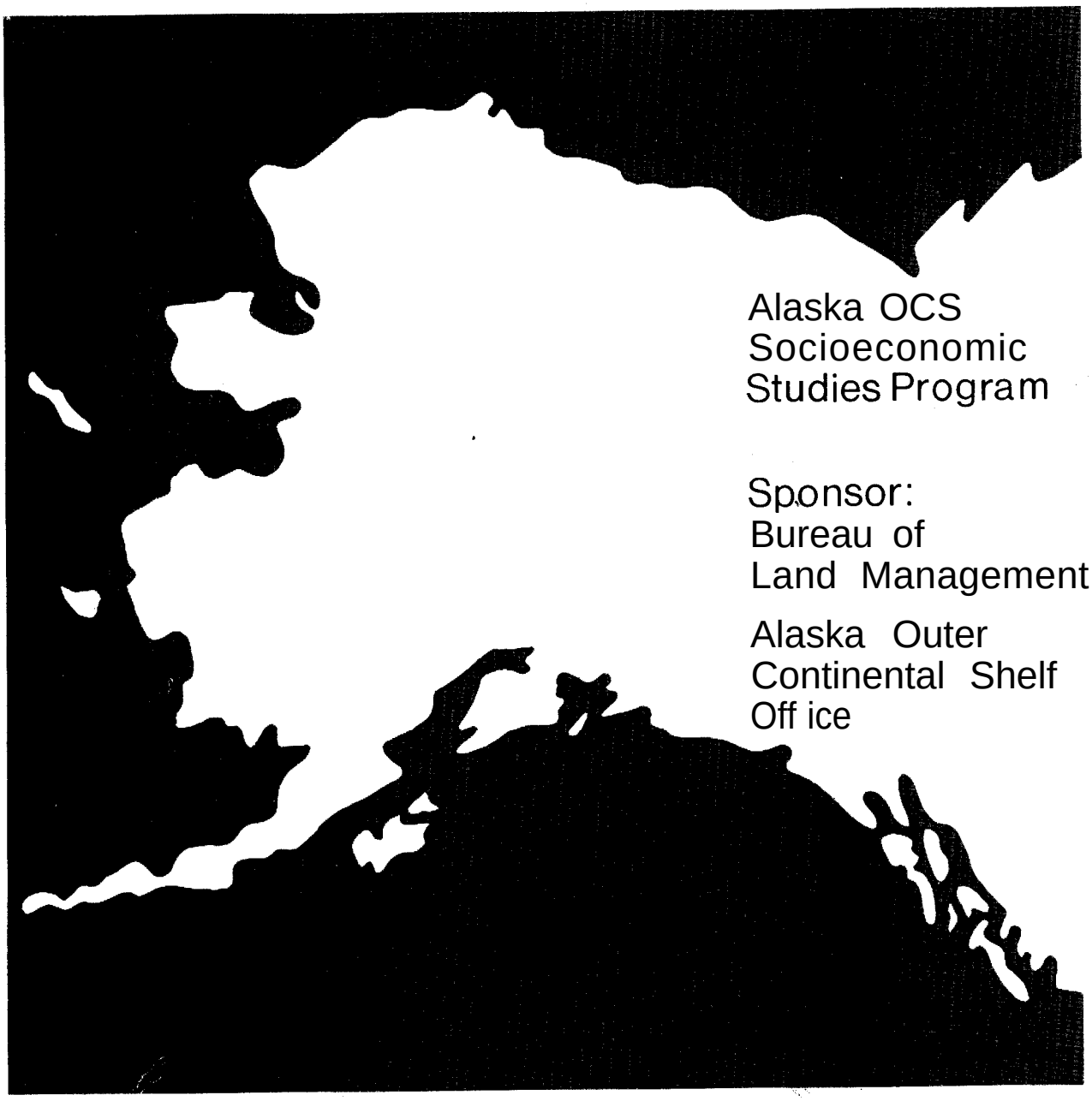
Technical Report
Number 5



Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of
Land Management

Alaska Outer
Continental Shelf
Office

Baseline Studies: The Beaufort Sea Region
. Interim Report

NOTICES

1. This document is disseminated under the sponsorship of the U.S. Department of the Interior, Bureau of Land Management in the interest of information exchange. 'The U.S. Government assumes no liability for its content or use thereof.

2. This is an interim report designed to provide preliminary community and regional profile data to groups working on the Alaska OCS Socioeconomic Studies Program. The data in this document provides an incomplete inventory of selected baseline information on the physical and mm-made environment organized into four categories: land use, land status, transportation, and utilities. A separate document will provide detailed baseline information focusing upon an understanding of the current social, economic, physical, and demographic conditions of the Beaufort Sea Petroleum Development Region. The baselines studies will form the basis of impact identification with and without OCS development.

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

BASELINE STUDIES
OF THE PHYSICAL AND MANMADE ENVIRONMENT

THE BEAUFORT SEA REGION

PREPARED FOR
BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

DECEMBER 1, 1977

CCC/HOK

BASELINE STUDIES: THE BEAUFORT SEA REGION

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I N T R O D U C T I O N

This report is part of a more comprehensive baseline study of the Beaufort Sea Petroleum Development Region and its communities as of mid-1977. It provides an inventory of selected baseline information on the physical and manmade environment organized into four categories: land use, land status, transportation, and utilities. A separate document will provide baseline information related to the socioeconomic environment.

The area that comprises the Beaufort Sea Petroleum Development Region is coterminus with the corporate limits of the North Slope Borough. Its communities include Barrow, Kaktovik, Point Hope, Point Lay, Wainwright, Ataksook, Nuiqsut, Anaktuvuk Pass, and the petroleum development base camp at Prudhoe Bay/Deadhorse.

The report is organized into three sections. The first section discusses land use and ownership patterns, transportation, and utilities service in the Region as a whole and in seven of its nine communities. The remaining two sections discuss aspects of the physical environment in greater detail for two communities that may receive some of the most significant impacts of OCS petroleum development in the Region: Barrow and Kaktovik.

METHODOLOGY OF THE STUDY

Preparation of the baseline study involved two basic work components:

- Compilation and synthesis of the most recent secondary data, drawing together information from a variety of published and unpublished sources; and
- Corroboration and updating of this information through a field visit to Barrow.

Compilation of Secondary Data

Compilation of secondary data involved research on published and unpublished documents and reports related to land use, land status, utilities and transportation. The amount and quality of this data varied considerably. Current, reliable information was available for some study areas, but was completely lacking in others.

Secondary sources utilized in this phase included land use plans, engineering and utilities studies, environmental impact statements, local newspapers and trade journals, inventories of archaeologic and historic sites and Native corporation publications. A bibliography of this material is included with each study.

Field Visit

A three-day visit to Barrow was made in May 1977 to corroborate and update information on the Region, Barrow, Kaktovik and other communities. No primary research or surveys were undertaken as a part of the field visit.

No field visit was made to Kaktovik specifically for the purpose of gathering baseline data. Recent trips by members of the study team, combined with discussions with Borough representatives, provided current information.

The sum of the information gathered from secondary sources and field visits was organized into descriptions of land use, land status, utilities and transportation in each community. In some cases, data gaps still exist for some components, and are noted in the studies.

IDENTIFICATION OF CRITICAL ISSUES

Critical issues related to the physical environment were identified for the Region as a whole and the communities of Barrow and Kaktovik, in accordance with the study design for the Alaska OCS Socioeconomic Studies Program.

Certain of these issues were common to all communities throughout the Region. The following discussion summarizes some of the key issues, with particular reference to conditions susceptible to change as a result of OCS oil and gas development.

Regional Issues

Subsistence activities are the earliest use to which the land and coastal waters in the Beaufort Sea Region were put. Of the nine communities in the Region, six are Native villages whose subsistence patterns are primarily oriented to the sea. During the ice-free summer season, whales, seal, walrus and fish are taken along the coast. In winter, polar bear and seal are hunted on the ice pack. Caribou and small game, such as waterfowl and foxes, are hunted from coastal areas and rivers.

Although snow machines and power boats have enabled Natives to hunt and fish within larger areas around their communities, many Natives perceive increasing difficulties in obtaining fish and game. A recent decrease in the size of the Western Arctic Caribou Herd has been followed by State restrictions on hunting, forcing greater reliance on purchased meat. Similarly, the harvesting of the bowhead whale, a significant part of Eskimo subsistence culture for many thousands of years, has been limited by the International Whaling Commission.

The North Slope Borough has expressed concern over potential long term conflicts between oil and gas development activities and the habitats on which subsistence hunters and fishermen depend. Subsistence areas and subsistence rights are likely to be impacted by prospective OCS development activities offshore and by on-shore operation and maintenance activities. The seasonal migration route of the bowhead whale in the Beaufort Sea, as well as the denning sites, population size and movement of terrestrial mammals, could all be affected by OCS petroleum development activities. The nature and extent of these impacts cannot be determined without more detailed information on the type and location of OCS facilities.

Archaeology

The Beaufort Sea Region contains materials that span at least 10,500 years of prehistory. Archaeological findings in the area have provided evidence of prehistoric migrations into North America, including occupations by prehistoric Eskimo and Indian groups.

Two coastal areas have received major archaeological attention: Point Hope and Point Barrow. Extensive archaeological research at Point Hope has led to the identification of the important Ipuitak Eskimo culture that existed on the Alaskan Arctic coast from about 200 to 300 A.D., as well as several thousand years of Eskimo prehistory. The Point Barrow area, the focus of archaeological investigations since the early 1900's, has revealed occupation by prehistoric Eskimo groups at least one thousand years ago.

Despite research that has been undertaken thus far in the Arctic, archaeologists believe that the known sites represent only a small portion of the total. Both known and unknown sites remain vulnerable to disruption from coastal erosion, overland transportation and any development activities. Without adequate pre-development archaeological reconnaissance, the construction of ports, overland pipelines and haul roads could disrupt undocumented sites. Oil spills could also destroy or severely disrupt sites. The Borough believes that documentation and preservation of these historical Inupiat hunting and fishing camps and other sites is critical to protect areas from intrusion and to maintain traditional subsistence areas.

At the same time, it is highly probable that any development activity, particularly in coastal areas or river valleys, would reveal undocumented sites. This could require planning for pre-development archaeological reconnaissance, relocation of development to alternative sites, the establishment of corridors to minimize impact on sites, and excavations or recovery of sites before actual construction.

Land Status

Most of the land in the Arctic is owned by the federal government. Of the approximately 50 million acres in the Region, one-half is included in National Petroleum Reserve-A and the Arctic National Wildlife Refuge. The State owns approximately 3.5 million acres between the Colville and Canning Rivers, centered on oil development in the vicinity of Prudhoe Bay. In addition, approximately 1.4 million acres are included in the State's trans-Alaska pipeline utility corridor. An additional 3.5 million acres are owned by nine village corporations that comprise the communities of Barrow, Kaktovik, Nuiqsut, Wainwright, Ataksook, Point Lay, Point Hope, and Anaktuvuk Pass and the regional corporation.

As a result of the passage of the Alaska Native Claims Settlement Act (ANCSA) in 1971 and the Statehood Act of 1959, the classification of the remaining land in the Arctic Region is yet to be finally determined. Major issues related to OCS development include classification of undesignated lands, as well as uses permitted on lands which have already been conveyed.

Prominent among current land status issues in the Beaufort Petroleum Development Region is the final resolution of Section 17(d)(2) National Interest Lands. The legislation finally enacted on (d)(2) lands will determine such land issues as the kind and amount of mineral extraction allowed to meet national energy needs, the locations of transportation and pipeline corridors, and the potential conflicts between subsistence activities and increased recreational opportunities.

Additional land status issues of relevance to OCS petroleum development in the Beaufort Region include resolution of pending village and regional corporation selections, and resolution of questions relating to the granting of easements across Native lands. The locations of petroleum development base camps, the alignments of supply roads and pipelines, or any resource development in the Region will be partially determined by these emerging ownership patterns and the use restrictions that accompany them.

Transportation

Significant difficulties with the construction of roads and railroads on the North Slope and the lack of construction materials forces reliance on air transportation and infrequent marine transportation. Although the terrain is flat and presents no topographic limitations to vehicular movements, the wet surface conditions in summer and the extremely low temperatures in winter make overland transportation difficult. There is only one inter-regional road in the Arctic, the haul road built to service the trans-Alaska oil pipeline. Although the haul road eventually may be open for public use, the Prudhoe Bay terminus is still at least 70 miles from the nearest community, Nuiqsut.

Barge and ship transport is used for the long distance transportation of heavy cargo, but its use is limited to the six-week period during which the North Slope is ice free. A further constraint to the use of marine transport is that the waters off the entire Arctic Coast are shallow, making the lightening of goods to shore necessary from ocean-going ships and barges by shallow-draft barges. Nonetheless, marine transport continues to be the most widely used mode for the long distance transportation of cargo.

All passenger traffic into and out of the Arctic is by air. Both scheduled commercial flights and non-scheduled charter aircraft serve communities in the region. Air transport is also the sole year-round means of transporting supplies to the North Slope.

Reliable and efficient transportation is critical to the communities in the Beaufort Sea Region and to petroleum exploration and development activities. OCS petroleum activities will require increased coverage and frequency of air service as well as the upgrading of existing airport facilities. Continued use of ship and barge transport is anticipated, with further analysis

of the feasibility of deep draft port development along the Arctic Coast. With respect to overland road transport, investigation will likely be given to the use of the haul road connecting Fairbanks and Prudhoe Bay to support development of OCS base camps or other new settlements.

Utilities

Basic utilities service in the Arctic is extremely limited. With the exception of base camps at Prudhoe Bay, specialized military installations, and a few public facilities in the larger communities, piped water supply and water-borne sewage disposal systems are not presently in use. Electrical generation and distribution systems are found in most communities, but are often unreliable. Gas distribution systems, where they exist, are poorly designed and maintained.

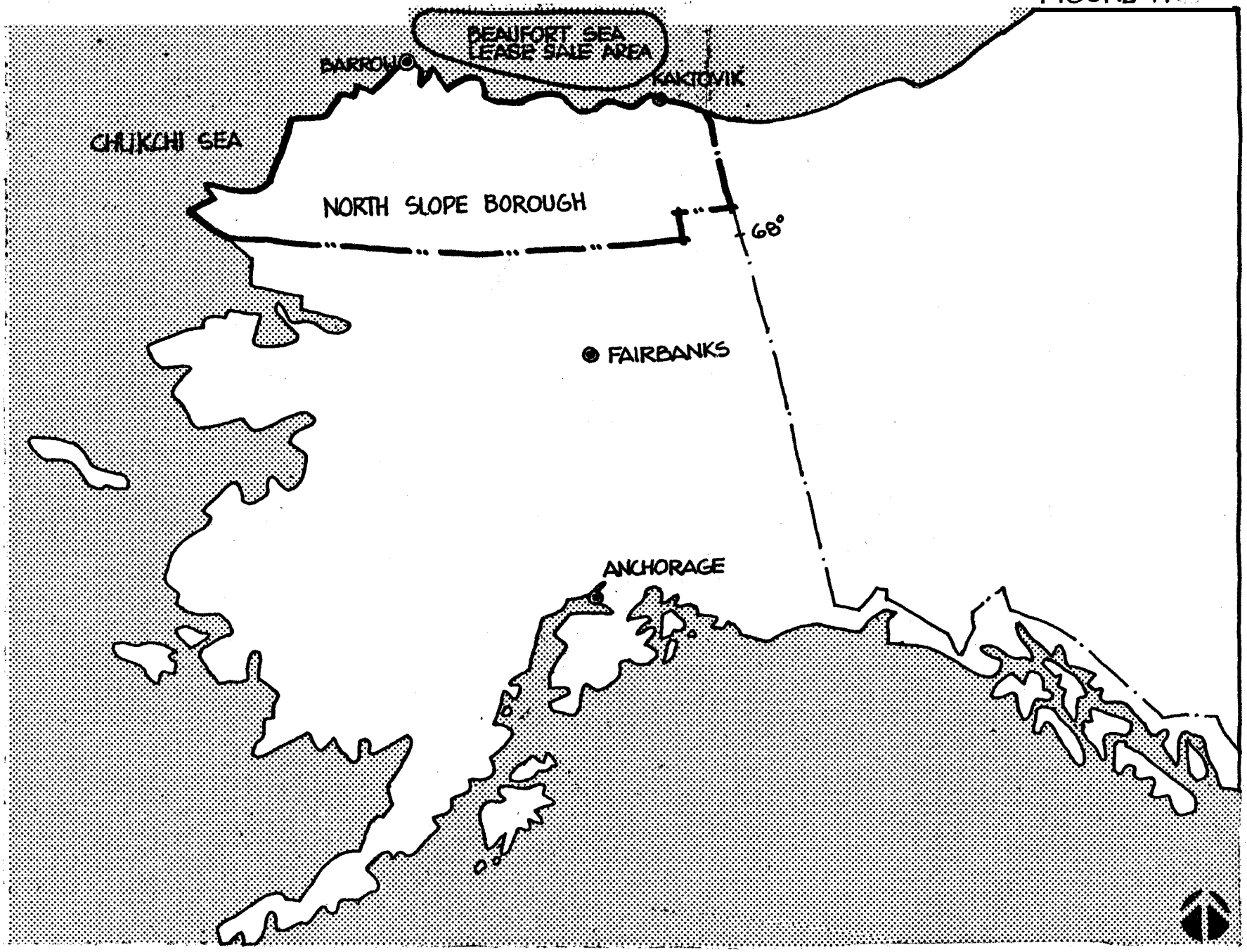
The limited availability of fresh water, sewage disposal and power generation facilities in the Region has created unsanitary conditions and physical hardship. Inadequate water storage and sewer and water distribution systems have in the past also restricted the development of housing and the provision of other essential community services.

Utilities such as fuel, power and water supply are also important for petroleum exploration and development activities. In the absence of adequate infrastructure and utilities services, the petroleum development base camp at Prudhoe provided its own. OCS petroleum development will similarly require an adequate utilities infrastructure as well as specialized facilities. As in the case of Prudhoe, it is likely that it will be necessary for OCS-related base camps to be self-contained.

All of these issues will be discussed in greater detail as part of this baseline report describing existing physical conditions in Beaufort Sea communities as of mid-1977. The complete baseline report, including socio-economic information, will provide a benchmark against which future growth and development can be measured.

Beaufort Sea Regional Study

FIGURE A



BEAUFORT SEA PETROLEUM DEVELOPMENT REGION

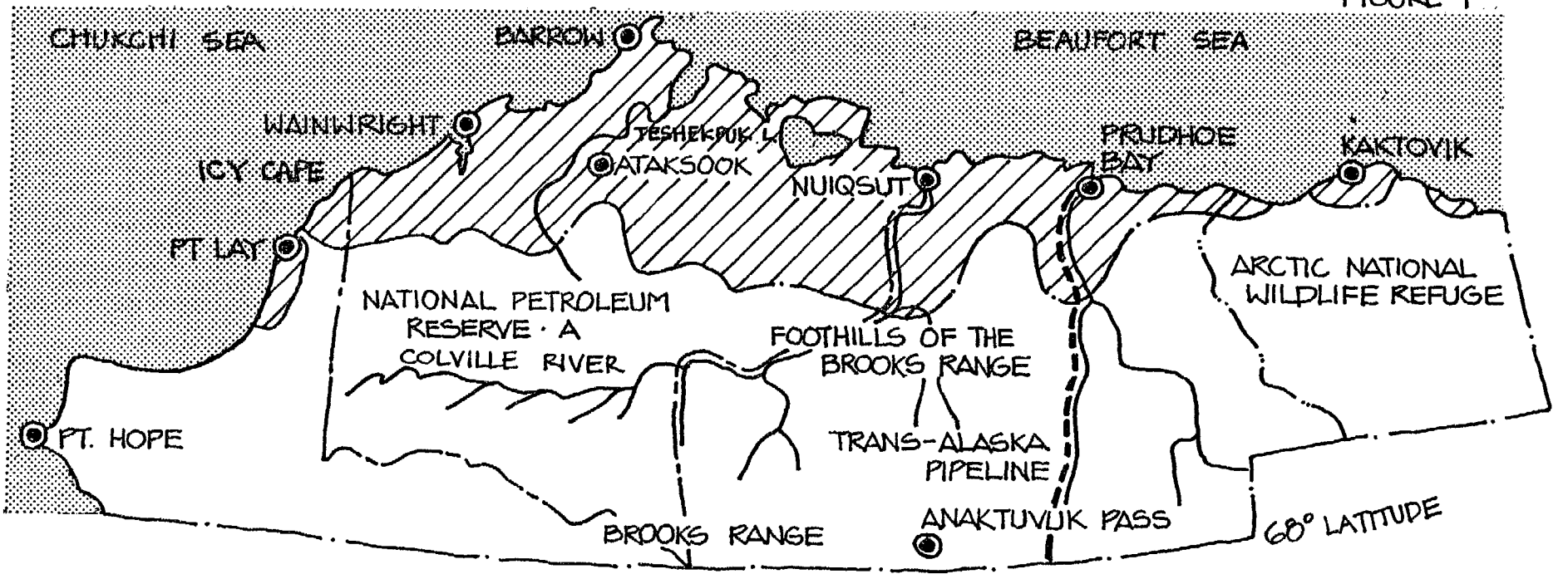
INTRODUCTION

The boundaries of the Beaufort Sea Petroleum Development Region are coterminous with those of the North Slope Borough. The Borough comprises a land area of more than 88,000 square miles, an area exceeded by only nine of the fifty states (Dupere & Associates, 1973). Borough boundaries encompass almost the entire northern portion of Alaska, from Point Hope on the Chukchi Sea in the west to the Canadian border on the east. Point Barrow is the northernmost point in the Borough; 68 degrees north latitude forms the southern border. The Borough is characterized by three physiographic regions: the Brooks Range, the Arctic foothills, and the Arctic coastal plain (see Figure 1, Description of the Region).

The North Slope Borough is sparsely settled. In 1976, an estimated 9,053 persons lived within the North Slope Borough, as contrasted with a 1970 population of 3,451. The Borough's population is located in nine settlements: Barrow, Wainwright, Anaktuvuk Pass, Ataksook, Nuiqsut, Point Lay, Kaktovik, Prudhoe Bay/Deadhorse, and Point Hope. Population change in individual settlements and in the region as a whole is presented in Table 1. With the exception of Prudhoe Bay and Barrow, population growth in the region has been slow. Completion of the trans-Alaska pipeline has actually caused a reduction in population in the Borough since 1976.

The North Slope Borough was incorporated as a first-class borough on July 1, 1972. The Borough, with administrative headquarters in Barrow, has a variety of areawide powers, many of which affect the settlements within its borders. Borough powers include responsibility for streets and sidewalks; sewers and sewage treatment; water course and flood control; telephone systems; light, power and heating facilities; water; transportation systems; libraries; airport and aviation facilities; garbage and solid waste collection and disposal; housing and urban renewal rehabilitation and development; preservation, maintenance and protection of historic sites (North Slope Borough, 1977).

FIGURE 1



ARCTIC COASTAL PLAIN

BEAUFORT SEA REGIONAL STUDY · DESCRIPTION OF THE REGION

TABLE 1

NORTH SLOPE BOROUGH POPULATION GROWTH

CENSUS DIVISION (Community)	1976[2/]	1975[1/]	1975[1/]	1974[2/]	1973	1970	1960
BARROW							
Barrow	2,218	2,141	2,163	2,163	2,167	2,104	1,314
Wainwright	344	341	354	354	353	315	253
Anaktuvuk Pass	129	129	134	134	134[3/]	99	35
Cape Lisburne	112	112	112	112	83[3/]	83	N.A.
Ataksook	N.A.	N.A.	N.A.	N.A.			
Nuiqsut	149	149	145	145	i 28		
Point Lay	48	48	27	27	31[3/]	62	N.A.
Census Div. Remainder			91	91	62[3/]		
UPPER YUKON							
Kaktovik	119	119	141	141	144[3/]	123	N.A.
Deadhorse					163[3/]	163	
Prudhoe Bay					49[3/]	49	
Borough Remainder [4/]					67[3/]	67	N.A.
Prudhoe Bay/Deadhorse	5,531	5,022	3,158	927			
KOBUK							
Point Hope	403	384	404	404	376	386	324
TOTALS	9,053	8,445	6,729	4,498	3,757	3,451	

N.A. Not Available

1/ Borough Planning staff count plus actual count by oil industry for July

2/ Borough Planning staff count plus actual count by oil industry for January

3/ Estimate same as 1970 Census

4/ Alaska Geographic Presentation of 1970 Census Population Counts, State of Alaska, Department of Labor, Employment Security Division, 1971.

Source: North Slope Borough, Alaska, General Information and Economic Factors, July 1976.

The following discussion is divided into the four sections of land use, land status, utilities and transportation. Each section includes a discussion of regional patterns and networks, as well as a summary of facilities or networks within each of the communities and military settlements in the region.

LAND USE

The Arctic Region is composed of a flat, treeless coastal plain and the gently rolling foothills and the North Slope of the Brooks Range. With the exception of mountainous portions of the Range, most of the land is inhabited by waterfowl and large mammals, such as caribou and polar bear. The area is primarily used for subsistence activities of Eskimos living in eight small villages. These isolated communities are located either along the coast or inland along fishing rivers or near caribou migration routes. Although the 88,000 square miles in the Arctic Region comprise fully 15 percent of Alaska's land, these communities represent only one percent of the State's population.

In addition to Native villages, there are a number of other specialized settlements in the region. The location of these facilities has been based either upon their strategic importance to national defense, or upon their proximity to prospective locations of underground reserves of oil and gas.

Approximately 17 U.S. Air Force Distant Early Warning (DEW Line) radar communication sites were established in the 1950's, five of which are in operation today. These stations serve to monitor enemy aircraft movement along the entire Arctic coast.

Oil and gas exploration and development base camps are located at Prudhoe Bay and at isolated locations within the National Petroleum Reserve-Alaska" (formerly Naval Petroleum Reserve-4). Petroleum exploration has taken place in the Reserve for 35 years, and continues today. In 1968, oil exploration in the vicinity of Prudhoe Bay yielded the discovery of the largest underground petroleum reservoir in North America. Construction of base camps, wells and the trans-Alaska pipeline created a community at Prudhoe Bay, which will be maintained during the estimated 20-25 years life of the field (David Maze, Administrator, BP Alaska).

This section of the Regional Baseline report discusses categories of land use in the Arctic Region: settlement (including Native villages, military installations, and oil and gas development base camps); historic uses and archaeological sites; and areas used for subsistence hunting and fishing.

SETTLEMENT

CURRENT SETTLEMENT PATTERNS

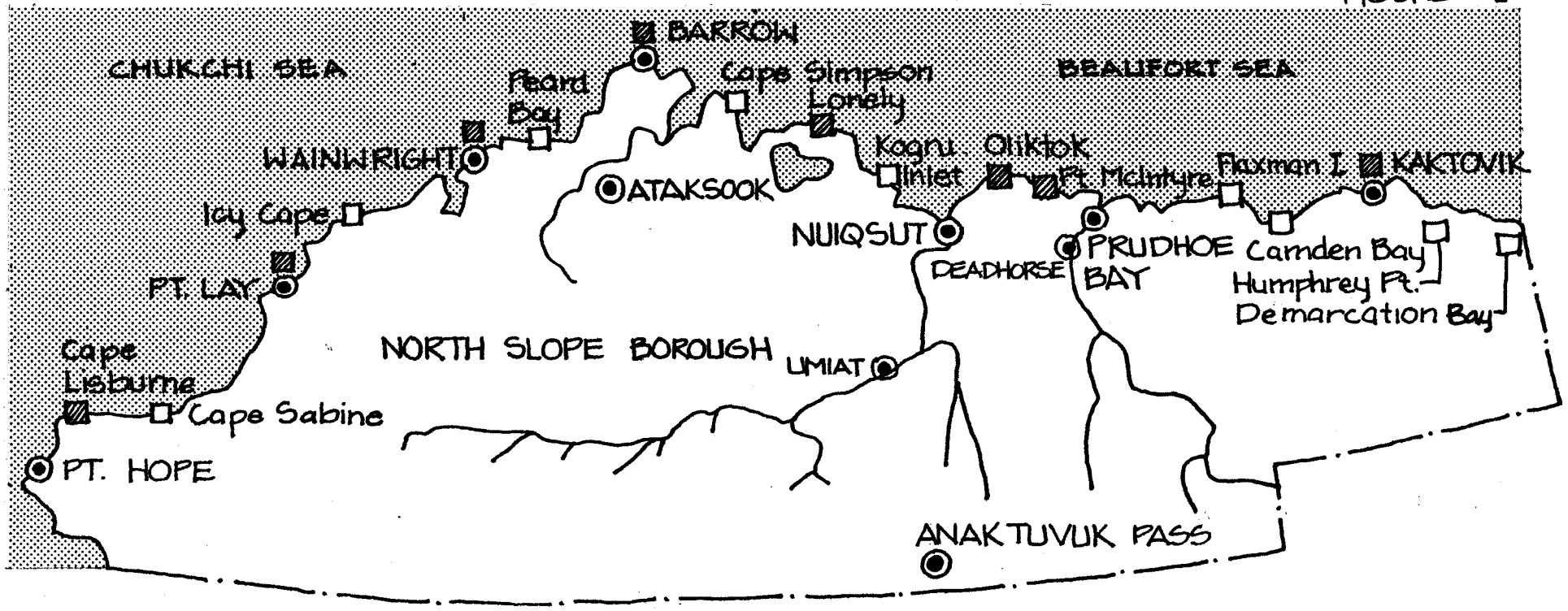
Settlement in the Beaufort Sea Region includes traditional Native villages and more recently developed military and oil and gas development base camps. Most of these settlements are located near the coast of the Chukchi or Beaufort Seas (see Figure 2., Settlements in the Region). Military installations include Navy research stations and Distant Early Warning (DEW Line) radar communications facilities. Facilities at each of the approximately 17 DEW Line Stations are discussed under Air Transportation.

Traditional settlement in the Arctic consisted of bands of Eskimos or villages whose location and size was determined by available fish and game. With the coming of the white whalers in the mid-nineteenth century, the military after World War II, missionaries and centralized government 'services, there have been major changes in settlement patterns (Dupere, 1973). Today, these small Eskimo encampments have been consolidated into five principal villages: Barrow, Kaktovik, Wainwright, Anaktuvuk Pass and Point Hope. Three other villages -- Point Lay, Nuiqsut and Ataksook -- are also traditional Inupiat village sites that are now being resettled under the sponsorship of the Arctic Slope Regional Corporation pursuant to the Alaska Native Claims Settlement Act of 1971.

Community Development

Nearly all of the people in the NorthS lope Borough live in eight communities and the petroleum development base camps around Prudhoe Bay. Barrow is the largest of these settlements, with a population which is now estimated at approximately 2,300 (North Slope Borough, 1977). Of the total of 2,170 people in 1975, government employment comprised approximately 300 persons (U.S. Dept. of the Navy, 1977).

FIGURE 2



◉ COMMUNITIES
▨ ACTIVE DISTANT EARLY WARNING (DEW Line) STATIONS
□ ABANDONED OR CONVERTED DEW Line STATIONS

SCALE IN MILES
0 10 20 50

BEAUFORT SEA REGIONAL STUDY • SETTLEMENT% IN THE REGION

to Prudhoe Bay. Total transient population housed at Prudhoe Bay in 1976 was estimated at 5,531 (North Slope Borough, 1976).

Each of the self-contained camps has its own personnel quarters for a module of approximately 150 men, including office space, shops, warehouses, kitchens/dining facilities, recreation facilities and related storage. Each camp has its own enclosed water supply/treatment and sewage systems. BP supplies electricity for its own facilities and those of ARCO. Most of the service companies purchase electricity from Arctic Utilities, Inc., a subsidiary of the NANA Development Corporation.

Other land uses include two airports and a small service airport in the western field, water storage sites, gravel sites, service company support buildings (for such services as engineering and supply), a planned central utility facility for BP and ARCO, port development on Prudhoe Bay itself, and sanitary dumps.

- National Petroleum Reserve-A Exploration Base Camps

The National Petroleum Reserve-A covers an area of approximately 37,000 square miles or nearly 50 percent of all the land in the Region. It extends along the coast from Icy Cape on the west to the Colville River on the east, and follows the Colville south into the Brooks Range. (See Figure 1, Description of the Region.)

The NPR-A was created as Naval Petroleum Reserve-4 (NPR-4) by President Harding in 1923. Under the Executive Order, the Secretary of the Navy was charged to "explore, protect, conserve, develop, use and operate" the Reserve. The description of past and planned oil and gas exploration in NPR-A which follows is largely based upon the Draft Environmental Impact Statement, Continuing Exploration and Evaluation of Naval Petroleum Reserve No. 4, by the Dept. of the Navy, 1977.

Initial oil and gas exploration was conducted between 1944 and 1953 by a civilian contractor. Drilling near Barrow in 1949 created the South

Barrow Gas Field, on which the City of Barrow still depends for electrical generation and heating fuel. During the nine-year exploration period, a total of nine gas and oil fields were investigated. Recoverable reserves were estimated by the Navy at over 80 billion barrels of oil and over 300 billion cubic feet of natural gas. Other estimates by the Bureau of Mines for the Umiat Field alone were much higher (Dept. of the Navy, 1977).

After the 1944 to 1953 exploration period, it was determined that exploration was not complete. Navy geophysical surveys and test wells were drilled in succeeding years with inconclusive results. In 1973 the oil embargo by Arab countries directed new attention to domestic reserves. Congress approved additional exploration of NPR-4 in order to have reliable estimates on which to efficiently undertake production, should Congress so authorize.

Seismic and related geophysical work was begun in 1976 by Husky Oil Company in Zone "A", between Dease Inlet and the Colville River, in the vicinity of Teshekpuk Lake. The location was chosen as a result of its proximity to the highly productive Prudhoe Bay Field to the east. Although oil industry geologists have recently stated their belief that potential oil reserves in NPR-A have been greatly exaggerated by the Navy, the exploration goes on (Anchorage Daily News, April 7, 1977).

The Navy has requested authorization for well exploration at 19 additional sites. This exploratory activity will take place under the control of the U.S. Dept. of the Interior, to whom responsibility for NPR-A was transferred in 1977. Large areas of NPR-A will undergo geophysical survey, and the specific locations of the 19 wells will then be chosen.

Each of the five wells drilled in the Teshekpuk Lake vicinity during the winter of 1976-77, and the 19 planned in the near future require specialized industrial facilities. A 5-foot thick gravel runway or ice airplane runway (to 5,000 feet in some cases) is built near the drilling site, and is equipped with runway lights, a homer beacon,

wind-measuring equipment and other facilities for safe and efficient operation. Drilling takes place on a 5-foot thick gravel drill pad on which housing, maintenance shops, drilling equipment, and steel or bladder fuel tanks are also placed. Water tanks are built nearby to meet the estimated 40,000 barrel requirement for a typical 60-day drilling period. It will require 150 to 300 days to drill each of four planned deep exploratory wells. Each camp will also have its own package waste water treatment and solid waste incineration facility.

