,	Sec. 1 through 36	all;	23,008 acres ±
T.14N. R.10W.,	Sec. 4 through 9	all;	3,802 acres ±
	Sec. 17 through 20	all;	2,528 acres ±
	Sec. 29 through 32	all;	2,536 acres ±
T.14N. R.11W.,	Sec. 1 through 5	all;	3,200 acres ±
	Sec. 6	All west of west (right) bank of Beluga River;	185 acres ±
	Sec. 7	All west of west (right) bank of the Beluga River;	380 acres ±
	Sec. 8	All lands west of the west (right) bank of the Beluga River, E½, NW¼;	508 acres ±
	Sec. 9 through 16	All;	5,120 acres ±
	Sec. 17	All west of the west (right) bank of the Beluga River;	200 acres ±
	Sec. 18	All;	623 acres ±
	Sec. 19	All;	625 acres ±
	Sec. 20	All west of west bank of Beluga River;	140 acres ±
	Sec. 21 through 27	all;	4,480 acres ±
	Sec. 28	All west of west (right) bank of the Beluga River;	50 acres ±
	Sec. 29	All west of the west (right) bank of the Beluga River;	460 acres ±
	Sec. 30	All;	627 acres ±
	Sec. 31	All;	629 acres ±
	Sec. 32	All excl. SW¼NE¼SW¼, SE¼NW¼SW¼;	620 acres ±

	Sec. 33	All west of west (right) bank of the Beluga River;	455 acres ±
	Sec. 34 through Sec. 36	All;	1,920 acres ±
T.14N. R.13W.,		Tract "B"	11,425.20 acres ±
T.14N. R.14W.,	Sec. 1 through 36	All;	22,946 acres ±
T.15N. R.10W.,		That portion of Tract "A" further described as:	
	Sec. 5	All;	640 acres ±
	Sec. 6	E½;	320 acres ±
	Sec. 7	E½;	320 acres ±
	Sec. 8	All;	640 acres ±
	Sec. 9	All;	640 acres ±
	Sec. 16 through 21	All;	3,788 acres ±
	Sec. 28 through 33	All;	3,794 acres ±
T.15N. R.11W.,		Tract "A" and USS 3952, excl. lower Beluga Lake;	22,871.39 acres ±
T.15N. R.12W.,		Tract "A", excl. Beluga Lake, Lower Beluga Lake, Beluga River and Chichantna River;	20,675 acres ±
T15N. R.13W.,	Sec. 1	All excl. Beluga Lake and coal creek	590 acres ±
	Sec. 2	All excl. Beluga Lake;	100 acres ±
	Sec. 6	All excl. Beluga Lake;	525 acres ±
	Sec. 7	All excl. Beluga Lake;	230 acres ±
	Sec. 12	All excl. NE¼NE¼, Beluga Lake;	60 acres ±
	Sec. 13	All excl. Beluga Lake and Chichantna River;	240 acres ±
	Sec. 15	All excl. Beluga Lake;	10 acres ±
	Sec. 16	All excl. Beluga Lake;	5 acres ±
	Sec. 17	All excl. Beluga Lake;	50 acres ±
	Sec. 18	All excl. Beluga Lake;	340 acres ±
	Sec. 19	All;	615 acres ±
	Sec. 20	All;	640 acres ±
	Sec. 21	All excl. Beluga Lake;	625 acres ±
	Sec. 22	All excl. Beluga Lake;	600 acres ±
	Sec. 23	All excl. Beluga Lake;	510 acres ±
	Sec. 24	All excl. Beluga Lakd and Chichantna River;	510 acres ±
	Sec. 25 through 33	All;	5,714 acres ±
	Sec. 34	All excl. Chichantna River;	600 acres ±
	Sec. 35	All excl. Chichantna River;	615 acres ±
	Sec. 36	All excl. Chichantna River;	600 acres ±

T.15N. R.14W.,	Sec. 1 through 36			22,882 acres ±
T.16N. R.11W.,	Sec. 20 through 21	All;		1,280 acres ±
	Sec. 25 through 36	All;		7,613 acres ±
T.16N. R.12W.,		That portion of Tract "A" further described as:		
	Sec. 7	All;		600 acres ±
	Sec. 16 through 22	All;		4,406 acres ±
	Sec. 25 through 29	All;		3,200 acres ±
	Sec. 30	All incl. USS 3947;		601 acres ±
	Sec. 31 through 36	All;		3,807 acres ±
T.16N. R.13W.,		That portion of Tract "A" further described as:		
	Sec. 1 through 9	All;		5,679 acres ±
	Sec. 12	E½;		320 acres ±
	Sec. 13 through 14	All;		1,280 acres ±
	Sec. 15	S½;		320 acres ±
	Sec. 16 through 30	All;		9,492 acres ±
	Sec. 31	All excl. Beluga Lake and NE¼NE¼SW¼;		467 acres ±
	Sec. 32	All excl. Beluga Lake;		440 acres ±
	Sec. 33	All excl. Beluga Lake;		500 acres ±
	Sec. 34	All excl. Beluga Lake;		615 acres ±
	Sec. 35	All excl. NE¼NE¼NE¼;		630 acres ±
	Sec. 36	All;		640 acres ±

SURFACE ESTATE
SEWARD MERIDIAN, ALASKA

T.11N	R12W.,	Sec. 18	SE¼;	160 acres±
		Sec. 19	E½NW¼, NE¼, N½SE¼;	320 acres±
		Sec. 20	All;	640 acres±
T.13N	R10W.,		that Portion of Tract "A" further described as:	
		Sec. 11	E½;	320 acres±
		Sec. 12	All West of West (right) Bank of Beluga River excluding that parcel. Commencing at M.C. No. 1 U.S. Survey 3901; thence North along the meanders of the Beluga River 800 feet to Corner No. 1 (Common to Corner No. 4 A.D.L. 49427); thence Southeast 84 degrees 25 minutes, 544.5 feet to	550 acres±

Corner No. 2 (Common to
Corner No. 3 A.D.L. 49427);
thence North 660 feet to
Corner No. 3; thence
East 990 feet to Corner
No. 4 (Common to the right
bank of the Beluga River);
thence South along the
meanders of the Beluga
River to Corner No. 1 the
point of beginning of this
metes and bounds description;
containing 15 acres and
situated within Section 12;
and U.S.S. 3901
T13N, R10W, S.M.

Sec. 13	All West of West (right) Bank of Beluga River;	630 acres±
Sec. 14	All;	640 acres±
Sec. 22	All;	640 acres±
Sec. 23	All;	640 acres±
Sec. 24	All;	640 acres±
Sec. 25	All;	297.53 acres±
Sec. 26	All;	584.70 acres±
Sec. 27	All;	640 acres±
Sec. 34	All excl. USS 3596, OSS 3963;	602.92 acres±
Sec. 35	All excl. USS 3962;	83.41 acres±

Subsequent to the classification of these lands the Division of Lands proposes to convey said lands to the United States for the purpose of reconveyance to Cook Inlet Region, Inc., under the "Terms and Conditions for Land Consolidation and Management in the Cook Inlet Area."

The conveyance of the described lands are subject to the following valid existing rights:

BELUGA POOL
VALID RIGHTS

Coal Lease	Mining Claim	Oil & Gas Lease	
25081	303117 to 303132	41878	57565
36283		46578	57567
36323	SLUP	47878	58020
64526	67095	48928	58133
75703	60882	49787	59865
		50119	60129

ROW Per
28471
32180
32183
33939
34126
34494
37198
56013
57588
58034
200680

Tbr. Sale
60524
Mat. Sale
81259

MLUP
37463

Coal Pros. Per
64545

50120
50752
51627
51971
52642
53393
53905
54307
54400
54583
56183
56375
56466
57012
57014

62462
62950
62952
63652
64923
66947
67146
67987
68006

VALID RIGHTS
CHICALOON

Coal Lease

33557

ROW Permit

52374
2311

VALID RIGHTS
KNIK

ROW Permit

57236
56583

Ltr. Permit
57798

Oil & Gas Lease

57050
55913
52645
73241

VALID RIGHTS
NINILICHIK

Oil and Gas Lease

68001
56990
56996
56041
59625
42865
42343
40832
63236
45961

A determination of whether or not any body of water or waterway within or adjoining the subject lands is navigable under the laws of the State of Alaska has not been made. This subject will be addressed prior to the conveyance of the subject lands to the United States.

Maps delineating the proposed conveyance lands are available for public review and inspection at the following location: Alaska Department of Natural Resources, Division of Lands, Planning and Classification Section, 323 E. 4th Avenue, Anchorage, Alaska 99501.

Written comments relating to the proposed conveyance action must be received by the Planning and Classification Section of the Division of Lands, 323 E. 4th Avenue, Anchorage, Alaska 99501 on or before 4:30 p.m., October 30, 1978 in order to be considered. Please direct said correspondence to Stephen Reeve, Chief, Planning and Classification Section, Alaska Division of Lands.

The Division of Lands reserves the right to waive any technical defects in this notice.

TRIBAL OWNED Tyonek Reserve

INDIVIDUALLY OWNED ______

GOVERNMENT OWNED ______

FILE NO. 72-1

GRANT OF EASEMENT FOR RIGHT-OF-WAY

KNOW ALL MEN BY THESE PRESENTS:

That the United States of America, acting by and through Roy Peratrovich, Bureau of Indian Affairs, Department of the Interior, Superintendent, Anchorage Agency, hereinafter referred to as "Grantor", under authority contained in the Act of March 11, 1904 (33 Stat 65) as amended by the Act of March 2, 1917 (39 Stat 973); and pursuant to the provisions of the Act of February 5, 1948 (62 Stat 17; 25 U.S.C. 323-328), and Part 161, Title 25, Code of Federal Regulations, in consideration of $1,670.00, the receipt of which is acknowledged, does hereby grant to the Marathon Oil Company and Union Oil Company of California, its successors and assigns, hereinafter referred to as "Grantee", an easement for right-of-way for the following purpose, namely: "The right, easement, and privilege to construct, operate and maintain an underground gas pipeline with necessary appurtenances thereon or therein, together with the right of ingress and egress when necessary for the above mentioned purposes, through," on, over, under and across the land embraced within the right-of-way situated on the following described lands located within the Moquawkie Reservation, State of Alaska:

> Sections 22, 23, 25, 26 & 27, Township 11 North, Range 12 West, Seward Meridian.

The said easement, as shown on the tract map attached hereto, limited to and more particularly described as:

As shown on attached plat

This easement is subject to any prior valid existing right or adverse claim and is for a term of 20 years from that date of approval, so long as said easement shall be actually used for the purpose above specified; PROVIDED, that this right-of-way shall be terminable in whole or in part by the Grantor for any of the following causes upon 30 days' written notice and failure of the Grantee within said notice period to correct the basis of termination (25 CFR 161.20):

A. Failure to comply with any term or condition of the grant or the applicable regulations.

B. A nonuse of the right-of-way for a consecutive two-year period for the purpose for which it was granted.

C. An abandonment of the right-of-way.

D. Failure of the Grantee, upon completion of construction, to file with the Grantor an affidavit of completion pursuant to 25 CFR 161.16.

The condition of this easement shall extend to and be binding upon and shall inure to the benefit of the successors and assigns of the Grantee.

IN WITNESS WHEREOF, Grantor has executed this grant of easement this 15 day of December, 1971.

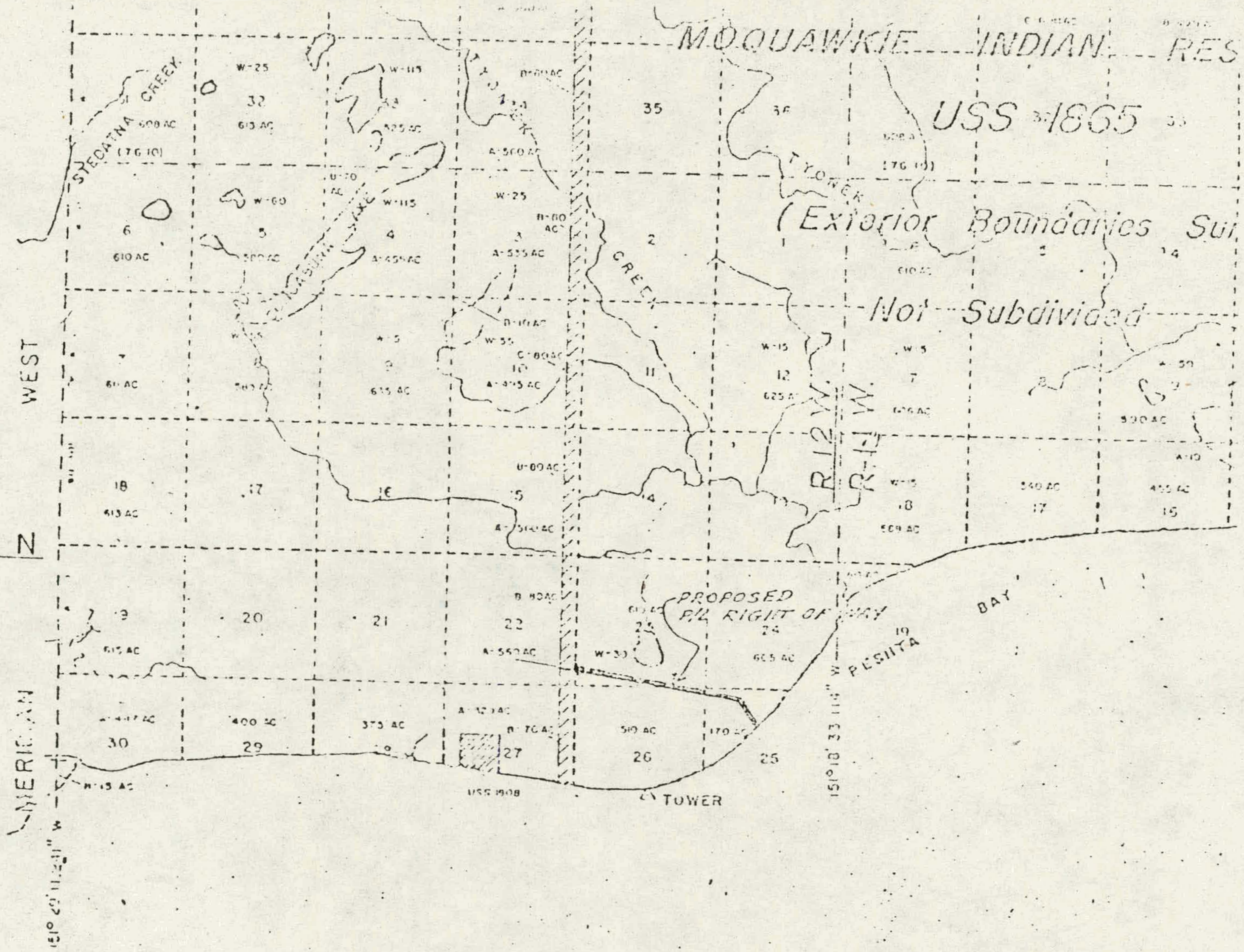
UNITED STATES OF AMERICA

By: ______

U.S. Department of the Interior
Bureau of Indian Affairs

APPENDIX 4-F (cont)

Figure 4-F-1



CHAPTER 5

COAL TECHNOLOGY

CHAPTER 5
COAL TECHNOLOGY

INTRODUCTION

The Beluga Coal Field has two important assets: It is located near tidewater, and its subbituminous coal has a low sulfur content. For these and other reasons, development of the field is being seriously considered. A preliminary examination has been made to determine potential uses of this coal field within the next decade.

However, there are numerous options available throughout the development process from the method of recovery to its end use. With the increasing national emphasis on coal for electrial generation or as a source of synthetic fuels, the number of potentially feasible alternatives appears to be expanding. This chapter describes various coal technologies which might be employed at Beluga.

In 1977, the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys developed a large color map of Alaska showing not only the energy resources in Alaska, but also energy operations. Included are all of the coal generating facilities, capacity in megawatts, location, and the size and location of the major electrical transmission lines.

COAL RECOVERY

With advances in equipment and technology, surface mining of coal has been replacing underground mining in the United States since 1915. Surface mine production currently comprises half of the total United States coal production.

The cost per ton of surface mined coal is less than that of sub-surface mined coal because of the relative ease of obtaining the mineral. As the primary costs for surface mined coal are for equipment and maintenance, strip-mine produced coal is more economical on a large scale.

The decision as to which mode of coal mining should be employed will be determined by the stripping ratio, i.e. cubic yards of overburden to tons of marketable coal. A surface mining depth of less than 180 feet is the current limitation imposed by available machinery.

SURFACE

Importantly, the recoverable coal is increased from approximately 50% in underground mines to nearly 85% in surface mines. Surface mining permits recovery of coal where coal bed thinness, multiple beds close together, split seams, roof characteristics, or other geologic conditions would prevent extraction by underground methods (Tetra Tech, 1976).

The basic functional steps of surface coal mining begin with the removal of the overburden, the earth and rock covering the coal seam. After the overburden is fragmented with explosives, it is "spoiled" at the side of the pit opposite the cut. The exposed coal is then broken up and removed. Finally, the spoiled overburden is back-filled and vegetation is restored to the area.

Machines used in surface mining range in size from trucks, bulldozers and front-end loaders to gigantic power shovels and draglines. These shovels and draglines are the world's largest mobile land machines; the biggest dragline available is capable of picking up 180 cubic yards per scoop.

Surface mining can be developed along three lines depending upon the physical characteristics of the area to be mined:

Area coal seams running relatively parallel to flat or rolling surface.

Contour - mountainous or hilly terrain.

Open Pit - coal beds are extremely thick or sharply pitched.

Part of the exposed coal may be augered for further extraction once the normal surface operations have reached their economic limits as shown in Figure 5-1.

UNDERGROUND

Underground mining systems can be classified according to the equipment used. In the conventional and continous systems, about half of the coal is removed from the seam, leaving the rest as pillars to support the mine roof. Roof supports are installed and the coal pillars are sometimes removed for the additional coal.

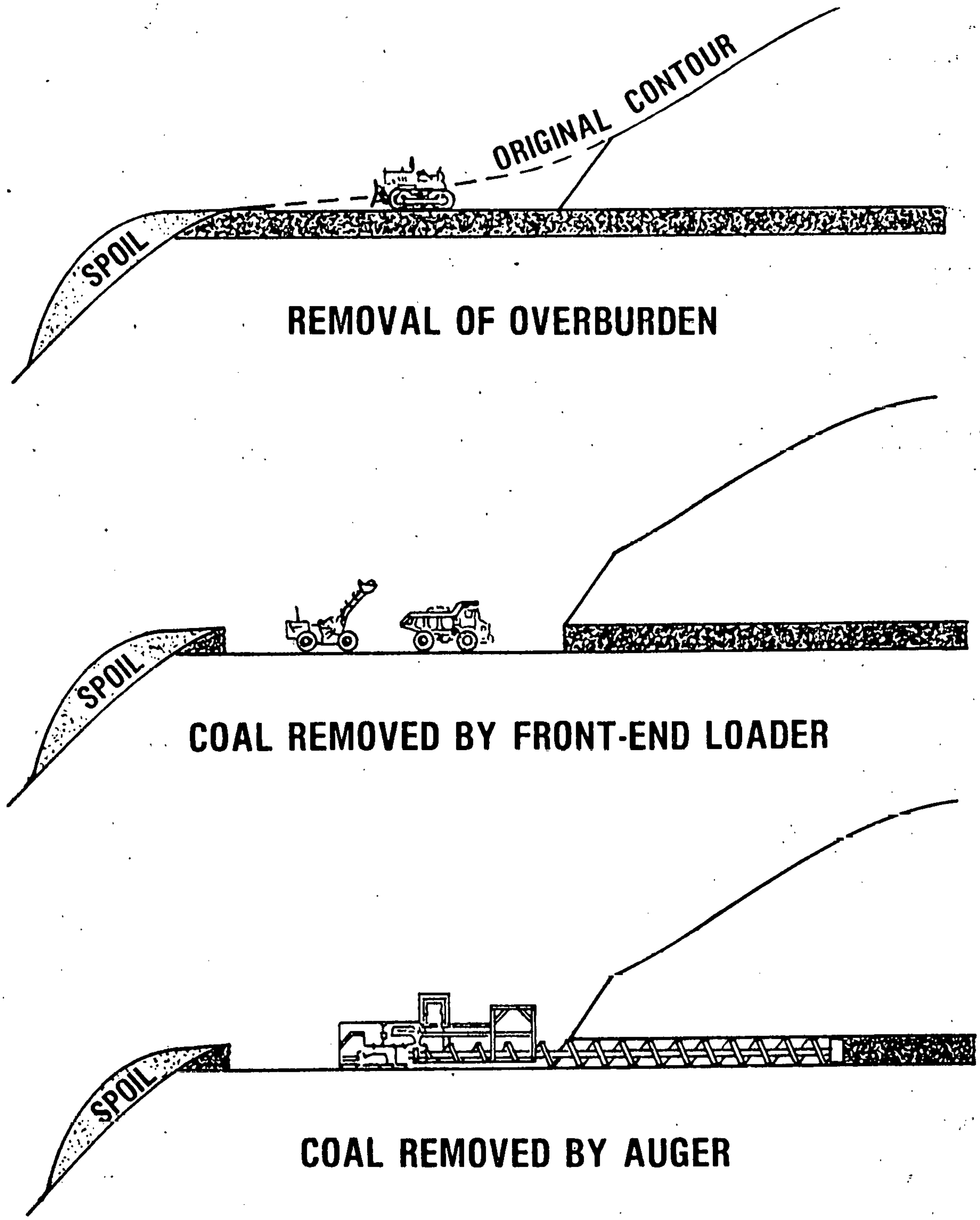
The conventional method is to use sparkproof explosives or compressed air to shatter the coal. The continuous mining method is employed in the extraction of over half of the coal mined underground in the United States. This method uses a single machine to mechancially break and load the coal.

In the longwall mining system, hydraulic yielding jacks support the roof along the immediate face of removal. As the face advances, the roof behind is allowed to collapse.

The shortwall system uses continous or conventional mining systems in conjunction with longwall roof supports to extract the coal pillars (Tetra Tech, 1976).

RECOVERY EXPERIENCE IN ALASKA

Early coal production in Alaska came from a number of underground mines. Between 1916 and 1940, production was primarily bituminous coal from the Wishbone Hill district of the Matanuska Coal Field and subbituminous coal from the Healy and Suntrana areas of the Nenana Coal Field. Within ten years of its introduction in 1943, surface mining became the dominant means of extraction in Alaska.



Source: Phelps, Edwin R. *Elements of Practical Coal Mining.* Baltimore: Port City Press, 1973.

Figure 5-1

Contour Mining with Bulldozer and Auger

Source: Tetra Tech, Inc., Energy From Coal: A State of Art Review, p. IV-3.

Currently, Alaska's only major commercial operation of coal is a surface mine at Usibelli which extracts about 700,000 tons per year. A dragline with a 33 cubic yard capacity was recently constructed at Usibelli.

PLANS FOR BELUGA

President Carter's emphasis on conversion to coal as a national policy has prompted interest in opening the Beluga Coal Field. At Beluga, conventional surface mining equipment such as trucks, scrappers, front-end loaders and draglines for overburden removal will be considered. If overburden must be moved very far, bucket wheels may be used (Patsch, 1978). The planned rate of coal extraction will largely determine the specific equipment employed.

BENEFICIATION

Beneficiation, the preparation of coal(s) prior to usage, has been practiced, with varying degrees of proficiency, from the time coal was first used. Consisting of any or all of the following, the beneficiation of coal enables man to utilize its heating or chemical qualities to their fullest:

Raw coal preparation

Size reduction (breaking or crushing)

Screening

Cleaning (wet or dry methods)

Drying

RAW COAL PREPARATION

To improve product quality and uniformity, various underground preparation methods can be used depending upon the specific geographic location and seam characteristics of the raw coal.

Sampling the entire mine area provides a basis to determine optimum mining and preparation methods. Selective mining can then be employed to maintain uniformity in chemical quality, eliminate removable impurities, regulate sizes and size ratios, and control moisture content. Thus, the coal obtained can better satisfy predetermined market requirements by selecting or blending coals of several characteristics from the area (Anderson in Leonard, 1968).

Futher treatment of the raw coal prior to mechanical beneficiation involves the removal of large pieces of tramp iron and other impurities. Tramp iron must be removed from the coal prior to further beneficiation as the iron can damage equipment and lead to expensive down-time and repairs. The primary means of removing tramp iron is by magnetic attraction involving:

1. a protative electromagnet which lifts the iron from the coal,
2. a permanent type magnet which is a self-cleaning version of the above but is slow and inefficient, or
3. an electromagnetic pulley that is expensive but highly efficient.

Hand picking, the earliest form of coal preparation, is still used to remove impurities. First used to remove pieces with an objectionable outward appearance, it is still practiced on the plus one-in. sizes, and especially on the plus four-in. and larger sizes (Anderson in Leonard, 1968).

SIZE REDUCTION (BREAKING & CRUSHING)

As of 1967, 65 percent of the coal in the United States underwent beneficiation processes involving breaking and crushing. Reduction of particle size facilitates the cleaning process and supplies the variety of uniform sizes demanded by end users.

The reduction is accomplished through two or more stages of mechanical action involving impact, compression, splitting, shearing, or attrition. Primary breakers reduce the raw coal to a maximum size of four to eight inches for washing and other preparation. The various sizes may be screened before delivery to different washing units and the secondary crushers where it is further reduced to sizes from about 1½ or 1 3/4 to 0-in (McClung in Leonard, 1968).

Breaking and sizing activities are extremely efficient. Processing 10^{12} BTU's of coal consumes about 2.0×10^{9} BTU's of the energy, of which 80-85 percent is provided by electricity and the remainder by oil. Costs for breaking and sizing operations in 1972 were about $2,250 per 10^{12} BTU's of which 87 percent were operating costs and 13 percent fixed costs. This approximates $0.002 per million BTU's or $0.055 per ton of coal (Science and Public Policy Program, 1975).

SCREENING

The sizing of coal fragments, its separation into groups of particles ranging between defined maximum and minimum dimensions, is one of the most important beneficiation operations. Although it is usually accompanied by some crushing, sizing may often be the only beneficiation operation performed from the time the coal is broken at the face until it is received by the customer.

Usually, sizing is accomplished by sifting the coal through screens. Although relatively uncommon, very fine particles may be commercially separated by differential settling in air or water currents (Shotts in Leonard, 1968).

CLEANING

In the cleaning, or washing, of coal, two categories of methods are used. The first, wet washing, is most commonly used by coal operators. Three basic methods of wet washing are employed: 1) flotation of coal on a magnetite-pulverized iron ore-slurry allowing impurities the settle out; 2) entraining the coal in an upward flow of water; and 3) froth flotation which employs chemicals to make the coal water-repellent, allowing it to attach itself to air bubbles and be skimmed off the surface of the water (Science and Public Policy Program, 1975).

The second cleaning category is the dry washing technique. Basically, this uses forced air to remove small particles from crushed bituminous coal. While not all coals can be pneumatically cleaned, it is the most acceptable method in terms of delivered BTU cost (Leonard, 1968).

Washing is generally 96-97 percent efficient, depending on the percentage of feed that requires washing. For each 10^{12} BTU's washed 2.2-2.4x10^9 BTU's are required of which 80 percent is supplied by electricity. Costs for washing in 1972 were approximately $11,900 per 10^{12} BTU's of which 24 percent was for fixed costs and 76 percent for operating costs. This is approximately $0.012 per million BTU's or $0.31 per ton of coal assuming an energy content of 26 x 10^6 BTU's per ton.

The water requirements for wet washing operations varies with the specific method employed. Battelle indicates that an average of 1,500 to 2,000 gallons of water are required for each ton of coal washed. Tenakron, however, estimates only 524 gallons are used per ton, of which 18 gallons are consumed in the process.

The solids generated during any washing process total about 4,000 tons of every 10^{12} BTU's. For a typical plant processing 500 tons of coal per hour, approximately 1,000 tons of waste which must be disposed of are generated daily, depending on the type of coal (Science and Public Policy Program, 1975).

DRYING

Drying of coal is required regardless of the washing method employed. Drying is a costly project and is usually accomplished by forcing hot air streams over the wet coal (Science and Public Policy Program, 1975).

Surface moisture may be removed for a variety of reasons:

1) facilitation of handling, shipment, and storage, including the avoidance of freezing;

2) maintenance of high pulverizer capacity;

3) increase in heating efficiency by reduction of heat lost through evaporation during burning;

4) increase in quality when coal will be used to produce coke, briquettes, or chemicals;

5) reduction of transportation costs through lower shipping weights;

6) facilitation of dry coal washing processes (Leonard, 1968).

Industrial coal dryers employ continuous direct contact and convection to dewater coal. Coal dryers can be grouped into six basic types: (1) fluidized bed, (2) suspension or Flash, (3) Multi-Louvre, (4) vertical tray and Cascade, (5) continuous carrier and (6) drum type (Leonard, 1968).

A considerable amount of dust is produced and collected in the drying process. If used as fuel to heat dryer gases, collected dust can provide all or most of the heat required for drying. To reduce dust during subsequent handling and losses during transport due to wind, the application of 1.5 to 2.0 gals./ton of heavy oil has been found to be quite successful (Ellman, 1975).

EXPERIENCE IN ALASKA

Research on washability of Alaskan coals supplementing the efforts of the U.S. Department of Energy (formerly U.S. Bureau of Mines) has been recently published (RAO, 1978). Nine coal samples were collected from the Nenana, Jarvis Creek and Matanuska coal fields. These samples were crushed to 38mm, 8mm, and 14 mesh sizes and sinkfloated at 1.30, 1.40, and 1.60 specific gravities. The products were analyzed for moisture, ash, heating value, total sulfur, and pyritic sulfur and washability data was calculated and tabulated.

The results showed that subbituminous "C" coals from the Nenana field could yield products ranging in heating values from 10,500 to 11,500 btu/lb with 0.25% sulfur on a moisture free basis. Subbituminous "C" coal from Jarvis Creek could be upgraded to more than 11,000 btu/lb on a dry basis and sulfur could be reduced to less than 1% after crushing to 14 mesh. High volatile "B" coal from Premier Mine gave a product with a heating value of 13,300 btu with 0.42% sulfur while high volatile "A" coal from Castle Mountain produced 14,400 btu/lb with 0.49% sulfur, both on a dry basis. (For a sample analysis of coal from the Beluga coal field, see Appendix 5-C.)

Currently, the Usibelli Coal Mine crushes and screens coal to 4 inch minus. About 10-15% of the coal is washed, depending upon specifications which vary from customer to customer.

BENEFICIATION AT BELUGA

Beneficiation technology to be used for the Beluga coal has not been determined at this time. Inevitably, however, it will depend upon customer specifications.

STORAGE

Coal is unique in its storage characteristics. It is the only fossil fuel that may be stored in any quantity, for any time period, indoors or out, on surface or under water, with safety, and at low cost. Storage may occur at the mine, preparation plant, and user's plant and is classified according to purposed use. Live or active storage feeds directly to firing equipment and is usually kept under cover. Reserve or inactive storage is normally stockpiled outdoors.

Storage policies will vary according to plant size and type, coal characteristics, transportation facilities from the mines, seasonal fluctuations in demand, and storage facilities. The amount of active storage is usally 3 to 7 days supply, while reserve stockpiles are for a 30-day supply or 20% of annual consumption, whichever is greater.

OUTSIDE STORAGE

Outside storage piles should be located in open, well drained, hard-surfaced sites that avoid heat elements of any kind. Although piles are commonly conical, wedge and kidney shapes can be used to increase capacity.

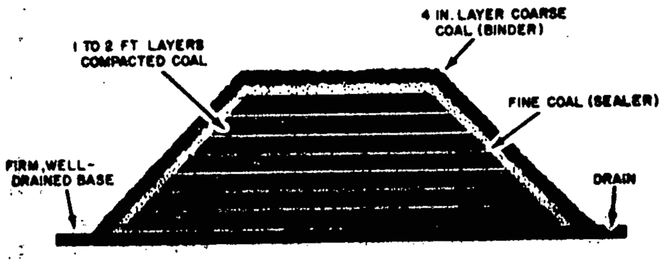
Uncompacted piles may be used by plants requiring less than 500 tons of outside storage. Using double-screened or slack coal, these piles should not exceed 20 feet in height, reductions being made in relation to the coal's reactivity.

