Reconnaissance Study for

Kotzebue to Chicago Creek Highway Project

Project Number — A 80351

Volume I

State of Alaska
Department of Transportation & Public Facilities
Division of Highway Design & Construction
2301 Peger Road, Fairbanks, Alaska 99701

submitted by

MICHAEL BAKER, JR., INC.
ENGINEERS & SURVEYORS

FAIRBANKS, ALASKA
DECEMBER, 1981

RECONNAISSANCE STUDY FOR
KOTZEBUE TO CHICAGO CREEK
HIGHWAY PROJECT
Project Number-A 80351

VOLUME I

submitted to

State of Alaska

Department of Transportation & Public Facilities

Division of Highway Design & Construction

MICHAEL BAKER, JR., INC.

Fairbanks, Alaska

December 1981

KOTZEBUE TO CHICAGO CREEK

RECONNAISSANCE STUDY

VOLUME I

TABLE OF CONTENTS

VOLUME II

TABLE OF CONTENTS

KOTZEBUE TO CHICAGO CREEK

RECONNAISSANCE STUDY

LIST OF FIGURES

KOTZEBUE TO CHICAGO CREEK

RECONNAISSANCE STUDY

LIST OF TABLES

1.0 INTRODUCTION

1.1 PROJECT LOCATION

This report presents the recommended route alignment, and study results for an all-weather highway connecting the town of Kotzebue, Alaska with a point near the coal mines on the Kugruk River just south of its confluence with Chicago Creek. The nearest community to the Chicago Creek terminus is the village of Deering, Alaska, which is approximately 14 miles northwest of the terminus. (See Figure 1-1)

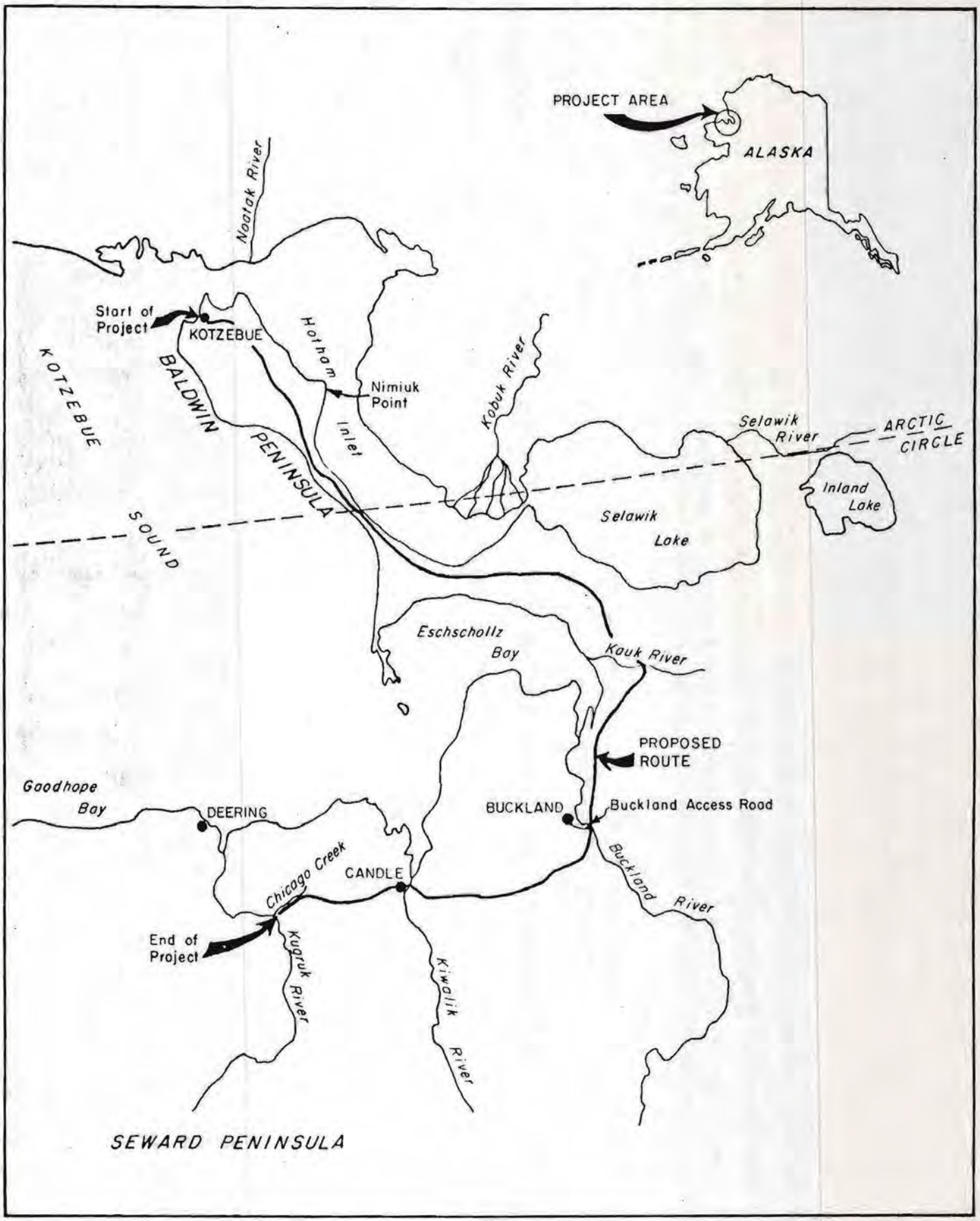
1.2 SCOPE OF WORK

The State of Alaska Department of Transportation and Public Facilities (ADOT/PF), Division of Highway Design and Construction, engaged Michael Baker, Jr., Inc. to perform a reconnaissance study and recommend a highway route from Kotzebue to Chicago Creek, as Project A-30351. The reconnaissance study began on August 3, 1981. The final report for the study and a set of color aerial photographs at a scale of 1 inch = 1000 feet was submitted in December 1981.

The scope of work for this reconnaissance phase is shown in Appendix I. Previous roadway studies completed for the Seward Peninsula for the Department of Transportation and Public Facilities are:

1. Western Access Road Reconnaissance Study by the State of Alaska, Department of Highways Western District, 1973.
2. Western and Arctic Alaska Transportation Study, Nome - Kotzebue Road, Louis Berger and Associates in association with Philleo Engineering and Architectural Service, Inc., 1980.

Figure 1-1



PROJECT LOCATION

1.3 METHOD OF STUDY

1.3.1 General

The work plan for accomplishing the project consisted of the following primary project activities:

- o Collection and Analysis of Existing Pertinent Data
- o Aerial Reconnaissance of Corridor (fixed wing aircraft)
- o Identification of Route Alternatives, Environmental Concerns and Land Ownership Status.
- o On Site Investigation of Proposed Routes (helicopter)
- o Route Selection and Final Report Preparation

1.3.2 Collection and Analysis of Existing Data

The initial activity of this project was thorough and detailed collection, review and analysis of all pertinent data and information for the Kotzebue to Chicago Creek Corridor. This research effort included the analysis of all existing available photos, reports, maps, land ownership information, and hydrological, topographic and materials data. Particular attention was given to the review of environmental information pertaining to the Corridor.

It was during this phase of the project that a data base was collected which included the following route selection considerations:

- o Climatology
- o Geology
- o Economics
- o Environmental Factors
- o Land Ownership/Use Permits
- o Hydrology
- o Highway Design Parameters
- o Service Points

Aerial photos utilized early in the study were 1:60,000 color, infrared (1978) and 1:40,000 black and white, ca. 1950.

The research, analysis and evaluation of the existing data on the Kotzebue to Chicago Creek Corridor formed the basis for the selection of the alternate routes given further study during this project. These routes were chosen primarily on the basis of tolerable grades, anticipated foundation conditions, and proximity to anticipated material-producing landforms and service points.

1.3.3 Aerial Reconnaissance of Corridor

The second phase consisted of an aerial reconnaissance of the general route alternatives. A fixed wing C-206 aircraft was used by the reconnaissance team. The reconnaissance area was investigated in this manner on four consecutive days. The preliminarily chosen routes were flown to confirm the data supporting their selection. Major river crossings were investigated for the most desirable alignments and bridge locations. Team members were able to familiarize themselves with the general topography of the corridor, and to verify previous photo interpretations. This activity better enabled the project team to relate aerial photos and topography maps to actual route conditions.

1.3.4 Identification of Route Alternatives

Upon the completion of the analysis of existing data and aerial reconnaissance of the Kotzebue to Chicago Creek Corridor, the Project Team identified the most favorable possible route(s) for the highway.

The selection process of the most promising route alternates was based on evaluation of the following basic route location factors:

- o economics
- o highway design parameters and service points
- o climatic factors
- o bridge sites

- o environmental concerns
- o topography
- o hydrology
- o material site prospects
- o foundation conditions
- o land use permits/authorizations

A major emphasis was placed on the analysis and interpretation of existing aerial photography as verified to the extent possible by fixed wing overflight.

A multi-disciplined Project Team approach was utilized to assure that proper consideration was given to each of the above mentioned route location factors.

1.3.5 On Site Investigations

Once the number of routes were reduced to one or two alternatives, a limited number of on site inspections of these candidate routes utilizing helicopter flights with numerous landings were conducted.

The information collected during these on site investigations was of substantial aid in making the final route selection. More specifically, the purpose of the on-the-ground inspections was to:

- o Familiarize the Project Team members with actual terrain conditions.
- o Investigate soils conditions along the route.
- o Collect site-specific environmental data.
- o Inspect major stream crossing locations to observe foundation conditions, length of spans required, alignments, approach gradients and apparent highwater levels.
- o Obtain numerous photographs from hand held cameras of conditions along the proposed route (photos were indexed, dated and identified).

In order to determine the number and location of on-the-ground inspections for each alternate route, careful pre-planning and scheduling of the work was

accomplished prior to initiating the on site inspections. Project Team members developed data check lists and prepared predesignated flight plans.

Two Bell 206-B helicopters were utilized for this phase of the project. One helicopter team investigated that portion of the project from Kotzebue to the Buckland area, the second helicopter team investigated that portion of the route from Buckland to Chicago Creek. Additional fuel was flown to Candle prior to this phase of the project in order to maximize working helicopter time available to team members.

Equipment utilized by team members in the field consisted of abney levels, brunton compass, hand held augers, and smooth 3/8" round frost probes.

1.3.6 Aerial Photography and Preparation of Mosaics

Upon completion of the on site investigation phase of the study, the proposed highway alignment was plotted on 1:63,360 U.S.G.S. quadrangle maps and submitted to the aerial photo subcontractor to complete the required color photo coverage at the scale 1" = 1000'. Aerial photography was completed on September 27, 1981.