These operations are planned to be serviced from logistical bases along the coast of NPR-A. The five wells drilled during 1976-77 utilized gravel borrow sites along the coast at Cape Simpson and Cape Hal kett, and logistical bases at the Lonely DEW Line site (POW-1) and the NARL base at Barrow. The planned exploration program will use Lonely, . NARL and possibly Umiat and the Wainwright DEW Line station. The potential also exists for utilization of other DEW Line stations in NPR-A (Peard Bay-LIZ C, Cape Simpson-POW A; Kogru Inlet-POW B, and Icy Cape-LIZ B).

- Lonely

The Lonely DEW Line site served as the base camp for exploration during the winter of 1976-77. It has a-recently lengthened and widened runway, 5,200 feet long by 150 feet wide, with lighting and navigational equipment. It also has a small hangar and freight handling equipment.

Fuel is delivered by barge and piped ashore into gasoline tanks having a total capacity of 141,000 gallons, or into JP-5 fuel tanks with a total capacity of 1,680,000 gallons. JP-5 fuel is used for aircraft, drill "rig operation, electrical generator operation, diesel powered equipment and heating. Two additional 1,260,000 gallon welded steel tanks were scheduled for construction in the summer of 1977 for JP-5 fuel. This fuel is transported by aircraft or smooth-tired rolligon-type trucks to operating sites.

The fuel storage capacity of NARL is 2,385,000 gallons, contained in five welded tanks containing JP-5 fuel, and one bolted steel tank containing gasoline. All the tanks were constructed in the late 1940's and early '50's. Since that time, the tanks have had their bottoms reinforced and are continually maintained. A 6-inch line offloads fuel into the tanks from barges that arrive each summer. Two airstrips are available at Barrow. One is the community's State-owned 6,500-foot long by 150-foot wide asphalt runway, which has minimal fueling capability; and the NARL 5,000-foot by 150-foot steel-planked airstrip. The latter has lighting, navigational aids, two hangars, storage warehouses and equipment for freight handling and major repairs, as well as the extensive fueling facilities.

The NARL facility at Barrow served as a trans-.shipment and communications headquarters for operations during 1976-77, with Lonely as its field headquarters (Dept. of the Navy, October 1975). It is likely that NARL will be used for exploration supply in the northwestern portion of NPR-A during the current program.

In order to provide operational and safety communications to geophysical survey camps within NPR-A, the Lonely DEW Line station's transportable earth station will connect to a loop network of eight telephone repeater stations within the Reserve.

Housing at Lonely consists of accommodations for 20 at the DEW Line station, an additional 24 at the nearby Navy camp, and an expanded base camp for 50 men built recently by Husky Oil.

- Umi at

Depending on the new areas outside of Zone "A" to be explored, Umiat may be used as a secondary site, as it was during the early exploration of NPR-4. Umiat has a camp, a good airstrip, and good nearby sources of gravel.

- Wainwright

  It is possible that barges may be offloaded at Wainwright for overland or air transport of supplies to some of the 19 proposed well sites. Because Wainwright Inlet is more protected from pack ice than Beaufort Sea offloading sites, Wainwright could be used for a longer time each summer than could either Barrow or Lonely. Additionally, supplies could be transported 20 miles over the ice of Wainwright Inlet during winter.

  Depending on the success of seismic surveys in the area, Wainwright could have a fuel storage site and prefabricated housing for 50 men constructed near the DEW Line station. In this capacity, Wainwright would function as a field operation center, similar to Lonely.

ARCHAEOLOGIC AND HISTORIC SITES

CURRENT STATUS OF ARCHAEOLOGIC AND HISTORIC SITES

Archaeological Data

The Beaufort Sea Region contains materials which span at least 10,500 years of prehistory. Archaeological findings in the area have provided evidence of prehistoric migrations into North America, including evidence of interior occupations by prehistoric Eskimo and Indian groups. Prehistoric and historic material from the area have provided insights into the movements and interactions between prehistoric Eskimo groups, as well as between Eskimo and interior Indian groups.

The archaeological data and literature for the Beaufort Sea Region reflect the intensity of research at certain locations and the complete absence of archaeological investigation at others. Two coastal areas have received major archaeological attention: Point t-lope and Point Barrow. In the interior of the Beaufort Sea Region, two broad areas have been the focus of archaeological investigations: an area of northwest Alaska, which includes the National Petroleum Reserve-A and the Utikok, Kukpowruk, and Kokilik River area; and a large area of the central Brooks Range and the Arctic Slope area to the north. ".

Of the coastal areas, Point Hope has been the focus of extensive archaeological research. Several thousand years of Eskimo prehistory have been identified from numerous archaeological sites, which have led to identification of the important Ipiutak Eskimo culture that existed on the Alaskan Arctic coast from about 200 to 300 A.D.

The Point Barrow area has been the focus of archaeological investigations since the early 1900's. Archaeological materials have revealed occupation by prehistoric Eskimo groups at least a thousand years ago. Earlier material has been recovered from the Barrow area, but these findings have not been fully reported in the archaeological literature at the present time.

The coastal area of the Beaufort Sea to the east of Point Barrow has been subjected to only minimal archaeological research, although there has been archaeological reconnaissance of the lower Colville River and its delta.

The central Brooks Range and the Arctic Slope is an area that has received continual archaeological attention since the 1950's. This area has yielded important archaeological materials related to the prehistory of Alaska for the last 10,500 years, as well as interior Eskimo adaptation.

An extensive discussion and bibliography of the archaeologic literature relevant to the areas described above can be found in Chapter 15 of the Literature Survey, Technical Report 2, of the Socioeconomic Studies Program.

Inventories of Archaeologic Sites

Inventories, maps and other published material that attempt to provide a comprehensive picture of known archaeological resources in the Beaufort Sea Region have been produced by State, federal and Borough agencies and Native corporations.

The Alaska Division of Parks, Office of History and Archaeology, has published a computerized inventory of known archaeologic and historic sites (Alaska's Heritage Resources, 1976). The list includes data for over 4,000 sites by U.S. Geological Survey quadrangle, but the inventory is perhaps 50 percent complete and individual entries exhibit a high degree of inaccuracy.

The Arctic Slope Regional Corporation, with the assistance of the University of Alaska Arctic Environmental Information and Data Center (AEIDC), has produced maps at a scale of 1:500,000 which document Native land uses. These maps, called Native Land Use and Place Name Maps of Arctic Alaska, depict subsistence use areas and trails, as well as cemeteries, old places-villages, cabins, old graves, "siniktaknalok" (forbidden places), ruined cabins, hunting camps, travel camp places, drying rack places, and fish camps. The

maps, which were published in 1975, confirm the pattern of known archaeological sites in coastal areas, river valleys, and the central Brooks Range in the general region of Anaktuvuk Pass. Other areas are less fully covered because of a lack of documentation or exploration. No text accompanies these maps.

The data on these maps will be updated through a program presently being carried out by the North Slope Borough to identify sites and nominate them to the National Register of Historic Places.

ARCHAEOLOGICAL AND HISTORIC SITE ISSUES

Planning Implications

Archaeological resources of the Beaufort Sea Region have at least two important planning implications. First, all relevant literature concluded that only a small portion of existing archaeological sites in the Region have been identified or studied. Thus, it is highly probable that any development activity, particularly in coastal areas or river valleys, would potentially reveal undocumented sites. This could require planning for pre-development archaeological reconnaissance, relocation of development to alternative sites, the establishment of corridors to minimize impact on sites; or excavations or recovery of sites before actual construction.

Second, sites are important to Natives of the Region as providing evidence of the continuity of their culture and as corroboration of present subsistence rights. Since many archaeologic sites are historic hunting and fishing sites, the Borough's program to identify and nominate sites to the National Register may offer additional protection to subsistence areas. Protection provisions for sites in the Register would also be a factor to be considered in any development planning.

Legislation and Administrative Programs

Federal and State laws pertaining to cultural and archaeological resources in the Beaufort Sea Region include:

- Federal Antiquities Act of 1906, requiring the protection of American antiquities, including historic and prehistoric sites on federal lands.
- The Historic Preservation Act of 1966, creating the National Register of Historic Places. Sites listed in the National Register are protected from encroachment by projects funded or licensed by the United States, and in most cases are eligible for 50 percent matching grants under the National Historic Preservation Act. Grants may be used for acquisition, stabilization and/or restoration (Division of Parks, September 1976).
- Executive Order 11593 of 1971, requiring federal agencies to inventory their cultural resources and submit nominations to the National Register for all qualified sites.
- Alaska Native Claims Settlement Act of 1971, Section 14(h)(l), authorizing the Secretary of the Interior to withdraw and convey to appropriate Native Regional Corporations title to existing cemetery sites and historical places.
- National Petroleum Reserve Act of 1976, requiring determination of the historic value of the National Petroleum Reserve in Alaska by 1979, as part of the land use planning process for the Reserve.
- Alaska Historic Preservation Act of 1971, providing for the protection and preservation of historic and archaeologic resources in Alaska.

North Slope Borough Land Use Inventories

The North Slope Borough, through its areawide historic preservation responsibilities, is documenting traditional land uses in three areas:

- The Wainwright area and inland in the Utukok River watershed;
- The coastal region between Teshekpuk Lake and Prudhoe Bay; and
- The coastal region and foothills from Nuiqsut to Kaktovik and the Canadian border.

These studies are being carried out by Ms. Flossie Hopson, of the North Slope Borough Planning Department. Oral histories gathered from interviews with Native informants have identified and determined the cultural importance of

historic and archaeological sites, including cabins, graves, physical remains, sod houses, fishing areas, trapping areas and whaling sites. Some of these sites will be submitted for inclusion in the National Register of Historic Places as a means of preservation and protection.

This material is also being used by the Borough to document the "overall significance of the land and its subsistence resources to the Inupiat people in the past, at present and in the future." (North Slope Borough, Feb. 1977). The assessments of sites will be used by the Borough Commission on History and Culture as a guide for protection of sites; the Planning Commission will also use the data as an element of a future areawide land use plan.

The North Slope Borough Commission on History and Culture has adopted the completed Beaufort Sea Traditional Land Use Inventory and the Nuiqsut-Tasikpak Traditional Land Use Inventory. It is projected that perhaps one-third more sites than are currently indicated on the AEIDC maps, cited earlier, will be identified through these studies. More importantly, these studies go beyond a simple inventory to assess the value of the sites in maintaining Inupiat culture. The Borough is in the process of publishing the results of this inventory and assessment program to be titled Beaufort Sea Study/ Historical and Subsistence Site Inventory: A Preliminary Cultural Resource Assessment (Flossie Hopson, North Slope Borough Planning Department, 1977).

National Petroleum Reserve Studies

The National Petroleum Reserve in Alaska (NPR-A) was transferred to Department of the Interior management by the National Petroleum Reserve Act of 1976 (P.L. 94-258). Under the terms of the Act, historic values of the Reserve are to be determined by April 1979.

Assessment of the Known Cultural Resources of the National Petroleum Reserve in Alaska (Schneider and Bowers, 1977) is both a summary, based on secondary sources of archaeological resources of the Reserve, and a series of recommendations for research. Both the data summary and the research recommendations identify the disparity in archaeological data for areas outside the Reserve which are relatively well researched, and the "virtually unknown" interior

of the Reserve. The data summary is accompanied by maps at 1:250,000 scale locating 152 known sites within NPR-A and 467 sites adjacent to Reserve boundaries. This distribution is cited to document the need for archaeological reconnaissance within the Reserve.

Archaeological field work is being undertaken by the National Park Service during the summer of 1977 to determine historic values of the Reserve. Five teams will be based at Umiat, on the Colville River, and will perform reconnaissance and site testing to determine the archaeological potential of representative environments in the Reserve. Two teams will work along the Colville River by raft; the other three teams will cover areas of Howard Pass, Knife Blade Ridge, and tributary creeks of the Colville River.

This survey of various physical environments will cover only a small area of the Reserve, but will give an indication of the archaeological resources that could be potentially found in similar, unexplored areas of the Reserve. A report on this field work is anticipated to be available in early 1978.

As part of a recently begun land use planning program for NPR-A, a contract is currently being negotiated between the North Slope Borough and federal offices of the National Park Service, Bureau of Indian Affairs, and Bureau of Outdoor Recreation, which would provide continued funding to the Borough for historic and archaeological site identification. Responsibilities of the BIA and BOR include determination of subsistence and recreation resources in the Reserve. It is anticipated that the Borough, through Flossie Hopson, will continue the oral history techniques to identify sites significant to the past and present culture of Natives.

Proposed Projects

Archaeological resources have been considered in environmental impact statements on proposed projects in the Beaufort Sea region. These reports include the Arctic National Wildlife Refuge (U.S. Dept. of the Interior, 1974), the proposed natural gas pipeline (ibid., 1976), offshore oil and gas development (ibid., 1975), and exploration of the National Petroleum Reserve (U.S. Dept. of the Navy, 1977).

Common to these environmental impact statements is reference to the relative lack of knowledge of archaeological sites in project areas. The statements also cite the high probability that many new archaeological sites will be identified through additional field work. The EIS on NPR-A exploration states, "with proper precautions, exploration may have a positive impact, as scientific benefits could result from the discovery of new historical or archaeological sites." (U.S. Dept. of the Navy, 1977).

Alyeska Pipeline Impact

Archaeological data relevant to the Alyeska Pipeline project have been included in field studies and reports since 1970. John Cook, the archaeologist directing this work for the University of Alaska, has authored a series of reports that document the significant archaeological material obtained from locating and excavating sites along the pipeline route. These studies also provide a basis for estimating the cost of researching and recovering the archaeological resources impacted by pipeline or other petroleum-related development: the total cost of the University of Alaska research for 680 miles of the pipeline route was $1.75 million.

Other Impact Considerations

Certain coastal areas of the Beaufort Sea Region are subject to severe coastal erosion processes. For example, the Point Hope peninsula has been eroding at the rate of 8.6 feet per year on the north side and depositing 2.9 feet on the south side (Dupere and Associates, 1973).

The impact of such natural processes on coastal archaeological resources has not yet been documented. The magnitude of this impact could be severe.

SUBSISTENCE

CURRENT SUBSISTENCE LAND USE

Subsistence activities are the earliest use to which the land and coastal waters in the Beaufort Sea Region were put. Patterns of hunting and fishing for coastal communities have traditionally been different from those for inland communities. Coastal Eskimos (Taremiut) have traditionally occupied numerous permanent villages along the Arctic coastline and at the mouths of rivers. Here they hunted migratory marine mammals, fish, and terrestrial mammals. While the hunting of sea mammals, such as bearded seal, spotted seal and walrus, was important to the Taremiut subsistence lifestyle, bowhead whaling has always provided its focus (Dupere & Associates, 1973). Of the nine communities in the Region today, six are Native villages whose subsistence patterns are oriented to the sea.

The inland Eskimos (Nunamiut) were more nomadic. Their land use patterns have been constantly limited by the occurrence, abundance and movement of wildlife, especially the Arctic and Porcupine Caribou Herds. -The summer range of the Arctic Herd is located generally west of the Colville River and the Porcupine Herd east of the river. Temporary settlements were established along the annual northern and southern caribou migration routes crossing the Brooks Range. The caribou provided meat for food, skins for making clothing and tents, and antlers for making implements. Anaktuvuk Pass, a settlement in a valley of the Brooks Range, is the last remaining Nunamiut community.

Today, patterns of subsistence around coastal villages are dependent upon seasonal fish and wildlife migration, and terrain and sea ice conditions. During the ice-free summer season, whales, seal, walrus and fish are taken along the coast. Wet tundra makes overland travel difficult, so caribou and small game, such as waterfowl and foxes are hunted from coastal areas and rivers. In winter, polar bear and seal are hunted on the ice pack.

In the past, there were isolated areas on the North Slope where caribou were free from any human hunting. Great distances, dog sled transportation and hand boats limited hunting areas to locations accessible to villages and camps.

Today, however, hunting efficiency has increased significantly. The use of outboard motorboats, snow machines and portable communications devices such as CB radio have increased accessibility to an extent that there are no areas of the North Slope that are not hunted (John Burns, Biologist, Alaska Dept. of Fish and Game). Although the most intensively hunted and fished areas are within 25 to 40 miles of each coastal community, residents of Barrow and Kaktovik occasionally trap and fish in the central portion of the Beaufort Sea coast, between the Colville and Canning Rivers (Alaska Div. of Policy Development and Planning, 1975).

SUBSISTENCE LAND USE ISSUES

The rights of Native Alaskans to hunt and fish are presently undergoing much discussion in Alaska. During 1977, hunting restrictions were placed both on the harvesting of the bowhead whale as well as on caribou. The issues surrounding each of these decisions are discussed below.

Bowhead Whale Hunting Restrictions

During the latter half of 1977 much of the attention regarding subsistence hunting focused on the attempt to reconcile the harvesting of the bowhead whale by the Inupiat Eskimos with national and international policies surrounding declining whale populations in general and the alleged decline of the bowhead in particular.

The relationship of the Inupiat Eskimos to the bowhead whale is a symbiotic one that has existed for many thousands of years. The whale is an integral

part of the Eskimo experience. Preparations for the hunting season, the hunt itself, the butchering of the whale and the division of food and other products from the whale are not onTy important elements of Eskimo life but, in the opinion of many Eskimos and anthropologists, the defining elements of Eskimo culture (Newsweek, November 7, 1977). According to Dale B. Stotts, the North Slope Borough official responsible for resource protection and management for the Borough, "hunting the bowhead is what keeps our communities together. Our people depend on the bowhead, first for food and, just as importantly, for the survival of our culture (Rensberger, October 5, 1977).

For the Inupiat Eskimos, the bowhead whale has provided a variety of products. It is principally valued as a food source. The bowhead is more flavorful than other whales, and for this reason is highly regarded (Weller, October 31, 1977). The flipper, consisting of skin and fat, is especially prized, as is muktuk, the skin of the whale plus a thin strip of meat (Anchorage Daily News, November 3, 1977).

Between 1848 and 1910, the period in which the bowhead was commercially hunted by Yankee whalers, the bowhead was valued in world commerce for its baleen, used for stays in corsets, and for its whale oil (Rensberger, October 5, 1977). Following the turn of the century, the numbers of bowhead whale were so severely depleted that the commercial harvesting of bowhead was outlawed by international treaty in 1931 (North Slope Borough, NSB Asserts Leadership in Whaling Controversy, paid advertisement in Anchorage Daily News, October 10, 1977). The protection afforded the bowhead was enhanced by the Marine Mammals Protection Act of 1972 and the Endangered Species Act of 1973; both pieces of legislation address the protection of the bowhead, but both exempt aboriginal people from regulation (Weaver & Brown, 1977).

The current controversy regarding subsistence hunting rights of the Eskimo in relation to the possible extinction of the bowhead whale arose from the June 1977 meeting of the International Whaling Commission, a 17-member organization formed in 1946. At the June meeting, the Commission, concerned about the depleted population of bowhead and the increasing number of reports of whales "struck and lost," voted to impose a zero quota on aboriginal hunters beginning with the 1978 season. The United States, concerned about its leadership role in reducing the commercial harvesting of whale, abstained from the vote and refused to file an objection to the IWC ruling.

However, at a special meeting of the IWC on December 6-7, 1977, the Commission voted to lift its ban on the bowhead and to permit hunting until 18 whales have been struck with a harpoon or 12 landed. North Slope Borough Mayor Eben Hopson termed the 18-whale quota as inadequate to meet nutritional needs (San Francisco Chronicle, December 8, 1977).

The relationship between OCS activities in the Beaufort Sea and the whale harvest is unknown, but it can be conjectured that OCS activities may disrupt bowhead migration patterns and Eskimo whaling activities.

Caribou Hunting Restrictions

An important concern of North Slope residents relates to State game management of the Western Arctic Caribou Herd. Because of recent drastic declines in the size of the Herd, the Alaska Department of Fish and Game (ADF&G) has restricted hunting of caribou in the North Slope Borough.

The ADF&G has concluded that declines from 250,000 animals in 1970 to 50,000 in 1975 were caused by a number of factors, including subsistence hunting and the predatory activities of wolves. The increased efficiency of hunting brought about by greater use of the snow machine may also have contributed to the devline (John Burns, Biologist, ADF&G). Until recently, the 10,000 residents of the 30 communities of northwest Alaska were taking approximately

30,000 animals annually while wolves were estimated to consume 1,160 to 1,400 caribou each year (Alaska Consultants, Inc., 1976).

The recently created North Slope Borough Department of Conservation and Environmental Security also notes this decline in the Herd, but attributes it to migration of caribou from the Western Herd to the Eastern Porcupine Herd, perhaps as a result of such activities as seismic petroleum exploration in National Petroleum Reserve-A, and construction and operation of the trans-Alaska pipeline.

In order to restore the Herd's size, seasonal limits on hunting were imposed by ADF&G during the hunting season which ended March 31, 1977. In the North Slope Borough, a harvest of 3,000 bulls was allowed and allocated among communities on a need/historic use basis as follows: Barrow-320, Wainwright-150, Ataksook-10, Anaktuvuk Pass-340, Point Lay-40, Point Hope-150. Kaktovik was not limited by the restrictions, since its residents hunt the Porcupine Caribou Herd in the East Arctic.

In the past, some families in Barrow have killed as many as 20-caribou in a single year. Consequently, representatives of the Department of Conservation and Environmental Security of the North Slope Borough have stated that this restriction represents an extreme hardship for North Slope residents. Further, they have termed inadequate the State's compensation of $10,000 for purchase of supplementary foodstuffs at Barrow. In response to the State's caribou hunting restrictions, the North Slope Borough formed a Borough Game Management Committee in 1976 in conjunction with the Arctic Slope Regional Corporation (ASRC). This Committee represented an initial step in the recent formation of the Department of Conservation and Environmental Security. The Committee's purpose is to establish policies which include man as the "index specie", recognizing his subsistence needs as an integral part of game management. The Committee plans to work with federal and State agencies to conduct surveillance of the Arctic Caribou Herd, documenting its size, migration patterns, age and general health. The Borough hopes to combine this empirical

knowledge with oral history of traditional Inupiat hunters to pioneer the role of local government in North American Arctic game management (Statement of Environmental Protection Policy of the North Slope Borough, 1977).

Game Management

The federal and State governments share joint responsibility for game management in Alaska. Under present programs, the State manages game on federal and State lands, with the exception of federal programs for marine mammals (Marine Mammals Protection Act of 1972), and migratory birds (International Migratory Bird Treaty Act of 1918).

The federal Marine Mammals Act prohibits hunting on federal lands by non-Natives, but not by Natives for subsistence use. Native subsistence hunting cannot be restricted under the law unless the species is proven to be endangered, or it is used for commercial purposes. Federal activities are generally confined to enforcement of the hunting prohibition against non-Natives, and cataloging the uses by Native subsistence hunters.

The State believes, however, that the federal systems policies of non-intervention are not protecting certain marine mammal species (John Burns, Biologist, ADF&G). This position is endorsed by federal wildlife managers as well (Andy Williams, May 26, 1977). The Joint Federal-State Land Use Planning Commission (FSLUPC) has also stated in a recent paper that wildlife management and regulation of fishing and hunting through a permit system should remain under statewide management plans developed for each species (Janet McCabe, FSLUPC). These plans are now under preparation.

The management of walrus has been returned to the State after a period of approximately 5 years during which it was protected under the Marine Mammals Act. The ADF&G is also anxious to have polar bear management returned to the State because federal management places no bag limits, or sex, size or seasonal restrictions on the hunting of polar bear (John Burns, Biologist, ADF&G).

In developing its policies for game management, ADF&G and some State legislators are interested in defining better the term "subsistence" in order to establish who may hunt and fish, and how much fish and game may be taken. Particularly at issue is the commercial value of subsistence resources. Originally, subsistence was defined largely in terms of self-sufficiency. Commercial value was not traditionally recognized. However, since cultural artifacts have become valuable, Native craftsmen have been provided an outlet for their handicrafts, and demand for walrus ivory in particular has increased dramatically (John Burns, Biologist, ADF&G). Recognizing the potential threat to certain wildlife, recent federal legislation has been enacted for marine animals and endangered species, such as the polar bear. This legislation restricts hunting to the Native Alaskan, who may sell parts of the animal only after some local labor is performed to make it a work of art or handicraft (North Slope Borough, 1976).

The State, however, is concerned that subsistence for commercial purposes may be jeopardizing sound game management procedures. The number of walrus harvested in Alaska, for example, has doubled during the last ten years. During the same period, harvests of seal, which have no commercial value, have decreased 60 percent (John Burns, Biologist, ADF&G). It is argued that a more explicit definition of subsistence could allow ADF&G to create better criteria for allocating game resources among Natives and non-Natives.

The Alaska Legislature is presently discussing formation of an Interim Committee on Subsistence which would work for a legal definition of subsistence. Others, such as David Chase, Director of the Alaska Federation of Natives Bush Justice Project, opposes a definition that they believe could result in further restrictions to Native subsistence activities (Jeffery Richardson, May 18, 1977).

Because federal law recognizes Natives as ethnic entities under international treaties, and grants them special consideration in maintenance of subsistence values, the federal government receives greater support by Alaska Native

groups in its game management programs than does the State. Citing the federal government's "trust responsibility to protect aboriginal subsistence rights to the Arctic Caribou Herd," Billy Neakok, Director of the Department of Conservation and Environmental Security, recently asked the Secretary of Interior to intercede on the Borough's behalf in removing State caribou hunting restrictions (letter to Secretary Cevil Andrus, May 25, 1977).

Land Management

In addition to policies for management of game, there are a number of alternatives for management of lands under Section 17 (d-2) of the Alaska Native Claims Settlement Act that could affect subsistence activities in the Region in different ways. The Act extinguished Native aboriginal rights, but stated that subsistence rights were to be protected. It is contended by some, however, that the 40 million acres to which Natives received title under the Act is not sufficient to maintain a subsistence economy. Two basic reasons are cited. The piecemeal distribution of this land, often not in proximity to Native villages, does not coincide with migratory patterns of game. This is especially true on the North Slope, where much of the land around Barrow is unavailable for regional selection because it lies within NPR-A. Further, land selected under the ANCSA will compete with other prospective profit-making uses, under pressure for development before the lands will be taxable in 1991.

Consequently, there is great interest in proposals now before Congress on alternative mechanisms for management of game on proposed National Interest Lands (d-2) and final decisions relative to subsistence uses permitted on Public Interest Lands (d-1). The Joint Federal-State Land Use Planning Commission has recently stated that subsistence rights should be given priority over sport and commercial use on National Interest Lands, with the exception of national parks (McCabe, JFLSUPC).

Proposals of Representative Morris Udall would be most restrictive in controlling large blocks of d-2 land under federal management. Although the

Alaska Federation of Natives is not endorsing the Udall bill, they are supportive of federal game management procedures, such as the Marine Mammals Protection Act, that could be continued for d-2 lands.

A total of over 3 million acres is included in d-1 and d-2 lands in the Arctic Region. Final decisions relative to activities permitted on these lands will have significant consequences for future subsistence activities on the North Slope, particularly for residents of inland villages closer to these lands, such as Anaktuvuk Pass.

Land Use Conflicts

Rapid increases in State population during the last ten years and new growth and development have created additional pressures on subsistence resources. Between 1965 and 1975 the State's population increased 65 percent while hunting and fishing licenses sold, and private aircraft registered, almost doubled (Wentworth, Alaska Center for the Environment, 1977). With the decreased wildlife habitat in urban areas, hunters and fishermen are finding more incentive to fly into remote areas to hunt and fish,

Although recreational hunting and fishing in the Arctic is now limited (ADF&G estimates that less than 4 percent of the total caribou harvest is attributable to recreational hunting), it can be expected to increase. Potential OCS oil and gas development, potential public use of the trans-Alaska pipeline Haul Road, development of tourist facilities in North Slope communities, and more frequent and reliable air service will all contribute to increased recreational hunting and fishing. With limitations on land areas and seasons open to hunting, severe competition between subsistence needs and recreational desires could result. Since economic benefits could accrue to North Slope residents for outfitting recreational hunting and fishing parties, conflicts with villages over cultural versus economic values are expected.

State game management plans do not discriminate between subsistence hunters and fishermen on the basis of race. That is, both Native and non-Native

residents of Alaska are subject to the same game management principles and practices of the State. Federal game management, under the Marine Mammals Act, however, requires no bag limit-or seasonal restriction to Natives. If State plans to manage polar bear and all other species on a sustained use basis are approved, no special privileges for subsistence hunting and fishing in Alaska would prevail. Consequently, there is much concern among Native groups and Borough officials that State game management will exacerbate competition between Natives and non-Natives over restricted game.

Issues of Oil and Gas Development

Declines in the Arctic Caribou Herd raised questions over activities of the Navy in oil exploration in NPR-A. Residents of Barrow believe that construction and use of ice roads for seismic exploration have affected migration patterns of caribou who have eventually died. Dead fish found on the banks of streams and lakes in the vicinity of oil exploration have been attributed to seismic detonation close to bodies of water.

Concerns for future oil and gas development include locating base camps where minimal impact to subsistence activities could occur, and restricting hunting and fishing activities of non-resident temporary workers (Resource Planning Associates, 1976).

The construction, operation and maintenance activities associated with Outer Continental Shelf exploration and development could involve the movement of people and supplies into an area important to subsistence. This intrusion could affect animal movements, denning sites and population size.

A second issue arising from OCS activities concerns the relationship between subsistence and potential transportation and utility corridors. Frequently used roads, airports and the construction and maintenance of pipelines can create disturbance or barriers to movement of terrestrial mammals.

The North Slope Borough is actively pursuing formal working relationships with the Inupiat of the Canadian Arctic for purposes of game management, land management and joint policy development for OCS activities in the Beaufort Sea. In June 1977, the North Slope Borough hosted an international Inuit Circumpolar Conference, bringing together Eskimos from Alaska, Canada and Greenland, along with energy experts from those areas. Since migratory fish, fowl and caribou do not obey international borders, the Borough argues that policies must be developed which allow for maintenance of subsistence values along with oil and gas development policies for the entire Arctic.

LAND STATUS

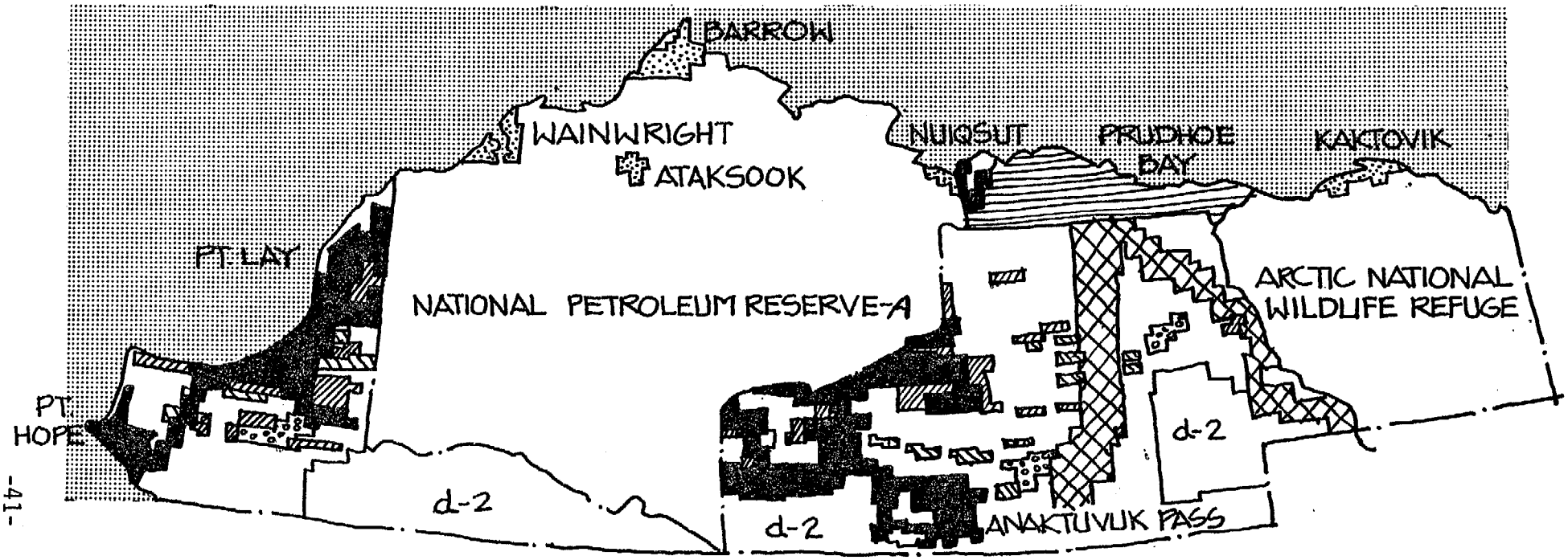
CURRENT LAND STATUS

Land tenure in the Arctic is divided between areas of fixed ownership and areas in a state of flux. Most of the land in the Arctic is owned by the federal government. Of the approximately 50 million acres in the Region, one-half is included in the National Petroleum Reserve-A (formerly Naval Petroleum Reserve-4) and the Arctic National Wildlife Refuge. The State owns approximately 3.5 million acres between the Colville and Canning Rivers, centered on oil development in the vicinity of Prudhoe Bay. An additional 3.5 million acres of land is owned by nine Native village corporations comprised of the communities of Barrow, Kaktovik, Nuiqsut, Wainwright, Ataksook, Point Lay, Point Hope and Anaktuvuk Pass, and the regional corporation. Approximately 1.4 million acres in the region are included in the State's trans-Alaska pipeline utility corridor.

As a result of passage of the Alaska Native Claims Settlement Act (ANCSA) in 1971, and the Statehood Act of 1959, the classification of the remaining land in the Arctic Region is yet to be finally determined. The ANCSA called for disbursement of 40 million acres of federal land to newly-formed Native regional and village land corporations. The Statehood Act calls for transfer of 104.5 million acres of national forest, community expansion, education and recreational lands from the federal government to the State. Since the passage of the ANCSA, the State's program has been largely suspended, and much of its original entitlement remains to be selected. In turn, the organized boroughs created by the legislature in 1963, are permitted to select 10 percent of the State lands that are included within the Borough's boundaries. More detailed discussion of the ANCSA and-the Statehood Act and their provisions is included in the. Alaska Regional Profiles: Arctic Region, published in 1975 by the Arctic Environmental Information and Data Center.

Figure 3, Regional Land Status, illustrates areas of fixed federal, State and Native Corporation ownership as well as remaining areas where other

FIGURE 3



REGIONAL & VILLAGE CORPORATION SELECTIONS WITHIN NORTH SLOPE BOROUGH

FEE

FEE OVERSELECTION

SUBSURFACE RIGHTS

SUBSURFACE OVERSELECTION

SURFACE RIGHTS ONLY

STATE LANDS

STATE UTILITY CORRIDOR

SOURCE : ARCTIC SLOPE REGIONAL CORPORATION

BEAUFORT SEA REGIONAL STUDY

REGIONAL LAND STATUS

federal, State, Borough, and Native corporation land applications have been made. The following briefly summarizes major land status classifications within the region and discusses issues of current importance regarding final settlement or jurisdiction.

