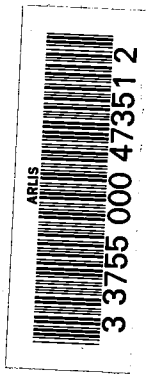

SECOND DRAFT

PRELIMINARY ENVIRONMENTAL REVIEW
ALASKA NEAR-COAST ROUTE

Northern
Engineering Services

DRAFT-For Comment Only

NOTE:
This report has been prepared for discussion purposes prior to preparation of the final report.

SECOND DRAFT

PRELIMINARY ENVIRONMENTAL REVIEW
ALASKA NEAR-COAST ROUTE

NORTHERN ENGINEERING SERVICES COMPANY LIMITED
Calgary, Alberta

Prepared for
Canadian Arctic Gas Study Limited

March 1977

Project 18731

PROJECT 18731

CANADIAN ARCTIC GAS STUDY LIMITED
CALGARY ALBERTA

PRELIMINARY ENVIRONMENTAL REVIEW
ALASKA NEAR-COAST ROUTE

DATE MARCH 1977

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CANADIAN ARCTIC GAS STUDY LIMITED
CALGARY ALBERTA

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FIGURES

NOTE:

All figures in this draft are contained in the pocket at the back of the report.

PROJECT 18731

CANADIAN ARCTIC GAS STUDY LIMITED
CALGARY ALBERTA

PRELIMINARY ENVIRONMENTAL REVIEW
ALASKA NEAR-COAST ROUTE

DATE MARCH 1977

1. SUMMARY

In preparation.

2. INTRODUCTION

This report summarizes the results of a preliminary environmental review of the Alaska near-coast route. The review is part of an overview study which is being conducted in the event that Arctic Gas is required by U.S. regulatory agencies to move from the current filed route to a route nearer the Beaufort Sea coast. This report was compiled by NESCL based on the work of third-party consultants and staff.

The purpose of the environmental review was to determine the environmental acceptability of the route, identify any sensitive areas, identify additional information requirements and provide recommendations. The report highlights the principal issues concerning vegetation, revegetation, mammals, birds, aquatic resources and land ownership. A summary biological description of the Alaska North Slope is given in: Initial Brief of the Arctic Gas Project on Environmental Matters, October 27, 1976, and will not be repeated here.

3. PROJECT DESCRIPTION

The preliminary Alaska near-coast route strip maps (in pocket) and alignment sheets (accompanying) outline the route, location of facilities, and construction information. The route would be approximately 200 miles in length from Prudhoe Bay to the Alaska-Yukon Territory border. Four compressor stations would be located along the route, three of which are in the Arctic National Wildlife Range. The only permanent settlement along the route is at Kaktovik (M.P. 125).

The pipeline right-of-way would be 120 feet wide, and a 48-inch O.D. pipe would be buried at a minimum of 30 inches below the original ground surface. The ditchline would be crowned with spoil, tundra replaced where applicable, and disturbed areas revegetated.

4. VEGETATION

The vegetation designations shown on the environmental alignment sheets are preliminary because little ground information is available for assistance in air photo interpretation. The route crosses a mosaic of sedge-dominated terrain types. Different vegetation types are formed within this sedge matrix by the co-dominance of other species, e.g., dwarf willows, cottongrass, mosses and ericaceous shrubs. A general moisture regime gradient is associated with these types. For example, former oriented lakes are associated with wet wedge, or wet sedge-cottongrass meadows, whereas the Arctic coastal plain usually contains more scrub (dwarf scrub) and also more relief or patterned ground. Fossil floodplain and outwash terrain may be intermediate to the above types, but ground observations are needed to verify this.

Shrub vegetation is usually associated with the active floodplains. However, some sedge-dominated types were recognized for this terrain as well. From air photo interpretation and general experience in this part of Alaska, very limited raparian shrub cover along the route is anticipated.

No definite or strong trends in vegetation types from Prudhoe Bay to the Alaska-Yukon border are evident on the alignment sheets, although wet sedge meadows and the associated terrain of former oriented or fossil lakes are more prevalent in the Prudhoe Bay to Kavik River area.

The impact of this route on vegetation would be acceptable considering the limited amount of terrain disturbance and the potential for development of revegetation procedures for sites not investigated to date.

5. REVEGETATION

A major portion of the route is covered with a silt mantle from 5 to 50 feet deep, with varying ice content. Combinations of alluvial silt, sand and gravel occur at the major river and stream crossings.

The silty soils, particularly those that are ice-rich, are susceptible to both alluvial erosion and thermokarst formation. Because of the widespread occurrence and depth of these materials it is expected that, once disturbance takes place thermal erosion problems could develop. However, the low relief of a large portion of the route would reduce the potential for alluvial erosion and the low average temperature will inhibit thermokarst.

One method of stabilization currently under investigation involves the selective stripping of the surface organic mat and replacing it on the pipeline berm after construction. Initial results indicate that the organic layer replaced in this way significantly retards thawing of the permafrost and assists in the recovery of the native vegetation in areas where moisture conditions are suitable (NES 1977, Tundra Replacement Study Progress Report, in preparation). The portions of the route where tundra stripping and replacement would be feasible cannot be identified at this time. The organic layer on the most erosion-susceptible terrain types (RSR, FOL and ACP) is highly variable ranging from 0 to 50 cm over short distances. This is particularly evident around the surface frost patterns such as frost boils and ice wedge polygons.

Research conducted at Prudhoe Bay and in the outer Mackenzie Delta region demonstrates that revegetation of a major portion of the route would be feasible.