1.3.7 Route Selection, Alternates and Report Preparation

Based on the detailed analysis and evaluation of all of the information and data collected and the field inspections conducted during the above discussed phases of this project, a single basic route was selected as the optimum route between Kotzebue and Chicago Creek. The route selection process involved the coordination weighting, and evaluation of all of the highway location factors previously discussed. Inputs to this selection phase of the project were obtained from all of the Project Team members.

Environmentally sensitive areas and issues were identified and a determination made of the level of environmental assessment necessary to obtain the required permits for road construction. Also, the ownership status of all lands along the route was defined.

The preparation of the project report commenced approximately at the midpoint of the project. This report presents a description of the recommended route and documents the study methodology employed, data collected, results and recommendations.

Volume II of this report includes a contact mylar half tone mosaic presentation of the photography, at the scale of 1" = 1000', on which the recommended route alignment is superimposed.

One alternate route which was evaluated was the Kotzebue to Cape Blossom section along the western shoreline of the Baldwin Peninsula. This route would leave Kotzebue and cross the active runway which is a major obstacle. Proposed extensions of the runway would block access to the south. Relocation of the existing access road beyond the Airport Clear Zone was not possible due to existing physical limitations. The remainder of the route to Cape Blossom crosses numerous native allotments along the beach or muskeg lowlands inland for approximately eight miles. Another problem is the route from Cape Blossom easterly, approximately eleven miles, crosses numerous native allotments in muskeg lowlands with no apparent material sources near this roadway section. This roadway section would take a large material source of extraordinary high cost to construct.

Other alternate routes were evaluated along the eastern portion of the Baldwin Peninsula to Mile 25 and from Mile 50 to Mile 64. The alternates were longer in most cases and did not provide benefits which would provide an economic route.

An alternate route from Mile 25 to Mile 97 to the east along the ridge tops was considered, but due to the greater length and higher elevations it was not selected as the preferred route.

Many other alternate routes were evaluated between the Kauk River and Chicago Creek but were longer with steep grades and greater horizontal alignment. Some poor soil conditions and economic haul distances eliminated the alternate route across and along the Kauk River Flats.

These are not all the alternate routes investigated and evaluated but are the major alternates. Upon design further investigations will be required to include soils and material source exploration and field surveys for the recommended route.

2.0 RECONNAISSANCE AREA DESCRIPTION

2.1 HISTORY

The history of the reconnaissance area is an ancient one. The Seward Peninsula and the Baldwin Peninsula are remnants of the Bering Land Bridge across which it is postulated that man came to North America from Asia over 14,000 years ago. The cultures based upon hunting, fishing, gathering, and trading continued to evolve in the region without much outside influence until early in the nineteenth century.

A German Estonian, Otto von Kotzebue, sailing for the Russain Navy in search of a northwest passage to the Atlantic Ocean gave the sound his name during his 1816 voyage. The remainder of the century saw only sporadic visitors. These men came to the region to trade, hunt whale, and continue their futile search for the passage to the Atlantic. Christianity came to the region in 1897 when the Friend's Church built a mission in Kotzebue.

The discovery of gold on the Seward Peninsula in the early 1900's brought more population to the region. The gold mining community of Candle had a population of some 2000 during its peak in 1902 and 1903. Coal was mined at Chicago Creek and on the Kugruk River until 1947.

Many of the people of the region today are natives of the Kotzebue Sound, the Kobuk, Noatak, Buckland, and Selawik Rivers , and coastal areas. Also many of the people are descendants of traders, ex-whalers, missionaries, teachers, and miners from many national origins.

Today the population of Kotzebue is approximately 2000 persons. Figures obtained from the Governor's office in Fairbanks indicate the current population of Buckland is 175 persons and the population of Candle is 8 persons.

Kotzebue is the gateway to the more remote villages in the area. Three major river systems drain into Kotzebue Sound, the Noatak, Kobuk and Selawik. Kotzebue is a transfer point between ocean and inland shipping as well as a major air transport service center for the region. No regular overland transportation network currently exists in the area. Kotzebue was incorporated in 1958 and has a city manager form of government. The city water and sewer systems were developed by the U.S. Public Health Service and are now managed by the city. The Kotzebue Electric Association has supplied power since 1955 by use of a diesel power plant.

Buckland is located on the west bank of the Buckland River approximately 75 miles southeast of Kotzebue. The village has been in several locations in recent time as conditions have changed, affecting the village subsistance economy. At the present location the village was originally on the northeast bank of the river but moved to the present location due to extensive erosion and flooding. The area surrounding Buckland is frequently flooded during spring break-up as a result of ice jamming. In 1971 the residents were evacuated to higher ground. Newly constructed homes were not damaged but the majority of the airstrip was under water. Buckland was again flooded in 1972 due to ice jamming. The U.S. Public Health Service has developed a central water supply. Household sewage is emptied into disposal bunkers then deposited into a sewage lagoon northwest of the village.

A village co-op provides electricity. Major transportation modes are plane, small boat, barge and snow machine as there are no roads outside of the village. Approximately 12 new homes were under construction during the reconnaissance.

Candle lies southwest of Buckland approximately 25 miles. Candle began just after the turn of the century as a gold mining camp. The name Candle was derived from Candlewood willows which grow in the area. Recent favorable gold prices have generated substantial mining activity in the area. Candle is also the center of reindeer herding activity.

Chicago Creek is approximately 17 miles east of Candle. Seasonal gold mining activity is currently underway by the same persons associated with the mining activity at Candle. Coal deposits were observed from the air but they are not being mined at present.

2.2 CLIMATOLOGY

2.2.1 General

The reconnaissance area is located within a transitional zone between maritime and continental climate types.

The climate is characterized by cool, humid summers during the three months that Kotzebue Sound and Hotham Inlet are free of ice. Summer brings cloudy skies, fog, and generally westerly winds.

As the Kotzebue Sound ices over, the maritime influenced climate approaches a continental type of climate. Winter temperatures are very low but are moderated by cyclonic storms and the Arctic Ocean, which is often relatively free of ice. Winter skies are generally clearer than in the summer, and winds are generally easterly.

The climate of the entire reconnaissance area is generalized in this manner since the selected route varies only about 75 miles north to south and does not go far enough inland to significantly lose the maritime effect. Furthermore there are no significant sheltering terrain features to divert the air movement or storm patterns.

Tides and current movements in the vicinity of Kotzebue are complex and have received little study. In general the tides are mixed, semidiurnal type and have a range of 1.5 feet. At times this pattern is obscured by large flows from the Noatak and Kobuk rivers or by storm surges from the west.

2.2.2 Climatic Data

The climatic data is presented in Table 2-1, 2-2, and 2-3 and Figures 2-1, and 2-2. The data was obtained from several sources and the various items have different periods of record.

TABLE 2-1

TEMPERATURE AND PRECIPITATION AT KOTZEBUE

MONTH	TEMPERATURE (°F)					PRECIPITATION (IN INCHES)							HEATING DEGREE DAYS
	Means			Extr.					Snow, Ice Pellets				
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Record Lowest	Mean	Greatest Daily	Greatest Monthly	Mean	Greatest Daily	Greatest Monthly	Greatest Depth on Ground	
(a)				33	33							26	
J	3.2	-10.6	-3.7	39	-47	0.29	0.81	1.77	6.0	10.0	23.9	33	2130
F	3.3	-11.8	-4.3	35	-52	0.30	0.68	1.13	5.4	6.8	14.0	34	1940
M	8.1	-9.1	-0.5	39	-48	0.33	0.47	1.23	5.7	8.6	21.9	35	2031
A	22.3	3.7	13.0	46	-44	0.33	0.36	1.34	5.2	4.6	18.1	47	1560
M	37.8	23.7	30.8	74	-18	0.40	0.56	0.94	1.7	3.5	12.0	34	1060
J	49.6	37.3	43.5	83	20	0.52	0.80	1.32	0.2	2.1	2.4	8	645
J	58.7	47.1	52.9	85	34	1.55	1.78	2.98	T	0.1	0.1	T	375
A	55.9	45.4	50.7	80	31	2.26	1.48	5.18	T	0.3	0.3	0	443
S	46.5	35.7	41.1	68	15	1.43	0.94	2.85	1.2	7.4	7.4	4	717
O	28.7	18.5	23.6	51	-19	0.61	0.54	1.53	6.9	18.0	18.0	11	1283
N	13.4	2.0	7.7	38	-36	0.41	0.43	1.31	8.2	6.3	17.1	21	1719
D	2.6	-10.3	-3.9	36	-47	0.33	0.40	0.79	6.9	7.5	19.3	23	2136
YR	27.5	14.3	20.9	85	-52	8.76	1.78	5.11	47.4	10.0	23.9	47	16039

(a) Period of record years

Reference: Selkregg, L., Kotzebue, a village profile

TABLE 2-2

WIND AND HUMIDITY AT KOTZEBUE

	MEAN SPEED (mph)	PREVAILING DIRECTION	RELATIVE HUMIDITY %
J	15.3	E	71
F	14.3	E	72
M	13.2	E	73
A	13.4	ESE	79
M	10.3	W	84
J	12.2	W	85
J	12.9	W	83
A	13.9	W	86
S	13.0	ESE	85
O	13.6	NE	84
N	13.9	ESE	78
D	12.9	NE	72
YEAR	13.3	W	79
P.O.R.	13	14	14

