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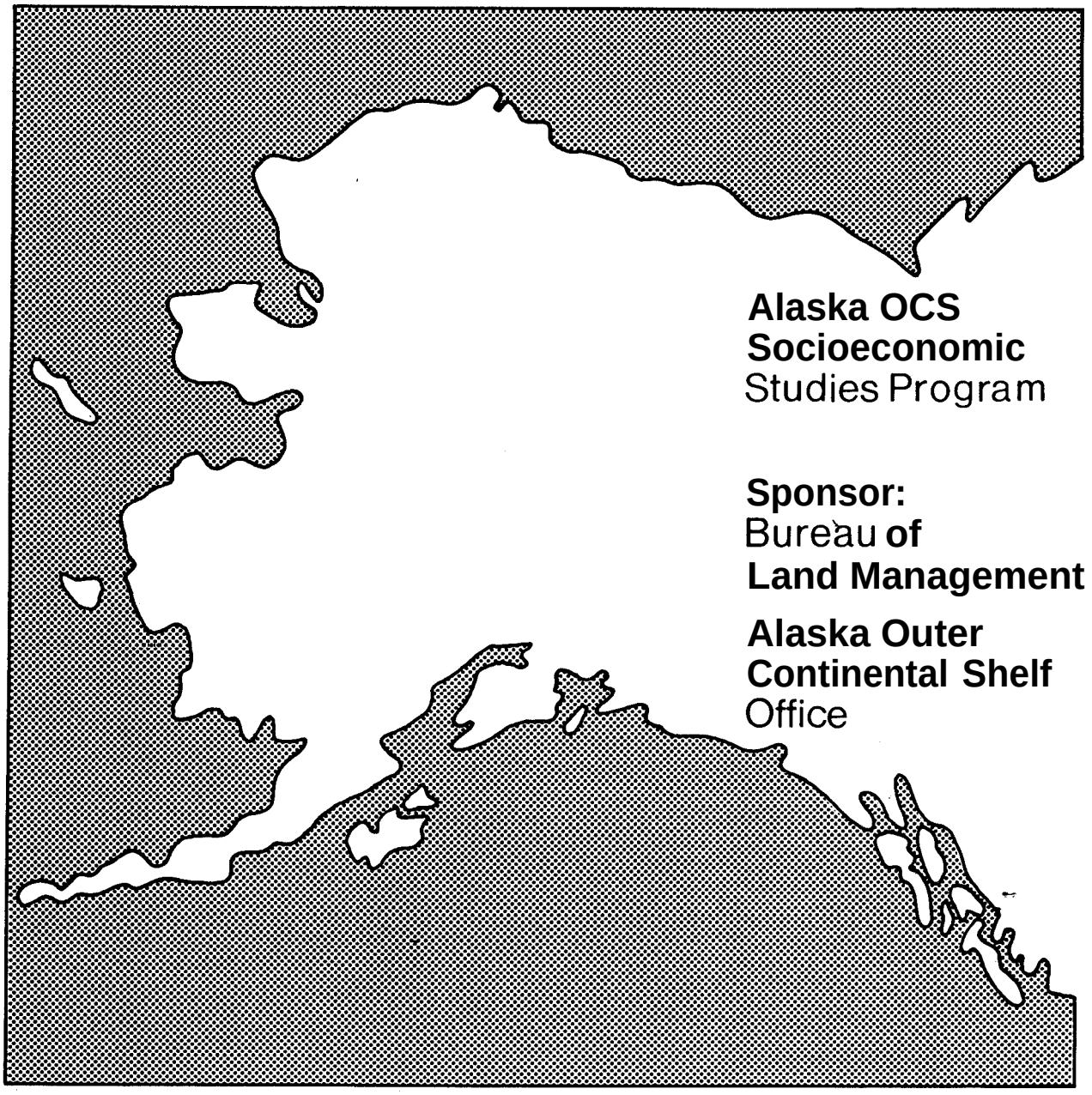

Alaska OCS Socioeconomic Studies Program

Sponsor:
Bureau **of Land Management**

Alaska Outer Continental Shelf Office

Beaufort Sea Petroleum Development Scenarios Summary of Socioeconomic Impacts

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of off-shore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of off-shore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program.

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The analysis addresses the differing effects among various geographic units: the State of Alaska as a whole, the several regions within which oil and gas development is likely to take place, and within these regions, the various communities.

The overall research method is multidisciplinary in nature and is based on the preparation of three research components. In the first research component, the internal nature, structure, and essential processes of these various geographic units and interactions among them are documented. In the second research component, alternative sets of assumptions regarding the location, nature, and timing of future OCS petroleum development events and related activities are prepared. In the third research component, future oil and gas development events are translated into quantities and forces acting on the various geographic units. The predicted consequences of these events are evaluated in relation to present goals, values, and expectations.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decision making. In addition to making reports available through the National Technical Information Service, the BLM is providing an information service through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

TECHNICAL REPORT NO. 23 CONTRACT NO. AA550-CT6-67

ALASKAOCS SOCIOECONOMIC STUDIES PROGRAM

BEAUFORT SEA PETROLEUM DEVELOPMENT SCENARIO:

SUMMARY OF SOCIOECONOMIC IMPACTS

Prepared by

James Lindsay and Associates

Prepared for

PEAT, MARWICK, MITCHELL & co.

and

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

December 1978

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ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM
BEAUFORT SEA PETROLEUM DEVELOPMENT SCENARIOS:
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15. Supplementary Notes

16. Abstract

This report is a summary of six Beaufort Sea Petroleum Scenarios Impact reports prepared for the Alaska OCS Socioeconomic Studies Program between 1977 and 1978.

Technical Report Number 13, "Beaufort Sea Petroleum Development Scenarios: Impacts on Anchorage, Alaska," Rick Ender and Associates.
Technical Report Number 18, "Beaufort Sea Petroleum Development Scenarios: Economic and Demographic Impacts," Institute of Social and Economic Research (ISER).
Technical Report Number 19, "Beaufort Sea Petroleum Development Scenarios: Man Made Environment Impacts," Alaska Consultants.
Technical Report Number 20, "Beaufort Sea Petroleum Development Scenarios: Transportation Impacts," Dooley and Associates.
Technical Report Number 21, "Beaufort Sea Petroleum Development Scenarios: Natural Physical Environment Impacts," Dames and Moore.
Technical Report Number 22, "Beaufort Sea Petroleum Development Scenarios: Sociocultural Impacts," Worl and Associates.

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I. Introduction

Purpose of the Socioeconomic Studies Program

The Alaska OCS Socioeconomic Studies Program (SESP) is a multiyear, multidisciplinary research program designed to assess the social, economic, and physical impacts likely to result from future offshore oil and gas development on Alaska's outer continental shelf (OCS). The studies program is sponsored by the Alaska OCS Office of the U.S. Department of Interior, Bureau of Land Management (BLM). BLM bears major responsibility for administering mineral leasing activity in offshore areas under federal jurisdiction.

Program products are designed to assist in making federal OCS decisions, but state and local governments and others may also find them useful. Immediate applications include the preparation of environmental impact statements for specific OCS lease sales, development of lease-sale stipulations and limitations, and long-range assessment of the socioeconomic effects of federal lease-sale policy. In addition the program seeks to develop a better understanding of the potential consequences which OCS marine mineral development may have on Alaska's unique natural endowment and culture and to provide a foundation for better planning for and management of such development at all levels of government.

The program began in late 1976 and is expected to continue through 1981. This span of time allows for substantive longitudinal investigation of the development process as it actually occurs, including assembly of predevelopment baseline data and petroleum development scenarios, determination of impacts from postulated effects of OCS oil and gas developments, and monitoring of actual development impacts on specific communities, regions, and the entire state. The time frame also allows necessary changes in scope, focus, or method as more is learned about initial issues and requirements of impact research in Alaska. After 1981, the Alaska BLM-OCS office is expected to continue the program through monitoring or additional research projects as needed.

Background

Progressive depletion of U.S. domestic petroleum reserves and uncertainty about the reliability of foreign supplies have led to increasing concern in the United States about future energy sources. The federal government has begun to establish policies aimed at increasing domestic energy supplies. The U.S. outer continental shelf has drawn considerable attention as a future source of petroleum because of its high untapped potential, and is expected to figure importantly in future U.S. energy programs. Historically, Alaska has played only a small part in supplying oil and gas for U.S. energy needs. Cumulative Alaska production through 1974 was less than 1 percent of the U.S. domestic total. Alaska's petroleum production in the Upper Cook Inlet, however, accounted for about 7 percent of cumulative domestic OCS oil production by the end of 1974 (U.S. Geological Survey, 1975).

Production of oil at Prudhoe Bay and the potential oil and gas reserves of Alaska's OCS will increase Alaska's importance as a source of future U.S. energy resources. Alaska accounts for more than one fourth of the identified oil and gas reserves and more than one third of the estimated undiscovered recoverable reserves in the United States. Alaska's importance in the OCS program results from estimates that more than 60 percent of the undiscovered OCS reserves are in the outer continental shelf off Alaska (U.S. Geological Survey, 1975). The Federal Energy Administration (1976)" projected that by 1985 as much as 25 percent of total domestic crude oil production could be from Alaska.

Changes resulting from past petroleum development in the state, particularly in Cook Inlet and at Prudhoe Bay, have been major and have created strains on the Alaska society, economy, and environment. At the same time, these petroleum developments generated the most prosperous economic period in the state's history, a situation likely to continue in the next decade. The prospect of even further transformation looms large in the state's future as planned development extends to Alaska's coastal waters. The first steps were taken toward developments of Alaska's coastal resources with recent federal lease sales in the Northern Gulf of Alaska and Lower Cook Inlet. The next planned step involves the opening of the Beaufort Sea area to oil and gas development with a joint federal-state lease sale.

The nature of the changes induced by new developments, however, will not necessarily resemble those of developments of the recent past, characterized by rapid population and economic growth. The technology, resource levels, and institutional arrangements surrounding the Beaufort development are subject to wide-ranging uncertainties. Consequently, the implications of Beaufort Sea development for Alaskan socio-economic processes can be accurately assessed only by an analysis which incorporates both the unique institutional and technological features as well as the uncertainties surrounding them (ISER, 1978).

Purpose and Organization of Report

The purpose of this report is to summarize the socioeconomic impacts that may occur as a result of a range of OCS petroleum development activities in the Beaufort Sea. This report summarizes the major substantive findings of six individual impact studies conducted concurrently for the Beaufort Sea Region between 1977 and 1978. The information contained in this report has been taken from each of the reports listed below, and in many instances the information is directly quoted.

Technical Report Number 13, "Beaufort Sea Petroleum Scenarios: Impacts on Anchorage, Alaska," Rick Ender and Associates (Ender and Assoc.);

Technical Report Number 18, "Beaufort Sea Petroleum Development Scenarios: Economic and Demographic Impacts," Institute of Social and Economic Research (ISER);

Technical Report Number 19, "Beaufort Sea Petroleum Development Scenarios: Man Made Environment Impacts," Alaska Consultants;

Technical Report Number 20, "Beaufort Sea Petroleum Development Scenarios: Transportation Impacts," Dooley and Associates (Dooley and Assoc.);

Technical Report Number 21, "Beaufort Sea Petroleum Development Scenarios: Natural Physical Environment Impacts," Dames & Moore; and

Technical Report Number 22, "Beaufort Sea Petroleum Development Scenarios: Sociocultural Impacts," Worl and Associates (Worl and Assoc.).

Other technical reports related to the Beaufort Sea Region include:

Number 4, "Preliminary Report - Prudhoe Bay Study," Crittenden, Cassetta, Cannon/Helmuth, Obata, Kassabaum (CCC/HOK).

Number 5, "Baseline Study - Beaufort Sea Region - Interim Report," CCC/HOK.

Number 6, "Beaufort Sea Petroleum Development Scenarios," Dames and Moore.

Number 8, "Beaufort Sea Region Man-Made Environment," Alaska Consultants, Inc.

Number 9, "Beaufort Sea Region Sociocultural Systems," Worl and Associates.

Number 10, "Beaufort Sea Region Natural Physical Environment," Dames and Moore.

Number 11, "Beaufort Sea Region Socioeconomic Baseline," Peat, Marwick, Mitchell & co.

Number 12, "Anchorage Socioeconomic Baseline," Richard L. Ender.

Number 14, "Alyeska-Fairbanks Case Study," Wordsmiths.

Number 16, "Beaufort Sea Region Governance Study," ISER.

This summary report is organized around two major chapters. Chapter Two, entitled "Non-OCS Base Case," summarizes the projected growth and development of Alaska; Anchorage and Fairbanks; the Beaufort Sea Region; and the Beaufort Sea Region communities of Barrow, Kaktovik, Nuiqsut, and Wainwright from 1977 through 2000 as expressed in each impact study, assuming no OCS oil and gas development. This process establishes a baseline from which Chapter Three, "Projected Impacts of OCS Development," predicts possible impacts of oil and gas development in the outer continental shelf of the Beaufort Sea Region. Chapter Three summarizes the significant impacts and substantive conclusions derived from each impact study, assuming various levels of OCS oil and gas development. Impacts are summarized in five subjects by geographic region. Individual impacts are especially emphasized as well as, where possible, the interrelation or cause and

effect of impacts resulting directly and indirectly from OCS oil and gas development in the Beaufort Sea Region.

Impact Evaluation Process

This Summary of Socioeconomic Impacts discusses direct and indirect socio-economic impacts on the Beaufort Sea Region (North Slope) of Alaska, other regions of the state, and the state as a whole in two situations -- no OCS development and OCS development in the Beaufort Sea Region. This report is based upon an impact evaluation process that is divided into four parts: preparation of petroleum development scenarios, analysis of existing state, regional and local conditions; analysis of projected statewide and regional impacts, and analysis of projected local or community impacts. Figure 1 illustrates this process and shows the general relationship between each part.

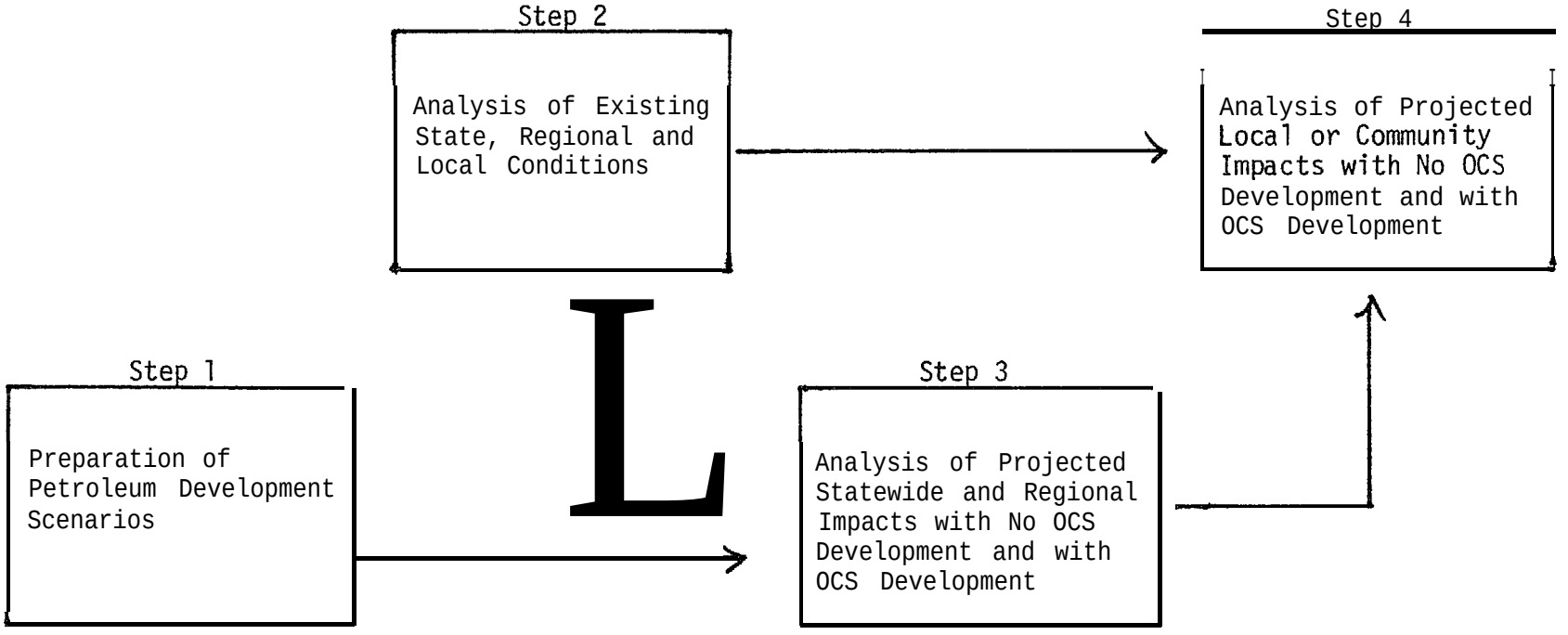
In order to analyze socioeconomic impacts of Beaufort Sea petroleum exploration, development, and production, it is necessary to make reasonable predictions of the nature of that development. The petroleum development scenarios contained in "Technical Report Number 6, Beaufort Sea Region, Petroleum Development Scenarios" serve that purpose; it provides a "project description of four petroleum development scenarios for subsequent analysis. "

A petroleum development scenario is defined as the sequence of potential petroleum development events in a lease sale area corresponding to a given level of potential recoverable oil and gas resources. Petroleum development scenarios provide a reasonable range of technological, economic and geographic options so that both minimum and maximum development impacts can be discerned.

Construction of petroleum development scenarios is based upon resource probability levels developed by the U.S. Geological Survey (U.S.G.S.), allocated into four regions covering the Beaufort Continental Shelf out to 20 meters (66 feet) depth. The construction of 24 skeletal scenarios involves the combination of resource probability levels with locational data produced from an independent geologic assessment of the oil and gas potential of the Beaufort Sea. The purpose of the assessment is to provide the geologic reality and geographic specificity to the location of the hypothetical oil and gas fields. The geologic analysis also provided ranges for certain oil field variables such as reservoir depths, fill factors, and oil and gas ratios.

Each skeletal scenario was subjected to a parametric economic analysis to establish approximate capital recovery after several combinations of parametric values for investment costs, tax status, transport costs, and market levels. As a result of the economic analysis five scenarios, representing a range of geographic locations, and resource levels, were selected. Each selected scenario was detailed, including scheduling, manpower and facility requirements. Four of the five detailed scenarios were selected as input to the impact evaluation process. The fifth detailed scenario was dropped as part of the impact evaluation process because it was concluded the four selected OCS scenarios bracketed the range potential OCS development, in order to adequately assess OCS petroleum impacts.

FIGURE 1
GENERALIZED IMPACT EVALUATION PROCESS



Source: Peat, Marwick, Mitchell & Co., 1978

Baseline studies were prepared for the Beaufort Sea Region and Anchorage region. In addition, data was collected for the Fairbanks region and the state as a whole. The purpose of baseline studies or data collection was to provide a basis upon which to project socioeconomic impacts of the Beaufort Sea Region, the communities of Barrow, Kaktovik, Nuiqsut and Wainwright: Anchorage and Fairbanks regions: and the State of Alaska. The categories investigated varied by geographic area; however in total they included these categories: demographic, economic, fiscal, cmunity and urban services, land use and land status, natural resources, archaeological and histor cal sites, subsistence activities and sociocultural systems.

Statewide/regional analysis and community analysis have two steps in the impact evaluation process. The first is the creation ofa non-OCS base case, and the second is a forecast for each petroleum development scenario.

The analysis of existing conditions together with known future events serve as the basis to construct the "Non-OCS Base Case." The purpose of the non-OCS base case is to describe growth and development of each geographic area analyzed assuming no new OCS development (other than existing lease sales) takes place in the state of Alaska between 1977-2000. The base case is analyzed in detail to determine the type and magnitude of impacts that may occur as a result of this assumed "conservative" development pattern.

The categories investigated for the state and each region include the economic and fiscal issues of each area, population, urban services and transportation. The analysis method employed in the economy, fiscal and population categories is the Man-in-the-Arctic-Program (MAP) econometric model, which contains both statewide and regional submodels. The description of urban services is based on an analysis of those services likely to be impacted as a result of OCS development.

The transportation systems analysis is based on an evaluation of terminal points, for air, land, and water systems and each transport mode capacity and utilization.

The local or community level impacts focus specifically on the North Slope communities of Barrow, Kaktovik, Nuiqsut and MainWright. The categories that are investigated include the economy, fiscal structure, population, community services, natural resource base and sociocultural systems.

forecasts of OCS development build directly on the Non-OCS base case. Estimates of manpower and onshore and offshore facilities requirements for each petroleum development scenario are individually added to the base case in order to develop forecasts of potential OCS development in the state as a whole, Anchorage and Fairbanks regions and the Beaufort Sea region arid each of the four communities specified above.

The program seeks to make a direct comparison between the base case and the forecasts of growth and development for each petroleum development scenario. The categories of analysis are the same for each forecast of

OCS activity. The analysis process attempts to determine impacts, either positive or negative, that may result from each individual scenario. Direct and indirect impacts are analyzed in addition to the cause and effect impacts.

II. Non-OCS Base Case

Introduction

This chapter sets the stage for assessment of future impacts of oil and gas development in the Beaufort Sea OCS on Alaska; Anchorage and Fairbanks; the Beaufort Sea Region (Figure 2); and the Beaufort Region communities of Barrow, Nuiqsut, Kaktovik, and Wainwright. The impact of OCS development in the region must be described in contrast to the pattern of growth likely to occur without this development. This chapter describes the assumed "base case" from which the impacts of OCS development can be measured for the period between 1977 and 2000. The base case permits the formulation of a range of assumptions which constitute a conservative development pattern in order to delineate the range of possible outcomes from alternative OCS development scenarios.

The non-OCS base case assumes no new significant oil, gas, or other mineral development in Alaska beyond that implied by current commitments, including Prudhoe Bay and several fields surrounding Prudhoe, Upper Cook Inlet, Northern Gulf of Alaska OCS, Lower Cook Inlet OCS, and existing coal and mineral development. Further assumptions are:

1. Proven reserves at Prudhoe Bay; (Figure 3) will be augmented by discoveries in the Lisburne and Kuparuk formations that will produce a maximum flow of 1.785 million barrels of oil a day through the trans-Alaska pipeline in 1985;

2. No significant new reserves will be discovered in the Upper Cook Inlet and production there will decline over the forecast period;

3. Resource discoveries in the Northern Gulf of Alaska will be minimal ;

4. Mean levels of estimated recoverable reserves in Lower Cook Inlet will be discovered and produced;

5. Exploration in the National Petroleum Reserve-Alaska (NPR-A, formerly called Naval Petroleum Reserve No. 4 or Pet-4) results in no commercial discoveries;

6. Other mineral development activity remains at current levels; and

7. The Alcan gas pipeline is constructed between 1979 and 1983.

This scenario, while representing a consistent and plausible development pattern, should not be construed as a "best guess" of development likely to occur in Alaska during the forecast period. The actual pattern is subject to an enormous amount of uncertainty regarding technology, market prices, federal policies, etc., and forecasting any specific development path at this point is little more than idle speculation. Therefore, this

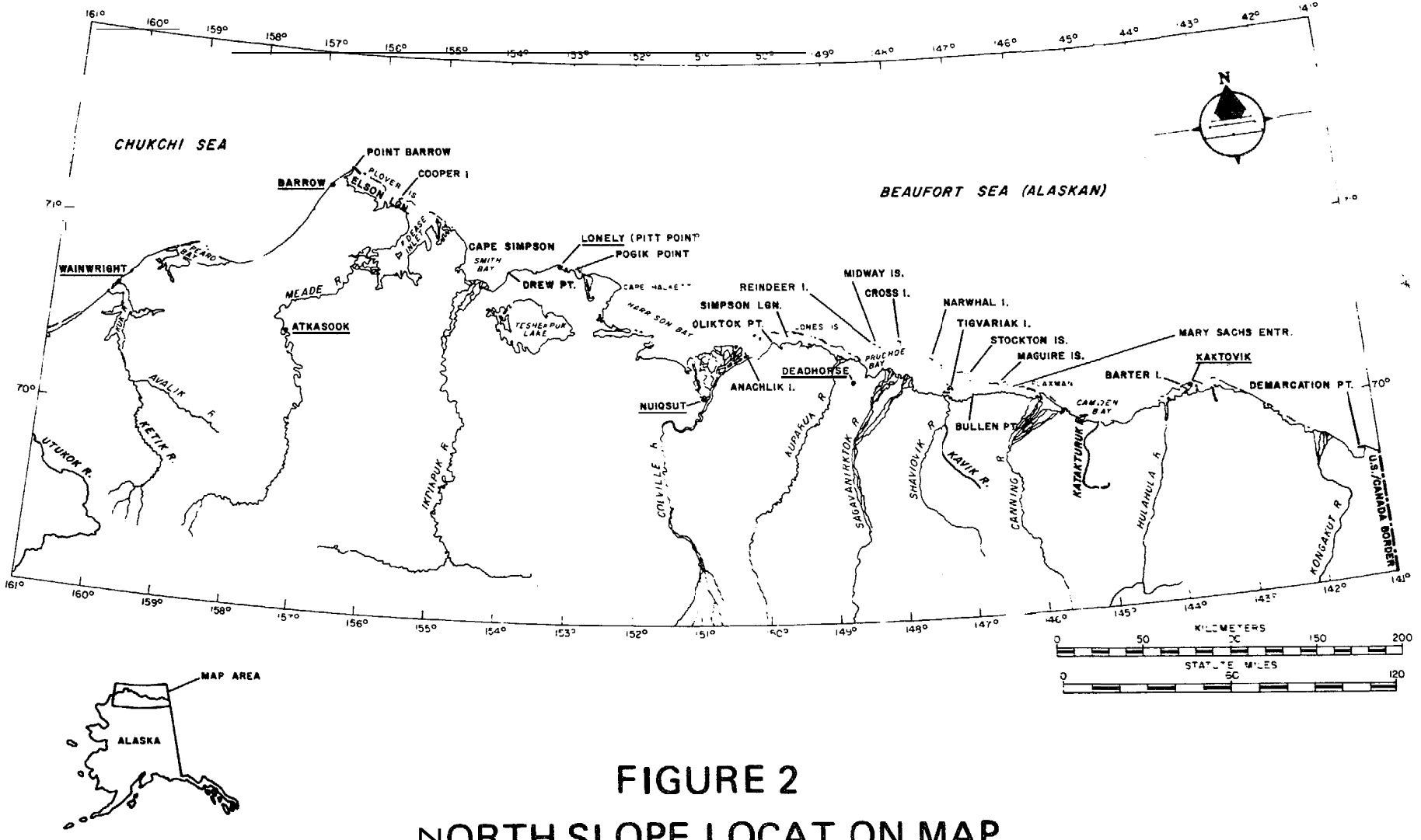
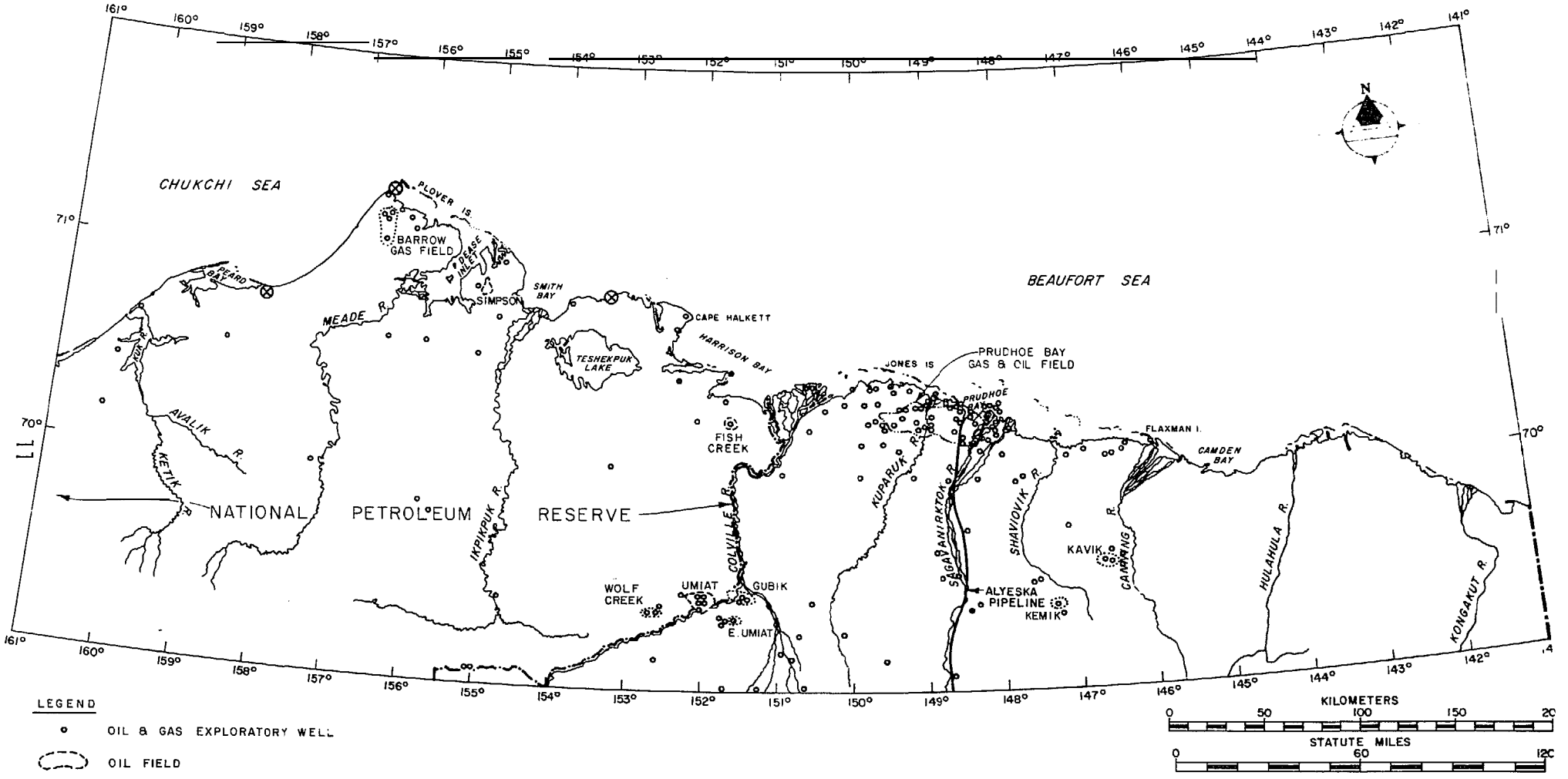


FIGURE 2
NORTH SLOPE LOCAT ON MAP

Source: Dames & Moore



LEGEND

- OIL & GAS EXPLORATORY WELL
- OIL FIELD
- GAS FIELD
- OIL & GAS FIELD
- N P R-A STAGING AREA

Source: Dames & Moore

FIGURE 3
EXISTING NORTH SLOPE PETROLEUM DEVELOPMENT

base case should be regarded as a very conservative development pattern which includes only activities to which current commitments have been made (ISER, 1978).