Compacted coal piles should always be used for larger reserve piles. Successive layering and compaction seal out air and water, minimizing spontaneous heating and reducing heating-value loss to no more than one percent (Figures 5-2 and 5-3).

If stockpiles are properly built, further sealing is usually not required. However, for additional protection, the pile may be capped with asphalt, road tar, or a 6 inch layer of fine coal (¼ x 0 inches) anchored by a 4 inch layer of at least 2 x 0 inch (National Coal Association, ND).

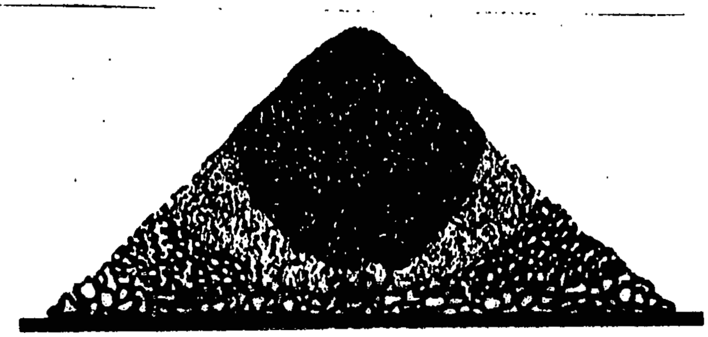
Haphazard Stacking, Showing Air Circulation

Figure 5-2



Cross Section of Compacted Pile

Figure 5-3



Segregation of Different Sizes of Coal
in Conical Pile.

Figure 5-4

Source: "Coal Storage Methods," Fuel Engineering Data, National Coal Association, Washington, D.C.

STORAGE EFFECTS

The following effects of storage vary according to the characteristics of the coal in question and the storage method used. These effects are almost eliminated in a correctly compacted stockpile. In-plant live storage normally presents few problems because of its location and rapid usage.

Coals, especially those of lower rank such as subbituminous and lignite, suffer from slacking. During warm weather, gradual moisture evaporation cracks and breaks up the coal particles with exposed surfaces.

Changes in burning characteristics are important in slack-size coals. Its caking tendencies may decrease significantly, improving efficiency in some types of fuel-burning equipment. After long storage, kindling temperatures may rise and mineral matter may oxidize to some extent.

Deterioration in heating value varies widely, depending upon the method of storage and the climate. For example, an uncompacted West Virginia coal showed a loss in heating value of 1.2 percent the first year, while a compacted storage pile of Central Pennsylvania slack lost only 0.3 percent after six years (National Coal Association, ND).

Spontaneous combustion is more likely to occur with coals of high bed-moisture, oxygen, and volatile content, the properties of the low-rank coals. For example, Australian brown coal ignites at about 200°C. (392°F). The main cause of spontaneous combustion is the absorption of oxygen by the coal, a process which generates heat and produces carbon dioxide, carbon monoxide, and water. However, low-temperature oxidation is complex and not completely understood.

Catalysts, such as pyrite (FeS_2), can occur in the coal. Although the effects of pyrite are disputed, experts believe that it unites with oxygen and water to form sulfuric acid and iron sulfate. The heat generated in this process raises the temperature and oxidation rate of the coal. Pyrite, however, can be removed by washing (Sondreal, 1974).

The heating process is dependent on the total coal surface exposed to the air. Air currents within a pile not only carry away heat, but also supply oxygen for combustion. Larger lumps fall to the outside when coal is piled by letting it drop into a conical pile (Figure 5-4). This creates a spectrum of conditions, one of which may provide the heating and ventilation ideal for combustion. Wet storage of coal, in contrast, cools the coal, but alters ventilation and increases pyrite activity.

When dried coal is used, it is important that it be cooled before stockpiling. The greatest danger is during the initial storage period and any additional heat will encourage spontaneous combustion (Figures 5-5 and 5-6).

Coal pile fires can usually be extinguished by isolating the burning coal from the pile. Water may be temporarily effective, but excessive moisture will increase the rate of oxygen absorption in the coal. Carbon dioxide may also be used but, as with water, heating is likely to redevelop (National Coal Association, ND).

Surface moisture may cause winter freezing problems. These can be prevented by using large, double-screened coal and/or thermally dried, oil-treated coal. Dried coal should be cooled to ambient temperature before stockpiling to prevent the subsequent release and condensation of water vapor (Paulson, 1975).

Coal storage facilitates blending, allows mines and plants to function more independently, and permits adjustments for fluctuations in demand and weather conditions (Tetra Tech, 1976).

EXPERIENCE IN ALASKA

Coal storage in Alaska has encountered few difficulties. On occasion, a customer in the Interior Region will sprinkle coal with water to settle dust and if this action is followed be very cold weather, the result is a

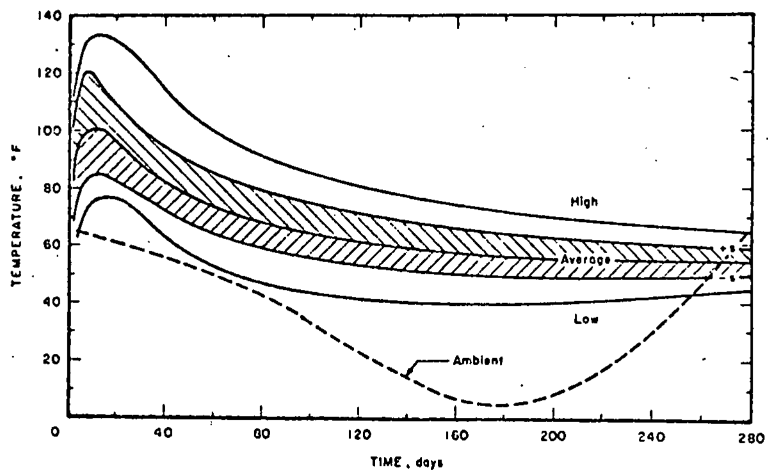


Figure 5-5

Temperature history of dried subbituminous stockpile.

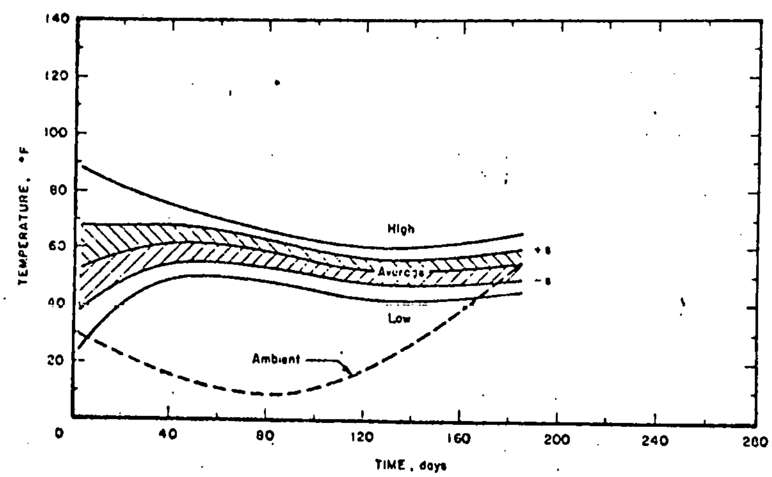


Figure 5-6

Temperature history of dried lignite stockpile.

Source: Paulson, Cooley, U.S. Bureau of Mines, Wegert, and Ellman; "Experiences in Transportation of Dried Low-Rank Western Coals;" to be presented at SME Meeting; September 10-12, 1975.

"freeze" of the coal which makes handling very difficult. However, the coal is not washed for shipping, thus avoiding the problem of surface water. Inherent (internal) moisture does not present freezing difficulties.

Golden Valley Electric Association has had some minor problems with spontaneous combustion. At Usibelli, the mine workers merely remove that portion which is smoking to a remote area and allow it to decompose safely. While spontaneous combustion occurs occasionally, it is limited by the low pyritic sulfur content of the Nenana coal. It is further reduced by the fact that the coal is not dried during beneficiation (Rao to DEPD, 1978).

In the Beluga Coal District, Placer-Amex is considering the storage and transporation of coal in oil. (See "Coal Transported in a Slurry," Chapter 6: Transportation.)

GENERATION OF ELECTRICITY

The technology of burning coal to produce electricity was discussed in Phase I, Volume I Report of this project. An excellent status of combustion systems is given in "Fossil Energy Research and Development Program for the U.S. Department of Energy. " 1978. Since the Clean Air Act of 1970 and the Amendments of 1977 are extremely important to the coal-fired segment of the electric utility industry, an abstract of the contents of the Act and Amendments are given below (Bromberg, 1978).

THE ORIGINAL CLEAN AIR ACT

After a long and frustrating legislative ordeal, the Clean Air Act Amendments of 1977 were finally signed into law by President Carter on August 7, 1977. This is not a new philosophy. The basic framework and objectives of the 1970 Act have been retained. Certain features have been strengthened, certain modes of compliance, such as intermittant controls, have been eliminated as viable options; but the general thrust of achieving lower ambient air concentrations of certain pollutants remains the same.

When the Clean Air Act of 1970 was enacted, SO_2 was considered the major hazard in emissions from coal-fired plants. Regulations and enforcement procedures were established for SO_2 on a two tier system. On the national level New Source Performance Standards (NSPS) were set for all new coal-fired generators, limiting their emissions to 1.2 lbs SO_2 per 10^6 BTU of heat input. This is the maximum allowable Federal emission rate for new sources. The individual states can, and often have, imposed more stringent regulations for urban areas. The objective of these emission limitations is the attainment of certain maximum ambient concentrations of pollutants.

Additionally, each state was required to establish its own State Implementation Plan (SIP) for the control of SO_2 and other pollutants. These regulations apply to existing plants as well as to new plants if the State regulations are more stringent than those of the Federal Government. Pennsylvania, for instance, has a three-tiered SIP for large, stationary sources. Plants located in rural areas are limited to about 4 lbs. $SO_2/10^6$ BTU; and plants in urban areas (Pittsburg and Philadelphia) are limited to about 2 lbs. $SO_2/10^6$ BTU.

The Clean Air Act has also added a new dimension to the design and operation of coal-fired boilers. As a result, the sulfur content of coal has become a characteristic of importance equal to that of the calorific value and ash content.

The SO_2 emissions from coal-fired combustion plants can be reduced either by adjusting the feedstock before combustion or by treating the effluent gases after combustion, or by a combination of the two. Under the constraints of existing technology there are only <u>three techniques</u> which are applicable to large scale operations. First, before combustion, the sulfur content of the raw coal may be reduced by mechanical beneficiation or, secondly, alternate sources of low sulfur coal which meets emission limitations upon direct combustion may be employed. As the third alternative, higher sulfur coals may be used, and the SO_2 in the effluent gases removed by lime or limestone flue gas desulfurization (FGD). Alaska is fortunate in that much of Alaska's coal is lower in sulfur than the so-called "low sulfur" western coals.

Active research and development programs are presently underway in a number of other areas including: chemical desulfurization; magnetic beneficiation; fluid bed combustion; regenerable FGD systems as well as coal gasification and liquefaction. At the present time, however, only the aforementioned three technologies are available.

The use of low sulfur coal is not really a new technology but a change in fuel supply. Traditionally, "low sulfur" coal has been classed as a coal with a sulfur content of less than 1 percent. When used as fuel for combustion, the term "low sulfur" coal should properly be defined with respect to the applicable clean air regulation. Before a coal can be classified as "low sulfur," the calorific value of the coal must be determined, as well as the geographic location of the boiler. Table 5-1 indicates the maximum percentage sulfur content of coals of various BTU ratings which may be burned and not exceed the indicated SO_2 emission limitations.

THE CLEAN AIR ACT AMENDMENTS OF 1977

The Clean Air Act Amendments of 1977 have introduced changes in the Act of 1970. The general objective of improved ambient air quality remains, but the choice of compliance modes is less clear than previously. In the past, a utility generally had its choice of technology to meet the prescribed emission limit. The options are now more nebulous and "low sulfur" coal may no longer be a viable mode of compliance, an important consideration for Alaska.

The objectives of improved ambient air quality standards have been strengthened as evidenced by the emphasis on best available control technology (BACT) and lowest achievable emission rates (LAER). The new amendments have changed the term "emission standard" to "standard of performance," a wording change which may have a great impact depending upon how EPA proceeds to establish these standards.

TABLE 5-1

Sulfur Content of Coal Required to Meet Sulfur Oxide Emission Standards in Coals of Different BTU Content

Emission Standard (lba SO_2 per million Btu)	% S Meeting the SO_2 Emission Standard* for a Coal Whose Btu Content (in Btu per lb.) is			
Btu/lb	8,000	10,000	12,000	14,000
0.6	0.24%S	0.30%S	0.36%S	0.42%S
1.2	0.48	0.60	0.72	0.84
2.0	0.80	1.00	1.20	1.40
4.0	1.60	2.00	2.40	2.80
6.0	2.40	3.00	3.60	4.20

* Assumes all sulfur is converted to SO_2. The fact that some sulfur remains in the ash (about 5 percent) would raise these entries by a comparable amount.

Source: J. Philip Bromberg, "The Implications of the Clean Air Act Amendments of 1977 for Coal Utilization," Society of Mining Engineers of AIME, 1978.

The original Act mandated the attainment of National Ambient Air Quality Standards (NAAOS) by 1975. While some progress has been made, these standards were clearly not attained in many parts of the country, including almost all urban areas. A major purpose of these amendments was to provide an additional and stronger thrust in the direction of the prevention of significant deterioration (PSD) and nonattainment of air quality standards.

The punitive aspects of the act has been harshened. Fines of $25,000 per day are possible. In addition, financial penalties are mandated in cases of delays in compliance. The non-complier must forfeit any financial benefit he achieved by his non-compliance, either to the state if the state initiates the action, or to the Federal government if the Federal government initiates the action in the face of state inaction.

The problem of interstate pollution is also addressed. It allows neighboring states to protest the operation of sources which might affect their own states.

That water is a resource with vested property rights was recognized centuries ago with the development of riparian rights to water. It is now being recognized that air is also a resource with vested property rights, particularly within the context of nonattainment and PSD.

LOW SULFUR COAL

Under the Clean Air Act of 1970, low sulfur coal was a viable and acceptable mode of compliance with the new source performance standards. Many eastern utilities made plans to utilize large quantities of imported western low sulfur coal to meet these standards. Projections of future production in the western coal fields were based on the assumption that large tonnages would be consumed in eastern boilers.

Each state must determine with respect to its SIP "the extent to which compliance with the requirements of such plan is dependent upon use of coal or coal derivatives which is not locally or regionally available."

The Amendment then goes on to note that any major source may be prohibited from burning fuels other than locally or regionally available coal or coal derivatives if such use would result in local economic disruption or unemployment. It is reasonable to assume that the governors of the individual coal mining states will be under extreme pressure to invoke this section whenever imported low sulfur coal threatens to displace local coal. In invoking this prohibition, the Act goes on to state that the effects of ultimate consumer costs must be taken into account. The mode of taking these costs into account will presumably be established by later regulations. Apparently, in-state use of Alaska's low sulfur coal will be permitted, but out-of-state shipment may depend upon the location of the customer.

Section 111 (109) has considerably altered the concept of NSPS. EPA must now revise the present standards to require not only emission limits, but also percent reductions in effective sulfur content. This has considerably altered the efficacy of the three technologies previously discussed and has altered the relationship between them. Scrubbing or beneficiation will apparently be required on all coal regardless of the sulfur content of the coal. The percent reduction is to be determined by regulations yet to be promulgated by EPA. It should be noted that if this percentage exceeds the amount by which the sulfur can be removed by beneficiation, then this section may require scrubbing virtually everywhere, regardless of the coal used. On the other hand, there is some legislative history indicating that the Administrator may establish a range of percent reductions based upon the sulfur content of the raw coal. "BACT, LAER (and NSPS) will mean what the Administrator of EPA eventually says they mean. In addition, they will be determined on a case by case basis." (Bromberg, 1978)

The application of BACT may require a case by case imposition of limitations more stringent than NSPS, particularly in PSD areas, and LAER will require the imposition of limitations more stringent than NSPS in nonattainment areas. In other words, the yet to be established LAER standards will effectively be the NSPS in nonattainment areas. Considering EPA's history of committment of scrubbers, it is not unreasonable to expect that a substantial portion of compliance technology will be defined in terms of scrubber capability.

In establishing these standards, the Act mandates that consideration must be given to such factors as costs, available technology, energy consumption, as well as environmental impacts. The new permitting procedures may well require the preparation of an environmental impact statement, or the equivalent thereof, for the construction of any new plants or the conversion of old plants.

The term "emission standards" has been changed to "standard of performance." This subtle change could be of great significance. An "emission standard" is fixed uniform number such as 1.2 lbs. SO_2 per 10^6 BTU. It allows the operator to comply by any means which will achieve the designated number. It is uniform for all plants in a class. A "standard of performance" is more variable, and may have a different effect on different plants in the same class. A standard of performance may be a specified percentage reduction in effective sulfur content of the coal, or it may be a specified technology. If it is to a specified technology, past history indicates that it would be flue gas scrubbing, at least until newer technologies are developed. Under a fixed emission standard, it would appear to be permissible to construct an FGD system such that it treats only that portion of the stack gas required to meet the standard.

Under a standard of performace system, this approach may not be allowed, and total scrubbing may be required regardless of other factors. Section 109 (111) further stipulates that these standards must be continually reviewed and revised downward as improved technology is developed to allow for more stringent standards of performance.

Also, the market for coal derivatives from Alaska's coal may be limited in the future because "derivatives" may be specifically identified in the amendments as noted earlier.

SO_2 EMISSIONS

The emissions of SO_2 from natural sources, volcanoes, sulfur springs or hot springs exceeds by far the emissions under the control of man (power plants, smelters, etc.). Nonetheless, the fact that the man related SO_2 emissions are often released close to areas of high population density, heightens the importance of the man made emissions.

Public concern over SO_2 was stimulated by a number of incidents related to the effects of SO_2. These include the human losses in the Donora, Pennsylvania smog of 1948, and the vegetation losses in Ducktown, Tennessee (early 1900's), and in Trail, British Columbia (1920's), (Niessen, 1975).

A summary of worldwide SO_2 emissions, the SO_2 effect in health and a comparison of limit levels versus disaster levels is given in Figure 5-7.

FLUE GAS DESULFURIZATION

In flue gas desulfurization (FGD), the SO_2 is removed from the effluent stack gas by a chemical process. In lime/limestone FGD, the gas is brought into contact with a slurry of lime or limestone and is precipitated as a mixture of $CaSO_3$ and $CaSO_4$. When the lime or limestone in the slurry is spent, the entire slurry is discarded and replaced with new slurry.

FGD systems are capable of removing 90 percent of the SO_2 from the stack gas. Lime/limestone scrubbers, while conceptually simple, are complicated chemical factories which treat the effluent flue gases. They are capital intensive, expensive to operate, and consume relatively large quantities of energy (Princiotta, 1978).

It is anticipated the EPA will propose an upgraded NSPS for utility boilers which will call for a specified percentage of sulfur reduction, probably between 85-90%.

Figure 5-7

SO_2 EMMISSIONS

ANNUAL WORLD-WIDE SO_2 EMISSIONS

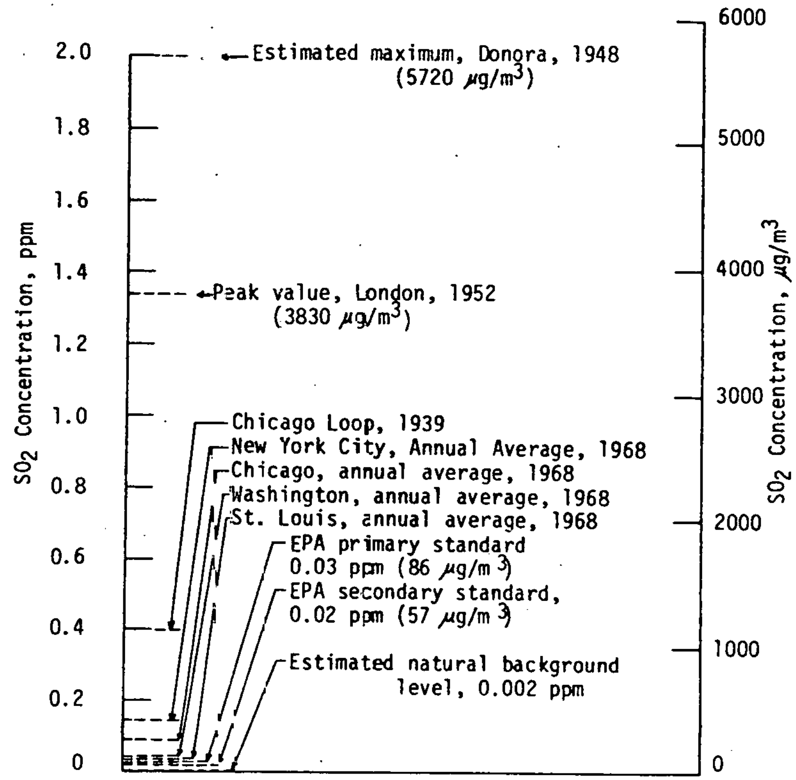
Source	Emmissions, 10^6 tons	
Coal	102	
Petroleum	28	
Nonferrous smelting	16	
Industrial (H_2 equivalent)	6	
Total man-generated SO_2		152
Marine (H_2 equivalent)	60	
Land H_2S(SO_2 equivalent)	140	
Total natural sources oxidized to SOH_2		200
Sulfur in SO_2 from sea salt (SO_2 equivalent)		88
Total world-wide:		440

EFFECTS OF SO_2 ON HEALTH BY LEVEL OF RESPONSE

	Sulfur dioxide		Sulfates
Level of response	$\mu g/m^3$	ppm	$\mu g/m^3$
Death	500-1000	0.20-0.40[a]	No data
Illiness (acute, chronic)	80-275	0.03-0.11[a]	7-14[a]
Functional changes Preceding disease	90-120	0.035-0.45[b]	9-11[a]
Changes of uncertain Significance	500-1000	0.20-0.40[c]	250[c]
Pollutant burdens	No data	No data	No data

a. 24-hr average. b. Annual average c. Experimental studies

COMPARISON OF SO_2 LEVELS for disasters, averages in cities, and standards gives an insight into severity of EPA limits



Source: Thomas C. Elliott, "SO_2 Removal From Stack Gases," Power, September 1974.

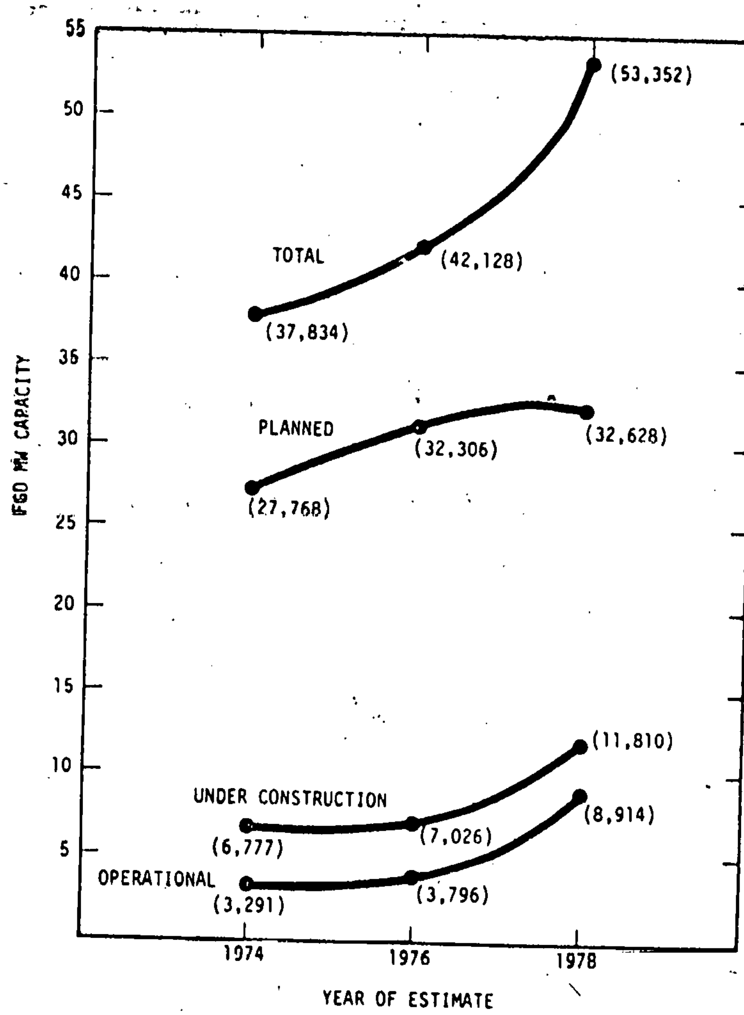
The number of FGD systems installed annually has steadily increased from 1968 to 1976. As of December 1977, there were 29 units in operation and an additional 51 units in design or under construction. Figure 5-8 illustrates this trend by showing the estimated utility committment to FGD as a function of the survey year. Total utility committments are estimated to be over 50,000 Mwe. The great preponderance of these units are lime or limestone scrubbing systems producing a disposable product. In order to put this number in perspective, the current coal-fired power plant capacity is about 200,000 Mwe.

Unlike the use of low sulfur coal and mechanical beneficiation which are independent of the boiler operation, FGD systems form an integral part of the boiler system. A breakdown of the FGD system may necessitate shutting down the entire plant; this can be very costly. Cost calculations of scrubber technology generally ignore this factor. Unfortunately, the experience of a number of utilities may indicate that the frequency of down-time is sufficiently high that this factor should not be completely ignored.

For example, the Bruce Mansfield installation (Unit #1 - 825 MW) was forced to shut down for an extended period of time to repair the damage to the chimney liner arising from the corrosive nature of the flue gas. The capital charges attributable to a complete shutdown amounted to some $300,000 per day, not including the cost of repairing the chimney.

Significant problems affecting United States plant operation have included mist eliminator performance degradation, calcium sulfate-scaling, stack lining failure, instrumentation malfunction and reheater plugging or corrosion. However, operating experience and design modifications have resulted in both higher reliability in newer plants and increasing reliability in existing plants.

While some recent United States reliabilities have been over 90%, Japanese FDG installations with reliabilities greater than 95% indicate that additional improvements can be anticipated. During February 1978, a task



INCREASE IN FGD UTILIZATION AS A FUNCTION
OF THE YEAR THIS ESTIMATE WAS MADE.
FGD MW CAPACITY

Figure 5-8

Source: Frank T. Princiotta "Engineering Update for Flue Gas Desulfurization Technology", ENERGY TECHNOLOGY V, Proceeding the Fifty Energy Technology Conference, February 27 - March 7, 1978, Washington, D.C., Government Institutes, Inc., page 996.

force visited Japan to determine the performance of several key FGD facilities. This task force included representatives of EPA, TVA, and the Electric Power Research Institute. The Task Force examined five FGD systems which are now operating in Japan on coal-fired boilers; all are either lime or limestone scrubbing facilities, producing a disposal product or saleable gypsum. Preliminary evaluation indicated that all five facilities had extremely high reliabilities, with essentially none of the problems which have affected certain U.S. installations (Princiotta, 1978).

FLUE GAS DESULFURIZATION RESEARCH

Research is underway in methods to improve the limestone scrubbers. For example, a development program has been initiated to integrate all the chemical and process steps of conventional limestone/gypsum processes into one vessel. This has led to the development of a new limestone based process employing a new, more efficient gas-liquid contracting device. Flue gas is sparged into the absorbent through an array of vertical spargers generating a froth for efficient gas-liquid contact. SO_2 is absorbed producing sulfite which is oxidized to sulfate. Oxidizing air from the bottom supplies sufficient oxygen to completely oxidize the sulfite. Benefits claimed from this new process are: simplicity of design, lower capital cost, energy conservation, saleable or easily disposable gypsum by-product, and elimination of calcium scaling problems.

An extensive research and development program that included operation of a 650 scfm pilot plant was conducted to provide prerequisite data and information for the design and operation of a prototype plant. Construction is now underway on a demonstration plant at Gulf Power Company's Scholz Steam Plant to demonstrate the cost and energy effectiveness and operability of this advanced technology (Clasen, 1977).

Additional significant research is underway on different methods for removing sulfur in coal-fired industrial power plants. For example, the results of pilot operation of Citrate Flue Gas Desulfurization in process at a base metal smelter application in Kellog, Idaho are being applied to a Gomn coal-fired generating unit owned and operated by St. Joe Minerals Corporation at Monaca, Pennsylvania, on the Ohio River, northwest of Pittsburgh (Madenburg, 1977).

The citrate process controls SO_2 emissions by the use of aqueous solutions of organic acids. The ten years research by the Bureau of Mines showed that a buffered solution of sodium citrate is the most effective. The Kellogg pilot operation confirmed previous laboratory research that the citrate process is capable of 99 percent removal of sulfur dioxide discharge from industrial waste gases. Some of the leading processes that are technically feasible for SO_2 removal from boiler stacks are given in Table 5-2.

FGD COSTS

The TVA has updated their previous estimates of flue gas desulfurization costs and have also utilized a computer code developed by TVA and Bechtel Corporation to relate FGD costs to some of the important design parameters.

The inclusion of an FGD system in a new high-sulfur coal-fired larger than 500 Mwe, requires an additional investment ranging from $80 to $100 per kilowatt ($/Kw). Annualized total investment and operating revenue requirements average four to five mills per kilowatt hour (mills/kwh). The corresponding coal-fired power plant costs without an FGD system are about 500 $/Kw and 30 mills/Kwh (Princiotta, 1978).

An analysis of the economics of coal versus nuclear for a power plant beginning operation in 1984 in Boise, Idaho gives a total mills/kwh of 33 without scrubber and 39 with scrubber (Rutledge, 1976). The capital and operating cost annualized for a 200 MW unit using the limestone/gypsum jet bubbling scrubbing system has been estimated at $31/kw and 1.87 mills/kwh respectively (Clasen, 1977). The annualized operational cost of the citrate FGD process previously discussed has been estimated to be 2.07 mills/kwh for a 500 MW coal-fired power plant using coal containing 2.5% sulfur (Madenburg, 1977).

Leading processes technically feasible for SO_2 removal from boiler stacks

Name of process	Reagent used	End products	Comments
Scrubber addition of limestone	$CaCO_3$	$CaSO_3$, $CaSO_4$	Probably the least expensive process to install; removal efficiency heavily dependent on limestone selected.
Scrubber addition of lime	CaO	$CaSO_3$, $CaSO_4$	Improved efficiency at the expense of greater potential for scaling. Less solid wastes produced.
Double alkali	NaOH	$CaSO_4$ (gypsum)	No scaling in scrubber, although a problem at precipitation stage. Smaller scrubbers and liquor flows possible.
Magnesia scrubbing	Magnesium compounds	H_2SO_4	Program today processes sulfuric acid at central plant from $MgSO_3$ salts scrubbed out and shipped from power plant.
Catalytic oxidation	Vanadium-pentoxide (Catalyst)	H_2SO_4	Catalytic oxidation occurs at 850 F, producing 80% sulfuric acid at the rate of 12 gallons/min.
Wellman-Lord/SO_2 reduction	Na_2SO_3	Sulfur	Wellman-Lord process produces concentrated SO_2 by thermal stripping of $NaHSO_3$. SO_2 is reduced to S with natural gas.
Citrate	Sodium citrate, citric acid	Sulfur	Twin actions continually occur: Absorption of SO_2 in citrate solution, regeneration of H_2S with sulfur produced.
Dry adsorption	Char from noncoking coal	Sulfur	Advantages of dry process are minimum water use, minimum waste disposal, no stack plume, no stack gas reheat.

TABLE 5-2

Source: Thomas C. Elliott, "SO_2 Removal From Stack Gases," POWER, September, 1974, p. 5-8.

The cost for flue gas desulfurization in Alaska has not been determined at this time, but hopefully it will be less than that of the lower 48 since the sulfur content is lower. However, higher construction costs and operational costs in Alaska continue to offer a challenge to utility managers with respect to holding down electrical costs.

EXPERIENCE IN ALASKA

Currently about 700,000 tons of coal per year are burned in Alaska to generate electricity and for space heating. The use of coal in years past, starting with Nathaniel Portlock burning coal in his ship in 1786, has been documented in Phase I, Volume 2 of this project. Plans for an additional 150 megawatts at Usibelli with joint participation by Golden Valley Electric Association (GVEA) and the Fairbanks Municipal Utility Service (FMUS) have been postponed. The decision was based on a slowing of demand growth and stricter environmental considerations. If future regulations permit a stack emission standard of 0.5 lbs. SO_2 per million BTU, no further sulfur removal would be necessary.