Reference: Wilson, C., CRREL Monograph I-A3b

TABLE 2-3

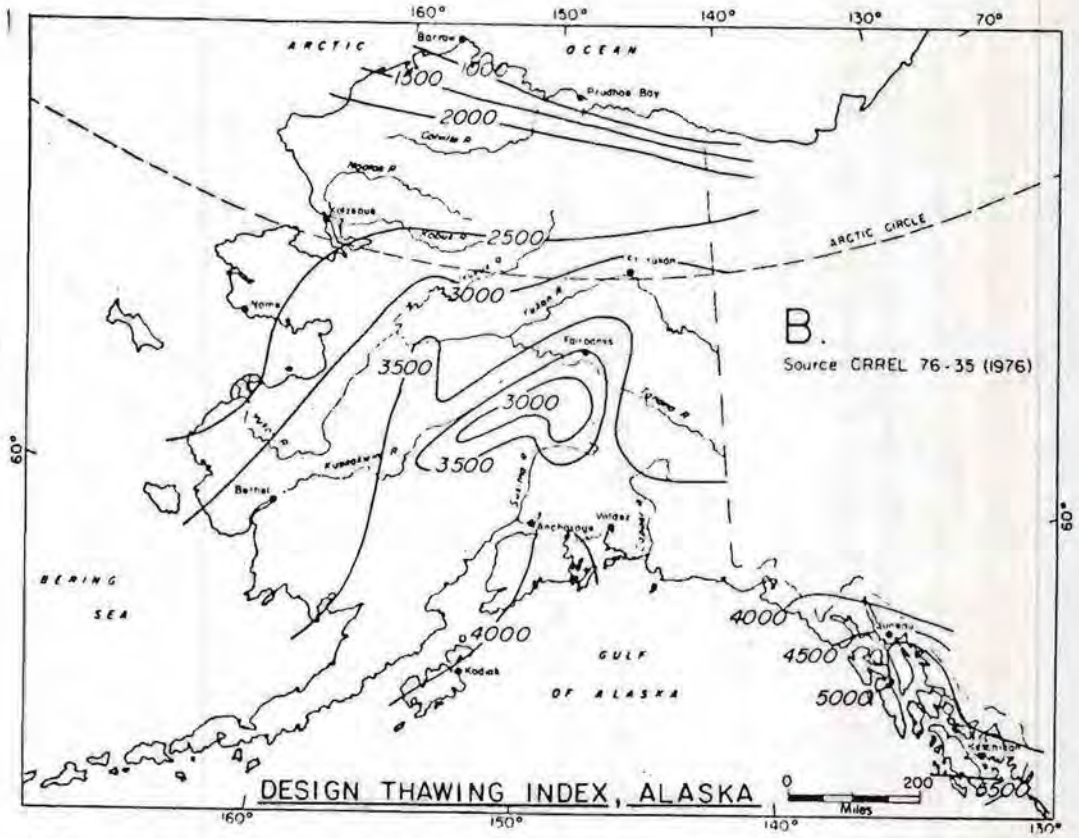
TEMPERATURE AND PRECIPITATION AT CANDLE
(considered representative of Buckland)

MONTH	TEMPERATURE (°F)					PRECIPITATION (IN INCHES)							HEATING DEGREE DAYS
	Means			Extr.					Snow, Ice Pellets				
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Record Lowest	Mean	Greatest Daily	Greatest Monthly	Mean	Greatest Daily	Greatest Monthly	Greatest Depth on Ground	
(a)	15	15		20	20	5-17	5-17	5-17	6	6	6	6	
J	-2.6	-19.7	-11.2	38	-60	0.55	0.75	1.71	4.8	7.0	14.9	34	2362
F	1.7	-15.8	-7.1	38	-56	0.44	0.19	1.17	3.6	2.5	8.5	40	2037
M	10.2	-6.7	-1.8	39	-48	1.00	0.81	1.87	8.6	4.0	15.0	44	2071
A	20.4	-0.1	10.2	50	-36	0.17	0.09	0.50	3.3	4.0	10.5	21	1644
M	40.3	23.3	31.8	80	-15	0.44	0.44	1.15	1.0	7.0	3.0	25	1029
J	57.5	35.6	46.6	82	22	0.73	0.80	1.93	0.0	0.0	0.0	0	552
J	63.4	42.4	52.9	85	24	1.20	0.80	2.44	0.0	0.0	0.0	0	375
A	59.3	40.7	50.0	85	22	1.46	0.75	2.78	0.2	2.0	2.0	0	465
S	47.8	32.8	40.3	75	6	1.23	0.54	2.23	0.2	1.0	1.0	0	741
O	30.6	17.8	24.2	57	-26	0.62	0.36	1.22	4.8	3.0	13.3	10	1265
N	13.0	-3.0	5.0	43	-43	0.36	0.18	0.60	3.8	2.0	11.5	11	1800
D	1.4	-13.9	-6.3	37	-49	0.37	0.23	0.70	5.6	2.0	13.4	19	2210
YR	28.6	11.1	19.9	85	-60	8.57	0.80	2.78	35.9	7.0	15.0	44	16551