National Petroleum Reserve-A

In 1923 an Executive Order established the 23 million acre Naval Petroleum Reserve-4. A series of Navy claims to areas included in the Reserve has been contested by the State and Native corporations. The boundary of the Reserve is in dispute along the entire Colville River and the coast to Icy Cape. Additionally, the Navy claimed jurisdiction to a 2-mile buffer zone around the Reserve, and ownership of coastal tidelands in Smith Bay, Harrison Bay, Peard Bay and Kasegaluk Lagoon in 1974 (Skladel , May 1974). Al though the State received title to tidelands three miles from the highwater mark of the coastline under the Submerged Lands Act of 1953, the Navy redefined the NPR-4 boundary from the highest highwater mark to the mean highwater mark, thereby assimilating shallow, potentially oil-rich submerged tidelands from the State. To date, the State has made no formal response to the Navy's action.

On June 1, 1977, Congress placed the Reserve under control of the Department " of Interior and renamed it "National Petroleum Reserve-A". "Presently, it is not clear how jurisdictional transfer from the Navy to DOI will affect resolution of these boundary disputes.

Arctic National Wildlife Refuge .

The Arctic National Wildlife Refuge extends from the Canning River at Camden Bay to the Canadian border, and south across the Brooks Range, approximately 150 miles from the Beaufort Sea. An estimated 8.9 million acres, or two-thirds of its entire area, is included within the Borough's boundaries.

As part of the "National Interest" federal parkland selections under provisions of Section 17(d)(2) of the ANCSA, the Department of Interior in October 1974 proposed an expansion to include an additional 3.7 million

acres south and west of the Refuge. Along with portions of the proposed Gates of the Arctic National Park in the central Brooks Range, these d-2 lands in the Borough comprise approximately 2.8 million acres. Final decision on d-2 recommendations by Congress is expected no later than December 17, 1978.

State Lands

The State has 3,411,700 acres of land patented and an additional 1 million acres pending or tentatively approved along the eastern bank of the Colville River, and in the vicinity of Point Lay, Point Hope and around other Native villages. Additional selections are expected with boundary resolution of d-1 and d-2 withdrawals.

North Slope Borough

In 1963, when the legislature created the organized boroughs, it permitted each borough to select 10 percent of the State's General Grant Lands conferred under the Statehood Act. The North Slope Borough has applied for nearly all of its 10 percent allotment of State patented land, or 33,324 acres. The State, however, has rejected these applications, maintaining that the lands are unavailable for selection because of prior State commitments in the form of oil and gas and other leases and permits. Because this has not been the practice of the State in the past, the Borough has the issue in court (Alaska Consultants, Inc., December 1976).

Whatever additional lands the State selects, once boundaries of the d-1 or d-2 lands are more formally fixed, the Borough will be entitled to an additional 10 percent of the State's lands. Under the Statehood Act, the State is required to complete its land selection procedure by 1984, but the Borough has no set time for selection of its entitlement.

Native Regional and Village Corporations

The Arctic Slope Regional Corporation recently became the first Native regional corporation in the State to receive interim conveyance of nearly all the land it is entitled to under the ANCSA. On June 3, 1977, the

ASRC received its last conveyance from the Bureau of Land Management, bringing its total of surface and subsurface lands to 2.9 million acres, with an additional 221,575 acres near Anaktuvuk Pass pending Although the lands will not be fully conveyed until surveyed-sometime in the future, the Corporation now has all the privileges and rights of ownership.

Regional Corporation Conveyances

Lands yet to be conveyed to the Corporation include "in lieu" and "dual withdrawal" lands. The in lieu lands consists of subsurface rights that normally would have been requested in conjunction with village-selected surface lands at Barrow, Wainwright, Nuiqsut and Kaktovik, but were unavailable because of prior subsurface rights of the NPR-A and the Arctic National Wildlife Refuge. Dual-withdrawals lands include areas selected by the ASRC but which are also identified for inclusion in the proposed d-2 lands.

Village Corporation Conveyances

Villages in the region have obtained interim conveyance for lands totalling more than 700,000 acres. Wainwright was the second community in the State to receive its full conveyance of 105,312 acres. Barrow, the eighth largest Native village in the State, received most of its remaining allotment at the same time--a transfer of 201,232 acres. The status of village selections is shown on Table 2.

Native Allotments

The Alaska Native Allotment Act of May 17, 1906, authorized the Secretary of Interior to grant up to 160 acres of land to Native Alaskans. Although the Act was terminated by the passage of the ANCSA in 1971, applications filed before that date are still being processed and honored. About 250 parcels, totalling 37,500 acres are applied for in the Arctic Region (Alaska Regional Profiles: Arctic Region). Most allotments are located along the coastal zone from Harrison Bay to Kaktovik and lesser numbers from Harrison Bay west to Cape Lisburne, and inland along rivers.

CURRENT NATIVE VILLAGE CONVEYANCES UNDER THE ANCSA (SECT. 12a)

	Acreage Received	Acreage Pending
Ataksook (Ataksook Corporation)	no information	no information
Barrow (Upgeagvik Inupiat Corporation)	201,232	-0-
Kaktovik (Kaktovik Inupiat Corporation)	65,000 (selected)	no information
Point Hope (Tigara Corporation)	127,912 (selected)	no information
Point Lay (Cully Corporation)	85,300	--
Wainwright (Olgoonik Corporation)	105,312	5,160
Subtotal	703,000	
Nuiqsut (Kuukpik Corporation)	-0-	115,200
Anaktuvuk Pass (Nunamiut Corporation)	-0-	90,000

Source: Anchorage Times, June 4, 1977; Arctic Environmental Information and Data Center, Alaska Regional Profiles: Arctic Region, April 1975

LAND STATUS ISSUES

The Alaska Native Claims Settlement Act is the dominant land status issue in the region. The following discussion relates to the distribution of conveyed lands as well as to the uses to which they may be put.

National Interest Lands

Congress is presently considering legislation (HR-39, sponsored by Representative Morris Udall) on so-called National Interest, Section 17(d)(2), lands. Important components of the legislation include: the amount of land to be included in the system of National Parks, Wildlife Refuges, Forests and Wild and Scenic Rivers; the schedule for absorbing the designated lands into these systems; and the recreational, resources extraction and transportation uses allowed under each.

The Udall proposal would include 115 million acres in the system. Portions of this land area included in the North Slope Borough are all of the proposed additions to the Arctic National Wildlife Refuge (8.4 million acres), portions of the Gates of the Arctic National Park in the Central Brooks Range (13.6 million acres total), and portions of the Noatak National Preserve (7.6 million acres total).

Key alternative proposals to the Udall bill include those of Governor Jay Hammond and the Joint Federal-State Land Use Planning Commission (JFSLUPC). The Governor's proposal would set aside 25 mi 11 ion acres until the year 2000, allowing for potential resource development in the interim period. The proposal of the JFSLUPC would include 44 million acres in the four national systems, an additional 46.7 million acres into a "fifth system", designated as Alaska National Lands, to be jointly managed by four federal agencies: Fish and Wildlife, Park Service, Forest Service and the Bureau of Land Management.

Differences in these proposals within the Beaufort Sea Petroleum Development Region are presently inconclusive, but relate to alternative delineations of land areas to be included in the Brooks Range portion of the system. The

proposal of the JFSLUPC would add the following North Slope rivers to the wild and scenic rivers sytem: the 1 tuko River (which empt es into the Chukchi Sea near Icy Cape); the Ikp kpuk River (which empties into the Beaufort Sea at Smith Bay); and the Cann ng River (which empties into the Beaufort Sea at Camden Bay).

The legislation finally enacted on (d)(2) lands will determine such land uses as the kind and amount of mineral extraction allowed to meet national energy needs, the locations of transportation and pipeline corridors, and the potential conflicts between subsistence activities and increased recreational opportunities.

Native Corporation Management

Recent conveyances to the Arctic Slope Regional Corporation and village corporations have created conditions for the planning, management and potential development of resources on these lands. For example, the conveyance of Regional Corporation lands to the ASRC has resulted in an exploratory drilling program approximately 30 miles southeast of Umiat. The second well at the "Tulugak" location was recently drilled. These and other lands selected by the ASRC will be managed by the Corporation at least unti 1991, when shareholders have the option of leasing or selling the shares of stock in the corporation.

Future oil and gas development activities on reg onal or vii" age corporation lands could require special agreements relating o surface and subsurface rights. For example, the village of Nuiqsut has received a selection of approximately 5 square miles within the boundaries of the State Nearshore Oil Lease Area. Under an agreement between the ASRC, the village corporation and the State Division of Lands, Nuiqsut will retain surface rights and the State will retain the subsurface rights to these five sections (State Division of Policy Development and Planning, April 1975).

Easements Across Native Lands

Future activities of the regional and village corporations are dependent upon resolution of litigation against the Bureau of Land Management by the ASRC.

Six regional corporations are challenging the right of the Department of Interior to grant easements across all conveyances made under the ANCSA, including Native lands. These rights were promulgated by the Secretary of Interior in two administrative orders, dated February 5, 1976 and March 5, 1976, which qualify rights of access preserved under section 17(d)(2) of the ANCSA.

The administrative orders are significant to the regional and village corporations, first because they establish broad discretionary power of use and access across Native lands; and second, resolution of litigation over these rights and specific requested easements could delay the land conveyances to Native corporations. Earliest expected settlement is-late summer 1977.

The first administrative order (DOI, February 5, 1976) related to reservation of local public easements across all lands conveyed under the ANCSA. The easements are meant to reserve lands for transportation, utilities, communications corridors and facilities and for recreational use by the public. Transportation easements could be established for such facilities as roads and trails, railroad spurs, docks, navigational aids for watercraft or aircraft, and aircraft landing sites.

The easements would be precisely located wherever possible, "exceptw here they would result in substantial delay in the issuance of conveyances." Guidelines for reservation of easements include assessment of public use along with special consideration of the "effect of a proposed easement on Native lifestyle and subsistence needs." Additional guidelines require review of recommendations of the Joint Federal-State Land Use Planning Commission (JFSLUPC), other federal agencies, the State, Native corporations and the general public.

The JFSLUPC has stated its position that no surface easement corridors should be established across (d-2) or other lands at this time (Janet McCabe, Land Management Planner, JSFLUPC). Because locations of resource development in

the future are speculative, and intercommunity transportation needs cannot be projected with certainty, the Commission finds no present justification for designation of corridors. It believes that multi-modal transportation corridors should be planned in the context of a statewide land use planning process.

Two additional provisions of the Act have particular significance to subsistence fishing activities. The order established a continuous linear easement of 25 feet in width along the entire coastline of the State. This easement would be used for the beaching of watercraft and aircraft, travel along the shore, recreation and other similar uses, such as camp sites. A second provision calls for reservation of a 25-foot wide easement along the banks of rivers and streams that have highly significant present recreational use.

The second administrative order (DOI, March 5, 1976) relates to additional public easements for inter-regional or interstate transportation of natural resources. This order requires reservation of public easements across all Native land for transportation of resources that are property of the United States or that are intended for delivery to the United States. The easements include the right to construct any related facilities necessary during periods of planning, locating, constructing, operating, and maintaining or terminating transportation systems. Pipelines carrying federally owned-oil and gas from National Petroleum Reserve-A to the trans-Alaska pipeline corridor, for example, could cross Native Lands at Nuiqsut, or Regional Corporation-selected lands in the vicinity of Umiat. Although the easements are not meant for benefit of privately owned energy, fuel and natural resources, the provision of easements for transport of resources to the United States would appear to allow easements for nearly all resource development. For example, energy fuels such as coal could be mined and shipped through regional corporation and village corporation lands to ports along the Arctic Ocean.

Additionally, the order provides for crossing of all lands conveyed pursuant to the ANCSA, rather than delineating specific rights-of-way. Although consent by the owner of the land is required before designation of a right-of-way,

the United States may exercise right of eminent domain if such consent is not given.

An additional suit has been filed by-the Alaska Public Easement Defense Fund, representing sportsmen and recreational interests. In contrast to the suit by regional corporations to restrict transportation corridors, this suit seeks a broader interpretation of the Act, allowing for greater public access onto Native lands.

The relationship between OCS development and all of these easements is not known at this time. Because OCS development areas have not yet been identified, potential impacts of easements to serve them can not yet be assessed.

UTILITIES

CURRENT UTILITIES SERVICE

Basic utilities service in the Arctic is extremely limited. With the exception of base camps at Prudhoe Bay, specialized military installations, and a few public facilities in the larger communities, piped water supply and water-borne sewage disposal systems are not presently in use. Electrical generation and distribution systems are found in most communities, but are often unreliable. Gas distribution systems, where they exist, are poorly designed and maintained. Most fuel for heating is costly, and fuel storage facili ties are typically inadequate. Solid waste and sewage containers are disposed of at community dumps too infrequently to keep pace with demand. As a result, refuse and garbage remains around most houses, creating unsanitary conditions detrimental to community health.

Despite the inadequacy of existing systems, basic utility services are of critical importance to life safety in the Arctic. In recognition of this fact, the North Slope Borough has given highest priority to their development (1977 Capital Improvements Program Revisions). Electrical generation and distribution are scheduled to proceed first, followed by safe water and sewage systems.

The following summary of utilities in the Arctic Region is primarily based on surveys undertaken for the North Slope Borough by Dupere & Associates (Reconnaissance Study : An Inventory of the Borough and Its Communities, October, 1973; and Manpower Development and Community Survey Reports, July 1974) . Although nearly four years have passed since completion of the first study, much of the information remains valid. While housing, commercial development and community facilities have been developed in North Slope communities, utility systems have typically not been expanded to serve them. In the past, the Public Health Service Aid Program for sanitary facilities (Sanitary Faci li ties for American Indians Program Public Law 86-121), was tied to new housing construction in Alaska communities. However, in order

to expedite the construction of needed housing, PHS requested that funds for new housing be separated from funds for development of sanitary facilities.

Water, Sewer and Solid Waste

Utilities service to housing units in the Region are woefully inadequate. Over 90 percent of the housing units surveyed in the 1970 Census lacked some or all basic plumbing facilities. The Dupere & Associates' survey of communities in 1974 showed that only 10 percent of the housing units surveyed in Barrow and Kaktovik had piped water systems. Moreover, where piped water systems exist, they are for internal distribution only. Water still has to be hauled to the dwelling unit where it is deposited in central storage tanks before distribution. Seventy percent of the new housing units surveyed lacked a bathtub or shower, and even fewer units had installed sinks.

The same study indicated that the only flush toilets in the Region are self-contained, and operate like honey bucket systems -- requiring emptying. Similarly, water used in cooking, cleaning and washing is generally disposed of through dwelling unit drainage systems, directly onto the ground outside of the dwelling. Dupere noted that such a system of sewage disposal was undoubtedly one of the major factors contributing to recurrent epidemic outbreaks of infectious hepatitis within communities.

Human waste is collected in plastic bags or fifty gallon barrels which are then dumped at community dumps and covered with gravel. In some communities, dump sites are left uncovered, while at others such as Wainwright and Barrow, facilities exist for incineration.

The majority of the Region's residents obtain their water by either hauling water and/or ice from lakes near their communities. Water consumption varies from an estimated 10 gallons per day in Barrow to 2 gallons per day in smaller communities (Johnson and Dryer, in press). By contrast, water used at the DEW Line stations averages 47 gallons per day, and water used at the Naval Arctic Research Laboratory (NARL) in Barrow, averages 124 gallons per day (ITT Arctic Services, Inc.).

Because each dwelling unit provides its own water, consumption is not monitored. Consequently, water consumption estimates can vary dramatically. The Public Health Service estimates a present per capita consumption at Barrow of as high as 35 gallons per-day. Thus, the amount of water consumed under the present ad-hoc system provides little reliable basis for design of newer systems.

Electricity and Heating

Eighty-five percentof the housing units surveyed by Dupere and Associates in 1974 had electrical service. Communities with the most efficient electrical service were Nuiqsut, Point Lay and Anaktuvuk Pass.

Power generation and distribution systems range from those which are Borough-owned and privately operated, such as Barrow, to communities with small generators serving a very few homes, such as Anaktuvuk Pass. Gas turbine powered generators recently installed at Barrow have a 2710 kilowatt capacity, with 1600 kw generators as back-up capacity.

The NARL facility at Barrow has a 3000 kw system of four 750 kw gas turbine generators.

The Central Power Station being built for British Petroleum will have a capacity of 24,000 kw and will include a 69 kv switch yard. A major gas turbine generator plant is now under construction in California for shipment to Prudhoe Bay, which could help provide more power for the operation of oil field production facilities.

The heating fuel used in most communities is heating oil, with the exception of Barrow which uses natural gas. A reliable, inexpensive source of heating fuel and permanent storage facilities are high priorities for communities in the Beaufort Seat Region. The North Slope Borough recently negotiated a lower consumer rate for gas from the South Barrow Field to serve the community of Barrow. As a result 'of these negotiations, the rate was lowered from 50¢ per thousand cubic feet (MCF) to 32.4¢ MCF.

The Borough is also attempting to convince national energy policy planners to adopt an Arctic Community Energy Policy that will provide other Arctic communities with low-cost gas from nearby gas fields. The Borough's successful effort in lowering the Barrow gas rate and its new regional policy is based upon a provision of the Naval Petroleum Reserve Act of 1976 that prohibits the Secretary of the Navy from including amortization of the federal investment in the rate base for Barrow (North Slope Borough, January 1977).

UTILITIES SERVICE ISSUES

The North Slope Borough has been instrumental in developing plansfor improvements to utilities systems in the Region. The proposed improvements are based on an inventory of the Borough and its communities conducted by Dupere & Associates in 1974 that projected capital improvement requirements from FY 1974 - FY 1980. Each year this capital improvement program is updated by the Borough, incorporating the projects identified in the inventory together with any newly identified projects.

The Borough's annual capital improvement program contains a brief description of each project, the costs identified by the Dupere & Associates study, an identification of funding, and any potential difficulties in-obtaining required funds. The basis for cost estimates in the yearly CIP does not reflect inflation since 1974. The Dupere & Associates study as well as the annual revisions are essentially a statement of broad-based objectives rather than a definitive action plan. Although a priority ranking from 1 to 3 is assigned for each project, there is no assurance that any specific project will be undertaken in a given year.

The demand estimates are based on the projections of individual agencies, such as the Public Health Service, which provide services to Borough residents. The assumptions underlying these estimates often are not stated.

The provision of a multi-use facility (designated "Life-Health-Safety" facilities), containing a reliable water supply, power source and health care facilities, is an important priority of the North Slope Borough Plan-

ning Department. The construction of these facilities is seen as the necessary precondition for the provision of other facilities, such as basic health care clinics. Similar facilities, or variations containing public showers, laundry, sewage and solid waste treatment, are likely to be built in North Slope communities in the future.

One such facility was built in Wainwright in 1972 by the U.S. Environmental Protection Agency, under a program called the Alaska Village Demonstration Project. The facility contained water and water treatment and a one million gallon storage, sewage treatment and solid waste disposal (incinerator) and laundry. Because of the chlorine taste of the treated water, many residents preferred hauled water. The facility was destroyed by fire in 1973, and was recently rebuilt by EPA.

Other systems (e.g., Kaktovik) are in the design phase. In order to capitalize upon waste heat produced by electrical generators, the systems are planned to be integrated with future water, storage and sewage treatment facilities. Space will be provided in each central community utility facility for the relocation of electrical generation equipment.

The draft Capital Improvements Program includes plans for concurrent development of water and sewage systems in North Slope communities: costs of improvements will be jointly shared by the U.S. Public Health Service (which will fund service to the community at large), and the Borough (which will fund service to public facilities within the community).

Initial development will be funded substantially by the PHS. During this first phase, all villages will receive the following facilities: a developed water source, with a central watering point and safe water treatment; a central laundry/showers/toilet facility; and a sewage disposal system. The sewage disposal system will typically consist of an outfall into a sewage lagoon, or vehicular collection and disposal.

A second phase, with portions to be funded by the Borough and village residents, will consist of distribution service to public facilities and individual homes as required by residents. The Borough has allotted 1977/78 funds for development of a Utility Management System under which it plans to establish maintenance and operational procedures with the PHS.

The communities scheduled for water improvements in the Beaufort Sea Region are as follows:

- Barrow - PHS study of three-block-long utilidor due fall 1977 (future linkages due 1980)
- Nuiqsut and Point Hope - 1979 (presently in design phases)
- Ataksook - 1980
- Point Lay - 1981
- Wainwright - Not needed (EPA Central Utility Facility complete)
- Anaktuvuk Pass - No participation by PHS. Borough responsibility for completion of initial phase "as soon as possible."
- Prudhoe Bay - Borough-funded project underway.

The Prudhoe Bay water supply and waste disposal project is unique among community projects funded by the Borough. The Borough is in the process of developing a Central Utilities Facility at Prudhoe Bay containing water supply, sewage and solid waste disposal facilities. A solid waste incinerator is presently complete but not in operation. When the entire complex is constructed, it will provide contract services to oil companies in Service Area 10 of Prudhoe Bay. NANA Environmental Systems has been contracted to design, construct and operate the complex (Herbert Bartel, Planning Director, North Slope Borough).

Plans for water supply include a three-year program for dredging of a gravel site near the Sagavanirktok River to create a reservoir for water supply.

The 600,000 cubic yards of gravel will be used to supply development in the area, including potential improvements requiring 300,000 cubic yards of gravel at the State airport at Deadhorse which is approximately one to two miles south of the gravel/water supply site. Permit applications were filed with the Army Corps of Engineers in January 1977.

The project is being held up, however, pending settlement of litigation against the Borough by oil companies at Prudhoe Bay. The companies have contested the Borough's rights to levy special assessments within Service Area 10 to cover its general obligation bonds totaling $2.5 million in construction costs for the complex. The State has funded the balance of the approximately $14.5 million facility.

COMMUNICATIONS

Communications facilities are operated by State and federal government agencies for civil aviation and national defense installations, and by private industry such as RCA and Wien Air Alaska airlines. Until recently, radio and radio-telephone were the primary communications systems serving individual communities such as Kaktovik, as well as construction camps at Prudhoe Bay and Deadhorse. However, the construction of telecommunications satellite earth stations at Barrow and Wainwright, and the planned construction of others at North Slope communities will bring long distance telephone service to some otherwise isolated locations. Within communities, citizens' band (CB) radio is enjoying increased use as well.

Facilities for communications in the Beaufort Sea Petroleum Development Region are established to serve three basic needs:

- Telephone service via telecommunications satellite
- Military defense through DEW Line radar sites
- Specialized communications to serve oil exploration and development

Each of these broad categories of communications is discussed below in terms of functional requirements and the facilities.

Telecommunications Satellite System

Within a few years of assuming responsibility for the Alaska Communication System from the Air Force in 1971, RCA Alascom has introduced satellite technology throughout the state. As part of its agreement with the State to construct 100 satellite earth stations throughout Alaska, RCA inaugurated satellite telephone service in the Arctic early in 1977. At that time, RCA put into service a new satellite earth station at Anaktuvuk Pass, giving this settlement its first reliable telephone contact with the outside world, and a second satellite earth station at Barrow.

The capabilities of the 33-foot diameter earth station at Barrow suggest the range of telecommunications services that can be brought to other isolated areas of Alaska. Prior to the installation of the earth station, Barrow had seven long distance circuits. Now Barrow has 20 long distance channels for public use, and more can be added to meet future needs. In addition to public long distance uses, the earth station also carries private line circuits, including channels for the Public Broadcasting System, the Alaska Native Health Service and teletype and telex customers (Alaska Industry, 1977; Paul F. Reitmeier, Manager, Industrial Marketing, RCA Alascom).

The following is a list of selected communities within which RCA Alascom plans telephone system improvements:

	Present Toll Circuits	1981 Planned Toll Circuits
Barrow	20	32
Wainwright	1	1
Nuiqsut	2	2
Kaktovik	0	0

Source: Paul F. Reitmeier, Manager, Industrial Marketing, RCA Alascom.

DEW Line Stations

Alaska's military Distant Early Warning System (DEW Station) was established by the Air Force in the 1950's to provide intermediate radar detection of enemy aircraft. Stations were built along the Arctic coast from Point Lay to the Canadian border at approximately equal intervals (50 miles optimum).

Operational difficulties with the doppler radar system and more sophisticated detection systems have eliminated the need for most of these stations. Of the approximately 12 stations originally built, only four are now in operation: Point Lay, Wainwright, Barrow and Barter Island (Kaktovik).

The remaining stations have either been abandoned or converted to other uses such as logistical bases for petroleum exploration in National Petroleum Reserve-A, or wildlife research such as two stations within the Arctic

National Wildlife Refuge. The most potentially useful facilities at these deactivated DEW Line stations are air strips and fuel storage facilities. Original communications facilities established at each DEW Line station included three small buildings housing radar equipment, vehicles and staff quarters. Nearby, fuel was provided in storage tanks to power a tractor and electrical generator, and to heat the buildings. A gravel runway of between 1500 and 3500 feet in length was built to serve all of the supply needs of the station. Some of the airstrips have been widened and lengthened and outfitted with navigational aids and lighting.

The communications facilities are under exclusive use by the Air Force, and permission to land must be granted in advance by the DEW system office in Colorado Springs, Colorado. Villages normally use the airports for special cargo deliveries or emergency. However, the North Slope Borough has established a Joint Use Agreement which allows commercial use of the Barter Island airstrip for Kaktovik residents.

Communications for Oil and Gas Exploration

Continuing exploration of NPR-A from the deactivated DEW Line station at Lonely on the east side of Smith Bay, approximately 60 miles southeast of Barrow, includes plans for communications facilities.

The POW-1 site about one-half mile east of Lonely has an RCA transportable earth station. Communication links are also planned between the earth station and 7 small telephone repeater station points in NPR-A (U.S. Dept. of the Navy, 1977). Included in the closed loop system is a repeater station at the deactivated Cape Simpson DEW Line site. As backup to the system, there is a long-haul VHF/UHF radio hookup to the Deadhorse and Barrow stations, which in turn are tied into their respective telephone systems.

TRANSPORTATION

The two major modes of long distance transportation to and within the Arctic are air transport and ship or barge transport. With the exception of rudimentary road systems in each community, there is only one inter-regional road in the Arctic, the haul road built to service the trans-Alaska oil pipeline.

Transportation in the Arctic is characterized by great travel distances and significant seasonal limitations to vehicular movement. The distance between Barrow and Fairbanks, for example, is 475 miles; between Barrow and Nuiqsut is 140 miles, and between Barrow and Kaktovik is 300 miles.

Significant difficulties with the construction of roads and railroads on the North Slope forces the reliance on air transportation and infrequent marine transportation. Although the terrain is flat and presents no topographic limitations to vehicular movements, the wet surface conditions in summer and the extremely low temperatures in winter make overland transportation difficult. The trans-Alaska pipeline haul road follows an alignment along a river and avoids most of the wet tundra coastal plain. Although the haul road eventually may be open for public use, the Prudhoe Bay terminus is still at least 70 miles from the nearest community, Nuiqsut.

The development of roads has been further limited by the lack of road construction materials. It is necessary to place three to five feet of gravel over the surface of the tundra in order to prevent disturbance to permafrost. Removal or damage of the tundra mat causes exposure of the permafrost and erosion which is hard to arrest. The erosion can produce frost heave that can make a road impassable..

Marine transportation has been the best alternative to overland transportation, although it too has significant seasonal limitations. Goods can only be brought in for a few months a year, when the shore-fast ice melts and allows shallow draft barges to approach the shore. Six tons of freight enter the state by water for every ton shipped by air (Parker, 1972). Most of the

heavy cargo and fuel transported to Arctic communities is carried by ship and barge. However, air transportation is assuming an increasingly important role.

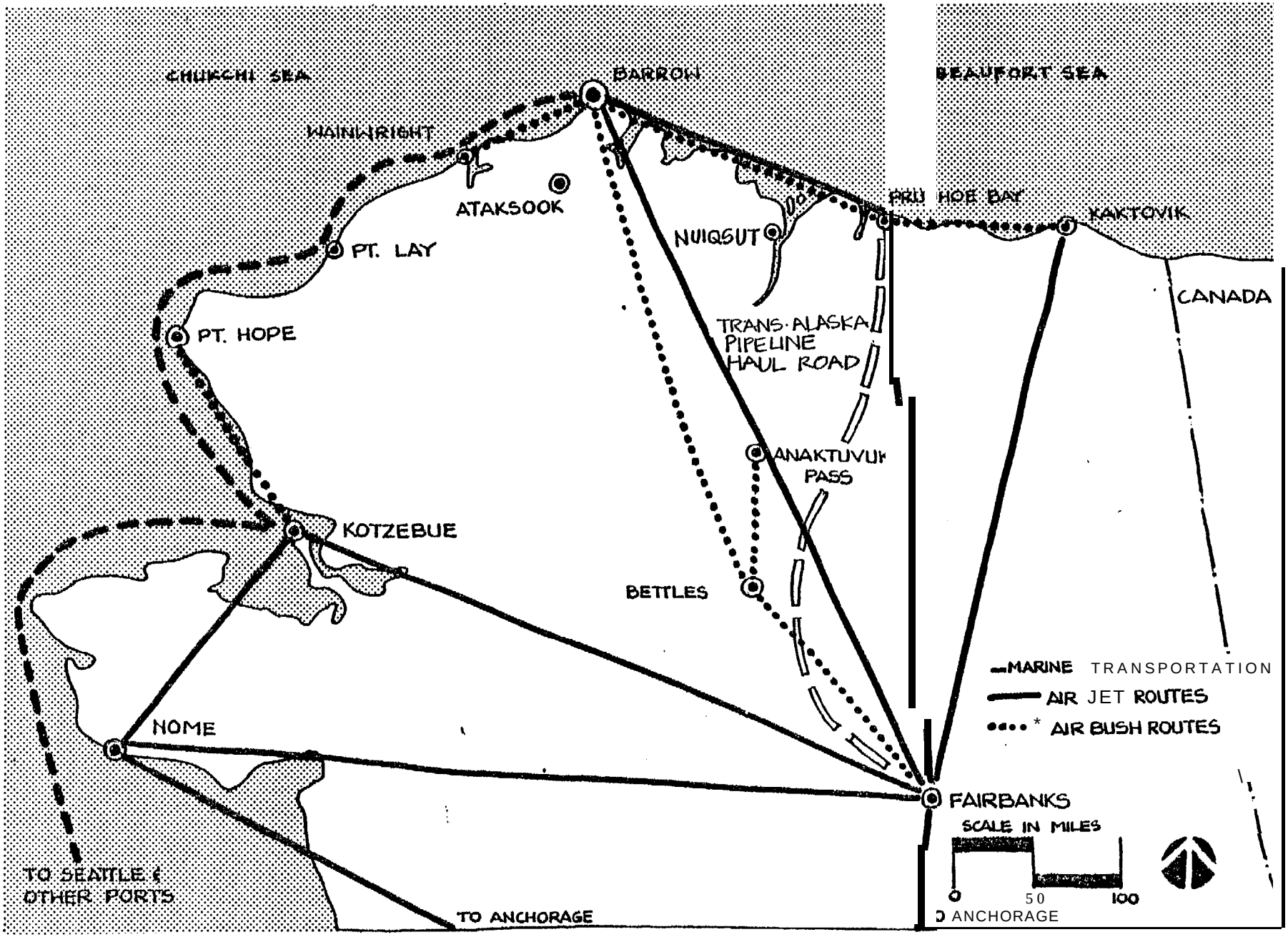
All passenger traffic into and out of the region is by air. Both scheduled commercial flights and non-scheduled charter aircraft serve communities in the region. All the cargo transportation requirements in winter are met by aircraft. Figure 4, Regional Transportation Systems, indicates the current intra-regional and inter-regional scheduled air and marine transportation routes and the alignment of the trans-Alaska pipeline haul road.

Limitations of the Study

Significant limitations accompany the baseline assessment of transportation facilities on the North Slope. Information on transportation movement characteristics and facilities at different communities is often unreliable and out of date. Much documentation by the State regulatory agencies and the Borough on facilities at airports and DEW Line stations and on the costs of movement of people and goods is conflicting. There seems to be no systematic procedure for compilation and reporting of data in the-transportation sector. Attempts have been made to corroborate data by cross comparison of source material and by discussion with agency representatives. However, even the owners and operators of some airports, for example, are unaware of the size and length of their airstrips or the support facilities they contain. Information in this inventory may be assumed to be reasonably accurate for larger, more accessible communities, such as Barrow, and less reliable for isolated, or abandoned settlements such as DEW Line stations.

The following sections summarize the existing air and marine transportation in the region. The principal routes and facilities are discussed together with problems or other issues associated with improvement of transportation services to North Slope communities. Also included is a discussion of highway transportation issues associated primarily with the trans-Alaska pipeline haul road.

FIGURE 4



BEAUFORT SEA REGIONAL- STUDY . REGIONAL TRANSPORTATION ROUTES

AIR TRANSPORTATION

CURRENT AIR TRANSPORTATION

Because the North Slope has no highway system linking communities (with the exception of the trans-Alaska pipeline haul road) and its marine transportation is limited to a short ice-free summer season, the region is primarily dependent upon air transportation. Regularly scheduled air service via Wien Air Alaska serves Barrow, Deadhorse, Kaktovik and Anaktuvuk Pass from Fairbanks, and Point Hope from Kotzebue. Air taxi service exists for intra-regional service to other communities. The Air Force provides contract chartered flights to three DEW Line sites as well as Kaktovik (Barter Island DEW Line), Barrow (NARL), Wainwright and Point Lay, with public use on a space available basis.

The schedule and fare structure for North Slope communities (June 13, 1977 to September 30, 1977) is shown in Table 3.

Most of the following summarizes information contained in an inventory of airport facilities prepared for the North Slope Borough in 1975 (Airport Facilities Study, H.V. Lounsbury & Associates). Facilities are grouped according to two categories: federal government operated and maintained airports that" are restricted to military use; and State and privately operated and maintained airports, serving most villages.