But if the government regulation is, for example, 0.2 rather than .5, some method for removing sulfur will be required. Consideration is being given to a process whereby a baking soda type chemical is added to the flue gas prior to it passing into a teflon coated fiber glass bag (in a "bag house") with the sulfur compound that is formed depositing on the surface of the bag. The primary purpose of the bag is to collect dust and solid matter, not remove sulfur, so that air particulate standards can be met. However, if such a sulfur removal process works, the cost could be reasonable. Dow Chemical and other companies have expressed an interest in taking the ash collected in the bag house.

BELUGA

Currently, the fuels used for electrical generation in the Anchorage-Beluga area are natural gas and to a lesser extent, hydropower. Even if the Susitna Hydroelectric Project is approved, additional interim electrical generating facilities may be needed. While some preliminary studies have been made for coal-fired generating facilities using Beluga coal, neither of the two major electrical utilities in the area -- Chugach Electric Association or Municipal Light & Power -- have commited themselves to a coal-fired plant at this time.

The economics of a coal-fired generation plant at Beluga will depend to a great extent upon the government regulations that are forthcoming from the Clean Air Act Amendments of 1977. In the past, a utility generally had its choice of technology to meet a prescribed emission limit of 1.2 lbs. SO_2 per 10^6 BTU. Now the emphasis is on the best available control technology (BACT) and lowest achievable emission rates (LAER). The new amendments have changed the term "emission standards" to "standard of performance" -- a change that may be very significant depending upon how EPA proceeds to establish these standards.

It is possible that EPA will require a specified percentage of sulfur reduction, probably between 85-90%. The technology required for removing 90% of the sulfur in eastern coal with 3% sulfur, leaving .3% sulfur, (more than some of the sulfur in Alaska's run of mine coal) may be very different for Alaska's coal.

However, there is some legislative history indicating that the Administrator may establish a range of percent reduction based upon the sulfur content of the raw coal. Hopefully, Alaska's very low sulfur coal, unique in the nation, will receive appropriate consideration as regulations are firmed.

COAL PROCESSING

Future coal processing technology may be very important to Alaska since there is no doubt that Alaska has significant coal deposits, a large quantity of which is both low in sulfur and near tidewater. If the carbon-to-hydrogen ratio of coal can be rearranged in an economic and environmentally satisfactory manner, an assortment of solids, liquids and gases can be produced for in-state and export use. Using a variety of catalysts, temperatures, and pressures, technologies are being developed to accomplish these chemical transformations.

Options for the formation of low or intermediate BTU gases include Lurgi, Koppers-Totzek, Winkler, and Wellman-Galusha that have recently or are currently being used commercially in various parts of the world. Experimental processes such as Bureau of Mines, Stirred Fluid Bed, Westinghouse Fluid Bed Gasifier, and Ash Agglomerating Fluidized Bed Gasifier Processes are also possibilities. The major difference between low and intermediate BTU gases is the presence of nitrogen as a diluent in the low BTU gas. This is avoided in the intermediate BTU gas processes by utilizing pure oxygen for combustion, or by keeping the combustion gases separate from the process gases.

Intermediate BTU gas may be converted to high BTU gas or substitute natural gas (SNG) by shifting, purification, and methanation. Some intermediate BTU gas processes inherently produce more methane than others and thus have an advantage when SNG is the desired product. Such experimental processes include Hygas, Bi-gas, Synthane, and CO_2 Acceptor (Souby, 1978).

Options for liquid fuels include the Modified Ash-Agglomerating Synthoil, H-coal, Consol Synthetic Fuel, COED, Toscoal, Fisher-Tropsch and Methanol processes. The solvent refined coal (SRC) process can produce either a high BTU solid or a liquid for utility fuel depending upon selected operating conditions.

Development will depend upon site specific considerations such as the amount of coal, rank of coal, sulfur content of coal, cost of transportation of product to market, construction and operation costs at the location selected. The purpose of this section on coal technology is to examine, the options available for the use of Alaskan coal. Special attention is given the Beluga Coal District which has significant subbituminous coal deposits which are low in sulfur and near tidewater, but high in ash and moisture. The section on Recommendations will identify suggested courses of action for Alaska to consider with respect to further coal development.

COKING

The carbonization of coal to produce coke was known and practiced as early as the late 1600's, but relatively large scale operations were not conducted until the mid-1700's. Even then coke was a by-product of other coal processing operations. Primarily the distillation of coal in an iron retort was to produce illuminating gas. It wasn't until 1856 that the first coking ovens were constructed in France to produce boiler-furnace and foundry coke as the main products (Tetra Tech, 1976).

Gradually the demand for pig iron for industrial growth grew; so too did the requirement for the coking coal which was used to produce the pig iron. By 1974, the United States alone consumed 64.1 million short tons (58.1 million metric tons) of coking coal (Cooper, 1976) in spite of improvements in blast furnace design and operating techniques which have reduced the amount of coke consumed per ton of pig iron by 20-25 percent since 1960 (Tetra Tech, 1976).

Production of coking coals in the United States, reached 61.581 million short tons (55.6 million metric tons) in 1974, 15 percent of the world's total production. Required for this production figure were 89.8 million short tons (81.4 million metric tons) of bituminous coal, 15 percent of the 1974 domestic production of bitiminous coal, and .444 million short tons (.40 million metric tons) of anthracite, 7 percent of domestic production. (The anthracite was used primarily in the production of foundry coke to achieve greater size and density, both of which are desirable properties in the melting of iron in foundry cupolas.) More recent figures for 1977 indicate that 15 percent of the United States coal production is used in the production of coke (Scollen, 1977). Projected annual requirements for coking in the U.S. range from 82-108 million short tons (74.4-98.0 million metric tons) by 1985 to 89-151 million short tons (80.7-137 million metric tons) by 2000 (Tetra Tech, 1976).

United States exports of coke for 1974 totalled 1.278 million short tons (1.16 million metric tons), approximately 2.1 percent of domestic production. Canada remained the principal foreign market, receiving nearly 56 percent of the exported coke. Imports for the same period totalled 3.54 million short tons (3.21 million metric tons), an increase of 228 percent over 1973 figures. West Germany was the source of 2.76 million tons (2.51 million metric tons) of those imports. Producers' stocks declined by 0.249 million short tons (0.226 million metric tons) over the year (Cooper, 1976). Future American participation in the world coking coal market has been projected to reach 20 percent of the world's requirements by 1985, provided increased production is not hindered and prices remain competitive (Tetra Tech, 1976).

With respect to the value of coke, foundry coke prices averaged $78.92 per ton in 1974 and the total value of all coal carbonized in slot ovens in the United States was over three billion dollars (Cooper, 1976).

Properties of Coke

Coke is a strong porous residue consisting of carbon and mineral ash formed when bituminous coal is heated in a limited oxygen supply or in the absence of air. The limitation of the oxygen available for combustion allows the volatile matter in the coal to be driven off without the combustion of the carbon, thereby leaving behind the lumps or small powdery particles of coke. Coke may also be formed by thermal decomposition of a petroleum residue.

Coke formation represents an intermediate stage in any fuel bed. In a boiler furnace, for example, some coals become plastic, soften upon heating and form lumps or masses of coke. Those coals that show little or no fusing action are called free-burning coals and are of little value as coking coals. It is the coal that demonstrates high fusing ability that is most valuable for coke production.

Coke production begins with the selection of a coal or a blend of coals to be used as the charge, the original mass of coal placed in the coking oven. The caking properties of a coal and the size and strength of the coke masses it forms are valuable indicators of the future performance of that coke as a fuel (Tetra Tech, 1976).

There are many qualities which determine the suitability of a coal for coke production. First and foremost it must have sufficient caking ability to melt and agglomerate during the coking process.

Secondly, the coal should be low in ash and sulfur content, although current technology is capable of tolerating the problems these two properties create. The ash and sulfur content of the feedstock coal bears directly on the quantity of coke required per ton of pig iron produced.

> High ash content means less fixed carbon in the coke and more slag volume in the blast furnace which in turn means more coke per ton of iron and less iron production. Some operators claim they can show from three to six percent increase in iron production for each percentage point of ash reduction in blast-furnace coke. (Leonard, 1968)

Lastly, the coal used as feedstock must be capable of being carbonized without damaging the coke-ovens or creating difficult operating procedures. The expansion of the charge in the oven when heat is applied is one of the major problems in the creation of coke. Expanding coals are mostly in the medium-volatile to low-volatile rank; therefore coals of the high-volatile ranks are the coals generally selected. Operating temperature regimes of the coke-ovens also influence the expansion of the charge. In general, the more rapidly a charge is heated, the more it expands. Therefore, ovens operated at high flue temperatures are more likely to be injured by expanding charges than those operated at medium or low temperatures (Leonard, 1968).

BLENDING

If a coal does not meet the above requirements, a blend of different coals may be created which does meet the qualifications. Blending is performed to improve the chemical and physical properties of coke, limit the expansion pressure developed on oven walls during carbonization and broaden the use of lower quality coals that could not be used alone for metallurgical-grade coke production. Currently, blending of coals is the standard practice at oven-coke plants because many coals do not produce satisfactory quality coke when used alone (Cooper, 1974).

COAL COKING METHODS

The selection of a coal, or blend of coals, is dependent on the method of coking to be employed. Coal is presently coked by four methods, although there are several experimental methods being researched. Each of the four methods of coking--the by-product slot type oven, the beehive oven, the rotary hearth process and the traveling gate process--requires a certain type of coal or blend if the method is to function properly.

Nearly all of the coke produced in the U.S. is of the by-product slot type oven process, requiring a coal charge of low ash, low sulfur, low coking pressure and high coke strength (Appendix 5-A). Because of these requirements, coal which originates from any given mine is not likely to be charged alone for conversion to coke.

The beehive oven process, the second method of producing coke, turns out several million tons of blast-furnace and foundry coke each year. The beehive is a slow coking process and the resultant coke is generally large and strong. Also, coals are frequently coked at the mine site. With the exception of when coals are blended, sulfur and ash content ranges from low to medium and is dependent on the area from which the coal was mined.

The third and fourth methods of producing coke, the rotary hearth and traveling gate processes, are used to carbonize very high quality coals for use in producing chemical cokes. However, the tonnage produced annually is extremely small. The rotary hearth requires sized, subbituminous coal or fine coking coal of generally less than six percent ash content. The traveling gate process requires a highly volatile coal with less than six percent ash and a free swelling index of six to eight (Leonard, 1968). (Appendix 5-B)

Several new processes for the production of coke are being researched and tested in an effort to develop techniques that will allow the use of a greater range of coals for coke production. Two experimental processes, the Arthur D. Little (ADL) Extractive Coking Process and the USS Clean Coke Process, appear to be viable possibilities for future coke production.

The ADL process was developed by Arthur D. Little, Inc. in cooperation with the Foster Wheeler Co. and the Pittsburgh Energy Research Center (PERC) of the Department of Energy. The process uses equipment and hardware already proven commercially feasible in petroleum refining operations. The process involves the use of a hydrogen donor solvent under mild conditions to achieve liquefaction. Then the cracking and coking separates the product out as an overhead vapor and the coal ash and heavy portion of the coal extract remains (Reber, 1977).

The Clean Coke Process is described in the sub-section "Aromatic Chemicals from Coal - Clean Coke Process" and in more detail by Schowalter (1977) and USS Engineers and Consultants, Inc. (1976).

RECENT DEVELOPMENT IN JAPAN

As steel production since World War II accelerated, Japanese consumption of coking coal for blast furnaces increased by nearly 600% between 1960 and 1973. Since approximately 84% of this is imported, stable supply sources have been sought in coal-producing countries. Present Japanese coal sources are world-wide and include the United States, Australia and Canada, the three major coal-producing countries in the world.

However, serious coal supply difficulties will rise as world consumption of coking coal increases. From 1972 to 1985, world consumption is expected to rise from 465 to 639 million tons. Some forecast the eventual exhaustion of high-quality hard coal necessary for the production of metallurgical coke even in the United States, where coal reserves are abundant.

With these predictions in mind, intensive efforts have been made to decrease coke consumption in Japanese blast furnace operations and reduce the cost of coke production. Simultaneously, technologies utilizing poor coking or noncoking coal have been developed.

Techniques expanding the range of metallurgical coke manufacture can be divided into many methods. The successful method most used in Japan increases the blending ratio of low-quality coal by adopting the briquette charging method. Here, the binder material, non-coking coal and a part of the coking coal are blended and formed by a briquette machine. Other normal coking coals are charged together with the briquettes in the coke oven.

The formed coke process is the other method for metallurgical coke manufacture of primary importance in Japan. They plan for its practical application in the near future (Sugasana, ND). (See the DKS process shown in Table 5-3.)

FORMED COKE PROCESSES THROUGHOUT THE WORLD

Use of great quantities of non-coking coal in conventional coking methods is impossible. Consequently, formed coke processes, which use non-coking coals, have been studied and developed in many countries. However, except for a few small-scale plants, commercial formed coke plants are not yet in operation. Table 5-1 shows the main processes of several pilot plants. Their methods are complicated and additional development is needed.

EXPERIENCE IN ALASKA

The Chickaloon deposit in Matanuska Valley does have some coal with coking properties. The Kukpowruk River deposit on the North Slope of the Brooks Range has a substantial amount of coal with good coking properties, similar to coal from Sunnyside, California. However, mining costs and transportation difficulties discourage the development of the deposit. The sea is open to barge traffic only 80 days per year. The Bering River Field, southeast of Cordova, also has coal with good coking properties. While water access would be much better than at Kukpowruk River, the area has experienced extensive faulting and the deposit would be very difficult to mine (Bottge, 1979).

TABLE 5-3

Formed Coke Processes

Process	Country	Outlines of the processes	Production capacity (t/d)	
			Existing	Planned
BLF	W. Germany	Heating Mixing Non-coking Coal —— Char —— Hot briquetting —— Coking Coking coal	120	300
ANCIT (EBV)	W. Germany	Dehydration and pulverization mixing Non-coking coal —— Hot briquetting —— Coking Coking coal	250	720
SAPOZ HNIKOV	USSR	Partial degasification Non-coking coal —— Hot briquetting —— Coking	300	2,700
CCC	USA	Heating Non-coking coal —— Rotary Kiln —— Pellet —— Coking Coking coal	10	450
FMC	USA	Dehydration Tar Non-coking coal —— Carbonization at a low temperature —— Cold briquetting —— Coking	250	-
DKS	Japan	Pitch tar Non-coking coal —— Cold briquetting —— Coking	160-200	2,300-13,300

Source: W. Peters: Materials of HSC (1974) at Dussardorf as presented in Kiyoshi Sugasawa, "Development of Briquette Charge and Formed Coke Techniques in Japan," Technocrat, vol. 9-No. 8.

COKE AT BELUGA

Although Beluga coal does not have the properties necessary for a coking coal, it is possible that Beluga coal could be solvent refined and the solid product blended with other coal in such a manner that it could be used in a blast furnace. "High-sulfur blast furnace coke requires more limestone, and more limestone means more coke and less iron-ore in the burden; therefore, a low-sulfur coke will increase iron production and require less coke per ton of iron produced." (Leonard, 1968) The possibility of using low sulfur Beluga coal as a coke substitute, either by direct blending and/or as a solvent refined coal product, should be examined in greater detail since the significant add-on value of the product might make such production economically attractive in the distant future.

COAL GASIFICATION

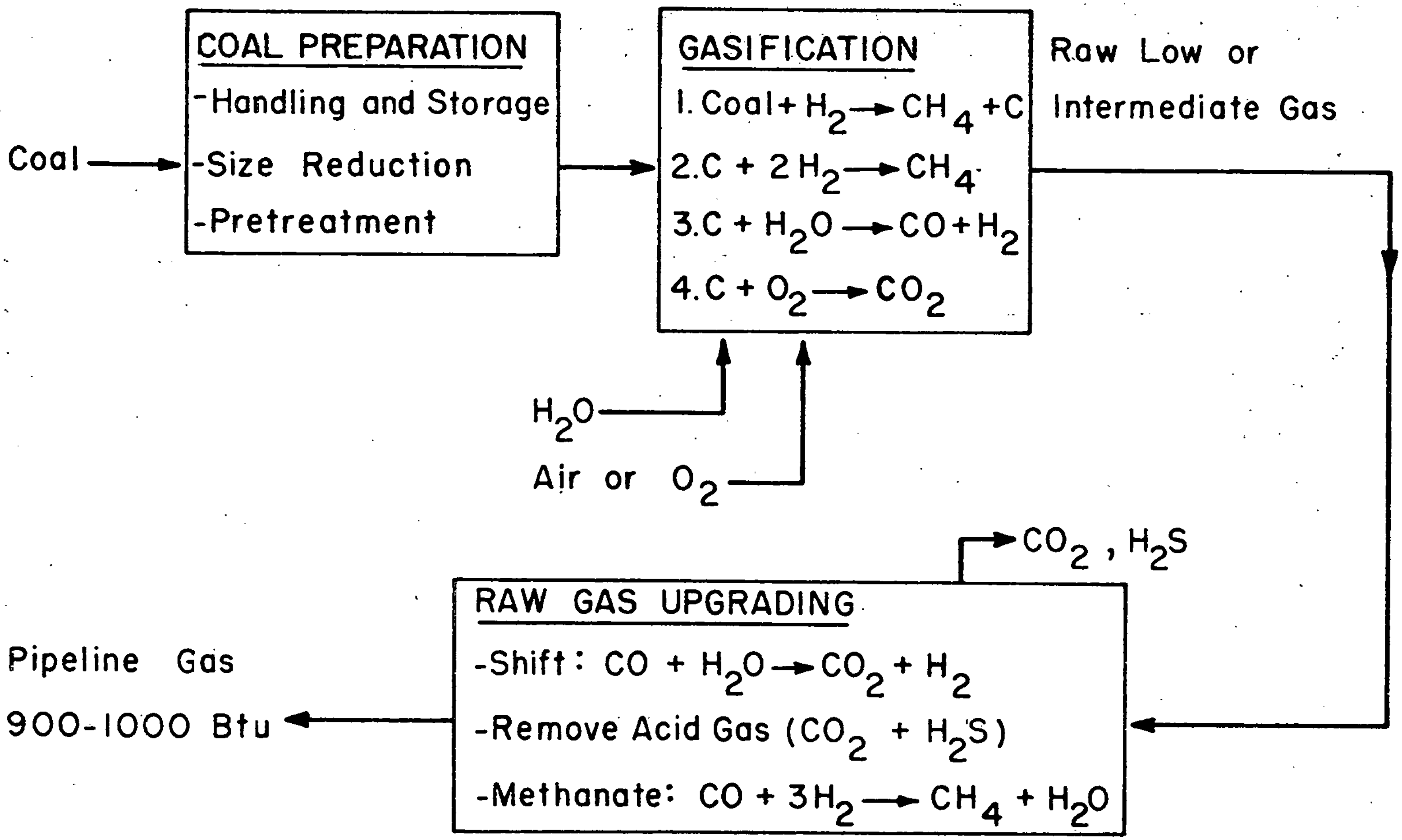
Several options are available for one interested in research in the gasification of coal, namely: location above ground or in-situ; formation of low BTU gas, intermediate BTU gas or high BTU gas (pipeline quality). Some of the various process schemes which are involved in making gas from coal are given in Figure 5-9.

Gasification

The gasification of coal involves three key elements - carbon, hydrogen and oxygen. The carbon and hydrogen comes from the coal which is chemically $CH_{.9}$ with some oxygen, sulfur, nitrogen, ash and moisture. (See Phase 1, Volume 1 page 104 of this project.) Water, in the form of steam, is a source of hydrogen and oxygen; however, sometimes hydrogen and oxygen are used in elemental form in the coal gasification processes. The necessary heat can be supplied either by directly burning coal and oxygen or supplying heat from an external source. Some process steps require a catalyst (i.e. Raney nickel) and some may require high pressure. Depending upon the process chosen, an assortment of boilers, filters, beds, valves, etc. are needed.

Figure 5-9

GENERAL PROCESS SCHEME FOR PRODUCING GAS FROM COAL



Source: Science and Public Policy Program, University of Oklahoma, Energy Alternatives: A Comparative Analysis, p. 1-69.

Combustible Gases

Coal gasification produces carbon monoxide (CO), methane (CH_4), hydrogen (H_2), carbon dioxide, hydrogen sulfide, and nitrogen, of which the first three are combustible. Carbon monoxide and hydrogen heating values by volume are approximately one-third that of methane, which is the primary component of natural gas and has a similar heating value.

Most coal gasification processes aim for high quality gas production during the initial gasification stage. The methods of introducing hydrogen, oxygen, and heat are the critical determinants of the end products.

Trade-offs are involved in each method. Pure oxygen is more expensive than air, but it lowers the production of nitrogen and raises the heating value of the gas. Hydrogen introduced into the process by steam produces mostly carbon monoxide and hydrogen. Direct introduction of hydrogen results in an exothermic (heat producing) reaction producing methane and carbon; the carbon production is relatively high and much of it is left in the gasifier as char.

Process Equipment

Categorization of gasification systems can be made on the basis of engineering features especially bed type. Gasification systems may use a fixed-bed, a fluidized-bed, or entrainment. In the fixed-bed system, steam or hydrogen are passed through a grate supporting the lumps of coal. In the fluidized-bed system, gas flows through finely sized coal. The lifting and "boiling" effect promotes chemical reactions by increasing exposed coal surface area.

The entrainment system transports finely sized coal particles in the gas (e.g. steam and oxygen) prior to their introduction into the reactor. Product gases and ash are removed separately. Unlike the other two systems, (which have difficulties with caking coals), there are few limitations to the kinds of coal that can be used in entrainment.

High pressure systems have several advantages over those operated at ambient pressure:

1. Improvement of product gas quality.
2. Maximization of hydrogasification reaction.
3. Reduction of equipment size.
4. Elimination of need to separately pressurize gas before introduction into a pipeline.

Status of Low, Intermediate and High BTU Gasification Systems

The design features of several low and intermediate Btu gasification processes are given in Table 5-3. However, only the Lurgi and Koppers-Totzek processes are used commercially to any great extent at present, although the Winkler and Wellman-Galusha processes have been used on a smaller scale (Souby, 1978). The other processes in Table 5-4 are in the pilot plant stage. Some of these technologies are described by the Science and Public Policy Program of the University of Oklahoma (1975). The Koppers-Tozek process is shown in Figure 5-10.

The design features of five high-BTU gasification processes are given in Table 5-5. It is important to note that all five systems are still in the developmental stage. To date, there is no completely proven commercial methanation (high BTU gas) process (Lewis, 1975).

Underground Coal Gasification

Underground coal gasification, which was started by the Soviets in the early 1930's, has reached the commercial stage in Russia and has produced low BTU gas which is used for power generation (Fisher, 1975).

In the United States, significant in-situ coal gasification experiments of special interest to Alaska are being conducted at the Hanna Coal Field, Wyoming by the Laramie Energy Research Center. These tests are called Hanna I, II, III, IV, and V.

TABLE 5-4

SELECTED DESIGN FEATURES OF FOUR
LOW- AND INTERMEDIATE-BTU GASIFICATION PROCESSES

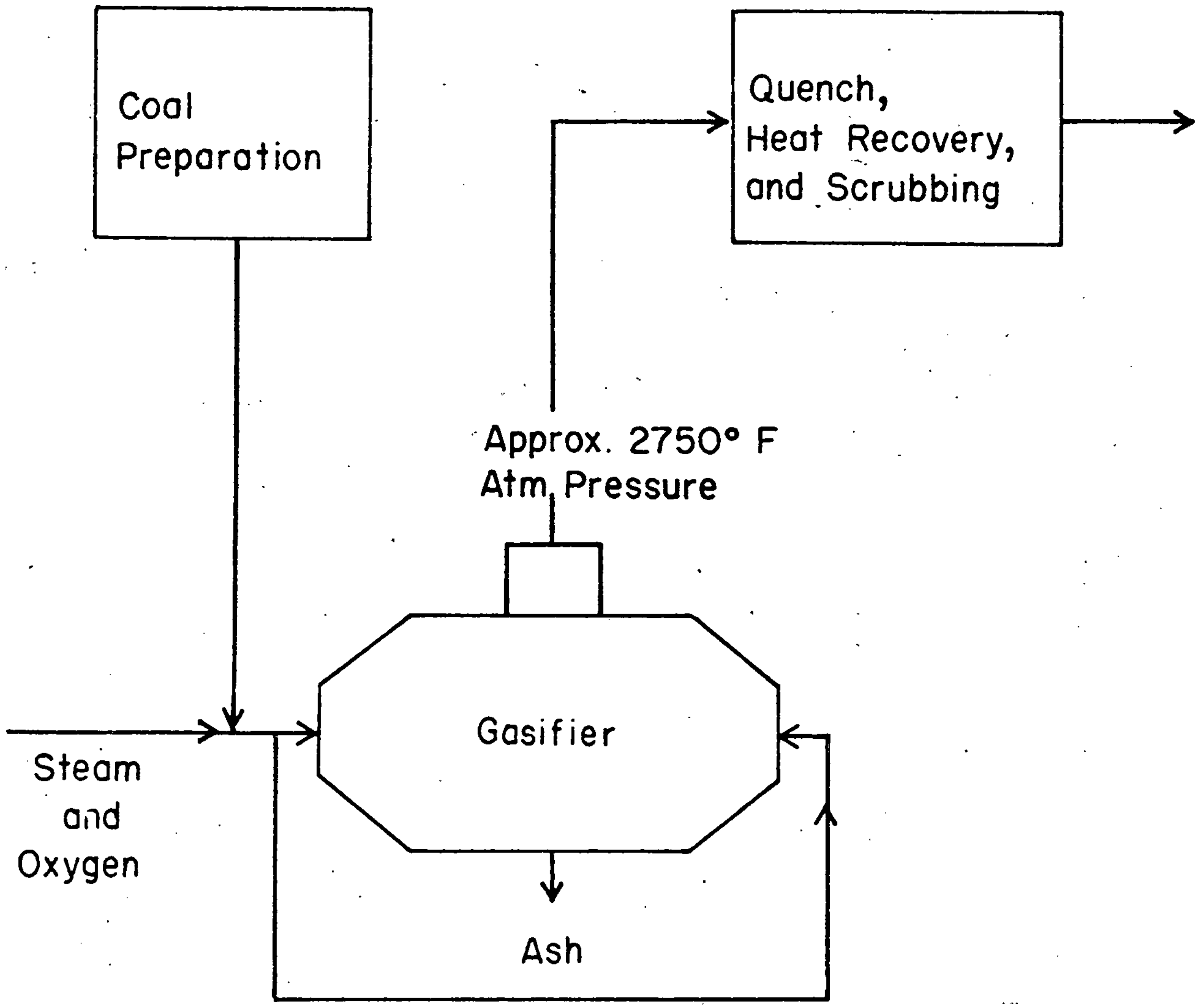
Name	Reactor Type	Bed Type	Pressure	Hydrogen Sources	Oxygen Sources	Heat	Pretreatment	Coal Input
Lurgi	Gasifier	Modified fixed	300-450 pounds per square inch	Steam	Air/ oxygen	Direct burning	Sizing	Noncaking 1/4x2 inch, no fines
Koppers-Totzek	Gasifier	Extrained suspension	Atmospheric	Steam	Oxygen	Direct burning	Pulverizing	Caking or noncaking, pulverized[a]
BuMines[b]	Gasifier	Modified fixed	Atmospheric to 300 pounds per square inch	Steam	Air	Direct burning	Pulverizing	Caking or noncaking, coarse or fine
Westinghouse	Gasifier	Fluidized	200-300 pounds per square inch	Steam	Air	Direct and internal exothermic reactions in desulfurizer	Pulverizing drying, integrated devolatiles/ desulfurizers	Caking or noncaking, pulverized
Ash agglomerating	Gasifier	Fluidized	Pressurized	Steam	Air	Direct burning	Pulverizing	Caking or noncaking, pulverized

[a]Pulverized means crushed so that 70 to 80 percent of the coal passes a 200-mesh screen (0.003 inch).

[b]The BuMines process listed here is often identified as two processes. The only difference between the two is that one is pressurized.

Source: Science and Public Policy Program, University of Oklahoma, Energy Alternatives: A Comparative Analysis, p. 1-73.

Figure 5-10



Koppers-Totzek Coal Gasification Process

Source: Science and Public Policy Program, University of Oklahoma, <u>Energy Alternatives: A Comparative Analysis</u>, p. 1-75.

TABLE 5-5

SELECTED DESIGN FEATURES OF FIVE HIGH-BTU GASIFICATION PROCESSES

Name	Reactor Type	Bed Type	Pressure (pounds per square inch)	Hydrogen Sources	Oxygen Sources	Heat	Pretreatment	Coal Input
Lurgi	Gasifier	Modified Fixed	300-500	Steam	Oxygen Plant	Direct	Sizing	Noncaking, 1/4x2 inch, no fines
HYGAS	Hydrogasifier	Fluidized	1,000	Hydrogen[a]	Oxygen Plant	Direct	Sizing, heating and slurry	8 to 100 mesh fines all coals
BI-GAS	Gasifier and Hydrogasifier	Entrained Flow	1,000	Steam	Oxygen Plant	Direct	None	Liquid to rank A bituminous pulverized
Synthane	Gasifier devolatilizer	Fluidized	1,000	Steam	Oxygen Plant	Direct	Sizing and heat and volatilize	All coals fines of 200 mesh
CO_2 Acceptor	Gasifier devolatilizer	Fluidized	150	Steam	Air	Direct and Indirect	Sizing	Lignite or subbituminous, 1/8 inch

[a]Hydrogen introduced into the gasifier is produced by reaction of steam, char, and oxygen.

Source: Science and Public Policy Program, University of Oklahoma, Energy Alternatives: A Comparative Analysis, p. 1-82.

Hanna I and II were conducted in the Hanna #I coal seam, a 30 foot thick subbituminous coal seam about 400 feet deep with a dip of 7 to 9 degrees. Conducted from March, 1973, through March, 1974, Hanna I utilized 4,000 tons of coal to produce 1.6 MM scfd of 126 BTU/scf gas.

The Hanna II, Phase I, test was conducted in 1975 and Phase II and III in 1976. The Hanna II test was very successful in several aspects. For example, the highest gross heating value ever produced from an air-blown UCG (underground coal gasification) experiment was obtained (2.7 MM scfd of 152 BTU/scf gas during 38 days of gasification between two wells on a 52.5 feet spacing with the utilization of 1,260 tons of coal). With the success of Hanna II, plans have been made for Hanna III, IV, and V.

Hanna III has been designed to determine the impacts of UCG on groundwater quality, a significant environmental issue. Hanna IV involves a significant scale up of prior experiments, especially use of larger piping.

The Hanna V test must await the results of IV for final design; however, the general objectives are:

1. Demonstrate expansion of technology to smallest process unit.

2. Demonstrate operation of multiple-channel system.

3. Determine impacts of subsidence on the process.

4. Demonstrate an automated process control system.

5. Develop baseline information for pilot plant design.

6. Develop data for commercial scale economic analyses.

The Hanna V test is currently scheduled to start in FY79 and run for a maximum duration of 12 months, utilizing 100,000 tons of coal, and having an air injection rate of 65 MM scfd with a 110 MM scfd gas rate and a heating value of 170 BTU/scf. Successful completion "would be followed by construction and operation of a pilot plant for electrical generation to demonstrate the totally integrated technology" (Bradenburg, 1977).

The Linked Vertical Well Technique

The UCG process being tested by the Laramie Energy Research Center (LERC) is known as the Linked Vertical Well (LVW) Technique. It involves two major steps: preparation of the coal seam followed by gasification as depicted in Figure 5-11. The details of this process are given by Fisher (1977).

The composition typical of gas produced using the LVW technique in the underground coal gasification experiment at Hanna, Wyoming is given below:

Constituent	Mole-Percent
H_2	15.96
Argon	0.76
N_2	53.18
CH_4	3.91
CO	6.33
C_2H_6	0.39
CO_2	19.22
C_3H_8	0.13
C_3H_6	0.04
$i\text{-}C_4H_{10}$	0.01
H_2S	0.07
Heating value, 124 BTU/std. cu. ft.	