(a) Period of record-years
Reference: Selkregg, L., Buckland, a village profile

FIGURE 2-1

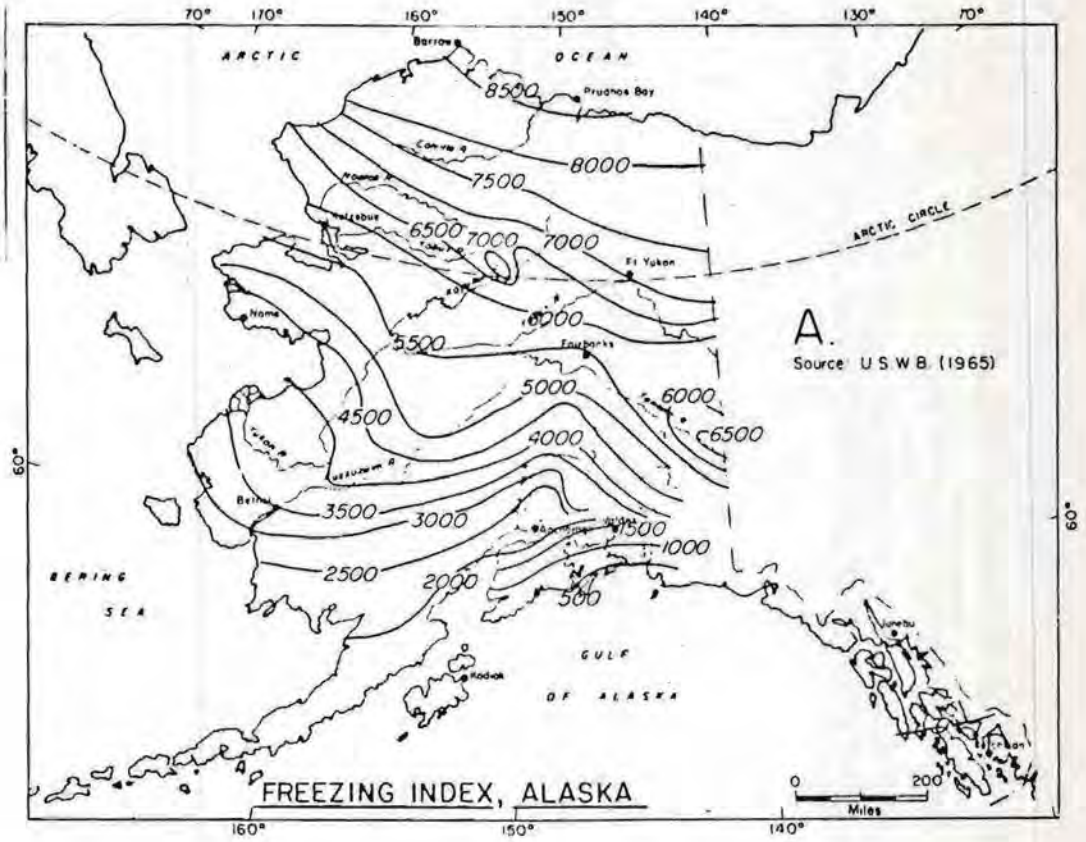
THAWING INDICES

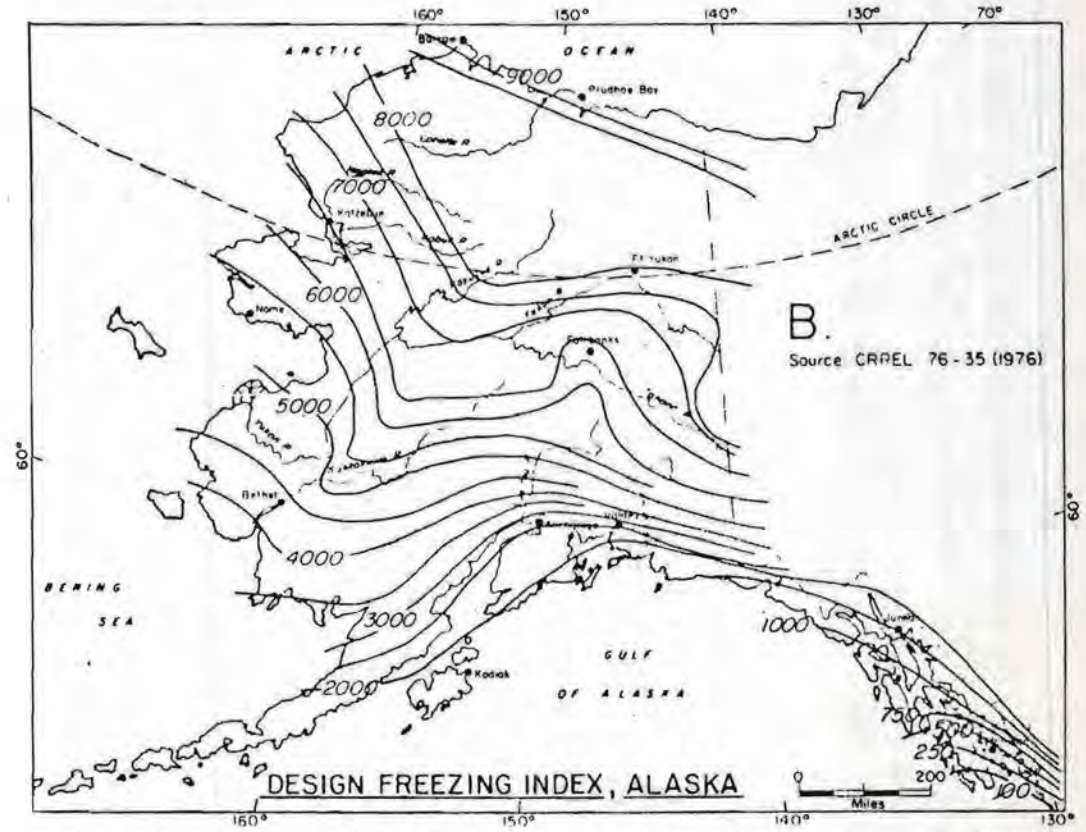


References: University of Alaska, Environmental Atlas of Alaska

FIGURE 2-2

FREEZING INDICES





References: University of Alaska, Environmental Atlas of Alaska

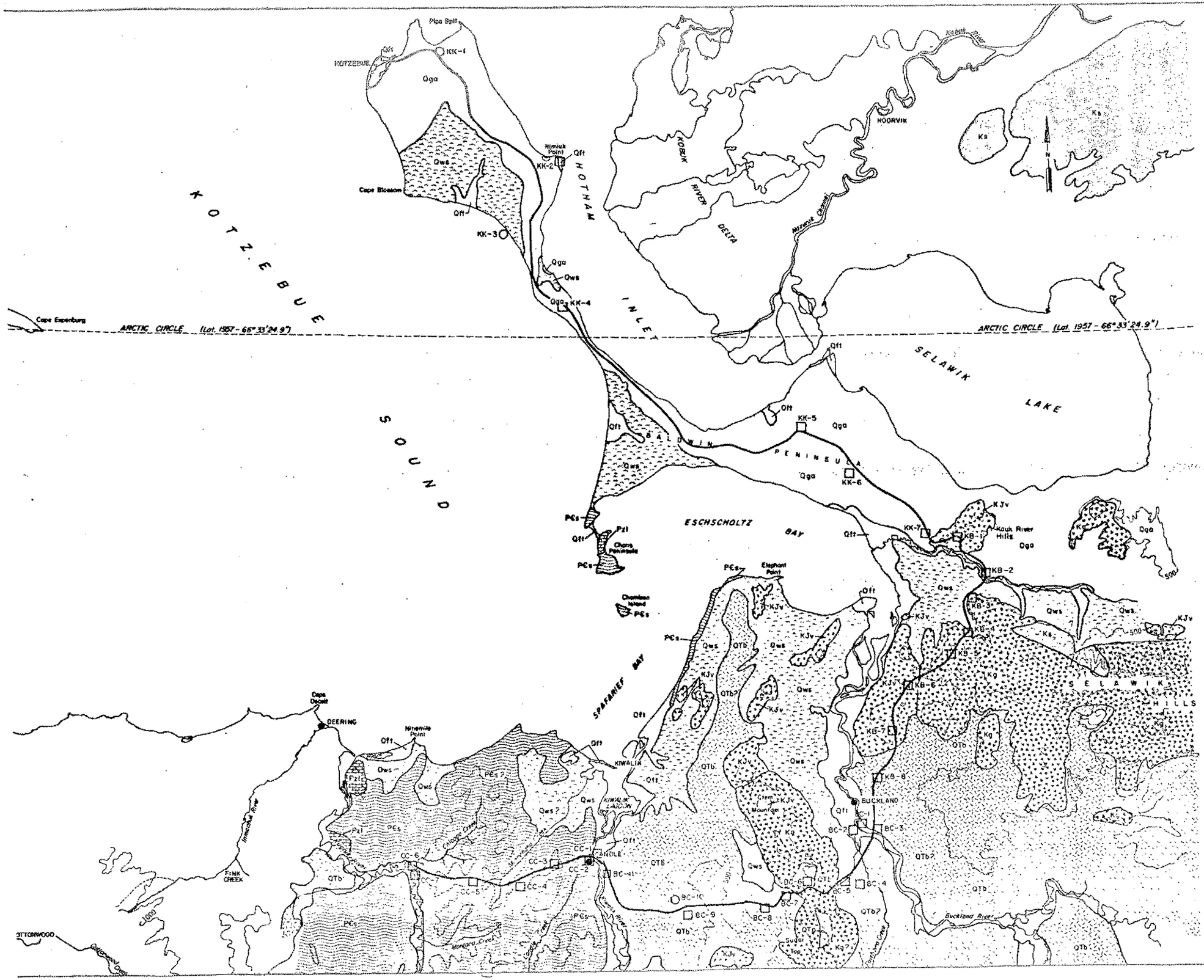
2.3 GEOLOGY (See Map 1)

2.3.1 General Geology

The proposed route crosses two physiographic terrain units. The Baldwin Peninsula area is an old glacial feature (moraine) which has been extensively modified by erosion and wind deposition. The higher areas of the peninsula are underlain by glacial till, including deformed clayey sediments, clayey gravel till, and outwash deposits. These are mantled by wind blown silt in depths up to 50 feet. Subsequent to the silt deposition these areas of the peninsula have undergone surface modification by gullying and frost action such as solifluction and thaw lake formation. This has resulted in a broad rolling knoll and valley topography with many flat areas of active and dormant thaw lakes. The lower lying portions of the peninsula are relatively recent alluvial or ocean front deposits. The alluvial areas are uniformly silty and covered with thaw lakes while the ocean front deposits are sandy gravel beaches and spits.

The area beginning at the Kauk River Hills and extending to the Kugruk River consists of low relief bedrock hills separated by relatively broad flat bottomed valleys. The bedrock types range from granites and volcaniclastics in the Selawik hills, Kauk River hills, and Clem Mountain vicinity to schists with minor limestone in the uplands between the Kiwalik and Kugruk Rivers. Much of the area, especially from the Buckland River to the Kiwalik is covered by basalt flows of quaternary and/or tertiary age.

The hills from the Kauk River to Clem Mountain are capped by bedrock knobs and ridges with very thin residual soils. Uplands from Clem Mountain to the Kugruk River are underlain by either basalt or schist and have gentle slopes. They



EXPLANATION

QUATERNARY

- **Qff** — Active floodplain and tidal flat deposits, primarily fine grained alluvium with sands and gravels in higher river reaches
- **Qws** — Chiefly reworked eolian and fluvial silt, includes large areas of active and dormant thaw lakes.
- **Qga** — Undifferentiated glacial drift, usually mantled by thick eolian silt deposits.

QUATERNARY AND/OR TERTIARY

- **QTb** — Flows of gray to dark red vesicular basalt, generally mantled by thick eolian silt.

CRETACEOUS

- **Ks** — Sedimentary rocks, conglomerates, sandstone and mudstone, high grade metamorphism on northside of Selawik Hills.
- **Kg** — Granitic rocks, chiefly monzonite and syenite

JURASSIC TO CRETACEOUS

- **KJv** — Wide variety of andesitic tuffs and volcaniclastic rocks.

PALEOZOIC

- **Pzl** — Light gray recrystallized limestone and dolomite.

PRECAMBRIAN

- **PCs** — Quartz mica schist, mica schist, and quartzite. Locally includes thin beds of limestone generally mantled by colluvium and eolian silt.

- Proposed Material Sources, High Probability
- Proposed Material Sources, Low Probability
- Proposed Route

COMPILED FROM :

Patton, Jr., W.W., 1967,
REGIONAL GEOLOGIC MAP OF THE CANDLE QUADRANGLE, ALASKA
U.S. Geologic Survey Miscellaneous Geologic Investigation, Map I-192, scale 1:250,000.

Patton, Jr., W.W. and Miller, T.P., 1968,
REGIONAL GEOLOGIC MAP OF THE SELAWIK AND SOUTHEAST BAIRD MTNS QUADRANGLES, ALASKA,
U.S. Geologic Survey Miscellaneous Geologic Investigation, Map I-530, scale 1:250,000.

Sainsbury, C.L., 1974,
GEOLOGIC MAP OF THE BENDELEBEN QUADRANGLE, SEWARD PENINSULA, ALASKA
pg. 39, map, scale 1:250,000.

Baldwin Peninsula Quaternary features mapped from 1978 color infrared air photos, 1:60,000.

SCALE 1 : 250,000

0 5 10 15 20 25 MILES

CONTOUR INTERVAL = 500 FEET
MAP TAKEN FROM U.S.G.S. TOPOGRAPHIC MAPS

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK
HIGHWAY RECONNAISSANCE PROJECT
RECONNAISSANCE GEOLOGY MAP

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MICHAEL BAKER, JR., INC. – ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9-81	PKH
DRAWN	9-81	ESA
CHECKED		REJ
APPROVED	9-81	PKH

MAP NO 1
PROJECT NO A-80531
DRAWING NO.
SHEET 1 OF 4

are generally mantled by deposits of eolian silt. These deposits may be quite deep (greater than 20 feet) and ice rich.

The river valleys are floored by broad flats of water worked silt deposits, and are bordered by moderate slopes covered with colluvium or slope wash which varies from very rocky to entirely silt depending on the source material of the ridge above. The rivers have very narrow active flood plains which broaden into large active tidal flats at their mouths.

2.3.2 Foundation Conditions

Foundation conditions for the proposed route are quite variable but can be characterized as being generally poor. The entire route lies within the zone of continuous permafrost. Consequently the foundation soils throughout the route are frozen at shallow depths. Due to the fine grained nature of most subgrade soils, the frozen zone is usually ice rich and the soils generally are not thaw stable. In addition, much of the Baldwin Peninsula and the river valleys has been extensively altered by thaw lakes. Where these lakes have been active the soils are generally very organic silts to peat and have high ice contents. They are susceptible to degradation when their thermal regime is altered.

The better foundation soils along the route occur on or near the ridge tops of the upland from the Kauk River to the Kiwalik River. Here the overlying silts either have been removed by erosion or were never present. The soils are gravels with some silt to sand size material and are thaw stable except where they contain excess ice. Foundation materials forming a transition group between the very silty and gravelly soils cover most slopes from the Kauk River Hills to Chicago Creek. The soils are predominantly fine grained, with some gravel. Embankments on this material should be designed on the basis of the Army Corps of Engineers reduced subgrade strength procedure or similar procedure.

The distribution of subgrade soils along the route can generally be directly related to the geomorphic terrain unit in which they occur. These terrain units were mapped on aerial photographs and field checked during helicopter reconnaissance. The mapped units are shown on the photo mosaics and are discussed below.

2.3.2.1 Bedrock Units (Ib-basalt, Iv-volcanic, Ig-granite, Ns-schist)

These units are composed of in-place bedrock or thin residual soils overlying bedrock. The subgrade soils are gravels with varying small amounts of sand silt and clay depending on the weathering products of the particular rock type. The subgrade will generally be thaw stable.

2.3.2.2 Fluvial Units (Fp, Fs)

Terrain Unit Fp includes all recent and active floodplain deposits. Subgrade materials in this unit are primarily sands and gravels where the floodplain is active. The recent floodplain deposits have a thin (approximately one foot) covering layer of silt and organics. These materials are generally thaw stable.

Terrain Unit Fs consists of retransported eolian silts. The material has been moved down slope by various slope processes and is transitional to eolian Unit E. The subgrade soils are generally ice rich silts and are not thaw stable. There are occasional zones with less ice and minor amounts of sand and fine gravel.

2.3.2.3 Organic Unit (P)

This unit has a high percentage of organic materials and highly organic silts. It is primarily low lying and flat and is associated with depressions formed by melting of ground ice. It includes active and older thaw lakes. The subgrade materials are ice rich organics and are very thaw unstable.

2.3.2.4 Eolian Unit (E)

This unit consists of thick deposits or windblown silt. It may contain organic rich zones and local areas of windblown sand. It also generally contains zones of massive ice. The subgrade materials are ice rich silts and are thaw unstable.

2.3.2.5 Colluvial Unit (C)

Colluvial landforms are gentle to moderate slopes formed by downslope movement of soil materials. It is distinguished from Fs materials in being composed primarily of sand and gravel sized material in a silty to clayey matrix. These granular soils are generally not ice rich, although they may contain isolated zones of massive ice. They are generally thaw stable.

2.3.2.6 Glacial Unit (G)

This terrain unit underlies isolated hills, ridges and bluffs of the lower Baldwin Peninsula. It is composed primarily of sand with gravel and small amounts of silt. The subgrade materials are thaw stable.