The airports operated by the U.S. Air Force or Navy are generally well-maintained and better capable of handling larger aircraft under adverse weather conditions than are public use airports at most villages. Airport facilities located at active and deactivated DEW Line stations along the Arctic coast were constructed in the 1950's. Of the approximately fifteen sites, five are in active use; four are being used for research; two are being utilized as logistical bases for exploration of petroleum reserves in National Petroleum Reserve-Alaska (NPR-A); and the remaining four are abandoned. The following lists airport facilities at each of these sites. (Lounsbury & Assoc., 1975; Dept. of the Navy, 1977; Dupere & Assoc., 1974)

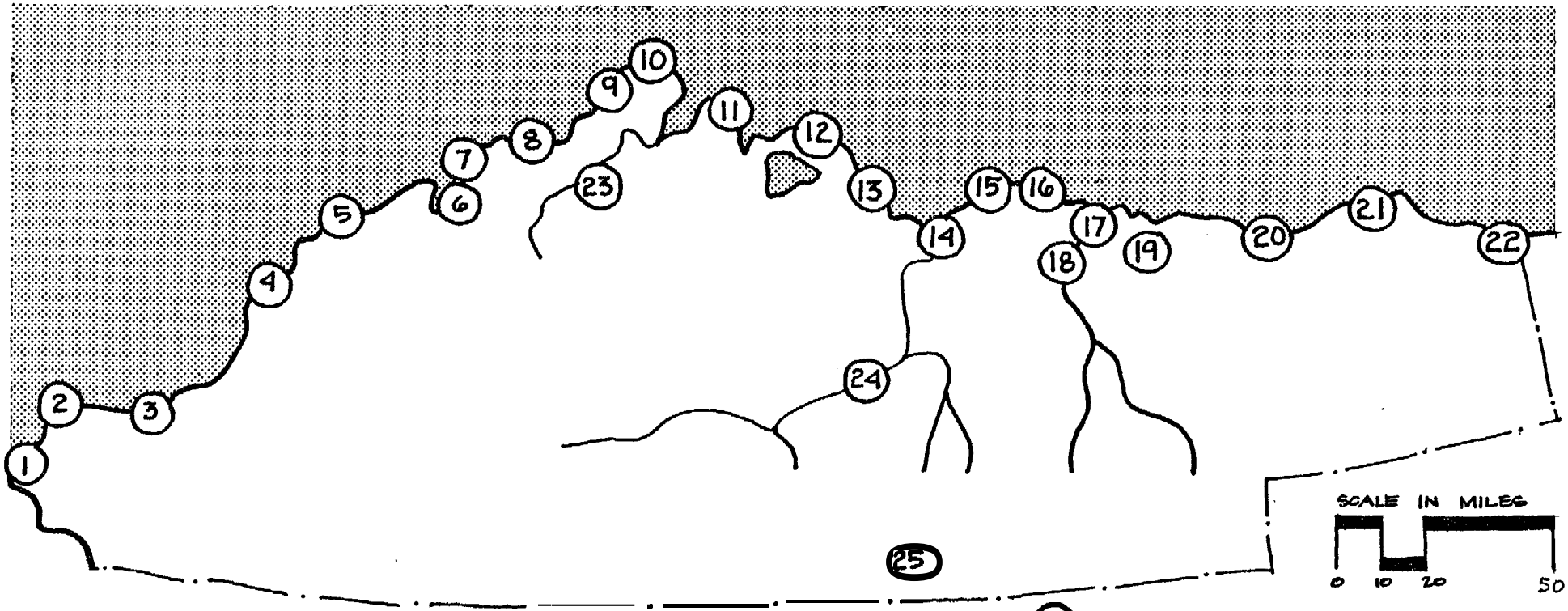
TABLE 3

SCHEDULE AND FARE STRUCTURE FOR NORTH SLOPE COMMUNITIES
(June 13, 1977 to September 30, 1977)

DESTINATION	ORIGIN	CARRIER	AIRCRAFT	SCHEDULE	ONE-WAY FARE
Barrow	Fairbanks	Wien	737-Jet	Daily	$77.24
Barrow	Anchorage	Wien	737-Jet	Daily	$109.03
Barrow	Fairbanks	Frontier Flying Service	Piper Navajo Chieftan	Once a week	$123.26
Kaktovik	Deadhorse	Sea Air Motive	Twin Otter	2 days/wk	$67.68
Kaktovik	Deadhorse	ERA	Helicopter	2 days/wk	$67.68
Deadhorse	Fairbanks	Wien	737-Jet	Daily	$77.24
Nuiqsut		None scheduled - Frontier Flying Service has requested route			
Wainwright	Fairbanks B	Wien			$96.36
Point Lay	Nome	Munz Northern Airlines, Nome		N/A	N/A
Point Hope	Nome	Munz Northern Airlines, Nome		N/A	N/A
Anaktuvuk Pass	N/A	N/A	N/A	N/A	N/A
Ataksook	N/A	N/A	N/A	N/A	N/A

Source: CCC/HOK

FIGURE 5



1. PT. HOPE
2. CAPE LISBURNE
3. CAPE SABINE (CAPE BEAUFORT)
4. PT. LAY
5. ICY CAPE
6. WAINWRIGHT DEW STATION
7. WAINWRIGHT
8. PEARD BAY
9. WILEY POST/ WILL ROGERS (BARROW)
10. NARL (BARROW)
11. CAPE SIMPSON
12. LONELY DEWLINE STATION
13. KOGRU
14. NUIQSUT
15. OLIKTOK DEWLINE STATION
16. PT. McINTYRE
17. PRUDHOE BAY
18. DEADHORSE
19. EAST FORK
20. BROWNLOW PT. (CAMDEN BAY)
21. BAR-MAIN DEWLINE STATION (KAKTOVIK)
22. DEMARCATION BAY
23. ATAKSOOK
24. UMIAT
25. ANAKTUVUK PASS

BEAUFORT SEA REGONAL STUDY · AIRPORTS IN THE REGION

Active Use Stations

Clearance for landing at each of these stations must be obtained in advance from the DEW station office in Colorado Springs, Colorado.

- Point Lay - 2892 acres
  - Gravel airstrip: 3519 feet long x 100 feet wide (certified for medium size cargo C-124 aircraft)
  - Lighting: medium intensity (runway and taxiway)
  - Navigational aids: communications tie-in (FSS Kotzebue)

- Wainwright (LIZ-3) - 3724 acres
  - Gravel airstrip: 3500 feet long x 100 feet wide
  - Lighting: runway lights
  - Navigational aids: ground to air radio communication, homer beacon and wind driven measuring equipment
  - Fuel: limited

- Barrow - 4541 acres (including NARL)
  - Gravel airstrip: 5000 feet long x 150 feet wide (solid steel base installed in 1964)
  - Lighting: runway lights
  - Navigational aids: ground to air radio communication, homer beacon and wind measuring equipment
  - Fuel: extensive
  - Buildings: two hangars, storage warehouses, equipment for freight handling and major repairs

- Lonely (POW-1) - 2830 acres (also used as an oil exploration base camp)

  60 miles southeast of Barrow
  - Gravel airstrip: 5200 feet long x 150 feet wide
  - Lighting: runway lights
  - Navigational aids: ground to air radio communication, homer beacon, wind measuring equipment, RCA transportable earth station
  - Buildings: 90-man base camp
  - Fuel: four 420,000 gallon bolted steel airplane fuel tanks (to be replaced by welded tanks in 1977); 126,000 and 65,000 gallon welded gasoline tanks

- Barter Island (Bar-Main at Kaktovik) - 4359 acres
  - Gravel airstrip: 4817 feet long
  - Lighting: N/A
  - Navigational aids: N/A
  - Buildings: Borough-owned and operated warm storage space

Research Stations

- Icy Cape (LIZ-B) (custody of NPR-A) - 218 acres

  Navy research on offshore sand bars
  - Gravel airstrips: 2400 feet long x 100 feet wide (recently improved); 2200 feet long x 100 feet wide (poor condition)
  - Lighting: runway lights
  - Navigational aids: Antenna system
  - Buildings: three small deactivated DEW Line buildings (good condition)
  - Fuel: limited

- Oliktok (POW-C) - 759 acres

  40 miles northwest of Prudhoe Bay. NARL (Barrow) research station
  - Gravel air strip: 1500 feet long
  - Fuel: 85,000 gallon diesel storage tank

- Camden Bay - Brown Low Point (POW-D) - 456 acres

  Us. Fish & Wildlife Research Station
  - Gravel airstrip: damaged by coastal erosion (roadway landings)
  - Buildings: three small deactivated DEW buildings
  - Fuel: tanks capacity 14,000 gallons

- Demarcation Point (POW-E) - Acreage N/A

  U.S. Fish & Wildlife Research Station
  - Gravel airstrip: 1800 feet long x 100 feet wide
  - Buildings: three small deactivated DEW Line buildings
  - Fuel: tanks - 1400 gallon capacity water storage tank and additional supplies in support of wildlife research

Oil Exploration Base Camps

- Lonely (POW-I) (Also Active Use Station) - 2830 acres

- Cape Sabine (LIZ-A) -431 acres

  Industry use for seismic exploration

  - Gravel airstrip: 2900 feet long x 100 feet wide (maintained)
  - Lighting: not operable
  - Buildings: three deactivated DEW buildings, 25 to 30 portable housing units
  - Fuel: four large fuel storage tanks, 65,000 gallon water storage tank

Abandoned Stations

- Cape Simpson (POW-A) (Custody of NPR-A) - 229 acres

  40 miles southeast of Barrow

  - Gravel airstrip: 2500 feet long x 100 feet wide (excellent condition)
  - Lighting: runway lights
  - Navigational aids: Antenna system
  - Buildings: three deactivated DEW Line buildings
  - Fuel: four 20,000-gallon steel tanks

- Point McIntyre (POW-C) - 1100 acres

  20-40 miles northwest of Prudhoe Bay

  - Gravel airstrip: 1636 feet long x 70 feet wide
  - Lighting: none
  - Navigational aids: none
  - Buildings: 3 small deactivated DEW Line buildings

- Peard Bay (LIZ-C) (Custody of NPR-A) - 1460 acres

  55 miles southwest of Barrow

  - Gravel airstrip: 1600 feet long x 100 feet wide
  - Lighting: runway lights
  - Navigational aids: antenna system
  - Fuel: none
  - Buildings: one deactivated DEW Line building

- Kogru Inlet (POW-B) (Custody of NPR-A) - 790 acres
  120 miles southeast of Barrow
  - Gravel airstrip: 1800 feet long x 75 feet wide

- Flaxman Island - acreage N/A
  North of Canning River
  - No information available

Public Use Airport Facilities

The second category of airports on the North Slope is related to public use airports. Facilities at villages are summarized below.

- Anaktuvuk Pass (Owned by BLM, operated by Wien Air Alaska)
  - Gravel airstrip: 4430 feet long x 100 feet wide (poorly graded and maintained, subject to flooding -- incapable of receiving large cargo aircraft)
  - Lighting: none
  - Communications: tie-in FSS (Fairbanks)
  - Buildings: none
  - Fuel: none

  North Slope Borough's 1977 Capital Improvements Program indicates that preliminary planning efforts in coordination with FAA and the State Division of Aviation should result in improvements of the Anaktuvuk Pass airport in 1977/78.

- Ataksook (Owned and operated by BLM)
  - Turf airstrip: 2000 feet long x 50 feet wide (usable only when when weather and ground conditions permit)
  - No existing facilities

  The 1977 North Slope Borough Capital Improvements Program indicates that Borough funds have been appropriated for design work in application for funds from State and federal agencies for airport construction.

- Barrow: Wiley Post/Will Rogers Memorial Airport (owned and operated by the State of Alaska)
  - Paved airstrip: 6500 feet long x 150 feet wide
  - Lighting: high intensity, medium intensity taxiway, and apron lighting
  - Navigational aids: FAA VORTAC, FAA UHF, VHF directional finder
  - Buildings: new Wien terminal, FAA flight service station, State Division of Aviation offices, air charter service hangar
  - Fuel: limited, charter operations-owned tanks

- Deadhorse (Owned and operated by State Division of Aviation)
  - Gravel airstrip: 5000 feet long x 150 feet wide
  - Lighting: medium intensity runway and taxiway lights
  - Navigational aids: FAA facilities, and radio nav-aid facilities (FSS Wien antenna, VHF)
  - Buildings: terminal, utility-storage shop, power and small transient camp, and adjacent gravel helipad
  - Fueling: extensive

  Improvements, including widening of the airstrip and the installation of additional navigational aids, are scheduled by the State. When completed, operation at the Prudhoe Bay runway will be discontinued.

- Kaktovik (See Barter Island - Bar-Main at Kaktovik, listed above under DEW Line Active Use Stations)

- Nuiqsut (Owned by BLM)
  - Sand airstrip: 2000 feet long x 75 feet wide (capable of receiving small aircraft such as Twin Otter)
  - Lighting and navigational aids: none

  This sand airstrip was recently constructed by the State and has been turned over to village ownership. Operation and maintenance is carried out by the State.

The North Slope Borough has funded applications to obtain State and federal funds for construction of additional improvements at the Nuiqsut airport (1977 Capital Improvements Program). Plans are to extend the runway to 2500 feet with lighting, and then to 3500 feet to 4500 feet with an apron and lighting. Expansion to accommodate Hercules-type cargo aircraft will allow for the airlifting of supplies and workers for the construction of major community facilities by the Borough (1974-75 Capital Improvements Program).

- Point Lay (Owned by BLM, operation in public domain)
  - Sand airstrip: 600 feet - 800 feet long x 60 feet wide (soft, unmaintained strip)
  - Existing facilities: none

- Point Hope (Owned and operated by Alaska Division of Aviation)
  - Gravel airstrip: 4000 feet long x 100 feet wide [maintained summer and winter, but 800 feet of runway is soft and not recommended for use)
  - Lighting: medium density (runway lights)
  - Navigational aids: Communication tie-in FSS Kotzebue
  - Fueling facilities: Emergency only

- Prudhoe Bay (Owned by Alaska Div. of Lands, operated by ARCO)
  - Gravel airstrip: 5500 feet long x 150 feet wide
  - Lighting: medium intensity
  - Navigational aids: two channel VHF andUHF radio (FAA, ARCO and RCA), communications tie-in FSS (Fairbanks)
  - Buildings: unknown (several)
  - Fueling: N/A

- Umiat (Owned by Alaska Div. of Aviation, privated operated)
  - a Gravel airstrip: 5470 feet long x 158 feet wide
  - Lighting: high intensity runway lights
  - Navigational aids: FAA beacon
  - Fueling facilities: none

- Wainwright (Owned and operated by the State Division of Aviation)
  - Gravel airstrip: 2200 feet long x 100 feet wide
  - Lighting: low intensity runway lights (city installed and maintained)
  - Navigational aids: communications tie-in (FSS Barrow)
  - Fueling facilities: none

AIR TRANSPORTATION ISSUES

The dependency of North Slope communities on air service for transportation and goods movement makes reliable low cost service essential. Significant air transportation issues include the cost, coverage and frequency of air service. They also include the need of industry for improved airport facilities on the Slope.

Oil and Gas Industry Air Transportation Requirements

Oil and gas exploration and development requires the use of large planes and frequent air service. Air transportation facilities typically require upgrading in order to respond to the heavier aircraft and increased air traffic demands of petroleum development.

The current oil and gas exploration program in NPR-A is an example of the immense air transportation service requirements of a drilling program. In the 1976-77 winter season, fuel and cargo were planned to be shipped by barge or Hercules aircraft to supply bases at Wainwright, Barrow, the DEW Line station at Lonely, and Umiat. From these bases, fuel was to be carried to well locations using rollagon-type vehicles or aircraft. If the transport of fuel were accomplished by aircraft alone, it would require approximately 100 flights just to serve the fuel requirements (500,000 to 600,000 gallons) of one medium-depth well (10,000 to 12,000 feet). A ten-day fuel supply of 70,000 gallons is maintained at the test site for 24-hour per day drilling operations.

Although airlifting of fuel is more costly than barge transport to the logistical bases, aircraft are occasionally used for this purpose in order to

provide direct service from Fairbanks to the well sites.

Government agencies that have a role in responding to industry requirements for improved air transportation include State Division of Aviation and the North Slope Borough. The Division of Aviation is taking a reactive stance to impacts arising from OCS activities on State-owned and maintained" airport facilities. That is, the Division will respond to private sector decisions rather than attempt to anticipate them (Harry Shawbach, Acting Director, State Division of Aviation).

Other than maintaining existing airport facilities at current levels, the Division of Aviation's primary role in responding to OCS activities would be to make available for lease to private industry undeveloped land surrounding an airport. Industry uses of this land would include expansion of existing apron and servicing areas, construction of enclosed hangars, and as corridors to bring in needed utilities. The Division will try to restrict warehousing activities to privately owned land near an airport. In some instances, industry has constructed new airstrips and upgraded navigational equipment (e.g., Deadhorse and Yakataga).

The Borough has no official position regarding airport development to meet industry needs. The City of Barrow has set aside land south of the State-owned airport for industrial development. A study was conducted in 1975 for the Borough which inventoried airport and other facilities at abandoned DEW Line stations on the North Slope, and identified procedures by which the Borough could potentially acquire the sites from the General Services Agency (H. V. Lounsbury & Associates). If OCS oil and gas development base camps were required at locations along the Arctic coast, the potential would appear to exist for the Borough to obtain certain abandoned DEW stations for lease to oil companies for use as base camps.

MARINE TRANSPORTATION

From the days of their earliest settlement, North Slope communities were oriented toward the sea. The Taremiut Eskimo were dependent upon the sea for food and skins of sea mammals. With the coming of commercial whaling in the mid-nineteenth century, trade was established with the western world which encouraged migration from inland Nunamiut settlements to communities such as Barrow. New dependencies on commercial goods gradually began to replace trading between coastal and inland Eskimos (U.S. Dept. of the Navy, 1977) .

CURRENT MARINE TRANSPORTATION

Shipments of goods to Barrow have continued ever since the advent of commercial whaling. World War II liberty ships have given way to sea-going barges for delivery of cargo in Alaska, with the sole exception of the liberty ship "Northstar III," operated by the Bureau of Indian Affairs to serve northwest and North Slope communities.

Today, marine transportation to the Arctic consists of annual trips by the Northstar III, and more frequent use of barges to supply specialized petroleum development operations. The cargo ship and ocean-going barges are offloaded onto shallow- and medium-draft ships and barges for lightening to shore. Barges presently offer the best means of transporting heavy cargo such as fuel and fuel tanks, tractors, drilling mud, and pipe and casing, as well as prefabricated housing and entire modular petroleum development camps. Smaller craft are occasionally used to shuttle cargo to some areas where there are no port facilities. Barges have served the needs of oil exploration in NPR-A during the last 20 years (U.S. Dept. of the Navy, October 1975). The NARL base at Barrow serves as a storage site for fuel (2,385,000-gal lon capacity). Transfer of JP-5 airplane fuel and gasoline from offshore fuel barges is carried out using a 6-inch flexible line.

Operations at Prudhoe Bay require unloading from sea-going barges and lightening of freight for six miles with smaller barges to reach the unloading

dock. Port facilities at Prudhoe Bay were built in 1969. A gravel causeway and four barges placed at the end of it serve as the unloading dock. Adjacent to the dock is a 25-acre gravel pad storage area. Three heavy cranes are stationed at the dock for unloading cargo. A road connects the port to the principle camp facilities and airport approximately 4 miles to the south, and to the Deadhorse airport approximately 9 miles to the south. A second dock, 5,000 feet long and 50 feet wide, was built at Prudhoe Bay during the winter of 1975/1976.

In addition to cargo ship service to coastal communities, the government contracts for barges to serve the DEW Line stations, the NARL Facility at Barrow, NPR-A oil exploration, and Prudhoe Bay oil development requirements. Most ports of embarkation are in Washington State or California, with Seattle being the primary port for Alaska.

In 1968, 5,714 short tons of cargo were shipped to the North Slope, most of which went to Barrow (Parker, 1972). With the beginning of oil development at Prudhoe Bay, that figure rose dramatically to 91,089 s.t. in 1969 and 175,000 s.t. in 1970. Only a small portion of this freight normally comes from intra-state ports; apparently in 1969 only 4,000 tons were trans-shipped to Prudhoe Bay from Anchorage (ibid.).

Water transport is the most economical method of transporting heavy bulk materials to the North Slope. The principle advantage of air transport over barge transport is its speed and capability of serving immediate needs. Barge traffic, however, usually requires costly storage of large quantities of materials until needed. Barges are also more prone to accidents, and insurance rates for barges in Alaska are among the highest in the world.

Even with these limitations, however, barge transport remains essential to oil development operations. During the North Slope exploration boom in 1968-69, water transport was passed over in favor of air, but a shift was made to waterborne commerce at the earliest opportunity, in the summer of 1969 (ibid.). The 90,000 tons of freight, including buildings, drilling cement and mud and fuel oil shipped during that summer, were stockpiled at

Prudhoe Bay. As a result, air freight requirements were cut drastically, and Hercules-type aircraft were largely removed from the North Slope during 1969/70.

For lighter and less bulky materials, shipment by water to Anchorage, or shipment by water or truck to Fairbanks, and then transfer to airfreight or airmail, may be feasible because of the high cost of lightening (estimated at 26 percent of ocean freight rates). A combination of air and water shipping seems to be rate competitive with existing all-weather routing, is quicker and reduces the necessity of monitoring large inventories at destinations.

MARINE TRANSPORTATION ISSUES

Issues of continuing importance to the use and development of marine transportation in the Arctic include barge support for continuing oil exploration of NPR-A, and the feasibility of developing deepwater ports (particularly in support of oil exploration and development) along the Beaufort Sea coast.

NPR-A Oil Exploration

Plans for continuing oil exploration in NPR-A will utilize ports at Barrow, and the DEW Line stations at Lonely and Wainwright. The NARL base at Barrow was the primary base for the 1944-53 exploration program, and will be used for supply of exploration of the northwestern portion of NPR-A during the current program. The Lonely station, approximately 80 miles southeast of Barrow, is an important offloading site for airplane fuel and gasoline serving exploratory activities in the eastern portion of NPR-A. The DEW Line site LIZ-3, on Wainwright Inlet, could also be used because it is ice-free for a longer period each summer than either Barrow or Lonely.

Supplies brought to these locations by barge are transported overland by all-terrain vehicles in winter, a maximum of approximately 50 miles. Alternatively, cargo may be airlifted to ice airstrips at inland camps.

Port Development

For many years there has been interest in developing deep draft ports at communities along the Arctic coast. With the continued exploration and development of oil and gas reserves on the North Slope, that interest has increased. A number of problems, however, are inherent in barge traffic and port development on the Arctic coast. These limitations include:

1) Limited ice-free summer season, resulting in inactive use of barges during the iced-in winter season;
2) Shallow coastal waters, requiring lightening of cargo from deeper waters to shore;
3) Absence of port facilities;
4) Lack of good offloading areas and safe anchorages; and
5) Potential adverse environmental impacts of port and causeway construction on fish and marine mammals.

Provision of a deep draft harbor at Barrow or other locations along the coast does not seem feasible, because all protected anchorages are shallow and have poorly defined entrances. It is believed that high investments in dredging operations and creation of a causeway-breakwater cannot obviate the needs for lightering of cargo via medium-draft (20 foot) boats at any prospective port location (Parker, 1972).

HIGHWAY TRANSPORTATION

CURRENT HIGHWAY TRANSPORTATION

The only inter-regional highway in the Arctic is the trans-Alaska pipeline North Slope haul road. This road was constructed parallel to the alignment of the oil pipeline for its construction and maintenance.

The agreement under which the haul road was built required the State of Alaska to obtain the necessary permits from the federal government for construction, and the Alyeska Pipeline Service Company to build the road (to secondary highway standards), and turn it over to the State upon completion of the pipeline.

It was assumed that when the State secured over $27 million of federal funds for project construction and the route was placed on the Federal Aid Highway System, that the road would be opened for public use. However, the current State administration has questioned the wisdom of immediate unrestricted public use of the road as well as the long term public subsidy of a facility used for the benefit of a few (Alaska Consultants, 1976). Consequently, the Governor has instituted a planning study to determine appropriate uses of the haul road.

HIGHWAY TRANSPORTATION ISSUES

The important issues related to future highway transportation in the region include interim use and long term use of the trans-Alaska pipeline haul road. Initial use of the road will probably relate to continued oil and gas industry requirements. In September 1976, the Governor adopted an interim policy for continued use by industrial and mining interests. User fees would be charged for road maintenance. The policy would remain in effect until industrial demands have diminished. Depending on when construction of a gas pipeline is completed, this policy could be continued until the mid-1980's (Alaska Consultants, 1976).

Future oil and gas development within the State's territorial waters is expected to rely much less on air transportation than earlier onshore development. The State Division of Policy and Development Planning predicts that the trans-Alaska pipeline haul road can more efficiently handle transport of bulk materials than air transport (Alaska, Office of the Governor, 1975). Longer lead times associated with Beaufort Sea development will allow for planning of shipments via waterborne or truck-carried cargo.

The potential for public use of the road once the Alyeska Company transfers its ownership and maintenance to the State has yet to be determined. The timing of the State nearshore leasing program, the federal offshore leasing program, and the proposed natural gas pipeline, could place heavy demands on the haul road. In a recent statement, Interior Secretary Andrus expressed his opinion that "it may be desirable to use the road exclusively for construction purposes" if Congress approves a proposed pipeline to bring natural gas from the North Slope to the Lower 48 (Anchorage Daily News, November 3, 1977). If the road were to be opened to public use as well, there could be a shift to greater dependence on waterborne transportation to serve the needs of any or all of these projects.

These issues are being considered in the Governor's study of the haul road. The study program is divided into two phases. The first phase, to be completed in July 1977 by the Alaska Department of Highways, the Joint Federal-State Land Use Planning Commission and the Bureau of Land Management, is focused on a series of questions (Alaska, Office of the Governor, 1977).

1) What land use pattern do you envision developing in Northern Alaska? How do these uses relate to alternative State policies for the haul road?

2) What type of overall transportation network appears best for Northern Alaska? Does the haul road fit into this network?

3) What haul road usage is implied by each of the three proposed gas pipelines? Is general public usage likely to prove incompatible with commercial usage once one of these projects is underway?

4) What problems should the State anticipate if general public usage is allowed? For example, are ATV's (All-terrain vehicles) likely to become a significant problem? If so, how could the State best cope with this potential problem?

Also needed are:

5) Current and projected use of the haul road to support the complete development of the Prudhoe Bay oil field;

6) Cost to operate and maintain the haul road for the above use;

7) State policies on who should pay for maintenance and operation; and

8) Alternative methods or sources of funding number 7.

The Phase II long-term work program is to be completed by January 1, 1978, and will be carried out by the North Slope Borough; State Departments of Community and Regional Affairs, Fish and Game, Natural Resources, Office of the Governor, Division of Policy Development, and the University of Alaska Arctic Environmental Information and Data Center; the Joint Federal-State Land Use Planning Commission, the Bureau of Indian Affairs, Bureau of Mines, Geological Survey, Parks Service, Fish and Wildlife Service, Forest Service, Outer Continental Shelf Office, and other federal agencies. This baseline inventory is one component of that studies program.

Among the other study components to be undertaken by these agencies are a tentative land use plan for the region; possible transportation networks, ports and harbors; and federal, State and Borough policies on mineral development, wildlife, subsistence, new communities, employment, tourism, community facilities, etc. The final recommendation on use of the haul road is to be made in the context of this Arctic Policy framework.

Meanwhile, the Office of the Governor is examining various options for the haul road. As deliberation continues, October 1, 1978 remains the date that the State, under terms of the agreement it makes with the Alyeska Pipeline Service Company, will take possession of the road.

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Barrow Community Study

INTRODUCTION

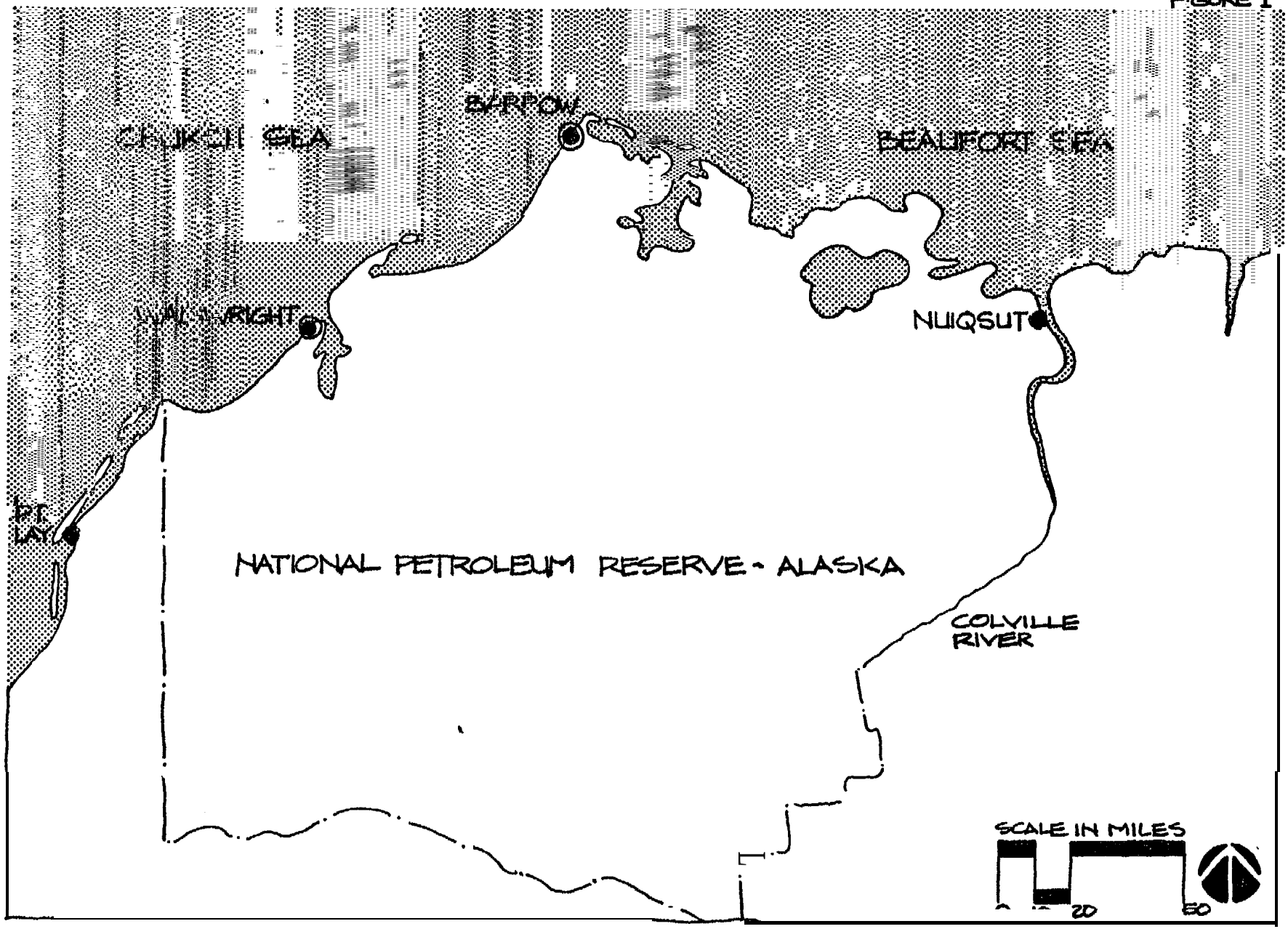
The community of Barrow is the northernmost settlement in the United States. It is located approximately 350 miles north of the Arctic Circle on a point of land which separates the Chukchi Sea on the west from the Beaufort Sea on the east. The community is entirely surrounded by the huge National Petroleum Reserve-Alaska (NPR-A).

Barrow is comprised of two largely separate settlements: the City of Barrow and the Naval Arctic Research Laboratory (NARL), separated by a three-mile long coastal road. Barrow is a native community of approximately 2,300 persons who still rely heavily upon subsistence as well as upon federal and Borough government and Native corporation employment. The NARL camp is comprised of approximately 70 to 90 persons, most of whom are white males who are employed in Arctic research, communications or military defense activities sponsored by the federal government or the University of Alaska. Each community has its own airport, housing and services, although the City is increasingly providing more services for both.

Historic patterns of settlement along the Arctic coast were based upon subsistence harvesting of sea mammals. Small bands of Taremiut, or coastal Eskimo peoples, hunted and fished and traded with the more nomadic Nunamiut, or inland Eskimos, who hunted the caribou. The traditional village of Utkiakuik was located at the present site of Barrow. It was formed by consolidation of several Taremiut settlements scattered along the coast.

In 1826, Captain Frederick W. Beechey, a British explorer, landed at Point Barrow, which he named in honor of his friend, Sir John Barrow. But it was not until 1848, when the first extensive commercial whaling began, that changes began to take place which affected the Taremiut as well as the Nunamiut Eskimos. Taremiut trading of commercial goods with the whalers gradually replaced trading with the inland Nunamiut (Federal Field Committee, October 1968). In consequence, the Nunamiut were forced to move to the coast in search of their central supplies.

FIGURE 1



BARROW COMMUNITY STUDY • LOCATION MAP

The first U.S. government research installation at Barrow was a polar station for meteorological and magnetic research, built in 1881 approximately 1/2 mile northeast of Barrow. Additional federal employment resulted from petroleum exploration in NPR-4 in the early 1940's as well as from construction of a DEW Line station in the early 1950's. The Naval Arctic Research Laboratory was built in 1947 near the site of this first oil exploration base camp. Its airstrip was built along the beach in 1944, and resurfaced with solid steel planking in 1964. The state airport in Barrow was built in the early 1960's.

In 1959 Barrow was incorporated as a fourth class city with a seven-man council. In 1972 the Alaska Legislature made it a second-class city.

The population of Barrow grew from 950 in 1950, to 1300 in 1960, to 2100 in 1970. By 1973 it had grown to 2400 (John Graham & Co., 1973), and by July of 1975 Barrow's population had declined to 2141 (North Slope Borough, 1976). No explanation is given for this decline. A slight rise to 2167 was shown in 1974, with projections to 2330 in fiscal year 1976/77 (Alaska International Academy, 1974).

LAND USE

The community of Barrow is comprised of the city itself and various federal government activities grouped around the Naval Arctic Research Laboratory, located north of the city. The principal land uses in the city consist of two residential areas: Browerville to the north of Isatkoak Lagoon, and the older part of the city to the south of the lagoon (See Figure 1, Barrow Area Land Use). The lower or westward portion of the lagoon is used as a sewage outfall for the Bureau of Indian Affairs (BIA) school located adjacent to the lagoon in the older part of the city. A dam is being built across the upper portion of the lagoon by the Public Health Service (PHS) to contain the city's principal water source.

Within the older part of Barrow are located most of the governmental and commercial facilities in the city. Federal governmental functions include the BIA school, the PHS hospital, the Weather Service, the new Post Office, and the Federal Aviation Administration (FAA) at the State-owned airport. North Slope Borough facilities include the new administration building, the City's electrical generators and electrical distribution system, Inupiat University and a movie theatre. Commercial land use in the older part of the city includes the new Artic Slope Regional Corporation-owned supermarket/ department store and the Top of the World Hotel, Schontz's general merchandise store, a gas station and smaller commercial activities which operate out of individual homes. Block "A" and Block "B" are designated as residential and industrial expansion areas of the city respectively.

South of the airport are located the FAA airport navigational aids site (VORTAC), and RCA Alascom Earth Satellite Communications Station, and the community's second water source, Lake Emaiksoun.

Within the Naval Arctic Research Laboratory (NARL) tract are located the following federal government activities: the Air Force POW Main DEW Line Station, the NASA Weather Rocket Launch Facility, the Coast Guard

communications station at NARL, and FAA antennae complex and the research laboratory itself. The NARL facility is sponsored by the Office of Naval Research (ONR) as a support station for applied scientific research throughout the Arctic. Its activities are-housed in approximately 175 small buildings. It is staffed by personnel of the University of Alaska. This report refers to the laboratory and all the governmental facilities included in the 4,500-acre Navy tract as "NARL".