Three basic mixtures of grass seed could be used to revegetate disturbed areas along the route. A mixture of Arctared Creeping Red Fescue *(Festuca rubra)*, Engmo Timothy *(Phleum pratense)*, and Common Meadow Foxtail *(Alopecurus Pratensis)* could be used on areas of low erodibility. These three and Reton Redtop Bentgrass *(Agrostis alba)* could be used on areas of medium to high erodibility while arctared Creeping Red Fescue, Engmo Timothy and Nugget Kentucky Bluegrass *(Poa pratensis)* could be used on areas of very high erodibility. Arctared Creeping Red Fescue and Nugget Kentucky Bluegrass would be used for follow-up seeding on areas where reseeding was necessary. Newly released varieties such as Tundra Glaucous Bluegrass *(Poa glauca)*, Alyeska Arctic Grass *(Arctagrostis latifolia)*, and Sourdough Bluejoint Reedgrass *(Calamagrostis canadensis)* would be considered for the seeding program if adequate supplies were available.

The use of native shrub cuttings for bank stabilization would have only limited application on the route because environmental conditions along the route severely limit shrub growth.

All areas, except those of low erodibility, would require fertilization. Relatively low levels of 56, 112, and 56 kg/ha N, P_2O_5 and K_2O respectively would provide adequate nutrients for plant establishment. Follow-up applications, if necessary, could be applied at half this rate.

On areas of high erodibility physical control measures would be required in conjunction with revegetation to control erosion. This includes the use of erosion control mats and blankets or insulating mats to minimize permafrost degradation. These materials would be used only on areas of high erodibility because of the relatively high cost of materials and labour required for installation and maintenance.

6. MAMMALS

6.1 CARIBOU

Large numbers of calving caribou occur in certain years between MP 85 and 120 (see environmental alignment sheets - in preparation). In this area, the dryer upland terrain, favored for calving, extends nearly to the coast. In 1972 and 1973 the western boundary of the calving grounds was the Hulahula River; however, in 1974 and 1975 a significant segment of the calving cow group continued farther west onto the uplands north of the Sadlerochit Mountains. Calving in this area prior to 1972 has also been reported. In both 1974 and 1975, however, the bulk of the calving that occurred north of the Sadlerochit Mountains took place several miles south of the route.

In some years the bulk of the cow/calf segment forms post-calving aggregations on or near the coast between MP 80 and 130. In 1975 only about one-half of this segment congregated in this area, and in 1976 only a few thousand animals were observed. These aggregations usually last for only two to three days, after which large groups of caribou move rapidly eastward and southeastward to enter the British Mountains.

The route would avoid direct contact with large numbers of calving cow caribou in almost all years. In years of below average snow cover, particularly if combined with an early spring, relatively small numbers of cows, peripheral to the bulk of the calving segment could be expected to contact the route anywhere between the Alaska-Yukon Territory border and the Katakturuk River. In some years of average to above-average snow cover a few scattered animals might wander into the vicinity of the route. Large bull groups entering Alaska would rarely have to cross or contact the route.

Between MP 85 and 120 of the route a more significant contact with calving caribou (i.e. when compared to the rest of near-coast route) can be expected in certain years. Also, direct contact with the bulk of the cow/calf segment would occur along the route at points between MP 80 and 130 in years when the post-calving aggregations form on or near the coast. In certain years contact with eastward-travelling aggregations may occur as far east as MP 160 when this movement follows a coastal or near-shore route during early July (1973). A longer period of direct contact with the route during July-August would occur primarily during warm years when above-normal insect harassment tends to occur prior to the time caribou normally return to the British Mountains. During such years if a reversal in movement direction were to occur (1972) caribou would tend to use coastal areas beyond the early mid-July period.

Compressor station CA-02 and the Bullen wharf site and associated facilities are located within the post-calving aggregation area. These facilities represent a potential long-term disturbance factor in this important area. CA-02 falls within the area where virtually the entire herd comes together at one time in most years.

In summary, the near-coast route would have an acceptable level of impact on caribou. Based on 1972-76 data, major contact between the project and caribou would be short in duration and limited to one section of the route in most years and during some years even this contact would be reduced. Relocation of CA-02 and associated wharf facilities at Bullen Point to east of Simpson Cove or west 2 - 4 miles would avoid this potential adverse impact.

6.2 ARCTIC FOX

Arctic fox denning areas occur primarily in two frost-free land form types: (1) river deltas, and (2) eskers and older pingos. Additionally, some sections of the Beaufort Sea coast itself (i.e. the eroding coastal banks and driftwood deposits may contain numerous dens.

In river deltas the best denning habitat is located where channel banks have built up and where sand dunes have formed. A classic example is the Sagavnirktok River delta.

The route crosses several major deltas (i.e. Sagavnirktok, Canning, Hulahula, Jago, Aichilik, Egaksrak, and Kongakut rivers) and numerous smaller deltas where prime denning habitat is either known to exist (Quimby and Snarski, 1974) or where prime denning habitat is very likely to occur. East of the Canning River, pingos are relatively small, but do provide important fox denning habitat. They occur primarily between the Sadlerochit River and the Alaska-Yukon Territory border, with concentrations in the Hulahula River and Turner River areas.

The potential impact of pipeline development on this species is now expected to be less than was first anticipated several years ago. Even though denning areas would be unavoidably traversed by the route, winter construction will substantially reduce potential impact by avoiding disturbance during the crucial spring and summer period when foxes are utilizing dens for reproductive purposes. In addition, the width and final alignment of the right-of-way can be surveyed in the field so that existing den sites can be avoided or only a minimum number physically destroyed.

The nearness of a buried gas pipeline, once actual construction is complete, will probably not eliminate such sites in terms of eventual utilization by Arctic foxes. Arctic foxes appear to be relatively resilient and adaptable to man-made objects. At the Beaufort Lagoon DEW line site (abandoned) and at several other similar abandoned installations, Arctic foxes have regularly denned in stocks of abandoned and rusting fuel drums. At Kavik camp a pair successfully denned under an abandoned pile of wood timbers and boards in 1972. The operating pipeline right-of-way will not provide any such artificial den sites, but because of the opportunistic behavior of foxes, any disturbance of denning habitat

by the project will probably have a minor impact. Some attraction to construction and camp facilities may occur. This can be minimized by proper garbage disposal techniques and strict policies regarding the feeding of animals.