ALASKA

Economic/Demographic

Table 1 illustrates projected economic growth in Alaska for the period 1977 to 2000, which is less rapid than in the several previous years. These projections were made using the University of Alaska, Institute of Social and Economic Research, "MAP" model which is an econometric model developed as part of the "Man-in-the-Arctic-Program."

In the base case, the state economy is assumed to be primarily influenced by two events, first the construction of the gas line from Prudhoe Bay in 1979 and the decrease in petroleum-related employment in the state after it peaks in 1980. These events influence employment growth throughout the early part of the base case period. Employment increases to a peak of 226,700 by 1981, then falls about 3.5 percent in the following year with winding down of the gas line project.

The other major determinant of economic growth is state spending. The state expenditure rule used for the analysis assumes that as petroleum revenues grow, bonuses and 60 percent of royalties are deposited in the permanent fund and that current expenditures equal the remainder of current revenues. As petroleum revenues eventually decline, it is assumed the state maintains per capita expenditure levels by gradually reducing the saving rate to zero and eventually consuming the accumulated balance. State expenditures are therefore governed by increases or decreases in state revenues.

State expenditures increase at an average annual rate of 9.6 percent between 1977 and 1990; this rate slows to 4.4 percent annually for the remainder of the period (Table 2).

The growth of the Alaska economy as described by the "MAP" model is assumed to be influenced by three separate but interrelated factors.

1. Changes in the level of employment in the exogenous sectors of the economy;

2. Changes in the level of personal income; and

3. Changes in the level of state spending.

Economic growth is directly affected by the employment created in the exogenous sector. The source of this growth is external to the Alaska economy; the most obvious recent example-of this is the construction of the Trans-Alaska Pipeline. The second major cause of growth is an increase in real disposal personal income which increases the demand for goods and services thereby increasing employment in the state. Personal income is affected by the growth of wage rates and the growth in the number of wage earners. The third major cause of growth is state expenditures. State

TABLE 1

AGGREGATE INDICATORS OF NON-OCS BASE CASE GROWTH
STATE OF ALASKA
1977-2000

YEAR	TOTAL POPULATION (Thousands of Persons)	TOTAL EMPLOYMENT Thousands of Employees)	PERSONAL INCOME[2] (Millions of $)
19771	400.0	191.0	4,129.0
1978	402.4	187.8	3,948.0
1979	419.1	198.6	4,523.0
1980	449.2	218.5	5,561.0
1981	466.9	226.7	6,053.0
1982	463.2	218.7	5,710.0
1983	470.1	221.3	6,010.0
1984	479.5	226.1	6,440.0
1985	491.9	233.7	7,032.0
1986	500.0	237.8	7,507.0
1987	504.0	239.0	7,832.0
1988	504.4	237.9	8,067.0
1989	508.4	240.5	8,509.0
1990	512.5	243.4	9,008.0
1991	518.1	247.6	9,604.0
1992	522.4	250.9	10,187.0
1993	528.3	255.6	10,873.0
1994	533.3	259.5	11,561.0
1995	539.8	264.7	12,358.0
1996	545.2	269.1	13,152.0
1997	552.4	274.9	14,085.0
1998	558.9	280.0	15,026.0
1999	567.3	286.8	16,135.0
2000	575.6	293.2	17,289.0

[1]Projected value may differ from actual 1977 estimate.
[2]Nominal dollars
SOURCE : ISER, 1978

TABLE 2

NON-OCS BASE CASE GROWTH OF THE FISCAL SECTOR
STATE OF ALASKA
1977-2000
(Millions of Dollars[1])

Year	Total Revenues	General Fund Balance	Permanent Fund Balance	Total Expenditures
1977 [2]	1,134.	696.	43.	981.
1978	1,225.	696.	147.	1,231.
1979	1,391.	675.	343.	1,336.
1980	1,693.	675.	608.	1,563.
1981	1,927.	675.	912.	1,767.
1982	2,178.	675.	1,247.	1,988.
1983	2,450.	675.	1,631.	2,219.
1984	2,739.	675.	2,096.	2,434.
1985	3,030.	675.	2,634.	2,661.
1986	3,178.	675.	3,186.	2,803.
1987	3,180.	603.	3,717.	2,906.
1988	3,246.	520.	4,252.	2,984.
1989	3,291.	348.	4,783.	3,097.
1990	3,235.	110.	5,276.	3,216.
1991	3,242.	0.0	5,487.	3,353.
1992	3,316.	0.0	5,540.	3,484.
1993	3,394.	0.0	5,530.	3,634.
1994	3,330.	0.0	5,318.	3,782.
1995	3,329.	0.0	4,946.	3,951.
1996	3,420.	0.0	4,522.	4,115.
1997	3,456.	0.0	3,946.	4,305.
1998	3,482.	0.0	3,219.	4,493.
1999	3,519.	0.0	2,324.	4,712.
2000	3,551.	0.0	1,251.	4,936.

[1] Nominal dollars
[2] projected value may differ from actual 1977 estimate.

SOURCE: ISER, 1978.

expenditures affect the state economy in two primary areas; capital expenditures and state employment. These expenditures are primarily distributed between nine functional categories: education, social services, health, natural resources, public protection, justice, development, transportation, and general government (ISER, 1978).

Transportation

Impacts on local, regional, and statewide transportation systems will be discussed as a single system with component parts and terminal points rather than for each geographical area separately. Impacts of the non-OCS base case are principally of two types - those resulting from normal or incremental growth and those caused by major developments. Impacts usually affect one geographic part of the system as a whole or specie modes: highway, rail, water, and air. Alaska's transportation system is multimodal with a series of inter-connections between modes for the movement of goods and services. Figure 4 illustrates alternative transportation routes from cities in the lower 48 states to the Beaufort Sea Region.

Highway Mode

In recent years increases in highway traffic have exceeded the rate of population growth, particularly in urban areas. A compounded annual growth rate of 4 percent is projected for intercity traffic during Non-OCS base case period. Principal likely impacts to other routes result from nominal or incremental growth related to increased recreational travel in summer, principally the route between Anchorage and Homer and roads to the north of Fairbanks and Anchorage.

In addition to normal growth, the construction of the gas pipeline may place additional demands on the state highway system because of heavy loads attributed to pipeline construction. Potential impacts should be less than during construction of the Trans-Alaska Pipeline because the state's reconstruction program will enable the roads to better handle such traffic. One possible exception is the haul road. This road may be used extensively for movement of goods and materials to Prudhoe Bay and for use during the construction of the gas pipeline. Alcan has indicated that it intends to use the road as a work pad.

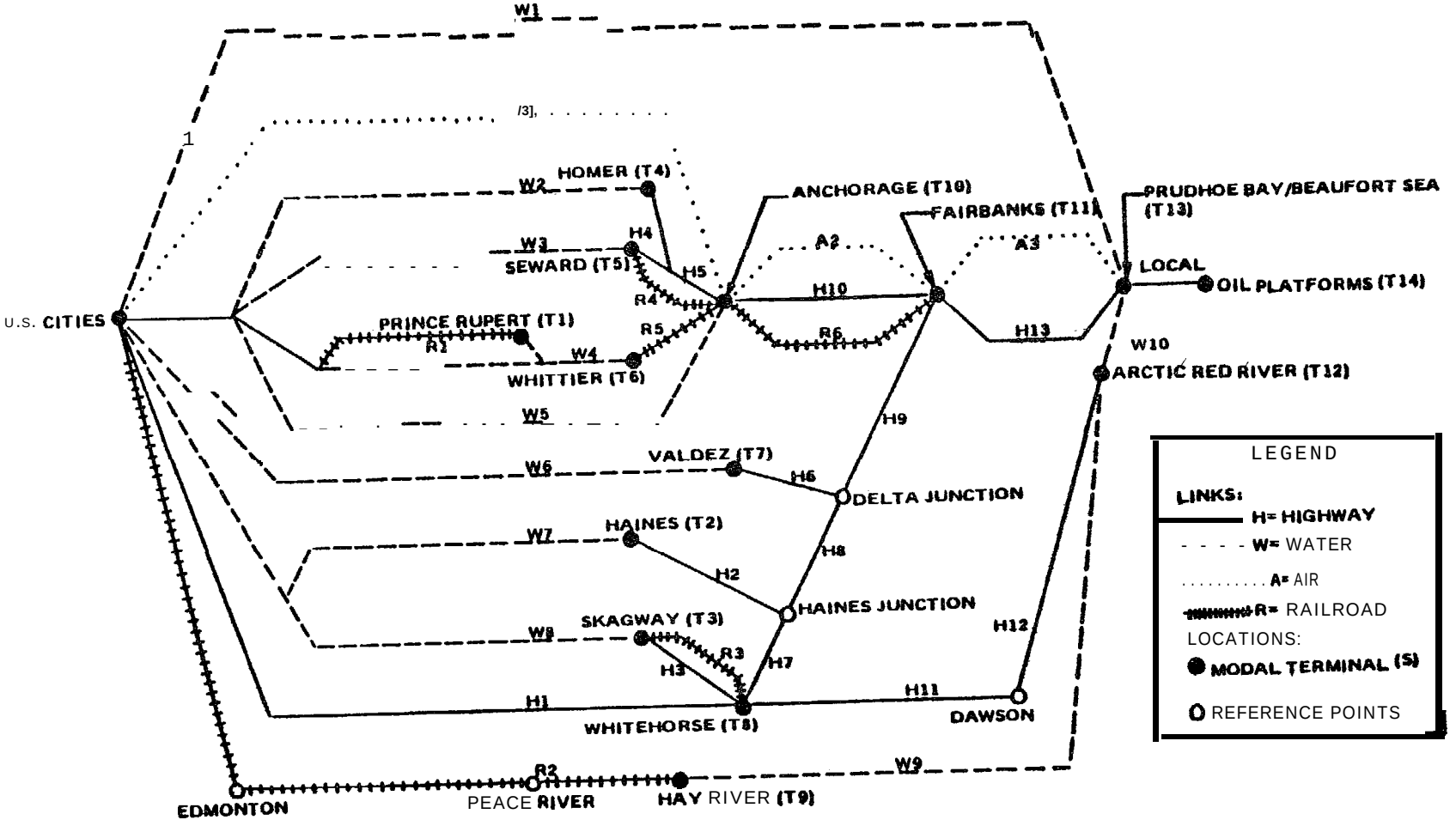
Based on pipeline experiences, the trucking industry will be able to respond to demands that might exist in the non-OCS base case.

Rail Mode

The Alaska Railroad satisfies all foreseeable traffic demands during the study period. The new refinery at North Pole near Fairbanks eliminates the need for rail shipments of some petroleum products from Anchorage, but peaking of demand during the Alcan pipeline construction offsets this loss. Thus, from a capacity viewpoint, the Alaska railroad will be better able to meet the demands resulting from the Alcan Gas Pipeline than the TAPS line, although few problems were encountered with the latter. The prospects are for ton-miles to decrease faster than tons carried in the near future.

FIGURE 4

ALTERNATIVE TRANSPORTATION ROUTE FROM U.S. CITIES TO PRUDHOE BAY/BEAUFORT SEA



Source: Dooley and Associates, 1978.

Water Mode

River and marine transportation systems should continue to play an important role in Alaska. Air travel offers the advantage of reliability, but the differential cost to gain this advantage is worthwhile only for certain commodities, such as perishables and spare parts. Ports serve Haines, Skagway, Anchorage, Seward, Whittier, Valdez, Homer, and Prudhoe Bay. Other communities, such as Barrow, occupy coastal areas where marine transport can only be accomplished by a combination of oceangoing ships and shallow draft space lighters. All deepwater ports are interconnected with one or more alternative land modes of transportation. Steady growth during the base case period, including construction of the gas pipeline, does not exceed current capacities of the marine transportation system.

Water routes from the lower 48 via the Bering Straits to the Beaufort Sea Region are mostly used to transport heavy and bulky freight for: NPR-A exploration activities, Beaufort Region communities (particularly fuel and building materials), oil company activities at Prudhoe Bay, oil and gas exploration in the Canadian Arctic. Total traffic for these activities over the base case period projected to be considerably less than during the height of exploration and development activities at Prudhoe Bay during the early 1970's. Support of NPR-A exploration requires annual shipments of 18,145 metric tons (20,000 tons), mostly fuel, to Barrow until the year 1982 (CCC/HOK, 1977). Besides resource development, Barrow increases its demand for shipments via water, which for the period 1975-1977 averaged almost 1,200 tons per year on the Bureau of Indian Affairs' North Starr III alone (BIA, 1977).

Air Mode

The Federal Aviation Administration has indicated the capacities of both Anchorage and Fairbanks International Airports will be exceeded by the early to mid-1980's because of steady growth forecast for Alaska's economy and the continued reliance of Alaskans on air travel for intercity trips. Plaster plans are presently being prepared for each airport to determine how additional traffic can be accommodated.

Future demand on the Deadhorse Airport is difficult to forecast. During the height of exploration and development at Prudhoe Bay, takeoffs and landings averaged 1,000 per day, but the pipeline haul road may reduce such intense activity in the future. Air Taxi and scheduled carriers with operations within the Beaufort Region show steady growth because of exploration in NPR-A (administered from Barrow) and construction of the Alcan gas pipeline. Contract and scheduled services from Barrow .expands to meet peak seasonal and annual demands during the study period, and new permits may be issued for air taxi and scheduled operators. Air facilities at Kaktovik and Nuiqsut were upgraded to improve safety and operations, but they did not induce noticeably higher levels of service for these communities (Dooley and Assoc., 1978).

ANCHORAGE/FAIRBANKS

Economic/Demographic

State economic growth does not occur uniformly throughout the state but varies by region. Regional growth depends on the source of overall growth and is stimulated by the same factors as at the state level. Additionally, however, the increases in state revenues and expenditures will lead to regional growth not directly attributable to exogenous factors. For example, changes in wage rates resulting from general employment growth may increase personal incomes in a region not directly affected by exogenous influences, while growth in the regional centers of Anchorage and Fairbanks responds to growth in other regions of the state.

The amount of economic interdependence between regions depends on the strength of four major processes: government spending, which works to distribute growth between regions; changes in state wage rates; growth in the regional centers of Anchorage and Fairbanks, which reflect growth in other regions since they provide many of their goods and services; and population migration between regions.

Anchorage is the largest urban center in the state and serves as its financial, administrative, and distribution center. Because of this role, growth in most other regions is reflected in Anchorage. Fairbanks, a smaller regional center, recently experienced tremendous growth because of its role as an operations center for the Trans-Alaska Pipeline and is discussed here because of this recent experience.

Table 3 summarizes the changes in Anchorage employment, population, and personal income. Employment in Anchorage more than doubles during the base case, increasing from 82,800 jobs in 1977 to 168,300 by 2000. Rapid growth is experienced during construction of the Alcan gas line from 1978 to 1981. When peak employment on the Alcan is reached, the average annual growth of total employment is 5.7 percent - almost twice the annual average growth rate for the whole forecast period. Growth in Anchorage employment is a result of increasing personal income and increasing demand for locally available goods and services. Population growth during the base case also centers in Anchorage. Its share of total state population increases evenly from 42 percent in 1977 to 56 percent in 2000, primarily due to steady expansion in retail and service employment. Anchorage experiences a fast rate of growth in personal income as a result of changes in state spending and exogenous employment. Personal income grows at an annual average rate of 8.1 percent throughout the period.

Table 4 summarizes changes in Fairbanks employment, population, and personal income. Fairbanks employment increases by approximately 3,500 jobs throughout the base case period, mostly due to changes in the exogenous sector of the economy. Employment declines in 1977 because of completion of trans-Alaska pipeline construction, from 33,900 jobs in 1977 to 28,300 in 1978. Employment increases by approximately 10,000 between 1978 and 1980 because of the construction of the Alcan gas line. Employment falls by about 8,400 jobs at gas line completion, which is more than twice the decline in direct construction employment of 3,200. Throughout the period

TABLE 3

NON-OCS BASE CASE GROWTH OF ANCHORAGE ECONOMY
1977-2000

YEAR	TOTAL POPULATION (Thousands of Persons)	TOTAL EMPLOYMENT (Thousands of Employees)	PERSONAL INCOME[2] (Millions of $)
19771	169.7	82.8	1,568.6
1978	178.2	83.2	1,626.2
1979	183.8	86.7	1,790.6
1980	194.6	94.2	2,093.6
1981	205.5	98.4	2,308.4
1982	212.6	97.3	2,350.9
1983	218.9	99.7	2,520.3
1984	226.6	103.0	2,730.3
1985	234.4	106.9	2,986.7
1986	240.4	109.8	3,212.0
1987	244.8	111.5	3,395.4
1988	246.6	112.6	3,560.2
1989	250.6	114.7	3,787.3
1990	254.9	117.5	4,050.7
1991	260.3	120.8	4,360.9
1992	265.1	?24.1	4,676.5
1993	271.1	128.1	5,055.2
1994	276.5	132,1	5,445.3
1995	283.1	136.7	5,891.9
1996	289.3	141.6	6,369.4
1997	296.9	147.2	'6,923.6
1998	304.3	153.2	7,525.9
1999	313.4	160.3	8,233.0
2000	322.6	168.3	9,026.0

[1]Proiected value may differ from actual 1977 estimate.
[2]Nominal dollars
SOURCE: ISER, 1978.

TABLE 4

NON-OCS BASE CASE GROWTH OF FAIRBANKS ECONOMY
1977-2000

YEAR	TOTAL POPULATION (Thousands of Persons)	TOTAL EMPLOYMENT (Thousands of Employees)	PERSONAL INCOME[2] (Millions of $)
19771	70.0	33.9	811.4
1978	61.5	28.3	607.4
1979	68.2	32.1	766.2
1980	81.2	39.8	1,100.0
1981	81.0	39.2	1,128.1
1982	67.3	30.8	812.3
1983	67.7	30.8	844.0
1984	69.1	31.4	905.1
1985	70.2	32.0	975.6
1986	70.9	32.4	1,036.9
1987	71.4	32.6	1,085.8
1988	70.8	32.4	1,119.6
1989	70.7	32.6	1,174.1
1990	70.6	32.8	1,239.1
1991	70.7	33.2	1,313.3
1992	70.6	33.4	1,386.9
1993	70.7	33.8	1,472.2
1994	70.5	34.1	1,557.4
1995	70.5	34.5	1,652.0
1996	70.3	34.9	1,749.2
1997	70.2	35.3	1,857.6
1998	70.0	35.8	1,970.0
1999	69.8	36.3	2,095.6
2000	69.5	36.8	2,228.0

[1]Projected value may not agree with actual 1977 estimates.
[2]Nominal dollars
SOURCE: ISER, 1978.

after 1983, employment grows at an average rate of approximately 1 percent per year, mostly due to growth in state and local government expenditures and personal income. Fairbanks population peaks at 81,200 people during gas line construction, then drops to 67,300 - an increase of 9.4 percent over 1978 following completion of the trans-Alaska pipeline. Population increases at a rate of 1.2 percent a year from 1983 to 1987 and then begins to decline. Over the remaining 13 years of the base case, population declines by approximately 2,000 people because of faster growth in other regions which attracts Fairbanks residents. Personal income in Fairbanks grows at a rate of 6.1 percent per year between 1977 and 2000. There is a drop at the end of the gas line construction in 1981. Personal income grows at an average annual rate of 5.8 percent per year after 1981 (ISER, 1978).

Urban Services

The discussion that follows focuses primarily on Anchorage, because the impacts to the Fairbanks region resulting from OCS development are not significant. The largest increase in population over the Non-OCS base is 3,800 by the year 2000 in the Prudhoe High Scenario which is not significant compared to the recent "boom" Fairbanks experienced during the construction of the Trans-Alaska Pipeline. Therefore, the discussion of urban services for the base case and each OCS scenario will focus on Anchorage.

Table 5 displays Anchorage service projections, where quantifiable, for the base case period. When qualitative standards were the only means of determining impact for a particular service, the conditional qualifiers are discussed in sections of Technical Report Number 13, an overview of infrastructure standards and description of services likely to be impacted. Anchorage future service requirements are based on a variety of population forecasts which are much higher than the Non-OCS forecast through the year 2000. The Municipality of Anchorage forecast a total population of 313,000 by 1990, the Metropolitan Anchorage Urban Study (MAUS) developed a forecast of 507,000 people by 1995, and as part of Operation Breakthrough, a private citizens group produced a set of forecasts and estimated that 478,000 people would live in Anchorage region by 1997. As a result of these forecasts, which are significantly higher than the projection developed for the Non-OCS base (Table 3) a range of required urban services such as water, waste, transportation, etc. have been estimated based on higher projections of population. Problems will arise only if present plans and target dates are not met. This is especially critical for some of the utilities and the transportation system. The primary issue facing Anchorage is whether the pace of economic growth and expansion is sufficient to maintain and operate current service systems while also expanding them to meet new population growth. The weakening of the growth pattern in the mid-1980's could cause financial problems for local government and negatively affect long-term fiscal capacity. The major problems then could be the lack of ability to expand or slowing of expansion below the rate anticipated by municipal planners. Change in the Anchorage Non-OCS base case is incremental rather than overwhelming.

TABLE 5

NON-OCS BASE CASE
ANCHORAGE URBAN SERVICE REQUIREMENTS

	1980	1985	1990	1995	2000
Population	194,636	234,393	254,910	283,070	322,608
Education: Primary/Secondary -No. of Teachers	1,557	1,875	2,039	2,265	2,581
Public Safety: Police - Manpower		356	387	430	490
State Troopers - Manpower	29	35	38	42	48
Fire - Manpower	286	345	375	416	474
Leisure: Play Lots	77	93	101	113	123
Neighborhood Parks	19	23	25	28	3Z
Softball Diamonds	65	78	84	94	107
Basketball Courts	389	468	509	566	645
Swimming Pools	19	23	25	28	3Z
Skating Rinks	6	7	8	9	10
Community Centers	8	9	10	11	12
Utilities: Water - (Millions of Gallons per Day)	39.5	47.6	51.7	57.5	65.5
Sewer - (Millions of Gallons per Day, Wastewater Generated)	31.5	38.0	41.3	45.9	52.3
Housing: Units	65,297	78,635	85,518	95,145	103,Z3C
Health: Bed Needs	376	453	493	547	624
Primary Care Physicians	243	292	318	353	403
Social Services: Day Care Space	2,919	3,515	3,823	4,246	4,939
Unemployment Claimants	12,651	15,235	16,569	18,399	20,969
Low Income Housing Units	3,017	3,633	3,951	4,396	5,000

SOURCE: Ender & Assoc., 1978.

Another issue related to services is the finite availability of buildable land in the municipality. Geological and public land restrictions may mean that enough land will not be available to meet housing and public service requirements of the population. Scarcity of buildable land is not expected to be a serious problem before the end of this century, but its preliminary effects are already being felt (Ender and Assoc., 1978).

BEAUFORT SEA REGION

Economic/Demographic

The North Slope Borough population is made up of two distinct population groups -- permanent residents, primarily Inupiat Eskimo, who live in traditional communities and transient oil-and-gas-related personnel, primarily white, who live in company camps, The two groups have little direct contact (Alaska Consultants, 1978). The North Slope Borough is basically rural but is unique because of the tremendous petroleum activity at Prudhoe Bay and NPR-A and possible activity in the Arctic National Wildlife Range and Beaufort Sea -- all within borough boundaries.

The North Slope economy is split between the local sector and the enclave petroleum-related sector. Table 6 summarizes the Non-OCS base case employment forecasts between 1977 and 2000 for the region and the communities of Barrow, Kaktovik, Nuiqsut, and Wainwright. Employment growth in the local economy results from continuing expansion of borough services to the region, additions to the Arctic Slope Regional Corporation central office staff in Barrow, and some growth in tourism. The Naval Arctic Research Laboratory and the Distant Early Warning line stations are not expected to change in emp" oyment significantly.

The dominant sources of employment in the North Slope are related to the oil and gas fields at Prudhoe Bay which causes considerable fluctuations dur' ng the non-OCS base case (Table 6). Employment declines in 1978 with the completion of the trans-Alaska pipeline and then increases by 3,300 jobs through 1981 as a result of increases in employment on state leases near Prudhoe Bay. Reductions in employment at Prudhoe Bay and on the Alcan result in a drop of employment, from 8,900 in 1981 to 5,600 by 1983. Employment at other Prudhoe Fields increases until 1986, when it accounts for the majority of the mining employment in the North Slope Borough. After 1990 the economy continues to grow more evenly (ISER, 1978). Forecasts of employment in the cases of Kaktovik and Nuiqsut assume that almost all new jobs will be derived for the activities of the North Slope Borough. The same is generally trueof MainWright. However, the latter community also has some potential for increases in employment related to tourism (Alaska Consultants, 1978).

Enclave sector jobs are primarily petroleum related, but some are in transportation and nonpipeline construction. The percentage of total employment in mining and pipeline construction gives some indication of the distribution between local sector and enclave sector jobs. More than one third of the jobs in the region are connected with the enclave sector in the early part of the period. Once employment in this sector stabilizes, its share

TABLE 6

FORECAST OF EMPLOYMENT
NON-OCS BASE CASE
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Employment				
	Barrow a/	Kaktovik b/	Nuiqsut b/	Wainwright c/	Region d/
1977	915 e/	36 e/	42 e/	58 f/	6,490
1980	962	36	43	63	8,308
1985	1,075	37	46	72	7,043
1990	1,202	39	48	81	5,769
1995	1,344	41	51	94	6,483
2000	1,502	43	53	100	7,533

a/ Barrow's employment forecasted at the current ratio of approximately 1 job for every 3 local residents.

b/ Kaktovik and Nuiqsut's employment forecasted at the current ratio of approximately 1 job for every 3.8 local residents.

c/ Wainwright's current ratio of approximately 1 job for every 6.9 local residents is not considered to remain constant in this forecast. It is estimated that the 1980 ratio will be 1:6.5, the 1985 ratio 1:6.0, the 1990 ratio 1:5.5, the 1995 ratio 1:5.0 and the 2000 ratio 1:5.0, thus tending toward the existing 'ratios in other traditional villages of the region outside Barrow.

d/ Regional employment forecasts developed by ISER for the Alaska OCS socio-economic studies program. Majority of employment is oil and gas related.

e/ Average annual employment estimates derived from Alaska Consultants, Inc. count in December 1977.

f/ Average annual employment estimate derived from Alaska Consultants, Inc. count in April 1977.

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

of total borough employment is reduced. By 2000 enclave employment accounts for only 19 percent of the borough total.

The region's population decreases and increases dramatically with changes in the exogenous employment associated with natural resource development. Population peaks at 10,700 in 1981 with the construction of the gas line, declines and then rises to 8,500 in 1986 with increases in mining employment. By 1990 exogenous employment reaches a plateau which lasts through the remainder of the period. Table 7 summarizes population change between 1977 and 2000 for the communities of Barrow, Kaktovik, Nuiqsut, Wainwright, and the North Slope Borough. Enclave population is 23 percent of the total in 1977 but by 1981 during gas line construction, this sector accounts for 34 percent of the total population. By 2000, after 10 years of stable enclave sector employment, enclave population accounts for 16 percent of total population. The share of the state population in the region falls from 2.3 percent in 1977 to 1.6 percent by 2000 (ISER, 1978).

Community Services

Population growth places new demands on community facilities and services. In small villages even seemingly mimer increases in population can result in a local government unit's having to increase such services as education, public safety, recreational facilities, public utilities, and housing.

'The principal source of funding for these services is borough property taxes on oil-and-gas-related companies -- about 93 cents of every dollar collected. Currently, almost all of the Borough's tax base is oil-and-gas-related property in the Prudhoe Bay area and the northern portion of the trans-Alaska pipeline. Other sources of borough revenue are the state and federal governments, primarily for health and educational services. The Borough also collects revenue from miscellaneous sources, including earnings from interest, the teacher lunch and housing program, and athletic gate admission charges. A review of existing facilities and services in this region shows that despite the heavy financial commitment of the North Slope Borough, service levels are still relatively low. Almost all projected community facilities needed through the year 2000 are scheduled for construction under the North Slope Borough's Capital Improvements Program within the next two or three years. This includes high schools, public safety and major recreation facilities, and, in the smaller villages, utility systems. Completion of capital improvements projects currently authorized should satisfy most basic service needs, except, perhaps, housing and a piped water and sewer system for Barrow. Many housing programs require adequate water and sewer utilities as a prerequisite for funding and the Public Health Service has not yet committed money for this project. Except for utility services in the Deadhorse area, which the Borough provides on a service area basis, there are essentially no facilities and very few services outside traditional communities during the non-OCS base case.

The Borough experiences periods of deficits in revenue through FY 1989/90 forcing it to levy a debt service mill rate (Table 8). However, surpluses occur from that time to the end of the study period. The most severe revenue problems occur from FY 1978/79 through 1980, when substantial

TABLE 7

FORECAST OF POPULATION a/
NON-OCS BASE CASE
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Population				
	Barrow	Kaktovik	Nuiqsut	Wainwright	Region b/
1977	2,700 c/	134 d/	157 d/	398 d/	9,323
1978	2,761	135	159	402	7,168
1979	2,823	136	161	406	8,516
1980	2,887	137	163	410	9,980
1981	2,952	138	165	414	10,678
1982	3,018	139	167	418	8,385
1983	3,086	140	169	422	8,191
1984	3,155	141	171	426	8,251
1985	3,226	142	173	430	8,273
1986	3,299	143	175	434	8,477
1987	3,373	144	177	438	8,259
1988	3,449	145	179	442	8,287
1989	3,527	146	181	446	7,080
1990	3,606	147	183	450	7,110
1991	3,687	148	185	454	7,300
1992	3,770	149	187	459	7,449
1993	3,855	150	189	464	7,641
1994	3,942	152	191	469	7,796
1995	4,031	154	193	474	7,984
1996	4,122	156	195	479	8,157
1997	4,215	158	197	484	8,366
1998	4,310	160	199	489	8,562
1999	4,407	162	201	494	8,796
2000	4,506	164	203	499	9,021

a/ Barrow's population forecasted at an annual rate of increase of 2.25 percent through 2000; Kaktovik, Nuiqsut and Wainwright's population forecasted at an annual rate of increase of 1 percent through 2000.

b/ Regional population forecasts developed by ISER for the Alaska OCS socio-economic studies program.

c/ Barrow's 1977 population estimated by Alaska Consultants, Inc.

cl/ North Slope Borough Planning Department population estimates.