RESIDENTIAL LAND USE

CURRENT RESIDENTIAL LAND USE -

Residential land use in Barrow consists of the older housing area south of Isatkoak Lagoon; the relatively newer housing of Browerville, north of the Lagoon; and camp housing at NARL. Within the 200 acres of built-up land area in Barrow, including Browerville, residential land use comprises approximately 85 acres, or 42 percent of the land area (see Figure 2, Land Use).

No comprehensive surveys of housing have been undertaken in Barrow since 1974. A new survey would be required to document the current condition of older housing as well as the condition and tenure of newly constructed units. According to the Borough Planning Director, there are approximately 500 dwelling units in Barrow. Recently constructed housing (since 1973) consists of single-family, multi-family and teacher housing. This new housing includes: 54 single-family units; and 40 multi-family units which are arrayed in buildings of 28 units, 12 units (four-plex) and 9 units. The four-plex units are for Barrow teacher housing, ultimately planned for 20 units. The only non-governmental multi-family structures of more than two units in the Borough exist at Barrow.

Most new housing has been constructed in the Browerville area. Of the 58 units occupied by the federal and State personnel (URSA, 1974), most are located here. The lots and houses are larger and more costly than those in the southern part of Barrow. The new housing lots are generally 50 feet wide by 125 feet long (John Graham & Company, May 1973). Most of the newer housing was designed and built outside of the region and shipped by barge to Barrow. Consequently, floor plans favor arrangements of bedrooms (usually two), living, dining and kitchen areas more typically found elsewhere in the country. Because of the larger size and higher purchase price and heating costs of these homes, some remain unoccupied.

Housing Conditions

Housing conditions in Barrow are among the poorest in the region. Although no exhaustive surveys of housing have been undertaken since the Dupere & Associates study in 1974, much of the information for the older housing

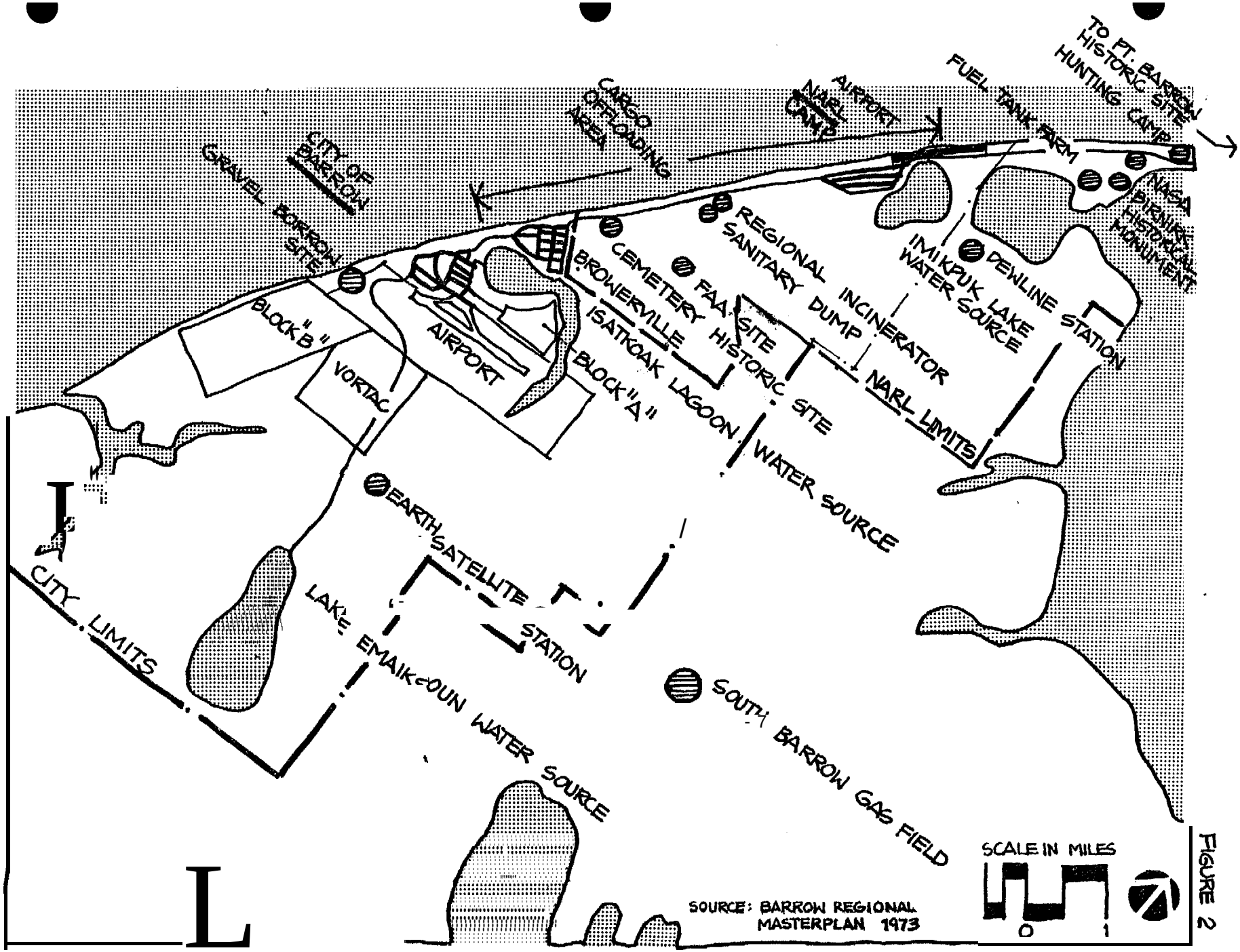


FIGURE 2

BARROW COMMUNITY STUDY. BARROW AREA LAND USE

remains valid. The Dupere study describes severe conditions of housing deterioration, inadequate insulation, together with high costs of heating, maintenance and renovation. The fact that these conditions resulted in a high vacancy rate (16%) at the same time that existing dwellings were severely overcrowded, is testimony to the extreme inadequacy of much of the housing.

A typical house is a single story wood frame structure of one or two rooms. It is constructed either on a gravel pad or upon pilings driven into the permafrost. Differential settlement caused by inadequate foundations can be seen in some cases. The roof framing is usually sheathed with wood planks over which galvanized corrugated metal is laid to provide a slip surface for snow.

The single-family units are built on small lots, often with little space between dwellings or between dwellings and the street. Although construction of a new fire department has alleviated some of the danger, the proximity of houses creates dangerous conditions of fire safety.

A typical dwelling is small, averaging 725 square feet. The construction of newer, larger housing since 1974 would skew this average, but the figure still describes the typical older housing of most of the village. Although the borough average house size is even smaller (630 square feet), the occupancy rate of Barrow housing was 5.64 persons per dwelling unit, the highest in the borough. The most frequent complaint of Barrow residents about their housing in 1974 was overcrowding.

The harsh climate makes habitation difficult and causes rapid deterioration of housing. Dupere reported that Barrow homes were the most poorly insulated in the borough. Twenty-five percent had either no insulation in the ceiling or walls, and 38 percent had none in the floors. The slip surface of the corrugated metal roof eliminates snow build-up, but often contributes to even greater heat loss.

Utilities service to older housing is almost nonexistent. No housing has piped-in water supply. Seventy-nine percent of the units in 1974 had no shower/bathtub, or combination. Even fewer have installed sinks. Although some units have flush toilets, all sewage is collected and disposed of by dumping into "honey buckets", for periodic pick up by tank trucks.

RESIDENTIAL LAND USE ISSUES

A continuing demand for new housing exists in Barrow. The need arises not only from deterioration and overcrowding of the existing housing stock, but from population growth in the community as well. The provision of new housing, perhaps more than any other factor, will determine the basic growth patterns of the community.

Deteriorated Housing, ·

The number of housing units in deteriorated or dilapidated condition has been variously estimated by several agencies and consultants. The 1973 Regional Master Plan reported that 250 dwelling units, or 60 percent of all housing, was in need of major repair; and that at least 30 houses were in need of immediate replacement. Extrapolating upon a 1969 ASHA study, the Master Plan speculated that as many as 80 units could be dilapidated and in need of replacement. By contrast, the 1974/75 to 1979/80 Capital Improvements Plan (CIP) of the Borough proposes the replacement of approximately 20 percent of the non-federal housing (60 units) that do not meet minimum standards.

l-lousing Programs

Programs to replace existing substandard housing are a continuing high priority of the North Slope Borough (NSB). Technical assistance has been provided to families in Barrow to assist therewith loan applications and other negotiations with the Farmers Home Administration, and the Alaska Housing Finance Corporation (an agency of the Alaska State Housing Authority) and private housing contractors. Approximately 20 new FHA and AHFC-financed housing units were prefabricated by CAPP Homes and shipped to Barrow by barge in 1973. An

additional 15 homes were rehabilitated or substantially replaced under the FHA home improvement loan program (William Tegoseak, former Director, Borough Housing Program).

The North Slope Borough has also built housing in Browerville using funds from general obligation bonds. This effort is part of a five-year program of housing construction throughout the Borough. Thirty-four of the planned 36 single-family units, 12 of the 20 planned four-plex housing units, and 9 housing units for the elderly have been built under this funding program.

The Borough's Draft 1977 Capital Improvements Program (CIP), now suspended, called for the construction of an additional two single-family units, two more four-plex teacher housing units, a 29-unit apartment, and another four-plex. When funded, Blackstock Homes will manage the construction of its pre-cut units for all of these projects using Borough crews. In the longer run, the 1974/75 CIP estimated a need to construct 150 units to accommodate the growth of the community. The Plan, recognizing the difficulty in meeting this goal within the six-year period of the CIP, deferred 35 percent, or 53 units, until after FY 1979/80.

An additional housing assistance program of the Arctic Slope Regional Corporation has resulted in a grant of $4.32 million from the Department of Housing and Urban Development. The monies willbe used for the purchase of 72 existing apartments for Native housing in Barrow (Anchorage Times, May 24, 1977).

Utilities Service

There is a reciprocal relationship between the programs for the provision of housing and the programs for the provision of sewer and water facilities. In 1973, for example, the construction of federally assisted new housing in Barrow was contingent upon a State Department of Environmental Conservation-approved water supply and sanitation system. In order to obtain federal funding, the Borough requested implementation by the Indian Health Service (IHS) of the Public Health Service of the City's 1972 Water and Sewer Master Plan.

The response of the IHS, however, was that the City would need to construct or improve 100 homes before such improvements could be justified. The Borough was caught between conflicting requirements of two governmental agencies. The situation was resolved by implementation of an interim water supply, sewage and solid waste hauling service by the City of Barrow. The FHA and the Alaska Housing Finance Corporation in turn financed the new housing; this housing now lends impetus to the completion by IHS of the long range Water and Sewer Master Plan,

Community Growth

According to the Borough Planning Director, the number of new or replaced housing units constructed since 1973 has increased the total housing in Barrow by approximately 20 percent. Virtually all of this housing has been constructed within the existing residential areas of Barrow and Browerville. However, little land remains for new residential development. Approximately two to four acres are available in Browerville, and a few isolated lots are available in the City.

Projected population growth to 5,000 in 1990, under moderate growth assumptions (John Graham & Company, 1973), will create additional demands for housing that cannot be met within the existing built-up areas of the city, without substantial redevelopment at higher densities. Although the Borough has not yet undertaken an update or revision of the Master Plan, the Planning Department presently sees no reason to doubt its growth assumptions and projections.

Other improvement programs forecast similar growth. The Public Health Service Preliminary Design Analysis for Water Supply and Distribution (1974) is based upon a growth factor of 198 percent -- from 2200 persons and 370 homes, to 4350 persons and 750 homes. No timetable is established for reaching this design capacity, but the schedule probably will not keep pace with new housing construction.

The two basic options for expansion of the city's residential areas consist of Block "A" east of Barrow, and land within the NARL tract east of Browerville. Block "A" contains approximately 150 platted lots (H.V. Lounsbury, 1976). This expansion area is fixed in size by the airport along its southern boundary and by Isatkoak Lagoon along its north and east boundaries.

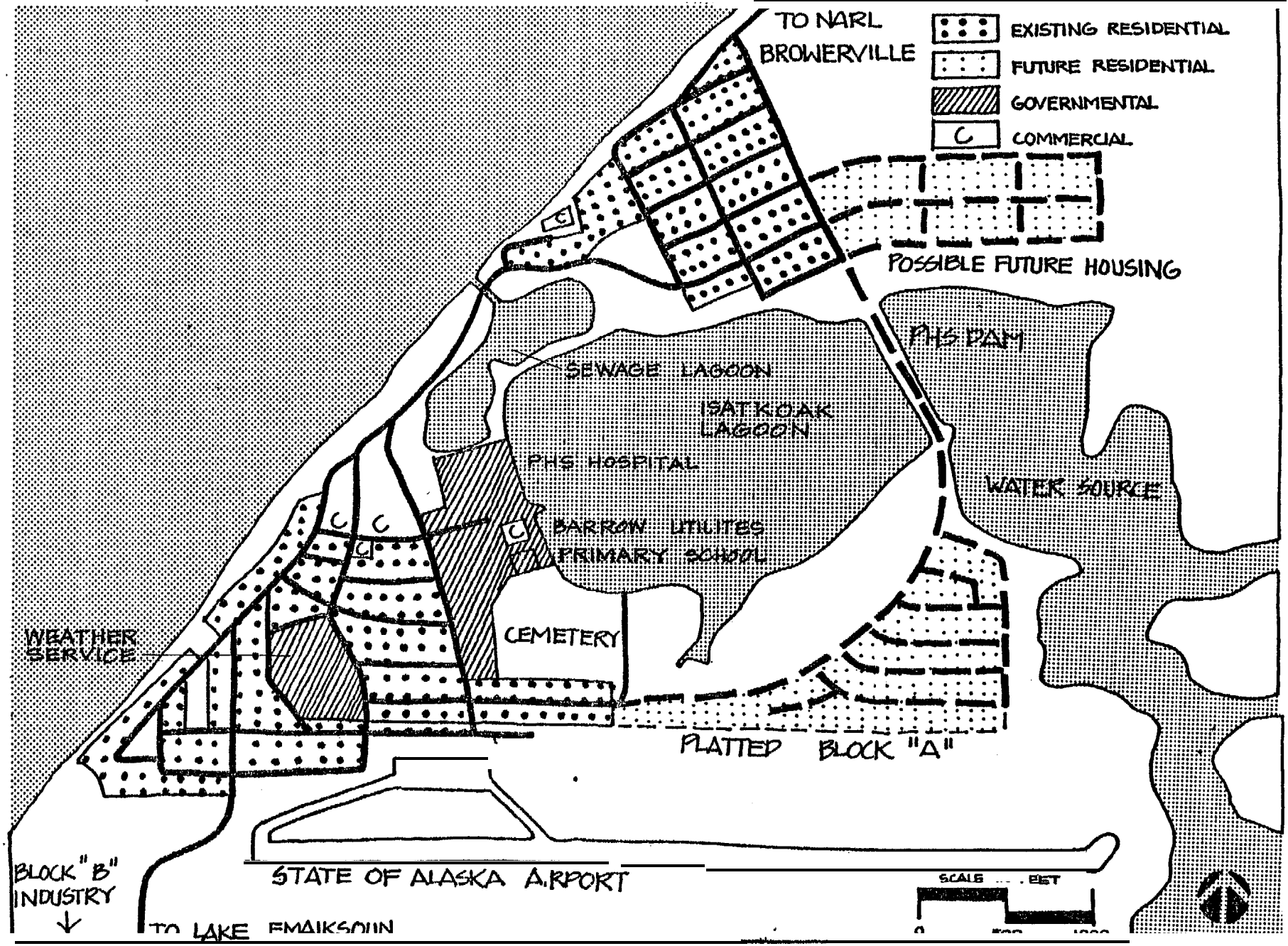
Expansion within the NARL tract east of Browerville would require an agreement with 'the Office of Naval Petroleum and Oil Shale Reserves, which administers the tract. The Borough is presently seeking to lease land along the east side of Ahkovak Road. An easement of 200 to 400 feet in width will be left along the portion of the Isatkoak Lagoon east of the PHS dam, to avoid runoff contamination of the city's water source (See Figure 3. Land Use).

The Barrow Region Master Plan assumes that approximately 750 dwelling units is the single-family dwelling holding capacity of the city with expansion into Block "A" (138 lots} and into the area east of Browerville (170 lots). It should be noted that this figure assumes an even higher occupancy rate (6 persons per dwelling unit) than existed in 1973 (5.64 persons per dwelling units). The severe problems of overcrowding are apparently to be alleviated by construction of larger houses. Such housing, however, may be beyond the financial reach of many of Barrow's residents. Originally, 100 housing units in Block "A" were to be built under federal funding.

A third potential area for housing construction is the 8-acre site in the center of Barrow occupied by the U.S. Weather Service. The Barrow Master Plan recommends that the Weather Service relocate its operations to Block "B", south of the airport, designated by the NSB for industrial development. The feasibility and status of this relocation is unknown.

Implicit in the planning for expansion into these areas has been the assumption that the single-family house will continue to be the dominant form of

FIGURE 2



BARROW COMMUNITY STUDY

LAND USE

housing. The Barrow Master Plan, drafted in 1973, assumes that demands for privacy would inhibit public acceptance of apartment living. A year later in 1974, Dupere & Associates reported that 86 percent of the housing units were owner-occupied; and that fully half of the people renting units were dissatisfied with their housing. Another response indicated that higher housing densities would not be found objectionable. This apparent change in attitude is reflected in recent housing constructed in Barrow.

While the long term population growth assumptions contained in the Barrow Master Plan and the PHS Preliminary Water Supply Plan remain in effect, the form of housing meant to accommodate that growth may be changing significantly. The construction of multi-family units in the past four years is generally keeping pace with single-family construction. It is not known if the new apartments are occupied primarily by new residents, former (dissatisfied) renters 'of existing housing, or former residents of other overcrowded housing.

New patterns of land use may emerge in Barrow as a result of a shift toward higher density housing. Limited land area available for construction, together with the high costs of providing utilities service to new areas, and increased construction and maintenance costs may have an effect on provision of other services as well. Educational, recreational and commercial facilities may have to be built to serve higher concentrations of development than envisioned in the 1973 Master Plan.

RECREATIONAL LAND USE

CURRENT RECREATIONAL LAND USE .

Recreational opportunities are relatively limited in Barrow. Indoor recreation includes two movie theatres (one owned by the Borough and the other by the Arctic Slope Regional Corporation), two poolrooms, City-owned ping pong and pool facilities, the school gymnasium, the Youth Center and the young children's play area in the village corporation-owned supermarket. NARL has a theatre and a small recreational building, but these facilities are limited in size and restricted to use by camp personnel (U.S. Dept. of the Navy, 1977). Tourists can see a collection of stuffed arctic wildlife at the NARL camp, including wolves, polar bears, wolverine, arctic foxes and several types of birds (Stenmark and Schoder, 1974).

The City of Barrow is responsible for recreation programs. Along with public safety it is the only public service not carried out by the North Slope Borough. The City has a 6-7 person recreational advisory committee and has recently hired a recreational director. The City and local service clubs (VFW, Lions' Club, Mothers' Club) fund a program which provides an older building for ping pong and pool (William Tegoseak, City Manager, Barrow).

The BIA school has a gymnasium for basketball and a basketball league. The community also uses the gym for community events and meetings. The City's recreational program has no direct relationship with the school's program. The school also operates a local summer camp.

Outdoor recreation in the vicinity includes hunting and fishing by local residents for subsistence purposes. Because of the rigorous climate, relative inaccessibility and the absence of nearby big game and game fish, there has been little local tourist hunting and fishing. An air taxi service, however, shuttles hunters and fishermen to the major rivers and other hunting areas in the region.

Within the community of Barrow and NARL there are no parks. Young children now play on abandoned trucks, fuel storage tanks and other industrial equipment found throughout the community. The BIA school has some outdoor play equipment.

The most prevalent form of local recreation for teenagers and adults appears to be riding snowmobiles and three-wheeled monocycles, and duck hunting at a summer camp on the Point Barrow spit.

RECREATIONAL LAND USE ISSUES

A pressing need for more recreational facilities exists in Barrow. Indoor facilities and a variety of activities are lacking. The Youth Center is overburdened as a community hall (U.S. Dept. of the Navy, 1977). Outdoor recreation potential is restricted by a lack of available land.

Anticipated development of facilities has been slowed by a 75 percent reduction in City revenues resulting from elimination of a. City sales tax on food. However, funding is expected to increase as a result of the sale of liquor at a recently completed, City-owned liquor store. "

Outdoor Recreation

The City Manager is seeking appropriation of $19,000 for outdoor equipment at a 1.5 acre Browerville park site. The City is also investigating areas in the older part of the city for another park site. Possible activities under consideration are tennis courts convertible to an ice skating rink in winter, and baseball and other field sports. The City is investigating federal funding opportunities for these park facilities.

Potential for other outdoor recreation includes cross country skiing and water sports. The North Slope Borough Department of Public Works has mentioned the possibility of developing Lower Isatkoak Lagoon into a small boat harbor (Harry Stotts, Public Works Di rector, North Slope Borough).

Indoor Recreation

Indoor facilities under consideration by the City include a library, dance hall, new theatre and a community building in conjunction with a community laundry/shower/sauna facility. The 32,000 square-foot supermarket-department store recently opened by the Barrow Ukpeagvik Inupiat Corporation is apparently the first phase of a complex which is planned to include a theatre, bowling alley, laundry, restaurant and new corporate headquarters for the Arctic Slope Regional Corporation.

ARCHAEOLOGIC AND HISTORIC SITES

CURRENT ARCHAEOLOGIC AND HISTORIC SITE STATUS

There are at least seven archaeologic or historic sites in the Barrow vicinity worthy of preservation. Point Barrow, 7.5 miles northeast of Barrow, is the northernmost point of land in the United States. In 1912, the Advisory Board on National Parks, Historic Sites, Buildings and Monuments identified Point Barrow as having significance in commemorating the history of the United States (CCC/HOK and MKGK, 1973). A second site, the Birnirk archaeological site, located on the Point Barrow spit, was listed in the National Register of Historic Places. The site includes a series of mounds which have enabled archaeologists to trace the development of Eskimo culture from approximately 600 A.D. to the present. The nearby Kugusugaruk site was also nominated to the National Register.

Sites recognized by the State of Alaska include the Wiley Post/Will Rogers Monument and the Brewer Cafe in Browerville. The Wiley Post/Will Rogers Monument is located about 10 miles southeast of the village where the two flyers crashed in their small plane in 1935. Because there is no road access, the monument is difficult to visit.

Charles Brewer, a whaler and fur trader from New York, founded Browerville in 1886. A post office was established in 1901. Brewer also founded a cafe that has been cited by the State Historical Commission. It is located near the coast on Brewer Street.

In the older part of Barrow, at least two other sites are worthy of note. The Utkeavgik Presbyterian Church was built in 1898 and is located on Momegana Street near the North Slope Borough office building. It is a clapboard structure in reasonably good repair. The other site is an historic sod house located near the coast on Stevenson Street. The North Slope Borough Council has noted the value of the structure as the only remaining example of what was once the traditional form of dwelling in Barrow.

ARCHAEOLOGIC AND HISTORIC SITE PRESERVATION ISSUES

Programs for preservation and enhancement of these archaeologic and historic sites include provisions of the National Historic Preservation Act, and historic preservation programs of the Borough. Sites listed in the National Register of Historic Places are protected from encroachment by projects financed or licensed by the United States, and in most cases are eligible for 50 percent matching grants under the National Historic Preservation Act. Grants may be used for acquisition, stabilization and/or restoration (Alaska Division of Parks, 1976).

In recent years, interest has been expressed in developing historic attractions in Barrow that are of interest to tourists. One possibility is the establishment of an Eskimo cultural center that would house artifacts uncovered in abandoned villages on the North Slope, as well as other exhibits (John Graham & Company, 1973). It is speculated that the most logical source for funding of this museum would be the National Park Service. The exhibits could follow or expand upon the collection of artifacts included in the small museum located on the NARL base. An upgrading of tourist accommodations would necessarily have to accompany the development of tourist attractions.

LAND STATUS

CURRENT" OWNERSHIP

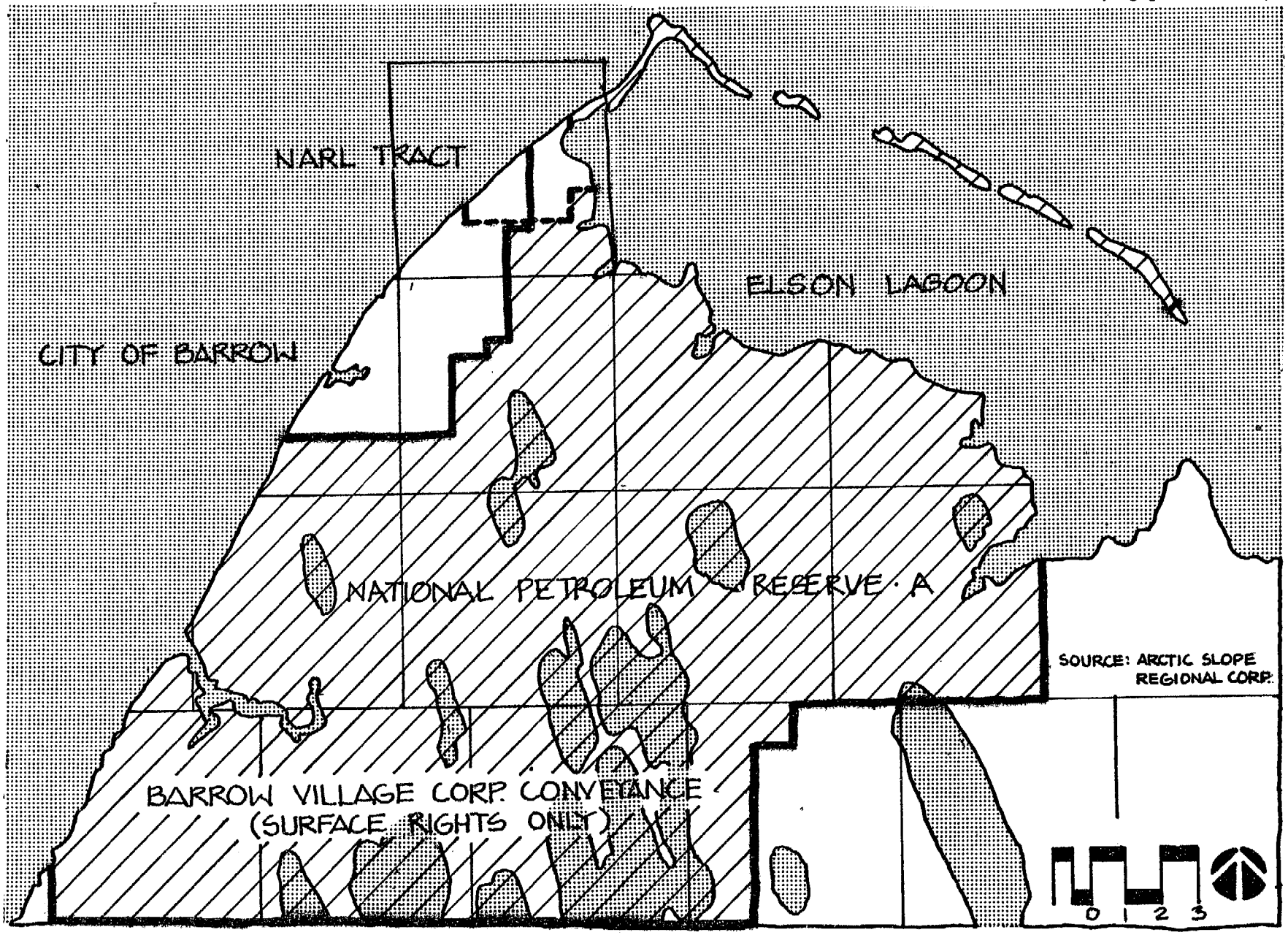
The City of Barrow occupies a land area of approximately 23 square miles along the north coast tip of Point Barrow. With the exception of the State territorial waters to the west, the land around the city is entirely dominated by federal ownership. The massive National Petroleum Reserve-Alaska (NPR-A) surrounds the community to the south and the east; and the Naval Arctic Research Laboratory tract (U.S. Naval Tract No. 1) l i es to the north. The surface rights to an area of approximately 200,000 acres overlying NPR-A around the city are held by the Barrow Native Village Corporation (See Figure 4, Barrow Region Land Status).

The Ukpeagvik Inupiat Corporation, the Barrow village corporation, has received entitlements totalling 201,232 acres. These-entitlements extend three townships, or 18 miles, south of Barrow and approximately four townships, or 24 miles, to the east. The selection also includes Point Barrow and the Barrier Islands of Elson Lagoon. Since all of the village surface lands lie within NPR-A, the Arctic Slope Regional Corporation is selecting an equivalent acreage of "in lieu" subsurface lands outside the Reserve.

Vil age entitlements provided for under the Alaska Native Claims Settlement Act are limited to the surface estate only. The basic purpose of village en t tlements is to protect the lands around villages used for subsistence. The surface rights, however, also entitle the village corporation to sell or lease parcels of land to individuals and organizations as required by the Act.

The following principal activities are located within the U.S. Naval Tract: the 4541-acre Naval Arctic Research Laboratory and its airport; the 268-acre POW Main DEW Line facility (U.S. Air Force Tract "A"); a small National Aeronautics and Space Administration (NASA) weather rocket launch site just south of the Point Barrow spit; and a Coast Guard Communications site south

FIGURE 4



BARROW COMMUNITY STUDY

BARROW REGION LAND STATUS

of South Salt Lagoon (see Figure 5, Barrow Area Land Status). To the east of Barrow is located South Barrow Gas Field Tract No. 2, which is under the control of the Office of Naval Petroleum and Oil Shale Reserves. The field supplies all of the natural gas fuel for the city and operations in the NARL tract.

Within the city, the major blocks of ownership are the State of Alaska Airport, occupying approximately 730 acres of land, and the Federal Aviation Administration Very High Frequency Omnirange and Tactical Air Navigation (VORTAC) facility on a 370-acre tract of land, both south of the developed portion of the city. Most of the remaining land in Barrow is in private ownership. It is estimated that more than 85 percent of the single-family units in the city are owner-occupied (Dupere & Associates, 1974).

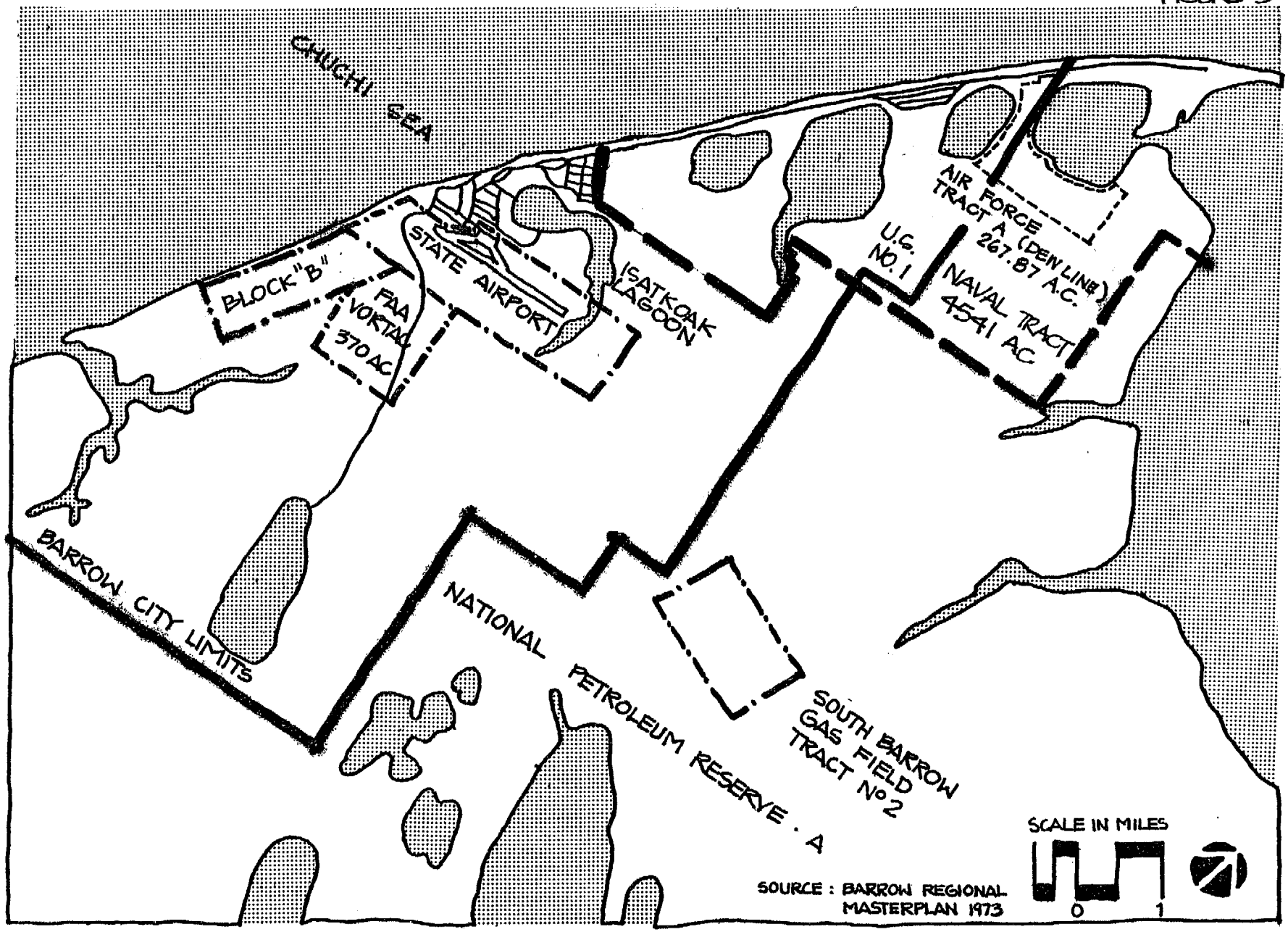
Other smaller blocks of ownership in the city proper are the 8-acre site of the U.S. Weather Service established in the early 1940's; the approximately 10-acre Bureau of Indian Affairs (BIA) elementary school site located adjacent to Isatkoak Lagoon; and the Public Health Service (PHS) hospital, also located adjacent to the lagoon on an approximately 9.5 acre site. The North Slope Borough occupies a new administration building in the city and owns other facilities such as the Polar Bear Theatre and the facilities of Inupiat University.

LAND STATUS ISSUES

Important issues of land status at Barrow include planning for the use of lands conveyed to the Native village under the Alaska Native Claims Settlement Act, and land ownership limitations to community growth.

The Barrow village corporation has undertaken a land use planning program for its lands. Working with the North Slope Borough Planning Department, the ASRC has begun to locate potential sites for extraction of gravel, binder material (clay-like soils which can be used as a base for gravel in the construction of roads) and coal.