6.3 POLAR BEAR

Few actual polar bear inland dens have been reported in recent years along the Beaufort Sea coast. However occasional dens could be encountered along the route. Several miles of the lower reaches of rivers and streams which cross the coastal tundra zone flowing into the Beaufort Sea, provide banks and "cuts" where sufficient drifted snow may provide den sites in certain years. An area of potential inland denning habitat occurs between the Canning River and the Sadlerochit River.

During the winter months free-ranging polar bears wander along or into near-shore areas of the Beaufort Sea coast. Polar bears commonly appear in and about the village of Kaktovik and the Barter Island DEW line station.

The route would be crossed by sows coming on land during this period. Similarly, sows emerging from inland den sites with their cubs during the March-April period would have to recross the route as they move north onto sea ice. During winter construction chance encounters with construction personnel would be of prime concern. These encounters would result in danger to personnel and the potential destruction of bears. The likelihood of encounters with both denning and free-ranging bears will vary from year to year and be highest in years when ice conditions and movements bring "greater than usual" amount of heavy drift ice farther south into the coastal areas.

Several recommendations (see Section 10) have been made to control the impact of the project on polar bears and to protect personnel from polar bears. Implementation of these should allow construction and operation of the project with acceptable levels of impact.

6.4 MUSKOXEN

Based on 1972 and 1973 data and subsequent casual observations, it is expected that the three current muskox groups inhabiting the northeastern Arctic slope of Alaska will be encountered with greatest frequency between approximately MP 65-90, 100-115 and 150-165 of the route. It appears that Group I[1] and Group II[1] muskoxen are more likely to be encountered along the route during the winter construction months than are those individuals comprising Group III[1]. In the past (1972, 1973) Group III individuals have moved northward during the summer months and have utilized the coastal tundra on and near Angun Point. In the case of Group I and II muskoxen, individuals have occasionally moved northward to near the coast during the winter months. In November 1976 Group II individuals were observed along the Sadlerochit River within four or five miles of the coast. This group appears to be utilizing the lower Sadlerochit River drainage to a greater extend than in past years. With regard to all three groups, however, the bulk of the 1972-1976 observations indicate that these bands of muskoxen spend considerably more time south of the near-coast route than on or north of it. The three groups are rapidly increasing in number and, from current observations, can be expected to expand their ranges to some degree. The location of the pipeline and its necessary facilities near the coast would leave a much larger less-disturbed area for future expansion of the groups.

[1] These groups are defined and described in Roseneau and Stern (1974) and Roseneau and Warbelow (1974).

7. BIRDS

During most years large numbers (100,000 - 260,000) of staging Snow Geese use the section of the Alaskan North Slope east of Camden Bay from approximately August 15 to September 25. During this period the geese accumulate fat reserves that are essential for their southward migration. If disturbance during this period was at a level which significantly reduced fat reserves, it could alter staging and migration patterns and produce short and/or long-term population changes. The areas of heavy use by Snow Geese that are crossed by the route (see environmental alignment sheets) occur from approximately MP 140 to 155 and MP 160 to 175. The coastal lagoons, reefs, and barrier islands are heavily used by a number of species of waterbirds as breeding areas, as moulting areas, or as staging areas during spring or fall migration. Moulting areas are probably used because they are remote from disturbance yet have abundant sources of food. The near-coast route also crosses areas (see environmental alignment sheets) that are utilized by several other species of nesting, moulting and migrating waterfowl, nesting and migrating shorebirds, and nesting and migrating passerines (especially Lapland Longspurs).

No major impacts on Snow Geese would be expected because no compressor stations are located within concentration areas. Aircraft over-flights of these areas would be restricted in frequency and limited to above 2,000 feet AGL. The impact on other waterfowl, shorebirds and passerines should not be significant.

The Point Brower area (breeding and moulting Snow Geese and Brant and moulting Canada Geese) is a very sensitive area. Breeding and moulting geese require undisturbed areas and may abandon breeding

and moulting areas if they are disturbed. The present alignment is 4-6 miles south of this area and no impact is expected from construction or maintenance of the near-coast route.

Beaufort Lagoon (moulting and staging sea ducks, breeding Whistling Swans and Arctic Terns, and staging geese) and Demarcation Bay (large numbers of moulting and staging sea ducks, staging geese, and breeding Common Eiders and Glaucous Gulls) are very sensitive areas that are used by numbers of birds throughout the open water season (May to September). The near-shore route passes approximately one mile from Beaufort Lagoon, and no facilities are planned within this area. The impact of the pipeline on Beaufort Lagoon would be minimal.

Bullen Point - Wharf and Associated Facilities

These facilities conflict with use of the near-shore areas by moulting Oldsquaw, but the numbers involved are moderate and nearby relocation of the facilities would probably not result in a decrease in disturbance.

Simpson Cove - Wharf and Associated Facilities

The facilities at this location are adjacent to (but not in direct conflict with) near-shore areas which are used by moulting Oldsquaw and migrating Brant. The present location is acceptable. If the location is to be moved, movement to the west would be preferable; however, the paramount concern for caribou in this area should take precedence over the bird concerns.

Jago Lagoon - Wharf and Associated Facilities

There are no known conflicts in this location. Adjacent areas on both sides of the facility are utilized by nesting Glaucous Gulls and Brant, moulting Oldsquaw, and migrating Brant. In view of other adjacent areas of concern, this area is the most preferable for the facilities. Movement to the Kaktovik area would also be acceptable.