(Fisher, 1975)

Other Coal Gasification Concepts

In addition to the LVW (Linked Vertical Well) concept, which is applicable for a bed thickness of 15 to 50 feet, there is the Longwell Generator (LWG), the Steeply Dipping Bed (SDB) and the Thick Packet Bed (TPB). Morgantown Energy Research Center is developing the LWG concept which involves eastern coals in beds less than 15 feet thick. The SDB involves

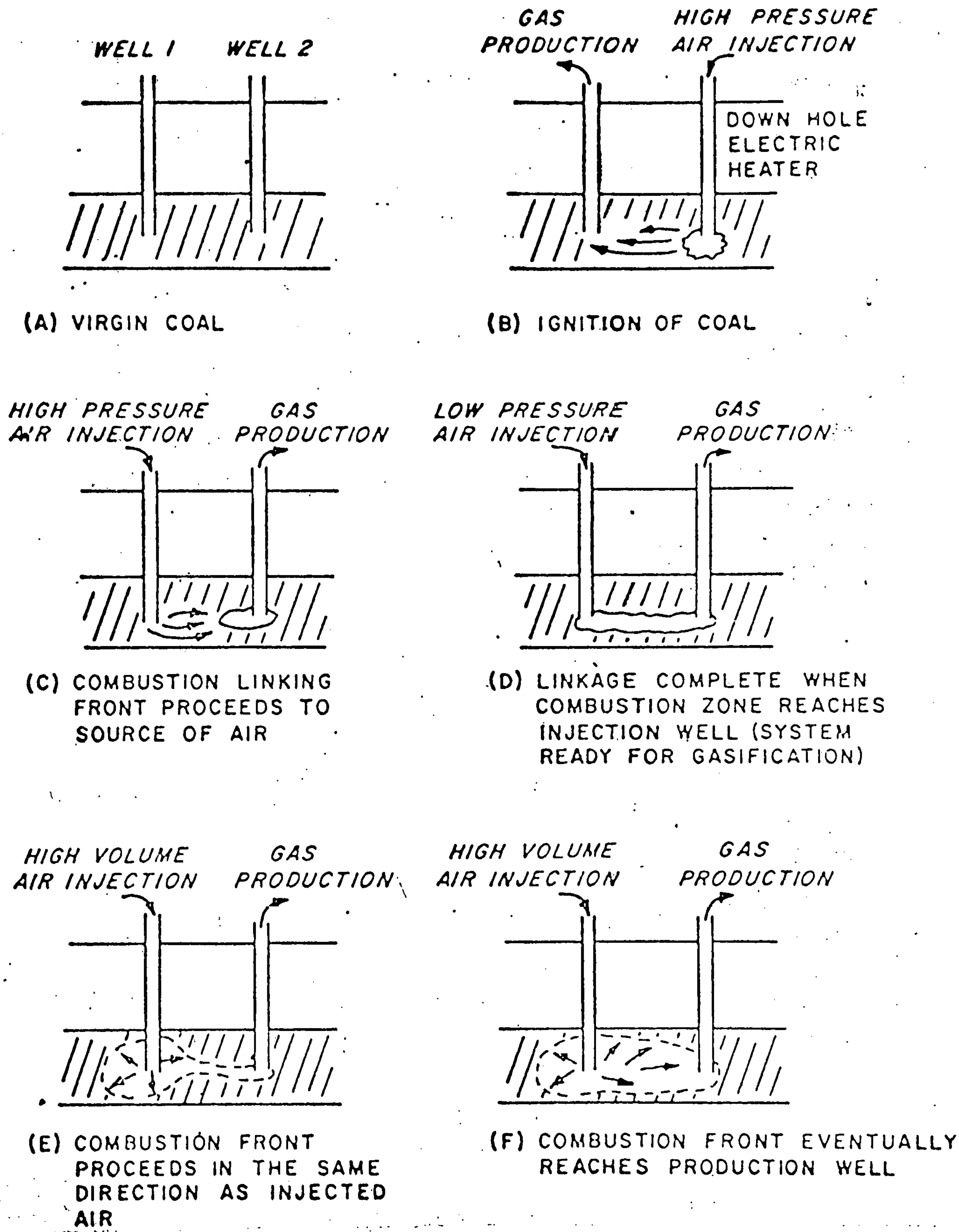


Figure 5-11

Schematic of the LVW UCG Process

Source: D. D. Fischer et al., "A Report on the Successful Development of Underground Coal Gasification at Hanna, Wyoming," 1977.

thicknesses of 15 to 50 feet with a dip greater than 45°. The Lawrence Livermore Laboratories are developing the TPB concept which involves a coal bed thickness of over 50 feet.

Experience and Interest in Alaska

Coal gasification technology is of major interest to Alaska, especially in the Southcentral Region where natural gas is rapidly diminishing as a future fuel for electric power generation. Natural gas has served much of the electrical and space heating need of the Anchorage area for years. Theoretically at least, gasified coal, either from on-shore or beneath the water in Cook Inlet, could supply the Anchorage area energy for decades.

The coal near and under the water of Cook Inlet deserves special attention since McGee and O'Connor (1975) have estimated in place coal resources to be 1.3 trillion short tons. These estimates are based upon coal counts made in 86 wells drilled for hydrocarbons in Cook Inlet. Also, these coals are not only low in sulfur, but probably have the desired properties of most western coals, i.e. they are shrinking coals in that they do not expand upon heating. (Eastern coals expand upon heating and therefore cause the internal pore structure to remain tight. This reductes the crack formation due to gasification and exposes only a small amount of the potential reaction area.) Also, a nearby demand for energy exists now and will increase in years to come.

The production of oil from some of the platforms in Cook Inlte is declining to the point that future production may soon be uneconomical. But, with some experimental hardware on the platform, underground gasification tests could be conducted. If successful, an oil platform could possibly serve as the location of the gathering station for low BTU gasification production. Natural gas could then be pumped on-shore to gas turbine electrical generating facilities. Perhaps the electrical generating facilities could even be installed on the platform requiring only an electrical transmission line to transport the energy to utility customers.

Recognizing the potential for energy from gasified coal, Chugach Electric Association, Inc. has been in contact with ERDA (Energy Research & Development Administration, now Department of Energy) for funding a of proposed in-situ coal gasification project. The steep-bed deposit under consideration is located along the lower Beluga River approximately six miles north-northwest of the Beluga Station (Gas Turbine Electrical Generation Plant). Land ownership in the area is addressed in detail in another part of this report; however, this land is owned by the State of Alaska.

Exploration work in the general area indicates that the beds occur in a homocline with fairly steep dips to the south. Six seams have been identified from drilling and from river bluff exposures overrun at intervals varying from 50 to 150 feet over a horizontal distance of approximately 3,000 feet. Beds range in thickness from 8 feet to more than 20 feet, and overburden depths are believed to vary from 20 feet to more than 70 feet.

No access roads yet exist to the area of the deposit. Helicopters and tracked vehicles (usually after freeze-up) are the practical means of access. Because overland access from Beluga requires traversing extensive muskeg areas, such access is difficult during the summer months.

The turbine which appears best suited to a gasification project is Beluga Unit No. 4, a 9-MW jet machine located in a separate wing on the east side of the power plant. Either Beluga Unit 1 or Unit 2 -- the 16.5 MW simple cycle machines located in the main building -- could be made available in lieu of Unit 4. The other three units in this station have 54.60, 65.50 and 67.81 megawatt base ratings.

CHEMICALS FROM COAL

Chemicals can be obtained from coal by (a) distillation, (b) heating coal with steam and oxygen to produce a synthesis gas, a mixture of carbon monoxide and hydrogen, which in turn is used as a feedstock to produce chemicals, (c) direct hydrogenation, and (d) producing a solvent refined coal (SRC) liquid for use as a feedstock to make chemicals. The SRC processes are addressed later in this chapter.

Historically, coal was used as a chemical feedstock, but petroleum and natural gas have been substituted as cheaper feedstocks as they became available. However, because of the recent rising costs and decreasing availability of petroleum and natural gas, there is renewed interest in the possibility of using coal-derived liquids as chemical feedstock (US Energy Reseach and Development Administration, 1976).

Today only a fraction of the world's organic chemicals are made from coal, derived from coke production, or by deliberate synthesis. About 10 percent of the total crude oil, natural gas, and gas liquid production now goes to satisfy petrochemical industry feedstock and energy demand.

Projections of demand for C_2-C_4 olefins in the United States for the next decade indicate that a two-fold expansion in manufacturing capacity will be necessary. This new capacity will be based primarily on "cracking heavier feedstocks, such as naphtha or gas oil derived from coal." Besides olefins, which are valuable as basic chemicals for the manufacture of plastics and rubber, the paraffinic C_2-C_3 hydrocarbons are valuable as high-BTU supplements for pipeline gas. Alcohols and hydrocarbons of somewhat higher molecular weight can be used as gasoline blending stocks or cracked to gaseous hydrocarbons (Pittsburgh Energy Center, ND).

Dow Chemical Company started a testing program in 1974 to determine the advantages and disadvantages of using coal-derived liquids for petrochemical feedstocks. The processing of the liquid sample involved (a) distillation, (b) hydrocracking, (c) hydrotreating, (d) reforming, and (e) steam coil cracking (U.S. Energy Research and Development Administration, 1976).

Distillation

Chemicals can be obtained from coal by different methods. The term "coal chemicals" refers to refined materials recovered from the crude liquids obtained from the gases and vapors released during coal carbonization, i.e. destructive distillation. Yields of chemicals vary with the kind of coals carbonized. Approximately 315 pounds of coke-oven gas (noncondensible material rich in hydrogen and methane), 90 pounds of tar, 20 pounds of crude light oil and 5 pounds of ammonia are recovered for each ton of coal carbonized at oven-coke plants (Cooper, 1976).

In the early days of the industry, coke byproducts were considered of value only for their tar content. The first recorded attempt to refine these byproducts by the distillation of coal tar was at Glasgow, Scotland in 1822.

The hydrocarbons from coke-oven byproduct gases boiling below 338°F are generally referred to as light oils. Prior to World War II practically the entire nation's supply of benzene, toluene and xylene were produced from this light oil. At that time, the tar was often burned as a fuel, but larger plants distilled it and manufactured additional byproducts. Some of the products produced by distillation of a high temperature coal tar are phenol, creosols, pyridine, benzene, toluene, xylenes, naphthalene, creosote, anthracene, and pitch. During World War II, coal could not meet the demand of these products and processes were developed for their production from petroleum (Tetra Tech, 1976).

Synthesis Gas

The production of C_2-C_4 hydrocarbons or other chemicals from coal could be achieved by a combination of processes with synthesis gas as the feedstock. The flow diagram, Figure 5-12, shows the gasification of coal in the presence of steam and oxygen to produce synthesis gas, a mixture of carbon monoxide and hydrogen. Commercial gasifiers such as Koppers-Totzek, Lurgi, or Winkler could be used. New gasifier designs,

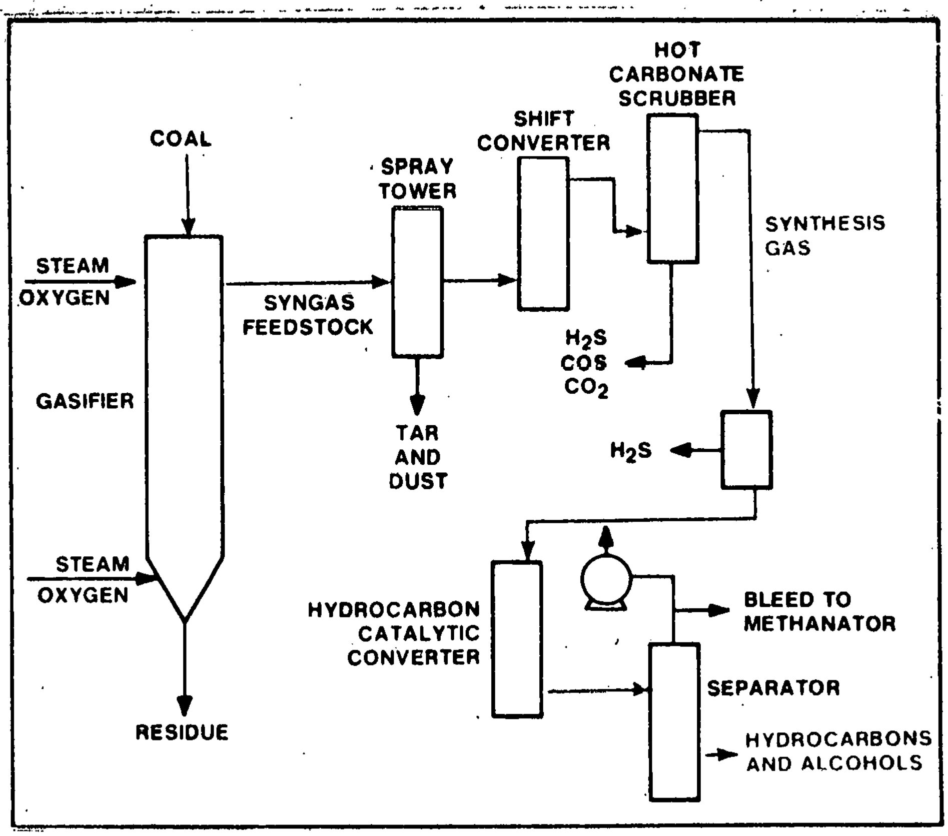


Figure 5-12

Hydrocarbon Synthesis
Coal to Fuels and Petrochemicals
Flow Diagram

Source: Pittsburgh Energy Research Center, Clean Energy From Coal, p. 19

such as that used in the SYNTHANE, HYGAS, or BI-GAS processes, are being tested and will become available for this purpose (Pittsburg Energy Resource Center, ND).

Utilizing synthesis gas as a feedstock, coal-based ammonia and methanol may be competitive in the United States with the products derived from gas and residual oils by 1980. Since 1970, Monsanto has been producing acetic acid using a methanol/carbon monoxide feed. Union Carbide is well into the pilot plant stage with a process that reacts carbon monoxide and hydrogen at extremely high pressure to produce ethylene glycol. Coal-based methanol can be converted to ethanol and then dehydrated to produce ethylene. This product could compete in cost with the same product produced by conventional processes.

Direct Hydrogenation

The March 1978 issue of the Fossil Energy Research and Development Program of the U.S. Department of Energy gives the status of a number of projects that make liquids from coal for chemical feedstocks, high grade fuel (gasoline and heating oil) and boiler fuels (for electric power generation). These government sponsored projects are grouped into direct hydrogenation, pyrolysis (or carbonization which amounts to destructive distillation to yield liquid and gaseous products and char) and solvent extraction processes.

The direct hydrogenation processes underway are:

H-Coal

Fixed-Bed Hydrogenation (Synthoil)

Zinc Chloride Catalyst

Disposable Catalyst Hydrogenation

Multistage Liquefaction

(Cooper, 1976)

The above processes are similar in that they add hydrogen to coal using a catalyst for liquefaction to oil and remove the sulfur as gaseous hydrogen sulfide. Some of the processes are directed more toward a liquid boiler fuel while some of the products can be used for chemical feedstocks.

Aromatic Chemicals From coal (Clean Coke Process)

A detailed economic study of a process which combines coking and liquefaction techniques indicates a substantially greater potential for aromatics yield than from other routes.

Carbonization was employed extensively until 1951 for the manufacture of metallurgical coke and was the principal source of aromatic chemicals. Coal hydrogenation, or liquefaction, offers another route to aromatic chemicals; however, until recently this process has been of little interest except to Germany for coal-based fuels during World War II.

U.S. Steel has combined the two historically basic routes to aromatics from coal -- carbonization and hydrogenation -- into a "Clean Coke Process." According to Schowalter and Petras (1975) the new process features:

1. Production of high-quality metallurgical coke from a high-sulfur, high-ash coal not normally considered suitable for metallurgical purposes.
2. Production of substantial quantities of aromatics, other chemicals, and gaseous and liquid fuels which generate substantial co-product credits and could tend to reduce the demand for domestic natural gas and imported crude oil.
3. Production of coke in an "enclosed" process offering substantial ecological advantages over the coke-oven route.

The Process

The coal, after benefication, is split into two fractions. Part of the coal is processed through a carbonization unit to produce char which serves as the base material for production of metallurgical coke. The second part of the coal is hydrogenated to convert most of the coal to liquid. The liquid products from the hydrogenation step as well as some liquid products from the carbonization step are combined and processed through a central liquids treatment unit where chemical feedstock, low-sulfur liquid fuels and two oil fractions (used for recycles) are formed.

One recycle fraction is used as the carrier oil for the hydrogenation step and the second recycle oil is blended with the char to form pellets which are subsequently baked to produce a formed metallurgical coke with properties equivalent to blast-furance coke. Gaseous products from all the steps are processed to provide chemical feedstocks, gaseous fuels and hydrogen for recycle.

The Products

The estimated annual production and revenue for the chemicals, fuels and coke, from a plant with a capital investment of $740-million (Schowalter, 1975) is given in Table 5-6. The plant would use a coal feed of 5.79 million ton/yr based on a 340 operating day/year.

The properties of the coal are given in Table 5-7. Note that the properties of Beluga coals shown in Appendix 5-C are much different than the Illinois No. 6 coal used in this study. The very low sulfur of Beluga coal would probably be a significant advantage, but the higher moisture and lower heat content would probably be disadvantageous; however, Alaskan coals have not been evaluated with respect to the Clean Coke Process.

SOLVENT REFINED COAL

The Solvent Refined Coal (SRC) process has been called a multisynthetic-fuels process and the plant employing the process has been called a "coal-finery" (Higginson, 1977). Coal, which is chemically designated as $CH_{.9}$, is so modified in a solvent refining plant that the products formed have different ratios of carbon to hydrogen with the liquids having more hydrogen than the solids.

TABLE 5-6

Annual production and revenue for clean-coke process commercial plant
Basis: mine-mouth site, using 17,000-ton/day Illinois coal feed, producing a maximum of coke pellets and chemicals and minimum fuels

Products	Annual production	Unit price, $	Annual revenue, $
Chemicals:			
Ammonia	34,000 ton	190.00	6,460,000
Sulfur	49,000 ton	42.00	2,058,000
Ethylene	723,000,000 lb.	0.08	57,840,000
Propylene	119,000,000 lb.	0.06	7,140,000
Phenol	152,000,000 lb.	0.26	39,520,000
o-Cresol	38,400,000 lb.	0.425	16,320,000
m-, p-Cresol	142,000,000 lb.	0.44	62,480,000
Xylenols	150,000,000 lb.	0.43	64,500,000
Pyridine	14,630,000 lb.	0.90	13,140,000
α-Picoline	6,100,000 lb.	0.60	3,660,000
Aniline	29,200,000 lb.	0.31	9,052,000
Benzene	80,400,000 gal.	0.85	68,340,000
Naphthalene	229,000,000 lb.	0.12	27,480,000
Creosote blend stock	4,130,000 gal.	0.55	2,272,000
Carbon black feed stock	3,700,000 gal.	0.35	1,295,000
Total chemicals	2,418,000,000 lb.	0.1577	381,557,000
Fuels: hydrogenation residue	669,000 ton	11.15	7,466,000
Coke	2,223,000 ton	120.00	266,760,000
TOTAL REVENUE			655,783,000

Source: K. A. Schowalter and E. F. Petras, "Aromatic Chemical from Coal," Coal Processing Technology, p. 111.

TABLE 5-7

Properties of raw and beneficiated coals

	Raw coal	Carbonizer feed	Hydrogenation feed
Moisture, wt.-%	8-10	3.5	3.5
Ash, wt.-%	15	5-6	14
Sulfur, wt.-%	3.5-4	2	3
Wt.-% of raw coal	—	42	42
Size		1/8-in. X 100-mesh	Minus 100-mesh

Source: K. A. Schowalter and E. F. Petras, "Aromatic Chemicals from Coal," Coal Processing Technology, p. 111.

The basic technology for the SRC process was developed in Germany soon after World War I. Two German scientists, Pott and Broche, patented the basic process for dissolving coal and reducing its ash content in 1932.

SRC Process

In the SRC process, crushed coal is slurried with a hydrogen donor solvent and exposed to 1,000 psi and 800 degrees F. in a hydrogen atmosphere. The coal then dissolves into the solvent, picking up hydrogen. The solution is filtered to remove most of the ash and the undissolved coal. The filter has been one of the most significant hardware problems in this process.

The undissolved coal makes up about 35% of the filter cake. This filter cake together with raw coal can be used to produce hydrogen. The remaining liquid (solvent, dissolved coal and light oil) is vacuum flashed at 3500°F to form a solid material. Fuel oils and high BTU gases are also formed. If a predominantly liquid product is desired, additional hydrogen will be needed.

The SRC process is designed to produce a clean solid or liquid fuel that has a significantly lower sulfur and ash content yet a higher heating value than feed coal (Anderson, 1977). A comparison of Illinois high sulfur coal with Wyoming low sulfur coal before and after treatment in the SRC plant at Wilsonville, Alabama is given in Phase I, Volume I (pp. 106) of this project (McConkey, 1977).

Pilot Plant - Ft. Lewis

Bench scale work on the present SRC process was carried out from 1962 to 1965 by the Spencer Chemical Company, under the sponsorship of the Office of Coal Research of the U.S. Department of the Interior. The Spencer Chemical Company was acquired by Gulf Oil Corporation and work on the SRC process was continued by the Pittsburg and Midway Coal Mining Company, a Gulf subsidiary. Under the sponsorship of the Energy Research and Development Administration (and later the Department of Energy), Pittsburg & Midway operates a SRC pilot plant at Ft. Lewis, Washington.

Initially the product at Ft. Lewis was a solid (SRC-I). One improvement that resulted from the pilot operation was the recycling of product slurry as solvent which increased the conversion of the coal to a lower molecular weight fuel. This result led to a process (SRC-II) that makes a liquid rather than a solid product. The customer for the SRC-II liquid is the utility industry.

The economics of an SRC-I plant (as well as other modes of operation, i.e. recycled SRC-liquid, co-product and solid) have been addressed by Schmid (1977) and SRC-II technology by Anderson (1977).

The next step for the SRC-II process may be a 6,000 tons/day demonstration plant which would be the equivalent of one module of a 30,000 tons/day commercial plant.

Pilot Plant - Wilsonville

The Edison Electric Institute and the Southern Company system began a joint plant project in March, 1972 to study the key steps in solvent refining. Beginning operations in January, 1974, the 6-ton per day plant was designed, constructed, and operated by Catalytic, Inc. near Wilsonville, Alabama.

Testing at Wilsonville has been successful in meeting coal product specifications for maximum ash and sulfur. Operating experimentally over a wide range of conditions, one subbituminous and four bituminous coals have been used to produce specification-grade SRC. The SRC product at Wilsonville is a high BTU, low ash, low sulfur solid which is designed for use in electrical power plants. Additionally, valuable mechanical performance information on the pumps, valves, filter, mineral residue dryer, slurry preheater, and instrumentation devices has been obtained (Huffman, 1976 and Harrison, ND).

The economics of solvent refined coal has been analysed by Chastain of Southern Company Services (Chastain, 1976).

Experience in Alaska

The Beluga Coal District was selected as the location for a study to determine if the solvent refined coal (SRC) process could be used as a means of "economically producing clean energy from coal deposits located in remote areas." As a result of this study by Stanford Research Institute, which was prepared for the Energy Research and Development Administration with financial support and proprietary data provided by Placer-Amex Inc. and Nissho-Iwai American Corporation, a wealth of information is now available on mining, conversion, transportation and markets for the Beluga Coal Fields.

The above study concluded that solvent refined products derived from Alaskan coals might not affect the fuel market place in the Pacific Rim countries. Delivered costs were estimated to be in the range of $3.80 to $4.00 (1975 dollars) per million BTU in both California and Japan for the solvent refined fuels. The price of low-sulfur fuel oil is expected to be significantly lower (Stanford Research Institute, 1976).

It is very important to note that non-fuel use of the solvent refined coal was not addressed. If some of the solvent refined coal is used as a petrochemical feedstock or as an additive to metallurgical coke or electrode coke, the economics would probably change in a favorable direction. But, whether this change would be extensive enough to make the production of SRC economically attractive for industry in Alaska is unknown.

METHANOL

The conversion of coal to methanol is considered by some technologists who are interested in coal development in Alaska, to be approching a commercial reality.

A conceptual design of a commercial facility to convert coal to methanol fuel and/or methanol has been recently completed by Badger Plants, Inc., Cambridge, Massachusetts for U.S. Department of Energy. Excerpts from the abstract are given below:

> [This] four-volume report presents the result of an in-depth engineering and economic assessment of a conceptual design for a commercial facility to convert coal into methanol fuel and/or methanol using a southern Appalachian coal feed. The process steps involve an advanced coal gasification technique followed by a hydrogen-carbon monoxide shift reaction, acid gas removal and sulfur recovery process, and finally, a methanol synthesis reaction.
>
> The plant processes 63,000 net tons per day (total weight basis) of washed sized coal from independent mine sources. An additional 11,000 net tons per day of coal is required for steam generation for support facilities. Salable products are 415,000 bbls of methanol fuel and methanol, and 660 tons of bright sulfur per day. The total capital cost is estimated at $3.1 billion (mid-1977 dollars).
>
> The product methanol fuel is estimated to cost 18.8 cents per U.S. gallon ($3.00 per million Btu) at the plant fence line and chemical grade methanol is priced at 20.8 cents per gallon ($3.22 per million Btu).
>
> Market aspects of the products are not addressed in this report; however, methanol fuel can be used as a feed for fuel cells, as a fuel in utility services for gas turbine-generator firing, as a raw material for SNG production (especially for emergency use), and as a potential feed stock for gasoline manufacture.
>
> The plant complex will require 2,500 acres of land. During a five-year construction period a total field labor effort of 48 million manhours will be required. The labor force will average 6,000 men with peak employment levels of up to 9,000 people. The completed facility will employ approximately 1700 full-time operating, maintenance, and support personnel.
>
> Environmental problems associated with this industrial complex are addressed. Waste water treatment incorporates "zero discharge" philosophy; gaseous emissions are held below the standards permitted by law.

Wentworth Brothers have published a pamphlet which describes their technology for the commercial production of <u>Methyl Fuel</u>. The fuel is produced by passing a synthesis gas, consisting of hydrogen (H_2) and carbon monoxide (CO), over a catalyst under controlled conditions of temperature and pressure. The company claims that coal-derived, fuel-grade methanol is the vehicle for a vast fossil energy delivery system. Methyl Fuel is a stable liquid mixture consisting principally of methanol (CH_3OH) with controllable percentages of higher alcohols.

With respect to the transportation of coal it is possible to convert some of the constituents of the fossil fuel into methanol and the remaining portion of the coal into liquid hydrocarbons. The methanol can then be mixed with the liquid hydrocarbon for transportation by pipeline (Gruber, 1977).

RECOMMENDATIONS

The use of Alaskan coals for generation of electricity is currently feasible in the Usibelli to Fairbanks area. The Beluga Coal District is on the verge of development and a slight improvement in technology and/or a change in fuel economics could make the sale of Beluga Coal profitable to both industry and the State of Alaska.

(1) With respect to the generation of electricity using Beluga Coal, consideration should be given to different methods to meet the requirements of the Clean Air Act, including recent amendments, without scrubbers. Scrubbers are expensive, may cause electrical plant down-time, and require special operating talent. Since the Beluga Coal is low in sulfur as mined, an examination of technological options for removal of sulfur in low sulfur coal should be made.

(2) While an earlier study indicated that a solvent refined coal would not be feasible for fuels produced from Beluga coal, a careful study should be made to determine the possibility of using Alaskan coals to make a solvent refined solid that could be used for metallurgical and electrode coke. Alaskan coals should be studied for possible use as a coke substitute and blend material for coke production since the market demand for coke is high and the price is much higher than that of coal. Also, the Clean Coke Process should be examined assuming

that the feed for the process would be low-sulfur Alaska coal, thereby lowering construction and operating costs and increasing the quality of the aromatic chemicals, coke and other products.

(3) With respect to the production of liquid fuels and chemicals, Alaska should carefully follow research progress of the various processes.

(4) Alaska should attempt to persuade industry and the Federal government to test various Alaskan coals in conjunction with pilot plant tests that are made on Eastern and Western Coals. Too often, coals are tested from all over the nation except Alaska.

(5) An analysis should be made of coal processing experiments that have been unsuccessful because of the high sulfur content of the feed coal to determine whether similar tests with Alaska's low sulfur coal may have been successful.

(6) Renewed interest in Beluga coal gasification projects is warranted. Both on-shore and off-shore locations should be analyzed, as well as underground (steeply or slightly dipping beds) and above ground locations.

A low BTU gasification pilot plant could be located near the gas turbine electrical generation facilities of Chugach Electric Association. Additionally, the existing holes near some of the oil platforms in Cook Inlet should be examined for the engineering feasibility of in-situ gasification tests. The electrical energy could be generated on the platform or the platform could be used to gather the gases for pumping to on-shore electrical generation facilities. Since the Beluga Coal District has (1) a huge quantity of low sulfur coal, (2) coal with shrinking properties which are probably favorable to the Linked Vertical Well (LVW) process, (3) many deep holes for which geological information is available, (4) a large rapidly growing Anchorage energy market potential, (5) electrical generation facilities favorably located and (6) utility, industry and State interest in a gasification test, an experimental program should be developed with the participation of all interested parties.

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APPENDIX 5-A

PHYSICAL PROPERTIES OF COAL NECESSARY FOR COKING

"Coal is not a uniform substance but rather is a mixture of combustible metamorphosed plant remains that vary in both physical and chemical composition. The diversity of the original plant materials and the degree of metamorphism, or coalification, that has affected these materials are the two major reasons for the variety of physical components in coal." (Harrision, 1968)

"If a coal is to be satisfactory for use in the production of metallurgical coke, it must first have sufficient coking ability to yield a coherent coke alone or in blends with other coals. Secondly, the coals or blends must be able to be carbonized without damaging the ovens or causing difficult operating problems. Lastly, the coal must be low in ash and sulfur." (Leonard, 1968)

The various ranks of coal (anthracite, bituminous, subbituminous, and lignite) can be classified by petrographical methods into five types all based on the composition of the coal as a rock: 1) Bright, 2) Semisplint, 3) Splint, 4) Cannel and 5) Boghead. Classification of coal as one of the five types is determined by the coal's concentration of the following four lithotypes, or ingredients: Vitrain, Clarain, Fusain, and Durain.

The first of the five types is known as "bright coal" due to the heavy concentrations of vitrain and clarain which are highly reflective crystalline structures and therefore produce a "shiny, bright" coal. Semisplint, the second type, is composed predominantly of clarain with some vitrain and durain. This coal is usually classed as a bright coal when considered for coking due to its relatively high concentration of clarain which gives it a moderately reflective surface.

The last three types, Splint, Cannel, and Boghead, or the "dull coals," are predominantly durain, a non-reflective substance, with varying amounts of vitrain, clarain, and fusain, an inert substance. These three types of coals are generally not considered acceptable coking feedstocks. However, they are used at times for blending.

The ordering of the types above is generally arranged in order of decreasing coking power or ability, yet in some ranges of rank, a mixture of bright and splint types produces a stronger coke than either alone (Leonard, 1968). The reason for this is that vitrain and clarain, while they soften and fuse readily, become too fluid in the plastic stage and form a brittle, glassy mass due to that very ability. The coke produced by coals high in vitrain and clarain lacks the tensile strength required of good coke. On the other hand, durain and fusain resist softening and fusing, thereby producing a weak, friable coke that is also unsatisfactory.

To improve the strength and quality of coke produced from either of these two types of coal, "bright" and "dull," a blend of the two is created. The vitrain and clarain by being melted and fused form the binding agents of the coke. Since durain and fusain, or other inert materials, do not melt easily, they tend to remain as individual particles which, when interspersed with the fluid vitrain and clarain, impart a greater tensile strength to the coke produced by forming a "concrete" rather than a brittle "cement."

Thus, the addition of fusain, durain, or other inert matter tends to be beneficial, resulting in a desired hard, blocky coke. However, an excessive percentage of inert matter can result in poor quality coke as the charge tends towards the characteristics of a "dull coal." Therefore, an optimum ratio of binding agents to inert materials based on the feedstocks available must be set.