FIGURE 5



BARROW COMMUNITY STUDY · BARROW **AREA** LAND STATUS

Land status at the local level is an important determinant of future city growth. The city is bounded on the west by the Chukchi Sea and on the east by Isatkoak Lagoon. Potential expansion to the north and south, however, is blocked by State and federal ownerships. North of the city is the Naval Arctic Research Laboratory. To the south lies the State-owned airport.

Options for city expansion include additional development on Navy land east of Browerville, and on land south of the airport, known as Block "B". The North Slope Borough is seeking a lease of Navy lands for contiguous community residential expansion east of Browerville. Although portions of Block''B" have already been platted by the Bureau of Land Management, any development could require costly connections to existing and future Barrow utilities, as well as other commercial infrastructure. Because of its proximity to the airport, the approximately 35-acre Block "B" has been proposed by the Borough for industrial development.

Continued development on lands within the city will be carried out under governmental sponsorship. Because of the extremely limited incomes of most Barrow residents, land ownership normally does not create the kinds of opportunities for private entrepreneurial development found elsewhere. Commercial development has been and continues to be carried out by government agencies. However, there has been a pronounced shift from exclusively federal government provision of goods and services to land ownership and development by local Borough government and the quasi-public Arctic Slope Regional Corporation. The Borough has built single-family housing and apartments. The ASRC has built the Top of the World Hotel, the Barrow supermarket, a warm-storage facility and a heavy equipment shop and fuel storage facilities in the NARL tract.

UTILITIES

Utilities service in a community like Barrowis critical not only for economic development but also for physical health and survival. Under winter conditions of darkness and severe cold (averaging -18°F. in February, with a wind chill factor of -55°F.), safe and reliable heating and electricity is essential. In a location where limited clean water sources are frozen for at least eight months of the year, methods of water supply, storage and distribution, and disposal of liquid wastes must be developed which guarantee minimum standards of sanitation. Surface drainage must be controlled so that spring thaw does not produce annual flooding of low-lying homes.

Unfortunately, most of the utility systems in Barrow are in need of significant improvements. Water and sewer service is limited to a few governmental and commercial facilities; and extremely costly extension of service to all of the homes in the city is unlikely for a number of years. The gas supply and distribution network for Barrow and NARL is dangerously unsafe and in need of immediate repair. There is no storm sewer system; surface runoff is now dammed by raised roadways, and a plan for providing culverts is proceeding very slowly.

WATER AND SEWER SERVICE

Barrow is the largest community in Alaska without a piped water supply and sewage disposal system. With the exception of a few governmental facilities, all housing, commercial and other government buildings rely upon costly purchase of hauled water or ice and upon inconvenient and often unsanitary disposal of stored wastes.

The provision of city-wide water distribution and sewage disposal systems have long been planned, but delayed because of high costs and federal agency priorities. Such factors as a limited supply of potable water, technical difficulties of piping and storing water in an extremely cold climate, and a limited number of housing units to be served, have historically made unit costs extremely high.

The recent implementation of an interim water supply and sewage disposal system, however, has allowed for the construction of new housing, which in turn has justified federal funding of the first phases of a long range plan. These improvements will eventually create a utilities infrastructure which will allow for other improvements of existing housing and more systematic growth of the community. Without this infrastructure, the community may not be able to support some of the new commercial and industrial development that could diversify its economy and provide additional services.

WATER SERVICE

Existing piped water supply, treatment and storage facilities include the BIA Indian Affairs School plant and the PHS Hospital in Barrow, and the new laboratory at the NARL base.

City of Barrow

The hospital and the 61A complex share a water and sewage treatment and disposal system. The facilities are located at the west end of Isatkoak Lagoon, near the Borough's new gas-powered electric generator. Water is withdrawn from the Lagoon and treated by a reverse osmosis (RO) system

that was meant to replace a more costly distillation system in 1973. Water treatment consists of removal of salt and brine by heating to 70° F. Unfortunately, the RO system is still not working efficiently, because of corrosion damage to water pumps, forcing reliance on the older steam distillation system (Dean Wolf, Barrow Utilities & Electrical Co-op).

In order to facilitate new housing construction, the PHS funded an expansion of the BIA water treatment facility in 1974, to 10,000 gallons per day. Water is delivered to homes by two tank trucks purchased for the City by the PHS. The cost to distill water is estimated at nearly 10¢ per gallon, and to deliver itan additional 5¢ per gallon (ibid.). The BIA treatment facility, a 10,000-gallon water storage tank, and the water distribution service is operated by Barrow Utilities and Electrical Co-op (BUI).

A second source of water for the village is Emaiksoun Lake, approximately three miles south of the city. Residents either haul their own water and ice or purchase hauled water and ice from a private individual. The cost of water is estimated at 6¢ per gallon and 35-40¢ per cubic foot for ice. Ice cut from the lake in winter is stored outside of houses an-d melted as needed, using gas-fired stoves.

Emaiksoun Lake is an unsanitary and unreliable source of potable water. The lake is shallow (54 inches deep) and winter supplies of ice have apparently run out as early as January in some years (U.S. Dept. of the Navy, 1977). When the lake has not completely frozen to the bottom, water beneath the ice has been nearly completely pumped out, leaving only small amounts of brackish and muddy water (Dupere & Associates, 1973). Possible contamination of the lake at the source, and contamination of ice outside of houses, may contribute to the periodic outbreaks of hepatitis in the village.

Purchased or hauled water is stored in enclosed water storage tanks in homes or other buildings. In order to qualify for FHA insured home improvements and new home construction, the City requires that delivery service only be extended to homes with a minimum of 200 gallons storage capacity (City of

Barrow, April 1973). It is not known how many homes in Barrow now qualify for water delivery by BUI.

Water consumption estimates for Barrow and other communities in the region vary greatly. Because of the extremely high cost and inconvenience associated with delivery and storage of water and ice, however, consumption is far below other communities in Alaska with conventional water supply and distribution sys terns. Estimates vary between 5 and 10 gallons per day per person in Barrow (U.S. Fish & Wildlife Service, March 1977).

Naval Arctic Research Laboratory

The primary source of water for NARL is Imikpuk Lake, located just northeast of the main camp. Water is piped to a plant in the center of the camp, where it is treated using a reverse osmosis system installed in 1973. Treated water is then piped to the dining hall and a laboratory.

The Navy plans to utilize Imikpuk Lake as a water source for the foreseeable future (John Graham & Company, 1973). The planned capacity of the RO unit installed in 1973 was 30,000 gallons per day. It was anticipated that a second unit of similar capacity could be installed when needed. Similar to the City's system, however, the RO unit has not performed reliably (Dean Wolfe, Barrow Utilities and Electrical Co-op). The camp's water reservoir capacity is unknown, but it is estimated that per capita water useage is nearly 125 gallons per day (ITT Arctic Services, Inc.).

SEWER SERVICE

With the exception of the BIA plant, the PHS hospital, the Weather Service, and the laboratory building at NARL, all sewage is collected in chemical toilets, "honey buckets" (55-gallon oil drums), or larger containers in major buildings. Some newer facilities, such as the Top of the World Hotel, partially treat their waste and dump it into the sea. The BIA operates a treatment plant, which handles wastes from its facility, and that of the PHS hospital. Primary treated sewage is dumped into a small lagoon at the lower end of Isatkoak Lagoon, with an outfall into the ocean. Residential water

wastes produced by cooking, washing and cleaning are disposed of through dwelling-unit drainage systems, which discharge directly onto the ground outside the dwelling (Department of the Navy, 1977).

At NARL, sewage from the laboratory building is treated and then discharged into Middle Salt Lagoon, which also has an outfall into the ocean (John Graham & Company, 1973). Kitchen water, shower and wash water is dumped directly into the ocean. In late 1973, an incinerator, funded jointly by the Navy, BIA and PHS, was built by the Navy adjacent to South Salt Lagoon. The purpose of this facility was to incinerate all solid waste and human waste generated by NARL and the city.

The incinerator, however, has failed to operate as planned and has been closed down. In addition to technical difficulties in processing the 55-gallon drums containing human wastes, the costs of operation proved exorbitant (Department of the Navy, 1977). Consequently, waste is collected by truck and dumped into plastic bags or barrels, and placed in the community dump adjacent to the incinerator.

In 1973, the Navy was constructing a package sewage treatment plant at NARL. Data on the use, capacity and performance of the sYstem are not available.

As part of the Borough's interim water supply and sewage disposal plant adopted by City ordinance in 1973, all new housing was equipped with chemical toilets with a holding tank of approximately 50 gallons capacity. Toilets were situated in the dwelling in a manner which would permit future gravity drainage a distance of not more than 40 feet to a public right of way. A vacuum haul truck now collects waste from a pipe outside of each house. The proposed ordinance also called for a twice-monthly pickup, for a monthly fee of $10.00. Wastes are then taken by two trucks purchased by the PHS for the City, either to the BIA treatment plant or to the sanitary land fill near the incinerator.

WATER AND SEWER SERVICE ISSUES

Improvements to the water and sewer systems of Barrow remain the highest priority of the North Slope Borough: Studies by the BIA, PHS, the Alaska State Housing Authority, and others, have documented the incidence of infectious diseases associated with unsanitary water supply and sewage disposal in Barrow (John Graham & Company, 1973). Even though systems which seem to offer great improvements, such as the NARL incinerator and the BIA water and sewer treatment plant, have had operational difficulties. The incinerator has been closed down and the BIA water treatment system continues to function inadequately. The BIA plant discharges only primary-treated (chlorinated and aerated) sewage into the lower Lagoon, and the unpleasant odor of this outfall has been noted by Browerville residents on the other side of the lagoon.

History of Planned Improvements

There is a complex history of federal agency involvement in improvements to Barrow's water and sewer systems. Because agency activities had traditionally been carried out independently and with little regard. to long-range plans, an Intergovernmental Coordinating Committee was formed in 1971. Its membership included representatives of the City of Barrow, the ASRC, the BIA, the PHS and the State of Alaska. Its work resulted in the preparation of the Barrow Region Master Plan by John Graham & Company in 1973. Since then, the Borough has actively sought to coordinate the activities of the PHS and the BIA in order to bring about some of the recommendations made in that plan.

Studies undertaken by the PHS resulted in a Water and Sewer Master Plan and Preliminary Engineering Report, whose recommendations were incorporated in the Graham master plan. Some of the elements of the plan are now being implemented, while others have been delayed or thought too costly to be carried out.

The Borough originally anticipated that the PHS would be funding all planned sewer and water improvements, but the Indian Health Service restricted PHS funding only to service to new or improved housing for Native people (North Slope Borough, April 1973). Since the proposed 100-unit federally funded housing project in Block "A" was not built, the water supply and sanitation facilities for this new housing and other older housing in the community could not be built using PHS funds. Consequently, the Borough would have to assume nearly all of the improvement costs in the community.

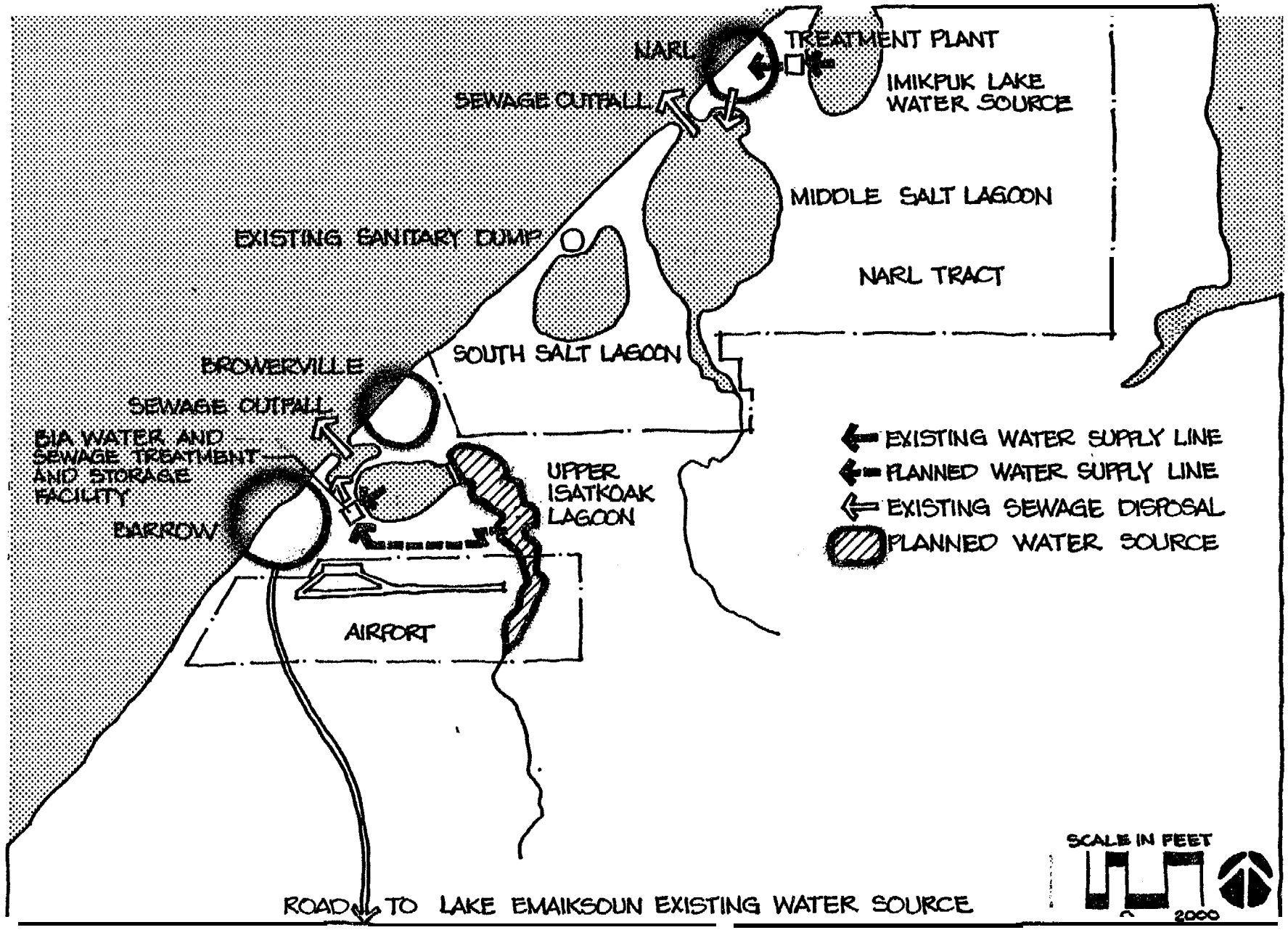
As a result, the Borough implemented the interim water supply, sewage and solid waste disposal plan which is in effect today. The plan provides for the hauling of treated water, and truck disposal of solid and liquid waste. The program is being carried out by Barrow Utilities-under the auspices of the City of Barrow.

The following summarizes key elements of the plan for water and sewer service that will be followed by the PHS during the next few years.

Water Supply

In order to provide a safe, reliable water supply for the city, the PHS is in the process of completing a dam across Isatkoak Lagoon between Barrow and Browerville. The dam will be wide enough (40 feet) to accommodate a road across the top to serve as a bypass to the rapidly eroding coastal road. An above-ground transmission line has been built between the BIA water treatment plant and a planned 20,000-square foot pump house at the upper portion of the lagoon above the dam (See Figure 6, Planned Mater and Sewer Improvements). The PHS estimates that the dam will be completed and water piped to the treatment plant sometime in 1978. An existing 600,000 gallon steel tank adjacent to the BIA complex will be utilized for storage of the treated water.

FIGURE 6



BARROW COMMUNITY STUDY • PLANNED WATER AND SEWER MPROVEMENTS

Water and Sewer Distribution ,

Long range water distribution improvements are planned to serve 750 homes with an average daily consumption rate of 45 gallons per person per day. Assuming a population of 4,350, the maximum daily flow would be 400,000 gallons (Alaska Native Health Service, 1974).

The plan recommends construction of an above-ground utilidor network containing sewer and water pipes. The utilidor system would serve the major potential users in the main part of Barrow (not including Browervil le). An engineering report on the first phase of the system is expected to be completed by the Office of Environmental Health of the PHS by September 1977. Under the original water and sewer master plan, utilidors were aligned along the rear lot lines of houses, but current plans are for alignments along principal streets. The first phase utilidor will run west from the BIA complex along Agvik Street, past the new NSB offices, the ASRC supermarket, Schontz's General Store, and the planned ASRC offices to the Top of the World Hotel. Because PHS funds are limited to community water and sewer needs (housing), the PHS expects that much of the costs of the first phase utilidor will have to be born by the Borough.

Additional linkages to the utilidor system extend south to-the airport on Kiogak and Momegana Streets, and east along Okpik Street towards the future Block "A" housing. Because of priorities within the Indian Health Service, OEH estimates that construction of these utilidors will not take place until the 1980's. Consequently, it can be surmised that the completion of a city-wide water and sewer system serving all homes is unlikely for a number of years.

Sewage treatment alternatives include construction of a mechanical sewage treatment plant near the PHS reverse osmosis water treatment plant, or utilization of South Salt Lagoon, near the Navy incinerator, as a sewage stabilization pond.

The Borough is planning construction of a public laundry and bathing facility for Barrow. Since the economic feasibility of a piped water supply and sewage collection system for the entire community was deemed questionable (North Slope Borough, April 1973), it was suggested that this facility could provide a more realistic solution to a pressing problem (although it was not included as an alternative in the original 1972 PHS Water and Sewer Master Plan).

This position is reflected in the Borough's 1977 Draft Capital Improvements Program which proposes construction of a two phase water and sewer system for all Borough communities. The first phase would consist of developing a water source, providing safe water treatment, a community watering point, central laundry, showers, toilet facilities and a sewage disposal system. Because these are public facility needs, as distinguished from community water and sewer needs, most of the costs would be met by Borough funding. The second phase would provide sewer and water service to individual homes, and would be funded by PHS.

The Borough's CIP has been suspended because of litigation initiated by the oil companies concerning the tax rate. As a consequence, the schedule for construction of the Borough's portion of these sewer and water facilities is in doubt.

GAS AND ELECTRICITY

Barrow and NARL have independent systems of gas and electrical service. The common source of natural gas is the South Barrow Gas Field, located in the National Petroleum Reserve south of the city. Gas is utilized for electrical generation and heating of all buildings. It is distributed through an obsolete network of above-ground pipes. Electrical lines are mounted on a conventional network of power poles.

Gas Source

Originally, Barrow utilized coal as its primary heating fuel. The coal was hauled by caterpillar train from the mine at Ataksook, approximately 60 miles to the south (Dupere and Associates, 1973). Today, Barrow receives its gas from the South Barrow Gas Field, approximately 5 miles south of the city. This Navy-owned field has been in production since 1949, when military installations at Barrow began using natural gas (John Graham & Company, 1973). In 1958, other federal agencies in Barrow, such as the BIA and the PHS, began using gas. Until 1964, the community utilized fuel oil for heating. Only after it ran out of fuel supplies during the winter of 1963 was gas made finally available to the residents of Barrow. The gas distribution lines to individual homes and businesses were built in 1964.

In 1968, the quantity of recoverable gas in this field was estimated at 17.7 billion cubic feet, or a 15-year supply (ibid.). By 1972 an assumed 11.6 billion cubic feet, a supply sufficient for an additional 7 to 8years, was estimated to remain. Before Barrow renegotiated its contract with the Navy in 1974, additional wells were drilled which gave some positive signs of success. A 1976 study by H.J. Gray & Associates indicated that there were 16.1 billion cubic feet of recoverable gas remaining in the field, enough to meet demand requirements (increasing at a rate of 5 percent per year) until 1986 (U.S. Dept. of the Navy, 1977).

Gas pressure in the field began to drop in 1976, and the North Slope Borough pressed for further drilling. In February of 1977 a "significant reserve"

of gas was discovered by Husky Oil. Although the exact size of the discovery has not been confirmed, indications are that there are sufficient quantities to serve Barrow's needs for at least 20years (NSB, February 1977).

The cost of gas for Barrow customers has always been a source of concern. In 1974, commercial rates were $1.25 to $1.65 per 1,000 cubic feet (MCF), and residential rates 50¢ per MCF. Government installations got their gas for free, and consequently there was much waste. In 1976, the NSB negotiated an agreement with the Navy under provisions of the Naval Petroleum Reserve Act of 1976, which reduced the wholesale costs to the Borough's utilities contractor, Barrow Utilities and Electrical Co-op, Inc., to $.32.4/MCF for both residential and commercial customers. At the same time, a rate of $.61 .4/MCF was established for governmental customers (Dean Wolfe, 1977).

Gas Distribution System

Gas from the South Barrow Gas Field is transported to the city in a 6-inch pipe and to NARL in a 4-inch pipe. These lines are laid on wood pilings with expansion loops placed at approximately 340 foot intervals. The lines operate under a pressure of about 250 psi from the collector/reducing station at the field to metering/reducing stations in the city and Browerville. A 4-inch, 80 psi from the BIA utility building crosses the lower sewage lagoon dam to Browerville. The City line is well-engineered and in good condition, while the NARL line is in poor condition (John Graham & Company, 1973).

Within the city, gas is distributed to individual homes and to Browerville through an above-ground network of surplus Navy pipe, installed by the BIA in 1964. The pipes which follow alignments along the rear lot lines of homes are crudely mounted at top of 55-gallon oil drums sawed in half. Where they follow alignments along streets, driveway arches have been installed to permit vehicles to pass under them.

Electrical Generators

Electrical generation and distribution in Barrow was established in 1964 under the operation of Barrow Utilities and Electrical Co-op, Inc.,

financed by the Bureau of Indian Affairs. In 1967, the BIA and the PHS replaced the original diesel generators, with a capacity of 1150 kw, with two gas turbines generating a total of 1500 kw. These facilities were built to meet the needs of the school and the hospital, and any excess capacity was sold to the village.

Increasing load demands, plus the age and condition of the existing power units, resulted in their replacement by the Borough in early 1977. With the construction in 1976 of the NSB administration building, the ASRC supermarket, the Eskimos, Inc. (an ASRC subsidiary) heavy equipment shop in Browerville, and new housing, load on the system increased 24 percent over the previous year. In 1975 the demand was at approximately 1400 kw and the winter of 1976-77 approached 1700 kw (Alaska Construction and Oil, February 1977).

Consequently two new generators with a total capacity of 2710 kw were installed by the Borough. With an estimated 10 percent increase in demand per year (ib. d.), excess capacity would appear to last for approximately five years. These gas generators have a dual-fuel system, which permits switch-over to liquid fuel operation under load condition. The 1500 kw units will be retained as a back-up supply.

The City's electrical distribution system was installed by the Golden Valley REA Cooperative and is considered to be in relatively good condition (U.S. Dept. of the Navy, 1977). It serves all existing housing in Barrow, including Browerville.

The Naval Arctic Research Laboratory has a plant which was instal led in 1972 and consists of four gas turbine-units generating 3000 kw. The plant replaced four badly deteriorated diesel generators that had been converted to natural gas use. These four generators had a capacity of 1400 kw, but were so unreliable they had to be supplemented with a 750 kw generator, which is now used for standby.

GAS AND ELECTRICAL SERVICE ISSUES

Safety of operation is the primary issue related to Barrow's gas and electrical systems. This section discusses improvements to these systems, including gas and electrical inter-ties between Barrow and NARL and replacement of Barrow's gas distribution pipeline network.

In order to minimize Barrow's present dependence upon its gas source and its gas distribution system, the Alaska Power Administration has commissioned an "Alternative Fuel Study for Barrow", by R.W. Beck, Denver, due for completion late July 1977 (Dean Wolfe, Barrow Utilities).

Gas and Electrical Interties

Because each of the gas supply and electrical generation and distribution systems of NARL and the city have been developed independently, neither system can provide back-up to the other in the event of an emergency. If there were a break in the trunk gas line serving Barrow or NARL, electrical generators would have to rely on limited supplies of diesel fuel until the line could be repaired. If one electrical generator failed, as it did in a 1973 storm, standby generating equipment can be used, although these older generators have limited capacity.

The most serious deprivation would occur if a gas outage were to restrict the fuel supply to homes and commercial facilities. Although government facilities maintain limited supplies of diesel fuel for their restricted use in case of an emergency, homes have no such supplies. If a gas transmission line were to fail in the middle of winter, there would be no fuel for home heating, cooking, or even melting ice for water. The situation poses a serious threat to the physical well-being of both Barrow and NARL residents.

In its Draft 1977 Capital Improvements Program, the Borough has included both a gas and electrical intertie between the city and NARL. The Borough anticipates that funding for the estimated $625,000 gas intertie and the

$375,000 electrical intertie would be shared among the Borough, Barrow Utilities and Electrical Co-op, Inc., and the U.S. Navy. These costs were originally identified in the 1973 Master Plan; undoubtedly they have escalated since that time.

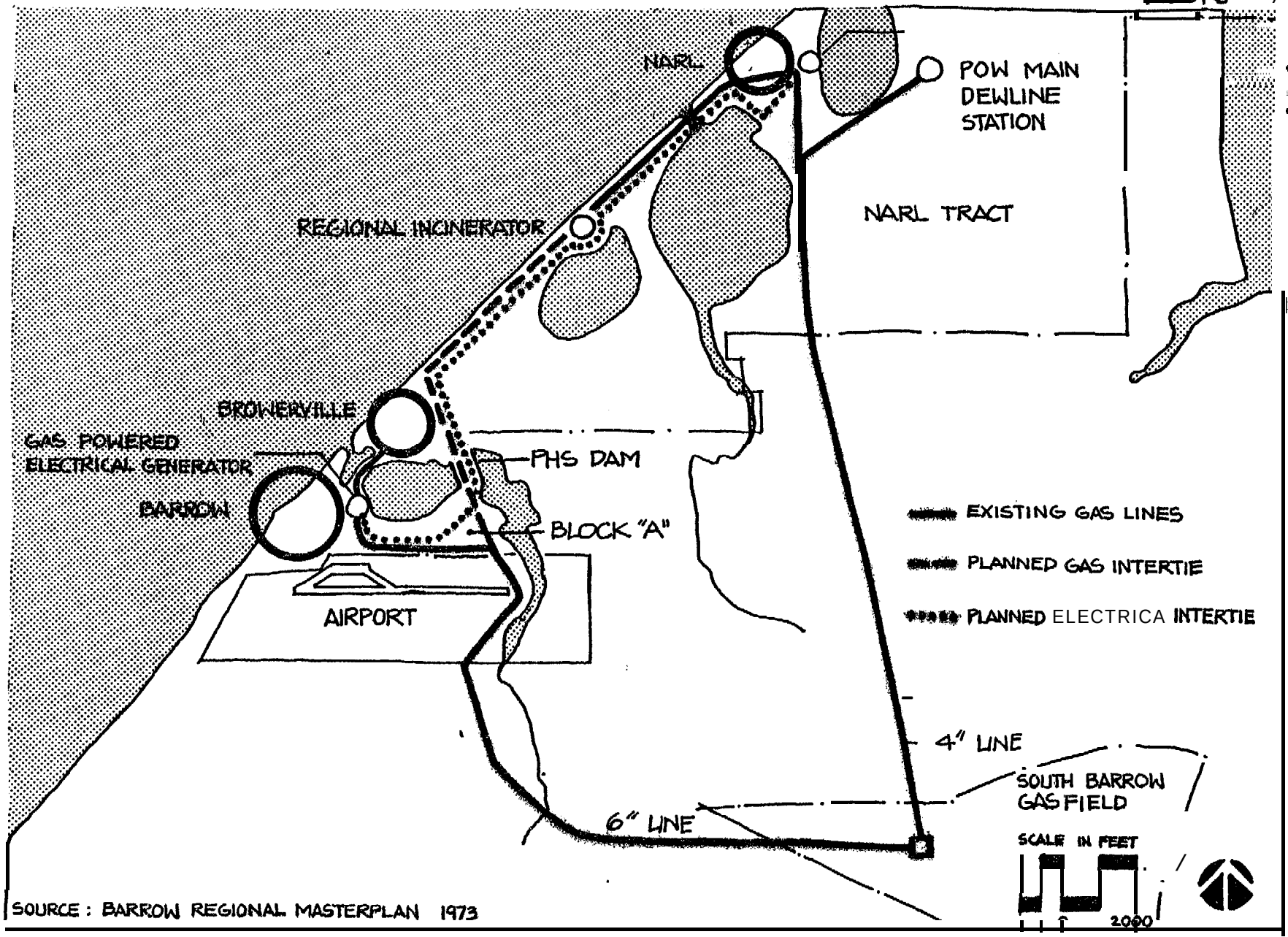
The recommended alignments are shown on Figure 7, Planned Gas and Electric Interties. The two-mile-long gas intertie would extend from the regional incinerator building, southwest along the Beach Road along the easterly boundary of Browerville, across Isatkoak Lagoon, to the 6-inch line at the easterly limit of Block "A". The new 6-inch welded steel pipe would be elevated to 4 feet along the Beach Road and not less that 8 feet in the vicinity of Browerville and Block "A" , with additional height for street crossings. A pressure-reducing valve and meter could be added in Browerville to serve that area and to provide a second point of supply to Barrow across the lower sewage lagoon dam.

The planned 15 kv electrical intertie would be mounted on conventional 45-foot power poles spaced at approximately 130 feet. Two transformer banks and switching systems would be built in enclosed metal buildings of approximately 20 feet by 30 feet for ease of maintenance and operation during adverse weather conditions. The 3-3/4-mile long recommended alignment extends south from the NARL power plant to Imikpuk Lake along the Beach Road (parallel to the existing 2400 v feeder) to the incinerator, to Browerville and thence south across the new dam to the BIA power plant.

Gas Distribution System Improvements

The gas distribution system installed by the BIA in Barrow in 1964 was originally planned as a temporary measure. The surplus Navy pipes were to be replaced in six months (U.S. Dept. of the Navy, 1977). Although the system still operates, it poses a continuous danger to the people of Barrow. The pipes are linked with clamped joints (instead of welded joints), which leak.

FIGURE 7



BARROW COMMUNITY STUDY. PLANNED GAS AND ELECTRICAL INTERTIES

Because most of the network in residential areas is mounted on sections of salvaged oil drums approximately 18 inches above the ground, it is exposed to snow machine collisions. The prevalence of bent pipes between houses is evidence of the frequency of these accidents. No back-up system exists for use while a faulty section is being repaired. When the pipes are broken, there is risk of explosion and fire. If an explosion were to occur between closely spaced homes, or near the PHS Hospital, for example, there could be a disaster (Dean Wolfe, Barrow Utilities).

The U.S. Army Corps of Engineers has designed a gas pipeline system for the BIA to replace the existing network. The planned project would replace all the 20 psi piping and existing pressure regulators at each building (BIA, Planning Support Group, August 1976). All pipe would be elevated on steel pipe supports, backfilled and frozen into place. Old joints would be welded using weld fittings and pipes would be sized to handle future load requirements. Alignments along property lines would be followed to permit orderly development and inspection.

The $6.4 million project is estimated to require 18 months to complete and would begin in the fall of 1977, according to Eben Hopson, Mayor of the North Slope Borough. Funding would come entirely from BIA and would utilize Barrow labor to complete the project. In order to obtain the necessary federal funding, a tri-party agreement was made between BIA, NSB and Barrow Utilities and Electrical Co-op (BUI) in September 1975. In principle, this agreement provided for:

- Forgiveness by the BIA of a $750,000 loan of indebtedness of Barrow Utilities, Inc., so that BUI could obtain the necessary new funding for expansion of service and-system maintenance once the gas pipeline improvements are made;
- Transferof distribution system owned by BUI to BIA (carried out in 1976);
- BIA upgrading of the entire gas distribution system to meet federal pipeline standards; and

- Transfer of the system to the NSB, which would contract with BUI for its operations and maintenance.

The NSB is also planning for new gas and electrical distribution in Block "A" and renovation of existing power lines in Barrow. The Draft 1977 Capital Improvements Program allocates $330,000 for gas distribution and $200,000 for electrical distribution to 163 lots in Block "A". Approximately 100 power poles have been shipped to Barrow for this project. Although no contracts have been negotiated pending resolution of litigation which suspended the CIP, the Borough rates both of these as high priority projects.

STORM DRAINAGE

EXISTING STORM DRAINAGE

Some residential areas of the city are susceptible to storm water drainage during spring thaw. These are older homes which were constructed close to the ground, with inadequate foundations, contributing to dampness and structural deterioration (John Graham & Company, 1973). Most of the newer homes have been constructed on pilings, and much of the commercial area is built on a continuous gravel pad which has covered over ponds and potholes.

Spring runoff is rarely great because snow accumulation does not exceed 30 i riches. However, a combination of impervious ground conditions and raised road barriers that block surface flow can create standing water and ponds" that can remain throughout the year. Because of the erosion susceptibility or surface soils, there has been reluctance to excavate drainage ditches or trenches for underground storm drainage pipes. Roads constructed on continuous gravel pads create dams that inhibit surface drainage. Some runoff is diverted into culverts and directed towards natural drainage channels, but additional cross-drains are needed.

STORM DRAINAGE ISSUES

The 1973 Barrow Regional Master Plan discussed the options for alleviating storm drainage problems in the city. An underground storm drainage system was ruled out because of the potential construction problems with permafrost, extensive ice lenses of 2 to 3 feet in thickness, and the need for insulated pipes. The plan recommended filling in all residential areas with gravel to a depth of 2 feet, and raising some residential streets an additional foot to divert water to natural channels. A few existing houses would have to be raised as the fill material is brought in.

In 1976 an alternative plan was prepared by H.V. Lounsbury Associates, Engineers, which provided for a total of approximately 20 culverts to be built and ten to be replaced in the older part of Barrow, approximately 10 culverts to be built and ten to be replaced in Browerville (where most

newer housing has been built), and 8 new culverts in Block "A" (where no housing yet exists). The Barrow and Browerville system drains into the sea and Block "A" drains into Isaktoak Lagoon. Thus far, the Borough's public works department is repairing streets and adding culverts on an as-needed basis, with no particular reference to the plan.

TELEPHONE SERVICE

Activities in the Arctic can be severely hampered by marginal or limited communications. Telephone communications can provide an emergency link to outside specialized medical facilities, can be used to order essential community supplies, and can provide for cultural interchange between isolated communities in the region.

In February 1977, Barrow's telephone communications were significantly improved by operation of an earth satellite communications station. This station replaced the poor quality General Telephone system installed twelve years ago. Some of the equipment was thirty years old. Electronic switching was installed in the school and government offices, and the number of long distance lines was increased from eight to twenty.

Today there are approximately 850 telephones in the city, or double the number of just three years ago. Demand for phones averages approximately three a day. There is a hookup fee of $30 and a rate of $16 per month for residences, and a hookup fee of $50 and a monthly rate of $21 for businesses.

Next year, the local telephone company expects to provide electronic switching apparatus for all telephone service in the city. Cable buried beneath the streets will be able to serve an ultimate capacity of 1,300 phones.

The earth satellite station has a capacity for additional functions such as real time radio and television news broadcasts, broadcasts of the affairs of the borough government to North Slope communities, and educational broadcasting. Once the $25,000 stations are provided to each of the eight borough communities, the North Slope Borough will have the capacity for providing such communications services.