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

TABLE 8

ESTIMATED REVENUES AND EXPENDITURES
NON-OCS BASE CASE
NORTH SLOPE BOROUGH
FY 1977/78 - FY 2000/01

(in 000's of Real $)

Fiseal Year	Expenditures			Revenues			Surplus (Deficit)	Debt Service d/ Mill Rate
	Operating Budget	Oebt Service	Total	Property Taxes	Other Revenues	Total		
1977/78a/	$30,126b/	$7,634	$37,760	$18,922	$11,204	$30,126	$7,634)	7.52
1978/79	29,288	23,027	52,315	22,309	12,342	34,651	17,664)	23.8
1979/80	31,631	22,026	53,657	28,644	13,595	42,239	11,418)	12.0
9 980/81	34,161	24,503	58,664	36,272	14,975	51,247	7,417)	6.1
1981 /82	36,894	23,200	60,094	41,921	16,497	58,418	1,676)	1.2
1982/83	39,846	23,252	63,098	39,473	18,174	57,647	5,451)	4.1
1983/84	43,034	25,737	68,771	37,476	20,027	57,503	11,208)	9.0
1 984/85	46,477	22,007	68,484	40,771	22,052	62,823	5,661)	4.2
1985/86	50,195	22,756	72,951	44,151	24,294	68,445	4,506)	3.1
1986/87	54,211	21,078	75,289	48,863	26,762	75,625	336	
1987/88	58,548	21,309	79,857	51,410	29,487	80,897	1,040	
1988/89	63,232	19,954	83,186	48,965	32,480	81,445	(1,741)	1.1
1989/90	68,291	19,034	87,325	51,374	35,780	87,154	(171)	.1
1990/91	73,754	15,301	89,055	55,719	39,413	95,132	6,077"	
1991 /92	84,654c/	--	84,654	61,792	43,424	105,216	20,562	
1 992/93	91,426	--	91,426	68,103	47,831	115,934	24,508	
1993/94	98,740	--	98,740	75,454	52,688	128,142	29,402	
1994/95	106,640	--	106,640	83,151	58,045	141,196	34,556	
1995/96	115,171	--	115,171	89,760	63,944	,153,704	38,533	
1996/97	t24,384	--	124,384	85,620	70,440	156,060	31,676	
1997/98	134,335	--	134,335	81,690	77,592	359,282	24,947	
1998/99	145,082	--	145,082	77,970	85,480	163,450	18,368	
1999/00	156,689	--	156,689	74,430	94,160	168,590	11,901	
2000/01	169,224	--	169,224	71,070	103,735	174,805	5,581	

a/ North Slope Borough budget figures (per Ordinance 77-3, adopted April 30, 1977). Revenues and expenditures, with the exception of debt service, projected at 8% annual rate of increase.

b/ Includes $3 million for capital outlay. The remainder is projected at 8 percent increase per year.

c/ Includes $5 million for capital outlay from FY 1991/92 compounded annually at 8 percent through FY 2000/01 for pay-as-you-go capital outlays.

d/ Levied per AS 29.53.055 above 30 mill levy under AS 29.53.045(c).

SOURCE: Alaska Consultants, 1978.

increases in millage rates must be levied. Thereafter, the debt service millage rate generally declines until surpluses can cover debt service payments. Over the long term the value of oil and gas property declines due to depreciation, and property tax yields therefore also decline. This may adversely affect the Borough's operating budget after FY 2000/01.

A number of problems affect regional and community infrastructures in the North Slope Borough, but three stand out: isolation of communities, high costs of capital improvements, and reduction of property tax. None of the region's traditional communities is accessible except by air or, in some cases, seasonally by water. Except for air facilities at Barrow, Barter Island (Kaktovik), and Point Lay, airports in the region are generally adequate even for current needs. Major borough capital improvements and other projects require that materials either be shipped via the North Star III or barge during the short ice-free season or be flown in during freeze up. In many communities, large cargo aircraft (commonly Hercules) require that ice strips be built. This is expensive, inconvenient, and also means that major shipments cannot be delivered during summer when most construction is undertaken. The region's inaccessibility, small population, and remoteness from major market places, combine to make the cost of all commodities and services the highest in the United States. Not only are initial construction costs extremely high (military construction indexes rate Barrow construction costs at twice those of Anchorage), but operating costs are also very high. The net result for the Borough is that it must maintain a very large operating budget to provide even basic services. Since the level of borough property taxes is expected to decline in FY 1995/96 because of depreciation of oil and gas properties, the Borough faces budgetary problems after that time, further complicating provision, replacement, and operation of community facilities and services.

Relatively modest annual population growth occurs in Barrow (2.25 percent) and the smaller villages (1 percent) until 2000 in the Non-OCS base case. It is assumed that some people living in the smaller communities may migrate to Barrow in addition to some additional immigration of non-natives. The net effect will not be a reduction of Inupiat population through outmigration, rather a shifting of the Inupiat population from smaller communities to Barrow. There currently is a lack of water and sewer utilities and available buildable land in Barrow. In addition, housing is in short supply, and the additional population increase forecast for Barrow may result in aggravating this situation.

From the industry standpoint, it is assumed that oil and gas developments in the North Slope region will continue to be restricted to industry enclaves with little direct contact with permanent residents of the region. However, it is difficult to anticipate results of Arctic Slope Regional Corporation investments and mineral exploration activities (Alaska Consultants, 1978).

Natural Resources

North Slope resources continue to be affected by population and employment increases and other influences of the man-made development. Most prominent are changes affecting subsistence hunting and fishing, water resources, and water quality.

The impact of human use on water resources between now and the year 2000 in the non-OCS base case corresponds directly to population growth in each village and to changes in the water supply and waste disposal methods. Water quality/resources, and sanitation will be impacted primarily because most Beaufort Sea villages currently are without a community water supply system and adequate sanitation facilities.

Barrow is the only village which experiences significant immigration during this period. The populations of the other villages increase only slowly from births. Consequently, if per capita water use remains relatively constant in Kaktovik, Nuiqsut, and Wainwright, the impact of water withdrawal and use remains essentially unchanged. If, however, piped water and sewage systems generally become available, per capita water use (and the impact of water withdrawal and use) could rise dramatically. Given the relatively low populations in Nuiqsut, Kaktovik, and Wainwright, an increase from about 8 liters per capita per day (lpcpd) to 40 lpcpd (10 gallons) per capita per day (10 gpcpd) is not likely to place much stress on the water resource. However, an increase to 190 lpcpd or 260 lpcpd (50 or 70 gpcpd) could create severe problems during the winter low water period if storage capacity is insufficient. A water system capable of serving 4,350 residents, each using 1970 lpcpd (45 gpcpd) is planned for Barrow. Without a large storage or a desalinization plant, this level of water use could seriously stress the raw water resource, particularly in winter.

Sand and gravel resources continue to be depleted by industry and community needs. Most demand comes from onshore petroleum development and mineral development in the Brooks Range and its northern foothills. Construction of the Alcan gas pipeline begins in 1980, and requires approximately 8.4 million m3 (11.0 million yd^3) of gravel. Table 9 shows gravel requirements for other onshore North Slope petroleum development during the base case.

Future gravel requirements of Beaufort Sea communities in insignificant compared to those of the petroleum industry. If an annual demand of 7,646 m^3 (10,000 yd^3) of gravel and a major construction project every five years requiring about 114,690 m^3 (150,000 yd^3) is assumed for Barrow, a total gravel demand from 1977 to 2000 would be about 584,506 m^3 (771,000 yd^3). That figure equals the requirements for 42 miles of pipeline haul road (state secondary standards). The gravel and sand requirements of the smaller communities are not known but will be somewhat less than those of Barrow.

A serious problem will develop if commercial finds of oil and gas are discovered near any of the communities. Discoveries in NPR-A would impact Atkasook. Wainwright and Atkasook are also located in the coal-rich Kuk-Kugru and Meade-Ikpikpuk River districts. Development of these resources would significantly impact the limited gravel and sand resources of the western Arctic Slope. Kaktovik, which lies in the Arctic National Wildlife Range, is unlikely to be affected by gravel demands of petroleum activities, and its community needs are expected to remain small. There appears to be no potential shortage of borrow materials in this part of the region.

TABLE 9

PROJECTED GRAVEL REQUIREMENTS FOR NORTH SLOPE PETROLEUM DEVELOPMENT SCENARIOS[2]

Scenario	Field Reserves Oil MMBbl	Field Location	Discovery Date	Production Start-Up Date	Total Gravel Requirements Cubic Meters (Cubic Yards)	Notes
Prudhoe Bay State Lands (PBSA-7)[2]	600	South and southeast of Prudhoe Bay	1987/1988	1990/1991	3,485,811 (4,559,000)	Two fields; TAPS connection
National Petroleum Reserve - Alaska (NPRA-5)[2]	1,000	Northeast sector of reserve	1978	1987	6,119,094 (8,003,000)	TAPS connection
National Petroleum Reserve - Alaska (NPRA-6)[2]	600	Northeast sector of reserve	1982	1992	4,087,552 (5,346,000)	TAPS connection
National Petroleum Reserve - Alaska (NPRA-7)[2]	300	Southwest sector of reserve	1986	1993	1,383,926 (1,810,000)	TAPS connection
Central North Slope (CNSA-2)[2]	900	South and southwest of Prudhoe Bay	1978/1980	1982/1983	4,989,015 (6,525,000)	Two fields; Arctic Slope Regional Corporation Lands
Western Arctic (WAR-2)[2]	900	North Slope, west of NPR-A	1979/1981	1987	11,939,993 (15,616,000)	Two fields; TAPS connection
Arctic National Wildlife Range (ANWR-3)[2]	5,000	East of Prudhoe Bay near coast	1993	1999	11,782,486 (15,410,000)	TAPS connection

1 Source: Alaska Department of Natural Resources, (Gibson and Kerschner, 1977).
2 Abbreviations (PBSA-7 etc.) for scenario designation as used in source reference.

SOURCE: Dames and Moore, 1978

Preservation of the traditional culture and historical patterns of subsistence (hunting, fishing, and gathering) is of major concern to the people of the Beaufort Sea Region. Residents of small villages most frequently cite hunting and fishing as the aspect of village life they like best (North Slope Borough, 1977). Interest will probably remain high in the future, but over the long term, total subsistence harvests should remain at a fairly constant level.

Recreational hunters and fishermen from outside the region pose the greatest potential for change during the non-OCS forecast period. More sports hunting and fishing would compete with subsistence pursuits and also increase demand for guides, transportation, fuel, food, and accommodations. Excessive recreational harvest can be controlled by adequate regulation and enforcement. However, conflicts between subsistence and recreational user groups may result in complex political and social problems.

The most serious future impacts on fish and wildlife will probably result from habitat disturbance through gravel mining, collection of potable water, and siting of facilities. Impacts will also result from harassment or disturbance of wildlife by boats," aircraft, road vehicles, and other human activity that increases because of improved access (Dames and Moore, 1978).

Sociocultural

The population of the North Slope is currently undergoing rapid change. The culture of the region has changed through economic development initiated both within and outside the region and this may continue to have direct and indirect effects. With increasing emphasis being placed on onshore oil and gas development, the activities of the North Slope Borough and regional and village corporation activities and additional subsistence regulations, it is likely the social and cultural transformations which began in the late 1960's and early 1970's will continue to impact the region and its traditional communities through the year 2000.

Petroleum-related activities, including continued trans-Alaska pipeline development, NPR-A exploration and development, the natural gas pipeline, and Arctic Slope Regional Corporation leases and developments, will impact Beaufort Sea communities in terms of the direct employment it provides for permanent residents and the employment of nonresident migrants. The employment of the permanent population in the referenced petroleum-related activities will increase cash income. As residents become more involved with such financial obligations as house payments, they may be under greater pressure to participate in petroleum development employment. If a significant number of the permanent population seek employment in petroleum industries and if they are not successful in obtaining employment, negative attitudes toward the migrant, non-Inupiat, employed population and the development activity will undoubtedly heighten. The attitudes of nonresident workers in the region toward the Inupiat and those of the Inupiat toward them will largely determine the type of interethnic relationships that develop.

Historical analysis of previous periods of economic development has not demonstrated that participation in employment activities decreased subsistence activities significantly, but this pattern, of course, depends on availability of wildlife resource populations. The greatest potential impact from the migrant population is pressures they may exert on wildlife through sport hunting and fishing activities. In addition to the competition for limited resources, this may also result in increased and enforced state and federal hunting and fishing regulations. Such actions would most severely affect the permanent population, who would resent regulations and restrictions on their traditional subsistence pursuits.

The current subsistence economy is restricted by caribou and bowhead whale regulations. If these severe restrictions on major subsistence resources continue for a prolonged period, they could destroy the present Inupiat socioeconomic-subsistence complex which depends on direct relationship with the natural environment. Other potential regulating forces may derive from NPR-A policies, (d) (2) legislation stemming from the Alaska Native Claims Settlement Act, and international treaties on migratory animals. State regulation may also be developed and enforced to cope with increased sport hunting and fishing activities within the Beaufort Sea Region, The major impact of oil and gas developments will be the revenues they generate for the North Slope Borough, which, in turn, will be the primary and direct agent of change throughout the non-OCS base case. At an institutional level, the North Slope Borough has acted politically to insure that the permanent population shared in the benefits of development through its taxation powers. The Borough has also attempted to control development in terms of mitigating potential negative impacts on the subsistence economy. Without question, the North Slope Borough is the primary institution that protects the sociocultural character of the region's population. It is also a primary employer in all traditional communities. From population projections of the non-OCS base, it appears that the Inupiat population will continue to have the political majority and control of borough activities.

Of the Borough's many influences, its housing programs perhaps have the greatest potential for social and cultural change. The cost and maintenance of modern housing requires a steady cash income which usually necessitates employment in the cash economy; but the effects go far beyond that. In the past, extended family units often occupied a single dwelling. Now, however, as modern housing becomes available, the typical pattern is that some family members move into the new house and others remain in the old. Obviously, there are other factors which come into play as well, but the fact is that Inupiat family units are beginning to outwardly resemble the nuclear unit characteristic of Western societies. Housing programs for senior citizens also impact the entire family and society. Elderly grandparents living in the extended family setting directly influence socialization and education of the young. Segregated in senior-citizen housing, there is much less interaction between various age groups and less continuity with traditional ways. It is not known whether the extended family unit, dispersed into two or three houses, will continue to interact as the characteristic Inupiat extended family.

Other borough programs, such as child advocacy and health care, will continue through the non-OCS scenario, resulting in more societal and cultural change. Many needs once met by the family and generally not met by State of Alaska programs are now in the process of being incorporated by the North Slope Borough.

Activities of the Arctic Slope Regional Corporation and the village corporations will also effect cultural changes in the resident population. These corporations, particularly the profit-oriented Arctic Slope Regional Corporation, will be involved in development projects of various kinds, some of them petroleum related. The most significant difference between Native corporation developments and those of outside interests is that most of the Inupiat population will share in the benefits as shareholders and many as employees. Under terms of the Alaska Native Claims Settlement Act of 1972, profit-making Native corporations become subject to taxation like any other in 1991. These corporations may have to intensify their development activities to meet their financial obligations, and this could lead to conflicts between subsistence interests and development requirements.

In summary, the greatest threat to maintenance of the Inupiat sociocultural system is disruption of the subsistence complex. The three most prominent potential threats during the base case are petroleum and other development that negatively affects wildlife resources, decreased participation and support of subsistence activities, and subsistence regulations. The cumulative effect of all impacts and forces of change cannot be conclusively determined. During past periods of economic development the Inupiat have demonstrated that they can adjust and adapt to the demands of the macroeconomy while still retaining the essential elements of their unique culture and way of life. However, through each of these periods they maintained a direct relationship to their environment. While they participated in employment opportunities, they also continued their subsistence activities and intensified them once development activities decreased. In the non-OCS base, the major instrument of change is internal -- the North Slope Borough (Worl and Assoc., 1978).

III. Projected Impacts of OCS Development

Introduction

To analyze the socioeconomic impacts of Beaufort Sea petroleum exploration, development, and production, reasonable predictions of the nature of that development must be made. This is the primary purpose of the following petroleum development scenarios for the proposed joint state-federal lease sale and subsequent federal OCS lease sales areas in the Beaufort Sea. They provide a range of technological, economic, and geographic options so that both minimum and maximum socioeconomic impacts can be estimated.

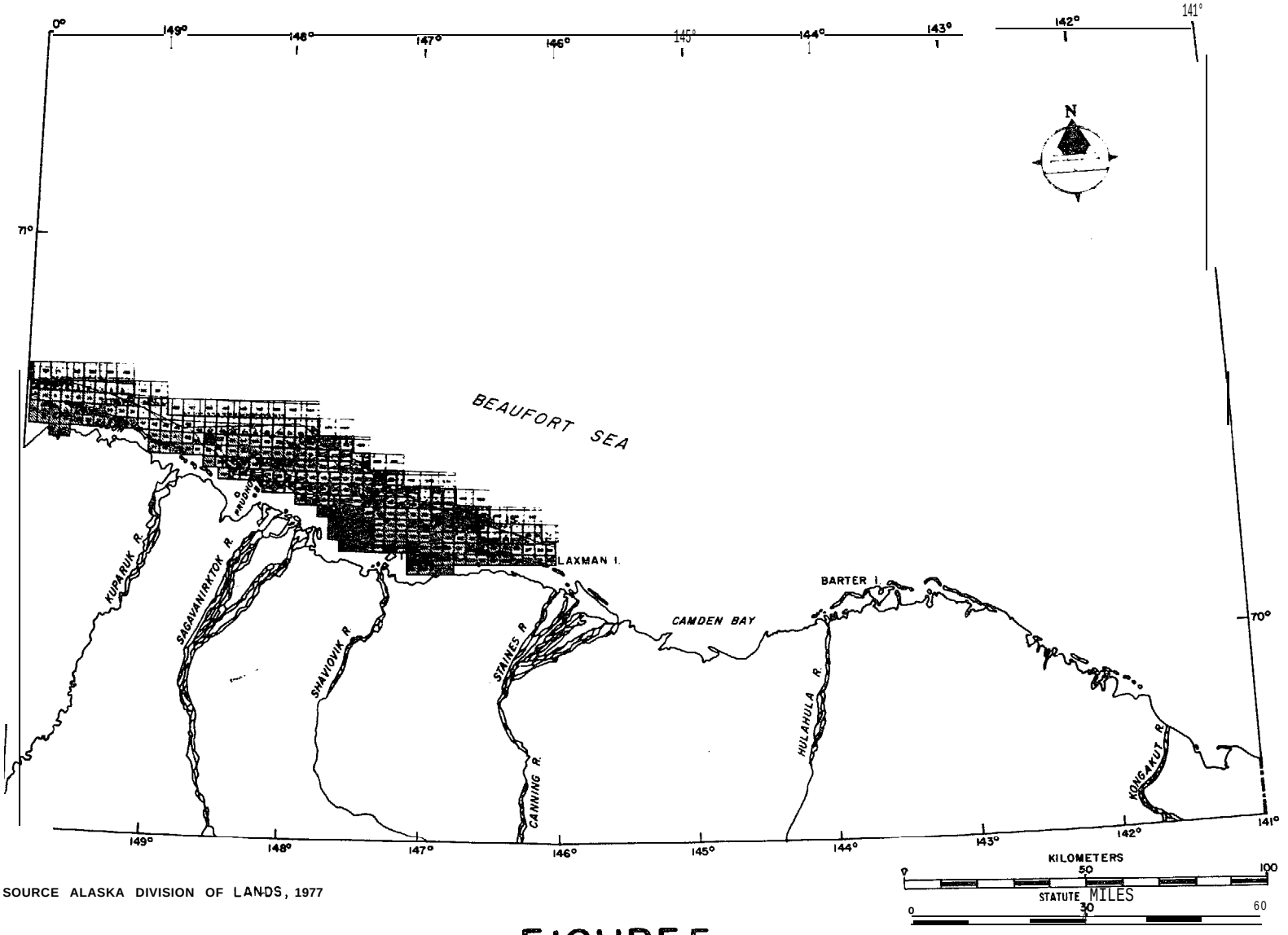
CHARACTERISTICS OF THE OCS PETROLEUM DEVELOPMENT SCENARIOS

The amount of the resource and its location are of paramount importance to assessment of potential impacts. Consequently, a selection of scenarios that covers probable locations and expected resource deposit sizes was chosen from 24 skeletal scenarios provided by U.S. Geological Survey assessments. Four of these were selected for impact analysis -- Camden-Canning, Prudhoe-High, Prudhoe-Modal, and Cape Halkett. These three areas represent cumulative petroleum development anticipated in the Beaufort Sea within the confines of the U.S. Geological Survey estimates and lease sale areas. The scenario selection process included an appraisal of resource discovery probabilities, ranging from 1 to 95 percent, which indicated that development of the central and eastern areas is more likely than in western areas (Figures 5a and 5b).

In the eastern area (Camden-Canning) a high probability was selected but split into two fields to allow for more detail. Two scenarios were chosen for Prudhoe modal and high (1 percent probability). In the Cape Halkett area a resource discovery probability of 5 percent was selected.

Scenario	Production	Schedule	Lease Sale
Camden-Canning	1.3 Bbbl; 3.25 tcf for two fields	Exploration, 1982 Development, 1986 Production, 1990	Joint State-Federal (Figure 6)
Prudhoe-High*	1.9 Bbbl; 4.75 tcf	Exploration, 1979 Development, 1984 Production, 1988	Joint State-Federal (Figure 7)
Prudhoe-Modal*	0.8 Bbbl; 1.6 tcf	Exploration, 1980 Development, 1985 Production, 1989	Joint State-Federal (Figure 8)
Cape Halkett	0.8 Bbbl; Gas not developed	Exploration, 1984 Development, 1989 Production, 1992	Federal OCS (Figure 9)

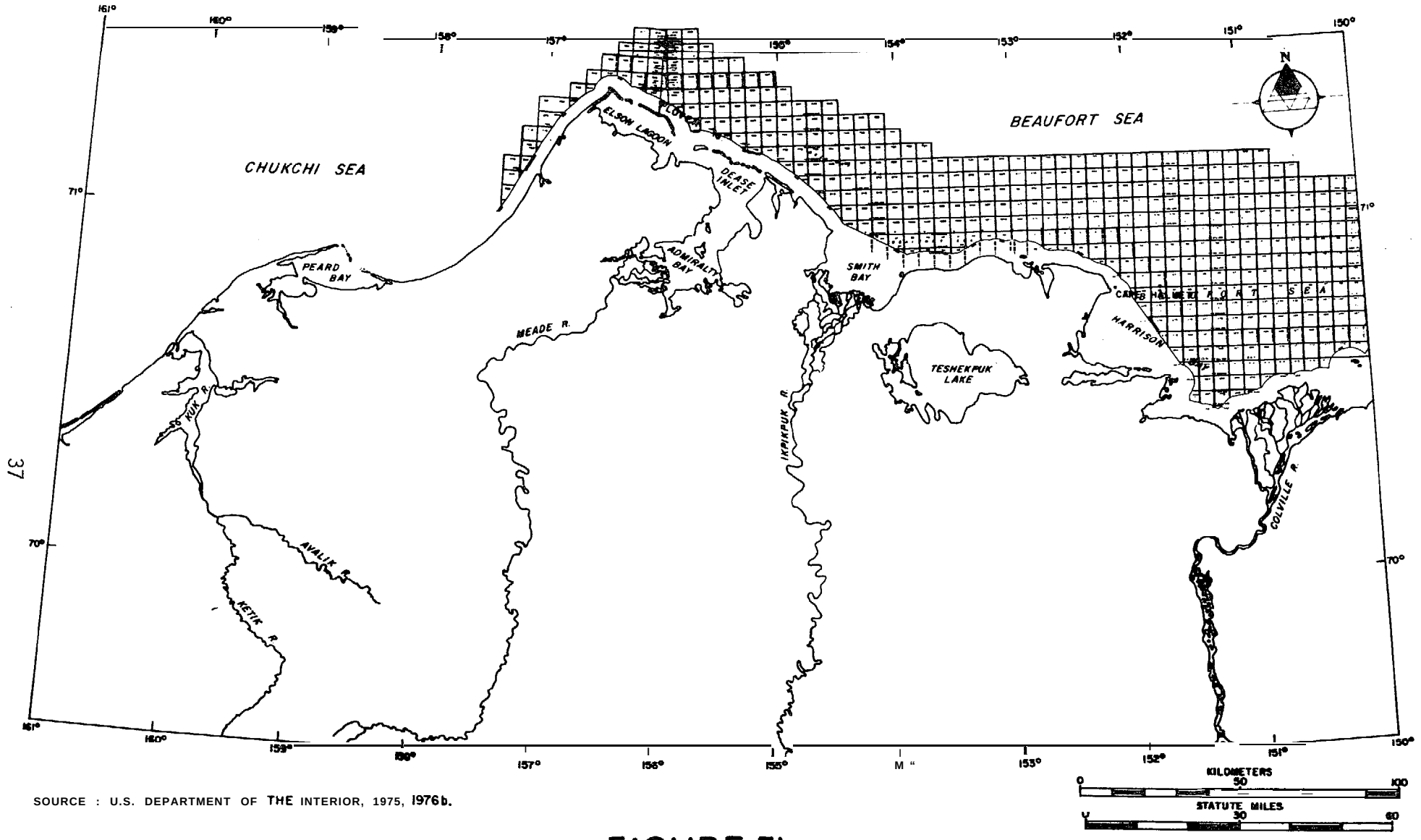
Note: Bbbl means billion barrels
tcf means trillion cubic feet
*For cumulative impact analysis, use one or the other scenario.



SOURCE ALASKA DIVISION OF LANDS, 1977

FIGURE 5a

BEAUFORT SEA STUDY AREA – EAST
SHOWING STATE–FEDERAL AND FEDERAL PROTRACTION



SOURCE : U.S. DEPARTMENT OF THE INTERIOR, 1975, 1976b.

FIGURE 5b

BEAUFORT SEA STUDY AREA – WEST SHOWING FEDERAL OCS PROTRACTION

These scenarios provide adequate variation, contrast, and coverage for assessment and review of socioeconomic and environmental impacts. Each scenario has a cost structure showing a range of economic outcomes. Small shifts in location of large scenario fields were reviewed -- offshore Prudhoe and in the eastern Beaufort to deeper waters -- and resulting economic effects (including revision of assumed platform types) are shown in cost considerations. Keep in mind that though the scenario areas reflect known geologic characteristics, the locations are only hypothetical. The following provides a summary description of the support facilities required for the exploration and development phases of OCS petroleum development.

Support Facilities - Exploration Phase

During the exploration phase few, if any, new onshore camps, airstrips, staging areas, communication sites, or other facilities will be constructed. Permits for new construction outside the vicinity of the Deadhorse industrial area would probably be difficult to obtain from state and federal agencies. Exploration support activities can be staged from existing shore-based facilities at Prudhoe Bay, with the possible exception of Lonely, which is currently serving as the staging area for exploration in the northeastern sector of NPR-A. Lonely could continue to be a staging area for exploration activities west of Harrison Bay (Figure 2). The facilities of existing or abandoned DEW Line stations, principally airstrips, may be used for offshore exploration if appropriately located with respect to the well site. A significant increase in exploration following the state lease sale will undoubtedly produce expansion of the Deadhorse (Figure 2) oil field supplies and services.

During exploration, each offshore platform (mainly artificial islands) will accommodate both a drill rig and a crew camp. During winter these camps could be supplied from Anchorage or Fairbanks by cargo aircraft that could land on ice strips near the drilling pads or at the Deadhorse airport. Deadhorse will probably be used as much as possible for a staging, supply, and communications center.

Unlike onshore exploration, Beaufort Sea exploration will be a year-round activity with construction of gravel islands taking place in summer or winter. In the case of summer-constructed islands, drill rigs will be transported to the site by barge prior to freezeup so drilling can continue throughout the fall and winter. In the case of ice islands and winter-constructed gravel islands, the option of either rig mobilization by air or land (and over-ice) is available.

Although there is a pool of arctic rigs at Prudhoe Bay, some of which are available for exploration, more will be required for exploration of state/federal lease tracts since many of those at Prudhoe are near the end of their life-span. Much of the supplies, such as mud, cement, and casing will be obtained from oil field suppliers at Deadhorse. These may be air freighted to the well site since air transport and trucking costs on the North Slope are similar.

Support Facilities - Production Phase

Permanent onshore facilities, such as airfields, harbors, and base camps, will be built if economically recoverable oil is found. They will, when feasible, be located near the closest landfall to the offshore field. Onshore facilities required for operation of an offshore oil and gas field (assuming that oil and gas treatment is conducted onshore at the pipeline landfall) include oil/gas/water separating plants (flow stations), a gas compression plant, a pump station, a base camp, an airstrip, a dock/harbor, a storage area, and access roads. A number of environmental and engineering criteria will have to be met before siting of onshore facilities, such as avoidance of environmentally sensitive areas, availability of fresh water, proximity to gravel, soil stability, and barge access.

The location of onshore facilities will only coincidentally be at existing DEW Line sites since no infrastructure of sufficient value exists at these sites to attract facilities. The cost of deviating 1 or 2 miles from an acceptable site would far exceed the cost of duplicating any usable DEW Line infrastructure.

No use of facilities at existing North Slope communities is anticipated. Even the two largest communities, Barrow and Kaktovik, do not have infrastructures of sufficient economic value to justify relocation of support facilities from points nearest the offshore production wells. In addition, there are strong social reasons why oil companies want to avoid development near an established community. Local Eskimo leadership is very sensitive to possible interference with the existing socioeconomic structure of their communities, and oil companies will not want to bear the responsibility for cultural changes imposed by establishing facilities in or near the villages. Existing communities are shown in Figure 2.

A detailed analysis was required for site-specific planning of support facilities. The general criteria for selecting the location of a production base camp/staging area are briefly described below. These factors would essentially "fine tune" the location of the staging area since for each scenario there is a certain length of coastline on which a staging area could be located opposite the offshore field. While the closest landfall is the most favored site, the position of the hypothetical fields relative to the shoreline (long axis parallel or subparallel to the coastal trend), which is dictated by geologic structure, means that there is some flexibility in the selection of onshore staging areas and production facilities. The approximate lengths of coastline on which a staging area could be located opposite the offshore field(s) in the four scenarios are:

Camden-Canning	40 kilometers (25 miles)
Prudhoe-Modal	19 kilometers (12 miles)
Prudhoe-High	32 kilometers (20 miles)
Cape Halkett	11 kilometers (7 miles)

The most important requirement for facilities location is proximity to the offshore area to minimize the running time of supply ships, over-ice vehicles, and helicopters. This is especially important during periods of inclement weather or emergency. Proximity also minimizes the length (and

therefore the cost) of offshore pipelines which have landfalls at the service base.

In all scenario analyses but Cape Halkett, the postulated base camp or staging area locations are also the location of the oil and gas treatment facilities (oil and gas separation, dehydration, gas compression, etc.). Economic and environmental factors will encourage centralization of facilities and minimization of duplication. The assumption has been made that oil and gas processing will be done onshore in the Camden-Canning scenario and possibly in the Prudhoe scenarios. If oil and gas processing is done on the platforms, the base camp/staging area does not need to be at the pipeline landfall.

The shallow waters along the Beaufort Sea coast (the 20 m isobath lies 16 to 72 km, or 10 to 45 miles offshore) generally require that freight be lightered from deep-draft vessels to shore in barges that draw less than 2.5 m (8 ft.) of water. Oceangoing tugs and barges so far involved in the annual runs to Prudhoe Bay draw 5.5 m to 6 m (18 to 20 ft.) of water. Even with causeways several miles long, such barges cannot be offloaded without lightening onto shallow-draft tugs. Other important factors in port site location include submarine topography, type of bottom sediments, coastal erosion, and nearshore sediment transport.