Demarcation Bay - Wharf, Associated Facilities, Permanent Road and CA-04

The Demarcation Bay area is an important waterfowl area. The wharf facilities here conflict with usage of the area by nesting Common Eiders and Glaucous Gulls, moulting Oldsquaw, and migrating Brant. The permanent road planned for access passes through the middle of a minor Snow Goose staging area. The locations of the wharf, associated facilities and permanent road are not acceptable and may have a serious impact on the birds utilizing this area; however, the present location of the compressor station is acceptable. Movement of the staging site to the Gordon area would be acceptable.

In summary, if the staging site at Demarcation Bay can be relocated to a non-sensitive area such as the Gordon area, and provided that no site-specific problems arise with the subsequent siting of ancillary facilities, the impact of a gas pipeline along a near-coast route on the birds of the area would be acceptable.

8. AQUATIC RESOURCES

The following section summarizes the available fisheries information for the principal streams and other water bodies crossed by or adjacent to the route from Prudhoe Bay east to the Alaska-Yukon Territory border.

Sagavanirktok River (West Channel)

This river contains large populations of Arctic char and grayling. Over-wintering of these species is known to occur in the vicinity of the pipeline crossing.

Sagavanirktok River (Main Channel)

This is the largest river crossed by the route. It contains large populations of Arctic char and gralying. Eleven additional species have been caught in the drainage. Arctic char and graying over-winter in pools in the vicinity of the pipeline crossing.

Kadleroshilik River

This river is utilized by Arctic grayling and other fishes to some extent. No spawning or over-wintering areas have been identified to date.

Shaviovik River

This river and upstream tributaries contain important spawning and over-wintering areas for Arctic char and Arctic grayling. The lower reaches of the river may contain fish over-wintering areas.

Vicinity of MP 40

Most lakes and ponds in this region are shallow and freeze annually to the bottom. These water bodies are not used as over-wintering areas by fish.

Canning River

This river is a major fish stream. It is an important migration route for Arctic char, Arctic grayling and round whitefish. Spawning and over-wintering areas for Arctic char are found 40 to 60 miles upstream. Grayling may over-winter in deep pools in the lower reaches of the river below the pipeline crossing.

Simpson Cove

Simpson Cover and adjacent near-shore coastal habitats are important migration and feeding areas for Arctic char, Arctic cisco, and other fish species. Marine fishes utilize these habitats for rearing, some spawning and over-wintering in areas which are deep enough (greater than 6 feet) and which do not freeze to the bottom.

Marsh Creek

There are no known over-wintering sites in Marsh Creek in the vicinity of the pipeline crossing.

Carter Creek

There are no known over-wintering sites in this creek in the vicinity of the pipeline crossing. The creek probably freezes to the bottom in winter.

Camden Bay

Camden Bay and adjacent near-shore coastal habitats are important migration and feeding areas for Arctic char, Arctic cisco, and other fish species. Marine fishes utilize these habitats for rearing, some spawning and over-wintering in areas which are deep enough (greater than 6 feet) and which do not freeze to the bottom.

Sadlerochit River

This river is utilized by Arctic grayling for feeding and as a migration route.

Kajutakrok Creek

This is a minor stream which probably freezes to the bottom in winter.

Hulahula River

This is an important migration route for Arctic char. Domestic fishing sites are located 15 to 40 miles upstream. There are important spawning and over-wintering areas located 15 to 40 miles upstream.

Jago River

This river is possibly used by Arctic grayling. There are no known fish over-wintering sites in the lower reaches below the pipeline crossing.

Niguanak River

Arctic grayling may use this river. There are no known over-wintering areas in the vicinity of the pipeline crossing.

Vicinity of MP 155

Small steams in this region probably do not support fish populations with the exception of ninespine stickleback.

Kogotpak River

There is possible summer utilization of the river by Arctic grayling.

Aichilik River

This river is a migration route for Arctic char and Arctic grayling. Spawning and over-wintering areas occur 40 to 50 miles upstream. Deep pools in the delta have potential as over-wintering areas.

Egaksrak River

This river is a migration route for Arctic char. Spawning and over-wintering areas occur 30 to 40 miles upstream. Deep pools in the delta have potential as over-wintering sites.

Kongakut River

This river is a major migration route of Arctic char. Critical spawning and over-wintering areas occur 10 to 30 miles upstream.

Kongakut Delta Springs

The pipeline route passes through the middle of the Kongakut Delta Springs. These springs may be utilized by over-wintering populations of fish. The route as shown on the alignment sheets passes close to an Arctic char over-wintering site.

Turner River

There are no known over-wintering sites in the vicinity of the pipeline crossing.

Clarence River

This river is an Arctic char migration route. Spawning and over-wintering areas occur 7 to 15 miles upstream.

The following section summarizes the known fisheries and liquid water availability information at the four wharf-compressor station locations along the route. Tables 1 and 2 and Figures 3 and 4 (in pocket) provide information on lakes and streams which were surveyed in 1976 as potential water sources. That survey was conducted for a more southerly route and therefore did not consider potential liquid water availability along the central portion of the near-coast route.

Bullen Point Wharf Site, Road, Camp and Compressor Station CA-01

The harbour and lagoon at Bullen Point are abundantly populated with Arctic char, cisco, broad whitefish and four-horn scuplin. The harbour is shallow (3m) and occasionally blocked by drifting ice when westerly winds occur (Griffiths et al, 1977). The road from the coastal facilities to the camp and compressor sites crosses one or two small tundra streams.

A dependable liquid water supply for the camp may be difficult to find in mid and late winter. Many of the lakes to the west are known to be shallow and to freeze solid in winter (Jones, 1976).

Simpson Cove Wharf Site, Road, Camp and Compressor Station CA-02

This wharf site is in close proximity to the Katkaturuk River delta. The road will cross some channels of the Katakturuk as well as one or two small tundra streams. Arctic char and cisco were captured in Simpson Cove by Roguskie and Komarek (1971).