The primary factor affecting the ability of a coal, or blend of coals, to be carbonized without damaging the coking ovens or causing difficult operating problems are the extent of the expansion of the coke upon heating and the chemical composition of the coal used in the charge. "Coals used for cokemaking contract while being heated under load to the beginning of the plastic range. After the plastic range is passed, the coke formed therein begins to contract on heating to higher temperatures; contraction continues as heating progresses to temperatures reached in high-temperature coking practice." (Yancy, 1968) Expansion begins when the coal reaches a plastic state as the fusing particles fill the voids in the charge. As the charge begins expanding, the pressure exerted on the oven walls due to that expansion may be so great as to damage or even ruin the walls.

"The main factors affecting pressures exerted by coking charges in coke ovens and gas retorts are the character of the coal, the bulk density, and the operating conditions. Expanding coals are mostly in the medium-volatile and low-volatile ranges of rank; nearly all high-volatile A coals and all those of lower ranks are classed as contracting. Rank appears to be the main characteristic of coal affecting expansion, but type is also important; the amount of ash the coal contains is a factor, but one of lesser importance. Coals and blends of coals in the medium and low-volatile ranges of rank are the most highly expanding (or exert the greatest pressures); the higher the bulk density, the greater the expansion obtained. Addition of splint coal reduces the tendency to expand. Ash acts in the same way." (Yancy, 1968)

APPENDIX 5-B

GLOSSARY

anthracite coal -	hard coal containing 86 to 98 percent fixed carbon and small percentage of volatile material and ash.
ash -	solid residue remaining after the combustion of coal.
binder -	carbon products, tars, etc., used to impart cohesion to the body to be formed; a coal-extract binder may be used to prepare formed-coke pellets from non-coking coals.
bituminous coal -	a broad class of coals containing 46-86 percent fixed carbon and 20-40 percent volatile matter.
caking -	the softening and agglomeration of coal as a result of the application of heat.
carbonization -	destructive heating of carbonaceous substances with the production of a solid, porous residue, or coke, and the evolution of a volatile product. For coal, there are two principal classes of carbonization; high-temperature coking (c. 900°C) and low-temperature carbonization (c. 700°C).
char -	the solid residue remaining after the removal of moisture and volatile matter from coal.
coke -	strong porous residue consisting of carbon and mineral ash formed when bituminous coal is heated in a limited air supply or in the absence of air. Coke may also be formed by thermal decomposition of petroleum residues.
delayed coking -	a process wherein coal is subjected to a long period of carbonization at moderate temperatures to form coke.
extractive coking -	similar to delayed coking process, with the emphasis on high tar yields to produce liquids.
free swelling index -	a standard test that indicates the coking characteristics of coal when burned as a fuel.
hydrocoking -	coking of tars, SRC, etc., under hydrogenating condition to form liquid products.
inerts -	constituents of a coal which decrease its efficiency in use, e.g. mineral matter (ash) and moisture in fuel for combustion.

lignite - brownish-black coal containing 65-72 percent carbon on a mineral-matter-free basis, with a rank between peat and subbituminous coal; contains 8-22 percent volatile matter and 91-93 percent carbon.

solvent refined coal (SRC) - a coal extract derived by solvent extraction; a brittle, vitreous solid (m.p. 300°F to 400°F) containing about 0.1 percent ash and about 10 percent of the sulfur in the original coal feedstock; heat value is about 16,000 BTU per pound; may be used as a clean fuel for power generation by combustion; utilized for the production of high grade metallurgical coke, anode carbon, and activated carbon by coking, or hydrogenated to produce synthetic crude oil.

subbituminous coal - the rank of coal between bituminous and lignite, classified by ASTM as having a range of heating values between 8,300 and 11,000 BTU per pound on a moisture and mineral-matter-free basis.

volatile matter - those constituents of coal, exclusive of moisture, that are liberated from a sample when heated to 1,750°F for seven minutes in the absence of oxygen.

APPENDIX 5-C

BELUGA COAL ANALYSES

Analyses

Twenty-four cores from the six most extensive coal beds have been analyzed in great detail. Twenty of these cores were studied for various properties by the Paul Weir Company, Chicago. The qualities for the various coal intervals were as follows:

AS RECEIVED AVERAGE PROXIMATE ANALYSES FIGURES FOR SIX MAJOR COAL INTERVALS
BASS, HUNT AND WILSON LEASES, ALASKA

Brown	-	7845 btu 10.13% ash 0.33% sulfur 24% moist	Blue	-	8216 btu 7.34% ash 0.16% sulfur 29% moist
Yellow	-	6782 btu 18.19% ash 0.23% sulfur 30% moist	Orange	-	8054 btu 7.99% ash 0.17% sulfur 28% moist
Green	-	7862 btu 11.25% ash 0.23% sulfur 29% moist	Red	-	7828 btu 7.57% ash 0.17% sulfur 28% moist

Source: Starkey A. Wilson, Correspondence to Gene Rutledge, June 22, 1978.

CHAPTER 6

TRANSPORTATION

CHAPTER 6
TRANSPORTATION

INTRODUCTION

In Alaska, transportation of coal to market is costly and difficult to arrange. The transportation network for the efficient and easy delivery of coal exists only at the Usibelli Coal Mining Company near Healy. Where there is no transportation network already intact, the movement of coal becomes a major financial handicap. Consequently, transportation options must be given primary consideration.

As a general guideline, transportation by ship or barge is usually the lowest in mills per ton-mile if the mine and plant are near the coast. On short hauls, rail is often cheaper than a slurry pipeline. The large investment at both ends of a slurry pipeline system may not justify the short, low volume movement of coal. Generally, for long hauls of large volume, coal slurry pipelines may be preferable to rail because the line has low inflationary vulnerability. It may be that several utilities or plants should be planned in unison so that 10 million or more tons of coal per year can be delivered over a single line. Over the long run, the slurry line may be the most economical. Table 6-1 gives a comparison of transportation modes by rail, slurry pipeline and transmission line between points in the western states, and a marine transportation comparison with Beluga.

Another important aspect of each possible mode of transportation is the percentage of initial capital cost which is subject to inflationary escalation once the initial system is installed and operating. Some modes have more areas vulnerable to inflation than others. Whereas transmission lines are relatively free of inflationary vulnerability, unit trains are almost completely subject to it. Table 6-2 gives the percentage of escalation of several transportation options, and Table 6-3 gives a 20 year projection of the costs of each option.

TABLE 6-1

Comparative Transportation Modes (10/1/76 Dollars)

Haul	Distance	Component	Cost/yr	Energy Cost
Rail				
Kemmerer, Wyoming to Arlington, Oregon	770 mi.	Rail Tariff	$16,432,000	
		Car Ownership & Maint.	1,421,000	
		TOTAL	$17,853,000	3.14 mills/kWh
Slurry Pipeline				
Kemmerer, Wyoming to Arlington, Oregon	635 mi.	Capital Cost	$16,744,000	
		O&M Cost	7,176,000	
		TOTAL	$23,920,000	4.20 mills/kWh
Transmission Line				
Kemmerer, Wyoming to Arlington, Oregon	635 mi.	Capital Cost	$18,211,000	
		O&M Cost	453,000	
		Line Losses	9,505,000	
		TOTAL	$28,169,000	4.95 mills/kWh
Ship Haul				
Beluga, Alaska to Aberdeen, Washington	1,500 mi.	TOTAL	$17,194,000	3.02 mills/kWh

ASSUMPTIONS:

1) Capital charge rate 8.5%
2) Annual coal volume 2,808,000 ton/yr.
3) 1000 MW @ 65% capacity factor = 5.694 x 10^9 kWh/yr.
4) Total cost of Capital, O&M, & Fuel = 20 mill/kWh (for line loss cost calculation)
5) Transmission cost from Transmission System section.

Source: Comparative Study of Coal and Nuclear Generating Options for the Pacific Northwest, Volume II: W. H. Carlson, "Fuel Transportation," Analysis of the Coal Option. Fuel and Technical Studies Department. Washington Public Power Supply System. Richland, Washington. WPPSS FTS - 028 -II. 1977.

TABLE 6-2

ESCALATION OF TRANSPORTATION OPTIONS

Transportation Option	Fixed Portion	Escalatable Portion
Rail	20%	80%
Slurry Pipeline	70%	30%
Ship	50%	50%
Transmission Line	90%	10%

Application of the escalation fractions to each option on Table 6-1 over a 20-year period at 5% escalation per year yields the results in Table 6-3.

Source: Comparative Study of Coal and Nuclear Generating Options for the Pacific Northwest, Volume II: W. H. Carlson, "Fuel Transportation," Analysis of the Coal Option. Fuel and Technical Studies Department. Washington Public Power Supply System. Richland, Washington. WPPSS FTS - 028 - II. 1977.

TABLE 6-3

20-YEAR LEVELIZED TRANSPORTATION COST

Transportation Option	1st Year Cost (1976) Mills/KWh	1st Year Cost (1976) As % of Rail Cost	20-Year Levelized Cost (1976-95) Mills/kWh	20-Year Levelized Cost (1976-95) As % of Rail Cost
Rail	3.14	100	4.54	100
Slurry Pipeline	4.20	134	4.90	108
Ship	3.02	96	3.86	85
Transmission Line	4.95	158	5.23	115

ASSUMPTIONS:
1) 1st year costs from Table 1
2) Escalation fractions from Table 2
3) Escalation at 5% per year
4) Discount rate of 7% per year

Though the 20-year levelized cost does not change the ranking of the transportation options, it does draw the options considerably closer together due to the low escalation of the capital intensive slurry pipeline and transmission line options.

Source: Comparative Study of Coal and Nuclear Generating Options for the Pacific Northwest, Volume II: W. H. Carlson, "Fuel Transportation," Analysis of the Coal Option. Fuel and Technical Studies Department. Washington Public Power Supply System. Richland, Washington. WPPSS FTS - 028 - II. 1977.

The following discussion of coal transportation options in Alaska will be directed toward the proposed development of the Beluga Coal Field, the most likely field to be developed in the near future. Each transportation option and associated costs are discussed separately with specific references to the Beluga situation cited from available resources.

There are basically two segments involved in a Beluga transportation system. The first segment involves transporting the coal from the mine site area to a connecting point with a major, longer distance transportation mode. In most cases, this major mode is marine transportation which, of course, requires harbor and docking facilities. The first segment could utilize one of the following methods: 1) a trucking operation from the mine site to a harbor located near Beluga; 2) a rail line from the mine site to a harbor near Beluga, or a rail line from Beluga connecting with the existing Alaska Railroad line to a harbor at Whittier; and 3) a slurry pipeline from the mine site to a harbor near Beluga.

The second segment involves movement of coal both within and outside the State. In-State transportation possibilities could include marine, rail, and transmission line options. At the present time, the only feasible choice for exporting coal is marine transportation.

TRUCKING

Trucking is likely to play an important role in initially moving coal to either a power plant in the area or a transportation link such as a shipping or railway terminal. Beluga Coal Company has indicated that trucking would most likely be utilized to supply coal to a 200 MW plant. Tractor-trailer units of 120 to 150 ton capacity may be used to haul the coal to the power plant. Supplying coal to a 400 MW plant located on the coast would justify construction of a rail line (Patsch, 1978). In a rail line operation, a larger stockpile would be built and would involve a tunnel-conveyor reclaim system to deliver crushed coal to high capacity railway loadout silos (Placer Amex, Inc., 1977).

Although between the Capps Glacier and waterfront there are numerous logging roads built by Kodiak Lumber Mill Company. There are no access roads from the possible mining sites in the area to the waterfront at the present time. (See section on Transportation in Land Tenure chapter.) Kodiak Lumber Mill Company's timber harvest sale agreement with the State expires in 1983, and it is speculated that harvesting may be terminated at that time. The timber roads could be of some use in coal mining transportation system.

Trucking has been used by the Usibelli Coal Mining Company to move coal several miles from its mining operation sites to both the Golden Valley Electric Association power plant and to the railway spur loading station at Suntrana, 8½ miles away. Coal delivered by truck to the GVEA costs 70¢/MMBTU (Battelle, 1978).

Joe Usibelli, president of Usibelli Coal Mining Company, estimates that each truck covers 150 miles per day and transports an average of eleven coal loads, each about 45 tons in weight. Each truck is operated on a 10 hour shift. The total operating cost per truck, including the $24 wage of the driver, is about $60 per hour. These figures are direct costs. If taxes, insurance, ownership of trucks and other costs are included, the wage of the driver approaches $30.00 per hour, and the operating cost of the truck is about $90.00 per hour. (Usibelli, 1978). The following tabulation illustrates the cost per ton-mile:

11 loads x 45 tons ea.	=	495 tons per day per truck
495 tons x 8.5 miles	=	4207.5 ton miles per one day's operation ($60 per hour x 10 hour shift, or $600)
4207.5 ton miles ÷ $600	=	7.0125 ton miles per dollar
	Or	14.26¢ per ton mile

RAIL

The advantage of utilizing the Alaska Railroad for coal transportation both in-State and to a water port of export (Whittier) is that some of the necessary infrastructure needed is already available. A rail line also provides a means of transportation for multiple uses, as well as controlled access, if desired.

RAIL LINE TO TIDEWATER

The distance from the contemplated first mining site at Capps Glacier to waterfront is approximately 16 miles. From an elevation of about 2000 feet, the terrain slopes to the coast. A 400 MW power plant at tidewater would justify construction of a rail route, and in an export situation involving five or more million tons per year, a rail line would definitely be required (Patsch, 1978).

BELUGA EXTENSION

In an Alaska Railroad report on Beluga Coal (November 7, 1977), a prospective scenario has been outlined for development of a rail link from Beluga to a connecting point with the established railroad. A tentative routing has been selected (Figure 6-1), which may vary after ground surveys have been completed. The terrain is level, and the distance anticipated is approximately 75 to 80 miles. Connection could occur near Pittman Station at milepost 166. A crossing of the Sustina River is necessary and will largely determine the final routing.

The cost of construction of a rail line link could not reasonably be assumed by private companies. The Alaska Railroad has suggested that financing be obtained through a venture with the State of Alaska.

The cost of rail line trackage has been estimated to be as high as $1,250,000 per mile in Alaska. Consequently, the project would approach at least $94 million excluding the cost of a Susitna crossing.

UNIT TRAINS

A unit train is a solid train of dedicated cars which remain intact as a unit and operate on a schedule between one shipper and one receiver in accordance with a special tariff which includes a guaranteed, annual minimum tonnage.

FIGURE 6-1

PROSPECTIVE BELUGA RAIL LINK

Source: Alaska Railroad, 1977

Unit trains have been developed recently and provide for a considerable increase in the efficiency of rail operations. A unit train car can log 150,000 miles of operation per year whereas a car being used for many uses average only 17,000 miles per year.

The tariffs involved in rail transportation are agreed upon between the railroad and the company involved. The tariff is a rate in dollars per ton and contains provisions for maximum loading and unloading times, minimum annual tonnages, etc. Under Interstate Commerce Commission (ICC) Regulations, railroads cannot enter into contracts in excess of one year in length. As a result, a letter of intent is usually signed which contains provisions for future annual escalation of the tariff (Carlson, 1977).

To obtain minimum rail rates, a unit train should have 90-110 cars. The cost of an aluminum car is approximately $30,000. Spare cars are also a necessity on high milage unit train hauls. Normally 10% spare cars are purchased and kept for use when needed. Although it is possible to secure railroad ownership, railroads prefer that the company using the cars purchase them.

The Alaska Railroad (ARR) has employed the unit train concept in the past. Fairly large tonnages were delivered to military bases prior to 1969 when the systems of the bases were converted to natural gas. More recently, the ARR has hauled gravel on a unit train basis from Palmer to Anchorage in standard hopper cars with 80 cars comprising the unit train length. According to the ARR a 100 car length is feasible.

From a possible Beluga spur connecting to Pittman station, the ARR extends an additional 80 miles to Whittier where there is an open port year round. Port facilities would need to be expanded at Whittier to accomodate a 30 to 60 day stockpile of coal. The Federal government presently owns 800 plus acres of land in Whittier; this would be suitable for a large volume storage area and additional terminal development. A finger pier and conveyors would be required for loading. On large conveyors, 1000 tons per hour could be loaded, and with several operating at the same time, loading speed would be increased. Table 6-4 gives the ARR's unit train proposed requirements for transporting five million tons per year from Beluga to Whittier.

In a 1975 Alaska Railroad memorandum, a unit train operation from Healy to Whittier was addressed. The Railroad suggested that 100 ton aluminum hopper cars with a pneumatic rapid bottom dump assembly could be utilized. This method of loading is equally feasible at a Beluga mining operation. Aluminum cars are lighter but still allow acceptably large loads. Table 6-5 gives rail car types and capacities. To carry 10,000 net tons between Healy and Whittier during a five consecutive day service, the ARR estimates that two trains would be required, totalling 286 cars including a 10 percent reserve. A similar operation would be required from Beluga. Table 6-6 describes a tentative schedule for coal transportation from the Beluga mine to Whittier.

COSTS

Current rail costs of transporting coal in Alaska are based on experience with the Usibelli Mine. Usibelli coal price at the mine mouth was $0.60 per MMBTU in early 1977. Coal delivered the 111 miles by rail from Healy to Fairbanks is $1.05 per MMBTU. The difference of $0.45 would include tipple* and rail costs, plus trucking from the mine site to the rail connection, a distance of several miles. Tipple costs in early 1978 were $0.11 per MMBTU. Usibelli coal delivered by rail to Anchorage to supply a 200 MW plant operating at 0.65 plant factor and requiring 650,000 tons per year would cost approximately $0.98 per MMBTU. This figure assumes a $0.60 per MMBTU mine mouth cost and $0.38 per MMBTU for transportation. Transportation of coal delivered to a 400 MW plant would decrease to $0.30 per MMBTU (Battelle, 1978). Table 6-7 gives Alaska Railroad tariffs from Healy to Anchorage and Whittier.

*A tipple is an apparatus for emptying coal from a mine car by tipping; it is also the place where the emptying is done.

TABLE 6-4

BELUGA TO WHITTIER UNIT TRAIN INFORMATION

Annual Volume	5,000,000 tons
Working Days	350; allow 15 days plant repair and maintenance.
Daily Volume	14,286 tons
Tons Loaded per car	80
Number of carloads daily	179
Cars per train - (2)	1 @ 90; 1 @ 89
Length of haul (tentative)	184 miles one way; 368 round trip
Cycle time	23-24 hours
Cars required	200 - 179 working; 21 replacements
Locomotives required	10 - 5 per train
Tonnage per train (net)	1 @ 7200; 1 @ 7120
Tonnage per train (gross)	1 @ 9450; 1 @ 9345

Source: Alaska Railroad, Beluga Coal, Nov. 7, 1977.

TABLE 6-5

RAIL CAR TYPES AND CAPACITIES FOR COAL SERVICES

Type/Capacity	Lt. Wt.	Load Limit	*No. Cars 10M Net Tons	Gross Trailing Ton	Trailing Tons - Empty
70 ton - aluminum	37,000	183,000	130	12,405	2,405
70 ton - steel	54,000	166,000	130	13,510	3,510
77 ton - steel	57,000	177,000	130	13,705	3,705
100 ton - steel	63,000	200,000	130	14,095	4,095
100 ton - aluminum	45,000	218,000	130	12,925	2,925

*Number of cars per 10M net trailing tons remains constant due to 77 ton maximum weight limitation per car for unit train operation account bridge limitations.

SOURCE: Alaska Railroad, Beluga Coal, November 7, 1977.

TABLE 6-6

TENTATIVE SCHEDULE

12:00 Noon	Depart mine site for Whittier
2:30 p.m.	Arrive existing ARR main line - 2' 30" running time over Beluga extension
5:00 p.m.	Arrive Anchorage - 2' 30" running time
5:30 p.m.	Depart Anchorage - 30" change crews, inspection
8:00 p.m.	Arrive Whittier - 2' 30" running time
12:00 p.m.	Dumping complete - 4 hours dumping, if rotary dump used
12:15 a.m.	Depart Whittier - 15" orders and air test
2:45 a.m.	Arrive Anchorage - 2' 30" running time
4:15 a.m.	Depart Anchorage - 1' 30" change crews, inspection, service locomotives
6:45 a.m.	Arrive Beluga branch line - 2' 30" running time
12:00 Noon	Depart mine - 2' 30" loading; 30 min. air, orders

This schedule represents the maximum expected time to complete the cycle. Time could be improved in the unloading process depending on type of cars used. Running time over the Beluga extension could be shortened depending on track configuration. Running times on existing trackage could be improved with strict scheduling.

Source: Beluga Coal. Alaska Railroad. Nov. 7, 1977.

TABLE 6-7

Alaska Railroad Tariffs - Healy Origin [a]

	ANCHORAGE						WHITTER					
	Unit Train						Unit Train					
	Shipper Owned Cars		Carrier Owned Cars		By Carload		Shipper Owned Cars		Carrier Owned Cars		By Carload	
Annual Tonnage	$/Ton	$/MMBTU	$/Ton	$/MMBTU	$/Ton	$/MMBTU	$/Ton	$/MMBTU	$/Ton	$/MMBTU	$/Ton	$/MMBTU
200,000 to 500,000	--	--	9.82	0.564	--	--	--	--	10.49	0.604	--	--
1,000,000	5.65	0.325	7.05	0.406	--	--	6.67	0.384	8.16	0.470	--	--
1,500,000	5.63	0.323	6.63	0.381	--	--	6.66	0.383	7.71	0.444	--	--
2,000,000	5.50	0.317	6.40	0.367	7.98	0.459	6.50	0.374	7.45	0.429	8.50	0.489

(a) Conversion to $/MMBTU based on 8700 BTU/# coal quality.

SOURCE: Mr. Arnold Polanchek, Alaska Railroad. November 16, 1979.

SLURRY PIPELINE

A slurry pipeline is a pipeline used to transport finely ground coal mixed with water, oil, or methanol at about 50/50 by weight. The coal is ground, slurried with its transporting liquid and pumped to its initial pressure (usually 1000-1200 psi) at the mine site. If the pipeline is a long one, there are pumping stations every 70-100 miles which restore the line pressure to its initial psi. If the pipeline slurry is delivered to a power plant, the coal is separated from the mixture by centrifuge and burned in the boiler (Figure 6-2).

Slurry pipelines are capital intensive and are well suited to movement of large volumes of coal, especially over long distances. Slurry pipelines have been used only a few times in the United States. One no longer operating was built by Consolidation Coal Company in Cleveland, Ohio; another runs 273 miles from the Black Mesa Mine in Arizona to the Mohave Power Plant in Nevada. This line is still in service.

Coal slurry pipelines offer the following advantages:

1. Low operating costs. Low cost escalation follows as a result of low operation costs.
2. Dust control. Coal dust particulates could pose an air pollution problem.
3. No danger of spontaneous combustion.
4. High reliability. (Long distance slurry pipelines show availability factors in excess of 95%.)
5. Ease of handling of bulk materials.

Disadvantages associated with coal slurry pipelines:

1. Large consumption of water, or other mixing agent.
2. Transportation of the mixing agent. For each ton of coal transported by water, close to a ton of water is also transported, which reduces the efficiency of the process.
3. Dewatering costs. If the coal is to be burned in a steam-electric plant, the coal must either be dewatered or burned as a slurry with loss of BTU value. Both represent an additional cost over dry coal transport.

4. Possible attrition of the solid product (coal particles) during transport. This can be a disadvantage if attrition is undesirable. If a finer product is desired, it can be an advantage.

5. Corrosion. With high sulfur content, this can be a sufficiently great problem to preclude use of a slurry pipeline. In Beluga, however, the sulfur content is very low and this problem is not a serious one.

6. Inflexibility of the system once installed. The capacity of an installed slurry pipeline cannot be varied significantly without complete reconstruction.

7. Possibility of freezing in cold climate.

8. Pipeline wear.

Characteristics of slurry pipeline technology are discussed in some detail in a recent Bureau of Mines Report (Hennagin, 1978). The report includes discussion of solids concentration, the optimum particle size range, pipeline velocity, head loss, and horsepower calculations. Actual pipeline operation features, and methods of loading from the storage area to a ship are described in the report, as are factors involved in the construction process, such as allowances for expansion and contraction of the line, pumping stations, and technical factors related to methods to prevent freezing.

The Bureau of Mines report investigate the possibility of a water slurry pipeline 15 miles long from the Beluga mine, 1500 feet in elevation, to dock facilities at tidewater, and transportation of the coal in a water slurry by ship to the West Coast. Cost estimates are developed for all phases of the operation.

The slurry pipeline would involve construction of a harbor and pier facilities for Beluga. Several locations are possible, and North Foreland was chosen for the site in the Bureau of Mines Report. Beluga Coal Company is considering harbor sites at three possible locations: McArthur Flats, Granite Point and North Forelands. (See Section on Harbor and Loading facilities under Marine Transportation.) A 30 inch diameter line system was considered the best and most economical size. Pipeline data are shown in Table 6-8. (For more specifics on hydrotransportation of coal, see Appendices 6-A and 6-B.)

Slurry Pipeline Costs

Costs associated with a slurry pipeline include those for construction of the line, the pump house, and operating costs. These costs are shown in Table 6-9. To adjust for higher Alaskan costs, a factor of 1.74 was used in calculating operating costs based on Northern Great Plains province strip mine experience. Capital costs of the pipeline system are shown in Table 6-10. A factor of 1.68 over costs in the Lower 48 was used in calculating Alaskan construction costs.

The estimated total cost of delivered coal by slurry pipeline to the Beluga tidewater port, and thence by ship to the west coast is $21.15 per short ton of coal, or $1.32 per million BTU's. Table 6-11 presents a cost summary of the various sized pipeline systems analyzed, and Figure 6-2 shows a cost breakdown for the optimum 30 inch system.

The report does not identify costs in detail, making it difficult to determine whether the facilities would meet today's environmental standards. The general tone of the paper does not place an emphasis on environmental considerations. However, parts of the report do reflect efforts to mininize environmental impact. Water removed from the slurry, for example, would be recycled or treated for use within the plant (Hennagin, 1978).

MARINE TRANSPORTATION

Marine transportation is generally thought to be the cheapest method of moving coal. There are no maintenance costs or capital costs in rights of way; there is increased fuel economy and small operating crew size. Major reductions in shipping costs have been achieved by increasing the size of vessels. Even extremely large vessels are operated by relatively small crews.

TABLE 6-8

SLURRY PIPELINE DATA

Nominal Diameter, inches	24	30
Inside diameter, inches	23.25	29
Solids concentration, by weight	55%	55%
Specific gravity of slurry	1.186	1.186
Pumping velocity, feet per second	7	8
Slurry capacity, cubic feet per second	20.64	36.69
Slurry capacity, gallons per minute	9263	16466
Slurry capacity, short tons per hour	2749	4888
Coal capacity, short tons per hour	1512	2688
Head loss, feet water per 100 feet pipe	1.60	1.59
Head loss for 16 miles of pipe, feet water	1352	1343
Altitude loss, feet	(1150)	(1150)
Net loss for pipeline, feet water	202	193
Slurry horsepower required	560	950
Pump efficiency	90%	90%
Brake horsepower required	622	1055
Efficiency of motor	90%	90%
Installed brake horsepower (3 pumps operating, 1 standby)	830	1400
Energy required per year, kilowatt-hours for 4,380,000 tons coal per year	1,493,600	1,424,900
for 8,760,000 tons coal per year	2,987,200	2,849,800

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast. Open File Report 17(1)-78. Jan. 5, 1978.

TABLE 6-9

SLURRY PIPELINE COSTS

Coal tonnage per year, millions of tons	4.38	4.38	8.76	8.76
Slurry pipeline diameter inches	24	30	24	30
Capital cost of pipeline and pumping station	7,442,700	9,333,400	7,442,700	9,333,400
Annual operating cost	208,200	252,200	238,100	280,700

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast. Open File Report 17(1)-78. Jan. 5, 1978.

TABLE 6-10
SLURRY PIPELINE CAPITAL COST FACTORS (1976 DOLLARS)

Line Cost (Installed, incl. IDC, O/H, etc.)

14 inch line - $150,000/mile
20 inch line - $250,000/mile
26 inch line - $330,000/mile

Pumping Station Cost

14 inch line - $1,500,000 each
20 inch line - $3,000,000 each
26 inch line - $4,500,000 each

Coal Preparation Plant (At Mine)

3,000,000 tons/yr - $30,000,000
6,000,000 tons/yr - $45,000,000
10,000,000 tons/yr - $60,000,000

Coal Dewatering and Storage Facility (At Plant)

3,000,000 tons/yr - $ 60,000,000
6,000,ooo tons/yr - $ 90,000,000
10,000,000 tons/yr - $120,000,000

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast. Open File Report 17(1)-78. Jan. 5, 1978.

TABLE 6-11

COST SUMMARY

COSTS IN DOLLARS PER SHORT TON OF CLEAN COAL
AND FINAL COST PER MILLION BTU'S

System	I	II	III	IV	V
Coal tonnage per year, millions of short tons	4.38	4.38	8.76	8.76	8.76
Slurry pipeline diameter, inches	24	30	24	30	30
Ship size, DWT thousands of tons	70	100	70	79	100
Number of ships	3	2	6	5	4
Costs:					
Mining	7.80	7.80	6.40	6.40	6.40
Washing	1.95	1.95	1.70	1.70	1.70
Slurry preparation	1.95	1.95	1.70	1.70	1.70
Water	0.10	0.10	0.07	0.07	0.07
Slurry pipeline	0.46	0.57	0.23	0.29	0.29
Loading pier	1.94	2.04	0.97	0.98	1.02
Shipping	10.37	8.37	10.37	9.40	8.37
Off-loading pier	0.94	1.00	0.47	0.48	0.50
Dewatering	1.27	1.27	1.10	1.10	1.10
Total	26.78	25.05	23.04	22.12	21.15
Per million BTU's	1.67	1.57	1.44	1.38	1.32

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast. Open File Report 17(1)-78. Jan. 5, 1978.

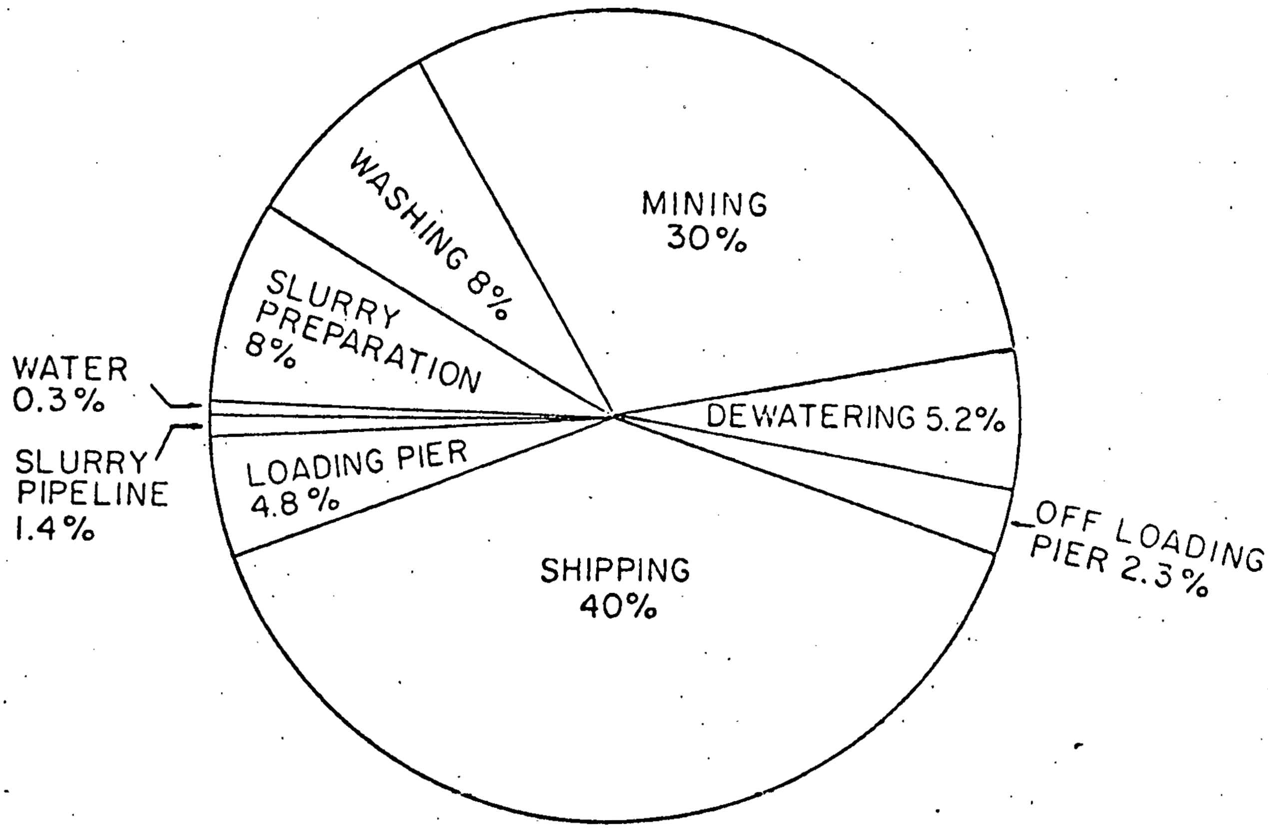

Figure 6-2

COST BREAKDOWN FOR SYSTEM V

Source: U.S. Dept. of Interior. Bureau of Mines. Open File Report 17(1)-78. Jan. 5, 1978.