2.3.3 Mineral Resources

The southern part of the route passes through an area rich in mineral resources. Extensive prospecting and mining activities have occurred since 1900. A study of the "Transportation and Economic Characteristics of Mineral Groups", was done in the Western and Arctic Alaska Transportation Study, for the Department of Transportation and Public Facilities, January, 1980.

The route passes through the west end of the Selawik Hills, an area that has seen some uranium prospecting activity. Additional uranium propecting has occurred near Fairhaven and Hunter Creek, six miles south of the alignment. Bear Creek, an additional twenty miles to the south, is an old gold mining area which also has lead-zinc-silver, molybdenum, and uranium prospects.

Extensive gold placer mining has occurred in the Candle-Kugruk River vicinity where active mining operations are ongoing at this time. Coal mines on the Kugruk River have been inactive for a number of years but serious consideration is

being given to opening one of them again. A lead-silver-gold prospect occurs at Independence Creek sixteen miles up the Kugruk River from the route. There is also considerable placer gold activity on the Inmachuk River, south of Deering, sixteen mile west of the end of the route.

2.4 VEGETATION

The vegetation types encountered within the reconnaissance area are few and quite similar to each other. The entire area can be classified as 'non-forested' or,for engineering purposes, 'treeless'. There are no trees of commercial value along the recommended route, and no salvage of cleared material would be required in the construction of a road.

The majority of the recommended route traverses moist tundra consisting of tussocks of cottongrass and other sedges with dwarf shrubs, such as Labrador tea, alpine bearberry, willows,and bog blueberry.

Areas of wet tundra were avoided in route location to the greatest extent possible, mostly because the poorest foundation conditions were found in these areas. Wet tundra consists of a sedge and cottongrass mat with woody shrubs occurring on areas of slight relief, often provided by frost action and ice wedges. Most areas of wet tundra do not contain tussocks rather a vegetative mat with small clumps or tussocks on the area of slight relief.

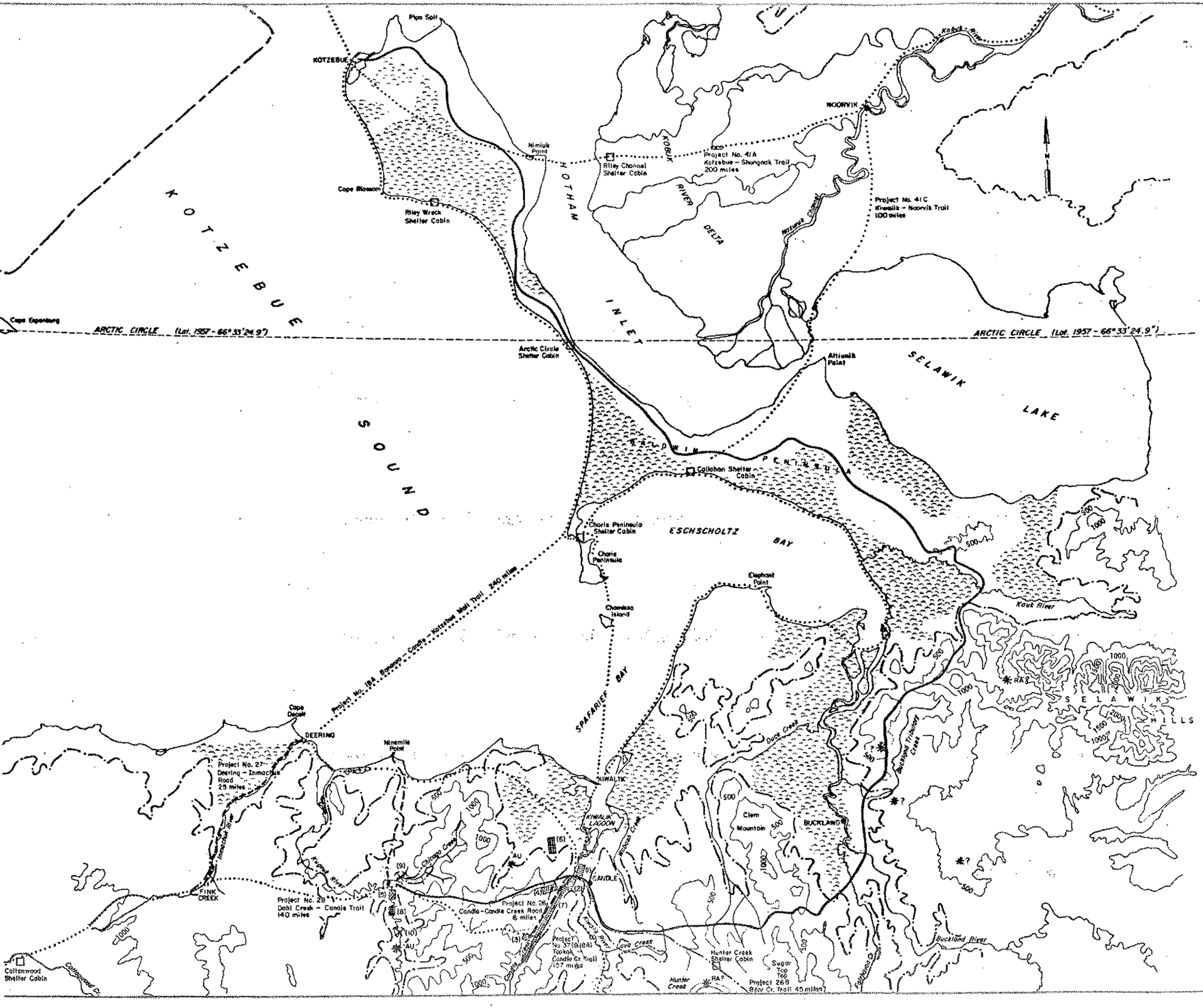
Shrub thickets containing alder, willows, resin birch, and other shrubs are encountered along many of the streams and rivers on the route. The thickets generally belt the banks of the stream and are of heights which vary from four feet on the Baldwin Peninsula to eight feet on streams of the Seward Peninsula. These thickets provide forage and the only cover in the area for moose.

2.5 LAND USE (See Map 2)

The land in the reconnaissance area is used primarily in three ways: subsistence activities, grazing, and mining. Recreation (including tourism), and commerce could be considered as land uses, but they are insignificant in a real extent at this time. Land used as the village sites of Kotzebue and Buckland are also very small areas in comparison to the extent of the reconnaissance area.

Virtually all of the lands and waters of the reconnaissance area are used for subsistence activities, although these activities are concentrated near the navigable waters of the area. Netting of fish and hunting of marine mammals necessitates boating from the villages and camping near the seasonal concentrations of migration paths of the animals. During the late summer and fall, the women and younger children of the families gather berries and other food plants. The rivers of the area provide the hunter avenues into the range of large land mammals such as moose and caribou. Only after freeze-up and snow cover are the areas away from the navigable water significantly opened to subsistence activities.

Reindeer graze throughout the reconnaissance area. The animals are rounded up, herded, and handled three or four times during the year. The rest of the time they are allowed to graze the entire area without herders. The exact number of animals present within the reconnaissance area is therefore difficult to fix, but may be about 6000. All of the reindeer within the reconnaissance area are owned by the Northwest Alaska Native Association (NANA) or under control through their joint venture with other herders. The only apparent attempt to control the range within the reconnaissance area is a wire fence across the Baldwin Peninsula at its narrowest point. Several herding stations, which include corrals and buildings, are found within the area, although most appear to be no longer in use.



EXPLANATION

1. THE ENTIRE AREA IS UTILIZED FOR SUBSISTANCE HUNTING AND FISHING.
2. THE AREA ALONG THE PROPOSED ROUTE IS UTILIZED FOR REINDEER GRAZING AND HERDING.
3. COMMERCIAL FISHING
   THIS EFFORT IS CONCENTRATED ON CHUM SALMON NEAR THE VILLAGE OF KOTZEBUE.
4. MINING
   - ACTIVE GOLD PLACERS, 1981
     - (1) KIWALIK RIVER
     - (2) CANDLE
     - (3) PATTERSON CREEK
     - (4) JUMP CREEK
     - (5) KUGRUK RIVER NEAR CHICAGO CREEK
   - INACTIVE PLACERS
     - (6) MUD CREEK
     - (7) CANDLE CREEK
     - (8) KUGRUK RIVER
   - INACTIVE COAL MINES
     - (9) CHICAGO CREEK (ABANDONED 1911)
     - (10) WALLIN MINE (ABANDONED AFTER 1947)
   - ACTIVE CLAIMS (NO EVIDENCE OF LARGE SCALE ACTIVITY)
     - AU - GOLD
     - RA - RADIOACTIVES (URANIUM)
5. U.S. & ALASKA ROAD COMMISSION ROUTES
   - DOG SLED TRAILS *
   - SLED & WAGON TRAILS
   - WAGON ROADS
   - SHELTER CABINS (LOCATION APPROXIMATE)
   - TRACTOR TRAIL MENTIONED IN U.S. BUREAU OF MINES R.I. 4150, 1947

   * ROUTES SUBJECT TO YEARLY & SEASONAL ADJUSTMENT. THEY HAVE MORE RECENTLY BEEN USED AS TRACTOR AND SNOW MACHINE TRAILS.
6. COASTAL ZONE MANAGEMENT (CZM) PL. 92-583
   - SEAWARD BOUNDARY
   - LANDWARD BOUNDARY

   FROM INTERIM COASTAL ZONE BOUNDARIES OF ALASKA MAPS, NOV. 1979.
7. WETLANDS
   LARGE CONTIGUOUS AREAS OF THAW LAKES AND STANDING WATER. THERE ARE MANY OTHER SMALLER AREAS ESPECIALLY ON THE BALDWIN PENINSULA.

PROPOSED ROUTE

SCALE 1 : 250,000

0 5 10 15 20 25 MILES

CONTOUR INTERVAL - 500 FEET
MAP TAKEN FROM U.S.G.S. TOPOGRAPHIC MAPS

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK HIGHWAY RECONNAISSANCE PROJECT LAND USE AND MANAGEMENT MAP

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MICHAEL BAKER, JR., INC. – ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9/81	PKH
DRAWN	9/81	ESK
CHECKED	9/81	REO
APPROVED	9/81	RHT

MAP NR 2
PROJECT NR A-80331
DRAWING NO.
SHEET 2 OF 4

Of the three primary land uses of the area, mining occupies the smallest amount of land. The community of Candle at the confluence of Candle Creek and the Kiwalik River is the largest active gold mining camp in the reconnaissance area. The only other active gold mining in the area is along the Kugruk River, south of Chicago Creek. There are numerous claims throughout the area, although there appears to be no other present activity.