The nearest known potential liquid water sources are lakes 10 miles to the west or springs 20 miles south on the Katakturuk (Jones, 1977).

Jago Lagoon Wharf Site, Road, Camp and Compressor Station CA-03

Jago Lagoon is immediately adjacent to Kaktovik Lagoon which was studied in detail by Griffiths et al (1977). Because of the direct influence of fresh water flow from the Jago River there may be significant differences in the species composition and relative abundance of fish species between the two lagoons. The road crosses no significant streams between the wharf sites and compressor station.

A dependable late winter source of liquid water may be difficult to find in close proximity to the camp site. The nearest springs are on the Okerokovik River approximately 25 miles south.

Demarcation Bay Wharf Site, Road, Camp and Compressor Station CA-04

Demarcation Bay is relatively deep (6m) and is inhabited by at least eight fish species including Arctic char, cisco, and grayling (Griffiths et al, 1977). A couple of small tundra streams enter the bay in the vicinity of the wharf sites and are crossed or paralleled by the road to the compressor station.

In summary, the impact of the near-coast route on aquatic resources is acceptable based on the available information and the ability of Arctic Gas to develop an implement environmental design and protection measures.

TABLE 1

LAKES SURVEYED AS POTENTIAL WATER SOURCES, 1976

Lake Code	Average Depth (m)	Surface Area (m^2 x 1000)	Total Estimated Volume	Estimated Freewater Volume with 0.73 m of ice	Estimated Freewater Volume with 1.5 m of ice
L-1	1.25	1,164	8,890	3,699	0
L-2	1.8	1,265	13,912	8,268	2,318
L-3	2.0	2,409	29,438	18,691	7,359
L-4	1.5	2,489	22,812	11,710	0
L-5	1.85	1,867	21,104	12,775	3,992
L-6	1.4	803	6,869	3,287	0
L-7	1.9	642	7,453	4,592	1,570
L-8	1.7	1,485	15,425	8,803	1,815
L-9	2.1	522	6,698	4,369	1,913
L-10	1.6	1,224	11,966	6,509	748
L-11	1.8	1,465	16,112	9,580	2,686
L-12	0.6	201	737	0	0
L-13	0.8	442	2,160	188	0
L-14	1.25	1,445	11,036	4,592	0
L-15	0.5	682	2,084	0	0
L-16	2.0	301	3,678	2,336	920
L-17	1.9	361	4,191	2,583	883
L-18	2.4	321	4,707	3,277	1,766
L-19	1.6	321	3,138	1,707	196
L-20	2.8	381	6,518	4,823	3,029
L-21	2.5	482	7,363	5,210	2,943
L-22	1.6	763	7,459	4,055	466
L-23	2.7	1,204	19,862	14,497	8,831
L-24	2.8	521	8,913	6,601	4,145
L-25	2.3	2,369	33,292	22,722	11,578

NOTE: See Figures 3 & 4 for lake locations

Based on: Jones, 1977

TABLE 2

SPRINGS SURVEYED AS POTENTIAL WATER SOURCES, 1976

Name	Code	Mean Depth (m)	Mean Velocity (m/sec)	Discharge m^3/sec.	Discharge cfs	Daily Discharge Imp.Bbl.x1000
Katakturuk-W. Fork	S-1	0.12	0.44	0.24	8.50	-
		0.06	0.05	0.01	0.45	-
(4 channels)		0.05	0.08	0.01	0.39	181
(not used by fish)		0.10	0.15	0.08	2.75	-
Katakturuk-E. Fork	S-2	0.13	0.23	0.22	7.67	-
(2 channels)		0.09	0.21	0.11	3.91	173
Sadlerochit R. (dwarf Arctic char and juvenile Arctic grayling)	S-3	0.25	0.46	1.22	43.20	645
Hula Hula R.	S-4	0.13	0.14	0.14	4.83	153
(2 channels)		0.17	0.20	0.15	5.43	-
Okpilik (Hot Sps.) (minor Arctic char overwintering area)	S-5	0.03	0.10	0.008	0.27	4
Okerokovik R.	S-6	0.03	0.09	0.008	0.31	-
(4 channels)		0.06	0.11	0.035	1.25	-
(not used by fish)		0.04	0.13	0.21	0.75	-
		0.05	0.13	0.03	1.04	50
Ekaluakat R. (Arctic char spawning and overwintering)	S-7	0.13	0.34	0.64	22.40	335
Kongakut Delta	S-8	0.31	0.36	2.08	73.59	-
(4 channels)		0.06	0.40	0.22	7.87	-
		0.04	0.17	0.07	2.56	1558
		0.12	0.27	0.57	20.22	-
Kongakut R.	S-9	0.12	0.30	0.53	18.8	281
Clarence R.	S-10	0.10	0.21	0.07	2.48	37

Note: See Figures 3 & 4 for approximate locations

Based on: Jones, 1977

9. LAND OWNERSHIP

M.P. 00 - M.P. 64.5

The majority of the land within this line segment is owned by the State of Alaska (see Figures 5 and 6). Some of the tracts within the first 10 miles may be subject to leasehold interest. One tract in T 10 N, R 15 E, owned in fee simple by Atlantic Richfield, may be crossed.

The wharf and material stockpile site lying north of CA-01 at M.P. 45.6 and a portion of the permanent project road may be within the now inactive Flaxman DEW line site. The U.S. Federal Government is thought to be in the process of transferring ownership of this site to the State of Alaska. This site does not appear to pose any special problem.

M.P. 64.5 - M.P. 111.2

This entire line sement lies within the Arctic National Wildlife Range.