TRANSPORTATION

The only passenger transportation available between Barrow and other communities is by airplane. All cargo is delivered by barge or supply ship in summer, or by large cargo planes year round. There are two airports in the community, but no marine facility for off-loading cargo.

Overland transportation is largely restricted to snowmobile transport to hunting and fishing camps in the area. Some specialized use is made of tractors and all-terrain vehicles to transport supplies overland to petroleum exploration base camps in National Petroleum Reserve-Alaska (NPR-A).

None of the roads in the community is paved. Their condition varies between wide, well-maintained gravel surfaces, to narrow, soft or badly eroding roads. Sidewalks are non-existent and pedestrian safety is jeopardized by reckless snowmachine driving.

AIR TRANSPORTATION

The City of Barrow is served by commercial air transportation to the State-owned airport south of the village; and by military aircraft to the Navy-owned airstrip at the NARL base.

Operations

Wien Air Alaska has regularly scheduled service to the Wiley Post/Will Rogers Memorial Airport at Barrow. As of this writing, however, Wien pilots are on strike, and the community must depend upon more costly air transportation via smaller carriers. Wien's normal service is daily during winter and twice daily during summer via scheduled Boeing 737 jets from Fairbanks. Other scheduled service is two or three times a week via nine-seat Frontier Flying Service aircraft, and Great Northern Airlines, Inc., jet from Fairbanks. One-way passenger fares from Fairbanks to Barrow via Wien are $77.24, and via Frontier Flying Service are $123.26.

Inter-regional air transportation has increased significantly both before and after discovery of oil on the North Slope in 1968. Between 1966 and 1970, the total number of revenue passengers boarding scheduled and unscheduled aircraft at Barrow nearly doubled, from 4682 passengers in 1966, to 9119 in 1970. In 1975 the number of enplaned passengers rose to 12,000 (FAA, 1976). The current and anticipated aeronautical activity at Barrow is indicated on Table 1.

The airport also receives unscheduled cargo planes such as C-130 Hercules aircraft carrying goods for the community as well as for certain operations of NARL. Navigational aids allow for 24-hour per day, all-weather landings throughout the year.

Cargo is moved via U.S. Postal Service parcel post and air-freighted by private air carriers. The two principal inter-regional mail carriers are Wien Air Alaska and Alaska Airlines. Although airmail costs are considerably lower than air freight costs, airmail is restricted to relatively small ,

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TABLE 1

AERONAUTICAL ACTIVITY

Type of Activity	Actual FY 1975	1978	FY 1979	1987
Total Operations (000)	8	67	70	115
Total Itinerant (000}	7	8	9	15
Air Carrier	2	2	2	3
General Aviation	3	4	5	6
Air Taxi	2	2	2	6
Instrument Approaches	124	145	209	345
Enplaned passengers (000)				
Air Carrier	12	14	15	24
Air Taxi	0	5	5	" 17
Based Aircraft	4	5	6	8

Source: U.S. Department of Transportation, Federal Aviation Administration. Alaskan Region Ten Year Plan 1978-1987. Anchorage, 1976: 1 v. (various pagings)

light cargo. Air freight and Hercules-type aircraft handle nearly all of the total tonnage delivered to North Slope communities. Air freight is handled by major airlines as well as air taxi companies (as opposed to schedule or contract carriers), using large commercial jets to ship specialized cargo. For example, the North Slope Borough chartered the Air Force's largest propeller-driven aircraft, a C-133B, to transport its new 24 foot long by 7 foot wide, 20-ton electrical generator to Barrow in November 1976.

The Wiley Post/Will Rogers Memorial Airport is also used as a transfer point for scheduled aircraft originating at Wainwright and charter operations to other communities or hunting and fishing areas. British Petroleum has a daily round trip Twin Otter flight to Prudhoe Bay for commuting employees.

Most NARL operations are via contract and charter aircraft. Generally, the Hercules aircraft is utilized for support of oil exploration efforts for drill rig moves, cement and fuel hauling and transportation of outsized cargo. The Lockheed Electra is used for general cargo resupply and passenger movement. Helicopters are used for oil exploration survey, scouting and cleanup operations (U.S. Dept. of the Navy, 1977). It is anticipated that both the State airport and the NARL strip will be used in support of the current exploration program.

Airport Facilities

The Wiley Post/Will Rogers Airport was planned and built in the early 1960's. It is located on a 732-acre parcel of State-owned land adjacent to the older, southern portion of Barrow. Its location was determined by an existing underlying gravel bar. The runway has a 9 inch asphalt-type surface which is 6500 feet long and 150 feet wide, aligned perfectly with the easterly prevailing winds. It has a paved taxiway and apron.

Navigational aids include the recently-installed FAA Very High Frequency Omnirange and Tactical Air Navigation (VORTAC) facility south of the airport,

radio communications facilities, FAA UHF, VHF directional finder, and visual landing aids (lights). Other approach aids include high intensity runway and medium intensity taxiway lighting.

Facilities at the airport include limited fueling tanks (particularly as contrasted to NARL), the FAA Flight Service Station, and air charter service hangar (air taxi-guided hunts and scenic tours), offices of the State Division of Aviation, and a new Wien terminal, which is under construction.

The 5000-foot airstrip at the NARL base was built in 1946 adjacent to the beach along a northeast-southwest alignment. In 1963 approximately 70 percent of the strip was destroyed during a storm. In 1964 steel planking was laid in the center 50 feet of the 150 foot wide surface. Although the steel deck is painted with an anti-skid paint, it is extremely slippery when wet (H.V. Lounsbury & Associates, Airport Facilities Study, n.d.)

Facilities at NARL include a terminal building, storage warehouses and two hangars, one built in 1970. Extensive fueling facilities consist of five tanks totalling 2,385,000 gallons for gasoline and JP-5 jet fuel. The runway and taxiway are illuminated with high intensity lighting. Navigational aids consist of two rotating homing beacons, ground to air-radio communication and wind-measuring equipment.

In addition to the air strip at NARL, a float plane air strip is operated in the summer on Middle Salt Lagoon, south of the camp. In winter, planes fitted with skis are used on two ice strips in Imikpuk Lake, just north of the camp. These small operations are essential to reach outlying research sites. Facilities at the summer strip consist of fuel tanks and a vehicular approach. Aircraft landing on the ice use the same fueling facilities as the wheeled aircraft (John Graham& Company, 1973).

AIR TRANSPORTATION ISSUES

Safety, economy of operation, and airport or industrial facilities expansion capability are some of the important issues of air transportation in Barrow. The NARL airstrip is maintained to serve the needs of Arctic research, the DEW Line station, and oil exploration in NPR-A. The better-equipped State airport at Barrow also meets NARL needs as well as its own. The need for two' airports in a community of less than 3,000 people, however, is open to question.

The NARL airstrip is poorly oriented to the prevailing easterly winds. The three *rows* of quonset-type buildings of the research camps are located on the east side of the last 3000 feet of the runway approach pattern. Normal landings from the southwest subject the camp to potential danger if cross-winds are strong.

The 1973 Barrow Master Plan suggested that consideration be given to consolidation of the Navy operation at the Barrow airport. Not only is the Barrow airport equipped with navigational aids for all-weather operation, but its orientation to prevailing winds is much safer than at NARL. Further, the Barrow strip is protected from the effects of storm surges which could again destroy the NARL airstrip.

The greatest limitation of this consolidation would appear to be the apparent loss of the six fuel storage tanks at the NARL base. Since the Barrow airport is unequipped with fuel tanks, new ones would have to be built near the coast to receive fuels pumped from fuel barges, but close enough to the apron to allow for pumping from the tanks into aircraft.

Both the State and the Borough can respond to expansion requirements at the Barrow airport. The State Division of Aviation's position in responding to industrial activity such as construction of storage tanks, or supporting Outer Continental Shelf oil exploration or development, would be if consistent with State policy, to make undeveloped land surrounding the airport available for lease. Improvements by the federal government or private industry would

include expansion of existing apron and servicing areas. The division would try to restrict the warehousing activities to privately owned land near the airport (Harry Shawbach, State Div.-of Aviation).

The Borough has land south of the airport which has been designated for future industrial or warehouse development. This parcel of land is identified as Block "B". It is approximately 3/4 mile wide and extends south of the airport along the coast approximately 1-1/2 miles. Portions of Block "B" have been platted by BLM.

Expansion capability of the NARL base has not been analyzed, but informal assessment indicates that space exists along the coastline within the 4500 acre research tract, but not contiguous to the NARL camp. The presence of two lakes -- Imikpuk to the north and Middle Salt Lagoon to the south -- restricts the linear expansion of the camp.

MARINE TRANSPORTATION

CURRENT MARINE TRANSPORTATION

Marine transportation to Barrow consists of annual deliveries of community goods via cargo ship and supplies to NARL (in support of its Arctic research operations and NPR-A petroleum exploration operations) via barge. Because of shallow waters off Barrow (only approximately 6 feet deep to 1000 feet offshore), it is necessary to lighter all goods except petroleum products that come ashore through hoses. The BIA cargo ship Northstar III anchors one to two miles off of Barrow and lighters cargo using four LCM landing craft kept abord the ship. Under ice conditions, goods have been transported by helicopter to shore.

The Northstar III delivers supplies to the Barrow Hospital and the village once a year, in early September. The Northstar is based in Seattle, the major gathering point for freight moving to northwest Alaska and the North Slope. Tonnage delivered via the Northstar III has varied each year in response to needs (see Table 2).

Since the transfer of the BIA schools to the Borough in 1975, the Northstar has carried less cargo for the BIA and more for the Borough and others, such as the City, PHS, store owners and private individuals. The ship has the capacity to carry 8,000 to 12,000 gallons of fuel oil and refrigeration to carry frozen food. Also shipped are snowmobiles, lumber for houses (but no prefabricated units) and other construction materials. Last year 7,000 sacks of cement were shipped to the PHS Hospital in Barrow (David Jallie, Bureau of Indian Affairs).

The total amount of cargo carried during the last few years had fallen off, due to the fact that aircraft were carrying more perishable foods and the BIA's requirements were not as extensive. The cargo shipped is once again increasing, however, as more construction and development is taking place. A total of 5,594 tons of cargo were shipped by the cargo ships and all other barges to Barrow in 1975, including 358 tons of goods to the PHS Hospital,

TABLE 2

CARGO DELIVERED TO BARROW VIA NORTHSTAR III

Year	Voyage	Tonnage
1975-1977		800-1500
1974	103	561
1973	101	2431
1972	99	1020
1971	97	773
1970	95	1257
1968	91	1767
1967	89	1920

Source: David Jallie, Bureau of Indian Affairs, Seattle Liason Office.

3779 tons to NARL in support of PET-4 operations, and 1857 tons forNARL activities (U.S. Navy/Air Force Estimates, 1975). This does not include additional cargos such as the new Barrow power utility poles and prefabricated houses, which have been sent by special barges. The total annual tonnage remained at approximately 6,000 tons between 1967 and 1975.

MARINE TRANSPORTATION ISSUES

Continued oil exploration in NPR-A will require approximately 20,000 tons of cargo to be shipped to Barrow each year until 1982 -- during which time the Navy plans to drill 19 more exploratory wells (Stefano-Mesplay and Associates, Inc., August 1975) . Fuel will constitute a significant portion of this cargo requirement. Each of the 19 wells will require 500,000 to 600,000 gallons of fuel (for a medium-depth well) for site preparation, drilling, abandonment and camp use. Based upon storage tank capacity of Barrow and the other supply base at the Lonely DEW Line station, it is estimated that Barrow will supply approximately 35 percent of the fueling requirements for the planned exploration program.

In order to capitalize upon future exploration and development of oil and gas and other natural resources, the North Slope Borough proposed the funding of a Barrow port facility in its 1974/75 to 1979/80 Capital' Improvements Program (Alaska International Academy, 1974). The site to be investigated is on the western, or Chukchi Sea, side of the tip of Point Barrow. According to the proposal, the effects of ice scour result in a channel approximately 32 feet in depth almost at the shoreline. Sheet piling-would be driven around an area to be excavated of approximately 300 feet by 500 feet.

The completed dredged harbor would apparently be protected from the pressures of pack ice by the sheet piling. It would serve the port requirements of the City of Barrow, NARL operations and NPR-A oil exploration. By eliminating cargo lightening, it is hoped that such a port could reduce freight rates.

Federal and State funding was identified for the estimated $10 million project. The source of federal monies was identified as the Army Corps of Engineers Civil Works Program. As of 1974, legislation was pending in the Alaska State Legislature for the State's portion ($2.5 million).

Recent studies (Parker, 1972; and Stefano-Mesplay, 1975) however, have concluded that the construction of a marine facility at Barrow is not feasible because of a lack of protection from sea ice and storms. Compared to other potential port sites along the Arctic coast, the sand spit north of Barrow has some good advantages: proximity to deep water, good gravel base, and proximity to Barrow. However, its low level terrain has a history of being inundated by high seas and ice storms.

In the absence of a suitable port development site in the area and region, the Stefano-Mesplay report recommends certain North Slope Borough improvements to existing operations, including:

- Acquisition of modern lightening shuttle craft;
- Development of oil and gas staging areas;
- Development of offloading ramps and paths;
- Construction of warehouses, institution of harbormaster control of operations; and
- Investigation of new techniques of barge-to-shore offloading.

ROAD TRANSPORTATION

CURRENT ROAD TRANSPORTATION

Barrow has approximately fifteen miles of gravel surfaced roads. The most important linkages include a four-mile road between Browerville and the NARL site, and a three-mile road to Lake Emaiksoun, the village's principal water source. The existing system and its planned improvements are shown on Figure 3 .

Roads in the city are constructed of gravel directly on top of the tundra to a depth of about three to five feet. New roads planned for construction in Block "A" are five feet thick and only twelve feet wide, while other arterials are planned for 18 feet in width. Gravel cost is estimated at $10 per cubic yard.

Normally, a binder material such as clay fines is placed in the upper 18 inches of the beach gravel fill to create a solid base th t does not slump or erode. During summer months the primary roads are oiled to reduce dust.

Road conditions vary according to the time of year, frequency of use and maintenance, and localized conditions of erosion near the beach. Spring thaw undermines roadways, particularly in sections where little or no binder materials have been used for the sub-base. In these cases, gravel varies in thickness and softness and becomes highly unstable, particularly for two- and three-wheeled motorcycles.

Because there is no storm drainage system in the city, runoff is damned by the raised roadways, until breached by floodwaters. Occasionally, sections of the road near the coast are washed out and made temporarily impassable. This causes considerable inconvenience and requires extensive reconstruction.

Maintenance of roads *in* Barrow is costly and frequent. All streets and roads in the city were constructed and maintained by the Bureau of Indian Affairs (BIA) until 1974, when the Borough received transfer of equipment, and assumed

responsibility for maintenance. Some capital improvements funds have been used to maintain BIA road equipment. NSB maintenance includes the three-mile road to the water source. The. road from Browerville to NARL is maintained by the Navy.

The Borough's Capital Improvements Program (CIP) for FY 1974 through FY 1980 authorized funding for road improvements and drainage construction ($303,000) and street lights ($2 million). The Draft 1977 Capital Improvements Program showed an expenditure of $348,000 by January 31, 1977, of a total of $588,000 for construction of a storm drainage culvert system and provision of additional gravel on the roads and streets of Barrow. Costs for new roads planned in Block "A" and improvements to three other streets (Stevenson, Montegana, and 10-Plex) total $943,000. The CIP has been suspended, however, because of oil company-initialed litigation against the North Slope Borough over its tax rate.

Road Use

Roads in Barrow are used by an estimated 200 automobiles and trucks, additional three-wheeled and conventional motorcycles, and numerous snow machines. Narrow roads, made more restricted by snow accumulation, create dangerous conditions for pedestrians. This condition is exacerbated by reckless and apparently random driving of snow machines both off and on the roads.

The snow machine is the most frequent form of vehicular transportation in Barrow. Individual homes may have as many as eight or ten machines parked around them, in various states of repair. The machines are driven on roads and between houses, where they occasionally strike natural gas pipes serving the houses. Collisions not only endanger the driver, but occasionally rupture the pipe. Although fire potential is great, fortunately this has not yet occurred.

Snow machines are used over snow as well as over gravel. During spring break-up, their movements are directed between patches of snow on roadways. Hence, driving is often erratic and dangerous. Perhaps their noisy operation signals unsuspecting pedestrians of their arrival, thereby preventing some mishaps. The machines are unlicensed, however, and their use is apparently not policed by the Borough.

Similar problems of pedestrian safety and road maintenance exist at the Naval Arctic Research Laboratory (NARL). The Barrow Regional Master Plan (John Graham & Company, 1973) discussed the extreme safety hazards due to conflict between vehicles and pedestrians in the existing camp plan. The main camp consists of four main access routes between parallel rows of facilities and the beach, but vehicular traffic is not confined to this road system. Wheeled vehicular traffic is permitted any place on the gravel fill which will support the vehicles, including smaller access areas between buildings. Camp speed limits set at 15 mph and 5 mph for the family housing area are generally unenforced because speedometers become inoperative due to the rigors of the Arctic climate.

Maintenance at the NARL base is extremely costly because of drifting snow. Because the roadway system is not aligned with the predominately easterly winter winds, substantial snow drifting occurs between buildings. The Barrow Region Plan indicates that thousands of dollars are spent on snow removal each year in these areas.

ROAD TRANSPORTATION ISSUES

Important issues related to Barrow's road system include the need for sidewalks, improvement of the major collector road through the city, construction of an alternative road connecting Barrow to Browerville and NARL, and the local availability of gravel for road construction and maintenance.

Footpaths

Pedestrian safety in Barrow is increasingly problematic. The raised, narrow roads present little rom for foot traffic. There is often no space off the roadway because of snow accumulation from road plowing. In addition, the front yards of houses are often crowded with snow machines and other equipment.

The increasing number of automobiles, trucks, snow machines and other vehicular traffic is creating hazardous conditions for pedestrians. The problem seems to be less a function of the volume of traffic on these roads (which is not great) than a function of reckless driving and restricted road width.

The North Slope Borough has included two projects in its Draft 1977 Capital Improvements Program, which when funded, may alleviate some of the problems. Funds totalling $300,000 have been identified for the construction of foot paths. The project is dependent upon State commitment of funds. The second project calls for provision of street lighting, but no specific areas of the city are identified. The extent of existing lighting is unknown. The long winter periods of darkness make good lighting imperative, both for drivers and pedestrians.

It would appear that regulation of vehicular traffic is a necessary component of any improvements program, particularly the construction of footpaths. Given the propensity of snow machine drivers to utilize any available path, pedestrian safety, even on footpaths, could be jeopardized without adequate and enforced restrictions on snow machine use.

Collector Road Maintenance

The North Slope Borough has requested the addition of a major collector road in Barrow to the Federal Aid Secondary Highway System (North Slope Borough, 1976). The 1.4-mile segment now extends from the Barrow terminal area, down Diogok Street in the center of the village, and through Browerville to the NARL road. It serves to link the post office to the airport, and is a public school bus route. It provides access to the barge off-loading

sites along the beach road to NARL, and to the sanitary dump near the incinerator plant at NARL. Other major facilities along the route include the hotel, bank, fire station and the planned ASRC Administration Building and the planned State Service Building.

The purpose of this request is to provide relief to the Borough from local road maintenance costs. Based on experience with the spine road at Prudhoe Bay, the North Slope Borough estimates an annual maintenance cost in excess of $25,000 per mile for the collector road.

An earlier request to the State Highway Department for FAS designation was rejected (April 1976). The State suggested that funds under a Local Service Roads and Trails (LSR&T) Program would be more suitable. However, the LSR&T Program does not provide maintenance funds.

An alternative source of funds -- revenue sharing -- has been deemed grossly inadequate because only $1500 per mile would be available. In terms of priorities, the Borough is particularly concerned that improvements using State and federal funds for local road improvements proceed before any commitments are made to that portion of the trans-Alaska pipeline haul road that is within the North Slope Borough's boundaries. However, the Borough Planning Department notes that the State Department of Highway's Six-Year Transportation Construction Program, January 1977, has no improvements projected for any communities in the entire region.

Alternative Access Between Barrow and Browerville

A portion of the collector road for which the North Slope Borough is currently seeking Federal Aid Secondary Highway maintenance funds is located along the beach between Barrow and Browerville. Spring thaw occasionally makes this road impassable. In addition, beach erosion, accelerated by past gravel removal threatens the entire beach road. Coastal erosion in some places is nearly five feet per year. Relocation of the road away from the beach in 1969 and recent construction of a section of sea wall (using gravel ballasted steel tanks) have been unsuccessful in stopping roadbed erosion.

Consequently, studies were undertaken to provide an alternative, all-weather road access between Barrow and Browerville (John Graham & Company, 1973). One of the alternatives discussed in that report, a beach bypass road located along the top of a dam across Isatkoak Lagoon, will be built using Public Health Service (PHS) and Bureau of Indian Affairs (BIA) funds. The dam is being built by the PHS to impound a sufficient capacity of water to supply the city for one year. It is estimated to be completed in mid-1978. A road will be built across the top of the dam from Block "A" to Browerville, where it will connect with the collector road from the beach.

When the PHS water supply project was authorized, the BIA provided the necessary funds to widen the dam so it could be used as a roadway. According to engineers in the PHS, the BIA dam surface will be paved with "soil cement", sufficient in strength (1,000 psi) to handle light vehicles only. Since heavy vehicles could damage or destroy the dam, this road could have limited usefulness as an emergency all-weather bypass to the coastal road.

A road to connect to the dam on the south side of the lagoon was begun by the NSB in the summer of 1976, but was suspended because of lack of funds. A total of $458,000 was originally authorized, a portion of which was set aside for road improvements in Block "A".

Consequently, the Borough has requested State assistance in constructing this road, under an Off Road System (ORS) project funding program. This road would follow an extension of Okpik Street, one block north of the airport, and continue east and north approximately .7 miles to the dam.

Gravel Availability

An important consideration in plans for construction or improvement of roads, as well as for other large scale construction in the community, is the availability of gravel. Gravel is needed as a sub-base for roads, buildings (in areas of ice lenses where placement of pilings is difficult), and it figures importantly in some plans for elevating large land areas to improve surface drainage.

Planned construction of platted roads in Block "A", or potential construction of roads for new housing east of Browerville, could require significant quantities of gravel. Industrial development in Block "B" could require new gravel roads and gravel paths for heavy construction.

Unfortunately, gravel remains in short supply in Barrow. Traditionally, gravel had been obtained from the Chukchi Sea beach, the only source where it could be easily removed without damage to permafrost. Several million cubic yards have been removed from the beach for federal projects since the 1940's, until that process was stopped in 1973, due to an increasing beach and beach road erosion.

In 1973, the City began gravel excavations from a pit estimated to have about a million cubic yards, located on the beach at the west end of the airport runway (Dupere & Associates, 1973). A study by J.C. LaBelle of the Arctic Institute of North America in 1973 indicated that gravel was available in commercial quantities (one million cubic yards) from two inland sources located on Navy land about five miles from the community.

Recently the village was given interim conveyance to the surface rights to these sites and any others within a 200,000 square mile area around the city. The ASRC has begun an assessment program to determine the location of other gravel sites within the area. Hopefully, reliable and economic sources can be located that will meet the community's needs for residential road expansion as well as satisfy its demands for future use in building pads. Without these sources, Barrow could be forced 'to limit its expansion, increase its residential densities, and increase its construction costs for large scale development such as industry-;

COMMUNITY CONTACTS

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Kaktovik Community Study

INTRODUCTION

Kaktovik is a Native village of fewer than 140 people, located on a coastal island in the East Arctic. It lies 360 air miles east of Barrow, 130 miles. east of Prudhoe Bay and approximately 90 miles west of the Canadian border.

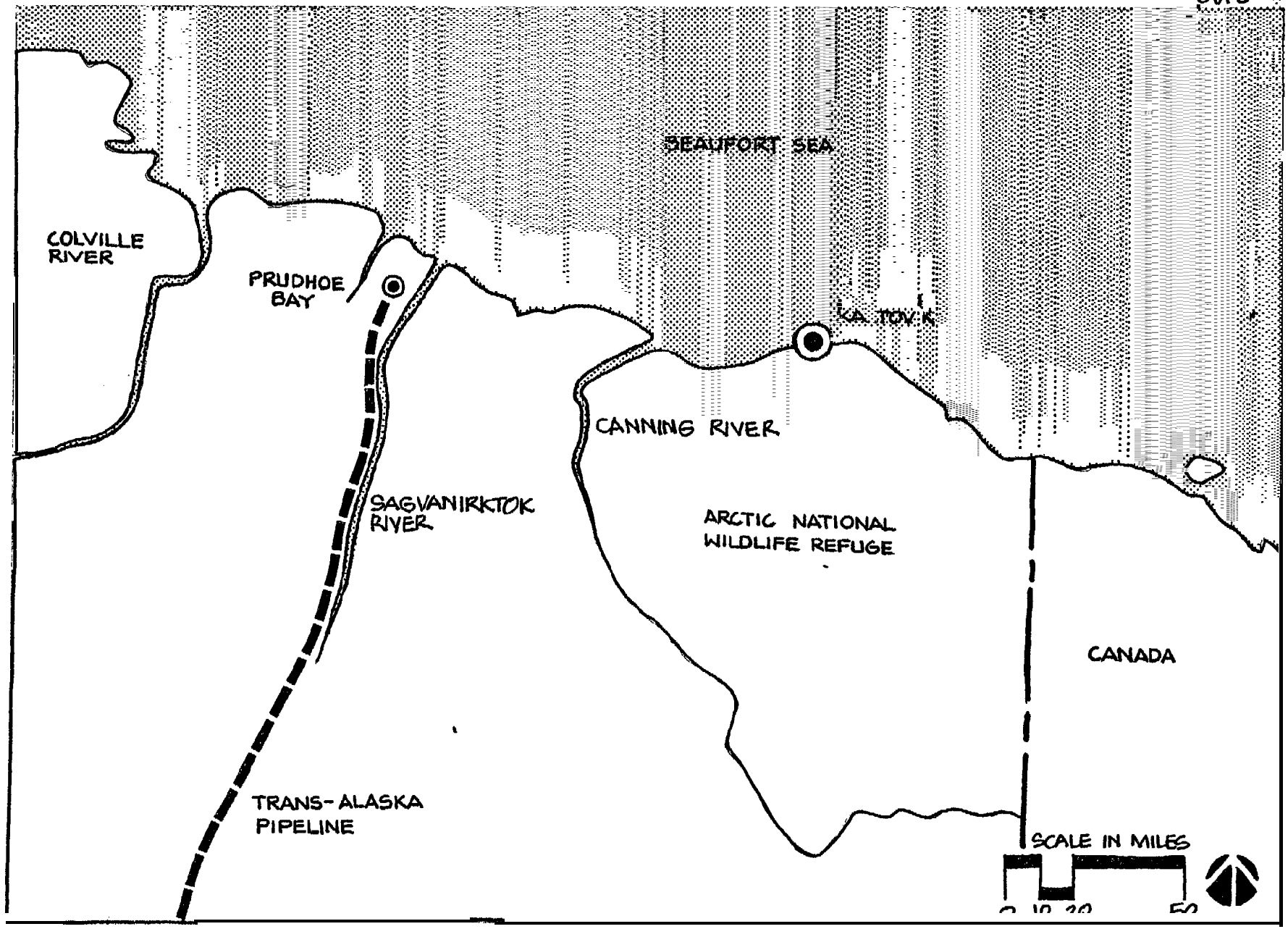
The village and the nearby Bar-Main DEW Line station are situated on the northeast coast of Barter Island, one of the largest barrier islands in a forty-mile-long chain. The island is seven miles long and five miles wide and is separated from the mainland by Kaktovik Lagoon, which is three and a half miles wide. Kaktovik took its name from the Eskimo word meaning "seining place", referring to the excellent net fishing in the lagoon.

Kaktovik began as the historic settlement of Elupak, a traditional Taremiut village, where goods were traded with the villagers from Nigalik on the Colville River to the west, and with the coastal Eskimos of the Canadian arctic to the east. It served as a distribution center for necessary items for hunting, fishing and trapping. "Barter Island" was so named because it was one of the four great trading centers of the northern aboriginal Eskimos (URSA, 1974).

With the arrival of European whalers, missionaries, explorers and prospectors in the nineteenth century, these trading patterns began to break down. By 1923, the first settlement was established in the form of a trading post. However, Kaktovik residents largely maintained their traditional subsistence lifestyle until the 1940's, when a portion of Barter Island was developed as a radar base to monitor aircraft movements. In 1947, the village was forced to relocate by the Air Force in order to build a landing strip on the island. Gradually, education, medical and public assistance, and housing programs were introduced.

In 1953, the Bar-Main DEW Line station was built, apparently requiring another village relocation. Many male residents became salaried employees. The station also brought in an influx of white men as well as Natives from other villages.

FIGURE 1



KAKTOVIK COMMUNITY STUDY LOCATION MAP

In 1960, Congress established the Arctic National Wildlife Refuge. The range extended from the Canning River on the west to the Canadian border on the east, and included all of Barter Island, with the exception of the village area. Although access to the range by non-residents was carefully managed, no restrictions were placed on Native subsistence requirements.

In 1964, the village was forced to move yet a third time. The Air Force took over the traditional site, a well-drained gravel strip, and the village was given a site with silty soils and a complete absence of gravel. The community cemetery remained inside the DEW Line station's boundaries (North Slope Borough, 1974). A location adjacent to the lagoon was established and lots were surveyed by the Bureau of Land Management. Shortly thereafter, the Bureau of Indian Affairs built an elementary school with two classrooms and a teacher's apartment.

Kaktovik was incorporated as a fourth class city in 1971, and reclassified as a second class city in 1972. As a second class city, Kaktovik may exercise the few municipal powers not carried out by the North Slope Borough. No public safety personnel or services are provided by the city. However, the village council acts as the town's official governing body, and it enforces village ordinances, arbitrates disputes, and publicly reprimands those who misbehave (URSA, 1974).

As of mid-1977, the total population of the community, including the 50 DEW Line station employees, is estimated at approximately 190 (North Slope Borough, 1977). The DEW Line station can house as many as 70 full-time, non-Native employees, and this number can double during the summers (U.S. Dept. of the Interior, 1976). Of the 128 village residents counted in 1976, all but eight were noted as Native. '"Mer"'b unnumbered women, 49 to 24, and there were 47 children (URSA, 1977).

The village economy is primarily dependent upon Borough, DEW Line station and village corporation employment, as well as subsistence. Employment varies from season to season; but there are few long term permanent jobs in

Kaktovik. Two-thirds of the 34 fulltime and part time jobs counted in 1976 were distributed among the North Slope Borough (12), the DEW Line station (5), and the village corporation (5).

Subsistence accounts for an estimated 40 percent of the food consumed in the village (ibid.). In 1973, Dupere & Associates estimated that individual resident's dependency upon subsistence can be as high as 80 percent. A "subsistence" economy has ceased to exist, and the maintenance of traditional hunting and fishing activities is now contingent on a cash economy. Without jobs needed to purchase weapons and vehicles, younger people leave the village, and traditional patterns of hunting and fishing are being eroded (URSA, 1977).

SUMMARY OF ISSUES

Kaktovik has been and continues to be one of the poorest communities in the Arctic. This is reflected in almost every aspect of village life: employment, housing, transportation and utilities services. Housing is among the oldest and most poorly constructed in the Borough. Air and marine transportation to the village is unreliable and roads in the area and to the water source are in poor condition. There is no piped *or* treated water for residential use, and there is infrequent disposal of collected solid and liquid wastes.

Recent activities of the Borough and potential economic activities of the village corporation, however, offer the potential for significant improvement. Since the discovery of oil at Prudhoe Bay, tax revenues have accrued to the Borough that are now finding their way into village projects. Housing is being built which may soon replace three-quarters of the 21 units described as dilapidated in 1973 (Dupere & Associates, 1973). Roads in the village have been improved, and roads to the dump and water source are planned for improvement. Installation of electrical generation and distribution and sewage disposal and water supply systems are planned. Land development potential also exists through the recent conveyance of surface rights to approximately 65,000 acres to the village corporation.

These and other programs will bring long-overdue improvements to Kaktovik, but will probably not provide an infrastructure upon which major new development can take place. For example, the potential for employment related to construction of the proposed Alaskan Arctic Gas Pipeline Company pipeline exists for some Kaktovik residents, but it is unlikely that construction or maintenance of the pipeline would utilize any local community services (U.S. Dept. of the Interior, 1976). The absence of a port or public airport or large water supply could inhibit the usefulness of Kaktovik as a service base for the pipeline or any nearshore or offshore petroleum exploration or development. Whatever opportunity for economic development of Kaktovik exists, it would appear that only the communications, air facilities and fuel storage facilities at the DEW Line station would offer a potential infrastructure. The likelihood or acceptability of such development to either the DEW Line station or Kaktovik, however, was not assessed as part of this interim study of community facilities.

LAND USE

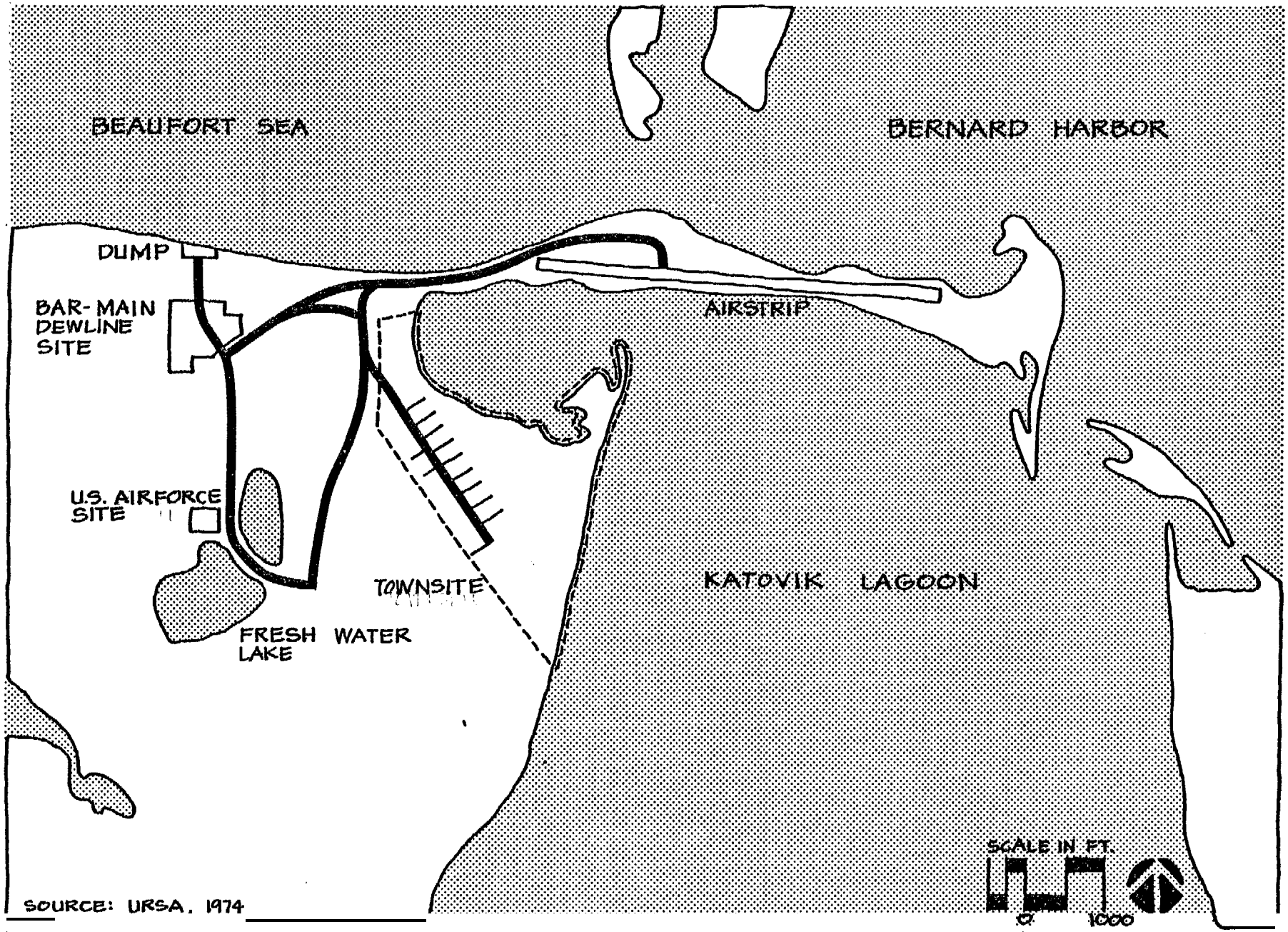
Land in the vicinity of Kaktovik is-used for fish and wildlife production, and for subsistence. The area is characterized by low-lying terrain, an absence of vegetation, and desert-like conditions of precipitation (averaging only 4 inches per year). The little snow which falls drifts against the shore, protecting the village from sea storms, but makes transportation even within the village difficult. In summer, the area is composed of thousands of small lakes, ponds, marshes, and meandering streams which are rich waterfowl habitats.