Few potential port sites along the Beaufort coast could accommodate ocean-going vessels. Sites that have been' identified as potential medium- to deep-draft ports include Pingak Island, Cross Island, Pole Island, Flaxman Island, and Kangigurik (Arctic Institute of North America, 1974). Lightering and long causeways will probably also be necessary to Beaufort Sea petroleum development transportation since there are no suitable port sites on the mainland adjacent to scenario field locations.

A sheltered harbor near the development area is a major factor in locating the supply base. Protection from fall storms and movement of sea ice requires location of the port in a protected natural harbor or inside a lagoon protected by offshore islands or construction of a jetty or causeway. Additionally, sites must be in the landfast ice zone. Potential port sites with suitable hydrographic conditions appear to lack shelter, and although the barrier islands afford protection from pack ice and storm waves, these waters are generally too shallow for port sites. Marine traffic in the Beaufort Sea will stay seaward of the barrier islands unless ice conditions force them shoreward where speeds have to be reduced because of shoals.

In selecting base camp and staging area sites, the location and timing of marine mammal and fish migrations must be considered (Table 10). Onshore habitats, such as polar bear dens, the caribou calving areas, and waterfowl nesting and molting sites, must be evaluated in the planning of ports and pipelines and the timing of onshore construction. These marine and terrestrial wildlife resources are important to the subsistence economies of the villages and the overall welfare of arctic ecosystems. Regulatory protection can be expected.

TABLE 10

LOCATION OF MARINE AND TERRESTRIAL WILDLIFE RESOURCES

SPECIES	LOCATION	REMARKS	USER GROUP[1]
Bowhead and Belukha Whales	Point Barrow-Pitt Point Harrison Bay	Seward to about 15 miles	Barrow
Ringed Seals	Wainwright-Barrow	Landfast ice and grounded pack ice	Wainwright and Barrow
	Cape Simpson-Pitt Point	Landfast ice and grounded pack ice	Barrow
	Cross Island-McClure Island	Landfast ice and grounded pack ice	None
	Maguire Island-Camden Bay	Landfast ice and grounded pack ice	Kaktovik
Waterfowl and Shorebirds	Plover Islands	Staging and molting	Barrow
	Pitt Pt.-Cape Halkett-Teshekpuk L.	Staging and molting	Barrow and Nuiqsut
	Colville River Delta	Nesting	Nuiqsut
	Jones Islands	Nesting	Nuiqsut
	Howe Island	Only snow goose nesting colony in Alaska	Nuiqsut
	Kaparuk River Delta	Nesting	Nuiqsut
	McClure Islands	Nesting	Nuiqsut
	Canning River Delta	Nesting	Kaktovik
	Sadlerochit River-Aichilik River	Snow goose staging area	Kaktovik
Musk Oxen	Canning River-Okpilak River	Resident	Tourists in Arctic Wildlife Range
Caribou	Teshekpuk Lake-Cape Halkett	Calving and resident caribou herd	Nuiqsut and Barrow
	Oliktok Point-Bullen Point	Calving and summer range	Tourists at Prudhoe Bay
	Katakturuk-Kougakut River	Calving	Kaktovik
Fish	Lower Meade River	Overwintering	Barrow-Atkasook
	Teshekpuk Lake	Overwintering	Barrow-Nuiqsut
	Lower Colville River	Overwintering	Nuiqsut
	Lower Kuparuk	Overwintering	Nuiqsut
	Lower Sagavanirktok River	Overwintering	Nuiqsut
	Lower Canning River	Overwintering	Kaktovik

References: Alaska Departmentof Fish and Game, 1977; Bergman, 1974; Burns et al., 1976; Cameron and Whitten, 1976, 1977; Craig and McCart, 1976; Davis and Valkenburg, 1977; Gavin, 1974, Hemming, 1971; Selkregg, 1975; Ward and Craig, 1974; Weller, 1977; Yoshihara, 1973.

[1] Communities depend upon marine and terrestrial wildlife primarily for subsistence.

SOURCE: Dames and Moore, 1978.

Marine traffic routes and the timing of such traffic may create significant impacts to marine mammal populations. Studies on the impact of the Canadian artificial soil island program in the southern Beaufort indicate that disturbance of wildlife is probably the most important impact. The availability of gravel and sand will not be very important to location of onshore facilities. If sand and gravel are in short supply at the chosen facilities site, alternative construction methods or substitute materials can be used, or gravel can be hauled to the site from another area. Either of these alternatives to local sources of gravel, however, significantly raise construction costs. Offshore petroleum development will probably require significantly more gravel for a given field size than an equivalent onshore arctic field.

Environmental concerns regarding sand and gravel extraction include siltation of fish spawning streams; siltation in offshore fish habitats, and acceleration of erosion on beaches, river and coastal bluffs, barrier islands, and the tundra surface.

Large quantities of fresh water are required during every phase of petroleum development. Like gravel availability, water availability will probably be only a minor influence in facilities siting, although the distance, and hence haulage or transmission costs, will be an economic factor in petroleum development.

The water supply problem in the Beaufort Sea Region is compounded by environmental impacts of its withdrawal, particularly in winter in portions of rivers and deep lakes where fish overwinter.

The discovery of important historic and archaeologic sites can modify the location of pipelines, base camps, etc. (The major river valleys of the North Slope, in particular, are historically and archaeologically important.) Archaeological surveys are generally conducted as part of siting studies and steps can be taken to protect or salvage significant finds without delaying construction schedules.

A typical staging area is characterized by harbor facilities which include a "T''-shaped loading dock (perhaps constructed of sunken barges as at Prudhoe Bay) connected to the shore by a 20-m (100-ft.)-wide causeway. Mooring space must be sufficient for the artificial island and platform construction and maintenance fleet, service vessels, shallow-draft tugs, and overwintering lightening barges. Depending on bathymetric conditions, the causeway may have to be 1 to 2 km (0.6 to 1.2 miles) or more long. The causeway may carry the offshore pipelines either buried or elevated. A ramp at the end of the causeway permits access on and off the ice for trucks and tractors. A dredge channel may be required; the dredged material could be used for construction of the causeway or artificial islands.

A marshaling area is developed near the dock for storage of such drilling equipment as casing and drill pipe, cement, drilling mud, water and fuel, tractors, skids, and other inactive materials. Base operation buildings are constructed on gravel pads. The total storage area is estimated to be 0.8 to 1.6 ha (2 to 4 acres).

An all-weather, gravel airfield from 1,523 to 1,828 m (5,000 to 6,000 ft.) long, capable of handling Hercules and medium-sized jet aircraft, is required.

Oil and gas processing facilities include an oil and gas separation and dehydration plant (flow station/gathering center), pump station, and a gas conditioning and compression plant. Other facilities include a permanent base camp and operations center, a power plant, a sewage treatment plant, and water storage. Camp accommodations for each selected scenario, as indicated by manpower estimates, are as follows:

	Number of Personnel Accommodated	
Scenario	Construction (Temporary Camp)	Operation (Permanent Camp)
Camden-Canning	2,000	650
Prudhoe-High*	2,500	800
Prudhoe-Modal*	1,500	500
Cape Halkett**	1,300	400

* Sufficient capacity is assumed to be available at existing Prudhoe Bay camps.
** Some of the operation workers will be housed on the platforms.
(Dames and Moore, 1978)

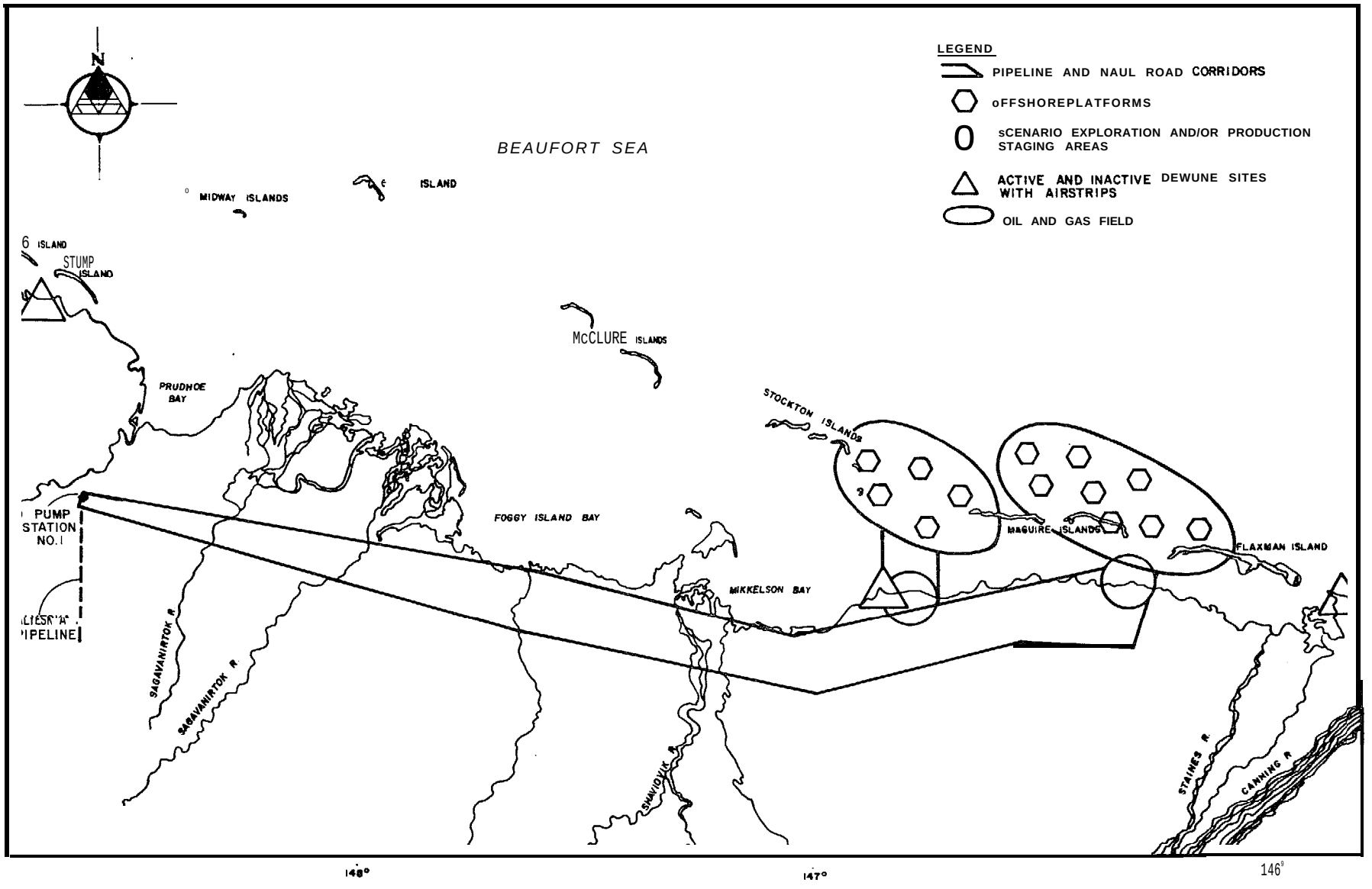
Camden-Canning Scenario

DESCRIPTION

The Camden-Canning scenario contains two major reservoirs (shown in Figure 6) within the lease-sale area. Surface expressions of the two fields encompass 10,500 ha (26,000 acres) and 6,900 ha (17,000 acres). The areas are assumed to be elliptical, underlying all or part of the following tracts cataloged in the joint state-federal lease sale area.(1)

Key: A - Joint and disputed ownership claim
B - Federal lands
C - State lands
D - Disputed

(1) Tract designations according to Alaska Division of Lands, Federal/State Beaufort Sea Oil and Gas Lease Sale Nominations Map (Preliminary, November 21, 1976).



SOURCE: DAMES & MOORE

FIGURE 6

CAMDEN–CANNING SCENARIO, 1.3 Bbbl. RESERVES

Camden Area - 18 tracts (19,578 ha)

181 (A)	199 (A)	217 (A)	230 (C)
195 (A)	213 (A)	218 (A)	231 (C)
196 (A)	214 (C)	227 (C)	232 (C)
197 (A)	215 (C)	228 (C)	
198 (A)	216 (C)	229 (C)	

52% state; 48% joint and disputed

Canning Area - 16 tracts .(17,464 ha)

176 (C)	190 (c)	194 (c)	212 (c)
177 (c)	191 (c)	209 (c)	223 (C)
178 (A)	192 (C)	210 (c)	224 (C)
179 (A)	193 (A)	211 (c)	225 (C)

82% state; 18% joint and disputed

Alternative tract locations with identical field expressions (area and shape) involved 37 tracts anda slightly different ratio of federal and state interests:

Camden Alternate Area - 19 tracts (25,432 ha)

663*	196 (A)	167 (B)	216 (C)	229 (C)
665*	197 (A)	181 (A)	217 (A)	230 (C)
191 (A)	198 (A)	214 (C)	218 (A)	231 (C)
195 (A)	199 (A)	215 (C)	228 (C)	

*Federal tracts of 2,304 hectares, not in joint state-federal area 24% federal; 48% joint and disputed, 28% state.

Canning Alternate Area 18 tracts (21,351 ha)

150 (A)	163 (A)	177 (c)	191 (c)	210 (c)
151 (A)	164 (A)	178 (A)	192 (C)	211 (c)
152 (B)	165 (A)	179 (.4)	193 (A)	
162 (C)	166 (A)	180 (A)	194 (c)	

9% federal; 57% joint and disputed; 34% state.

See Figures 5a and 5b for lease tract locations.

Exploration in the Camden-Canning scenario commences in 1982, development in 1986, and production in 1990. The life span of the field is estimated to be 26 to 31 years, starting with discovery in 1982 and field shutin for oil in the year 2010 and gas shutin by the year 2015.

The Camden-Canning oil fields straddle the barrier islands (roughly parallel to shore but separated by a small body of water such as a lagoon). Their long axis is approximately parallel to the trend of the islands. Seaward of the barrier islands the 20-m (60-ft.) isobath mostly lies just

outside the 5-km (3-mile) limit. Water depths at the field locations range from about 1 m (3 ft.) at the eastern end of Flaxman Island (inshore) to 4.3 m (14 ft.) about 600 m (1 mile) off Point Thompson to a maximum of about 15.4 m (50 ft.) outside the barrier islands.

The area outside the barrier islands may be affected by late summer storms and by grounding of pack ice ridges in fall and early winter. By late winter landfast ice will cover the field locations. Greater ice motion can be expected outside the barrier islands than landward of them. Offshore and onshore gravel resources can be anticipated in the Canning River delta area, the Shaviovik River, the barrier islands, and coastal beaches between the Canning and Shaviovik Rivers.

The two fields are assumed to share an airstrip and harbor but will have separate construction camps 24 km (15 miles) apart. A 103-km (64-mile road between Deadhorse and the Canning camp is assumed, including the harbor connector. Another 24 km (15 miles) of road are required for the Camden tie-in. A small boat ramp or removable pontoon pier is assumed at the camp (not adjacent to the harbor).

After construction, a single base camp area near the harbor will be used. A flow center with a capacity of 250 million barrels/day (Mb/d) and 230 billion cubic feet of gas/day (MMcfd) onshore opposite the Camden field will service that field and the remaining state lands production. Minimum capacity needed would be 180 Mb/d and 150 MMcfd. In the vicinity of the Canning field flow station, compressor and pump stations will provide motive force for delivery of the production to the respective Prudhoe Bay stations. A power plant will be included in the Canning onshore plant complex.

Primary oil and gas separation is accomplished on each platform, which averages 40 wells each. Some booster stations are used on the platforms to bring the oil ashore to the flow centers.

The exploration wells include, by allocation, all wells in the eastern Beaufort. Exploration within the Camden area is assumed complete with four wells; in the Canning, with five (Dames and Moore, 1978).

Platforms:		Soil/Gravel	Barge	Ice	Gravity
Camden:	Exploration	6	3	1	0
	Production	6	1	0	1
Canning:	Exploration	3	3	2	0
	Production	3	2	0	0

Wells:	Exploration	Oil	Gas	Development
Camden	10	262	7-8	53-52
Canning	8	171	5-4	22-23

Pipelines:	Oil		Gas		
	km	miles	km	miles	
Connector	85	53	63	39	Offshore
Trunk	10	6	10	6	
Onshore Trunk	87	54	87	54	

SUMMARY OF IMPACTS

Alaska

Economic/Demographic. The Camden-Canning scenario has the second largest statewide economic and demographic impact of those studied, but compared to recent Alaska experience the effects on aggregate indicators is relatively small. The major factor which moderates the substantial development impacts is the 19-year period over which they occur.

Table 11 shows total population, employment, and personal income for the Camden-Canning scenario over the non-OCS base. Population is 26,600 greater and employment is 11,700 jobs greater by the year 2000 than in the non-OCS base. These increases are cumulative throughout each phase of OCS development.

The Camden-Canning scenario reinforces trends found in the base case. OCS development generally supports the structural change found in base case employment. The local service sector of trade, service, finance, and transportation receives a majority of the impact employment. By increasing the economic opportunities available in Alaska, Beaufort development reduces outmigration of the young and reverses the general trend toward aging of the population.

Changes in personal income, exogenous employment, and state expenditures are responsible for generating statewide economic and demographic impacts over the base case. The most important causes of change in the Camden-Canning scenario are increases in exogenous construction and mining employment, which result from OCS development, and changes in state expenditures. OCS development produces revenues which increase state spending, which in turn affects economic growth. The expenditure impact is much greater in the production phase than in either exploration or development. The assumed flow of oil from the Camden-Canning scenario produces both royalties and severance taxes, which provide large increases in revenues over the base case, so state expenditures are a more important source of growth after the beginning of production.

Beaufort OCS development postpones the State's fiscal crisis when expenditures exceed revenues, for eight years after it occurs in the base (Table 12). After 1999 expenditures once again exceed revenues. This postponement is partially a result of the low increase in state services; real per capita expenditures increase only $5.60 over the base. This can be considered a positive fiscal effect of OCS development (ISER, 1978).

TABLE 11

CAMDEN-CANNING SCENARIO IMPACT ON AGGREGATE INDICATORS
STATE OF ALASKA
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	419.1	.0	191.0	1.0	4523.0	.0
1980	449.2	.0	187.8	1.0	5561.0	.0
1981	467.2	.3	226.9	.2	6061.3	8.3
1982[1]	464.3	1.1	219.5	.8	5741.3	31.3
1983	471.6	1.5	22.3	1.0	6053.9	43.9
1984	481.2	1.7	227.2	1.1	6488.5	48.5
1985	493.6	1.7	234.7	1.0	7077.7	45.7
1986[2]	502.4	2.4	239.2	1.4	7581.7	74.7
1987	508.4	4.4	241.8	2.8	7998.4	166.4
1988	512.4	8.0	243.2	5,3	8392.5	325.5
1989	517.6	9.2	246.0	5.5	8B44 .7	335.7
19903	525.1	12.6	251.0	7.6	9479.4	471.4
1991	532.6	14.5	255.9	8.3	10122.6	518.6
1992	539.0	16.6	260.0	9.1	10773.0	536.0
1993	546.4	18.1	265.1	9.5	11503.5	630.5
1994	553.4	20.1	269.9	10.4	12280.9	719.9
1995	561.8	22.0	275.7	11.0	13154.6	796.6
1996	567.5	22.3	279.7	10.6	13933.2	781.2
1997	576.1	23.7	285.9	11.0	14940.9	855.9
1998	583.3	24.4	291.0	10.9	15898.6	872.6
1999	592.5	25.2	297.9	11.1	17053.2	918.2
2000	602.2	26.6	304.9	11.7	18296.8	1007.8

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE: ISER, 1978

TABLE 12

IMPACT ON THE STATE FISCAL SECTOR OF
THE CAMDEN-CANNING SCENARIO
(measured as changes from the base)
[in millions of dollars][4]
STATE OF ALASKA
1979-2000

Year	Total Revenues	General Fund Balance	Permanent Fund Balance	Total Expenditures
1979	0.000	0.000	0.000	0.000
1980	125.002	0.000	125.000	0.003
1981	"134.022	0.000	250.000	9. 152
1982[1]	18.944	0.001	250.000	19.394
1983	20.750	0.001	250.000	21.382
1984	22.032	0.001	250.000	22.772
1985	22.958	0.001	250.000	23.707
19862	25.839	0.002	250.000	26.913
1987	36.539	-5.125	250.000	43.761
1988	60.150	-14.864	250.000	73.826
1989	85.288	-9.026	250.000	83.989
19903	211.581	56.750	287.469	114.741
1991	421.934	0.000	640.809	132.835
1992	591.347	0.000	1,087.400	153.484
1993	750.483	0.000	1,677.520	170.082
1994	897.615	0.000	2,393.060	193.164
1995	1,033.980	0.000	3,224.160	215.292
1996	1,150.47	0.000	4,164.800	222.652
1997	1,217.250	0. 000	5,153.200	242.859
1998	1,268.250	0.000	6,181.170	254.980
1999	1,304.450	0.000	7,230.370	270.875
2000	1,327.770	0.000	8,281.350	293.758

[1]Exploration begins
[2]Development begins
[3]Production begins
[4]Nominal dollars

SOURCE: ISER, 1978.

Transportation. Four separate types of transportation demands were analyzed to determine the impacts of each OCS scenario: (1) goods, materials, and supplies to the Beaufort Sea; (2) transportation of Beaufort Sea personnel, (3) induced statewide transportation of persons and goods; and (4) transportation of oil to markets. The discussion of transportation impacts for the state and each terminal point likely to be impacted will be under a section headed Alaska-Transportation for each scenario. The non-OCS base case established that adequate capacity exists for all transportation facilities except at Anchorage and Fairbanks airports and several sections of road that experience heavy recreational traffic in the summer. Forecasts for air and highway modes indicate that the contribution of OCS activities to the congestion of these facilities will be minimal over the forecast period.

Transportation impacts forecast for each of the Beaufort Sea OCS scenarios can be absorbed by existing and planned transportation facilities and services. However, during the course of the transportation analysis, two factors emerged which could significantly affect the nature and extent of transportation impacts -- the timing of other resource development activities and the use of ice-breaking vessels, including tankers.

If the Alcan gas line is constructed as scheduled, peak uses of transportation systems for its construction and for Beaufort Sea OCS activities will not overlap; but if it is delayed several years and Beaufort Sea development remains on schedule, conflicts could arise. The potential for other major construction projects to produce overlaps, particularly the building of a new capital city in Willow, could also produce problems that cannot be assessed at the present time.

The forthcoming results of oil and gas exploration in the Canadian Beaufort Sea may influence the oil companies' outlook towards all-water transportation of oil. Dome Petroleum Co. of Canada has taken preliminary steps toward constructing a large icebreaker (Class 10) that within a decade might assist LNG and oil tankers in reaching the east coast by an Arctic water route. Cape Halkett, in particular, may be more economically attractive if its resources can be transported by tanker rather than the existing pipeline system.

The Camden-Canning scenario is expected to have the largest number of exploration and development wells (538) and this consequently produces the greatest impacts for freight transportation. The projected annual tonnage in the first four years exceeds that for the 1970 sealift for exploration and development of Prudhoe Bay. Waterborne transportation is projected to carry approximately 97 percent of the goods and materials during these years. In order to handle the volume of goods and materials, barge and tug operators, such as Northern Transportation Co., Ltd., will probably have to expand its fleet to accommodate increased development in the Beaufort Sea. Alaska port facilities should not be impacted as a result of the increase in marine traffic because the movement of goods and materials will be direct from cities in the lower 48 via the Bering Sea route direct to the Beaufort Sea.

The remaining tonnage to be transshipped through major Alaskan ports will be minimal, and existing facilities should be able to accommodate the additional tonnage. The largest estimated tonnage in one year to enter by water and then eventually by air or road from Fairbanks to the Beaufort Sea is expected to be less than 3,175 metric tons (3,500 tons), or 3 percent of the total tonnage.

Transshipment via trucks is expected to peak in 1983 when manpower requirements are at their height, requiring a maximum of 19 trucks per month over the haul road. C-130 flights, which are used during spring breakup, will peak at approximately four per week. Passenger flights will peak at approximately eight per week (1.2 per day) in 1990. The impacts to motor freight, air freight, and air passenger systems should be negligible.

Impacts resulting from induced statewide transportation demand to Anchorage, Fairbanks, and the Beaufort Sea Regions are varied. Anchorage shows a steadily increasing induced employment beginning at approximately 100 in 1981 and reaching 8,800 in 2000. Until 1987 its impact on the annual growth in Anchorage is insignificant, but thereafter the effect is to double the increase in demand that would otherwise have occurred over the non-OCS base case. Because of the induced demand, the road systems will be less able to accommodate traffic; but the impact on intercity, routes, terminals, and carriers will be more limited.

Similar to Anchorage, employment in Fairbanks steadily increases and exceeds the non-OCS annual change beginning in 1988, but it never exceeds 1,000 employees during the study period. Induced employment throughout is roughly 15 to 20 percent of that for Anchorage. The buildup in transportation facilities that will occur for the gas line construction, even if inadequate, will be sufficient to accommodate subsequent increases, including that for the Camden-Canning scenario.

The impact on the Beaufort Sea Region of induced transportation demands will affect air transportation because most OCS workers have permanent residences outside the region. This will result in an increased demand for air passenger service between Barrow and Fairbanks and, to a lesser extent, points further south. In conjunction with the demand for Beaufort OCS on-site employees, an additional scheduled flight per day might be warranted. A larger base of demand might reduce the need for oil companies to engage in charter operations (Dooley and Assoc., 1978).

Anchorage/Fairbanks

Economic/Demographic. Anchorage, as was shown in the base case, is the headquarters for petroleum and petroleum support firms. Because of this past relation, it is assumed that increased petroleum activity on the North Slope will lead to increased support activity in Anchorage. Additionally, Anchorage growth is affected by increases in the demand for goods and services, which result from increases in the personal income of the region and remainder of the state.

Table 13 illustrates Anchorage's economic and demographic impacts resulting from the Camden-Canning scenario. This growth supports the increased concentration of population and employment in Anchorage. By the year 2000 population is anticipated to increase by 18,700 and employment by 8,800 over the non-OCS base case. Personal income rises by approximately $591 million for the same period.

Table 14 illustrates the growth in population, employment and personal income in Fairbanks. Fairbanks has the smallest proportionate employment impact of any of the regions described for this scenario. By 2000, the population is approximately 2,700 higher and employment is 1,000 jobs higher than the base case. However, the primary reason for this growth is increased state and local expenditures as a result of OCS development. The impact in Fairbanks is small for two reasons. First, there is no direct OCS employment assumed to locate in Fairbanks, as there was with the construction of the Trans-Alaska Pipeline. Second, because Fairbanks is small, the support sector response is not as great as Anchorage for either growth within the region or growth in other regions.

Fairbanks has only minimal impact for Camden-Canning development. Table 14 shows the expected growth in population, employment, and personal income. By 2000 employment is only 2.6 percent higher than the base case. Since Fairbanks has only minimal connection with oil and gas development, increases in employment are the major way the Fairbanks economy is impacted by OCS development. Although impacts are minimal, during exploration and development, they reduce the employment decline caused by decreases in Alcan construction (ISER, 1978).

Urban Services. Impacts resulting to Anchorage from oil and gas development in the Camden-Canning region primarily will be indirect. Table 15 shows the type and number of facilities projected as a result of increased population from Beaufort Sea OCS development. The timing of population growth is important in that Anchorage is expected to incur a downturn in the economy under the non-OCS base case at the time Camden-Canning scenario begins to have effects on the community.

The Camden-Canning scenario adds approximately 18,700 people to Anchorage by the year 2000 compared to the non-OCS base. While modest, this 5.5 percent cumulative increase adds to the non-OCS base ata time when the latter's growth rate is slowing. The later start up dates in this scenario could lead to a temporary downturn in the mid-1980's. The impact of service expenditures is incremental but would cause some budget increases. This scenario could also continue to alter the service demand structure to a more expansive model. However, stimulation to the economy and general revenue base should be sufficient to meet any projected needs. Because of this, increases resulting from the Camden-Canning scenario would most likely be positive in terms of the financial position of local government. The only difficult period would be from 1997 to 2000 when the aggregate growth rate turns sharply upwards. This could produce shortfalls in time of rapid growth (Ender and Assoc., 1978).

TABLE 13

CAMDEN-CANNING SCENARIO TOTAL ECONOMIC IMPACT
ANCHORAGE
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of $)	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	183.8	.0	86.7	.0	1790.6	.0
1980	194,6	.0	94.2	.0	2093,6	.0
1981	205.7	.2	98.5	.1	2312.0	3.6
19821	213.2	.6	98.0	.3	2362.6	11.7
1983	219.7	.8	98.0	.5	2536.6	16.3
1984	227.5	.9	100.2	.5	2748.6	18.3
1985	235.3	.9	107.4	.5	3005.2	18.5
19862	241.7	1.3	110.5	.7	3240.9	28.9
1987	247.1	2.3	113.0	1.5	3458.7	63.3
1988	250.7	4.1	115.5	2.9	3687.2	127.0
1989	255.6	5.0	117.7	3.0	3923.4	136.1
19903	262.3	7.4	121.5	4.0	4242.5	191.8
1991	269.1	8.8	125.3	4.5	4580.4	219.5
1992	275.4	10.3	129.0	4.9	4928.2	251.7
1993	282.6	11.5	133.3	5.2	5334.0	278.8
1994	289.4	12.9	138.1	6.0	5773.5	328.2
1995	297.4	14.3	143.3	6.6	6267.3	375.4
1996	304.0	14.7	148.1	6.5	6752.8	383.4
1997	312.7	15.8	154.4	7.2	7360.6	437.0
1998	320.8	16.5	160.6	7.4	7990.4	464.5
1999	330.7	17.3	168.2	7.9	8745.2	512.2
2000	341.3	18.7	177.1	8.8	9616.7	590.7

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE: ISER, 1978

TABLE 14

CAMDEN-CANNING SCENARIO TOTAL ECONOMIC IMPACT
FAIRBANKS
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] Millions of	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	68.2	.0	32.1	.0	766.2	.0
1980	81.2	.0	39.8	.0	1100.0	.0
1981	81.0	.0	39.2	.0	1129.2	1.1
19821	67.4	.1	30.9	.1	815.9	3.6
1983	67.9	.2	30.9	.1	848.7	4.7
1984	70.1	.2	31.5	.1	910.4	5.3
1985	70.4	.2	32.1	.1	980.3	4.7
1986[2]	71.1	.2	32.5	.1	1043.3	6.4
1987	71.5	.1	32.8	.2	1098.8	13.0
1988	71.0	.2	32.7	.3	1145.4	25.8
1989	71.3	.6	33.0	.4	1205.4	31.3
1990[3]	71.8	1.2	33.4	.6	1286.9	47.8
1991	72.4	1.7	33.9	.7	1369.2	55.9
1992	72.7	2.1	34.2	.8	1451.8	64.9
1993	73.1	2.4	34.7	.9	1542.6	70.4
1994	73.0	2.5	35.0	.9	1635.8	78.4
1995	72.9	2.4	35.5	1.0	1737.2	85.2
1996	73.0	2.7	35.8	.9	1833.5	84.3
1997	72.9	2.7	36.3	1.0	1947.2	89.5
1998	72.7	2.7	36.7	.9	2061.5	91.5
1999	72.5	2.7	37.2	.9	2190.2	94.6
2000	72.2	2.7	37.8	1.0	2330.3	102.3

[1]Exploration begins
[2]Development begins
[3]Production begins
[4]Nominal dollars
SOURCE: ISER, 1978

TABLE 15

CAMDEN-CANNING SCENARIO
ANCHORAGE URBAN SERVICE REQUIREMENTS

	1980	1985	1990	1995	2000
Population	194,636	235,334	262,262	297,321	341,297
Education: Primary/Secondary - No. of Teachers	0	8	59	114	150
Public Safety: Police- Manpower	0	1	12	22	29
State Troopers - Manpower	0	0	1	3	3
Fire: Manpower	0	1	11	21	28
Leisure: Play Lots	0	1	3	5	7
Neighborhood Parks	0	0	1	1	2
Softball Diamonds	0	0	3	5	6
Basketball Courts	0	2	15	28	37
Swimming Pools	0	0	1	1	2
Skating Rinks	0	0	0	0	1
Community Centers	0	0	0	0	1
Utilities: Water - (Millions of Gallons per Day)	0	.2	1.5	2.9	3.8
Sewer - (Millions of Gallons per Day, Wastewater Generated)	0	.2	1.2	2.3	3.0
Housing: Units	0	941	2,372	4,597	6,029
Health: bed Needs	0	2	14	28	36
Primary Care Physicians	0	2	9	18	23
Social Services: Day Care Space	0	15	110	213	280
Unemployment Claimant	0	61	478	925	1,215
Low Income Housing Units	0	43	110	212	279

Note: 1982 exploration begins
1985 development begins
1990 production begins

SOURCE: Ender & Assoc., 1978.