M.P. 111.2 - M.P. 120.2
M.P. 127.4 - M.P. 136.4

These line segments lie within lands, the surface estate of which was recently conveyed to the Kaktovik Inupiat Corporation under the provisions of the Alaskan Native Claims Settlement Act. Compressor station site CA-03, a material stockpile site, wharf, connecting permanent project road and airstrip, will all lie on these lands.

There seems to be no point in moving the line farther south to miss these lands because it appears that the selection made to date is only a part of the total entitlement, and additional lands to the south of the present selection may be selected by the Corporation in the near future.

Negotiations will have to be carried out with the Katovik Inupial Corporation to obtain the necessary land and land rights.

M.P. 120.2 - M.P. 127.4
M.P. 136.4 - M.P. 200.47

The remaining portion of the right-of-way and land required for various facilities lie within the confines of the Arctic National Wildlife Range. The lands lying between MP 120.2 and 127.4 may be subject to further selection by the Corporation.

10. ADDITIONAL INFORMATION REQUIREMENTS

Vegetation - Revegetation

A detailed vegetation and reclamation ground-sampling program is required to identify the types of vegetation, micro-topography and soil characteristics of terrain types crossed by the route. This information is required to assess and develop tundra stripping, revegetation and other reclamation programs. The use of mulches, takifiers, erosion control blankets and insultating mats will require further evaluation under northern field conditions.

Mammals

Additional work is required on Arctic Fox. The route should be surveyed for potential denning habitat and active denning concentrations. Some information is available on the Jago River delta. Important denning areas may also occur in the lower Aichilik River drainage, the lower Egaksrak River drainage, and the lower Kongakut River drainage. Other important areas may exist along the coast itself, and in some of the smaller drainages. This information is required prior to final design to provide input to final route location and the location of other facilities.

Birds

Several reconnaissance bird surveys of the route should be flown during the period May - September. All proposed locations of ancillary facilities along the route should also be surveyed. A document is currently being prepared by NOAA (O.C.S. Project) which will incorporate data that was collected during 1976. This document may shed further light on waterbird use of the Alaska Beaufort Sea cost.

Aquatic Resources

Detailed investigations are required of all lakes and streams along the route to further assess fisheries potential and water availability. Detailed investigations are also required of all borrow sites on beaches and any dredging sites.

Land Ownership

A detailed land search should be undertaken to provide complete details of land ownership.

11. RECOMMENDATIONS

In addition to the recommendations made to Arctic Gas in consultant reports, those contained in the 1974 Application, and those presented to hearings and contained in testimony, the following recommendations are pertinent to the near-coast route.

11.1 Compressor Station CA-02, Bullen Wharf and Associated Facilities

It is recommended that CA-02 and associated facilities be moved either east to the Brown Low DEW Line site or west 2-4 miles to the vicinity of Cabin Point.

11.2 Compressor Station CA-03

Noise abatement measures should be employed at this compressor station site. The runway should be oriented to minimize disturbance to coastal waterfowl habitat.

11.3 Compressor Station CA-04, Demarcation Bay Wharf and Associated Facilities

It is recommended that the Demarcation Bay wharf and associated facilities be located east of Demarcation Bay in the Gordon vicinity. Maximum noise abatement should be employed at the compressor station site. The runway should be oriented to minimize disturbance to Snow Geese habitat east of the site.

11.4 It is recommended that the route in the Camden Bay area be moved further inland to enhance the revegetation potential of disturbed terrain.

11.5 All "summer activities" schedules should be developed to limit interference with caribou presence/movements, Snow Goose staging and Arctic fox denning. That portion of the near-coast route from the Alaska-Yukon Territory border west to the Jago River vicinity could probably be worked best after mid-July when caribou are often not present and prior to mid-August when Snow Geese traditionally arrive. Major summer activities west of the Jago River area should be planned for after mid-July to avoid conflict with the post-calving aggregation of caribou. Late summer and fall is generally the preferred season for all major "summer activities".

11.6 All permanent access roads between the coast and the compressor station sites should be designed with as low a profile as possible to accommodate caribou movement. Raised gravel roads which caribou could not see over or which have steep shoulders could represent a modified barrier to caribou moving eastward in late June and July. If large numbers of caribou cross such roads, road shoulders could be broken down and lead to increased maintenance requirements.

Based on observations of various caribou ramps and animal crossings experimented with and/or built in the Prudhoe Bay vicinity, it is recommended that roads be limited to 3 feet or less in height and shoulders be limited to a 20% or less slope except in depressions or other areas where large amounts of fill are required.

11.7 Policies prohibiting the feeding of polar bears and other wildlife should be strictly enforced. All personnel should be educated on the predatory habits of polar bears and cautioned against approaching polar bears for any reason. The use of permanent camp dogs to forewarn of the approach of polar bears would be valuable and should be considered.

11.8 Immediately prior to the commencement of winter construction activity all potential polar bear denning areas should be surveyed for denning bears. Prior agreements should be made with the U.S. Fish and Wildlife Service and Alaska Department of Fish and Game on procedures for handling bears.

11.9 Aerial surveys along the coastal zone should be conducted in the October-November period and the March-April period of the construction year to assess sea ice conditions and the numbers and distribution of polar bears. In some years, near-shore densities may be relatively high. This information would be used to assess the likelihood of encounters and to develop appropriate management programs.

11.10 Ancillary facilities such as communication towers should be located as near the route as possible and the current yearly ranges of the muskoxen, caribou and Snow Geese avoided where possible.

11.11 Following construction an evaluation of fox den site disturbance should be made and consideration given to creating artificial "dens" in areas where suitable habitat is limited.

11.12 In several cases, stream crossings are located so as to cross two or more separate channels of the same stream. On the Katakleurk River for example, if the crossing were moved approximately 1/2 mile upstream, only one channel crossing would be required.