The Barter Island settlement is composed of the village of Kaktovik and the DEW Line station, approximately two-thirds of a mile apart by road (See Figure 2, Area Land Use). Facilities shared by the village and the station include the DEW Line airstrip, located on a gravel strip extending east into the sea; the freshwater lake, located south of the station and east of the village; and the dump, located a short distance to the north, on the Beaufort Sea coast.

Within the village, most of the land is used for privately owned residences. Other buildings house such functions as a Bureau of Indian Affairs school, a Public Health Service health clinic, a community hall, a church, a post office, a general store, a National Guard armory, an air charter service, village corporation offices, and a village corporation-owned coffee shop (See Figure 3, Town Site Land Use). Recreation is limited to a recently completed community building, a church, and a BIA school.

The school complex is located west of Barter Avenue, the main street in the townsite, and consists of the school itself, a portable classroom, a maintenance shed and fuel storage tanks. The facility lacks storage and recreation areas. Long planned Borough construction of a community elementary education and service facility has been suspended, since the State has undertaken plans to provide a new school (North Slope Borough, 1977). The State's

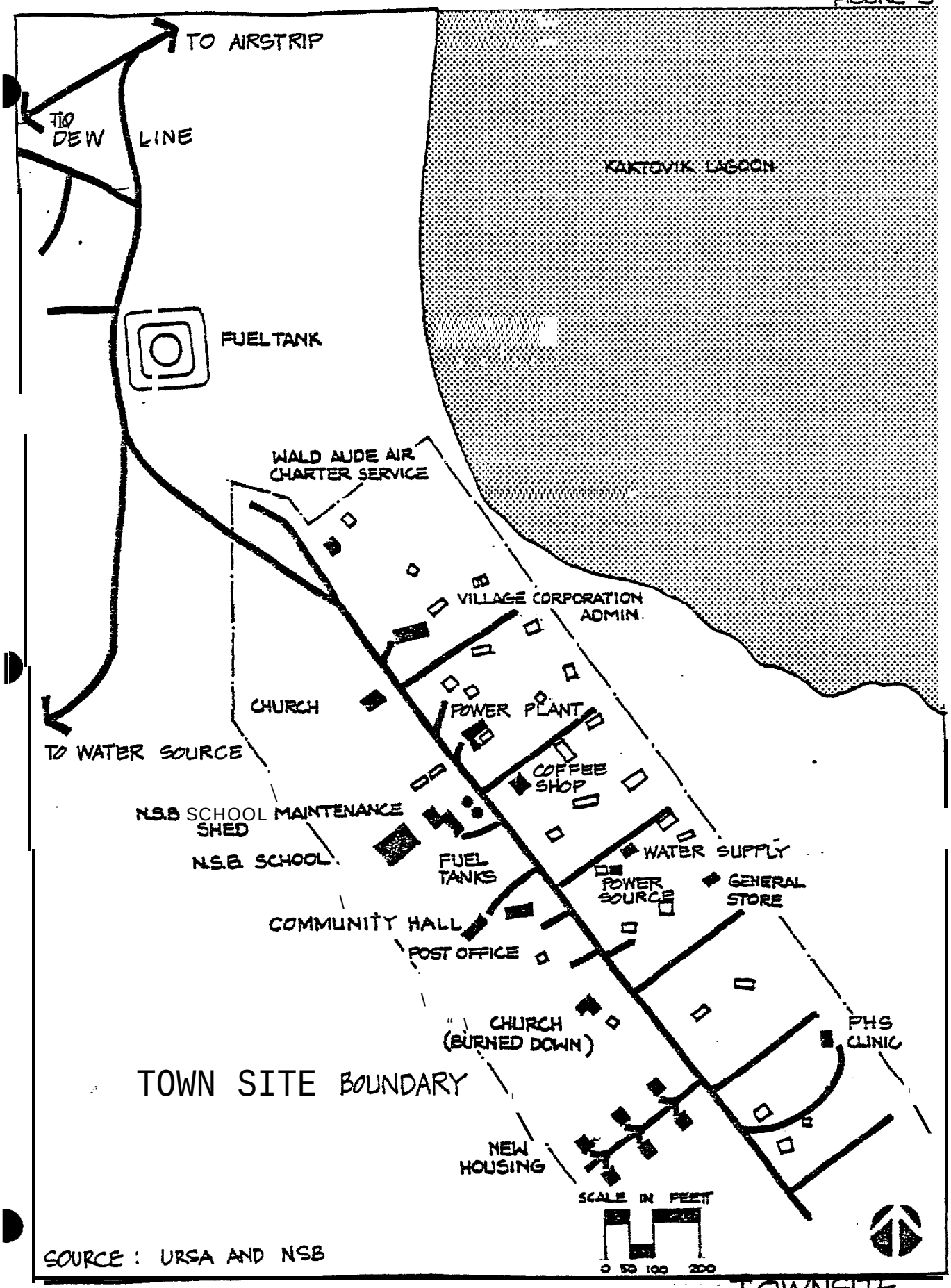
FIGURE 2



KAKTOVIK COMMUNITY STUDY

AREA LAND USE

FIGURE 3



KAKTOVIK COMMUNITY STUDY • TOWNSITE LAND USE

designs will provide for education of the 51 children presently living in Kaktovik, with a projected capacity for as many as 75 students in 1990.

The DEW Line station is composed of-15-20 buildings of varying size, containing such functions as communications, staff housing, aircraft maintenance, power generators, water treatment facilities and fire fighting equipment. The FAA maintains a Flight Service Station at the DEW Line facility (Alaska Dept. of Highways, 1973). Firefighting equipment is also provided for *fires* in Kaktovik, since the village's Volunteer Fire Department has no equipment (Dupere & Associates, 1973). Additionally, seven fuel storage tanks are located at the station.

SUBSISTENCE

Land area use for subsistence around Kaktovik extends within a thirty to forty mile radius, generally south of the community. Within this area, residents obtain such food sources as caribou, polar bear, grizzly bear, sheep, birds and waterfowl, and fish and sea mammals; vegetable food sources such as blueberries, cranberries and cloudberries; and such furbearing animals as wolverine, fox, wolf and groundsquirrel. The total monetary replacement value of subsistence foodstuffs taken by Kaktovik residents in 1973 was approximately $65,000 (U.S. Dept. of the Interior, 1976). Because these estimates were based on Anchorage costs and did not account for transportation to Kaktovik, the estimate was undoubtedly low. In 1977, of course, the cost of equivalent amounts of fish and game would be much higher.

Residents spend six to seven months a year in subsistence activities and supply 30 to 80 percent of their food requirements in this manner (Robert R. Nathan Associates, 1974; Dupere & Associates, 1973). Fish constitutes a significantly larger portion of the diet of Kaktovik residents than, for example, residents of Barrow or Wainwright (Resource Planning Team, 1974). Caribou, however, is the main game resource and is hunted year round. The Porcupine Caribou Herd crosses the Brooks Range in its spring migration to its calving ground south of Kaktovik in the Arctic National Wildlife Refuge. Hunting of the Porcupine Herd is not bound by restrictions imposed by the Alaska Department of Fish and Game, as is the badly depleted Arctic Caribou Herd in the West Arctic.

SUBSISTENCE LAND USE ISSUES

Kaktovik residents have identified subsistence as the most important element of their traditional lifestyle. At the same time that vehicles such as snowmachines allow for increased accessibility to subsistence food sources, there is a consensus that it is becoming more difficult for people to obtain the food they need by hunting, fishing and berry picking. The most common problems cited are game laws and restrictions, reduced game, competition

from outside sportsmen, development, and the cost of food and equipment (Robert R. Nathan & Associates, 1974).

Additional limitations on subsistence resources have been associated with construction and operation of the Alaskan Arctic Gas Pipeline Company pipeline. The project would require transport of men and supplies to staging areas along the coast during the summer which would cause potentially significant disturbance to waterfowl areas, including their displacement. Other activities could cause redistribution of polar bears, caribou, grizzly bears, seal and walrus, and fish. That is, the habitats of nearly every subsistence resource of the people of Kaktovik could be modified as a result of the Arctic Gas pipeline route (URSA, 1974).

It is not known if a combination of existing limitations noted above will result in changed subsistence areas, or inevitably will increase dependency on a cash economy.

RESIDENTIAL LAND USE

CURRENT RESIDENTIAL LAND USE

The North Slope Borough 1974/75-1979/80 Capital Improvements Program states that Kaktovik clearly has the poorest housing in the Borough. With the exception of eight prefabricated houses constructed in 1974 under the Alaska State Housing Authority Remote Housing Program, and a teacher's house constructed in 1976, most housing in Kaktovik is constructed by individuals using dunnage such as plywood, or quonset hut materials obtained secondhand from the DEW Line station (U.S. Dept. of the Interior, 1976). Of the twenty-three occupied older houses in Kaktovik, twenty-one have been designated by the village corporation for replacement (Dupere & Associates, 1973).

Most of the housing is older than 10 years of age; and some dates from the last relocation of the community in 1964. The housing is small (averaging 685 square feet) and generally lacks adequate insulation and plumbing. Heat is provided by fuel oil stoves, which consume approximately four 55 gallon drums per year (URSA, 1974).

In 1974, household size was 4.9 persons per dwelling unit, although fully 36 percent of the 37 houses in the village were vacant. This figure further testifies to the extreme inadequacy of the housing and the high cost of heating (Dupere & Associates, 1974).

The eight new housing units which were constructed in 1974 were provided under Alaska State Housing Authority's Remote Housing Program and were administered by the Kaktovik Village Corporation with the assistance of Inupiat Builders Inc., the Housing Development Corporation of the Arctic Slope Regional Corporation. Under the terms of the program, eligible families received a grant for 75 percent of the $30,000 cost of the unit, and financed the remained portion under a long term loan (URSA, 1974).

RESIDENTIAL LAND USE

Plans for replacement of dilapidated housing in Kaktovik are proceeding under Borough direction. The recently constructed $70,000 teacher's house was purchased in Fairbanks and constructed by Public Works Department crews. Seven new prefabricated houses have been shipped to Kaktovik at a cost of $240,000, or $34,000 each. The Borough Capital Improvements Program indicates that they will be installed in place before the end of fiscal year 1977/78. Other housing will be replaced after a more detailed needs assessment is made. The 1974 Six-Year CIP estimated a need for 5 additional houses during the planning period. Demand for new housing appears to be related primarily to the need to replace substandard housing rather than to accommodate any significant anticipated growth.

Without new jobs, young adults continue to leave the village. Some jobs could be created as a result of the construction and maintenance of the proposed Alaskan Arctic Gas Pipeline Company pipeline, which could use Kaktovik as a sub-base for maintenance (U.S. Dept. of the Interior, 1976)

It appears that sufficient land is available for any anticipated residential expansion. If none of the new housing were constructed on the same lot as existing dilapidated housing, space would still remain to accommodate approximately 30 lots within the BLM townsite. It also appears that there is sufficient land outside the BLM townsite, but within the city limits, to accommodate additional growth.

The suitability of this land for development, however, has not been assessed. Gravel necessary to fill in poorly drained areas and to provide roads to serve new houses is in short supply. Consequently, limitations on gravel availability may present a much more severe limitation to growth than would available land for expansion.

PLANNING

The City of Kaktovik lies within the boundaries of the North Slope Borough. The Borough, whose administrative headquarters are in Barrow, has a variety of areawide powers, many of which affect Kaktovik. Borough powers include responsibility for streets and sidewalks; sewers and sewage treatment; water course and flood control; telephone systems; light, power and heating facilities; water; transportation systems; libraries; airport and aviation facilities; garbage and solid waste collection and disposal; housing and urban renewal, rehabilitation and development; preservation, maintenance and protection of historic sites (North Slope Borough, 1977).

The City of Kaktovik, while empowered with public safety and recreation powers, effectively looks to the Borough and various federal agencies for the financing and provision of municipal services.

LAND STATUS

Land status in the vicinity of Kaktovik has recently undergone significant change as a result of interim conveyance of approximately 65,000 acres of land to the Kaktovik Inupiat Corporation (See Figure 4 , Kaktovik Village Corporation Land Status). Land outside the village had formerly been either in sole ownership of the Air Force or Department of Interior-managed Arctic National Wildlife Refuge. Because of these pre-existing federal ownerships, only surface rights were extended to the village corporation. Village deficiency selections of four townships outside of the refuge were also selected. It is not known *if* village selections on Barter Island required a reduction in size of the nearly seven square mile DEW Line station, or if the village's conveyances of surface rights were simply superimposed upon the Air Force ownership.

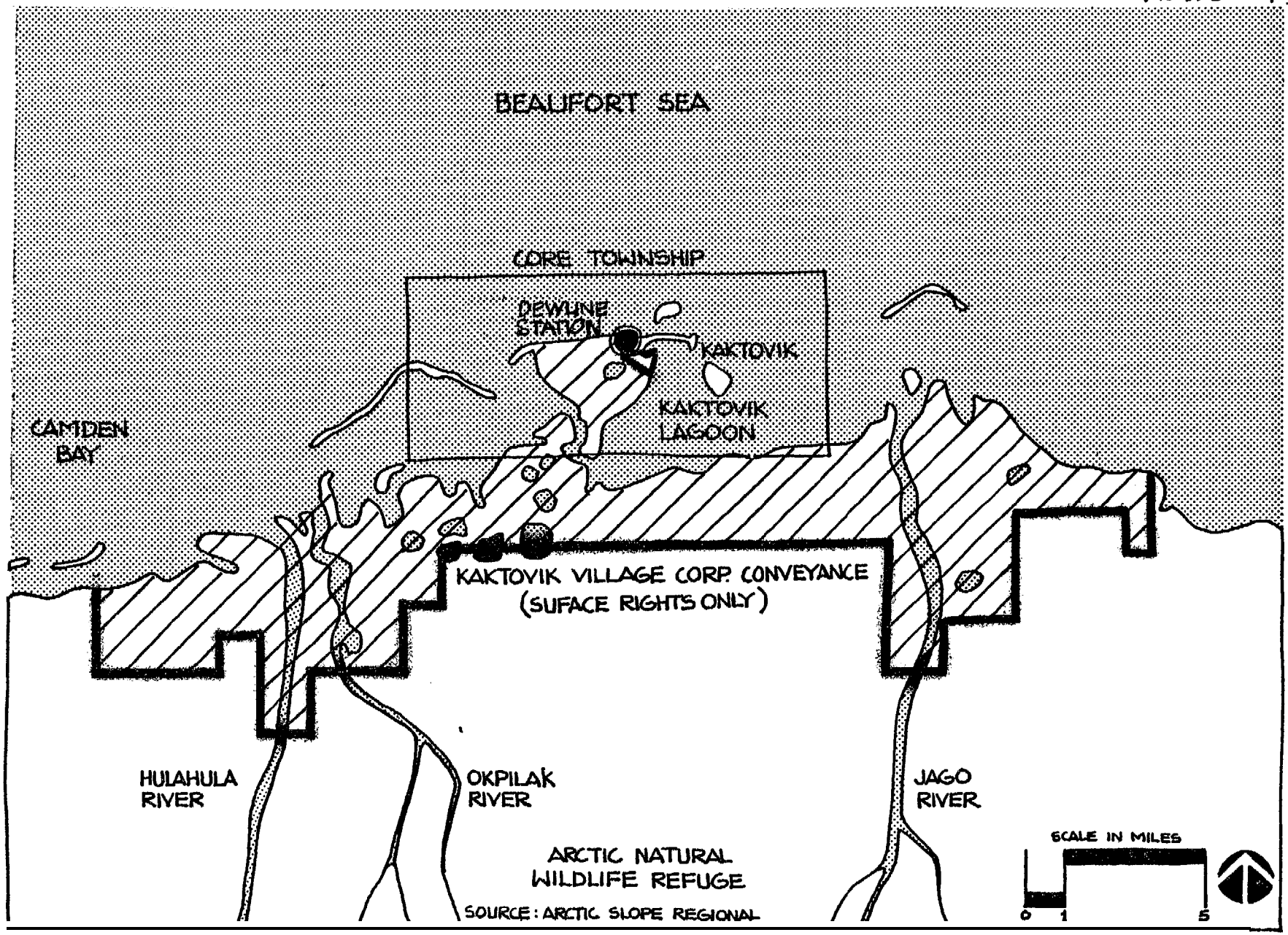
Village concepts of land use are very informal. There is consensus that land and resources are everyone's birthright; and consequently there is little interest in traditional land surveying functions, such as platting, and planning and zoning. Buildings occupy lots surveyed by BLM in 1964, but only very casually; there is no sense of building siting related to lot lines.

LAND STATUS ISSUES ,

The lands that have always been perceived as owned by everyone have finally been so designated. The conveyance of surface rights to these lands will have important long term economic consequences for the village of Kaktovik. The potential now exists for economic recovery of surface minerals and the leasing of village land to such industrial interests as oil exploration and development companies.

The Borough Capital Improvements Program indicates that Kaktovik's development potential is severely limited by lack of gravel (North Slope Borough, 1977) . The Bureau of Land Management had originally restricted the removal of any gravel from the Arctic National Wildlife Refuge, but this restriction

FIGURE 4



KAKTOVIK COMMUNITY STUDY · KAKTOVIK VILLAGE CORPORATION LAND STATUS

was effectively removed by the interim conveyance. Within this area are three known sources of gravel: a borrow pit on the western tip of the island, the Hulahula River, approximately 15 miles southwest of Kaktovik, and the Jago River, approximately 10 miles southeast of the community (URSA, 1977).

UTILITIES

Utilities in Kaktovik are very limited. Village residents still have to haul their water and dispose of wastes in honey buckets. Fuel essential for heating and operating equipment is expensive and often in short supply. Communications have recently improved through installation of two long distance telephone linkages between the community and the DEW Line station, which is tied into communications equipment at Prudhoe Bay/Deadhorse, but there are no other phones in the community.

Improvements to utilities services in Kaktovik are planned by the Borough, the State, and the U.S. Public Health Service, but the schedule for completion in most cases is inconclusive. Because the existing utilities and the planned improvements are sized only to meet modest local demand, there is no excess capacity to meet the needs of new industry. For example, the Alaskan Arctic Gas Pipeline Company, whose proposed pipeline follows an alignment from Prudhoe Bay to Canada and passes within 25 miles of Kaktovik, plans no use of community utilities or other services unless desired by Kaktovik residents (U.S. Dept. of the Interior, 1976).

WATER AND SEWER SERVICE

CURRENT WATER AND SEWER SERVICE

The village water source is at Fresh Water Lagoon located south of the DEW Line station and west of the village. Water is piped to the DEW Line station, but is hauled by truck to the village. While the station's water is treated, the village's water is not. The road to the lake parallels the utilidor to the station. Another poor quality road/trail extends west from the village, but may be impassable by truck most of the year.

Because of the inconvenience of hauling water over a poorly maintained road from the water source, water consumption in Kaktovik is among the lowest of North Slope communities. Only two gallons per day are estimated to be consumed (Johnson and Dryer, in press), significantly below the amount consumed by the DEW Line employees who have piped and treated water. Another factor which limits water consumption is the residents belief that the water source has been and continues to be contaminated by DEW Line vehicles that drive too close to the lake (Dupere & Associates, 1973).

None of the houses in the village is interconnected to a piped water system from the central storage tank. Six of the 8 houses built in 1972 were constructed with internal systems which pipe water placed in a residential storage tank to the bathroom and kitchen. None of the units has a hot water heater.

WATER AND SEWER SERVICE ISSUES

The Borough Capital Improvements Program indicates that the U.S. Public Health Service could complete the development of a utilities system in Kaktovik in 1978 (North Slope Borough, 1977). Phase I of this program would provide safe water treatment, a community watering point, a central laundry/showers/toilet facility, and a sewage collection and disposal service. The Borough's 1974, Six-Year Capital Improvements Program indicated that these" facilities would be located at *or* near the school complex (Alaska International Academy, 1974).

The State's plans for construction of a new school and gymnasium at Kaktovik anticipate purchase of treated water from the DEW Line station. It is possible that the gymnasium will be connected to the waste water system at the existing school. The Borough has indicated a need to coordinate the school's overall water, sewer and power needs with those of the community (North Slope Borough, 1977).

The long-range Phase II program would provide for construction of a utilidor from the fresh water lake following an alignment adjacent to a planned 0.8 mile road between the lake and the community. Individual homes and facilities would be served in the future under Borough and community funding.

It is the Borough's intent to expedite the construction of water and sewer facilities in order to provide a necessary infrastructure for development of educational and community health facilities.

An important issue to the residents of Kaktovik is the disposal of human wastes stored in the 55 gallon honey buckets. Although the Borough is apparently required to remove all accumulated containers once a year, residents note that in the past this has not taken place for periods as long as a year and a half. Infrequent disposal of wastes is not only an inconvenience to village residents, but also imposes conditions conducive to infectious diseases.

FUEL AND ELECTRICITY

CURRENT FUEL AND ELECTRICITY SERVICE

Fuel in Kaktovik has often been costly and in short supply. Infrequent delivery of fuel by barge and airplane, and inadequate fuel storage containers have caused fuel shortages in the past. Until a tank was recently constructed in the village, rubber bladders borrowed from British Petroleum had to be used (Dupere & Associates, 1973). This storage tank is located within a bermed area at the north end of the townsite. The school has its own fuel storage tanks.

Electricity serves all houses in the village. Until 1974, it was generated by two privately owned, oil-fired generating plants of 7 kilowatts and 4 kilowatts capacity. Today, electricity is obtained from a single 35 kilowatt generator owned and operated by Barrow Utilities and Electrical Co-op, . . Incorporated. Electricity costs 24¢ per kilowatt hour; most older houses are billed for approximately $45 per month, and the eight newer houses are billed approximately $55 per month. The Borough school has its own electrical generator and distribution system.

Consumption of electricity is rising (URSA, 1976). In 1973, a generating capacity of 11 kilowatts was sufficient to meet the community's needs, since electricity was used almost exclusively for lighting. In 1974, 25 percent of the village housing contained food freezers, used to store foods gained by subsistence activities. The construction of new housing and improvements to old housing, combined with increased use of appliances, has created a demand which the existing system cannot meet (Dupere & Associates, 1974).

FUEL AND ELECTRICITY SERVICE ISSUES

There is a consensus among the villagers of Kaktovik that an inexpensive source of fuel is the community's most pressing need (URSA, 1977). Residents spend more on fuel oil used for heating, and gasoline used for transportation than for any other item. The average annual cost for heating a home is

approximately $1,800 to $2,000, and for the electricity it is $540 to $660. Either a snowmachine or an outboard motor uses approximately 700 gallons of gasoline per year. In 1976, barged-in gasoline cost $1 per gallon and airlifted gasoline cost $2 per gallon. The cost of heating oil was expected to rise from 57¢ per gallon to over $1 per gallon in 1976 (URSA, 1976). The cost of electricity generated using fuel oil was similarly expected to rise.

The existing electrical generation and distribution system is inadequate to meet present needs. There is no back-up capacity in case of emergency. Consequently, the North Slope Borough has designated as a high priority project the installation of a new electrical generator, electrical distribution system and street lighting.

This project is estimated to cost $374,000, and would consist of two 90 kilowatt CAT generators and one 55 kilowatt CAT generator, electrical distribution and street lighting systems (North Slope Borough, 1977). The electrical distribution system would be intertied to the school's system. At present, the Borough is negotiating private easement statements with each homeowner. Because electrical street lighting is now provided only by individuals, this project would provide flood lights mounted on residences and community buildings (North Slope Borough, 1974).

Because of its high priority status, the project has been continued, even though the Borough's 1977 Capital Improvements Program has been suspended. However, the North Slope Borough notes that the project is apparently contingent on some State funding. The project is scheduled for completion by the end of fiscal year 1977/78.

The State plans for construction of a new school will provide additional electrical generating capacity for the community. Although the State anticipates purchase of power from the DEW Line station, a standby generator of sufficient capacity to operate both the existing and the new school will also be provided (North Slope Borough, 1977). The Borough had indicated its interest in coordinating plans for meeting the power needs of the community with those of the school.

COMMUNICATIONS

Telephone communications in Kaktovik rely on the bush communications system recently installed by RCA Alascom. Phones at the school and in the home of one individual in the village connect to a switching center at the DEW Line station, which is tied into the Earth Satellite station at Prudhoe Bay.

The specialized communications and data processing facilities at the DEW Line station are also provided by RCA. Instant communications with other stations, Fairbanks, or other communities in the state, are always available. However, security prohibits villagers from using these facilities except in case of emergency.

In case of medical emergency, there is also radio contact between the Public Health Service clinic in Kaktovik and the PHS hospital in Barrow.

Citizens' Band (CB) radio is used to monitor aircraft and is increasingly used for informal communication among residents. Operators of snowmachines can use CB radio for emergency contact in the event of machinery breakdown at an isolated location; or subsistence hunters can contact each other in order to direct the hunt.

TRANSPORTATION

Transportation service to and from Kaktovik is limited to twice weekly air service and annual barge service. Within and around the village, snowmachines and small outboard motor boats are used extensively. The road system is being improved in the town site and improvements are planned for linkages to the community dump and the water source.

AIR TRANSPORTATION

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The community's only airport is operated by the Air Force at the DEW Line station. The airstrip is restricted to certain aircraft approved by the Department of Air Force, forty-eight hours prior to landing.

Wien Air Alaska has a contract with the DEW Line station to provide regular air service to Barter Island. Flights are scheduled by 19-seat, Twin Otter aircraft, twice a week from Deadhorse. Seats are made available to civilians not employed by the DEW Line station on a space available basis. The local Wien agent estimated that in 1975 there were a total of 60-75 personal trips made outside the village. The most common trip was to Fairbanks, cost $130 round trip, and lasted 3 to 5 days (URSA, April 1976).

The Arctic Slope Regional Corporation also has an agreement with the Air Force which provides weekly charter service. A local pilot owns a Cessna 180 that lands on the road at the DEW Line site. The plane is also available for medical or other emergencies (URSA, 1974). The Public Health Service will also fly patients to the Barrow hospital when notified by radio.

Air transportation facilities include the 4,817 foot gravel runway and an air terminal building. Unlike the runway at the Barrow airport, which is equipped with approach radar and runway lighting, the DEW Line airstrip has only surveillance radar and no lighting. The airstrip cannot handle 737 jets, but the State and the DEW Line station are improving the strip to serve larger aircraft. Located near the airstrip is a Borough-owned warm storage building, where rental tractors, back hoes and augers are available for local Borough-funded and other projects.

MARINE TRANSPORTATION

Marine transport to Kaktovik is limited to barges serving the DEW Line station. Because of shallow water near shore, lightering of cargo to the unloading area near the landing strip is necessary.

The village of Kaktovik is normally not served by the DEW Line barges. However, because the BIA cargo ship Northstar III does not come as far east as Kaktovik, essential supplies, such as fuel oil purchased by the village corporation, have been brought in by DEW Line barge in 1972 and 1973. Some goods brought to Barrow via the Northstar are airshipped to Kaktovik. Because of unreliable barge service, the community is increasingly dependent upon air transportation. This dependency is reflected in the extremely high *cost* of goods brought to the village.

ROAD TRANSPORTATION

CURRENT ROAD TRANSPORTATION

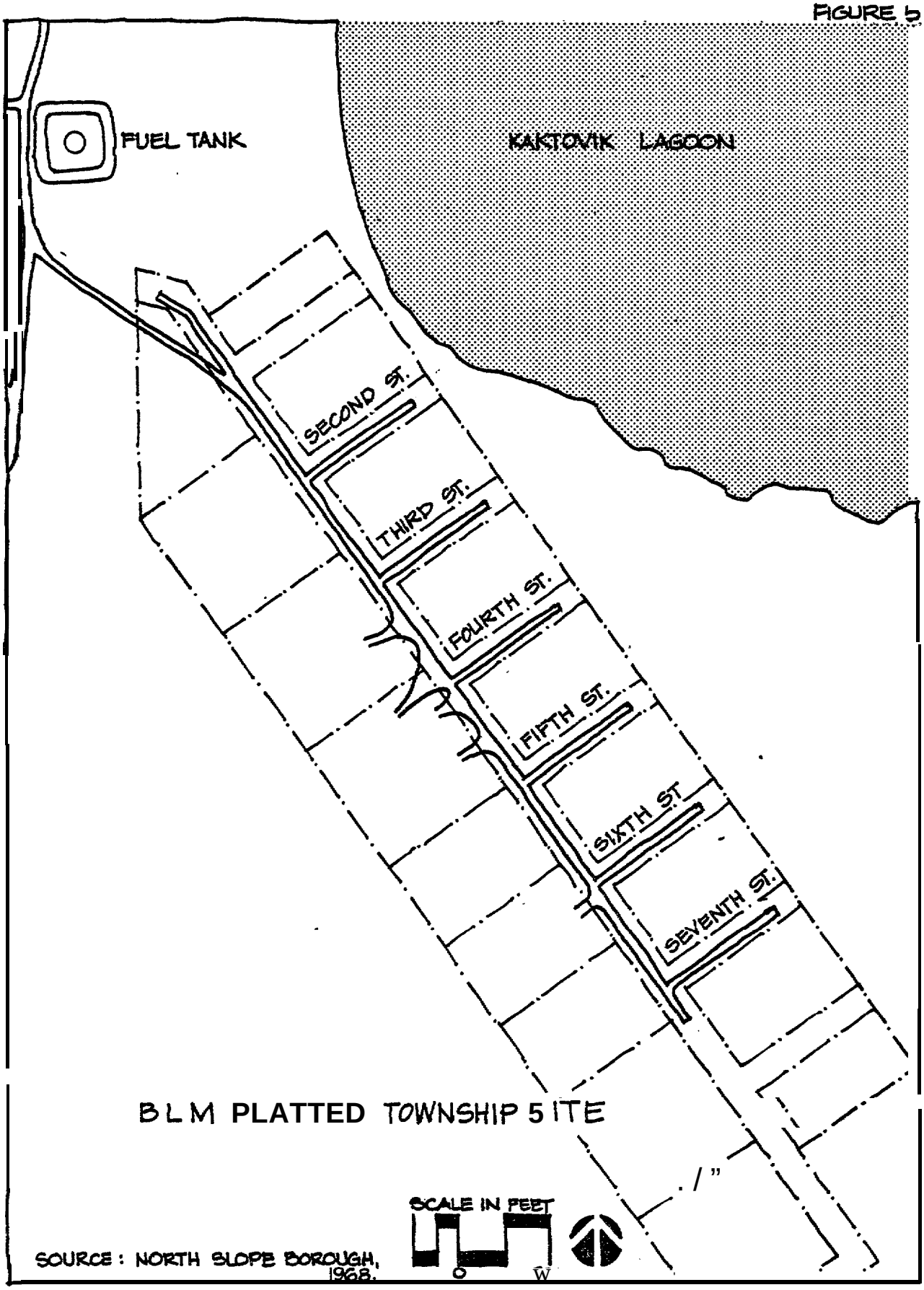
Kaktovik has a rudimentary gravel road system which connects the DEW Line site to the airport, and a gravel and composition side road which connects to the town site. The main road through the village, Barter Avenue, was improved in 1975. This 1,800-foot long, 12-foot wide road was constructed by the Borough at a cost of $120,000. In 1976, six side streets (Second Street through Seventh Street) totalling 1,670 feet in length were constructed. These 14-foot wide roads were installed for a total cost of $144,000, an expenditure for which the Borough expects to be reimbursed by the State Local Service Roads and Trails Program (North Slope Borough, 1977).

Vehicular use in Kaktovik consists of about five trucks, twenty to twenty-five snowmobiles, and various motorcycles and three-wheeled motorcycles ("Tote-Goats"). The average snowmachine costs over $2,000, requires approximately $200 per year for maintenance and last about two years (URSA, 1976). Gasoline to power snowmobiles and outboard motor boats costs $1 per gallon if shipped by barge, or $2 per gallon if flown in by airplane." Since each snowmachine uses about 700 gallons of gasoline per year, transportation is extremely expensive.

ROAD TRANSPORTATION ISSUES

The Borough's 1977 Capital Improvements Program discusses three long-range programs for development of the village's road system. The first is meant to continue improvements to the community's existing roads, and the others are meant to provide new roads to the community dump and the fresh water source. The community road improvement program will widen Barter Avenue from 14 to 18 feet and add an additional 1,600 feet of new roads. It is anticipated that the Borough would continue to fund these improvements under the expectation that reimbursement would come from the State's Local Service Roads and Trails Program.

FIGURE 5



KAKTOVIK COMMUNITY STUDY • ROAD TRANSPORTATION

The new road to the water source will require construction of 0.4 miles of new road and upgrading of 0.4 miles of old road. The road will be 18 feet wide on a five foot deep gravel base, and the road will bypass the existing road to the lake from the DEW Line station. Total cost, at $13 per cubic yard for gravel, is estimated at $250,000.

The new one-half mile long road to the community dump is identified as a low priority project. Planned to be 11 feet wide and 5 feet deep, its total construction cost is estimated at $210,000. It is not known whether the alignment of this road will follow the existing alignment from the DEW Line station, or will bypass the station to the east.

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