Beluga coals are unusual in that they are one of the few large reserves of low-sulfur strippable coal in the United States located close to tidewater. The marine transportation possibility makes the Beluga coal potentially competitive with other coals for use on the West Coast.

At the September, 1977 "Alaska Coal and the Pacific" workshop, in the paper "Beluga Field Potential: Transportation," Kirshenbaum suggested consideration of straight and self-unloading bulk carriers, and straight and self-unloading tug-barges. The paper gave an excellent overview of transportation options for the Beluga Coal District.

WEATHER CONDITIONS

Marine conditions are poor and unpredictable in Alaskan waters. Cook Inlet at its northern end has an average tidal range of 28 feet, which is more than twice the average range in the Pacific Northwest. Tidal currents in some parts of the Inlet can reach 8 knots. Such conditions involve increased costs in designing wharves and ship berthing facilities. Ice conditions, however, are not impossible to deal with in Cook Inlet. Storm conditions in the Gulf of Alaska are frequent; wind velocities are often in the 50 to 60 knot range. Delays of 1 to 3 days are not uncommon for barge operations, though Sealand ships are powered for the area and usually are able to adhere to a schedule.

BARGING

Barging operations are feasible in Cook Inlet waters on a year-round basis. Bulk urea is presently produced at the Union Collier Plant at Nikiski near Kenai, and is transported by barge to Portland, Oregon. Special loading and unloading features are designed into the barges currently in use. Barge loading facilities allow 12,000 tons to be loaded in 12 hours. The same tonage can be unloaded in 24 hours.

A barging operation transporting coal both intra-State and for export to the Western United States coastal states is probably the most feasible and, initially, least expensive system for Beluga coal.

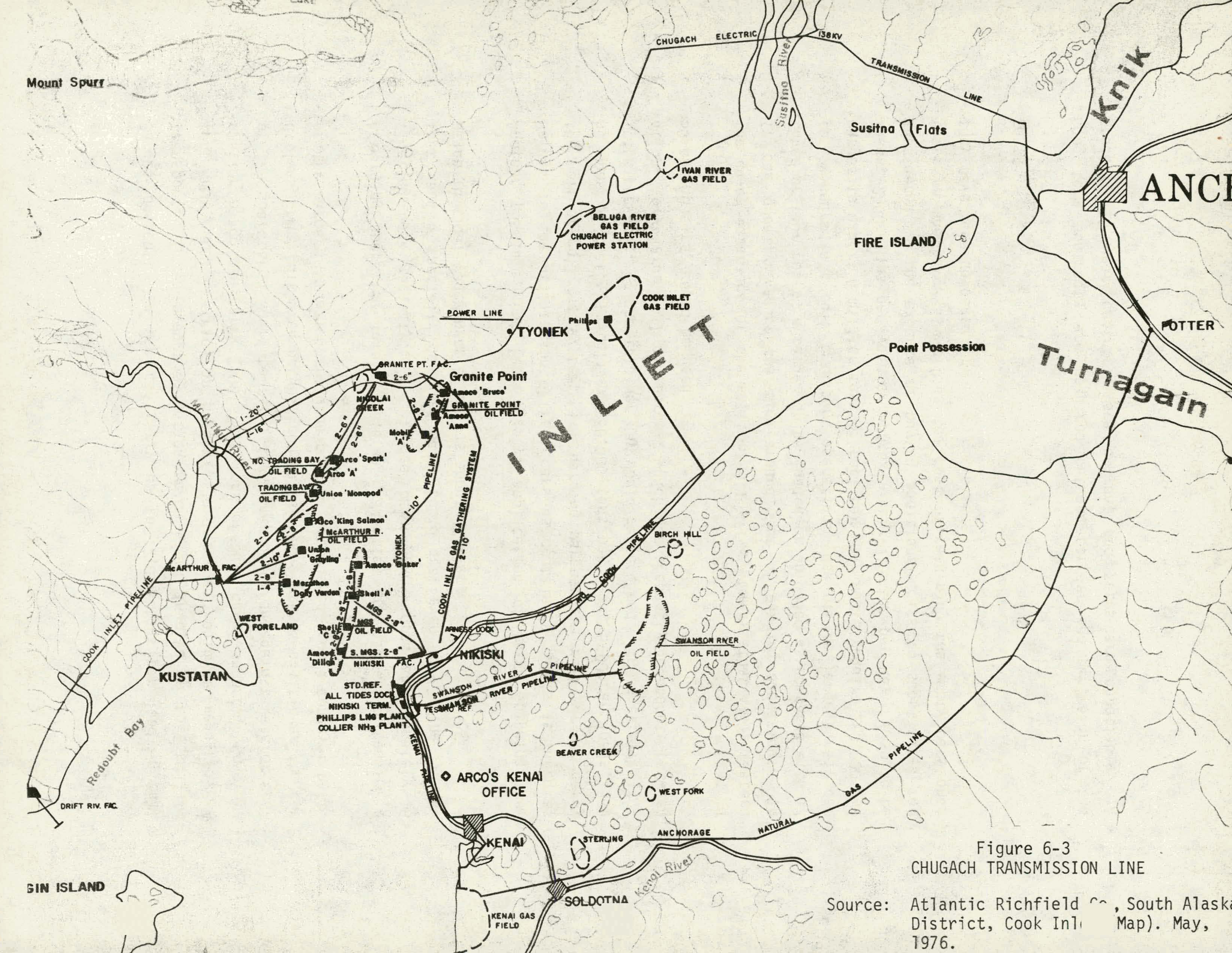

Figure 6-3
CHUGACH TRANSMISSION LINE

Source: Atlantic Richfield Co., South Alaska District, Cook Inl[illegible] Map). May, 1976.

Barges presently in use can carry up to 12,000 tons per load in bulk transport. In an export situation which might involve up to 6 million tons per year, 21 trips in present sized barges would be required. A smaller barge can carry 2500 short tons of bulk cargo on deck. Coverage of the coal cargo would be necessary for protection against weather conditions. The bulk urea barges from Nikiski have houses built over the top of the barge into which the urea pellets are poured from a conveyor belt.

A barging operation involving large quantities of coal would require a floating dock facility. The loaded barge would draw approximately 18 feet, and a specially designed barge could draw even more. The fluctuation in tidal range near Beluga is about 27 feet.

Another possible, but less likely, application of barge shipping from Beluga is the utilization of rail cars as containers. This is known as the roll on/roll off system. For barging purposes, a rail car can carry 50 tons of coal. To deliver 250,000 tons per year, 5000 car loads, 333 trips per year, or one trip per day would be required. In an export situation, very large rail car barges, which can presently accomodate between 50 and 60 cars, could be used.

The chief advantage of the roll on/roll off system is that it is faster. It can greatly reduce the turn around time of barging operations. In three or four hours, a barge can be loaded or unloaded as compared with 12 to 24 hours in a bulk transport operation. Use of the largest rail car barges to export 6 million tons of coal per year would require 120,000 car loads, 2400 trips per year or approximately 7 trips per day. Also to be considered is the expense of buying additional cars to substituted for those on the barge as well as the cost of returning the empty cars once they have been unloaded.

COSTS

Long term contracts are required between carrier and purchaser of the product; 15 year contracts are common, and rates are negotiable. A barging firm on the east coast estimated that $6.00 per short ton for barging coal from Beluga to Washington State was a reasonable charge in November of 1977. No loading and unloading costs were estimated in the $6.00 figure (Anderson, 1978).

SHIPS

Ships are faster and have higher fuel economy; they also require more initial capital investment, a deeper port, and more expensive loading and unloading facilities. Additionally, the Jones Act would tend to increase the capital and operating expenditures of ship transportation. The Jones Act requires that hauling from one U.S. port to another must occur in U.S. made ships and that registry must be under the U.S. flag.

COAL TRANSPORTATION IN A SLURRY

Ships designed specifically for the transport of coal slurry in a water mixture are not presently in use. Ships are currently being used to transport iron ore slurry, so background information is available which would be applicable to coal. Anderson (1978) proposes that an optimum size ship would be 100,000 DWT (dead weight tons) which would carry 66,000 dry short tons of coal in a slurry which is 60% coal by weight (Battelle, 1978). Tables 6-12 and 6-13 provide information and costs on ships built for slurry transportation.

Placer Amex, Inc. is also considering the possibility of transporting coal in an oil slurry. The optimum percentage of coal weight to residual oil depends upon the viscosity of the oil used and the size of the ground coal. At present, a 40% coal factor is being researched. A major problem of slurry transport is the settling of the coal particles which tends to occur. Research is underway to develop methods to keep the coal in suspension. There is also some concern as to what might happen to the composition of coal in an oil slurry.

Possible sources of residual oil are from expanded oil refinery capacity in Alaska, and from west coast oil refineries. On return voyages from

TABLE 6-12

SHIP COSTS

Ship size, DWT	70,000	79,000	100,000
Capital cost per ship	36,500,000	40,800,000	45,000,000
Annual operating cost per ship	5,298,150	5,464,500	6,192,850
Number ships used for analysis	6	5	4

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast/ Open File Report 17 (1)-78. Jan. 5, 1978.

TABLE 6-13

SHIP DATA

Ship sizes, DWT	70,000	79,000	100,000
Average speed, knots	16.5	16.5	16.5
Length, feet	810	820	890
Beam, feet	116	121	128
Draft, feet	42	43	47
Horsepower	19,000	19,400	23,000
Capacity, short tons	78,400	88,480	112,000
Allowance for bunker fuel and fresh water, short tons	1,800	1,850	2,000
Slurry capacity, short tons	76,600	86,630	110,000
Dry coal capacity, 60% coal, short tons	45,960	51,980	66,000
Diameter of slurry pipeline, inches	24	30	30
Round-trip time, days:			
sailing	7.07	7.07	7.07
docking, both piers	0.17	0.17	0.17
wait for slurry	0.06	0.06	0.06
load	1.27	0.81	1.02
unload	1.27	0.81	1.02
delay allowance	1	1	1
Total	10.84	9.92	10.34
Round-trips per year per ship	32.29	35.28	33.85
Number ships for:			
4,380,000 tons coal per year	3	-	2
8,760,000 tons coal per year	6	5	4

Source: Donald Anderson, U.S. Bureau of Mines. Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast. Open File Report 17(1)-78. Jan. 5, 1978.

the west coast, the otherwise empty tanker ships could carry residual oil which would also provide ballast on the return trip. Another possibility is the mixing of crude Alaskan oil #6 with coal in a slurry with separation to occur the point of destination. The crude oil would be diverted to a refinery for further processing and the sludge remaining from the slurry separation process could be used as boiler feed.

ELECTRIC TRANSMISSION

The Beluga Coal District has two locations for possible power plants. One is at the mine mouth near the Capps deposit. A plant in this location would probably use conveyors to move coal to a power plant stockpile and eliminate the use of a truck and rail haulage system (Placer Amex, Inc. 1977). Coal is estimated to cost 85¢ per MMBTU F.O.B. mine (Battelle, 1978). The other location for the plant is at or near tidewater. Initial hauling of the coal to the power plant will be in 120 to 150 ton tractor-trailer units, or possibly in large trucks similar to those utilized at the Usibelli Mining Company operation. A railroad would be required with an increase to a 400 MW plant. "As the electric load grows and coal consumption increases, a railroad operation will replace the truck haulage system. A larger stockpile will then be constructed, incorporating a tunnel-conveyor reclaim system to deliver crushed coal to high capacity railway load-out silos." (Battelle, 1978)

Transporting coal energy to local and in-State markets would involve construction of transmission lines from either the Capps area, or from tidewater to major towns in the Railbelt Area. Chugach Electric Association already has a 138 KV transmission corridor and line from its plant near Tyonek crossing the Cook Inlet via the Susitna River and Knik Arm (Figure 6-3). The cost to upgrade the existing system to a 350-500 KV or more system would be lower than construction of a completely new one.

Transmission costs including line loss have been estimated to be 2.5 mills per kwh in 1975 dollars from Beluga to Anchorage, and 3.9 mills in January 1, 1977 dollars (Battelle, 1978).

CONCLUSION

The equipment that would be used to transport coal from a site to market is, to a great extent, site-specific. The costs of fuels and many services have become quite volatile in recent years, making choices concerning modes of transportation to be used several years in the future even more difficult.

Many options for transportation have been identified in this chapter, as well as some general indications of cost. It seems clear that marine transportation is the only mode feasible for export of coal from the State. The distance to potential markets eliminates other alternatives. The specifics of the marine transportation to be used will depend largely on changes in the market structure, coal technologies, and transportation technologies.

The same factors will influence the choice of transportation for shipment to tidewater or to Alaskan markets. Here, the whole range of forms of transportation can be considered. To some extent, however, the consideration of coal transportation within the State may be secondary. In the near-term, it is unlikely that Alaska by itself will provide a large enough market to justify the development of the Beluga Coal field.

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November 7, 1972

CSMRI Project No. C20906

Mr. S. A. Wilson
852 Wilson Building
Dallas, Texas 75201

Dear Mr. Wilson:

The following letter report presents our findings with regard to the hydraulic transport of coal from your Alaskan deposit. The data included here should provide your engineering group with a firm basis for the preparation of a preliminary feasibility study of the hydrotransport problem.

INTRODUCTION

Mr. S. A. Wilson is interested in a coal deposit on the Chuitna River in Alaska and he wishes to market about 5 million tons of coal per year from this deposit. Although market requirements are not well defined, Mr. Wilson envisions an operation similar to the one at Black Mesa, Arizona, where the coal is ground and pumped, as a slurry, through a long distance pipeline.

In order to determine whether or not the hydrotransport idea was feasible, Mr. Wilson requested assistance from the Colorado School of Mines Research Institute. On September 14, 1972, a proposal to study the problem was made in a letter from Mr. James Link to Mr. Wilson. The proposal was accepted and the study was completed in October and November 1972.

OBJECTIVE AND SCOPE

The objective of the work discussed in this report was to provide preliminary data so that the feasibility of the hydrotransport of the Chuitna coal could be evaluated by Mr. Wilson. Basic product requirements were assumed to be similar to those published for the Black Mesa Pipeline coal.

Samples of core from the Chuitna coal deposit were provided by Mr. Wilson. These were split longitudinally and pulverized to a size approximating the Black Mesa coal. Slurries were then prepared in the rheology laboratory with this coal and their viscosities measured. These and other data were then analyzed by means of a computer and friction losses in 12-inch and 18-inch diameter pipelines were estimated.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of the preliminary rheology studies of the samples submitted, it appears that the Chuitna coal is amenable to pipeline transport in slurry form. No effort was made to develop cost data for this transport because the preliminary feasibility calculations were outside of the scope of this study. However, friction head losses for the slurry studied were found to be somewhat higher than those for Black Mesa slurries. At Black Mesa a friction head loss of 19 psi per mile for a 50% by weight slurry moving at a velocity of 5.8 feet per second in an 18-inch pipe is reported. A similar head loss for the slurries studied would be developed by a 40% solids by weight slurry moving at a velocity of 4.9 feet per second in an 18-inch pipe. This would indicate that somewhat greater effort would be required to move the Chuitna slurry than the Black Mesa slurry.

The specific gravity of the coal as received was found to be 1.452. This value appears to be toward the high end of the range for most coals and may reflect weathering or a high ash content. The effect of ash in the hydrotransport of coal is to increase the specific gravity of the coal and the viscosity of the vehicle, and thereby increase the friction losses in the slurry.

The viscosity of the coal slurry increased from 17 cps at a solids concentration of 38.3% to 96 cps at a solids concentration of 42.7% by weight. This rapid increase in viscosity may be a function of the particle size distribution chosen for this study.

If after completion of the feasibility study, the hydrotransport scheme appears to have merit, a study in the hydraulic test loop should be conducted. The effects of slurry concentration and particle size distribution should be thoroughly investigated at that time. Market requirements with regard to coal sizing should also be studied as should the physical and chemical properties of the coal.

DISCUSSION

Optimum pipeline design for the transport of a slurry requires the knowledge of that critical velocity for a given solids concentration which will prevent particle settling and minimize friction losses. In a coal slurry this velocity is a function of particle size, solids concentration, particle size distribution, and pipe diameter. Pipe diameter is also a governing factor in pipeline capacity.

For the purpose of the preliminary feasibility study, it was suggested that a coal size consist similar to that at the Black Mesa pipeline be used. This consist is reported to be as follows:

+14 mesh	<2%
14 x 28 mesh	<15%
28 x 325 mesh	70-84%
-325 mesh	<20%

Friction head losses for this slurry at a weight concentration of 50% solids are reported to be 19 psi per mile in an 18-inch diameter pipe.

Sample Description and Preparation

A sample bag containing several plastic wrapped lengths of drill core was received at the Research Institute. The bag was labeled "Chuitna River, Alaska, Core Hole D, August, 1971, 58-67'." The bag contained about 10 pounds of coal core.

The individual samples were carefully unwrapped and sawed longitudinally into two pieces. One half of the core was rewrapped and returned to the sample bag; the other half was put aside for the test work.

Upon completion of the sample sawing, the core was passed through a roll crusher to reduce it to proper size for testing. After passing through the rolls the sample was crushed to 20 mesh in a Raymond mill. The following particle distribution resulted

+20 mesh	0.4%
20 x 28 mesh	27.5%
28 x 325 mesh	68.0%
-325 mesh	4.1%

The resulting material was much coarser than that pumped at Black Mesa. Therefore, the sample was reground in the Raymond mill to pass 65 mesh. The results of this crushing were as follows:

Screen Product (Tyler) Mesh		Weight %
	+65	0
-65	+100	22.7
-100	+150	21.1
-150	+200	17.3
-200	+270	9.6
-270	+325	6.5
-325		22.8
		100.0

From this analysis it will be seen that 77.2% of the coal is in the minus 65 plus 325 mesh fraction. The minus 325 mesh material is somewhat over the 20% limit set in the Black Mesa contract. This grind is somewhat finer than desired, but the minus 325 mesh material increases the fluid viscosity and any friction loss results obtained with this sample should be conservative.

Specific Gravity of the Coal

Specific gravity of the coal sample was determined using a modified version of the procedure outlined in ASTM Standards, 1969, Part II, D884-58. Methanol was used as the liquid component. The average specific gravity of the coal after grinding to 65 mesh was 1.452.

Viscosities and Specific Gravities

Table 1 summarizes the slurry viscosities measured for given gravimetric concentrations at a constant temperature. Complete data sheets are given in the Appendix as Exhibit 1. Figure 1 shows the relationship between dynamic viscosity, in centipoise, and concentration by volume. Volumetric concentration is a more basic variable than concentration by weight.

Table 1

Summary of Viscometry Data

Slurry: Alaskan coal (minus 65 mesh) in water.

Viscometer	Concentration Weight %	Concentration Volume %	Temperature °C	Viscosity centipoise	$\tau = K\dot{\gamma}^n$ K	$\tau = K\dot{\gamma}^n$ n
Stormer	37.5	29.2	20.0	66	N.A.(2)	N.A.(2)
Stormer	40.6	32.0	19.4	125	N.A.(2)	N.A.(2)
Brookfield 2C(1)	38.3	29.9	20.0	16.8	12.3	0.233
Brookfield 3C	39.6	31.1	20.4	27.3	26.5	0.231
Brookfield 3C	42.7	33.9	21.2	95.9	93.6	0.220
Brookfield 3C	40.0	31.5	20.9	23.2	52.3	0.154

1/ Cylindrical spindle number.
2/ Not applicable.

These data suggest that 40% by weight or 32% by volume is about the maximum concentration for this particular size distribution for the coal submitted. Experience at the Colorado School of Mines with other coals indicates that concentrations of 35% by weight can be slurried to produce viscosities less than 10 cps. A major factor is the particle size distribution. It may be possible to slurry a higher concentration of the Alaskan coal to give the same viscosity if the particle size distribution is shifted slightly toward the coarser sizes. In addition to particle size distribution, the higher specific gravity of the coal and possibly its ash content may be responsible for the higher viscosities and lower concentrations than originally expected.

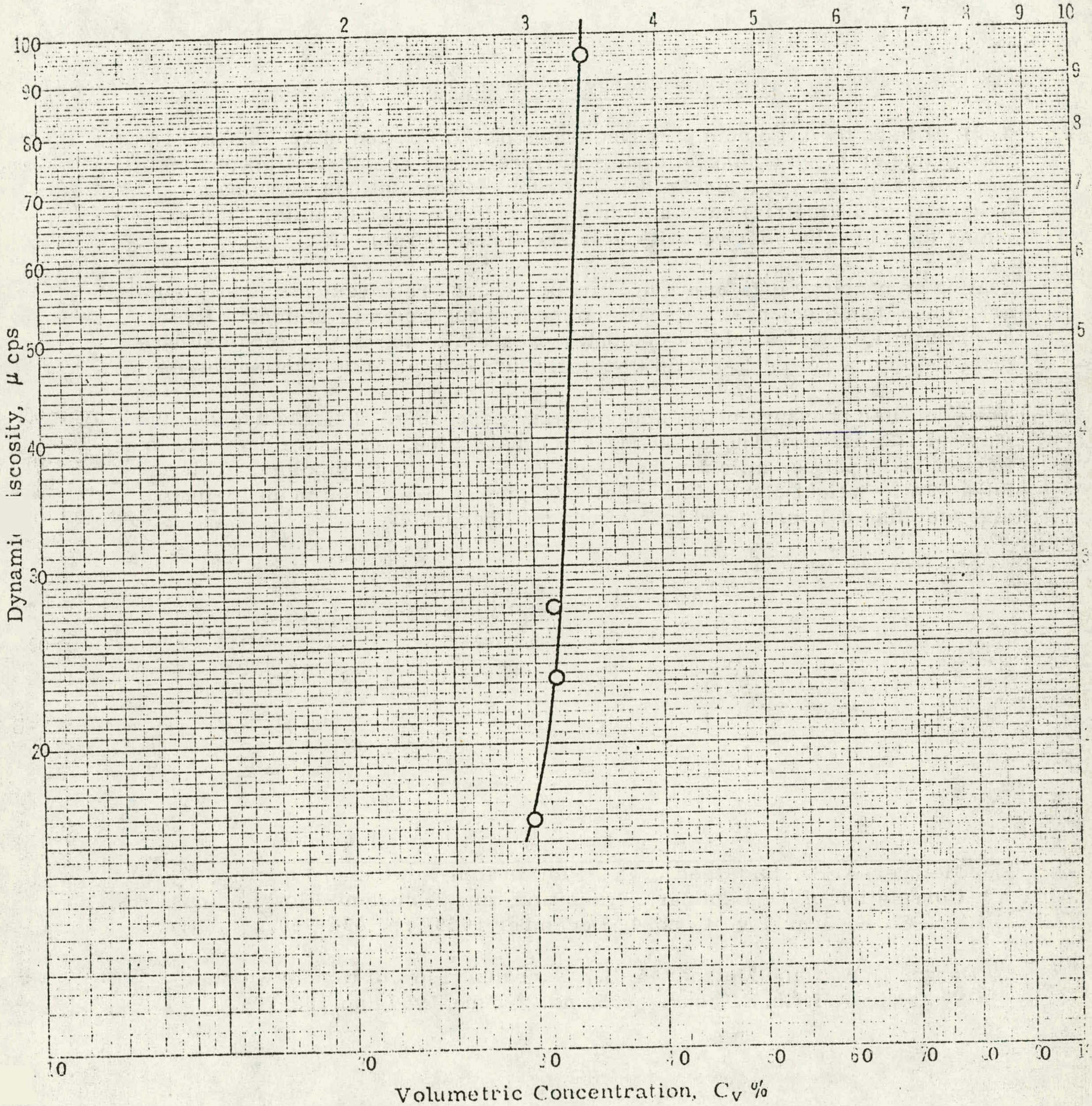

Figure 1. Viscosity vs. Concentration for Alaskan Coal

Pipeline Energy Requirements

Table II lists the predicted pressure drops due to friction in 12-inch and 18-inch diameter pipes transporting the slurries whose rheological properties were determined by a Brookfield viscometer. Computations were made originally in SI (metric) units and then converted to English units. This explains the odd values for velocity in ft/sec listed in Table II.

Scaling up rheology data to predict pipeline energy requirements is still an art rather than a science. A scale-up method suggested by Metzner, Reed, and Dodge (1, 2) was used in a computer program to convert rheological data measured for a power-law fluid (the coal slurry) to pipeline friction losses.

The computed pressure drops appear to be reasonable. J. G. Montfort in the May 8, 1972, issue of The Oil and Gas Journal, cites a pressure drop due to friction of 19 psi per mile for the Black Mesa coal slurry pipeline. This is for a 50% by weight slurry flowing at 4200 gpm or 5.8 ft/sec in an 18-inch diameter line delivering 660 tons of dry coal per hour.

1/ Metzner, A. B., and Reed, J. C., Flow of Non-Newtonian Fluids-Correlation of the Laminar, Transition, and Turbulent-Flow Regions, A.I.Ch.E. Jour., v. 1, no. 4, December 1955, pp. 434-440.

2/ Dodge, D. W., and Metzner, A. B., Turbulent Flow of Non-Newtonian Systems, A.I.Ch.E. Jour., v. 5, no. 2, June, 1959, pp. 189-204.

Table II

Pipeline Energy Predictions

Slurry: Alaskan Coal (minus 65 mesh) in water, S=1.452

C_W		Temp.	Vel.	Pressure Drop in Psi per Mile							
				for 12-inch diameter				for 18-inch diameter			
% Wt.	Sm	°C	ft/sec →	4.9	6.6	8.2	9.8	4.9	6.6	8.2	9.8
38.3	1.135	20.0		10.2	10.9	11.5	12.0	6.2	6.6	7.0	7.3
39.6	1.141	20.4		21.9	23.4	24.6	25.7	13.3	14.2	14.9	15.6
42.7	1.153	21.2		74.1	78.9	82.9	86.3	45.2	48.1	50.6	52.6
40.0	1.142	20.9		32.2	33.7	34.9	35.9	20.2	21.1	21.8	22.5

A similar pressure drop due to friction was computed for a 40% by weight Chuitna slurry moving at 4.9 ft/sec. On the basis of this comparison, it would appear that energy requirements for Chuitna slurries will be higher at lower solids concentrations than those at Black Mesa. This will increase the costs for slurry transport, but the extent may only be determined by a complete feasibility study.

Thank you very much for this opportunity to serve you. If you have any questions regarding this study, please contact me.

Sincerely,

James M. Link
James M. Link
Director of Research
Mining Division

R. R. Faddick
R. R. Faddick
Slurry Transport Specialist

ebm
enclosures

EXHIBIT 1

VISCOSITIES OF COAL-WATER SLURRIES

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Stormer.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 37.5% by weight; 29.2% by volume.
Temperature: 20.1°C before test; 19.9°C after test.

Force g	Time for 100 Rev. t sec, average	Dynamic Viscosity cps(1)	Time min
50	77.6	100+	
60	50.3	90	
80	33.5	78	
100	25.9	73	
150	16.5	66	
200	12.9	65	
300	9.5	65	
400	7.4	66	20.0

1/ From calibration charts for CSM Stormer viscometer.

Remarks: Dynamic viscosity is 66 cps at 20.0°C. Substantial settling in Stormer cup. Data not considered accurate.

EXHIBIT 1
(continued)

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Stormer.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 40.6% by weight, 32.0% by volume.
Temperature: 19.3°C before test; 19.4°C after test.

Force g	Time for 100 Rev. t sec, average	Dynamic Viscosity cps(1)	Time min
100	61.8	183	
150	36.0	157	
200	25.6	145	
300	16.6	135	
400	12.5	135	
500	9.9	130	
600	8.3	125	17.5

1/ From calibration charts for CSM Stormer viscometer.

Remarks: Dynamic viscosity is 125 cps at 19.4°C. Considerable deposition of coal in Stormer cup. Data not considered accurate.

EXHIBIT 1
(continued)

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Brookfield LVT, Spindle 2C.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 38.3% by weight, 29.9% by volume.
Temperature: 20.0°C before test; 20.0°C after tests.

rpm	Dial Reading	Average	Time min
6	27.0	27.2	
12	32.2	32.3	
30	40.1	39.8	
60	46.6	46.6	
60	46.6		
30	39.5		
12	32.4		
6	27.4		19.6

Remarks: Dynamic viscosity at 45 rpm by computer is 16.8 cps.

Rheogram equation: $\tau = 12.3\gamma^{0.233}$

EXHIBIT 1
(continued)

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Brookfield LVT, Spindle 3C.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 39.6% by weight, 31.1% by volume.
Temperature: 20.5°C before test; 20.3°C after test.

rpm	Dial Reading	Average	Time min
6	13.0, 14.1	14.8	
12	18.2, 17.8	18.8	
30	22.1, 22.5	22.6	
60	24.9, 25.9	25.5	
60	25.5, 25.6		
30	23.3, 22.5		
12	20.5, 18.5		
6	15.6, 16.4		18.0

Remarks: Dynamic viscosity at 45 rpm by computer is 27.3 cps.

Rheogram equation: $\tau = 26.5\gamma^{0.231}$

EXHIBIT 1
(continued)

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Brookfield LVT, Spindle 3C.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 42.7% by weight, 33.9% by volume.
Temperature: 21.2°C before test; 21.2°C after test.

rpm	Dial Reading	Average	Time min
6	52.3	52.3	
12	64.8	64.8	
30	77.1	77.1	
60	87.8	87.8	3.8

Remarks: Dynamic viscosity at 45 rpm by computer is 95.9 cps.

Rheogram equation: $\tau = 93.6\,\gamma^{0.220}$

EXHIBIT 1
(continued)

Sample: Minus 65 Mesh Alaskan Coal in Water.

Viscometer: Brookfield LVT, Spindle 3C.

Sample Description: Specific Gravity of Coal: 1.452 at 25°C.
Concentration: 40.0% by weight, 31.5% by volume.
Temperature: 20.8°C before test; 21.0°C after test.

rpm	Dial Reading	Average	Time min
6	28.2	28.2	
12	31.4	31.4	
30	36.4	36.4	
60	40.1	40.1	4.0

Remarks: Dynamic viscosity at 45 rpm by computer is 23.2 cps.

Rheogram equation: $\tau = 52.3\gamma^{0.154}$

HAROLD H. GALLIETT, JR.
REGISTERED CIVIL ENGINEER

REPORTS
SURVEYS
DESIGN
SUPERVISION

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13 November 1978

Dr. Gene Rutledge
Division of Energy And Power
Development
State of Alaska
7th Floor
MacKay Building
338 Denali Street
Anchorage, Alaska 99507

RECEIVED
NOV 16 1978
ALASKA ENERGY OFFICE

Telephone: (907) 276-0508

Subject: Proposed System,
Economical Shipment,
Beluga Coal

Dear Dr. Rutledge:

Economical shipment of Beluga coal will require ingenuity and innovation.

Beluga coal can probably be sold in the near future on the West Coast and in Japan in competition with desulphurized fuel oil. This would reduce our dependence on foreign oil, improve our balance of payments, free residual oil for upgrading to lighter fuels and create jobs in Alaska.

Beluga coal is about 25 percent moisture and 10 percent ash. Heat content runs about 8,000 BTU per pound. Average rank is Subbituminous "C". I believe this coal slacks comparatively easily on exposure to the air. Similar Alaska coals heat quickly when stored in ordinary piles, and there may be a greater than average risk of fire in piles and in ship's holds due to spontaneous combustion. Even so, Beluga coal has only about 0.2 percent sulfur, and is also thought to be very low in heavy metals.