Beaufort Sea Region

Economic/Demographic. The Beaufort Sea Region receives the majority of the direct impact resulting from Camden-Canning OCS development. At its peak in 1990, the region has 94 percent of the direct OCS employment. Because of the enclave nature of employment, its long-term secondary impact on the region is small. By 2000 approximately 56 percent of the impact employment is directly related to OCS development (ISER, 1978).

Table 16 shows the forecasts of employment for the region and the communities of Barrow, Kaktovik, Nuiqsut, and Wainwright. Employment growth in the case of the Camden-Canning OCS scenario parallels that of the non-OCS base case through 1981. Thereafter, the number of jobs added in the region due to Camden-Canning development rises each year through 1988 when a peak of 3,300 new jobs are forecast to occur.

Table 17 shows forecasts of population for the Beaufort Sea Region and the four communities mentioned above. As with employment growth, population growth in this area is expected to parallel the non-OCS base case through 1981. After peak gas line construction the population of the region falls off but not as severely as in the non-OCS base case (Alaska Consultants, 1978).

Community Services. Virtually all impacts of Beaufort OCS oil and gas development on community facilities and services in North Slope Borough traditional settlements will be indirect since it is assumed that oil and gas development will continue to be based out of industry enclaves. However, the various OCS scenarios will have a direct impact on local government finances through the North Slope Borough's taxation of oil and gas (and other) properties. These funds will, in turn, be expended to upgrade and operate community facilities and services in the various permanent towns of the region.

The timing of field development for the various OCS scenarios under consideration is generally not very significant in terms of impacts on North Slope Borough communities. However, startup dates are very important. In a non-OCS case, the North Slope Borough is forecast to experience a period of deficits in revenue through FY 1985/86 which would force it to levy a debt service tax. A similar, although less serious deficit position has been forecasted for FY 1988/89 through FY 1989/90 in a non-OCS case (Table 18). If exploration begins in 1982, and development in 1986, the revenues derived by the North Slope Borough from Camden-Canning development may eliminate the Borough's deficit between 1986/1987 and 1989/1990 and reduce the deficit between 1982/1983 and 1985/1986.

Although the traditional communities of the North Slope region will experience some growth in population and employment in a Camden-Canning OCS scenario, the added impacts on facilities and services will be minor. In many cases, the Borough has already planned for projected OCS needs. The only significant exceptions are additional needs for housing and utilities services in Barrow.

TABLE 16

FORECAST OF EMPLOYMENT
CAMDEN-CANNING SCENARIO
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Employment									
	Barrow [a]		Kaktovik [b]		Nuiqsut [b]		Wainwright [c]		Region [d]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	9159	0	36[e]	0	42[e]	0	58[f]	0	6,490	0
1980	962	0	36	0	43	0	63	0	8,308	0
1985	1,097	22	39	2	46	0	73	1	7,268	225
1990	1,256	54	43	4	50	2	86	5	8,338	2,569
1995	1,438	94	48	7	54	3	102	8	8,326	1,843
2000	1,647	145	53	10	58	5	110	10	8,784	1,251

a Barrow's employment forecasted at the current rate of approximately 1 job for every 3 local residents.
b Kaktovik and Nuiqsut's employment forecasted at the current ratio of approximately 1 job for every 3.8 local residents.
c Wainwright's current ratio of approximately 1 job for every 6.9 local residents is not considered to remain constant in this forecast. It is estimated that the 1980 ratio will be 1:6.5, the 1985 ratio 1:6.0, the 1990 ratio 1:5.5, the 1995 ratio 1:5.0 and the 2000 ratio 1:5.0, thus tending toward the existing ratios in other traditional villages in the region outside Barrow.
d Regional employment forecasts developed by ISER for the Alaska OCS socio-economic studies program.
e Average annual employment estimates derived from Alaska Consultants, Inc. counts in December 1977.
f Average annual employment estimate derived from Alaska Consultants, Inc. count in April 1977.

Note: 1982 Exploration begins
1986 Development begins
1990 Production begins

SOURCES: Alaska Consultants, 1978.
ISER. 1978.

TABLE 17
FORECAST OF POPULATION
CAMDEN-CANNING SCENARIO
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Population									
	Barrow		Kaktovik		Nuiqsut		Wainwright		Region[b]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	2,700[c]	0	1344	0	157$!	0	398[d]	0	9,323	0
1978	2,761	0	135	0	159	0	402	0	7,168	0
1979	2,823	0	136	0	161	0	406	0	8,516	0
1980	2,887	0	137	0	163	0	410	0	9,980	0
1981	2,952	0	138	0	165	0	414	0	10,679	
1982[e]	3,033	15	141	2	167	0	420	2	8,518	13;
1983	3,116	30	144	4	170	1	426	4	8,454	263
1984	3,202	47	147	6	173	2	432	6	8,484	233
1985	3,290	64	150	8	176	3	438	8	8,520	247
1986[f]	3,380	81	153	10	179	4	445	11	9,194	717
1987	3,473	100	156	12	182	5	452	14	10,242	1,983
1988	3,569	120	159	14	185	6	459	17	12,151	3,864
1989	3,667	140	162	16	188	7	466	20	10,049	2,969
19909	3,768	162	165	18	191	8	473	23	10,168	3,058
1991	3,872	185	168	20	194	9	480	26	9,661	2,361
1992	3,978	208	171	22	197	10	487	28	9,24	1,798
1993	4,087	232	174	24	200	11	494	30	9,095	1,454
1994	4,199	257	177	25	203	12	501	32	9,510	1,714
1995	4,314	283	181	27	206	13	509	35	9,779	1,795
1996	4,433	311	185	29	209	14	517	38	9,394	1,237
1997	4,555	340	189	31	212	15	525	41	9,873	1,507
1998	4,680	370	193	33	215	16	533	44	9,709	1,147
1999	4,809	402	197	35	218	17	541	47	9,879	1,083
2000	4,941	435	201	37	221	18	549	50	10,133	1,112

[a] Barrow's population forecasted at an annual rate of increase of 2.25 percent through 1981 (non-OCS forecast) and thereafter at an annual rate of 2.75 percent. Kaktovik, Nuiqsut and Wainwright's population forecasted at an annual rate of increase of 1 percent through 1981 (non-OCS forecast); thereafter Wainwright and Nuiqsut populations are projected at an annual rate of increase of 1.5 percent and Kaktovik's population at an annual rate of 2.0 percent.
[b] Regional population forecasts developed by ISER for the Alaska OCS socio-economic studies program.
[c] Barrow's 1977 population estimated by Alaska Consultants, Inc.
[d] North Slope Borough Planning Department population estimates.
[e] Exploration begins
[f] Development begins
[g] Production begins

SOURCES: Alaska Consultants, 1978
ISER, 1978,

TABLE 18

ESTIMATED REVENUES AND EXPENDITURES
CAMDEN-CANNING OCS SCENARIO
NORTH SLOPE BOROUGH
FY 1977/78 - FY 2000/01
(in 000's of Real $)

Fiscal Year	Expenditures			Revenues			Surplus (Deficit)	Debt Service[d] Mill Rate
	Operating Budget	Debt Service	Total	Property Taxes	Other Revenues	Total		
1977/78a/	$30,126b/	$7,634	$37,760	$18,922	$11,204	$30,126	($7,634)	7.52
1978/79-	29,288	23,027	52,315	22,309	12,342	34,651	(17,664)	23.8
1979/80	31,631	22,026	53,657	28,644	13,595	42,239	(11,418)	12.0
1980/81	34,161	24,503	58,664	36,272	14,975	51,247	(7,417)	6.1
1981 /82	36,894	23,200	60,094	41,925	16,497	58,422	(1.672)	1.2
1982/83	39,846	23,252	63,098	40,101	18,174	58,275	(4,823)	3.6
1983/84	43,034	25,737	68,771	38,684	20,027	58,711	(10,060)	7.8
1984/85	46,477	22,007	68,484	41,927	22,052	63,979	(4,505)	3.2
1985/86	50,195	22,756	72,951	45,474	24,294	69,768	(3,182)	2.1
1986/87	54,211	21,078	75,289	53,011	26,762	79,773	4,484	
1987/88	58,548	21,309	79,857	63,799	29,487	93,286	13,429	
1988/89	63,232	19,954	83,186	75,036	32,480	107,516	24,330	
1989/90	68,291	19,034	87,325	73,009	35,780.	108,789	21,464	
1990/91	73,754	15,301	89,055	79,786	39,413	119,199	30,144	
1991/92	84,654c/	--	84,654	81,859	43,424	125,283	40,629	
1992/93	91,426	--	91,426	84,608	47,831	132,439	41,013	
1 993/94	98,740.	--	98,740	89,869	52,688	142,557	43,817	
1994/95	106,640	--	106,640	101,502	58,045	159,547	52,907	
1995/96	115,171	--	115,171	112,733	63,944	176,677	61,506	
1996/97	124,384	--	t 24,384	116,944	70,440	187,384	63,000	
1997/98	134,335	--	134,335	132,759	77,592	210,351	76,016	
1998/ 99	145,082	--	145,082	140,991	85,480	226,471	81,389	
1999/00	156,689	--	156,945	154,945	94,160	249,105	92,416	
2000/01	169,224	--	169,224	171,656	103,735	275,391	106,167	

a/ North Slope Borough budget figures. Revenues and expenditures, with the exception of debt service, projected at 8% annual increase. "

b/ Includes 43 million for capital outlay. The remainder is projected at 8% increase per year.

c/ Includes $5 million for capital outlay from FY 1991/92 compounded annually at 8 percent through FY 2000/01 for pay-as-you-go capital outlays.

d/ Levied per AS 29.53.055 above 30 mill levy under AS 29.53.045(c).

SOURCE: Alaska Consultants, 1978.

As in the case of the other OCS scenarios under study, borough revenues should be significantly increased in the case of a Camden-Canning OCS scenario. These increases in revenue should be more than adequate to cope with any new impacts on community facilities and services.

No additional impacts on the Beaufort Sea Region beyond those identified in the non-OCS case are anticipated in a Camden-Canning OCS scenario. However, the following significant impacts on North Slope Borough traditional communities are anticipated.

1. Although Kaktovik is forecast to grow at a faster rate than Nuiqsut or Wainwright because of its proximity to the Camden-Canning area, the numbers of people added in all three villages will be small. Some continued outmigration to Barrow and outside the region will take place but to a lesser extent than in the case of the non-OCS scenario.

2. Barrow's population is forecast to grow at a faster rate than in the non-OCS case. Since rates of outmigration from the smaller villages of the region are expected to be lower in the Camden-Canning scenario, a significant share of Barrow's new population is expected to be non-Inupiat.

3. Borough revenues will be considerably above those which could be realized in a non-OCS case. Thus, additional needed community facilities and services could probably be provided without undue financial hardship to the Borough.

4. The major areas of additional impact on the community services of the region's traditional communities will be housing and utilities services, particularly in Barrow.

5. Although the Camden-Canning scenario will assist the Borough's long-term financial position, it will not be as timely as the High or Modal Prudhoe Bay scenarios in the immediate future because of later startup. This is significant because the Borough is facing a period of deficits, through FY 1985/86.

No additional problems or issues affecting the regional and community infrastructure are foreseen in this OCS scenario except, possibly, that the increased proportion of non-Inupiat in Barrow's population could lead to changes in demand for facilities and services as well as some potential social problems (Alaska Consultants, 1978).

Natural Resources. The same pressures that existed on North Slope natural resources in the non-OCS base are evident in the Camden-Canning scenario.

Direct impacts to the North Slope communities are not likely to be significant. The Camden-Canning exploration area is more than 100 kilometers (63 miles) from Kaktovik, the nearest village. Since most hunting and fishing occurs within one day's travel from the village, there should be little direct impact on these activities.

Water use and waste disposal at the Camden-Canning complex will not directly impact the residents of Kaktovik or other villages. Petroleum development is assumed to be of the enclave type, and it is anticipated that there will be little if any travel to Kaktovik.

There is insufficient gravel resource data to indicate possible borrow sites or to properly assess the impact on the resource base. However, the most likely onshore source will be the Canning River delta, which is an important habitat of waterfowl and shorebirds.

Table 19 illustrates and summarizes potential impacts that may occur in the North Slope region as a result of OCS development in the Camden-Canning area.

impacts may occur to wildlife and this will require that exploration and development in the Camden-Canning area be conducted with extreme care, including selection of staging areas, camps, and pipeline routes both offshore and onshore.

The calving area of the Central Arctic Caribou Herd extends from Bullen Point west to Oliktok. In addition, caribou make extensive use of beaches, spits, and river deltas from June to August to escape biting insects and parasitic flies. They also wade and swim in rivers and lagoons. Construction camps or above-ground pipelines in this area could cause critical summer ranges to be abandoned, as observed by the Alaska Department of Fish and Game at Prudhoe Bay (Cameron and Whitten, 1976; 1977). Coastal oil spills could influence caribou use of the coastal fringe. Burial of pipelines, especially through river deltas, would help to assure caribou passage.

Excessive disturbance at some barrier islands during exploration or construction of facilities can cause abandonment of seal pups and haulingout areas. However, no concentration of seals has been reported in this area to date.

Water contamination from petrochemical pollution would be a threat to marine mammals, birds, fishes, and the marine food web in general.

Critical fish overwintering areas have been identified on the deltas of the Kavik and Canning Rivers. Gravel mining or collection of potable water could seriously impact these areas (Wilson et al., 1977).

Dredged islands or onshore facilities with living facilities will undoubtedly attract Arctic foxes and other scavengers, even with good garbage disposal practices. Also, though it is prohibited, workers often feed wildlife. Animals attracted by garbage and deliberate feeding are often killed by moving equipment or shot when they become a nuisance.

Polar bears are known to den between the Sagavanirktok and Canning Rivers. The bears usually range beyond the shorefast ice but must be considered a serious threat to man whenever they are nearby (Dames and Moore, 1978).

TABLE 19

NATURAL RESOURCES

Summary of Impacts on Fish and Wildlife Resources, Water Quality/Resources, Sanitation, and Gravel Resources

RESOURCE	POTENTIAL IMPACT
Seals	Direct disturbance from boats and aircraft in the Maguire Islands - Camden Bay area.
Whales	Some direct disturbance from boats and aircraft within shipping zones and the oil field.
Polar Bear	Some potential for influence on denning.
Foxes and Wolves	Increased mortality from vehicle hits when animals are attracted by direct feeding or improper garbage disposal.
Caribou	Some direct disturbance of caribou calving and movements from motorized vehicle traffic east and west of the Canning River.
Muskoxen	Some potential for disturbance from motorized vehicles east of the Canning River.
Waterfowl	Direct disturbance from boats and aircraft; nesting habitat loss from gravel mining on the Canning River delta or barrier islands.
Fish	Siltation of feeding and spawning areas from gravel mining; blockage to fish passage by gravel mining - caused changes to stream channels; modification of groundwater flow to fish overwintering areas on the Canning River delta from gravel mining.
Hunting and Fishing	Minimal influence on target species within one day's travel from Kaktovik.
Water Quality	Increased turbidity and contaminants may occur, however if there is compliance with OCS operating orders and state operating orders, water quality impacts will be minimal.
Water	Increased water withdrawal may affect the Kavik and Canning rivers and overwintering fish. There may also be minor conflicts between village and industry water resource requirements.
Sanitation	Waste disposal will not directly impact Kaktovik or other villages.
Gravel	Total gravel requirements are 13,353, 211 cubic meters (17,360,952 cubic yards). Sufficient onshore borrow exists in the Canning River delta and Shaviovik River flood plain. Fish overwintering areas need to be avoided in eastern channels of Canning River as do waterfowl and shorebird habitats in lakes of delta.

SOURCE : Dames and Moore, 1978.

Sociocultural. Subsistence hunting and fishing is an important sociocultural activity for the Inupiat population. Pressures to the sociocultural system described in the Non-OCS base will exist through the forecast period in the Camden-Canning scenario. In addition, the exploration, development and production of oil and gas in the Camden-Canning area may intensify change to the sociocultural system. The primary impacts likely to occur as a result of this development are summarized below:

Population
The natural rate of increase projected for the Inupiat population through the year 2000 is not expected to affect the natural resource population or alter subsistence patterns. However, a significant Inupiat population migration induced by OCS employment opportunities would place additional pressure on these resources.

Non-Inupiat migrants to the Camden-Canning area can be expected to impact Inupiat subsistence through increasing levels of sport hunting and fishing, which will intensify pressures on wildlife population and stimulate competition between subsistence and sport users. In addition to potential conflicts over hunting and fishing, interpersonal contact between Inupiat and non-Inupiat (enclave population) can be expected to occur, and human influences on the environment within the enclave area can be expected to affect neighboring communities.

Employment
The Camden-Canning scenario is projected to create employment opportunities within all traditional communities. The expanded tax base available to the North Slope Borough and the increased business opportunities open to Native corporations may stimulate increased expenditures and investments in the communities, and this may stimulate immigration of non-Inupiat populations, particularly in Barrow. The result of this may affect the socioeconomic subsistence complex by increasing the availability of cash and altering levels of participation in subsistence activities.

Housing
Development of new housing units and increasing construction of multifamily units in Barrow are expected to affect subsistence. Housing costs, including payments, rents, utilities, and fuel will require cash income, which may necessitate permanent employment that restricts subsistence activities. However, multifamily housing may strengthen family ties by the need to return to the traditional family home to process and store harvested goods .

Natural Physical Environment
Adverse impacts on the environment and natural resources could potentially have a direct relationship to the subsistence complex. Damage to fisheries would have a greater impact on the

elderly, women, and children, whose primary subsistence pursuits are related to fish resources. Negative impacts on the marine mammal population would initially affect the activities of the male population but would decrease the resource base for the entire community. Adverse impacts to these resources may result from water pollution from offshore drilling and waste disposal from camps that may damage food sources. If this resulted in lowering the amount of hunting and fishing activity and, hence, a reduction in cooperative hunting efforts by the kin-based crews, the patterns of community sharing and various feasts and ceremonies would be altered.

Gravel extraction from the Canning River may affect overwintering fish, while offshore gravel mining operations could disturb the high-density ringed seal areas seaward of Flaxman and Maguire Islands. If gravel mining operations were to occur in the nearshore zone of the Canning River delta, they could adversely affect this biologically productive area for many species in the food chain.

Transportation

Potential regional transportation impacts on subsistence associated with the Camden-Canning scenario exist where traffic may affect the migrating patterns of wildlife populations. Because of the season and limited period of migration, compounded by restrictive quotas on caribou and bowhead whales, marine traffic which disrupts the harvest of marine mammals could result in serious impacts to Inupiat food supplies.

Cultural

The non-Inupiat population increase projected for Barrow is not expected to immediately and directly affect the Inupiat cultural traditions; however, their presence over time will influence cultural traditions. Potential impacts to environmental and wildlife populations will impinge on cultural values through adverse impacts to subsistence. Decreased subsistence activities are likely to affect cooperation and sharing and Inupiat dance and art, which are cultural expressions of their relationship with their environment.

Political

Projected population increases during the Camden-Canning scenario are not expected to negatively impact Inupiat political control and majority positions on local community councils and the regional borough government. Most new population will be housed in industry enclaves, and it is not anticipated that they will establish local governments or participate in borough politics. However, the level of population growth in Barrow may result in the election of non-Inupiat members to the city council.

Interethnic Relations

Two types of impacts have great importance to interethnic

relations -- those which are documented, such as oil spills, construction activity, and other tangible evidences of change, and those which are perceived. Perceived impacts need not be documented to be tangible. It is enough that they are felt to be occurring by a group.

Since activity for the Camden-Canning scenario is assumed to be staged away from North Slope communities, its visibility and direct interethnic impact should be low. However, the potential environmental impacts cited early in this report may effect perceptions of development, specifically for Kaktovik.

Social Health

Viewed in the context of non-OCS development, the Camden-Canning scenario may create an additional burden on the Inupiat feeling that their life-style is threatened by potential environmental impacts. Because of its proximity, Kaktovik will be most affected. The potential exists for deterioration of social health caused by conflicts and tensions from the already described cumulative impacts of the Camden-Canning scenario on the socio-cultural system. Possible results are increases in alcohol and drug abuse, intrafamily violence, and other crime.

Family Relationships

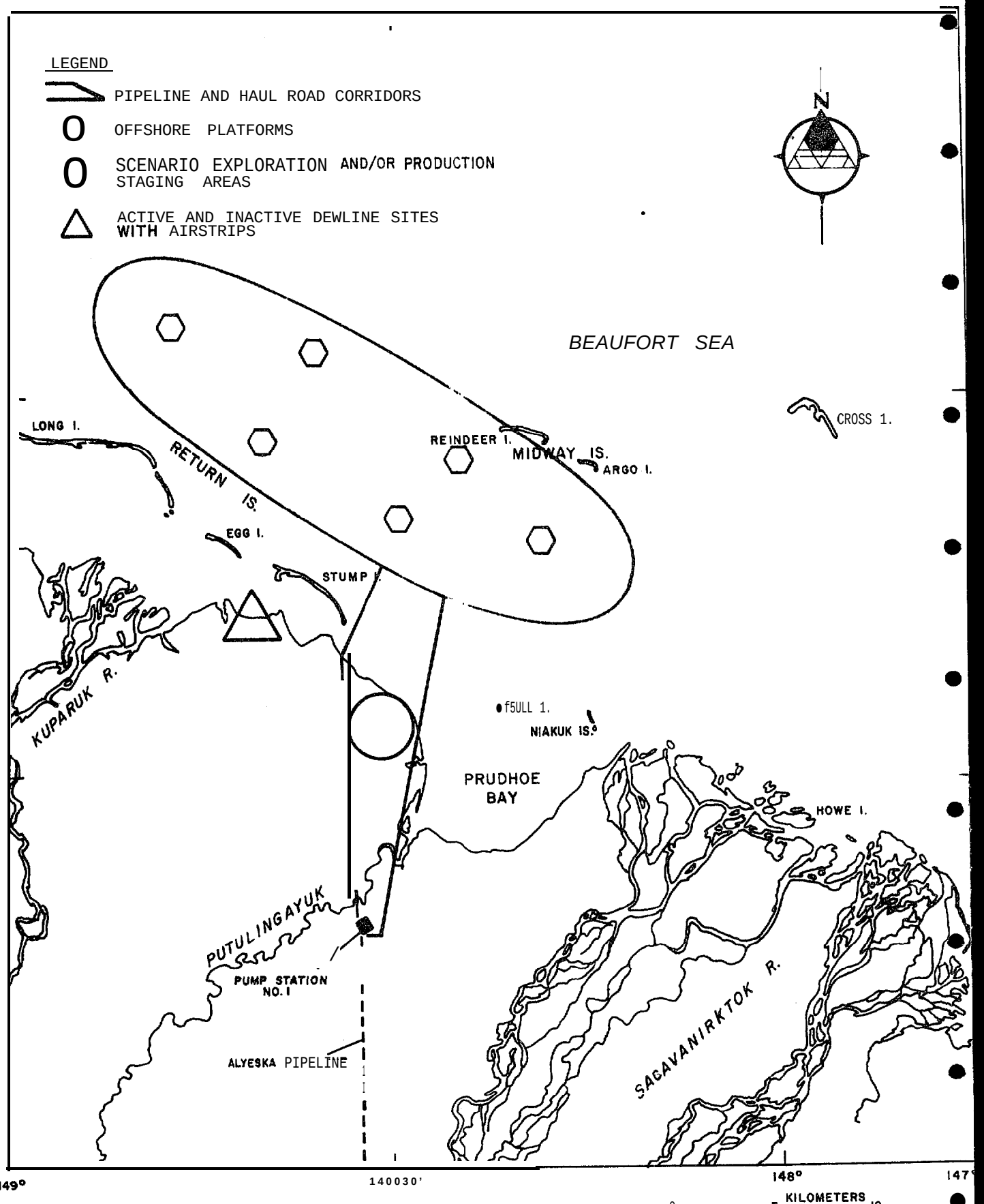
Changes in the physical, economic, and social environment will also manifest changes in family relationships. For example, an increased number of available housing units and moves by some members of extended families into two or more housing units will result in fragmentation of extended family living arrangements. While new living conditions may promote improved health, family relations may be weakened and some people may participate less in subsistence.

The cumulative effect of the impacts on the family together with other possible changes described in this section pose the potential for increased family violence, child abuse, divorce, and ultimate degeneration of the central role played by the family unit. Deterioration of family relations poses grave ramifications for the maintenance of the Inupiat society as distinct and unique from the Westernized and urbanized communities. The Inupiat extended family is the basic social unit through which traditional cultural and economic activities are conducted (Worl and Assoc., 1978).

Prudhoe-High Scenario

DESCRIPTION

The Prudhoe-High lease sale area as shown in Figure 7 encompasses 15,385 ha (38,000 acres) of the central Alaskan Beaufort Sea and is assumed to



SOURCE : DAMES & MOORE

FIGURE 7
PRUDHOE HIGH SCENARIOS, 1.9 Bbbl. RESERVES

contain 1.9 Bbbl of oil and 4.75 tcf of gas. The tracts assumed involved in the surface expression of the reservoir are:

Key: A - Joint and disputed ownership claims
B - Federal lands
C - State lands
D - Disputed

Prudhoe-High, 31 tracts (34,157 ha)

44 (A)	62 (C)	80 (C)	86 (c)	99 (c)	114 (A)
45 (A)	63 (C)	81 (A)	87 (C)	100 (A)	
46 (A)	64 (D)	82 (A)	95 (c)	110 (c)	
47 (A)	65 (A)	83 (A)	96 (A)	111 (A)	
48 (A)	66 (c)	84 (C)	97 (A)	112 (A)	
61 (A)	67 (C)	85 (C)	98 (C)	113 (A)	

36% state; 65% joint and disputed,

As an alternate location a short distance away in deeper water, the following tracts are involved. The shape and extent of the reservoir projection are identical, but the number of tracts involved is less.

Prudhoe-High Alternate, 30 tracts (37,511 ha)

427*	47 (A)	64 (D)	82 (A)	87 (C)	100 (A)
428*	48 (A)	65 (A)	83 (A)	96 (A)	111 (A)
429*	49 (A)	66 (c)	84 (C)	97 (A)	112 (A)
45 (A)	50 (A)	67 (C)	85 (c)	98 (A)	113 (A)
46 (A)	63 (A)	68 (c)	86 (c)	99 (c)	114 (A)

*Federal tracts of 2,304 ha not included in joint state/federal lease sale.
22% state; 18% federal; 60% joint and disputed.

Although the federal tracts are not included in the sale, it is reasonable to assume that they would be offered at a special sale along with other open tracts in the 1985-88 period. No adjustments or delays in development are anticipated since drilling and platform construction extend well beyond that period. Lease tracts are shown on Figures 5a and 5b.

Exploration commences in 1979, development in 1984, and production in 1988. The life span of the field is estimated to be 25 to 33 years, starting with discovery in 1982 and field shutin for oil in the year 2006 and gas shutin by the year 2014.

The physical setting and environmental considerations for Prudhoe-High are the same as for Prudhoe-Modal.

The Prudhoe-high scenario is assumed to make use of the Prudhoe Bay infrastructure, but oil facilities are not considered to be available. An airstrip, harbor, and construction camp will not be necessary.

Two flow centers onshore, each of about 325 Mbbl/d and 280 Mbbl/d minimal capacity, will be needed. Twin trunk corridors to shore may be used, although a single trunkline onshore is projected for the 15-km (9.5 mile) distance to the Alyeska-Alcan terminals, If onshore flow center space is not available, it is possible to locate the flow centers offshore. Modular treatment centers will be installed at each platform, possibly as an auxiliary platform separated for safety. Flow center power is purchased from surplus or expansion of existing facilities, depending on whether the field output is expanded in the 1979-83 time period.

With respect to the 14 exploration wells allocated to the scenario, only three of four are projected within the field boundaries (Dames and Moore, 1978).

Platforms:	Barge	Soil/Gravel	Ice	Gravity
Exploration	4	7	3	0
Production	1	4	0	1

Wells:

Exploration - 14
Oil - 253
Gas - 15
Development - 22

Pipelines:	Oil		Gas	
	km	miles	km	Miles
Connector	68	42	48	30
Offshore Trunk	6	4*	6	4*
Onshore Trunk	15	9.5	15	9.5

*With twin corridors - 16 kilometers (10 miles).

SUMMARY OF IMPACTS

Alaska

Economic/Demographic. The economic and demographic impacts from development of the Prudhoe-High scenario are highest of all those studied but still relatively small compared to recent Alaska experience. Table 20 shows total population, employment and personal income between 1977 and 2000.