2.6 LAND STATUS: As of September 1, 1981, (See Maps 3 & 4)

2.6.1 General

The objective of this section is to define land status, pertinent to Right-of-Way acquistion, along the proposed highway route. A preliminary route selection phase was accomplished to define potential problem areas so that they could be avoided if possible. The second phase more closely defined the status and ownership along the selected route.

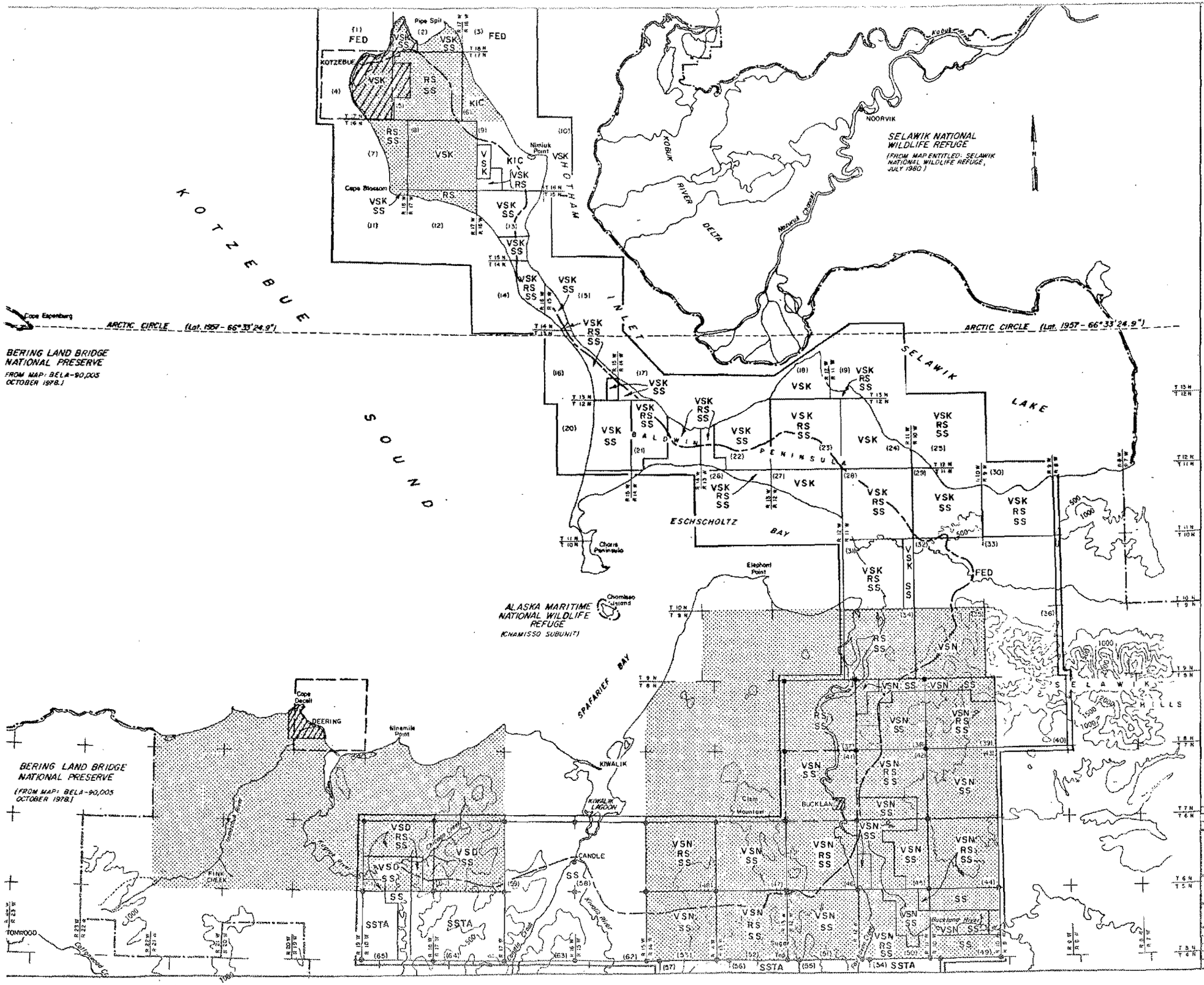
During the first phase a corridor was selected to include all the routes under consideration, and all potential material sources. For the purpose of ease in correlating data a number was assigned to each township (Tp 1 through 65). Withdrawal and selection data has been assembled and is presented in Tables 2-4 through 2-6. Preliminary ownership data was also collected concerning mining claims and native allotments. All lands in the corridor are within the Kateel River Meridian Zone.

A more detailed analysis was accomplished for the selected route during a second phase. This more closely defined the specific ownership, rights, and jurisdictions, that would have to be dealt with during Right-of-way acquistion.

2.6.2 Sources

The primary source of data was the Bureau of Land Management (BLM) office in Fairbanks, The following documents were used:

- Master Title Plat (MTP)
- Use Supplement
- Historical Index (HI)



EXPLANATION

- PROPOSED ROUTE
- CORRIDOR BOUNDARY
- VILLAGE CORE TOWNSHIP BOUNDARY
- NATIONAL INTEREST LANDS BOUNDARY (PL 96-487)
- VILLAGE SELECTION WITHDRAWAL AREA (PL 92-203)
- SURVEYED TOWNSHIP
- MUNICIPAL BOUNDARIES

SELECTION STATUS

FEDERAL OWNERSHIP WITH THE EXCEPTION OF MINOR BLOCKS OF PATENTED LAND

SS	STATE SELECTION
RS*	REGIONAL (NANA) CORPORATION SELECTION
VS*	VILLAGE CORPORATION SELECTION
VSK	KIKITAGRUK INUPIAT CORP. (KOTZEBUE)
VSN	NUNACHIAK CORP. (BUCKLAND)
VSD	DEERING IGNATCHIAK CORP.
FED	FEDERAL, NO SELECTIONS

*EXCLUDES PRIOR VALID EXISTING RIGHTS AND NAVIGABLE WATERS.

INTERIM CONVEYANCE (I.C.) STATUS

KIC	KIKITAGRUK INUPIAT CORP.

AT THIS TIME NO OTHER VILLAGES HAVE RECEIVED AN I.C. WITHIN THE CORRIDOR. THERE ARE TWO I.C. WITHIN KOTZEBUE

TENTATIVE APPROVAL STATUS

SSTA	STATE SELECTION, TENTATIVE APPROVAL

SCALE 1 : 250,000

0 5 10 15 20 25 MILES

CONTOUR INTERVAL - 500 FEET
MAP TAKEN FROM U.S.G.S. TOPOGRAPHIC MAPS

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK HIGHWAY RECONNAISSANCE PROJECT LAND STATUS MAP

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MICHAEL BAKER, JR., INC. – ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	3/81	PKH
DRAWN	4/81	ESA
CHECKED	5/81	REO
APPROVED	5-81	PKT

MAP № 3

PROJECT NO. A-80331

DRAWING NO.

SHEET 3 OF 4

- o Serial Register
- o Public Land Orders (PLO)
- o Public Laws (PL)
- o Mining claim cross-reference
- o Patents
- o Case files, if available

State of Alaska Division of Lands Plats were utilized and some information on Coastal Zone Management was acquired there. Further information on mining claims came from the Division of Geological and Geophysical Surveys, Mining Information Office at the University of Alaska. The U.S. Geological Survey Alaska Map Distribution Office supplied information concerning National Interest Lands. The University of Alaska Library on the Fairbanks campus provided U.S. Road Commission reports and other miscellaneous information.

2.6.3. Federal Lands

The Federal Government owns most of the land within the corridor subject to selection by both Native Corporations and the State of Alaska. The land is managed by the Bureau of Land Management (BLM). The only exceptions are patented lands near Kotzebue and Candle plus Interim Conveyances in and near Kotzebue.

Both the native regional (NANA) and village corporations have overselected large amounts of land. NANA has top filed over the village corporations and the State has top filed over both. Until conveyances have been made, all the separate entities must be dealt with over most of the route.

The corridor includes no National Interest Lands (P.L. 96-487). It is partially surrounded by such lands at considerable distance to the east, north and west. (see Map 3)

2.6.4. State of Alaska (State)

The State has no patented lands within the corridor except at Kotzebue. It does own all tide lands and lands under navigable rivers but a precise determination of which waterways are navigable will have to be made. The land around Candle is subject only to State selection and some tentative approvals have been given along the southern part of the corridor.

The State has top filed over most of the lands selected by Native corportations and can be expected to receive some lands in the rest of the corridor. As Conveyances to the native corporations are proceeding slowly and are fairly involved this can be anticipated to take some time.

2.6.5. Alaska Native Claims Settlement Act (ANCSA) P L 92-203

The entire corridor lies within the boundaries of the NANA Regional Corporation. Under ANCSA the corporation will receive the subsurface estate to lands selected by village corporations within it's region. This involves approximately 61 Townships (1.4 million acres). NANA has merged with these corporations but the right to withhold consent to mineral development within the village boundaries remains with the village. (PL94-204). It will also receive both surface and subsurface estates to about 35 more townships (800,000 acres) under regional selection. Both surface and subsurface estates will be received to Cemetery Sites(CS) and Historical Places(HP) within the corridor (Remarks, Table 2-5).

The selected route passes through lands owned or selected by the following three village corporations:

1. Kikitagruk Inupiat (Kotzebue)
2. Nunachiak (Buckland)
3. Ignatchiak (Deering)

The villages selection area and lands selected within the corridor are shown on Map 3 and listed in Table 2-5. The villages will eventually receive, excluding prior rights and navigable waters, the surface estate of their entitled land. Reservations for easements may be made but no easements for highways were made in the Interim Conveyances (IC) given Kotzebue in Township Parcel 6 and 9. The amount of land that the villages will receive will be considerably less than that shown on Map 3 due to overselection. Each village will receive land within its withdrawel area as follows (ANSCA Sec. 14a):

Kotzebue - 161,280 acres (7 Tp)

Buckland - 92,160 acres (4 Tp)

Deering - 92,160 acres (4 Tp)

They will also get additional lands from the Regional Corporation in a second round (ANCSA Sec. 12b).

In the corridor, Kotzebue received a deficiency withdrawal area consisting of lands east of Kotzebue and west of the Selawik Wildlife Refuge.

2.6.6. Native Allotments

The Native Allotment Act of 1906 provides for conveyances of up to 160 acres to each adult native. ANCSA revoked this act but allowed for the approval of applications already pending. The allotment will not receive fee title and it cannot be sold or leased without Bureau of Indian Affairs approval. Until the allotments have been surveyed the precise boundaries will not be known.

There are numerous allotments pending approval within the corridor, but apparently only one (Pipe Spit) has been certified. They are found principally along the coast in the Kotzebue-Cape Blossom area and the lower part of the Buckland River. There are also several scattered along the north coast of the Baldwin Peninsula.