The total system of coal use includes mining, land transportation, cleaning, sizing, storage, loading, marine transportation, unloading, land transportation, storage, recovery and firing. The total system must offer economies of scale, simplicity, specialization, security and low pollution to be competitive.

Mining is assumed to begin in the Capps coal beds. The stripping ratio is lower than in the Chuitna beds.

As-mined coal is loaded into 80-ton rail cars. Electric locomotives haul unit trains about 30 miles to a coal cleaning and processing plant at Beluga. About 24-miles of this run is on a 2 percent down grade. Locomotives are designed for regenerative braking. Empty trains on the upgrade would use some of the regenerative power and connection to the Anchorage power grid would stabilize the regeneration.

The coal is processed to yield two fractions - clean, sized coal for marine transportation and shaly coal for local power generation.

Shaly coal for local power generation is burned in fluidized bed boilers in the presence of limestone. The purpose is to reduce emissions of sulfur and nitrogen oxides and to burn shaly coal effectively without fusion of the ash. Ash is disposed of by filling.

Coal is handled, stored, loaded, unloaded, stored and recovered using the Marcona System. In this system, coal is suspended in water at the processing plant. The coal suspension is then pumped to storage ponds. These ponds are kept free of ice using power plant cooling water.

Coal is resuspended using Marcona jets, and then pumped aboard ships or barges. Because the coal pipeline from the storage pond to the ship is short compared with coal pipelines for long-distance coal transportation, high flow rates, high turbulence and high head loss are tolerable, and a relatively coarse coal can be loaded.

The water used to suspend the coal, drains freely through the relatively coarse coal in the hold of the ship or barge, and is pumped ashore. The use of relatively-coarse coal is essential to permit quick drainage. Drainage of free water allows the ship or barge to carry a much larger load of coal. Quick drainage avoids delay at dockside while potentially polluting drainage water is pumped ashore for settling and re-use or treatment and disposal.

Integrated tug-barges* are the least expensive way to transport coal to the West Coast, and may even be competitive with Japanese

* O'Donnel, J. P., "100,000-dwt Tug-barge planned," Oil and Gas Journal, October 1, 1973, page 61-65.

ships in transporting coal to Japan. The bow of the tugs is locked into a notch in the stern of the barge, and the barge is pushed, rather than being towed on a cable. Draft is about 80 percent of the draft of ships of equal tonnage, and the initial cost of the integrated tug-barge is only about 70 percent of the cost of a conventional collier of similar tonnage.

The ice, currents, tides and depths at Beluga seem to require a special loading facility. Such a facility is proposed to consist of an ice-breaking offshore mooring caisson connected to shore by pipelines laid in trenches on the bottom. Vessels vane with the current to a protected position behind the mooring caisson. Coal and return water are carried in hoses between the vessel and the mooring caisson.

An alternative to the ice-breaking offshore mooring caisson might be to provide ice-breaking and current-deflecting mooring caissons at both ends of the present North Forelands dock.

Unloading at destination is done with Marcona jets installed in the double bottom of the vessel. Power plants should be on or near navigable water to minimize further coal transportation costs.

Very truly yours,

Harold H. Galliett, Jr.

Harold H. Galliett, Jr.,
Registered Civil Engineer

HG:mg

CHAPTER 7

ENVIRONMENTAL ASSESSMENT OF THE BELUGA COAL FIELD

CHAPTER 7
ENVIRONMENTAL ASSESSMENT OF THE BELUGA COAL FIELDS

INTRODUCTION

The development of the Beluga coal fields is a massive project and, in the course of this discussion, some subjects have been only superficially covered. As originally envisioned, this report was to have drawn heavily on work to have been conducted by the Argonne National Laboratory. It was intended that their indentification of environmental parameters, establishment of a baseline data monitoring program and procedures, and identification of relevant reclamation technologies would provide valuable information and analysis which were not possible under the budget constraints of the DEPD study. Unfortunately, the Argonne program was not funded. Consequently, this chapter is presented with the acknowledgement that it is limited in scope and depth and additional study in needed.

As has been pointed out by the State of Alaska, Department of Environmental Conservation, Division of Planning and Program Coordination in their review of this chapter, some of the information sources used for this project have been superseded. Because this report covered such a large number of subjects, not all of the environmental issues have been covered in great depth. In line with the Department of Environmental Conservation's recommendations, more recent and more specific information can be found in the Alaska Department of Fish and Game (ADF&G) Coastal Habitat Atlas and Resource Inventories published through the Coastal Zone Management Program (CZM). These source materials contain current and detailed information regarding, among other subjects, escapement, habitat and life history data which supplement the distribution maps.

Further information on the environmental issues resulting from coal field development project can be found in the Placer Amex environmental impact statement. The Bureau of Mines also is developing information on this subject. Another source of information would be the United States Geological Survey.

ENVIRONMENTAL BASELINE

It is the purpose of this chapter to establish the environmental background of the Beluga Coal Fields. The chapter emphasizes soil and soil conditions dealing only summarily with environmental impact on water and air. The scenario for the decision-making process and governmental permit process discussed in another chapter. In regard to the information included in this chapter, unless otherwise noted, all quotations, tables or lists are from the Alaska Regional Profiles Study, "Southcentral Region," composed by the University of Alaska, Arctic Environmental Information and Data Center (1974).

LOCATION

Geographically, the Beluga Coal District discussed in this report is located on the western shore of Cook Inlet between 40 and 60 miles due west of Anchorage and is bounded by the Cook Inlet on the east and south; the Chakachatna River on the west; the Capps Glacier and Beluga Lake on the north and northwest, and the Beluga River on the north and northeast. By legal description, the area is contained in the following townships of the Seward Meridian:

T.11N., R.10 - 14W. inclusive
T.12N., R.10 - 14W. inclusive
T.13N., R. 9 - 14W. inclusive
T.14N., R.10 - 14W. inclusive
T.15N., R.11 - 14W. inclusive

CLIMATE

The Beluga District falls within the transitional climate zone between a maritime and a continental climate, at times assuming the characteristics of one or the other. The higher elevations and inland areas are less affected by ocean moderation and more closely resemble a continental climate zone.

With local variations, the mean annual temperature is generally above one degree Centigrade (thirty-four degrees Farenheit). January minimum and maximum temperatures range from 0-4°F to 16-20°F. July minimum and maximum temperatures range from 46-50°F to 64-68°F.

Based on regional information, the Beluga District can be assumed to have a growing season ranging from 68 days in the upland areas to 115 days along the coast.

The mean annual precipitation rate is 150 to 250 centimeters (60 to 100 inches) which includes the water equivalent of the mean annual snowfall of 50 to 100 centimeters (20 to 40 inches).

HYDROLOGY

Three major river systems, the Chakachatna, Beluga, and the Chuitna (Chuit), drain the area along with numerous small streams and creeks running through the systems. The Chakachatna, which heads in Chakachamna Lake, and its glacer-fed tributaries drain the extreme western and southwestern portions of the district. The Chuitna, also called the Chuit, a non-glacial river, and its tributaries drain the central and southern portions of the district. The glacier-fed Beluga, which has its headwaters at Beluga Lake, drains the northern sector of the district.

The Chakachatna System, which begins in the 26 square mile Chakachamna Lake, has a 1,620 square mile drainage basin. With an approximate length of 36 miles, the Chakachatna has an estimated flow of 4,140 cubic feet per second, an annual estimated runoff of three million acre feet, and is considered a prime potential hydroelectric site at an installed capacity of 366 MW with a very low index cost of 6.5 as defined by the Alaska Power Administration. The index cost is the estimated 1965-66 busbar mill cost per Kwh for developing the site, not including transmissions costs.

The Chuitna River (Chuit), which rises near the southern edge of the Capps Glacier and flows 27 miles westward to the Cook Inlet, is not a glacially fed river. It drains an approximate area of 150 square miles and has an average estimated flow of 200 cubic feet per second. Although it is identified as a potential hydroelectric site with an installed capacity of 9 MW, it has a very high index cost, 83.4.

The 35-mile long Beluga River drains an area of 930 square miles, has an annual estimated runoff of 1.8 million acre feet, and an average estimated flow of 2,400 cubic feet per second. Two potential hydroelectric sites have been identified on the Beluga: the Upper Beluga site with an installed capacity of 48 MW with an index cost of 11.1, a lower priced site as defined by the Alaska Power Administration, and the Lower Beluga site with an installed capacity of 15 MW with an index cost of 19.1 being slightly higher than the former.

Flooding occurs regularly in the spring along the entire length of the Beluga, lower portions of the Chakachatna, and upper reaches of the Chuitna. Almost all surface water of the area is of the calcium bicarbonate type and is low in dissolved solids although in the lowlands, water may contain objectionable amounts of iron and organic matter. Most of the glacially-fed streams have high silt concentrations, especially during the summer. Suspended sediment concentrations, range from less than 50 milligrams per liter, for streams originating in the area, to 50-200 mg/liter, for streams originating outside the district. Wells in the area yield 10-100 gallons per minute.

The water temperatures of most lakes and streams average 0°C (32°F) in the winter and 12°C (53°F) in the summer.

SOILS

During the Wisconsin or Illinoian age of the Quaternary times, the Beluga Coal District was covered by a large ice field. Because of the ice field, the present soil geology consists primarily of glaciolacustine deposits. These silt-rich deposits, produced by glacially-dammed lakes, discontinuously mantle glacial and glaciofluvial desposits of unconsolidated material laid during the Pleistocine Epoch.

Geologically speaking, the area is young with resulting soil profiles being poorly developed. The higher, upland elevations consist primarily of slightly to moderately modified glacial moraines and associated drifts. Wind blown silts cover much of these upland deposits. Along the major rivers and streams are well-sorted flood plain, terrace, and alluvial fan deposits. The lowland areas are mantled with glacial deposits that range widely in texture and are overlain by well drained to poorly drained silt loam often with peat bogs in the depressions.

The area is generally free of permafrost with a few isolated masses present.

Although the Beluga Coal District is geologically young, with corresponding poorly-developed soil profiles, there is a surprising array of soil types present.

The southern and southwestern portion of the district, T.11N., R.12-14W. and T.12N., R.13 and 14W., lies in a zone where soils are generally poorly drained, water-laid materials. The soils have a sandy texture with a low erosion potential and the slopes are generally less than 12 percent. For agricultural purposes, these soils are considered nonarable, suitable only for grazing or range.

The higher, alpine elevations of the west central portion of the area, near the Capps Glacier have soils that range from well-drained dark soils formed in fine volcanic ash of a medium loamy texture with medium erosion potential and slopes exceeding 12 percent to poorly-drained, partially decomposed peat containing lenses of volcanic ash. These soils are 25-50 percent arable and are well suited for grazing purposes. Both the Capps Coal Field, the first field scheduled for development, and the main portion of the Chuitna West Coal Field, lie in this soil zone.

The east central and northern portions of the district contains soils that range from poorly drained fibrous peat which freezes in the winter, to well-drained acid soils ranging from loamy texture to gravel with low to medium erosion potential on slopes of generally less than 12 percent.

Being 50 percent or more arable, these soils are eminently suited for some form of agriculture. The Threemile Coal Field lies entirely within this soil zone.

Locally, shallow bogs exist in the low, poorly drained depressions of the area, and along the coast, marshes of fine silt occur--particularly among the deltas of the major rivers.

FLORA

Five major vegetation communities are found within the boundaries of the Beluga Coal District study area: 1. Alpine, 2. High Brush, 3. Upland Spruce-Hardwood Forest, 4. Lowland Spruce-Hardwood Forest, and 5. Wet Tundra. Two of the systems, the Lowland and Upland Spruce-Hardwood Forests, dominate the area and comprise approximately 60-70 percent of the vegetation present.

See Appendix 7-A for a listing of those plants that may occur in the Beluga Coal District area.

Alpine Vegetation Community

The Alpine community, located in the extreme western higher elevations of the area, occupies less than three percent of the land area considered. This system "is composed mostly of low mat plants, both herbaceous and shrubby, and is typically found on rock and rubble of mountains above 2500 ft (800m). ...Regeneration (plant growth) is often extremely slow following damage by fire, mechanical disturbance, or by overgrazing. Some lichens may require more than 60 years to fully recover."

The plant material that comprises the core of the Alpine Vegetation community is as follows:

Shrubs

Resin Birch	Betula glandulosa
Dwarf Arctic Birch	B. nana, ssp. exilis
Arctic Willow	Salix arctica ssps.
Crowberry	Empetrum nigrum ssps.
Labrador Tea	Ledum palustre ssp groenlandicum
Mountain Heather	Phyllodoce ssp.
Rhododendron	Rhododendron lapponicum
Dwarf Blueberry	Vaccinium caepitosum
Alpine Blueberry	V. uliginosum ssp alpinum
Alpine Bearberry	Arctostaphylos alpina

Grasses, Herbs, Others

Mountain Avens	Dryas spp
Moss Campion	Silene acaulis ssps
Arctic Sandwort	Minuartia arctica
Cassiope	Cassiope spp
Alpine Azalea	Loiseluria procumbens
Sedges	Juncus spp
Lichens	
Mosses	
Mic. Fungi	

High Brush Vegetation Community

Located in the west central portion of the Beluga district, the High Brush plant community covers approximately 15 percent of the land area. "The dominant species in these dense, open brush systems range from willows along streams to alder above timberline. The type occurs between beach and forest, between treeline and alpine tundra, in avalanche paths through forests, on floodplains, and in old forest burn areas. Trees, such as quaking aspen, Alaska paper birch, and white spruce may be present but are widely scattered. The high brush system occupies a great variety of soils--from poorly drained with permafrost in low river valleys to well-drained shallow upland soils on moraines. It is also found on outwash and mountain slope soils with intermittent permafrost....Species composition varies considerably with location."

The following list identifies those plant species most likely to be found in this system:

Shrubs

Sitka Alder	Alnuscrispa ssp. sinuata
American Green Alder	A. crispa ssp. crispa
Thinleaf alder	A. incana ssp. tenuifolia
Devil's club	Echinopanax horridum
Willow	Salix ssp.
Currant	Vaccinium spp.
Blueberry	Rubus spp.
Raspberry	Shepherdia canadensis
Soapberry	Vaccinium vitis-idaea ssp. minus
Ligonberry	Spirea beauverdiana
Alaska Spirea	Rubus parviflorus
Thimbleberry	Var. grandiflorus
Salmonberry	R. spectabilis
Dogwood	Cornus spp.

Grasses, Herbs, Others

Bluejoint	Calamagrostis spp.
Fescue	Festuca spp.
Yarrow	Achillea spp.
Lupine	Lupinus spp.
Jacob's Ladder	Polemonium spp.
Horsetail	Equisetum spp.
Fireweed	Epilobium angustifolium ssps.
Parsley fern	Thelpteris phegopteris
Lady fern	Athyrium filix-femina
Marsh fern	
Fragil fern	
Lichens	
Mosses	

Upland Spruce-Hardwood Forest Vegetation Community

The Upland Spruce-Hardwood Forest covers most of the southern and central portions of the Beluga district; approximately 40 percent of the land area. "This is a fairly dense, mixed forest composed of white spruce, Alaska paper birch, quaking aspen, black cottonwood and balsam poplar." Occupying portions of nearly all well-drained soil types "large areas of this system are generally found on the more deeply thawed, well-drained southerly slopes at lower to mid-elevations and on bench lands..."

It is from this vegetation community that trees are being taken by the Tyonek Timber Company and Kodiak Lumber Mills for wood chip and saw log operations. The timber lease lands, located in the southern portion of the Beluga district (T11. and 12N., R12-14W., S.M.) occupies lands in which "the beetle-infested stands (of timber) are predominantly Sitka spruce with some white spruce...."

> "Timber productivity on the west shore of Cook Inlet is high. A U.S. Forest Service inventory of the area in 1971 indicated almost as much volume produced by the relatively small area (45,000 acres or 18,200 hectares) as in Alaska's entire Kuskokwim River floodplain. Most of the commercial forest land produces more than 30 cubic feet per acre (cu. ft./ac.) per year of new growth. Total net volumes per acre range from a low of approximately 600 BF to 30.2 MBF. The overall average is 10.6 MBF or 2,140 cu. ft."

> "Information on the specific mortality causes is not available, but blowdown, disease, insect, and animal damage in that order are the most likely agents. Presently, a condition exists which could destroy the entire timber resource of the west Cook Inlet area and the southwestern portion of the Susitna Valley. Due to a prolonged drought, possibly augumented by land clearing in the area over a period of years, the endemic spruce beetle, Dendroctonus rufipennis, population has exploded to epidemic proportions and has already ravaged thousands of acres. The beetles are spreading and will continue to destroy additional trees until checked naturally or chemically."

The following list identifies those plant species most likely to be found in the Upland Spruce-Hardwood Forest community:

Trees

White spruce	Picea glauca
Black spruce	P. mariana
Quaking aspen	Populus tremuloides
Alaska paper birch	Betula papyrifera spp. humilis
Black cottonwood	Populus balsamifera ssp. trichocarpa
Balsam poplar	P. balsamifera ssp. balsamifera

Shrubs

Willow	Salix spp.
Alder	Alnus spp.
Rose	Rosa spp.
High bush cranberry	Viburnum edule

Ligonberry	Vaccinium vitis-idaea ssp. minus
Raspberry	Rubus idaneus subsp. melanolasius
Currant	Ribes spp.

Grasses, herbs, others

Bluejoint	Calamagrostis spp.
Fireweed	Epilobium angustifoloium ssps.
Horsetail	Equisetum spp.
Parsley fern	Criptogramma crispa var. sitchensis
Marsh fern	Thelypteris phegopteris
Lady fern	Athyrium filix-femina
Fragile fern	Cystopteris fragilis ssps.
Other ferns	
Lichens	
Mosses	
Mushrooms	
Other fungi	

Lowland Spruce-Hardwood Forest Vegetation Community

The second major plant community, the Lowland Spruce-Hardwood Forest, covers approximately 35 percent of the land area and is located in the north and northcentral portions. "This is a dense to open lowland forest of evergreen and deciduous trees, including pure stands of black spruce. It usually occurs on areas of shallow peat, glacial deposits, outwash plains, and on north-facing slopes. . . .Open forest stands with lichens provide excellent winter range for caribou. Willows and other brush species furnish shelter and browse for moose."

The following are the core species of a Lowland Spruce-Hardwood Forest:

Trees

Black spruce	Picea mariana
White spruce	P. glauca
Alaska paper birch	Betula papyrifera ssp. humilis
Quaking aspen	Populus tremuloides
Balsam poplar	P. balsamifera ssp. balsamifera
Black cottonwood	P. balsamifera ssp. trichocarpa

Shrubs

Willow	Salix spp.
Dwarf arctic birch	Betula nana ssp. exilis
Ligonberry	Vaccinium vitis-idaea ssp. minus
Blueberry	Vaccinium spp.
Labrador tea	Ledum palustre ssp. groenlandicum
Crowberry	Empetrum nigrum ssps.
Bearberry	Arctostaphylos uva-ursi ssp. minus

Grasses, herbs, others

Cotton grass	Eriophorum spp.
Horsetail	Equisetum spp.
Fireweed	Epilobium angustifolium ssps.
Parsley fern	Cryptogramma crispa var. sitchensis
Marsh fern	Thelypteris phegopteris
Fragile fern	Cystopteris fragilis ssps.
Lichens	
Mosses	
Liverworts	
Mushrooms	
Other fungi	

Wet Tundra Vegetation Community

The last vegetation system, the Wet Tundra, occupies approximately seven percent of the area and is located in two separate areas. The first in the extreme southwest portion and the second in a belt along the eastern boundary of the district. This community occurs not only inland but also along the coast and among the river deltas.

The "dominant vegetation is sedge and cottongrass, usually occurring as a mat rather than as tussocks. A few woody and herbaceous plants occur on drier sites above the water table. Rooted aquatic plants occur along shorelines and in shallow lakes. This type occupies tide flats and areas of little topographic relief near sea level. Soils. . .are primarily peat. The limited activity of soil organism(s) due to cold temperatures reduces peat decomposition and there is little accumulation of vegetable matter." This community occupies an extremely important spot in the lifecycles of migratory birds and other waterfowl serving as resting stops or nesting grounds.

The following list identifies those species most likely to be found in a Wet Tundra community:

Shrubs

Willow	Salix spp.
Dwarf arctic birch	Betula nana ssp. exilis
Labrador tea	Ledum palustre ssp. groenlandicum
Shrubby cinquefoil	Potentilla fruiticosa
Lingonberry	Vaccinium vitis-idaea ssp. minus
Bog cranberry	Oxycocus microcarpus

Grasses, Herbs, Others

Lyme grass	Elymus arenarius
Pendant grass	Arctophila fulva
Cottongrass	Eriophorum spp.
Bur reed	Sparganium spp.
Mare's tail	Hippuris spp.
Rushes	Juncus spp.
Sedges	Carex spp.
Lichens	
Mosses	
Liverworts	
Mushrooms	
Other fungi	

Fresh Water and Estuarine Vegetation Communities

Two additional plant communities exist that are extremely sensitive to disturbance and encroachment by man. They are the fresh water and estuarine communities or systems.

Aquatic Plants

"The lakes, ponds, pools, ditches, and sluggish streams of Southcentral Alaska support a greatly varied flora. Not a drop of standing fresh water is without its complement of plants and life."

"These aquatic plants range from the ubiquitous, unicellular green and blue-green algae through the more visible filamentous green algae to the sedges, rushes, grasses, and other higher plants, many of which flower in their watery habitat. Aquatic mosses are present in many locations. A number of these tender underwater herbs are favored foods of moose."

A partial list of these aquatic plants which may be found in Southcentral Alaska follows:

Grasses, Herbs, Others

Single cell and filamentous algae	Chlorophyta
Blue-green algae	Chanophyta
Club moss	Lycopodium spp.
Spike moss	Selaginella spp.
Quillwort	Isoetes spp.
Horsetail	Equisetum fluviatile
Bur reed	Aparganium spp.
Pondweed	Pontamogeton spp.
Arrowhead	Sagittaria cuneata
Foxtail	Alopecurus aequalis
Manna grass	Glyceria spp.
Spike rush	Eleocharis palustris
Sedge	Carex aquatilis ssp. aquatillis
Duckweed	Lemna spp.
Rushes	Juncus spp.
Dwarf	Nymphaea tetragona
Yellow pond lily	Nuphar polysepalum
Marsh marigold	Caltha palustris ssps.
Awlwort	Subularia aquatica
Water starwort	Callitriche spp.
Water milfoil	Myriophyllum spp.
Mare's tail	Hippurus spp.
Water parsnip	Sium suave
Mudwort	Limosella aquatica
Bladderwort	Utricularia spp.

Salt Marshes and Wetland Plants

"The salt marshes and wetlands which are found on the shores of estuaries in Southcentral Alaska are heavily populated by a number of plant species. It is these wetlands which produce the greatly admired displays of wild-flowers each spring."

"These areas are very important to many different types of wildlife. Waterfowl rest during migrations, feed, and often breed and nest in these estuarine meadows. Brown bear, and black bear inhabit the coastal wetlands from time-to-time. Many small songbirds and small animals make their homes here, and young fish find shelter in the tidal channels which meander through them."

"Farthest from salt water, ryegrass and associates predominate. This zone is followed by the hairgrass community, and closest to the water, the sedges predominate. Close to the mouths of streams in brackish water some of the green marine algae may grow. Occasionally, a brown marine algae appears in brackish water, while eelgrass grows where the water is salty."

Some of the plant species to be found in the salt marshes and wetlands in Southcentral Alaska are:

<u>Grasses, Herbs, Others</u>

Ditch grass	Ruppia spiralis
Horned Pondwood	Zanichellia palustris
Arrow grass	Triglochin spp.
Alkali grass	Puccinellia spp.
Sedges	Carex spp.
Rushes	Juncus spp.
Reed bent grass	Calamagrostis spp.
Hair grass	Deschampsia spp.
Lyme grass	Elymus arenarius spp. mollis, var. mollis
Yarrow	Achilla spp.
Kamchatka fritillary, Sarana	Fritillaria camshatcensis
Shooting star	Dodecatheon pulchellum spp. superbum
Buttercup	Ranunculus spp.
Beach pea	Lathyrus maritimus ssps.
Indian paintbrush	Castilleja spp.
	Oenanthe sarmentosa
Marsh fivefinger	Potentilla palustris

FAUNA

Of all the large terrestrial mammals that inhabit Alaska, only three, the brown and black bears and moose, occupy the Beluga coal district with any great regularity and only moose have areas of high use within its boundaries.

Brown and black bear range the entire district yet have no denning or intensive use areas within the area. Brown bear do use the Chuitna River basin during salmon spawning, but apparently not in heavy concentration. However, an intensive use area for black bear exists approximately six miles southwest of the Beluga Coal District in T.10N., R.14W.

High concentrations of moose occur within the Beluga Coal District during different seasons. A major fall/winter concentration occurs in the high brush community in the west central portion near the head of the Chuitna (Chuit) River. A winter concentration area lies to the southwest of the southern border and extends across the Chakachatna River into the district. In the northeastern portion of the district, along the coast and for about four miles inland, a spring/summer/winter concentration area extends across the Beluga River from the Susitna River and River Delta area.

Coastal areas throughout the Cook Inlet area "support moderate populations of bald eagles and peregrine falcons."

"Golden eagles and gyrfalcons occupy upland areas. Great horned owls, great grey owls, and rough-legged hawks are some characteristic raptors of the spruce-birch forest in the more northern areas of the subregion. Other raptors known to breed in this subregion include goshawks, sharp-shinned hawks, redtailed hawks, Harlan's hawks, marsh hawks, osprey, pigeon hawks, and short-eared owls."

"Numerous shorebirds, including semipalmated, American golden and Black-bellied plovers; surf birds; ruddy and black turnstones; common snipe; whimbrels; spotted, solitary, pectoral, Baird's, least, semipalmated and western sandpipers; wandering tattlers; greater and lesser yellowlegs; dunlins; short-billed and long-billed dowitchers; Hudsonian godwits; sanderlings; and northern phalaropes are known to breed or occur in the Cook Inlet area." Therefore, it can be assumed that these species occur within and outside the Belgua Coal District, but field work is necessary to verify this.

"Other birds include the black-backed three-toed and northern three-toed woodpecker, yellow-shafted flicker, hairy and downy woodpeckers, gray jays, ravens, boreal and black-capped chickadees, redpolls, white-winged crossbills, water pipits, rosy finches, snow buntings, longspurs, and savannah sparrows."

"In addition, summer migrants include gray-cheeked, Swainson's, hermit, and varied thrushes; robins; orange-crowned yellow, myrtle and blackpoll warblers; northern waterthrushes; Bohemian waxwings; bank swallows; white-crowned and fox sparrows; slate-colored juncos; Say's phoebes; and olive-sided and alder or Traill's flycatchers."

A key, very high density area of water fowl occurs in the eastern portion of the district basically mirroring the Wet Tundra plant community boundaries. The rest of the area is designated as medium density and lies astride major migration routes.

Along the entire coastline of the Beluga Coal District marine mammals such as the harbor seal, sea otter, sea lion, and beluga whales are known to occur or be present. However, none seem to inhabit the area regularly as the upper Cook Inlet is not as attractive for marine mammals as the lower Cook Inlet.

The Alaska Department of Fish and Game has not identified any of the rivers or streams in the Beluga Coal District as being major anadromous fisheries according to the Alaska Regional Profiles, Southcentral Region study. Yet a memorandum from a State Fish and Game biologist dated August 30, 1974 states that:

> "The Chuit (Chuitna) River rates rather high as an anadromous fish spawning, quality fish rearing, and quality recreation area. The upper Chuit is also a stream of outstanding natural aesthetic beauty.
>
> Every effort should be made to protect the stream quality and the wilderness setting that surrounds it."

According to a typed manuscript attachment to the memorandum, the Chuitna is a clear stream of high productivity producing all five species of salmon plus rainbow trout, Dolly Varden, and round white fish. A king salmon run, of declining numbers, begins in the first part of June ending later in the same month. The silver salmon run begins in mid-July and is believed to last until November or December. Though red salmon enter the

Chuitna system with the tides in mid-July, few, if any, actually run upstream. A small pink salmon run occurs in June and July. There have been reports of dog salmon spawning in mid-August though the biologist saw none upstream.

The same source indicates that the sport fish rainbow trout, Dolly Varden, and round whitefish have large populations in the Chuitna system. See Appendix 7-B for the actual memorandum and attachments.

The following lists identify the major fauna species that possibly exist or occur in the Beluga Coal District. The lists are arranged according to the vegetation community where the species are most likely to occur.

Alpine Tundra and Barren Ground Vegetation Community

Mammals

Hoary marmot	Marmota caligata
Pika	Ochotna collaris
Black bear	Ursus americanus
Brown-grizzly bear	U. arctos
Wolf	Canis lupus
Wolverine	Gulo gulo
Coyote	Canis latrans
Red fox	Vulpes vulpes
Lemmings	
Ground Squirrel	

Birds

Ptarmigan	Lagopus spp.
Raven	Corvus corax
Golden eagle	Aquila chrysaetos
Marsh hawk	Circus cyaneus
Gyrfalcon	Falco rusticolus
Songbirds	
Shorebirds	
Open country owls	

High Brush Vegetation Community

Mammals

Black bear	Ursus americanus
Brown-grizzly bear	U. arctos
Moose	Alces alces
Wolf	Canis lupus
Wolverine	Gulo gulo
Snowshoe hare	Lepus americanus
Coyote	Canis latrans
Red fox	Vulpes vulpes
Lynx	Lynx candensis

Birds

Ptarmigan	Lagopus spp.
Raven	Corvus corax
Hawks	
Owls	
Songsbirds	

Upland Spruce-Hardwood Forest Vegetation Community

Mammals

Black bear	Ursus americanus
Brown-grizzly bear	U. arctos
Wolf	Canis lupus
Moose	Alces alces
Snowshoe hare	Lepus americanus
Red fox	Vulpes vulpes
Lynx	Lynx candesis
Weasel	Mustela erminea
Marten	Martes americana
Red squirrel	Tamiasciurus hudsonicus
Flying squirrel	Glaucomys sabrinus

Birds

Ptarmigan	Lagopus spp.
Raven	Corvus corax
Spruce grouse	Canachites canadensis
Ruffed grouse	Bonasa umbellus
Woodland owls	
Hawks	
Songbirds	

Lowland Spruce-Hardwood Forest Vegetation Community

Mammals

Black bear	Ursus americana
Brown-grizzly bear	U. arctos
Wolf	Canis lupus
Wolverine	Gulo gulo
Moose	Alces alces
Snowshoe hare	Lepus americanus
Red fox	Vulpes vulpes
Lynx	Lynx canadensis
Red Squirrel	Tamiasciurus hudsonicus

Birds

Spruce grouse	Canachites canadensis
Raven	Corvus corax
Hawks	
Woodland owls	
Songbirds	

Wet Tundra Vegetation Community

Mammals

Brown grizzly bear	Ursus arctos
Wolf	Canis lupus
Wolverine	Gulo gulo
Moose	Alces alces
Mink	Mustela vison
Weasel	M. erminea
Muskrat	Ondatra zibethica
Land Otter	Lutra candensis

Birds

Swans	Cygninae
Geese	Anatinae
Dabbling ducks	Anat
Diving ducks	Anythyinae
Loons	Gaviidae
Grebes	Podicipedidae
Raven	Corvus corax
Marsh hawk	Circus syaneus
Jaegers	Circus cyaneus
Shorebirds	
Open country owls	

Some of the major animal species which are likely to occur in the fresh water and marine environments of the Beluga Coal District are:

<u>Marine Environment</u>

Bacteria	Schizophyta
Dinoflagellates	Pyrrophyta
Eelgrass	Zostera marina
Protozoa	Sarcodina
Jellyfish	Scyphozoa
Sea anemones	Anthozoa
Marine worms	Polychaeta
Comb Jellies	Ctenophora
Shrimps	Pandalus and Pandalopsis spp.
Dungeness crab	Cancer magister
King crab	Paralithodes camtschatica
Tanner crab	Chionoecetes bairdi
Other crabs	Decapoda
Other crustaceans	Copepoda
	Mysidacea
	Euphausiacea
	Isopoda
	Amphipoda
Razor clams	Siliqua patula
Butter clams	Saxidomus giganteus
Other clams	Pelecypoda
Weathervane scallop	Patinopectin caurinus
Chitons	Amphineura
Sea stars	Asteroidea
Brittle stars	Ophiuroidea
Sea urchins	Echinoidea
Sea cucumbers	Holothuroidea
Pollock	Theragra chalcogrammus
Pacific cod	Gadus macrocephalus
Blackcod	Anoplopoma fimbria
Pacific herring	Clupea pallasi
Red (sockeye) salmon	Oncorhynchus nerka
Silver (coho) salmon	O. kisutch
King (chinook) salmon	O. tshawytscha
Chum (dog) salmon	O. keta
Pink (humpback) salmon	O. gorbuscha
Black rockfish	Sebastes melanops
Pacific ocean perch	S. alutus
Eulachon	Thaleichthys pacificus
Sculpins	Cottidae
Flatfishes	Pleuronectidae
Albatross	Diomedeidae
Shearwaters and fulmars	Procellaridae
Storm petrels	Hydrobatidae
Swans	Cygninae
Geese	Anserinae
Surface-feeding ducks	Anatinae

Sea & diving ducks	Subfamily Aythyinae
Cormorants	Phalacrocoracidae
Murres, murrelets, auklets, guillemots	Alcidae
Loons	Gaviidae
Plovers	Charadriinae
Sandpipers	Scolopacidae
Phalaropes	Phalaropodidae
Osprey	Pandion haliaetus
Peregrine falcon	Falco peregrinus
Grebes	Podicepedidae
Mergansers	Maginae
Jaegers	Stercorariidae
Gulls & terns	Laridae
Toothed whales	Odontoceti
Baleen whales	Mysticeti
Northern fur seal	Callorhinus ursinus
Harbor seal	Phoca vitulina
Steller sea lion	Eumetopias jubata
Sea otter	Enhydra lutra

Fresh Water Environment

Bacteria	Schizophyta
Protozoa	Mastigophora
	Ciliophora
Rotifers	Rotifera
Flatworms	Turbellaria
Aquatic earthworms	Oligochaeta
Crustaceans	Copepoda
	Ostracoda
Dragonflies	Odonata
Stoneflies	Plecoptera
Mayflies	Ephemeroptera
Caddiesflies	Trichoptera
Water beetles	Coleoptera
Midges	Chironomidae
Mosquitoes	Culicidae
Snails	Gastropoda
Clams	Pelecypoda
Burbot	Lota lota
Threespine stickleback	Gasterosteus aculeatus
Round whitefish	Prosopium cylindracea
Humpback whitefish	Coregonus pidschian
Rainbow trout	Salmo gairdneri
Dolly Varden	Salvelinus malma
Red (sockeye) salmon	Oncorhynchus nerka
Arctic grayling	Thymallus arcticus
Sculpins	Cottidae
Northern pike	Esox lucius
Loons	Gaviidae
Grebes	Podicepedidae
Diving ducks	Aythyinae

Mergansers	Merginae
Swans	Cygninae
Geese	Anserinae
Surface-feeding ducks	Anatinae
Plovers	Charadriinae
Sandpipers	Scolopacidae
Phalaropes	Phalaropodidae
Snipe	Capella haliaetus
Osprey	Pandion haliaetus
Peregrine falcon	Falco peregrinus
Beaver	Castor canadensis
Mink	Mustela vison
Land otter	Lutra canadensis
Muskrat	Ondatra zibethica

ENVIRONMENTAL IMPACTS

The development of a natural resource for man's benefit invariably alters the existing ecostructure. Merely by his presence, man alters the environment. Some natural resource development brings about relatively short term changes as when small deposits of valuable minerals like gold are removed or when oil or gas fields are developed. The development of other natural resources, such as coal, unfortunately results in extensive, long term alterations especially when surface removal is the method selected for retrieving the resource.