12. REFERENCES

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MILE POST	FACILITY DESCRIPTION	LAND USE	
		AREA ACRES	BORROW YD^3
0.0	METER STATION	3.44	25,000
	O & M SITE	8.04	78,000
15.0	BLOCK VALVE		2,000
30.0	BLOCK VALVE		2,000
45.6	CA-01 COMPRESSOR STATION PAD	24.79	150,000
	ROAD (4.5 mi)	65.45	225,000
	BULLEN - WHARF & STOCKPILE	30.00	235,000
	- AIRSTRIP (2400')	100.00	160,000
61.0	BLOCK VALVE		2,000
67.0	PIPELINE RIGHT OF WAY	974.54	
	TOTAL SPREAD ''D''	1,206.26	879,000

PROPOSED PIPELINE ROUTE MAP
MP - 0 TO MP - 90
PRUDHOE BAY TO ALASKA-YUKON BORDER
NEAR COASTAL ROUTE

FIGURE 1

THIS MAP HAS BEEN TAKEN FROM ORIGINAL PRINTED BASE MAPS PREPARED AND SUPPLIED BY THE DEPARTMENT OF MINES AND RESOURCES ONTO WHICH THE APPLICANT HAS SUPERIMPOSED THOSE INSTALLATIONS AND FACILITIES RELEVANT TO THIS APPLICATION.

AUGUST 1976

SCALE 1 : 250,000

MILES 5 0 5 10 15 20

KILOMETRES 5 0 5 10 15 20 25 30

LEGEND:

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
- HELIPAD
- PREFERRED BORROW PIT
- ALTERNATE BORROW PIT
- MATERIAL STOCKPILE
- PIPELINE ROUTE
- PERMANENT PROJECT ROAD
- PERMANENT ROAD
- TEMPORARY ACCESS SNOW ROAD
- BLOCK VALVE
- AIRSTRIP

DESIGNED BY :
CHECKED BY :
APPROVED BY :
PROJ. MANAGER :

NORTHERN ENGINEERING SERVICES COMPANY LIMITED

ALASKAN ARCTIC GAS STUDY LIMITED

REVISED :
DATE : FEB. 1977
PROJ. NO :
DWG. NO : 3D-0251-1001

MILE POST	FACILITY DESCRIPTION	LAND USE	
		AREA ACRES	BORROW YD^3
76.0	BLOCK VALVE		2,000
90.7	CA-02 COMPRESSOR STATION PAD	24.79	150,000
	ROAD (1.9 MI)	27.65	95,000
	CAMDEN BAY		
	WHARF & STOCKPILE	30.00	235,000
	AIRSTRIP (2400')	100.00	160,000
105.0	BLOCK VALVE		2,000
121.0	BLOCK VALVE		2,000
134.0	PIPELINE RIGHT OF WAY	974.54	
	TOTAL SPREAD ''A''	1,156.98	646,000
134.2	CA-03 COMPRESSOR STATION PAD	24.79	150,000
	ROAD (4.0 MI)	58.20	200,000
	JAGO LAGOON		
	WHARF & STOCKPILE	30.00	235,000
	AIRSTRIP (2400')	100.00	160,000
151.0	BLOCK VALVE		2,000
167.0	BLOCK VALVE		2,000
184.1	CA-04 COMPRESSOR STATION PAD	24.79	150,000
	ROAD (4.4 MI)	64.02	220,000
	DEMARCATION BAY		
	WHARF & STOCKPILE	30.00	235,000
	AIRSTRIP (2400')	100.00	160,000
200.5	PIPELINE RIGHT OF WAY	967.58	
	TOTAL SPREAD ''C''	1,399.38	1,514,000

PROPOSED PIPELINE ROUTE MAP
MP-90 TO MP-200.5
PRUDHOE BAY TO ALASKA-YUKON BORDER
NEAR COASTAL ROUTE

FIGURE 2

THIS MAP HAS BEEN TAKEN FROM ORIGINAL PRINTED BASE MAPS PREPARED AND SUPPLIED BY THE DEPARTMENT OF MINES AND RESOURCES ONTO WHICH THE APPLICANT HAS SUPERIMPOSED THOSE INSTALLATIONS AND FACILITIES RELEVANT TO THIS APPLICATION.

AUGUST 1976

SCALE 1 : 250,000

MILES 5 0 5 10 15 20

KILOMETRES 5 0 5 10 15 20 25 30

LEGEND

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
- HELIPAD
- PREFERRED BORROW PIT
- ALTERNATE BORROW PIT
- MATERIAL STOCKPILE
- PIPELINE ROUTE
- PERMANENT PROJECT ROAD
- PERMANENT ROAD
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- AIRSTRIP

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PROJ. MANAGER :	

NORTHERN ENGINEERING SERVICES COMPANY LIMITED

ALASKAN ARCTIC GAS STUDY LIMITED

REVISED :	
DATE :	FEB. 1977
PROJ. NO :	
DWG. NO :	3D - 0251-1002

NOTE:

THE LAKES AND SPRINGS MARKED ON THIS MAP WERE SURVEYED IN 1975 AS POTENTIAL WATER SOURCES FOR PIPELINE DEVELOPMENT.

FOR MORE COMPLETE INFORMATION SEE A REPORT BY: M. L. JONES, 1976. WATER AVAILABILITY ALONG THE PROPOSED ARCTIC GAS PIPELINE ROUTE FROM PRUDHOE BAY, ALASKA TO THE MACKENZIE DELTA, NORTHWEST TERRITORIES. ARCTIC GAS BIOLOGICAL REPORT SERIES.