The total population increase over the base case for the Prudhoe-High scenario by 2000 is approximately 40,200. According to estimates of the Alaska Department of Labor, the Alaska population increased from 302,000

TABLE 20

PRUDHOE HIGH SCENARIO IMPACT ON AGGREGATE INDICATORS
STATE OF ALASKA
1979-2000

YEAR	POPULATION TOTAL (Thousands of Persons)	POPULATION CHANGE FROM BASE CASE (Hundreds of Persons)	EMPLOYMENT TOTAL (Thousands of Employees)	EMPLOYMENT CHANGE FROM BASE CASE (Hundreds of Employees)	PERSONAL INCOME[4] (Millions of TOTAL	PERSONAL INCOME[4] (Millions of CHANGE FROM BASE CASE
19791	419.4	.3	198.8	.2	4531.7	8.7
1980	449.9	.7	219.0	.5	5584.9	23.9
1981	468.0	1.1	227.4	.7	6082.1	29.1
1982	464.7	1.5	219.6	.9	5748.5	38.5
1983	471.8	1.7	222.3	1.0	6052.4	42.4
19842	481.4	1.9	227.2	1.1	6488.0	48.0
1985	494.4	2.5	235,1	1.4	7103.0	71.0
1986	508.6	8,6	243.8	6.0	7862.9	355.9
1987	514.9	10.9	245.9	6.9	8239.2	407.2
19883	517.6	13.2	245.8	7.9	8501.6	434.6
1989	525.5	17.1	250.6	10.1	9072.0	563.9
1990	531.7	19.2	254.2	10.8	9633.9	625.9
1991	539.5	21.4	259.2	11,6	10302.1	698.1
1992	546.6	24.2	263.8	12.9	10977.1	790.1
1993	554.5	26.2	269.1	13.5	11731,7	858.7
1994	560.8	27.5	273.1	13.6	12457.6	896.6
1995	569.2	29.4	279.0	14.3	13338.5	980.5
1996	576.5	31.3	284.0	14.9	14222.8	1070.8
1997	585.7	33.3	290.6	15.7	15262.3	1177.3
1998	594.3	35.4	296.6	16.6	16320.4	1294.4
1999	605 .1	37.8	304.4	?7.6	17570.9	1435.9
2000	615.8	40.2	311.9	18.7	18876.8	1597.8

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE : ISER, 1978

in 1970 to 405,000 in 1975. This is an increase of more than 34 percent in only five years. The largest one-year population increase as a result of Prudhoe-High development is 6,100 between 185 and 1986 over the non-OCS base, comparable to the estimated 50,000 population increase between 1974 and 1975. Though the increase by 2000 over the base case is not minimal for any of the aggregate indicators (7 percent for population, 6.4 percent for employment, 9.2 percent for personal income, and 13 percent for state expenditures), the 20-year period minimizes the overall impact.

Base case trends in the employment sector were, for the most part, supported by this development. Prudhoe-High development leads to increased importance of the local service sectors, retail trade, service, and transportation. Growth of local support sectors due to Prudhoe-High employment bolsters the current trend toward reduced seasonality. However, development induces a population increase greater than the induced employment increase. Because of this, the overall population to employment ratio will increase, and more people per job may increase overall unemployment.

Age increases in the population will be slowed by Beaufort development, primarily because more economic opportunities decrease the outmigration of young people. Another population trend which will be reversed by Beaufort development is that the Native proportion of population will remain approximately the same as at the beginning of the period.

The revenues (Table 21) which flow to the State as a result of Beaufort development have two significant impacts. First, they allow an expansion of the services of state government. Real per capita state expenditures increase about 4 percent over the base case. Second, the increased state revenues delay the fiscal crisis which occurs when expenditures exceed revenues and the Permanent and General Funds must be drawn down to support expenditures. Because of the expenditures response to these increased revenues, Prudhoe-High development only delays this crisis; it does not eliminate it (ISER, 1978).

Transportation. The maximum number of oil and gas wells drilled in any one year for the Prudhoe-High scenario is 48, which is more than for all other scenarios except Camden-Canning. Peak annual freight requirements approach 80 percent of the 1970 Prudhoe Bay sealift. The total freight requirements for the development of this scenario are less than for Prudhoe-Modal, but the more intensive development scheduled for Prudhoe-High will mean greater peak annual demands.

Air transportation requirements are highest from 1989 to 1992. Passenger seat requirements peak with a demand of approximately 146 seats per dav. Air support for industrial and camp goods routed through Fairbanks are" expected to peak during periods of spring breakup in the years 1987 and 1988. Demand will equal approximately nine Hercules cargo trips per month.

TABLE 21

IMPACT ON THE STATE FISCAL SECTOR OF
THE PRUDHOE-HIGH SCENARIO
(Measured as Changes from the Base)
(in Millions of Dollars)[4]
STATE OF ALASKA
1979-2000

Year	Total Revenues	General Fund Balance	"Permanent Fund Balance	Total Expenditures
1979[1]	0.257	-0.925	0.000	1.293
1980	126.338	-0.925	125.000	1.629
1981	136.453	-0.924	250.000	11.881
1982	21.580	-0.923	250.000	22.173
1983	23.431.	-0.923	250.000	24.114
1984[2]	25.373	-0.923	250.000	26.162
1985	29.149	-0.923	250.000	30.213
1986	53.469	-9.343	250.000	65.931
1987	93.841	5.903"	250.000	83.734
19883	238.795	89.540	293.441	118.031
1989	477.152	230.821	416.621	221.092
1990	682.060	487.773	607.121	244.208
1991	886.073	597.322	1,123.690	270.910
1992	1,068.580	597.324	1,851.100	353.839
1993	1,184.520	596.135	2,668.160	382.667
1994	1,229.420	464.466	3,638.510	405.757
1995	1,218.210	179.654	4,720.350	437.683
1996	1,175.870	0.000	5,623.700	470.207
1997	1,119.900	0.000	6,256.240	507.098
1998	1,074.530	0.000	6,806.270	546.090
1999	1,046.020	0.000	7,284.710	591.312
2000	1,027.050	0.000	7,698.950	638.793

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars

SOURCE: ISER, 1978.

Truck transportation requirements for the Prudhoe-High scenario peak during the years 1988-89, approaching approximately 24 truckloads per month during fall and winter.

The Prudhoe-High scenario will require a large marine operation, which will peak during the period 1988-1991 at about 134,260 metric tons (148,000 tons), of which approximately 59,875 metric tons (66,000 tons) will be fuel. Total marine shipping capacity at peak demand will require approximately 54,431 DWMT (60,000 DWT) for fuel transport and approximately 65,317 DWMT (72,000 DWT) for goods transport.

The trends for induced transportation demands that were 'observed for Camden-Canning largely hold true in the Prudhoe-High scenario. The principal difference between the impacts is that the higher employment figures for this scenario accentuate the trends. For the Anchorage region, induced employment steadily increases. After 1985, it not only exceeds the non-OCS annual change but in many cases is approximately twice the change. In 2000 the induced employment represents an 8.4 percent increase over the base figure for that year.

The Prudhoe-High situation in Fairbanks resembles that for the Camden-Canning in that a slightly higher, steady increase occurs but should be easily accommodated. In the Beaufort Sea Region, this scenario accentuates an existing roller-coaster pattern than Camden-Canning helped reduce. The reason is that peak employment for this scenario occurs two years before that for Camden-Canning. From 1987 to 1988, induced employment drops from 2,400 jobs to 400 at the same time that employment for the non-OCS scenario is also decreasing. Peak induced employment of 2,700 people is expected in 1986, which is 50 percent of the total non-OCS employment.

Freight requirements will be increased substantially since much of the induced employment is for local public works projects, Regional carriers will be able to absorb this demand on top of requirements for Beaufort Sea activities. Local carriers will be able to get increased utilization of existing aircraft but may be unwilling to acquire new equipment to meet forecast peak passenger and freight flows because of the lean times that will soon follow (Dooley and Assoc., 1978) .

Anchorage/Fairbanks

Economic/Demographi c. Anchorage has been and will remain the center for petroleum and petroleum-support firms in Alaska. The composition of additional employment which results from OCS development supports the structural changes found in the base case. Table 22 shows the expected growth in population, employment, and personal income between 1977 and 2000 for the Prudhoe-High scenario. The annual growth rate of employment increases from 3.1 percent in the non-OCS base to 3.5 percent between 1977 and 2000. By 2000 the population impact in Anchorage is 70 percent of the total impact in the state, 14 percent higher than the increase in Anchorage in the base case. Personal income increases by $946 million over the base case by 2000, which is 4.8 percent higher by the end of the development phase.

TABLE 22

PRUDHOE HIGH SCENARIO TOTAL ECONOMIC IMPACT
ANCHORAGE
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of $)	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979[1]	184.0	.2	86.8	.1	1793.0	2.4
1980	195.0	.4	94.4	.2	2099.6	6.0
1981	206.1	.6	99.7	.3	2318.1	9.7
1982	213.4	.8	97.7	.4	2365.8	14.9
1983	219.8	.9	100.2	.5	2537.1	16.8
1984[2]	227.6	1.0	103.5	.5	2749.6	19.3
1985	235.7	1.3	107.6	.7	3014.5	27.3
1986	244.6	4.2	112.9	3.1	3337.9	125.9
1987	250.4	5.6	115.1	3.6	3547.5	152.1
19883	254.5	7.9	116.4	3.8	3730.0	169.8
1989	260.9	10.3	119.7	5.0	4017.9	230.6
1990	266.5	11.6	123.0	5.5	4311.2	260.5
1991	273.4	13.1	126.9	6.1	4661.0	300.1
1992	280.0	14.9	131.2	7.1	5032.9	356.4
1993	287.4	16.3	135.7	7.6	5454.3	399.1
1994	293.8	17.3	140.1	8.0	5978.5	433.2
1995	301.9	18.8	145.4	8.7	6380.2	488.3
1996	309.6	20.3	151.0	9.4	6916.6	547.2
1997	318.8	21.9	157.5	10.3	7541.2	617.6
1998	328.0	23.7	164.5	11.3	8230.8	704.9
1999	339.2	25.8	172.9	12.6	9047.4	814.4
2000	350.7	28.1	182.5	14.2	9972.0	946.0

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal Dollars
SOURCE: ISER, 1978

Table 23 illustrates growth in Fairbanks resulting from Prudhoe-High development. By the year 2000 employment is only 4.4 percent higher than the base, and the population increase is minimal, 3,800 higher than the base case. Since Fairbanks has only slight connection with oil development, increases in state and local expenditures resulting from revenue increases are the major way the Fairbanks economy is impacted by OCS development (ISER, 1978).

Urban Services. The Prudhoe-High scenario produces the largest overall impact on Anchorage. Its earlier startup dates also mean its effect will be felt before Camden-Canning. Provision of additional services is the only requirement that could put a strain on the infrastructure, but the Prudhoe-High scenario begins at a time when the capacity of the community to respond would be optimal. Timely completion of particular utilities and transportation become more critical under this scenario.

The Prudhoe-High scenario adds approximately 28,100 people to the population of Anchorage between 1980 and 2000. This 8.2 percent adds to the non-OCS base at a time when the latter's growth rate is slowing. This scenario is sufficiently large to generate significant service demands, especially in terms of human resources, public safety, and transportation. However, the increases are spread over an extended period, which mitigates the severe impacts that occurred during the oil pipeline boom. Because this scenario is incremental in its effects and adds to a slower growth period in the non-OCS case, the impacts are likely to be positive on the balance. This is because the stimulated economy will produce a more improved revenue capacity compared to additional service demands.

Table 24 displays the services likely to be impacted through the study period. No additional problems and issues affecting the community in the case of this OCS scenario are foreseen except that delays in expansion of some utilities and the transportation plans could mean temporary service shortfalls (Ender and Assoc., 1978).

Beaufort Sea Region

Economic/Demographic. Major direct economic and demographic impacts take place in the Beaufort Sea Region since development is located there. Almost 52 percent of the total employment impact on the North Slope is directly related to Beaufort OCS development. Tables 25 and 26 show the growth in employment and population. By 2000 total employment is 1,600 or 21 percent, greater than the non-OCS base. When direct employment at the OCS site peaks in the development phase, total employment is 4,500 jobs or 62 percent, higher.

Employment increases on the North Slope are of two kinds. First, petroleum and construction employment located at Prudhoe Bay are part of the enclave sector which increases with OCS development. This increase has only minimal impact on the local economy. Second, increases in employment at Prudhoe Bay lead to increases in the local economy because a rise in local and state government revenues and expenditures will lead to increases in the local economy.

TABLE 23

PRUDHOE HIGH SCENARIO TOTAL ECONOMIC IMPACT
FAIRBANKS
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of $)	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979[1]	68.3	.1	32.1	.1	767.4	1.2
1980	81.3	.1	39.9	.1	1103C0	3.0
1981	81,2	.2	39.3	.1	1131.7	
1982	67.5	.2	30.9	.1	816.2	3.9
1983	67.9	.2	30.9	.1	848.3	4.3
1984[2]	69.3	.2	31.5	.1	909.9	4.8
1985	70.4	.2	32.1	.1	981.7	6.1
1986	70.9	.0	32.7	.3	1061.2	24.3
1987	71.3	.4	33.0	.4	1117.8	32.0
1988[3]	72.5	1.7	33.1	.7	1168.4	48.8
1989	73.0	2.3	33.6	1.0	1238.5	64.4
1990	73.2	2.6	33.8	1.0	1309.8	70.7
1991	73.5	2.8	34.3	1.1	1392.1	78.8
1992	73.7	3.1	34.6	1.2	1478.7	89.1
1993	74.0	3.3	35.1	1.3	1568.3	96.1
1994	73.8	3.3	35.4	1.3	1657.2	99.8
1995	73.9	3.4	35.8	1.3	1760.1	108.1
1996	73.8	3.5	36.3	1.4′	1865.7	116.5
1997	73.8	3.6	36.7	1.4	1983.2	125.6
1998	73.7	3.7	37.3	1.5	2106.5	136.5
1999	73.6	3.8	37.8	1.5	2244.5	148.9
2000	73.3	3.8	38.4	1.6..	2390,4	162.4

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE: ISER, 1978

TABLE 24

PRUDHOE-HIGH SCENARIO
ANCHORAGE URBAN SERVICE REQUIREMENTS

	1980	1985	1990	1995	2000
Population	194,989	235,648	266,545	301,845	350,705
Education: Primary/Secondary - No. of Teachers	3	10	93	150	225
Public Safety: Police- Manpower	0	2	18	29	43
State Troopers - Manpower	0	0	2	3	5
Fire - Manpower	0	1	17	28	42
Leisure: Play Lots	0	1	5	7	11
Neighborhood Parks	0	0	1	2	3
Softball Diamonds	0	0	4	6	9
Basketball" Courts	0	3	14	37	56
Swimming Pools	0	0	1	2	3
Skating Rinks	0	0	0	1	1
Community Centers	0	0	0	1	2
Utilities: Water - (Millions of Gallons per Day)	0.1	0.2	2.4	3.8	5.7
Sewer - (Millions of Gallons per Day, Wastewater Generated)	0.1	0.2	1.9	3.0	4.5
Housing: Units	114	405	3,753	6,056	9,064
Health: Bed Needs	0	2	22	36	54
Primary Care Physicians	0	2	15	24	35
Social Services: Day Care Space	6	19	175	281	421
Unemployment Claimants	23	82	756	1,220	1,826
Low Income Housing Units	5	19	173	280	419

Note: 1979 Exploration begins
1984 Development begins
1988 Production begins
SOURCE: Ender and Assoc., 1978.

TABLE 25

FORECAST OF EMPLOYMENT
PRUDHOE-HIGH SCENARIO
BARROW , KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 -2000

Year	Forecasted Employment									
	Barrow [a]		Kaktovik [b]		Nuiqsut [b]		Wainwright [c]		Region [d]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	915 [e]	0	36 [e]	0	42 [e]	0	58 [f]	0	6,490	0
I 980	967	7	36	0	43	0	63	0	8,558	250
19B5	1,108	33	39	2	47	1	74	2	7,663	620
1990	1,268	66	42	3	51	3	87	6	7,302	1,533
1995	1,453	109	44	3	56	5	103	9	7,839	1,356
2000	1,664	162	48	5	61	8	111	11	9,108	1,575

[a] Barrow's employment forecasted at the current rate of approximately 1 job for every 3 local residents.
[b] Kaktovik and Nuiqsut's employment forecasted at the current ratio of approximately 1 job for every 3.8 local residents.
[c] Wainwright's current ratio of approximately 1 job for every 6.9 local residents is not considered to remain constant in this forecast. It is estimated that the 1980 ratio will be 1:6.5, the 1985 ratio 1:6.0, the 1990 ratio 1:5.5, the 1995 ratio 1:5.0 and the 2000 ratio 1:5.0, thus tending toward the existing ratios in other traditional villages in the region outside Barrow.
[d] Regional employment forecasts developed by ISER for the Alaska OCS socio-economic studies program.
[e] Average annual employment estimates derived from Alaska Consultants, Inc. counts in December 1977.
[f] Average annual employment estimate derived from Alaska Consultants, Inc. count in April 1977.

Note: 1979 Exploration begins
1984 Development begins
1988 Production begins

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

TABLE 26

FORECAST OF POPULATION
PRUDHOE-HIGH SCENARIO
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

1977	Forecasted Population									
	Barrow		Kaktovik		Nuiqsut		Wainwright		Region [a]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	2,700 [c]	0	1344	0	157 [d]	0	398 [d]	0	9,323	0
1978	2,761	0	135	0	159	0	402	0	7,168	0
1979 [e]	2,823	0	136	0	161	0	406	0	8,586	70
1980	2,901	14	138	1	164	1	412	2	10,237	257
1981	2,981	29	140	2	167	2	418	4	10,824	146
1982	3,063	45	142	3	170	3	424	6	8,666	281
1983	3,147	61	144	4	173	4	430	8	8,491	300
1984 [f]	3,234	79	146	5	176	5	436	10	8,600	349
1985	3,323		148	6	179	6	443	13	8,999	726
1986	3,414	17;	150	7	182	7	450	16	13,490	5,013
1987	3,508	135	152	8	185	8	457	19	13,072	4,813
1988 [g]	3,604	155	154	9	188	9	464	22	9,987	1,700
1989	3,703	176	156	10	191	10	471	25	8,658	1,518
1990	3,805	199	158	11	194	11	478	28	8.624	1,514
1991	3,910	223	160	12	197	12	485	31	8,788	1 ,48a
1992	4,018	248	162	13	200	13	492	33	8,779	1.325
1993	4,128	273	164	14	204	15	499	35	8,950	1,309
1994	4,242	300	166	14	208	17	506	37	8,994	1,198
1995	4,359	328	168	14	212	19	514	40	9,204	1,220
1996	4,479	357	171	15	216	21	522	43	9,421	1,264
1997	4,602	387	174	16	220	23	530	46	9,675	1,309
1998	4,729	419	177	17	224	25	538	49	9,911	1,349
1999	4,859	452	180	18	228	27	546	52	10,190	1,394
2000	4,993	487	183	19	232	29	554	55	10,458	1,437

[a] Barrow's population forecasted at an annual rate of increase of 2.25 percent through 1979 (non-OCS forecast) and thereafter at an annual rate of 2.75 percent. Kaktovik, Nuiqsut and Wainwright's population forecasted at an annual rate of increase of 1 percent through 1979 (non-OCS forecast); thereafter Wainwright and Kaktovik populations are projected at an annual rate of increase of 1.5 percent and Nuiqsut's population at an annual rate of 1.75 percent.

[b] Regional population forecasts developed by ISER for the Alaska OCS socio-economic studies program.

[c] Barrow's 1977 population estimated by Alaska Consultants, Inc.

[d] North Slope Borough Planning Department population estimates.

[e] 1979 Exploration begins

[f] 1984 Development begins

[g] 1988 Production begins

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

By 2000 the North Slope Borough population will increase by 1,400 over the base case. This will not have as large an impact on the local population since over half of this increase is the extra employment in the enclave sector (ISER, 1978)

Community Services. Although the traditional communities of the North Slope region will experience higher rates of growth in population and employment in a Prudhoe-high scenario, the added impacts on local facilities and services will be relatively minor. The North Slope Borough already plans to meet a major share of projected needs, especially for education facilities. The only significant gap is in housing and utilities services in Barrow.

Like the other OCS scenarios under study, borough revenues will be significantly impacted as a result of Prudhoe-High scenario. These increases in revenue should be more than adequate to cope with any new impacts on community facilities and services (Table 27).

No regional impacts beyond those identified in the non-OCS case are anticipated in the Prudhoe-High scenario. However, the following significant impacts on the man-made environment of North Slope Borough traditional communities are anticipated:

1. The population of the smaller villages of the region is forecast to grow at a faster rate than in the non-OCS case, but the number of additional people will be very small.

2. Barrow's population is forecast to grow at a faster rate than in the non-OCS case. A significant share of Barrow's new population growth is expected to be non-Inupiat from outside the region as rates of outmigration from the smaller villages are expected to be lower than in the non-OCS case.

3. Borough revenues will be considerably above those realized in a non-OCS case. Thus, additional community facilities and services should be able to be provided by the Borough without creating financial hardship.

4. The major areas of "new" impact are housing and utilities, particularly in Barrow, plus increased police services in Barrow. Few further impacts are anticipated. However, to accommodate expected housing needs in Barrow, an increase in multifamily units is likely as there is already a severe shortage of land.

5. The Prudhoe-High scenario offers the most promise of assisting the Borough's imminent revenue deficits because of its earlier start-up date. In this scenario, projected borough deficits from FY 1979/80 through FY 1985/86 would be reduced. In turn, this would permit a lower debt service mill levy against borough taxpayers during these years.

No major problems or issues beyond those identified in the non-OCS case are foreseen. However, the increased proportion of non-Inupiat in

TABLE 27

ESTIMATED REVENUES AND EXPENDITURES
PRUDHOE-HIGH SCENARIO
NORTH SLOPE BOROUGH
FY 1977/78 - FY 2000/01
(in 's of Real S)

Fiscal Year	Expenditures			Revenues			Surplus (Deficit)	Oebt Service d/ Mill Rate
	Operating Budget	Oebt Service	To ta l	Property Taxes	Other Revenues	Total		
1977/78a/	$30,126b/	$7,634	$37,760	$18,922	$11,204	$30,126	$7,634)	7.52
978/79	29,288	23,027	52,315	22,309	12,342	34,651	17,664)	23.8
979/80	31,631	22,026	53,657	28,880	13,595	42,475	11,182)	11.6
980/81	34,161	24,503	58,664	37,209	14,975	52,184	6,480)	5.2
981 /82	36,894	23,200	60,094	42,496	16,497	58,993	1,101)	.8
982/83	39,846	23,252	63.098	40,800	18.174	58,974	4.124)	3.0
983/84	43,034	25,737	68,771	38,854	20,027	58,881	9,890)	7.6
984/85	.46,477	22,007	68,484	42,502	22,052	64,554	3,930)	2.8
985/86	50,195	22,756	72,951	48,040	24,294	72,334	617)	.4
986/87	54,211	21,078	75,289	77,862	26,762	104,624	29,335	
987/88	58,548	21,309	79,857	81,480	29,487	110,967	31,110	
988/89	63,232	19,954	83,186	60,435	32,480	92,915	9,729	
989/90	68,291	19,034	87,325	62,872	35,780	98,652	11,327	-
1 990/91	73,754	15,301	89,055	67,634	39,413	107,047	17,992	
1991 /92	84,654c/	--	84,654	74,439	43,424	117,863	33,209	
1 992/93	91,426	--	91,426	80,312	47,831	128,143	36,717	
1 993/94	98,740	--	98,740	88,432	52,688	141,120	42,380	
1994/95	106,640	--	106 ,640	95,978	58,045	154,023	47,383	
1995/96	115,171	--	115,171	106,084	63,944	170,028	54,857	
1996/97	124,384	--	124 ,384	117,281	70,440	187,721	63,337	
1997/98	134,335	--	134,335	130,089	77,592	207,681	73,346	
1998/99	145,082	--	145,082	143,934	85,480	229,514	84,432	
1999/00	156,689	--	156,689	159,837	94,160	253,997	97,308	
2000/01	169,224	--	169,224	177,178	103,735	280,913	111,689	

a/ North Slope Borough budget figures. Revenues and expenditures, with the exception of debt service, projected at 8% annual increase.

b/ Includes $3 million for capital outlay. The remainder is projected at 8% increase per year.

c/ Includes $5 million for capital outlay from FY 1991/92 compounded annually at 8% through FY 2000/01 for pay-as-you-go capital outlays.

d/ Levied per AS 29.53.055 above 30 mill levy under AS 29.53.045(c).

SOURCE: Alaska Consultants, 1978.

Barrow could lead to changes in demand for facilities and services and some potential social problems (Alaska Consultants, 1978),

Natural Resources. Relatively little subsistence hunting or fishing occurs within the Prudhoe Bay area, and sport hunting and fishing is prohibited by the Alaska Department of Fish and Game.

No direct problems are anticipated with marine mammal populations except the potential for disturbance of ringed seals from Gross Island eastward, However, boat and aircraft traffic associated with exploration, gravel extraction, and offshore production will undoubtedly result in periodic harassment of birds and mammals. Direct disturbance will probably be the most common problem associated with development of the area.

The potential for impacts on wildlife and other resources will require that exploration and development be conducted with extreme care, including selection of staging areas, camps, and pipeline routes both offshore and onshore. Critical wildlife concerns in this area include snow geese nesting on Howe Island; black brant nesting on the delta of the Kuparuk River; eider, gull, and tern nesting on offshore islands; caribou calving near the beach; and winter water removal from the Sagavanirktok River (Cameron and Whi tten, 1977; Hemming and Moorehouse, 1976; Wilson et al., 1977). Collection of potable water and gravel mining near the mouth of the Sagavanirktok River associated with oil. field development and construction of the Trans-Alaska pipeline have already impacted overwintering fish populations (Wilson et al., 1977; U.S. Fish and Wildlife Service, 1976).

The Alaska Department of Fish and Game has concluded that essentially all of the Prudhoe Bay oil field has been abandoned as a caribou calving area since about 1974 (Cameron and Whitten, 1976, 1977; White et al., 1975). Therefore, the oil field area would be the best place to locate exploration and production facilities. Due to the fairly extensive losses to the caribou calving area to date, the Alaska Department of Fish and Game can be expected to be quite restrictive of activities within the remainder of the calving area.

Howe Island at the mouth of the Sagavanirktok River supports the only snow goose colony on the Arctic coast of Alaska. This small colony of about 60 nesting pairs would be threatened by any land uses on Howe Island or a summer oil spill in the area. Other nesting birds, such as glaucous gulls, Arctic tern, and eiders, make extensive use of Niakuk, Gull, Cross and Stump Islands.

Table 28 summarizes potential impacts on various natural resources which may occur as a result of OCS development at Prudhoe Bay. In comparison to undisturbed areas, the oil field area would be the best place to locate new exploration and production facilities. The use of existing dock facilities, roads, airports, etc., would significantly reduce the impacts to fish and wildlife resources of the area compared to development of new facilities (Dames and Moore, 1978).

TABLE 28

NATURAL RESOURCES
Summary of Impacts on Fish and Wildlife Resources,
Water Quality/Resources, Sanitation and Gravel Resources

RESOURCE	POTENTIAL IMPACT
Sea 1s	Some direct disturbance from boats and aircraft from Cross Island eastward.
Whales	Minimal potential for disturbance of migrating whales.
Polar Bear	Minimal potential for influence on denning.
Foxes and Wolves	Increased mortality from vehicle hits when animals are attracted by direct feeding or improper garbage disposal.
Caribou	Direct disturbance of caribou calving east and west of Prudhoe Bay.
Waterfowl	Direct disturbance from boats and aircraft; nesting habitat loss from gravel mining on the Kuparuk and Sagavanirktok River deltas or on offshore islands, e.g., Howe Island supports the only snow goose colony in Alaska.
Fish	Siltation of feeding and spawning areas from floodplain gravel mining; blockage to fish passage from gravel mining caused changes to stream channels; disturbance of fish overwintering areas from collection of potable water or gravel mining.
Hunting and Fishing	Very low potential for negative impact due to existing hunting and fishing regulations.
Water Quality	Increased turbidity and contaminants may occur; however, if there is compliance with OCS operating orders and state operating orders, impacts will be minimal.
Water Resources	Increased water withdrawal may affect the Sagavanirktok River and overwintering fish. There may be minor conflicts between village and industry water needs, but sufficient water may be available from the proposed Webster reservoir.
Sanitation	No direct or indirect impacts.
Gravel	Total gravel requirements are 5.100.223 cubic meters (6.683.772 cubic yards). Probably sufficient onshore resources.' Sagavanirktok River has already been heavily mined and additional suitable borrow sites will be more difficult to select. Borings offshore in Prudhoe Bay indicate significant subsurface gravel deposits. Important waterfowl and shorebird habitats in delta of Sagavanirktok and adjacent islands should be avoided. Destruction of fish overwintering areas has been a primary concern related to borrow extraction for Prudhoe Bay/Alyeska construction.

SOURCE: Dames and Moore, 1978.

Sociocultural. The sociocultural impacts resulting from the Prudhoe-High scenario are similar to those described for the Camden-Canning scenario. Subsistence activities around Prudhoe Bay and adjacent areas are relatively minor except, possibly, for Nuiqsut people. Because of Nuiqsut's proximity to Prudhoe Bay, its population and employment is expected to grow slightly faster than other villages, which may result in greater pressure on its traditional resource base.

Nuiqsut's interethnic contact and relationships in the Prudhoe-High scenario will correspond to those of Kaktovik in the Camden-Canning scenario. Since Nuiqsut residents have had previous contact with the Prudhoe Bay/ Deadhorse complex, this should provide therewith a basis of experience in dealing with the effects of the Prudhoe-High scenario. On the other hand, their past experiences and relationships may predetermine their attitudes and responses to further development at Prudhoe Bay (Worl and Assoc., 1978).

Prudhoe-Modal Scenario

DESCRIPTION

The Prudhoe-modal scenario as shown in Figure 8 encompasses 10,931 hectares (27,000 acres) of the central Alaskan Beaufort Sea and contains assumed reserves of 0.8 Bbbl of oil and 1.6 tcf of gas. The following tracts involved in the joint state-federal leasing area are 22 tracts totalling 22,177 ha (54,777 acres).