Previous natural resource development, oil and gas and timber, and hunting and fishing, has taken or is taking place in the Beluga coal district. Human activity, both recreational and permanent residency, occurs throughout the area. Therefore, it cannot be said that coal development in the Beluga district will be taking place on untouched wilderness. Admittedly, the impact of coal development would be significantly greater than previous development activity. However, intelligent planning based on comprehensive development plans can mitigate many of the potential environmental problems that may arise.

The following environmental impacts text is based solely on the U.S. Department of Interior, Final Environmental Impact Statements on the Proposed Federal Coal Leasing Program, 1977. All quotations found will be from that document.

EXPLORATION

In the development of any natural resource, several phases of operations occur and each phase has attendant environmental problems. The first phase, the initial exploration activity, must be conducted with special care; for as if no commercially exploitable minerals are discovered, the environmental damage will have been for nought.

Initial exploration work is frequently undertaken by using off-road vehicles or air travel as a means of transportation. Damage by off-road vehicles differs according to the type of vehicle used (tracked or wheeled), and the locale in which the exploration work takes place. The actual movement of the vehicle over the site injures or destroys vegetation while repeated travel compacts the soil which impedes water infiltration, gas exchange, and root growth. When soil is compacted and the normal vegetation is disrupted, water is more likely to flow overland during a storm or rain, resulting in erosion. Repeated travel during wet weather results in ruts which in turn can gully and erode. Concentrated off-road vehicle use, even during the exploration phase, can disrupt habitat particularly in wintering, breeding, or birthing areas.

At some point during the exploration phase, road construction will probably become necessary. The grading, cutting and filling required during such operations destroys vegetation, creates cut banks with high erosion potential, and leaves spoil piles of rejected material. The grading activity tends to increase runoff and sedimentation in addition to concentrating runoff along the road cuts.

The compaction of soil and the alteration of the existing soil regime during the road construction will cause the destruction or disruption of the soil's biotic mass. The actual road, and its construction, causes an increase in the dust and debris levels, alters land forms, can result in increased mineral solubility thereby polluting local water sources, is esthetically questionable, and can disrupt the local habitat-use areas and biotic community.

Exploratory drilling covers the smallest amount of area and results in a few permanent changes to the existing ecostructure. There is, of course, the physical damage to the immediate site along with the attendant prolongation of disruptive activity in the area. One major problem could result when drilling takes place. Should the drill holes penetrate several aquifiers, leakage between them and contamination could occur. On the positive side, a new source of water could result.

The last activity that could take place in the initial exploratory phase of development, would be the excavation and removal of a quantity of the resource for testing purposes. The pits created result in a total disruption of the immediate area, erosion, possibly the establishment of a new ecosystem, and could be hazardous and esthetically displeasing if left open.

OPENING THE MINE

The second phase of development, the opening of the mine if commercial exploitation is feasible, normally follows the completion of the initial exploration phase within a few years. The opening of a surface mine begins with setting up camp and moving in equipment and subsequent stripping or removal of the overburden to open the area to be worked. This results in spoil piles and large storage areas for the topsoil.

Stripping destroys the soil regime, impairs the soil structure, and disrupts the soil's biotic community. Stripping destroys habitat, creates barriers to natural animal movement and displaces the wildlife that cannot adjust to the intrusion.

The actual construction of the mine facility, (support buildings, beneficiation plant, etc.) requires the grading and leveling of large areas and requires large quantities of building material. Such requirements will: alter the surface water drainage; remove vegetation; rearrange land forms; increase erosion; contribute to soil instability, sedimentation, and water pollution; destroy plant communities; displace wildlife; and severely impact surrounding areas.

COAL RECOVERY

The actual development and exploitation of a coal deposit are the actions which cause the most severe environmental impacts.

> Coal deposits that lie near the surface are most economically and safely mined by surface methods.
>
> The operation completely eliminates existing vegetation, disrupts soil structure, alters current land uses, and to some extent changes the general topography of the area being mined.
>
> Surface mining can have impacts on the hydrology of all provinces. Deterioration of stream quality can result from acid mine drainage, trace elements in mine drainage water, high dissolved solids content of mine drainage water, and increased sediment loads. In addition, waste piles and coal storage piles can yield sediment to streams, and leached water from the piles can be acid and contain trace elements.
>
> Surface mining may also have impacts on ground water supplies. These include: (1) drainage of usable water from shallow aquifers, (2) lowering of water levels in adjacent areas and changes in flow directions within aquifers, (3) contamination of usable aquifers below the mining operation due to downward leakage of poor spoil piles. Where all the coal is removed during surface mining operations, and little or no carbonaceous shale is present in the spoil, increased infiltration may result in: (1) diminished runoff and erosion from spoil piles, (2) recharge of good quality water to the shallow ground-water aquifers, and (3) increased baseflow to nearby streams.
>
> Extreme flood events can cause severe damage to improperly constructed or located roads, plant facilities, waste and coal storage piles, settling basin dams, surface-water diversion structures, and the mine itself. Besides the danger to life and property, large amounts of sediment and poor quality water could have detrimental effects many miles downstream from the mine site.
>
> Removal of soil from the area to be surface mined destroys the natural soil characteristics by pulverization of the structure, disruption of the organic matter cycle, and by compaction. The micro-organism population and nutrient cycling process are upset by movement and redistribution of the soil. The general disturbance and compaction of the soil results in conditions that are conducive to the erosion.

The impact on wildlife stems primarily from disturbing, removing and redistributing the land surface. Some of the impacts are short term and confined to the mine site, others have farreaching, long-term effects. The direct effect on wildlife is the destruction or displacement of all species in the areas of excavation and spoil piling. The more mobile wildlife forms like game animals, birds, and predators, etc. will leave these areas. The more sedentary animals like invertebrates, burrowing rodents. . .etc. may be directly destroyed. If streams, lakes, ponds, or marshes are filled or drained, fish, acquatic invertebrates, amphibians, etc. will be destroyed. Animal populations displaced from populations in the surrounding ranges provided the habitat are eventually restored. An exception could be the loss of an endangered species.

Broad and long-lasting impacts on wildlife are caused by habitat impairment. The life requirements of many animal species do not permit them to adjust to changes created by land disturbance. This is impairment of the habitat component called living space. The degree to which a species or an individual animal will tolerate man's competition for space varies.

Big game and other animals displaced from their home ranges may be forced to use adjacent areas already stocked to carrying capacity. This overcrowding usually results in degradation of the remaining habitat, lowered carrying capacity, reduced reproductive success, interspecific and intraspecific strife, and potentially greater losses to the population than the originally displaced animals.

Overburden removal if improperly done, causes loss of topsoil, exposes parent material and creates vast wastelands. Pit and spoil areas are not capable of providing food and cover for most forms of wildlife. Without rehabilition, these areas must go through a weathering period which may take a few years or many decades before it becomes suitable habitat.

Degradation of aquatic habitats has been a major impact from surface mining. It may be apparent to some degree many miles from the mining site. Silt and sediment pollution is common with surface mining. The effects of silt and sediment on aquatic wildlife vary with the species and amount of pollution. These pollutants can kill fish directly, bury spawning beds for important species like trout and salmon, reduce production of aquatic organisms, reduce light transmission, alter temperature gradients, fill in pools, and spread flows, etc. These changes destroy the habitat of some species and sometimes enhance the habitat for undesirable species.

Existing conditions are already marginal for some of the coldwater game fish and anadramous species. Sedimentation of these waters can result in their elimination. The heaviest silt and sediment pollution of a given drainage normally comes within 5 to 25 years after mining.

The presence of toxic waste materials, exposed as a result of surface mining, can affect wildlife by eliminating habitat, and by causing direct concentrations, can suppress productivity, growth rate, and reproduction of many aquatic species. Acids, dilute concentrations of heavy metals, and high alkalinity can cause severe wildlife damage in some areas.

In certain situations, surface mining can have beneficial impacts on some wildlife. Where large, continuous tracts of forest, bush-land. . .or grasslands are broken up during mining, increased edges and opening are created. Preferred food and cover plants can be established in these openings to benefit a wide variety of wildlife. Under certain conditions, creation of small lakes in the strip area can also be beneficial. These waters may become important water sources for a variety of wildlife inhabiting adjacent areas. Many lakes are initially poor quality as aquatic habitat after mining.

The surface mining operation and coal transportation facilities are fully dedicated to coal production for the life of the mine. Existing land uses such as grazing and crop and timber production are temporarily eliminated from the mining area until rehabilitation processes have been completed. High value, intensive land use areas like urban and transportation systems are not normally affected by mining operations. If mineral values are sufficient, these improvements may be removed and replaced in an adjacent area.

Surface-mining operations have resulted in creating highwalls as high as 200 feet. Such highwalls may result at the end of a surface mining operation where stripping becomes uneconomic or where a mine reaches the property line that is the extent of a current lease or holdings. These highwalls are hazards to man, wildlife, and domestic livestock. They may impede normal wildlife migration routes.

The impact and final shape of highwalls is similar to that of highway cuts. They can be designed to be esthetically pleasing, or they could be dangerous and form barriers. The impact of the manmade slope will vary with the natural terrain and surrounding of the area.

Coal mining may affect the development of other minerals in the same site. There may be surface sand and gravel deposits, benetonite beds, commingled uranium, or oil shale deposits affected by coal development. Occasional shallow gas or petroleum reservoirs could also be affected by disrupting weak bedding planes or fault zones associated with the reservoirs.

Natural fires have occurred in coalbeds underground. When coalbeds are exposed, the fire hazards is increased. Weathered coal (smut) can also increase the ground temperatures if it is left on the surface. Almost all fires in solid coal are caused by man, lightning, and forest or prairie fires.

The impact of surface mining on geological features of human interest could exist in the strip-mine area. Geomorphic and geophysical features and outstanding scenic resources could be sacrificed by indiscriminate issuance of a lease and subsequent mining. Paleontological values might be endangered due to the disruptive activities of blasting, ripping, excavating, etc.

Stripping of overburden will eliminate and destroy all archelogical and historic features unless removed beforehand and carefully documented.

The extraction of coal by surface mining disrupts virtually all esthetic elements of the landscape to most of the population although in some cases only temporarily. The alteration of landforms impose conflicting configurations. New linear patterns appear as the material is extracted and waste piles are developed. Dust, vibration, and odors are created, affecting sight, sound, and smell. The grand scale of the operation impacts significantly on the quality of the environment.

COAL BENEFICIATION:

The process of coal beneficiation involves the installation of plant facilities to upgrade coal quality by separating out the low-quality material. The process can use either air or water for separation. Waste material is disposed in the immediate vicinity of where it is produced. Under some conditions, the quantity of waste material is significant.

Separation processes produce waste material that contains carbon, trace elements, sulphur, and other material. Unless special disposal precautions are taken, this material can become dust, adversely affecting all types of flora and fauna in the fallout area. The waste pile may also be subject to erosion and leaching. Adjacent land and drainage areas could become polluted by contaminants produced in the beneficiation process unless precautions are taken.

When a water-separation process is employed, a slurry impoundment is used for storage of the fine waste material and recycling or evaporation of the water. The slurry material may contain concentrations of dissolved solids, heavy metals, or other contaminants that could be leached into adjacent drainages or underlying aquifers and lower water quality. Storage reservoirs such as this are subject to breaching or overfilling by floods if improperly designed. Contaminated material would then be carried to streams and drainages, adversely affecting the land and water resources.

The fine slurry material in the pond area must be wetted or covered at all times, or it will be subject to becoming airborne under windy conditions. For this reason, abandoned pond disposal areas must be covered and revegetated to prevent wind and water erosion.

Disposal of waste material from coal beneficiation is important to wildlife because these materials could cause chemical and sediment pollution of terrestrial and aquatic wildlife habitats. Use of water in the cleaning process may cause excessive water demands that could lower water tables and dry up small lakes, ponds, or small streams if the water comes from local sources. In arid areas, all water sources may be critical to wildlife. Loss of these sources would destroy aquatic species and many land species.

Unless waste is returned underground or to the strip pits, it could have long-term adverse impact. If deposits are indiscriminately dumped on slopes they tend to be unstable. Landslides may occur which would be a hazard to anything in the immediate area of the slide. Fires are a problem in the waste disposal area, contributing smoke to the atmosphere and adversely affecting air quality.

COAL MARKETING:

Coal marketing may involve transporting coal for relatively short distances to mine-mouth power facilities by railroad, truck, or conveyor systems or long-haul transportation. All types of transportation systems, even cars, produce noise and air pollution and create safety hazards. Coal dust can be released from the moving carriers and accumulate along the transportation route. Unless trucks travel on paved or wetted road surfaces, dust is stirred up. Air and land pollution is esthetically displeasing and can adversely affect surrounding vegetation, wildlife, and human activity and noise along roadways or railroad tracks can drive some wildlife species out of the area. Roads and railroads commonly cause high direct animal mortality and right-of-way fencing can hinder big-game migration especially if the fences are net wire.

Energy for transportation is usually provided by diesel fuel used in trucks and locomotives. The engine emissions contribute to air pollution and produce considerable noise.

COAL-FIRED, MINE-MOUTH, ELECTRICTY-GENERATING PLANTS:

Secondary impacts include the potential coal-fired, mine-mouth, electricity-generating plants that could be built if coal resources are leased and the overall social and economic impacts that can be expected from all aspects of coal development and utilization. In terms of significance, these impacts will be among the more significant resulting from development of coal resource.

The environmental impacts from coal-fired, power-generating stations have been identified in numerous environmental impact statements on specific plant proposals. Some of the potential impacts from this type of development include:

Emission of particulates that will reduce visibility under certain atmospheric conditions. Impacts could be minor or relatively intensive depending on the level of development.

Emissions of concentration of SO_2 that could be hazardous to plant and animal health.

Emissions of oxides of nitrogen which if they reach the ozone layer in the stratosphere can reduce its effect of shielding humans from ultra-violet light which causes skin cancer (Johnson, 1973).

Emissions of vapor from water cooling towers and ponds, creating visual polution and impacting on esthetics.

Emissions of trace mineral elements including mercury, lead, cadmium, fluorine, boron and manganese.

Consumption of vast amounts of water resources, some of which will occur in regions where supplies are limited. This action will cause widespread loss and deterioration of aquatic wildlife habitats. The consumed water will also be denied to other possible beneficial users.

Change to intensive land use of significant acreages now in natural condition, affecting open space and other esthetic values.

Construction of new power transmission lines over extreme distances to power marketing centers. New corridors will be required that will introduce power lines to new areas and adversely impact on current land uses and the landscape in general.

Increased human concentration and activity in the plant area and in the general region that will cause competition between man and wildlife for food, cover, water, and living space at many levels.

Thermal pollution to streams, rivers, and lakes that will affect aquatic habitat and result in changes in species composition. The effects can be negative or positive depending on the animals involved and one's point of view.

Construction of new reservoirs and water conveyance facilities that will eliminate existing land uses, but create beneficial water facilities.

Two areas near the Beluga Coal Fields will be of special concern in evaluating the air emissions of a coal-fired, electricity-generating plant. To the south of the coal fields is the Tuxedni National Wildlife Refuge, classified with strict air quality standards (Class I Air Quality Area). A coal-fired generator could also contribute to NO_x and SO_x levels in Anchorage.

RECOMMENDATIONS ON ENVIRONMENTAL ISSUES

RESTRICTED OR PROHIBITED DEVELOPMENT AREAS

Areas in the Beluga Coal District should be avoided for intensive development if negative environmental impacts clearly outweigh the benefits. The most obvious places where activity should be restricted and where development should be prohibited can readily be identified. Future studies may be needed to define less apparent areas where development should be avoided.

Recommendations

Within the boundaries of the Belgua District, there are two areas in which development activity should be restricted. The first, located in T.13N., R.9 & 10W. and T.12N., R10W., S.M. or the northeastern and eastern portion of the district, is a key waterfowl area. This area, corresponding roughly to the wet tundra vegetation community and bog areas along the Susitna River deltas and the coast, is a portion of the Susitna Flats Game

Refuge. At present, activity is underway in this area with the 230-MW Beluga power plant and its transmission lines. Numerous gas wells dot the area. It is unknown what effect this gas development and activity has had on the area. However, intensive use, such as for a townsite, docking facilities, major highway or railroad development could reduce suitability or the area for waterfowl.

The second area in which use should be restricted is the fall/winter browse area for moose in the west central portion of the district; T.13N., R.13 & 14W., S.M. This is basically the extent of the high brush vegetation community which provides excellent browse for the moose population. Through it covers only about 36 square miles, the area is quite important to the local moose population for wintering purposes. As wintering areas determine the survival rate for the moose, browsing areas should be protected. In addition to this area there are two other browse areas for moose. One area corresponds to the high density waterfowl area and the other lies in the extreme southwestern corner of the district and is part of a still larger browse area immediately outside the district boundaries.

EXISTING INDUSTRIAL DEVELOPMENT ACTIVITIES

Natural resource development is already underway in the Beluga Coal District. Oil and gas wells dot the coastal area. Logging operations by Kodiak Lumber mills and Tyonek Timber Company to remove the beetle-infested stands of Sitka and white spruce in the western part of the district have been in operation for several years. Chugach Electric Association (CEA), the rural electric utility serving the Cook Inlet, built a 230-MW gas fired power plant and has constructed several transmission lines in the area. The power plant makes use of the natural gas produced in the district. Dock facilities for the logging operations are in place as are several private airstrips. A network of roads also exists in the southcentral portion of the district.

Recommendations

Since the Beluga coal field region will continue to develop, it is recommended that a long-range, comprehensive development plan be created to assure the intelligent land use of the district. Further, it is recommended that high activity projects be restricted to industrial parks. Development plans should be integrated among all resource development projects. Such planning is necessary to minimize the industrial impact on the ecosystem.

PERMANENT SETTLEMENT SITES

Permanent settlements in Alaska traditionally have been located along the coastlines. Inland they have been on major rivers and lakes. The waterways provided natural transportation routes, a source of food and commerce for the residents. Through experience it was discovered that these sites offered a milder climate than non-water related sites and gravel deposits were usually nearby on which to build the town.

Recommendations

Coastal lands northest of the Moquawkie Indian Reservation do not appear suitable for industrial or residential settlement. According to generalized soil maps of this district, the soils are unsuitable for building purposes and special designs for roads would be necessary to ensure that ground water infiltration and lateral movement of water through the soil is channeled into the marshes and bogs of the Susitna Flats Game Refuge. Several shore fisheries cover portions of the coastal zone in this area, and increased human activity might be detrimental. Additionally, large areas of standing water would create an insect problem (primarily mosquitoes) uncomfortable for humans.

After a preliminary examination of the Beluga Coal District, it appears that a prime location for a support community for coal operations could be located somewhere in T.11N., R.12W., S.M. or in the southern portion of the district to the west of the former Indian Reservation. This area is also one of the potential sites of the dock facilities required for the coal operations. This area is served by existing roads and is already being worked for logging purposes. It also contains Lake Congahbuna, a potential power generation plant site as identified by Beluga Coal Company and has easy access to the Cook Inlet Region, Inc. transportation corridor and the potential coal mining sites.

Additionally, the upland portion of the township has soil suitable for building as well as for agriculture, horticulture, or silviculture. The land is close to the Cook Inlet which moderates the climate providing relatively mild winter conditions. The forested area provides excellent recreational possibilities.

CHUITNA RIVER FISHERY AND SCENIC VALUES

The Chuitna River runs directly through the middle of the Chuitna coal field and heads in the area just south and east of the Capps Glacier field. On one of its waterfalls a coal outcrop is visible. Of all the waterways in the District, the Chuitna will be the one most effected by the development of the coal field.

Recommendations

To protect the Chuitna from irrevocable damage, certain protective measures must be taken: development activities would have to be restricted for a reasonable distance along both banks of the Chuitna to prevent siltation, erosion, and damage to fishery and recreational possibilities. Along the headwaters in the uplands, care must be taken to ensure that water courses are not altered, ground water sources are not interrupted, and that pollutants (dust, soluble minerals, waste material, etc.) are not introduced into the system.

REGENERATION OF VEGETATION

Reclamation of the land disturbed should not pose much of a problem given the nature of the vegetation of the area, relatively moderate climate, and the high rainfall. These and other factors should insure rapid regeneration of the plant communities, particularly in the lower and mid-elevations.

Recommendations

One area of possible concern is the Alpine Tundra system. Due to the nature of the plants that comprise this community, regeneration is extremely slow. Damage in this area (T.14N., R.14W., S.M.) will be slow in healing and during that process, exotic flora may accidentally be introduced.

Care must be exercised when revegetation plans are put into effect to ensure that exotic species are not accidentally introduced into the existing vegetation communities. An exception might be the case of agricultural or silvicultural introduction of exotic flora on reclaimed areas. Since vegetation is to be based on local species, a seed source must be located or developed. With silviculture, practice selection of the best variety of a species will be necessary.

LAND RECLAMATION

The word "reclamation" does not necessarily mean the return of the land disturbed to its exact, orginal condition. At times, such as with the surface mining of coal, it is not possible to do so. At other times such action may not be desirable. If a better use of the land can be determined, such as for agriculture, silviculture, browse for moose or grazing land, the land reclamation should take the necessary direction to accomplish the desired, final goal.

Recommendations

Important to the development of the Beluga Coal Fields is the planning, establishment, and implementation of a long range, comprehensive, reclamation program for the district. The entire development of the coal fields should plan for the day the coal fields are exhausted or economically impractical to work. The final, desired state of the land will help determine the method of development used for the fields. The reclamation of the land disturbed should not be seen as the last phase of the development project, but rather as the end result of the entire project.

APPENDIX 7-A

BELUGA VEGETATION

Following is a list of vegetation which is likely to occur in the Beluga Coal District.

Black Spruce	Picia mariana
White Spruce	P. galuca
Sitka Spruce (rare)	P. sitchensis
Mountain Hemlock (rare)	Tsuga mertensiana
Common Juniper	Juniperus communis
Balsam Poplar	Populus balsamifera
Black Cottonwood	P. trichecarpa
Quaking Aspen	P. themulaides
Netleaf Willows	Salix utliculate
Least Willow	S. rotundifolia
Arctic Willow	S. arcticia
Alaska Bog Willow	S. fuscescens
Ovalleaf Willow (rare)	S. ovalifolia
Sprouting Willow (rare)	S. stolenifer
Grayleaf Willow	S. glauca
Barren-ground Willow	S. brachycarpa ssp. niphoclade
Barclay Willow	S. barclaiy
Undergreen Willow	S. commutata
Richardson Willow	S. lanata ssp. richardonii
Feltleaf Willow	S. alaxensus
Bebb Willow	S. babbiana
Diamond Leaf Willow	S. planifolia ssp pulchra
Scouler Willow	S. scouleriana
Sitka Willow	Salix sitchensis
Littletree Willow	S. arbusculaides
Pacific Willow	S. lasiandra
Sweetgale	Myrice gale
Dwarf Arctic Birch	Betula nana
Resin Birch	B. glandulosa
Alaska Paper Birch	B. papyrifira var humilis
Kenai Birch	B. papyrifira var kenaica
American Green Alder	Alnus eriopa
Sitka Alder	A. sinuata
Thinleaf Alder	A. teniufolia
Swamp Gooseberry	Ribes lacustre
Northern Black Currant	R. hudsonianum
Skunk Currant	R. glandulosum
Trailing Black Currant	R. laxuflorum
American Red Currant	R. thistle

SOURCE: USDA Forest Service, ALASKA TREES AND SHRUBS, by Viereck and Little, Agriculture Handbook No. 410, 1972.

APPENDIX 7-B

CHUIT RIVER SPORT FISH

(From State permit application by Stanley W. Kubik, CPP 74-65, Chuitna River, April 221, 1976.)

The Chuit River is a clear stream of high productivity. It produces all five species of salmon, plus rainbow trout, Dolly Varden, and round whitefish. It is becoming of increasing importance to the fly-in sport fishermen from Anchorage; there are from five to twelve airplanes there on weekends, and one or two planes per day during the week from June to September.

The sport catch is aimed at king salmon and silver salmon, although a few people will take rainbows only. Dolly Varden and pink salmon are taken in conjunction with king salmon and silver salmon fishing. "Jack salmon" as called by the sportsmen, are mainly pinks.

A falls of about six feet is located two miles above the North boundary of the reservation. This falls is an exposed seam of coal. It could give trouble in the future, but at the present time, fish are able to jump the falls.

We could find no downstream migrants.

There is a lake with a small outlet creek near the mouth of the river which is reported to have once had a red salmon run. The creek fans out in a swamp, making it impassable to fish now.

King Salmon

The run comes in during the first part of June with a few moving in until the last of June. The size range is 12 to 30 lbs. They are reddish in color, not bright, when entering. The run has been declining in numbers of fish.

Measurements - Creel Census Fish - 25 June:

F 30½
F 30½
F 32
F 32½

Silver Salmon

The silver salmon run starts in mid-July, and is believed to extend to November or December. The run appears to be in good shape.

The first fish are of a smaller race than the later run fish.

Measurements

15 July	17-18 July	17 August
M 17¼	M 15¼	M 10½
M 18	M 16¼	M 17-3/4
M 18-3/4	M 17	M 17-3/4
	F 18-3/4	M 20½
	M 22½	M 23¼
	M 23	

Red Salmon

Many red salmon enter the system with the tide, but few run upstream. Those that do, go up the first major creek on the north side. The run occurs from mid-July to mid-August.

Measurements

25 June	17 July	17 August
M 19	M 13	M 13--repeat catch from July 17
	M 14-3/4	M 14½
	F 19-3/4	
	M 20½	
	M 21½	
	M 22½	
	M 22-3/4	
	F 22-3/4	
	M 22-3/4	
	M 23	

Pink Salmon

The run occurs in June and July, with spawned-out fish still alive in mid-August. This run was small, probably about 300 fish this year. The sport fishermen call them "jack" or "jack king" salmon, and they appeared to make up about 20 percent of the total salmon take.

Measurements

25 June	17 July	17 August
M 12½	M 15	M 16¼
M 12½	F 17-3/4	M 17½
M 12½	M 18	M 19¼
M 12-3/4	M 18¼	
M 15	F 18½	
M 15	F 19½	
M 16	M 19-3/4	
M 16¼	F 20½	

Rainbow Trout

There is a good population of rainbow trout in the river. Early rainbows up to 18" TL were reported common in the lower river. There appear to be no sea run fish in this system.

Measurements

25 June	15 - 18	July
6	6-3/4	7-3/4
7¼	7	7-3/4
7½	7	8½
7-3/4	7¼	8½
25 June	15 18	July
8	7¼	9-3/4
8½	7¼	10
9-3/4	7½	10¼
15-3/4	7-3/4	10-3/4
		11-3/4

Dog Salmon

Very few dog salmon spawn in this system. We saw none upstream, but caught a few in the mouth, and had a reliable report of them spawning.

The number was probably less than 25 spawners this year as of mid-August.

Measurements

17 July
M 23-3/4

Dolly Varden

There is a very large run of small sized sea run fish, which enter in July.

Measurements

	15 - 18 July					17 August	
Length:	Freq.	Length:	Freq.	Length:	Freq.	Length	Freq.
9"	3	11"	2	12-3/4"	3	9-3/4"	1
9-1/2"	2	11-1/4"	1	13"	5	10-3/4"	1
9-3/4"	3	11-1/2"	2	13-1/4"	3	11-3/4"	1
	1	11-3/4"	1	13-1/2"	2		
10"	1	12"	5	13-3/4"	4		
10-1/4"	1	12-1/4"	2	14"	2		
10-1/2"	1	12-1/2"	1	14-3/4"	1		
10-3/4"	3						

Round Whitefish

The round whitefish run late in the Fall, September-October. The ones we caught were taken in the intertidal area in the creek.

Measurements

25 June
F 10-1/2"
F 11"

APPENDIX 7-C

SUMMARY OF NATIONAL AIR STANDARDS

Pollutant	Time of Average	Primary Standard[1]	Secondary Standard[1]
Particulate matter	Annual (Geometric Mean)	75 mg	60 mg
	24 hour	260 mg[2]	150 mg[1]
SO_x (measured as SO_2)	Annual (Arithmetic Mean)	80 mg (0.03ppm)	
	24 hour	365 mg (0.14ppm)[2]	
	3 hour	--	1300 mg (0.5ppm)[2]
CO	8 hour	10 mg (9ppm)[2]	Same as Primary
	1 hour	40 mg (35ppm)[2]	Same as Primary
Hydrocarbons (nonmethane measured as CH_4)	3 hour (6 to 9 a.m.)	160 mg (0.24ppm)[2]	Same as Primary
NO_2	Annual (Arithmetic Mean)	100 mg (0.05ppm)	Same as Primary
Oxidants (measured as O_3)	1 hour	160 mg (0.08ppm)[2]	Same as Primary

1/ Concentration in weight per cubic meter (corrected to 25°C and 760 mm of Hg)
2/ Concentration not to be exceeded more than once per year

Source: El Paso Alaska Co. Application to FPC for Alaska Gas Pipeline.