WATER AVAILABILITY
PRUDHOE BAY TO ALASKA-YUKON BORDER NEAR COASTAL ROUTE

FIGURE 3

THIS MAP HAS BEEN TAKEN FROM ORIGINAL PRINTED BASE MAPS PREPARED AND SUPPLIED TO THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT BY ARCTIC GAS. AS REQUESTED, THOSE INSTALLATIONS AND FACILITIES RELEVANT TO THIS APPLICATION. AUGUST 1976

SCALE 1:250,000

5 0 5 MILES 10 15 20

5 0 5 10 15 20 25 30 KILOMETRES

LEGEND

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
- HELIPAD
- PREFERRED BORROW PIT
- ALTERNATE BORROW PIT
- MATERIAL STOCKPILE
- PIPELINE ROUTE
- PERMANENT PROJECT ROAD
- PERMANENT ROAD
- TEMPORARY ACCESS SNOW ROAD
- BLOCK VALVE
- AIRSTRIP

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APPROVED BY:
PROJ. MANAGER:

NORTHERN ENGINEERING SERVICES COMPANY LIMITED
ALASKAN ARCTIC GAS STUDY LIMITED

REVISED:
DATE: FEB. 1977
PROJ. NO.:
DWG NO.:

NOTE:

THE LAKES AND SPRINGS MARKED ON THIS MAP WERE SURVEYED IN 1975 AS POTENTIAL WATER SOURCES FOR PIPELINE DEVELOPMENT.

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WATER AVAILABILITY

PRUDHOE BAY TO ALASKA-YUKON BORDER NEAR COASTAL ROUTE

FIGURE 4

THIS MAP HAS BEEN TAKEN FROM ORIGINAL PRINTED BASE MAPS PREPARED AND SUPPLIED BY THE DEPARTMENT OF MINES AND RESOURCES ONTO WHICH THE APPLICANT HAS SUPERIMPOSED THOSE INSTALLATIONS AND FACILITIES RELEVANT TO THIS APPLICATION.

AUGUST 1976

SCALE 1 : 250,000

MILES 5 0 5 10 15 20

KILOMETRES 5 0 5 10 15 20 25 30

LEGEND:

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
- HELIPAD
- PREFERRED BORROW PIT
- ALTERNATE BORROW PIT
- MATERIAL STOCKPILE
- PIPELINE ROUTE
- PERMANENT PROJECT ROAD
- PERMANENT ROAD
- TEMPORARY ACCESS SNOW ROAD
- BLOCK VALVE
- AIRSTRIP

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APPROVED BY:	
PROJ. MANAGER:	

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ALASKAN ARCTIC GAS STUDY LIMITED

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DATE:	FEB. 1977
PROJ NO.:	
DWG NO.:	

LAND OWNERSHIP

PRUDHOE BAY TO ALASKA-YUKON BORDER
NEAR COASTAL ROUTE

FIGURE 5

THIS MAP HAS BEEN TAKEN FROM ORIGINAL PRINTED BASE MAPS PREPARED AND SUPPLIED BY THE DEPARTMENT OF MINES AND RESOURCES ONTO WHICH THE APPLICANT HAS SUPERIMPOSED THOSE INSTALLATIONS AND FACILITIES RELEVANT TO THIS APPLICATION.

AUGUST 1976

SCALE 1 : 250,000

MILES 5 0 5 10 15 20

KILOMETRES 5 0 5 10 15 20 25 30

LEGEND:

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
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- PREFERRED BORROW PIT
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- PERMANENT PROJECT ROAD
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- TEMPORARY ACCESS SNOW ROAD
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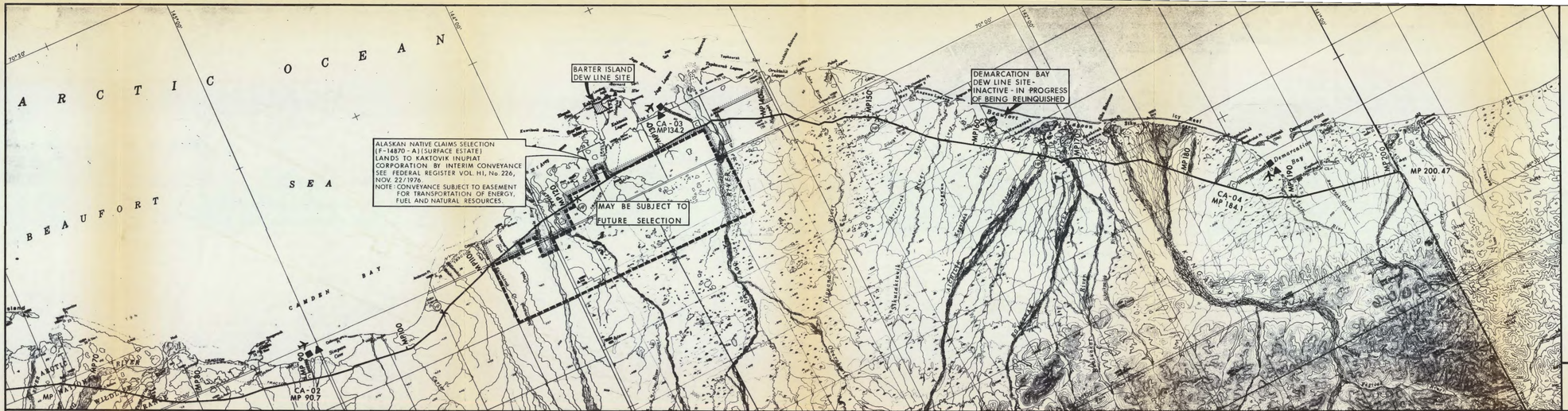

LAND OWNERSHIP

PRUDHOE BAY TO ALASKA-YUKON BORDER NEAR COASTAL ROUTE

FIGURE 6

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AUGUST 1976

SCALE 1:250,000

5 0 5 MILES 10 15 20

5 0 5 10 15 20 25 30 KILOMETRES

LEGEND:

- COMP. STN. & STOCKPILE
- COMPRESSOR STATION
- METER STATION
- WHARF
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