The proposed route apparently crosses two adjacent allotments near Kotzebue. They both lie in the NE quarter (1/4) of Section 11, T17N-R18W (Tp4). The first is Parcel B of an allotment (F17835) filed by L. Beltz in the E one half (1/2) of the NE quarter (1/4). It may also cross the southern part of an allotment filed by Willie Goodwin, Jr., in the NW quarter (1/4) NE quarter (1/4). The southern boundary of this allotment has not been firmly established and the route may miss it.

2.6.7 Patented Lands

The proposed route crosses patented lands only within the City of Kotzebue. The route appears to be immediately to the north of a large block of patented mining claims near Candle. These two areas are the only patented lands in the corridor.

2.6.8 Unpatented Mining Claims

The corridor lies in two recording districts, Kotzebue and Cape Nome (Fairhaven Precinct). The southern part contains numerous mining claims, many dating back to 1900. Most near Candle and the Kugruk River are still active but elsewhere many have not been active for some time. Precise locations will depend on field location of claim posts.

The proposed route apparently crosses unpatented claims only in the vicinity of Candle (Tp 58). For approximately one mile east of the Kiwalik River crossing it traverses claims controlled by Tundra Exploration (apparent owners: Rhinehelt (Rhiney) Berg, Thorlief Wettleson and associates). A portion of these claims to the north of the alignment are presently being worked. These are part of a much larger block of apparently contiguous claims stretching five miles to the north and south. The same owners have located a claim

(ADL 311835-Kari Gulch 2 AM) approximately in the SE quarter (1/4) of Section 29, T6N-R16w, (Tp 59). The route may or may not cross this claim, but a minor relocation would probably avoid it in any case.

Fred Weiner has one claim (#7 Candle Old Townsite) which appears to overlie the old townsite of Candle (Tp 58-59) on the west side of the Kiwalik River. Between 600 and 900 feet of the route apparently crosses this claim.

Another two claims located by J. P. Savok (Selawik) lie in Section 28 and 29, T8N-R11W (Tp 38). The route appears to be just east of these, although a proposed material source on this knob would need to take them into consideration.

An old claim post was encountered in Section 10, T9N-R10W, (Tp 35). This appears to be part of a larger block held by Wyoming Minerals Corporation. They have been inactive since 1978 and do not show on the BLM mining claim cross-index.

This review of unpatented claims was only cursory and that many more may exist which are valid. Further detailed study is recommended as the land status is constantly changing.

2.6.9 Coastal Zone Management (See Map 2)

The Coastal Zone Management Act (CZMA) of 1972 (P.L. 92-583), as amended in 1976 (P.L. 94-370), encourages coastal states to develop and implement programs for managing their coastal areas. In response, the Alaska Coastal Management Act (ACMA) was passed in 1977. This established an Alaska Coastal Policy Council (ACPC) and the Office of Coastal Management (OCM) which formulated a program accepted in 1979. Lands held by the Federal Government are excluded from the CZMA but activities here "must", to the maximum extent practical, "be" consistent with approved state management programs.

The ACPC has set the following standards for transportation and utilities in coastal development:

(a) "Transportation and utility routes and facilties in the coastal areas must be sited, designed, and constructed so as to be compatible with district programs."

(b) "Transportation and utility routes and facilities must be sited inland from beaches and shorelines... or no feasible and prudent inland alternative exists..."

It appears that the proposed route conforms to these standards.

The legislature also provided for local coastal resources districts. As this corridor lies in the Unorganized Borough a coastal resource service area (CRSA) was created based on Rural Education Attendance Areas (REAA). This corridor is entirely within the Northwest Arctic Schools, REAA #1. In 1979 the region's voters approved organization of the NANA CRSA. The service area (including the city of Kotzebue) is presently preparing a coastal management program and upon its acceptance will become a district. If the CRSA does not have or exercise zoning or other controls, its plan will be implemented by appropriate state agencies.

2.6.10 Wetlands (See Map 2)

Wetlands are defined (CFR 33, Chapter II, Section 323.2, 1980) as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (Also see Executive Order 11990, President Jimmy Carter, May 24, 1977). Section 404 of the Federal Water Pollution Control Act Admendments of 1973 (P.L. 92-500)

gave the U.S. Army Corps of Engineers regulatory control over the placement of fill material in naviagable water. This was later expanded to include adjacent wetlands. Executive Order 11990, Section 2 further states, "each agency, to the extent permitted by law, shall avoid undertaking to providing assistance for new construction located in wetlands unless the head of the agency finds; (1) that there is no practical alternative to such construction and (2) that the proposed action includes all practical measures to minimize harm to wetlands which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors."

The Corps of Engineers in conjunction with Fish and Wildlife Service are presently mapping wetlands in Alaska on a case by case basis. At present no delineation has taken place within the corridor except possibly at Kotzebue and Buckland.

The route generally avoids the large wet tundra, due to poor foundation conditions present. On the Baldwin Peninsula the alignment crosses areas with small pockets of wet tundra as there is no other possible route. Again foundation conditions dictate the crossing the shortest stretch of wet tundra as possible. South of the Baldwin Peninsula, the route crosses rolling hills and ridges, and the alignment attempts to avoid the wetter areas while still maintaining acceptable grades and economic haul distances.

2.6.11 Leases and Permits

The entire length of the proposed route crosses land covered by reindeer grazing permits. There is a fence across the narrowest part of the Baldwin Peninsula and the route passes through it. As the reindeer presently go around both ends of the fence it is not certain if cattle guards would be required for passing through it. There are several oil and gas leases on the northern end of the

Baldwin Peninsula, but these have either been closed or are inactive. There are a few material sale applications, just offshore, south of Kotzebue.

2.6.12 Existing Trails and Roads

In 1905 the U.S. Alaska Road Commission began laying out numerous trails and roads throughout the area. These trails primarily connected the gold fields between Candle and Nome, but also tied into a system connecting other areas of Alaska.

Most of these early passage ways were dog sled trails which were used as foot trails in the summer. The routing of these trails moved yearly and seasonly depending upon conditions. Shelter cabins were maintained a days travel apart (most of these are no longer in existence). The trails were marked with tripods and posts with flags. Some have been more recently used as tractor and snow machine trails. Many additional snowmachine trails have been established (especially near Buckland), although no evidence was visable from the air. A sled trail was maintained between Candle and Bear Creek and was passable to wagons during the summer with some difficulty. Two roads were built, one from Candle to Patterson Creek and the other from Deering up the Inmachuk River, both to service the local gold fields. The one in Candle has suffered from subsidence and is apparently useable only to four wheel drive vehicles on the upper end. The Inmachuk road has better foundation conditions and is in better shape. The proposed route cannot follow any of the dog sled trails as they crossed large bodies of water over the ice. The proposed route follows the Candle-Bear Creek Trail into Candle from its intersection at Lava Creek. Between Candle and the Kugruk River the route follows a newer tractor trail established by the local miners. It follows the Dahl Creek-Candle Trail for only a short distance as this route is considerably longer and crosses many mining claims.

2.6.13 Miscellaneous

2.6.13.1 City of Kotzebue

The proposed route begins at the intersection of Third Avenue and Lagoon Street and proceeds east on Lagoon to Seventh Avenue and then north to the Mission. It crosses lands originally patented to the Townsite of Kotzebue, 1955 (Pat. No. 1152223 L.M. Puckett Trustee). The proposed route then crosses land patented to the California Yearly Meeting of Friend's Church in 1941 (Pat. No. 1111840) to reach Grizzly Way. It then follows Grizzly Way to the City Water Line, crossing land originally patented to the Kotzebue Townsite in 1972 (Pat No. 50-73-0036, George E.M. Gustafson, Trustee). Apparently all of the land except the Mission Land has been subdivided with provisions for street easements.

2.6.13.2 Candle Airports

The route passes through Air Navigation Site Withdrawal No. 140 (April 17, 1940) at Candle. This was for an Alaskan Road Commission airstrip immediately across the Kiwalik River from Candle, which is visible on 1949 U.S. Geological Survey aerial photos. It is presently heavily overgrown and the only evidence from the air is an old plane in the brush. Due to incomplete data it is not known if this is the same airstrip as that built with territorial funds in 1928 (U.S. Alaska Road Commission Project 26E). This 1200 foot strip is described as "located on an island, one half mile downstream from the village of Candle". Candle presently utilizes a large private airstrip on patented land on the west side of the river. This strip includes part of the Candle Creek Road.

2.6.13.3 Candle Townsite

On the west side of the Kiwalik, the route passes through the old townsite of Candle. Nineteen structures, including the jail, burned in 1966 and only three

original buildings have survived (including the Fairhaven Hospital and a pool hall). Two newer buildings have since been built on the south end. All five of these existing buildings are reportedly in private ownership although no records have been found to support this. The route crosses through the sites of a number of burned buildings and passes close to one of the existing structures. Further investigations are required in this area.

The proposed route passes another old building on the ridge top just east of Minnehaha Creek. The purpose or ownership of this building is unknown.

2.6.14 Land Status Tables and Map Explanation

For simplification and ease of usage, data obtained for land ownership and status has been organized into Table 2-4, WITHDRAWAL STATUS, SUMMARIES, Table 2-5, WITHDRAWAL STATUS BY TOWNSHIP, Table 2-6 SELECTION STATUS, also shown on a Land Status Map, Map No.3, Sheet 1 of 1.

A broad based land corridor for the purpose of land identification was established along the proposed route. Townships within this corridor were numbered consecutively beginning at Kotzebue and designated Tp 1 through Tp 65. Documentation pertaining to withdrawals for these townships is summarized in Table 2-5. Data concerning selections are shown in Table 2-6.

The following is a summary of abbreviation utilized in the tables:

F - Designates Fairbanks District

Tp - Township Parcel

MTP - Master Title Plat

PL - Public Law

PLO - Public Land Order

HI - Historical Index

K - Kotzebue (Kikitagruk Corporation)

N - Buckland (Nunachiak Corporation)

D - Deering (Deering Ignatchiak Corporation)

V/Sel - Village Selection

Apln - Application

Reg/Sel - Regional Corporation Selection (NANA)

SS - State Selection

Table 2-4

WITHDRAWAL STATUS

SUMMARIES

F-870 June 18,1970

Notice of Classification of Lands for Multiple Use Management

Para. 1 "Pursuant to the Act of September 19, 1964...all of the public lands in the areas described below are hereby classified for multiple use management..."

Para. 2 "All of the public lands comprising the Baldwin Peninsula north of latitude 66°30' north."

Para. 3 (a) "Lands surrounding Kotzebue..."

(b) "Lands at the neck of the Baldwin Peninsula..."