Key: A - Joint and disputed ownership claim
B - Federal lands
C - State lands
D - Disputed

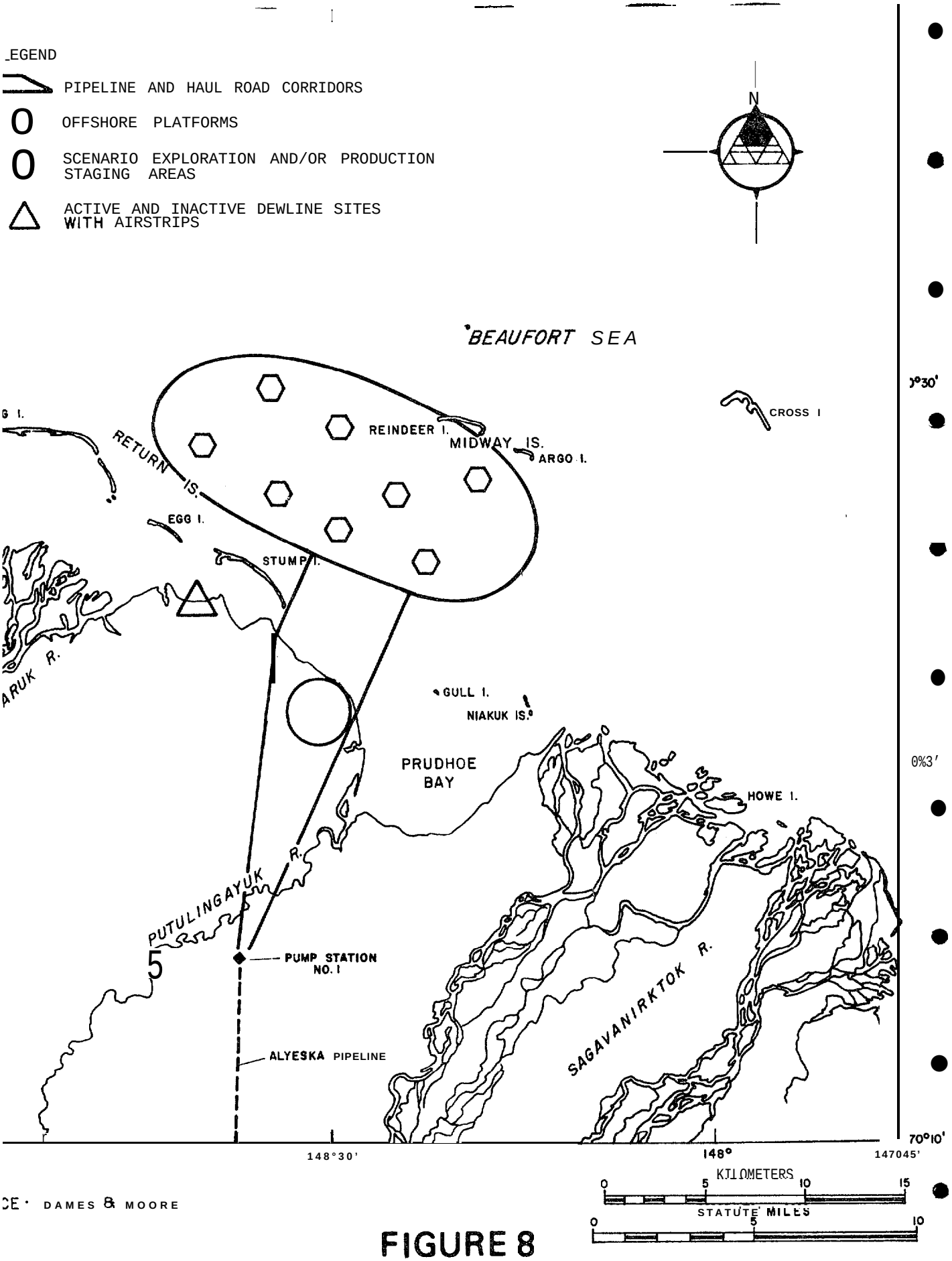
Prudhoe-Modal

47 (A)	66 (c)	84 (C)	97 (A)	112 (A)
48 (A)	67 (C)	85 (C)	98 (A)	113 (A)
63 (A)	81 (A)	86 (c)	99 (c)	
64 (D)	82 (A)	95 (c)	110 (c)	
65 (A)	83 (A)	96 (A)	111 (A)	

37% state; 63% joint and disputed.
Tracts are shown in Figures 5a and 5b.

Exploration commences in 1980, development in 1985, and production in 1989. The life span of the field is estimated to be 28 years, starting with discovery in 1982 and field shutin for oil and gas in 2010.

The oil field lies between the inner barrier islands of Stump, Egg, and Long Islands and the outer barrier island of Midway. Water depths at the field location vary from about 6m (20 ft.) near Stump Island, to about 8.5m (28 ft.) midway between Stump Island and Midway Island, and to a



DAMES & MOORE

FIGURE 8

PRUDHOE MODAL SCENARIO, 0.8 Bbbl. RESERVES

maximum of nearly 18 m (60 ft.), 19 dm (12 miles) west-northwest of Midway Island. A number of offshore shoals occur over the western half of the field.

Most of the oil field is located within the landfast ice zone, although in fall and early winter, pack ice ridges may ground on the shoals located in the northwest section of the field. Subsea ice-rich permafrost with 20 m (66 ft.) of the sea floor is restricted to Prudhoe Bay and the lagoon between the mainland and barrier islands.

Significant offshore sand and gravel resources appear to be present within and adjacent to the oil field location. These deposits are located off the Sagavanirktok River delta and in a band parallel to the bathymetric contours north of the barrier islands between Prudhoe Bay and the Colville River.

The Prudhoe-Modal scenario will resemble the Prudhoe-High scenario in the placement of facilities. Use of the infrastructure but not the processing facilities at Prudhoe Bay is assumed. An onshore flow center with a capacity of 200 Mbbl/d and 250 MMcfd is the only major unit assumed on land. Alternatively, offshore treatment centers will use smaller modules of 100 Mbbl/d and 120 MMcfd capacity. A single trunk line to shore is assumed. No new harbor, base camp site, or airstrip is assumed.

Only four of the 12 exploration wells associated with this scenario are within the field (Dames and Moore, 1978).

Platforms:	Barge	Soil/Gravel	Ice	Gravity
Exploration	4	6	2	0
Production	6	5	0	1

Wells:

Exploration - 12
Oil - 270
Gas - 13
Development - 47

Pipelines:	Oil		Gas	
	km	miles	km	miles
Connectors	80	50	32	20
Offshore Trunk	6	4	6	4
Onshore Trunk	15	9.5	15	9.5

SUMMARY OF IMPACTS

Alaska

Economic/Demographic. The Prudhoe-modal scenario has the third greatest effect of the four scenarios on Alaska's economy. This scenario is similar in most respects to Prudhoe-High, and the impact of development supports most of the trends found in the non-OCS base case. The local service sector of the economy is as important a portion of the Prudhoe-Modal impact as it is in the Prudhoe-High and supports the base case trend of the increasing proportion of employment in these sectors. The most important trends not supported are related to population. The aging of the population found in the base case is diminished somewhat by a decrease in the outmigration of the young because of increased economic opportunities associated with induced economic growth. The other trend which is not supported is the possible decrease in unemployment found in the base case. Population induced by Prudhoe-modal development is greater than the induced employment growth, which means the ratio of population to employment will be raised. Since this is a measure of the probability of finding a job, it may increase unemployment (Table 29).

Prudhoe-Modal provides smaller revenues to the State than does Prudhoe-High, resulting in two consequences. First, only minimal increases occur in the level of services over the base case, and second, it postpones the period when expenditures exceed revenues by only three years (Table 30). Relative effects of this can be seen by comparing them to Prudhoe-High, which provides almost six times the Prudhoe-modal increase in state services and postpones the fiscal crunch for six years (ISER, 1978).

Transportation. Transportation impacts resulting from the Prudhoe-Modal scenario will be minimal. Demands placed on various transportation modes will be considerably less than experienced in recent years and can easily be met by shippers. Peak freight tonnage is approximately 60 percent of the total goods and materials transshipped during the 1970 sealift for exploration and development at Prudhoe Bay. Peak truckloads via the haul road are projected to be approximately 14 per month and peak air freight flights, less than three per week. Peak passenger flights will not exceed one additional per day.

Induced transportation demand for this scenario in Anchorage and Fairbanks, given the use of employment as a primary indicator, will closely resemble the Camden-Canning scenario until 1987; after that its impacts will be approximately 30 percent less.

In the North Slope region, peak employment and subsequent decreases occur at the same time as for Prudhoe-High, but peak employment is considerably less -- 2,700 compared to 1,400 -- and the decrease is spread out over a longer period of time (Dooley and Assoc., 1978).

Anchorage/Fairbanks

Economic/Demographic. Table 31 shows the economic and demographic impacts to Anchorage resulting from the Prudhoe-Modal scenario. Total

TABLE 29

PRUDHOE MODAL SCENARIO IMPACT ON AGGREGATE INDICATORS
STATE OF ALASKA
?979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	419.1	.0	198.6	.0	4523,0	0.0
1980[1]	449.5	.3	218.7	.2	5569.7	8.7
1981	468.0	1.1	227.5	.8	6087.0	34.0
1982	464.6	1.4	219.7	1.0	5749.2	39.2
1983	471.7	1.6	222.3	1.0	6051.1	41.1
1984	481.2	1.7	227.1	1.0	6484.3	44.3
19852	493.6	1.7	234.6	.9	7074.0	42.0
1986	502.4	2.4	239.2	1.4	7580.4	73.4
1987	510.1	6.1	243.0	4.0	8070.1	238.1
1988	511.7	7.3	242.4	4.5	8330.1	263.1
1989[3]	517.5	9.1	245.9	5.4	8825.2	316.2
1990	522.0	9.5	248.6	5.2	9314.0	306.0
1991	528.7	10.6	253.2	5.6	9945.1	341.1
1992	533.7	11.3	256.6	5.7	10547.8	360.8
1993	540,9	12.6	261.9	6.3	11288.9	415.9
1994	547,4	14.1	266.5	7.0	12038.5	477.5
1995	555.1	15.3	272.2	7.5	12890.3	532.3
1996	561.2	16.0	276.6	7.5	13707.4	555,4
1997	569.0	16.6	282.4	7.5	14662.1	577.1
1998	576.4	17.5	287.9	7.9	15656.6	630.6
1999	584.8	17.5	294.3	7.5	16752.2	617.2
2000	594.0	18.2	301.0	7.8	17957.3	668.3

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE: ISER, 1978

TABLE 30

IMPACT ON THE STATE FISCAL SECTOR OF
THE PRUDHOE MODAL SCENARIO
(measured as changes from the base)
(in millions of dollars)[4]
STATE OF ALASKA
1979-2000

Year	Total Revenues	General Fund Balance	Permanent Fund Balance	Total Expenditures
1979	0.000	0.000	0.000	0.000
1980[1]	,125.243	0.000	125.000	0.346
1981	135.456	0.000	250.000	10.895
1982	21.019	0.001	250.000	21.612
1983	22.052	0.001	250.000	22.693
1984	23.381	0.001	250.000	24.101
1985[2]	24.638	0.001	250.000	25.378
1986	27.736	0.001	250.000	28.818
1987	41.429	-14.328	250.000	58.656
1988	59.789	-20.259	250.000	69.252
19893	121.324	2.641	267.820	85.080
1990	210.137	82.038	313.988	89.275
1991	270.267	0.000	571,160	100.491
1992	330.437	0.000	798.406	109.041
1993	385.664	0.000	1,067.390	123.372
1994	429.596	0.000	1,364.550	140.114
1995	468.312	0.000	1,685.750	155.702
1996	515.194	0.000	2,044.230	165.875
1997	593.367	0.000	2,471.590	175.723
1998	627.918	0.000	2,919.540	190.551
1999	597.5.07	0.000	3,333.030	194.793
2000	599.341	0.000	3,735.300	208.641

'Exploration begins
2Development begins
3Production begins
4Nominal dollars
SOURCE: ISER, 1978.

TABLE 31

PRUDHOE MODAL SCENARIO TOTAL ECONOMIC IMPACT
ANCHORAGE
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	183.8	.0	86.7	.0	1790.7	.0
19801	194.7	.1	94.3	.1	2095.8	2.2
1981	206.0	.5	98.7	.3	2318.6	10.2
1982	213.4	.8	97.7	.4	2365.5	14.6
1983	219.7	.8	100.2	.5	2536.6	16.3
1984	227.5	.9	103.5	.5	2748.2	17.9
1985[2]	235,3	.9	107.4	.5	3094.5	17.8
1986	241.7	1.3	110.5	.7	3241.0	29.0
1987	248.0	3.2	113.6	2.1	3485.2	89.8
1988	250.6	*4.0*	115.0	2.4	3665.1	104.9
1989[3]	256.0	*5.4*	*117.5*	2.8	3915.0	127.7
1990	260.6	*5.7*	*120.1*	2.6	4177.1	126.4
1991	266.7	6.4	123.8	3.0	*4507.4*	146.5
1992	272.1	7.0	127.2	3.1	*4833.9*	157.4
1993	279.0	7.9	131.6	3.5	*5241.9*	186.7
1994	285.5	9.0	136.1	4.0	*5664.5*	219.2
1995	293.0	9.9	141.1	4.4	*6143.0*	251.1
1996	299.8	10.5	146.2	4.6	6642.3	272.9
1997	307.9	11.0	152.1	4.9	7219.0	295.4
1998	316.1	11.8	158.5	5.3	7860.8	334.9
1999	325.4	12.0	165.7	5.4	5580.2	347.2
2000	335.3	12.7	174.2	5.9	9420.1	394.1

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE: ISER, 1978

employment is approximately 5,900 greater than the non-OCS base case by 2000, a 3.5 percent increase over the base. By 2000 population is approximately 12,700 higher than in the base case, or about 4 percent higher, The effect of these employment and population increases (as it is with three other scenarios under study) is to increase a major share of the state's population and employment in and around the municipality of Anchorage (Table 31).

Table 32 illustrates the growth of employment, population, and personal income in Fairbanks. Fairbanks will receive the smallest proportionate employment and population impacts of any of the regions under study; by 2000 employment is only 1.7 percent higher than the base case for two reasons. First, there is no direct OCS employment assumed to locate in Fairbanks as there was with construction of the trans-Alaska pipeline. Second, because Fairbanks is small, the support sector response is not as great as in Anchorage for either growth within the region or in other regions.

The population impact on Fairbanks eliminates the decline in population found in the base case after 1987. Between 1987 and 2000, population increases by 800 people, compared to a decline of 1,900 in the base case for the same period (ISER, 1978).

Urban Services. The Prudhoe-Modal scenario has only minimal impact on Anchorage. Many services would probably not be affected because the elastic nature of the service structures can absorb the slightly higher demand. The increases that do occur begin at a time when the capacity of the community to respond will be optimal. Anchorage will not only be able to handle but will benefit from this modest stimulation to the economy and general revenue base.

The Prudhoe-Modal scenario adds approximately 12,700 people to the non-OCS base case between 1985 and 2000. While small, this 3.7 percent cumulative increase adds to the non-OCS base at a time when the latter's growth rate is slowing. The increment is basically insufficient to have a significant impact on service expenditures. However, this addition would have a modest stimulative effect on the economy and general revenue base. Because of this, any increase from Prudhoe-Modal scenario would have to be positive in terms of the financial position of local government.

Table 33 summarizes the services likely to be impacted through the period under study. Increases represent the additional services required by the projected increase of population of 12,700 over the non-OCS base (Ender & Assoc., 1978).

Beaufort Sea Region

Economic/Demographic. Table 34 shows the increase in employment for the region and communities under study. By 2000 employment is 784 greater, or 10 percent higher than the base case. When direct employment at the OCS site peaks in the development phase in 1987, total employment is approximately 2,400, or 34 percent, higher than the base case.

TABLE 32

PRUDHOE MODEL SCENARIO TOTAL ECONOMIC INPACT
FAIRBANKS
1979-2000

YEAI?	POPULATION TOTAL (Thousands of Persons)	POPULATION CHANGE FROM BASE CASE (Thousands of Persons)	EMPLOYMENT TOTAL (Thousands of Employees)	EMPLOYMENT CHANGE FROM BASE CASE (Thousands of Employees)	PERSONAL INCOME[4] Millions of TOTAL	PERSONAL INCOME[4] Millions of CHANGE FROM BASE CASE
1979,	68.2	.0	32.1	.0	766.2	.0
1980	81.1	.1	39.8	.0	1101.3	1.3
1981	81.1	.1	39.3	.1	1132.1	4.0
1982	67.5	.2	30.9	.1	816.7	4.4
1983	67.9	.2	30.9	.1	848.1	4.1
1984	70.1	.2	31.5	.1	909.5	4.4
1985[2]	70.4	.2	32.1	.1	979.8	4.2
1986	80.0	.1	32.5	.1	1043.0	6.1
1987	71.6	.2	32.9	.3	1104.8	19.0
1988	71.3	.5	32.8	.4	1144.4	24.8
1989[3]	71.7	1.0	33.1	.5	1208.4	32.3
1990	71.8	1.2	33.3	.5	1273.6	34.5
1991	72.1	1.4	33.7	.5	1352.0	38.7
1992	72.1	1.5	33.9	.5	1425.8	40.9
1993	72.3	1.6	34.4	.6	1518.3	46.1
1994	72.3	1.8	34.7	.6	1610.9	53.5
1995	72.4	1.9	35.2	.7	1710.8	58.8
1996	72.3	2.0	35.6	.7	1809.8	60.6
1997	72.2	2.0	36.0	.7	1919.5	61.9
1998	72.0	2.0	36.5	.7	2036.8	66.8
1999	71.7	1.9	36.9	.6	2159.7	64.1
2000	72.4	1.9	37.5	.7	2296.3	68.3

[1]Exploration begins
[2]Development begins
[3]Production begins
[4]Nominal dollars
SOURCE : ISER, 1978

TABLE 33

PRUDHOE MODAL OCS SCENARIO
ANCHORAGE URBAN SERVICE REQUIREMENTS

	1980	1985	1990	1995	2000
Population	194,770	235.326	260.607	292,905	335.342
Education: Primary/Secondary - No. of Teachers	1	8	46	79	102
Public Safety: Police . Manpower	0	2	9	15	20
State Troopers - Manpower	0	0	1	2	2
Fire: Manpower	0	1	8	15	19
Leisure: Play tots	0	1	3	4	5
Neighborhood Parks	0	0	1	1	1
Softball Diamonds	0	0	2	3	4
Basketball Courts	0	2	12	19	25
Swimming Pools	0	0	1	1	1
Skating Rinks	0	0	0	0	1
Community Centers	0	0	0	0	1
Utilities: Water- (Millions of Gallons per Day)	0	0.2	1.2	2.0	2.6
Sewer - (Millions of Gallons per Day, Wastewater Generated)	0.1	0.1	0.9	1.6	2.0
Housing: Units	43	301	1.838	3,198	4.108
Health: Bed Needs	0	2	11	19	24
Primary Care Physicians	0	2	7	13	16
Social Services: Day Care Space	3	14	86	148	191
Unemployment Claimant	9	61	370	645	828
Low Income Housing Units	2	14	85	148	190

Note: 1980 Exploration begins
1985 Development begins
1989 Production begins

SOURCE: Ender and Assoc., 1978.

TABLE 34

FORECAST OF EMPLOYMENT
PRUDHOE MODAL SCENARIO
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecast of Employment									
	Barrow [a]		Kaktovik [b]		Nuiqsut [b]		Wainwright [c]		Region [d]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	915[e]	0	36[e]	0	42[e]	0	58[f]	0	6,490	0
1980	962	0	36	0	43	0	63	0	8,375	67
1985	1,089	14	39	2	46	0	72	0	7,244	201
1990	1,232	30	41	2	50	2	84	3	6,674	905
1995	1,394	50	44	3	54	3	99	5	7,498	1,015
2000	1,577	75	47	4	58	5	105	5	8,317	784

[a] Barrow's employment forecasted at the current ratio of approximat.ely 1 job for every 3 local residents.
[b] Kaktovik and Nuiqsut's employment forecasted at the current ratio of approximately 1 job for every 3.8 local residents.
[c] Wainwright's current ratio of approximately 1 job for every 6.9 local residents is not considered to remain constant in this forecast. It is estimated that the 1980 ratio will be 1:6.5, the 1985 ratio 1:6.0, the 1990 ratio 1:5.5, the 1995 ratio 1:5.0 and the 2000 ratio 1:5.0, thus tending toward the existing ratios in other traditional villages in the region outside Barrow.
[d] Regional employment forecasts developed by ISER for the Alaska OCS socio-economic studies program.
[e] Average annual employment estimates derived from Alaska Consultants, Inc. counts in December 1977.
[f] Average annual employment estimate derived from Alaska Consultants, Inc. count in April 1977.

Note: 1980 Exploration begins
1985 Development begins
1989 Production begins

SOURCES: Alaska Consultants, 1978
ISER, 1978.

Employment increases in the region are two kinds. First, petroleum and construction employment at Prudhoe Bay increases with OCS development. Because of the limited interaction this sector has with the local economy, this increase has only minimal impact on the local economy. Second, increases in employment at Prudhoe Bay lead to increases in local and state government revenue and expenditures which lead to increases in the local economy.

Table 35 shows regional and community population impacts of Prudhoe-Modal development. By 2000 the region's population has increased by 672 over the non-OCS base case. This total will not have as large an impact on the local population since more than 60 percent of this increase is the extra employment in the enclave sector (ISER, 1978).

Community Services. Growth of North Slope traditional communities will be slower in the Prudhoe-Modal scenario than in the Prudhoe-High or Camden-Canning cases. Thus, the added impacts on these communities are considerably less. A major share of projected community infrastructural needs in the region's traditional villages is already scheduled for implementation by the North Slope Borough. This is particularly true of education facilities and village utility systems. The only significant additional needs are for housing and utilities services in Barrow. However, these are foreseen to be relatively minor in this scenario.

Like the other OCS scenarios under study, borough revenues will be impacted positively by the Prudhoe-Modal scenario, although to a lesser degree than in the Prudhoe-High case. Nevertheless, these increases in revenue should be more than adequate to cope with any new impacts on community facilities and services (Table 36).

No additional impacts on the man-made environment of the Beaufort Sea region beyond those identified in the non-OCS case are anticipated in a Prudhoe-Modal scenario. However, the following significant impacts on North Slope traditional communities are expected:

1. Although the population of the smaller villages in the region is forecast to grow at a slightly faster rate than in the non-OCS case, the numerical difference is marginal.

2. Barrow's population is forecast to grow at a rate between the non-OCS and Prudhoe-High cases. One result should be a lower proportion of non-Inupiat living in Barrow than in the Prudhoe-High case.

3. Borough revenues will be considerably above those in a non-OCS case. Thus, additional community facilities and services required should be able to be provided without undue financial hardship to the Borough.

4. The major areas of impact are on housing and utilities, especially in Barrow. However, the impact is considerably less in the Prudhoe-Modal scenario than the preceding OCS cases.

TABLE 35

FORECAST OF POPULATION [a]
PRUDHOE MODAL SCENARIO
BARROW, KAKTOVI K, NUIQSUT, WA I NWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Population									
	Barrow		Kaktovi k		Nuiqsut		Wainwright		Region [g]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	2,700[c]	0	134[d]	0	157[d]	0	398[d]	0	9,323	0
1978	2,761	0	135	0	159	0	402	0	7,168	0
1979	2.323	0	136	0	161	0	406	0	8,516	0
1980[e]	2,387	0	137	0	163	0	410	0	10,048	68
1981	2,959	7	139	1	165	0	415	1	10,953	275
1982	3,033	15	141	2	167	0	420	2	8,554	169
1983	3,109	23	143	3	170	1	425	3	8,471	290
1984	3,187	32	145	4	173	2	430	4	8,553	302
1985[f]	3,267	41	147	5	176	3	435	5	8,515	242
1386	3,349	50	149	6	179	4	440	6	9,233	756
1987	3,433	60	151	7	182	5	446	8	10,978	2,719
1988	3,519	70	53	8	185	7	452	10	9,580	1,293
19899,	3,607	80	55	9	188	7	458	12	8,803	1,723
1990	3,697	91	57	10	191	8	464	14	8,229	1,119
1991	3,789	102	59	11	194	9	470	16	8,391	1,091
1992	3,384	114	61	12	197	10	476	17	8,350	901
1993	3,981	126	63	13	200	11	482	18	8,727	1,086
1994	4,081	139	65	13	203	12	488	19	8,731	935
1995	4,183	152	67	13	206	13	494	20	8,915	931
1996	4, 288	166	69	13	209	14	500	21	9,007	850
1997	4,395	180	71	13	212	15	506	22	9,146	780
1998	4,505	195	73	13	215	16	512	23	9,364	802
1999	4,617	210	75	13	218	17	518	24	9,440	644
2000	4,732	226	77	13	221	18	524	25	9,693	672

[a] Barrow's population forecasted at an annual rate of increase of 2.25 percent through 1980 (non-OCS forecast) and thereafter at an annual rate of 2.5 percent. Kaktovik, Nuiqsut and Wainwright's population forecasted at an annual rate of increase of 1 percent through 1980 (non-OCS forecast); thereafter Wainwright and Kaktovik populations are projected at an annual rate of Increase of 1.25 percent and Nuiqsut's population at an annual rate of 1.5 Percent.

[b] Regional population forecasts developed by ISER for the Alaska OCS socio-economic studies program.

[c] Barrow's 1977 population estimated by Alaska Consultants, Inc.

[d] North S1 ope Borough Pl arming Department population estimates.

[e] Exploration begins

[f] Development begins

[g] Production begins

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

TABLE 36

ESTIMATED REVENUES AND EXPENDITURES
PRUDHOE MOOAL SCENARIO
NORTH SLOPE BOROUGH
FY 7977/78 - FY 2000/01
(in 000's of Real $)

Fiscal Year	Expenditures		Revenues				Surplus (Deficit)	Debt Service d/ Mill Rate
	Operating Budget	Debt Service	Tota 1	Property Taxes	Other Revenues	Total		
1977/78a/	$30,162b/	$7,634	$37,760	$18,922	$11,204	$30,126	($7,634)	7.52
1978/79	29.288	23,027	52,315	22,309	12,342	34,651	(17,664)	23.8
1979/80	31 ,631	22,026	53,657	28,644	13,595	42,239	(11,418)	12.0
1980/81	34,161	24,503	58,664	36,520	14,975	51,495	(7,169)	5,9
1981 /82	36,894	23.200	60,094	43,004	16,497	59,501	(593)	.4
1982/83	39,846	23,252	63,098	40,271	18,174	58,445	(4,653)	3.5
1983/84	43,034	25,737	68,771	38,761	20,027	58,788	(9,983)	7.7
1984/85	46,477	22,007	68,484	42,269	22,052	64,321	(4,163)	3.0
1985/86	50,.195	22,756	72,951	45,447	24,294	69,741	(3,210)	2.1
1986/87	54,211	21,078	75,289	53,237	26,762	79,999	4,710	
1987/88	58,548	21,309	79,857	68,397	29,487	97,884	18,027	
1988/89	63,232	19,954	83,186	64,436	32,480	96,916	13,730	
1 989/90	68,291	19,034	87,325	63,929	35,780	99,709	12,384	
1 990/91	73,754	15,301	89,055	64,526	39,413	103,939	14,884	
1991 /92	84,6549	--	84,654	71,065	43,424	114,489	29,835	
1992/93	91,426	--	91,426	76,383	47,$31	124,214	32,788	
1993/94	98,740	--	98,740	86,221	52,688	138,909	40,169	
1 994/95	106,640	--	106,640	93,162	58,045	151,207	44,567	
1995/96	115.171	--	715,171	102,742	63,944	166,686	51,515	
1996/97	124 ,384	--	124,384'	112,111	70,440	182,551	58,167	
1997/98	134,335	--	134,335	122,954	77,592	200,546	66,211	
1998/99	145,082	--	145,082	135,996	85,480	221,446	76,364	
1 999/00	156,689	--	156,689	140,038	94,160	234,198	77,509	
2000/01	169,224	--	169,224	164,780	103,735	268,515	99,291	

a/ North Slope Borough budget figures. Revenues and expenditures with the exception of debt service, projected at 8% annual increase.

b/ Includes $3 million for capital outlay. The remainder is projected at 8% increase per year.

c/ Includes $5 million for capital outlay from FY 1991/92 compounded annually at 8% through FY2000/01for pay-as-you-go capital outlays.

d/ Levied per AS 29.53.055 above 30 mill levy under AS 29.53.045(c).

SOURCE: Alaska Consultants, 1978.

5. After Prudhoe-High, the Prudhoe-Modal OCS case offers the most immediate financial assistance to the Borough. The size of projected borough deficits from FY 1980/81 through FY 1985/86 is reduced to permit a lower debt service mill levy against borough taxpayers during those years. However, such a levy would be higher than in a Prudhoe-High scenario (Alaskan Consultants, 1978).

Natural Resources. Because proximity of the Prudhoe-Modal scenario to the Prudhoe-High scenario, the impacts to the natural physical environment are assumed to be the same. Table 28 summarizes the potential impacts to fish and wildlife, water quality, water resources, sanitation, and sand and gravel resources for Prudhoe-High. The description of these impacts applies to the Prudhoe-Modal scenario as well (Dames and Moore, 1978).

Sociocultural. The range of impacts and effects throughout the sociocultural realm are similar to those identified in the Camden-Canning and Prudhoe-High scenarios but on a reduced scale (Worl & Assoc., 1978).

Cape Halkett Scenario

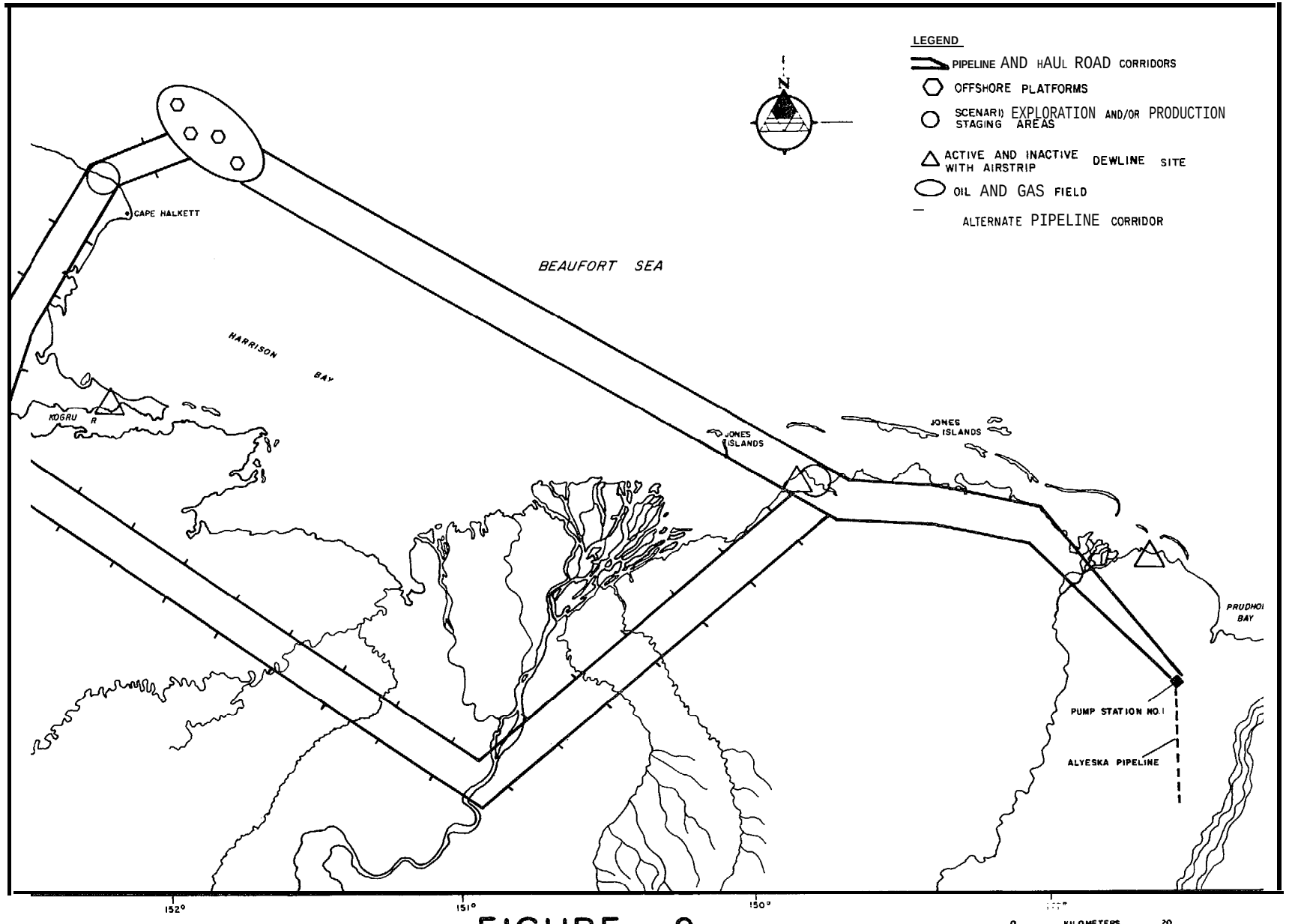
DESCRIPTION

The Cape Halkett lease sale area shown in Figure 9 has a surface expression of 8,097 ha (20,000 acres) and assumed oil reserves of 9.8 Bbbl. The following federal tracts of 2,304 ha (5690 acres) each make up the total 25,344 ha (62,600 acres) of the field (see Figures 5a and 5b).

7	52	96	140
8	53	97	141
51	95	98	142

Exploration commences in 1984, development in 1988, and production in 1992. The life span of the field is estimated to be 25 years, starting with discovery in 1985 and field shutin for oil in 2010, No gas is assumed to be found in Cape Halkett scenario.

The most seaward part of the Cape Halkett field lies 19 km (12 miles) northeast of Cape Halkett in about 13 m (44 ft.) of water, while the portion nearest the shore lies in about 7.6 m (25 ft.) of water. The field mostly lies in the landfast ice zone, although a distinct shear line that follows the 10-m (30-ft.) bathymetric trend in west Harrison Bay may affect the outermost portion of the field location. Based on limited data, bottom sediments in west Harrison Bay are assumed to be silt and clay. Shoal areas located immediately north of the field and to the southeast in Harrison Bay (Pacific Shoal) may be composed of sandy or gravelly sediments. Approximately 122,000 m^3 (160,000 yd^3) of sand and sandy gravel have been mapped along the beaches within 10 km (6 miles) of Cape Halkett.



SOURCE : DAMES & MOORE

FIGURE 9

CAPE HALKETT SCENARIO. 0.8 Bbbl. RESERVES

The Cape Halkett field is nearly 150 km (90 miles) from the trans-Alaska pipeline. The resulting cost of pipeline construction makes the economics marginal for a field of this size. The petroleum facilities are assumed to be offshore, with one of the four platforms built into a platform complex. Gas turbine power is used in the field. At the east Harrison Bay shore, the only installation is the pipeline landfall and aboveground facilities (including a road along the line). A base camp, harbor, and airstrip are assumed on Cape Halkett. A treatment facility with a 300 Mbbl/d capacity, on a segment of the complex, provides pumping power to the Alyeska terminus and separates gas for reinfection.

Three of the eight exploration wells will lie in the field boundaries. An alternative pipeline route onshore would measure in excess of 200 km (120 miles) (Dames and Moore, 1978).

Platforms:	Barge	Soil	Ice	Gravity
Exploration	2	0	6	0
Production	0	2	0	2

Wells:

Exploration	8
Oil	- 143
Gas	3
Development	- 14

Pipelines:

Connectors	- 67 km (42 miles)
Offshore	- 82 km (51 miles)
Onshore Trunk	- 66 km (41 miles)

SUMMARY OF IMPACTS

Alaska

Economic/Demographic. The Cape Halkett scenario has the smallest impact on the economy of all the scenarios because it is small, and there is no state share of its production. Exploration begins in 1984 and lasts until 1987. Exploration employment peaks in 1986. Development begins in 1988 and lasts through 1991. Peak development employment is in 1996, which is also the peak year for direct employment for the entire period. Production begins in 1992 and lasts through the remainder of the forecast period.

Cape Halkett increases employment and population by approximately 2 Percent over the base by 2000 (Table 37). There are no major population increases in any year; instead, growth is spread out through the entire period, minimizing the impact.

TABLE 37

CAPE HALKETT SCENAR10 IMPACT ON AGGREGATE INDICATORS
STATE OF ALASKA
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	419.1	.0	198.6	.0	4523.0	.0
1980	449.2	.0	218.5	.0	5561.0	.0
1981	466.2	.0	226.7	.0	6053.0	.0
1982	463.2	.0	218.7	.0	5710.0	.0
1983	470.1	.0	221.3	.0	6010. 0	.0
1984[1]	479.6	.1	226.2	.1	6445.8	5.8
1985	492.3	.4	234.0	.3	7049.0	17.0
1986	500.7	.7	238.3	.5	7533.0	26.0
1987	504.4	.4	239.2	.2	7341.4	9.4
19882	505.2	.8	238.4	.5	9097.6	30.6
1989	510.6	2.2	242.0	1.5	3612.4	103.4
1 990	517.5	5.0	246.8	3.4	9244.5	236.5
1991	523.3	5.2	250.8	3.2	9817.1	213.1
1 992[3]	529.1	6.7	254.9	4.0	10447, 6	260.6
1 993	535.8	7.5	259.3	4.2	11157.4	234.4
1994	541.7	9.4	264.0	4.5	11373.1	317.1
1995	549.1	9.3	269.6	4.9	12711.5	353.5
1996	555.4	10.2	274.3	5.2	13471.8	391.8
1997	563.2	10.8	2'90.2	5.3	14498.9	413.9
1998	570.5	11.6	285.6	5.6	15481.9	455.9
1999	579.3	12.0	292.4	5.6	16602.6	467.6
2000	538.3	12.7	299.1	5.9	17802.3	513.3

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars

SOURCE: ISER, 1978

Effects of Cape Halkett development on the base case are similar to those for other scenarios. They support the general structural change which increases the importance of employment in the trade, service, and finance sectors and, therefore, will likely reduce seasonality. Because the increased economic opportunities reduce outmigration of the young, Cape Halkett development decreases the general aging of the population found in the base case (ISER, 1978).

Transportation. The Cape Halkett scenario has the lowest number of total exploration and development wells (340), so its impacts to transportation are likely to be less than those of the other scenarios. Total freight tonnage does not exceed 66,224 metric tons (73,080 tons) in any one year. Because the camp location will not be linked to the rest of the state by road, marine and air modes will transport all freight and passengers.

Air transportation needs are highest from 1992 through 1996. Passenger seat requirements peak in 1992 at approximately 19 seats per day. This demand is expected to recur through 1995 during peak periods of employment. Consumable industrial and camp goods will be transported by air freight (routed through Fairbanks). Air freight traffic will peak during the 1991 period of high employment and construction activity in the late fall and early winter months, probably requiring three or four Hercules flights per week.

Marine transportation requirements for the Cape Halkett scenario will peak during the period 1992-96 at about 66,211 metric tons (73,000 tons), of which approximately 30,039 metric tons (33,120 tons) will be fuel. Total required shipping capacity will peak at approximately 27,215 DWMT (30,000 DWT) for fuel and approximately 32,658 DWMT (36,000 DWT) for other goods.

This scenario will have less overall impact on Fairbanks and Anchorage transportation systems than any of the other three scenarios.

In the Beaufort Sea Region, peak induced employment is forecast to be 1,500 jobs, or slightly more than that for Prudhoe-Modal. However, this peak occurs in 1990, three years after that of Prudhoe-Modal, so Cape Halkett trends tend to cancel out fluctuations in the non-OCS base at that time (Dooley & Assoc., 1978).

Anchorage/Fairbanks

Economic/Demographic. Table 38 shows economic and demographic impacts to Anchorage resulting from the Cape Halkett scenario. Total employment is approximately 4,400 jobs greater and population approximately 9,100 greater than the base case by the year 2000. The effects of this additional growth on Anchorage are similar to the impacts presented for the other scenarios.

Table 39 illustrates the growth in employment, population, and personal income in Fairbanks. Fairbanks receives the smallest economic and demographic impacts of the regions under study. By 2000 employment is 500

TABLE 38

CAPE HALKETT SCENARIO TOTAL ECONOMIC IMPACT
ANCHORAGE
1979-2000

YEAR	POPULATION TOTAL (Thousands of Persons)	POPULATION CHANGE FROM BASE CASE (Thousands of Persons)	EMPLOYMENT TOTAL (Thousands of Employees)	EMPLOYMENT CHANGE FROM BASE CASE (Thousands of Employees)	PERSONAL INCOME[4] (Millions Of $) TOTAL	PERSONAL INCOME[4] (Millions Of $) CHANGE FROM BASE CASE
1979	183.8	.0	86.7	.0	1790.6	.0
1980	194.6	.0	94.2	.0	2093.6	.0
1981	205.5	.0	98.4	.0	2308.4	.0
1982	212.6	.0	97.3	.0	2350.9	.0
1983	218.9	.0	99.7	.0	2520.3	.0
1984[1]	226.7	.1	103.0	.0	2732.1	1.8
1985	234.7	.3	107.0	.1	2992.3	5.6
1986	240.3	.4	110.0	.2	3220.9	8.9
1987	245.0	.2	111.6	.1	3399.5	4.1
1988[2]	247.0	.4	112.9	.3	3572.3	12.1
1989	251.8	1.2	115.6	.9	3228.9	41.6
1990	257.6	2.7	119.6	2.1	4147.6	96.9
1991	263.2	2.9	123.7	1.9	4452.6	91.7
1992[3]	269.3	4.2	126.3	2.2	4787.9	111.4
1993	275.9	4.8	130.4	2.3	5190.4	125.2
1994	231.9	5.4	134.7	2.6	5586.9	143.6
1995	289.2	6.1	139.6	2.9	6056.6	164.7
1996	296.1	6.8	144.8	3.2	6558.2	18S.S
1997	304.2	7.3	150.6	3.4	7131.8	208.2
1998	312.3	8.0	157.0	3.8	7764.0	238.1
1999	321.8	8.4	164.3	4.0	8490.5	257.5
2000	331.7	9.1	172.7	4.4	9322.8	296.8

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE:: ISER, 1978

TABLE 39

CAPE HALKETT SCENARIO TOTAL ECONOMIC IMPACTS
FAIRBANKS
1979-2000

YEAR	POPULATION		EMPLOYMENT		PERSONAL INCOME[4] (Millions of $)	
	TOTAL (Thousands of Persons)	CHANGE FROM BASE CASE (Thousands of Persons)	TOTAL (Thousands of Employees)	CHANGE FROM BASE CASE (Thousands of Employees)	TOTAL	CHANGE FROM BASE CASE
1979	63.2	.0	32.1	.0	766.2	.0
1980	81.2	.0	39.8	.0	1100.0	.0
1981	81.0	.0	39.2	.0	1128.1	.0
1982	67.3	.0	30.8	.0	812.3	.0
1983	67.7	.0	30.8	.0	844.0	.0
1984[1]	69,1	.0	31.4	.0	905.1	.0
1985	70.2	.0	32.0	.0	976.6	1.0
1986	71.0	.1	32.4	.0	1039.3	2.4
1987	71.4	.0	32.6	.0	1086.6	.3
1988[2]	70.8	.0	32.4	.0	1122.0	2.4
1989	70.7	.0	32.7	.1	1181.8	7.7
1990	70.6	.0	33.0	.2	1257.5	18,4
1991	71.0	.3	33.4	.2	1332.5	19.2
1992	71.4	.8	33.8	.4	1416.6	29,7
1993	71.7	1.0	34.2	.4	1504.8	32.6
1994	71.6	1.1	34.5	.4	1593.4	36.0
1995	71.7	1.2	34.9	.4	1691.5	39.5
1996	71.6	1.3	35.4	.5	1792.5	43.3
1997	71.5	1.3	35.8	.5	1902.5	44.9
1998	71.3	1.3	36.3	.5	2018.8	48.8
1999	71.1	1.3	36.8	.5	2144.7	49.1
2000	70.8	1.3	35.3	.5	2281.1	53.1

[1] Exploration begins
[2] Development begins
[3] Production begins
[4] Nominal dollars
SOURCE : ISER, 1978

higher and population is 1,300 higher than for the base case. The reasons for this small increase are the same as described for the Prudhoe-Modal scenario (ISER, 1978).

Urban Services. The Cape Halkett scenario has only minimal impact on Anchorage. Table 40 summarizes the services likely to be impacted as a result of OCS development. These increases represent the demands placed on urban services by the additional 9,100 people added to the population between 1985 and 2000. While small, this 2.7 percent growth rate is slowing. The increment is basically insufficient to have a significant, impact on service expenditures; however, as for the other scenarios, this addition stimulates the local economy and general revenue base (Ender and Assoc., 1978).

Beaufort Sea Region

Economic/Demographic. Table 41 shows the growth in employment for the Beaufort Sea Region and communities of Barrow, Kaktovik, Nuiqsut, and Wainwright resulting from the Cape Halkett scenario. By 2000 employment is 709 jobs, or 9 percent, greater than in the base case. When direct employment at the OCS site peaks in the development phase in 1990, total employment is 2,354 jobs, or 40 percent, higher. By the end of the exploration phase in 1987, employment is less than 1 percent higher than in the base case.

The overall distribution of employment is different from both the base and the other scenarios. Direct Cape Halkett employment and local construction account for more than 50 percent of the increased employment in all stages of petroleum activity, going against the base case trend in which jobs in trade, services, and finance increased their proportion of total employment and decreased the proportion of seasonal jobs. This may not be true for the local economy since most of the increase in seasonal employment will be in the enclave sector.

Table 42 shows regional and community population impacts of Cape Halkett development. By 2000 the North Slope Borough population has increased by 600 over the base case. This total will not have as large an impact on the local population since more than half of this increase is the extra employment in the enclave sector. Total population in the local sector is only increased by 200, or 2.7 percent, over base levels. By the end of Cape Halkett development the local population is 1,300, or 17 percent, higher than in the base (ISER, 1978).

Community Services. The Cape Halkett scenario is forecast to result in the least amount of additional community growth in the Beaufort Sea Region, mainly because of its later startup date. As such, it is expected to place very few additional demands on community facilities and services. As was the case with the other OCS scenarios, the only significant areas of impact will be on housing and utilities services in Barrow, although these will be relatively modest.

While a Cape Halkett scenario is expected to have little impact on the region's traditional communities, it also will contribute little in terms

TABLE 40

CAPE HALKETT SCENARIO
ANCHORAGE URBAN SERVICE REQUIREMENTS

	1960	1985	1990	1995	2000
Population	194,636	234,649	257,571	289 ,186	331,668
Education: Primary/Secondary - No. of Teachers	0	2	22	48	72
Public Safety: Police - Manpower	0	0	4	9	14
State Troopers - Manpower	0	0	1	1	2
Fire: Manpower	0	0	4	9	14
Leisure: Play Lots	0	0	2	2	3
Neighborhood Parks	0	0	0	0	1
Softball Diamonds	0	0	0	0	1
Basketball Courts	0	1	6	12	18
Swimming Pools	0	0	0	0	1
Skating Rinks	0	0	0	0	1
Community Center	0	0	0	0	1
Utilities: Water - (Millions of Gallons per Day)	.0	.0	0.6	1.2	1.8
Sewer - (Millions of Gallons per Day, Wastewater Generated)	.0	.0	0.4	0.9	1.4
Housing	0	83	858	1.973	2,923
Health: Bed Needs	0	0	5	12	17
Primary Care Physicians	0	1	3	8	11
Social Services: Day Care Space	0	4	40	91	136
Unemployment Claimant	0	17	173	398	589
Low Income Housing Units	0	40	40	91	135

Note: 1984 Exploration begins
1988 Development begins
1992 Production begins

SOURCE : Ender and Assoc., 1978.

TABLE 41

FORECAST OF EMPLOYMENT
CAPE HALKETT SCENARIO
BARROW, KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Employment									
	Barrow [a]		Kaktovik [b]		Nuiqsut [b]		Wainwright [c]		Region [d]	
	Total	Change from Base	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	915C	0	36[e]	0	42[e]	0	58[f]	0	6,490	0
1980	962	0	36	0	43	0	63	0	8,308	0
1985	1,078	3	38	1	46	0	72	0	7,169	126
1990	1,220	18	40	1	50	2	83	2	8,123	2,354
1995	1,380	36	43	2	54	3	98	4	7,237	754
2000	1,561	59	46	3	59	6	104	4	8,242	709

[a] Barrow's employment forecasted at the current rate of approximately 1 job for every 3 local residents.
[b] Kaktovik and Nuiqsut's employment forecasted at the current ratio of approximately 1 job for every 3.8 local residents.
[c] Wainwright's current ratio of approximately 1 job for every 6.9 local residents is not considered to remain constant in this forecast. It is estimated that the 1980 ratio will be 1:6.5, the 1985 ratio 1:6.0, the 1990 ratio 1:5.5, the 1995 ratio 1:5.0 and the 2000 ratio 1:5.0, thus tending toward the existing ratios in other traditional villages of the region outside Barrow.
[d] Regional employment forecasts developed by ISER for the Alaska OCS socio-economic studies program.
[e] Average annual employment estimates derived from Alaska Consultants, Inc. counts in December 1977.
[f] Average annual employment estimate derived from Alaska Consultants, Inc. count in April 1977.

Note: 1984 Exploration begins
1988 Development begins
1992 Production begins

SOURCES: Alaska Consultants, 1978.
ISER, 1978.

TABLE 42

FORECAST OF POPULATION [a]
CAPE HALKETT SCENARIO
BARROW , KAKTOVIK, NUIQSUT, WAINWRIGHT AND NORTH SLOPE REGION
1977 - 2000

Year	Forecasted Population [b]									
	Barrow		Kaktovik		Nuiqsut		Wainwright		Region [b]	
	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case	Total	Change from Base Case
1977	2,700[c]	0	134[d]	0	157[i]	0	398[d]	0	9,323	0
1978	2,761	0	135	0	159	0	402	0	7,168	0
1979	2,823	0	136	0	161	0	406	0	8,516	0
1980	2,887	0	137	0	163	0	410	0	9,980	0
1981	2,952	0	138	0	165	0	414	0	10,678	0
1982	3,018	0	139	0	167	0	418	0	8,385	0
1983	3,086	0	140	0	169	0	422	0	8,191	0
1984 [e]	3,155	0	141	0	171	0	426	0	8,289	38
1985	3,234	8	143	1	174	1	431	1	8,405	132
1986	3,315	16	145	2	177	2	436	2	8,671	194
1987	3,398	25	147	3	180	3	441	3	8,322	63
1988 [f]	3,483	34	149	4	183	4	447	5	8,660	373
1989	3,570	43	151	5	186	5	453	7	8,388	1,308
1990	3,659	53	153	6	189	6	459	9	9,859	2,749
1991	3,750	63	155	7	192	7	465	11	9,226	1,926
1992 [g]	3.844	74	157	8	195	8	471	12	8,410	961
1993	3; 940	85	159	9	198	9	477	13	8,424	783
1994	4,038		161	9	201	10	483	14	8,539	743
1995	4,139	1::	163	9	205	12	489	15	8,703	719
1996	4,242	120	165	9	209	14	495	16	8,866	709
1997	4,348	133	167	9	213	16	501	17	9,018	652
1998	4,457	147	169	9	217	18	507	18	9,225	663
1999	4,568	161	171	9	221	20	513	19	9,383	587
2000	4,682	176	173	9	225	22	519	20	9,628	607

[a] Barrow's population forecasted at an annual rate of increase of 2.25 percent through 1984 (non-OCS forecast) and thereafter at an annual rate of 2.5 percent. Kaktovik, Nuiqsut and Wainwright's population forecasted at an annual rate of increase of 1 percent through 1984 (non-OCS forecast); thereafter Wainwright and Kaktovik populations are projected at an annual rate of increase of 1.25 percent and Nuiqsut's population at an" annual rate of 1.75 percent.
[b] Regional population forecasts developed by ISER for the Alaska OCS socio-economic studies program.
[c] Barrow's 1977 population estimated by Alaska Consultants, Inc.
[d] North Slope Borough Planning Department population estimates.
[e] 1984 Exploration begins
[f] 1928 Development begins
[g] 1992 Production begins

SOURCES: Alaska Consultants, 1978
ISER, 1978.

of revenues during a period of anticipated borough deficits. Thereafter, like the other OCS scenarios under study, the additional tax revenues this scenario would generate should be sufficient to permit the Borough to cope with any new impacts on community facilities and services. -

In terms of impacts on borough revenues (Table 43), the Cape Halkett scenario would be of little assistance in the short term. This scenario is seen as the least desirable from the Borough's point of view since, because of its later start-up date, it will not help the Borough's immediate deficit position until FY 1984/85. However, it would eliminate the forecast deficit position in FY 1988/89 and 1989/90 in the non-OCS case (as would all of the OCS scenarios under consideration).

No regional impacts beyond those Identified in the non-OCS case are anticipated in a Cape Halkett scenario. However, the following significant impacts on North Slope traditional communities are expected:

1. The population of the smaller communities of the region is expected to grow at a slightly faster rate than in the non-OCS case. However, the numerical difference is marginal.

2. As in the Prudhoe-Modal case, Barrow's population is forecast to growat a rate between the non-OCS and Prudhoe-High cases, resulting in fewer non-Inupiat moving into this community than in larger OCS scenarios.

3. Like the other OCS cases, the Cape Halkett scenario contributes to significantly higher borough revenues through property taxation than possible in a non-OCS case. However, because this scenario does not get underway until the mid-1980's, its moderating effect on immediate borough deficits will be minimal.

4. In summary, of the four OCS scenarios Cape Halkett has the least impact on the man-made environment of the traditional villages of the Beaufort Sea Region, but it also offers the fewest benefits to the North Slope Borough and its people (Alaska Consultants, 1978).

Natural Resources. Subsistence activities are important in the Cape Halkett area. A great concentration of wildlife occurs near there, west of the Colville River. The community of Nuiqsut relies heavily on waterfowl, whales, seals and caribou for subsistence.

A nonmigratory caribou herd has been developing in the area around Teshekpuk Lake. The use of above-ground pipelines from a landfall at Cape Halkett to Prudhoe Bay could seriously influence the distribution of both the Teshekpuk and Central Arctic Caribou Herds. Teshekpuk Lake lies a few miles inland from the coast and is a major fish overwintering area. It also supports a traditional subsistence fishery for local residents. Adverse impacts could result from extensive activity near the lake.

TABLE 43

ESTIMATED REVENUES ANO EXPENDITURES
CAPE HALKETT SCENARIO
NORTH SLOPE BOROUGH
FY 1977/78 - FY 2000/01
(in 000's of Real S)

Fiscal Year	Expenditures			Revenues			Surplus (Deficit)	Debt Service Mill Rate d/
	Operating Budget	Debt Service	Total	Property Taxes	Other Revenues	Total		
1977/78a/	$30,126b/	$7,634	$37,760	$18,922	$11,204	$30,126	(S7,634)	7.52
1978/79	29,288	23,027	52,315	22,309	12,342	34,651	(17,664)	23.8
1979/80	31,631	22,026	53, 657	28,644	13,595	42,239	(11 ,418)	12.0
1 980/81	34,161	24,503	58,664	36,272	14,975	51,247	(7,417)	6.1
19S1 /82	36,894	23,200	60,094	41,921	16,497	58,418	(1,676)	1.2
1 982/83	39,846	23,252	63,098	39,473	18,174	57,647	(5,451)	4.1
1983/84	43,034	25,737	68,771	37,476	20,027	57,503	(11,208)	9.0
1984/85	46,477	22,007	68,484	40,950	22,052	63,002	(5,482)	4.0
1985/86	50,195	22,756	72,951	44,858	24,294	69,152	(3,799)	2.5
1986/87	54,211	21,078	75,289	49,986	26,762	76,748	1,459	
1987/88	58,548	21,309	79,857	51,804	29,487	81,291	1,416	
1988/89	63,232	19,954	83,186	51,481	32,480	83,961	775	
1989/90	68,291	19,034	87,325	60,905	35,780	96,685	9,360	
1 990/91	73,754	15,301	89,055	77,354	39,413	116,767	27,712	
1991/92	84,654c/	--	84,654	80,921	43,424	124,345	39,691	
1992/53	91,426	--	91,426	76,924	47,831	124,755	33,329	
1 993/94	98,740	"-	98,740	83,217	52,688	135,905	37,165	
1994/95	106,640	--	106,640	91,106	58,045	149,151	42,511	
1995/96	115,171	--	115,171	100,291	63,944	164,235	49,064	
1996/97	124,384	--	124,384	110,350	70,440	180,790	56,406	
1997/98	134,335	--	134,335	121,227	77,592	198,s19	64,484	
1998/99	145,082	--	145,082	133,941	85,480	219,421	74,339	
1 999/00	156,689	--	156,689	147,142	94,160	241,302	84,613	
2000/01	169,224	--	169,224	163,075	103,735	256 ,81 0	97,586	

a/ North Slope Borough budget figures. Revenues and expenditures, with the exception of debt service, projected at 8% annual Increase.
b/ Includes $3 million for capital outlay. The remainder is projected at 8% increase per year.
c/ Includes $5 million for capital outlay from FY 1991/92 compounded annually at 8% through FY 2000/01 for pay-as-you-go capital outlays.
d/ Levied per AS 29.53.055 above 30 mill levy under AS 29.53.045(c).

SOURCE: Alaska Consultants. 1978,

Increasing marine traffic related to OCS development may interfere with marine mammals. The major items of concern related to marine mamma 1s are:

- Direct modification of habitat or productivity resulting from construction of drilling platforms or islands, camps, staging areas, and underwater pipelines.

- Displacement of marine mammals from traditional migration routes and hauling-out and pupping areas due to excessive human activity or petrochemical pollution.

Nuiqsut's local water resource will be directly impacted if an onshore pipeline is built from Cape Halkett to Prudhoe Bay since the corridor passes near the village. The pipeline work pad and haul road will alter local drainage patterns and may affect the water quality at stream crossing sites.

Teshekpuk Lake, as mentioned above, is a critical wildlife area. Also, the Colville River delta has major waterfowl nesting areas and fish overwintering sites that could be adversely impacted if too much water is withdrawn. Any adverse impact to waterfowl or fish will ultimately be felt by villagers using this area for subsistence. Major waterfowl nesting areas and fish overwintering sites on the Colville River delta could be impacted by gravel mining, oil spills, and collection of potable water. Human activity, including movement of equipment and low-level aircraft operation, could result in desertion of nesting sites and seal hauling-out areas, and abandonment of seal pups.

It is doubtful that sufficient borrow exists west of the Colville River to support major offshore petroleum development without significant environmental impact and long barge haul of material. The potential also exists for serious environmental impacts if onshore and offshore gravel resources are mined west of Cape Halkett. There is a greater chance for encounters with marine mammals in this area than in the Prudhoe Bay and Camden-Canning areas. Smith Bay, for example, is critical summer habitat for the endangered bowhead whale, beluga whale, and ringed seal which could be seriously disturbed by marine traffic associated with dredging and island construction. Inland from Cape Halkett, gravel extraction of such deposits as the beaches of Teshekpuk Lake could involve significant impacts to the lake's fish resources and the small caribou herd.

Table 44 summarizes the potential impacts to fish and wildlife resources, water quality, water resources, sanitation, and sand and gravel resources resulting from Cape Halkett development (Dames and Moore, 1978).

Sociocultural. Employment/economy impacts are narrower than those anticipated during the Camden-Canning scenario except at nearby Nuiqsut.

The potential impacts on the cultural system are greater because of the significant environmental dangers associated with the Cape Halkett OCS . scenario development activities. The nature of these impacts and their

TABLE 44

NATURAL RESOURCES
Summary of Impacts on Fish and Wildlife Resources,
Water Quality/Resources, Sanitation and Gravel Resources

RESOURCE	POTENTIAL IMPACT
seals	Direct disturbance from boats and aircraft; modification of pupping or hauling-out areas by oil field development; attraction of migration due to human activity and water pollution.
Whales,	Direct disturbance from boats and aircraft; displacement from calving areas and migration routes due to human activity or petrochemical pollution.
Foxes and Wolves	Increased mortality when animals are attracted by direct feeding or improper garbage disposal.
Caribou	Direct disturbance of resident caribou near Teshekpuk Lake from human and vehicle activity and pipelines.
Waterfowl	Direct disturbance-of nesting, molting and migrating waterfowl from boats, aircraft and ground vehicles; nesting habitat loss from gravel mining.
Fish	Siltation of feeding and spawning areas from gravel mining; blockage to fish passage from gravel mining - caused changes to stream channels; disturbance of fish overwintering areas from collection of potable water or gravel mining at Teshekpuk Lake on the Colville River delta.
Hunting and Fishing	Increased marine traffic may displace bowhead and belukha whales from traditional hunting areas. Siltation of Teshekpuk Lake from gravel mining could reduce harvests of local fishermen. Shore based construction and vehicle traffic could displace waterfowl and caribou used by people from Barrow and Nuiqsut.
Water Quality	If an onshore pipeline is built there may be water quality impacts stemming from drainage pattern alterations. Increased turbidity and contaminants may occur, however, if there is compliance with OCS operating orders and state operating orders, water quality impacts will be minimal.
Water Resources	A possible impact will occur if an onshore pipeline is built due to increased water withdrawal from Teshekpuk Lake and the Colville River delta.
Sanitation	Assuming sewage treatment will take place by industry minimal affects will occur to the environment.
Gravel	Total gravel requirements are 4,528,388 cubic meters (5,931 ,048 cubic yards). There is a scarcity of onshore and possibly offshore gravel resources in the Cape Halkett area. 'It is doubtful that there is sufficient borrow west of the Colville River to support major petroleum development without significant environmental impact and/or long barge haul. West of the Colville there are important summer habitats of the bowhead and belukha whales and ringed seals which could be seriously impacted by offshore gravel extraction particularly disturbance from marine traffic.

SOURCE: Dames and Moore, 1978.

manifestations throughout the sociocultural system are the same as those described for the Camden-Canning scenario.

Potential for negative environmental and subsistence impacts is highest in this scenario, and it therefore has the most volatile potential impact on interethnic feelings and relationships. Development in the Cape Halkett scenario might cause direct confrontation between subsistence hunting and fishing by the Inupiat and OCS activities of the non-Inupiat. This area is of such extreme importance for marine mammals, including whales, that the mere presence of large-scale activities will likely cause strong local reaction. Proximity to Barrow and potential local hire on a large scale might partially mitigate against problems in interethnic relations, but this is doubtful at this time.

While the proximity of Cape Halkett to Nuiqsut may offer increased employment opportunities for residents, fear of the potential impacts of OCS development on fish, caribou, and marine mammals may well decrease the desirability of working in the Cape Halkett OCS scenario. Possible environmental impacts will create concern about the presence of non-Inupiat on the North Slope, potentially raising fears of losing control of the area's resources to outsiders. Decreased subsistence opportunities are of particular concern to the residents of Nuiqsut, all of whom recently migrated from Barrow to continue a more traditional way of life and heavily rely on subsistence. The sociocultural ramifications correspond to those described for Camden-Canning interethnic relationships (Worl and ASSOC., 1978).

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