Para. 4 "The following described lands comprising the watershed for the city of Kotzebue are further segregated from appropriation or settlement... and uses not compatible with the watershed values."

NOTE: Indicated by an X on Table 2-5.

PL 92-203 (ANCSA) December 18, 1971

Sec. 11.(a)(1)
NOTE: The following abbreviations are used on Table 2-5.

K - Kotzebue
N - Buckland
D - Deering

PLO 5171 March 9, 1972

Withdrawal for Selections by Village Corporations and Regional Corporation in Northwest Alaska Region and for Classification for Lands in Withdrawals.

Para. 1 "...the following described lands...are hereby reserved: (a) For selection under section 12 of said act (ANCSA) by the corporations... (b) for reallocation to Village Corporations under section 12(b)..."

1(a) Kotzebue:

Table 2-4 (continued)

WITHDRAWAL STATUS

SUMMARIES

PLO 5179 March 9, 1972

Withdrawal of Lands in Aid of Legislation Concerning Addition to or Creation of Units of the National Park, Forest,Wildlife Refuge, and Wild and Scenic Rivers Systems and for Classification.

Para. 1 "...the following described lands are hereby withdrawn from all forms of appropriation...and are hereby reserved for study and for possible recommendation to the Congress..."

PLO 5180 March 9, 1972

Withdrawal of Lands for Classification and for Protection of Public Interest in Lands.

Para. 1 "...the following described lands are hereby withdrawn...and are hereby reserved for study to determine the proper classification of the lands under section 17(d)(1) of said Alaska Native Claims Settlement Act.

PLO 5184 March 9, 1972

Withdrawal for Classification or Reclassification of Some of Areas Withdrawn by Section 11 of Alaska Native Claims Settlement Act.

Para. 1 "...all of those lands withdrawn by section 11 of the Act (ANCSA)...and which are outside paragraph 2 of this order are hereby withdrawn. ...and said lands are hereby reserved for study and review by the Secretary of the Interior for the purpose of classification or reclassification of any lands not conveyed pursuant to section 14 of said Act.

PLO 5192 March 17, 1972

Modification and Correction of Public Land Order No. 5179.

Para. 1 "...5179...is hereby modified and corrected by changing,adding to, or deleting from, the descriptions of the lands in paragraph 1 thereof...

NOTE: This PLO has no effect beyond mention, of lands within this corridor.

Table 2-4 (continued)

WITHDRAWAL STATUS

SUMMARIES

PLO 5250 September 12, 1972

Amendment of Public Land Orders No. 5179 and No. 5180 as Amended.

Para. 1 "...5179...as amended by...5192...is hereby amended to add the following described lands to paragraph 1 of said order."

PLO 5253 September 12, 1972

Amendment of Public Land Order No. 5171, and Public Land Order No. 5179, as Amended by Public Land Order No. 5192.

Para. 1 "...5171...is hereby amended to add the following described lands to said order."

Para. 3 "...5179...is hereby amended to add the following described lands to paragraph 1 of said order."

PLO 5389 September 14, 1973

Amendment of Public Land Orders No. 5171 and No. 5179, as Amended.

Para. 1 "...5179...amended by P.L.O. 5250...and P.L.O. 5171...amended by P.L.O. 5253...are hereby amended to the extent necessary to accomodate the right of the Village Corporation for the Village of Kotzebue to select and the Regional Corporation to identify the following described lands..."

Para. 2 "...5171...is further amended to add the following described lands to paragraph 1 of said order."

PLO 5418 March 25, 1974

Amendment of Public Land Order No.5180.

Para. 1 "...5180...is further amended to add the following described lands: All unreserved public lands in Alaska, or those which may become unreserved unless specified by order at that time."

Table 2-4 (continued)

WITHDRAWAL STATUS

SUMMARIES

PLO 5428 July 25, 1974

Amendment of Public Land Order Nos. 5169, 5171, 5172.

Para. 3 "...5171...is further amendend to add the following described land to paragraph 1(a) of said order."

THE FOLLOWING (PLO 5653, 5654,5701) THREE ORDERS PERTAINING TO THE SELAWIK REFUGE WITHDRAWAL APPARENTLY HAVE BEEN RESCINDED BY PL 96-487, DECEMBER 12, 1980 (National Interest Lands).

PLO 5653 November 16, 1978

Certain Lands in Alaska Emergency Withdrawal.

PLO 5654 November 17, 1978

Amendment to Emergency Withdrawal Order.

PLO 5701 February 11, 1980

Withdrawal for Selawik National Wildlife Refuge.

PLO 5657 January 26, 1979

Classification of Lands for Selection by the State of Alaska.

Para. 1 "...the following described lands are hereby classified as suitable for State selection and the listed public land orders are modified and amended..."

(e) "The lands described in this subparagraph are contained in Public Land Order No. 5171...as amended by...5389...,and...5428..."

Table 2-5

WITHDRAWAL STATUS BY TOWNSHIP

(See Table 2-4)

Tp No.	Township * Description	MTP Current to	F-870	PL 92-203	PLO 5171	PLO 5179	PLO 5180	PLO 5184	PLO 5250	PLO 5253	PLO 5389	PLO 5418	PLO 5428	PLO 5653 5654 5701	PLO 5657
1	T18N R18W	12/19/80	X	K				1							
2	T18N R17W	12/19/80	X	K				1							
3	T18N R16W	7/09/80	X	K				1							
4	T17N R18W	6/12/81	X	K				1							
5	T17N R17W	5/16/80	X	K				1							
6	T17N R16W	No Date	X	K				1							
7	T16N R18W	6/22/80	X	K				1							
8	T16N R17W	2/06/80	X	K				1							
9	T16N R16W	6/02/81	X		1(a)			1 ?		3	2				1(e)
10	T16N R15W	5/30/80	X ?			1		1 ?		1				X	
11	T15N R18W	No Date	X	K				1							
12	T15N R17W	6/17/81	X	K				1							
13	T15N R16W	6/17/81	X		1(a)			1 ?		3	2				1(e)
14	T14N R16W	3/25/81	X		1(a)			1		3			3 ?		1(e)
15	T14N R15W	6/02/80	X			1		1			2				
16	T13N R15W	3/25/81	X		1(a)			1		3	2				1(e)
17	T13N R14W	3/25/81	X			1		1			2				1(e)
18	T13N R12W	6/05/80				1		1		1	2			X	
19	T13N R11W	5/30/80				1		1			2			X	
20	T12N R15W	6/05/80			1(a)			1		3	2			X	
21	T12N R14W	6/05/80			1(a)			1		3	2			X	
22	T12N R13W	6/05/80				1		1			2			X	
23	T12N R12W	5/30/80				1		1			2			X	
24	T12N R11W	5/30/80				1		1 ?			2			X	
25	T12N R10W	5/30/80				1		1	1		1			X	

C - Closed 12/12/73 (Candle)

* Kateel River Meridian

? - Not noted on HI or MTP

X - Designated multiple use managment by F-870

Table 2-5

WITHDRAWAL STATUS BY TOWNSHIP

(See Table 2-4)

Tp No.	Township* Description	MTP Current to	F-870	PL 92-203	PLO 5171	PLO 5179	PLO 5180	PLO 5184	PLO 5250	PLO 5253	PLO 5389	PLO 5418	PLO 5428	PLO 5653 5654 5701	PLO 5657
26	T11N R13W	6/05/80				1		1			2			X	
27	T11N R12W	6/05/80				1		1 ?			2			X	
28	T11N R11W	6/05/80				1	1	1			2			X	
29	T11N R10W	5/30/80					1	1	1		1			X	
30	T11N R 9W	6/02/80					1	1	1		1			X	
31	T10N R11W	5/30/80				1		1 ?			1			X	
32	T10N R10W	6/02/80					1		1					X	
33	T10N R 9W	6/02/80					1		1					X	
34	T 9N R11W	9/29/80		N				1						X	
35	T 9N R10W	9/29/80		N				1							
36	T 9N R 9W	3/06/80					1		1						
37	T 8N R12W	9/29/80		N				1							
38	T 8N R11W	9/29/80		N				1							
39	T 8N R10W	1/16/80		N				1							
40	T 8N R 9W	1/18/80					1								
41	T 7N R12W	4/24/81		N				1							
42	T 7N R11W	4/01/81		N				1							
43	T 7N R10W	No Date		N				1							
44	T 6N R10W	4/09/80		N				1							
45	T 6N R11W	9/29/80		N				1							
46	T 6N R12W	11/19/80		N				1							
47	T 6N R13W	9/29/80		N				1							
48	T 6N R14W	11/20/80		N				1							
49	T 5N R10W	9/29/80		N				1							
50	T 5N R11W	9/29/80		N				1							

C - Closed 12/12/73 (Candle)

? - Not noted on HI or MTP

* Kateel River Meridian

Table 2-5

WITHDRAWAL STATUS BY TOWNSHIP

(See Table 2-4)

Tp No.	Township* Description	MTP Current to	F-870	PL 92-203	PLO 5171	PLO 5179	PLO 5180	PLO 5184	PLO 5250	PLO 5253	PLO 5389	PLO 5418	PLO 5428	PLO 5653 5654 5701	PLO 5657
51	T 5 N R12W	11/17/80		N				1							
52	T 5 N R13W	11/13/80		N				1							
53	T 5 N R14W	11/10/80		N				1							
54	T 4 N R11W	2/02/81										1			
55	T 4 N R12W	2/02/81										1			
56	T 4 N R13W	2/02/81										1			
57	T 4 N R14W	3/07/80						C				1			
58	T 6 N R15W	9/24/81						C				1			
59	T 6 N R16W	8/12/80						C				1			
60	T 6 N R17W	12/02/80		D				1							
61	T 6 N R18W	11/19/80		D				1							
62	T 5 N R15W	8/06/80						C				1			
63	T 5 N R16W	4/09/80						C				1			
64	T 5 N R17W	1/05/81						C				1			
65	T 5 N R18W	2/02/81						C				1			

C - Closed 12/12/73 (Candle)

? - Not noted on HI or MTP

* Kateel River Meridian

Table 2-6

SELECTION STATUS*

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
1	T18N R18W	--		--		--		
2	T18N R17W	F14880-K	11/14/74	--		F44413	11/14/78	
3	T18N R16W	--		--		--		
4	T17N R18W	F14880-A	1/03/74	--		--		
5	T17N R17W	--		F19154-2	7/11/74	F44412	11/14/78	

* All lands described are in Kateel River Meridian

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
6	T17N R16W	SSE 1C004 1C005 R/W SSE	9/24/74	--		--		Excludes Native Allotments (V/Sel F14880-C)
7	T16N R18W	--		F32014 14 (h)(8)	12/15/77	F44409	11/14/78	
8	T16N R17W	F14880-D	11/14/74	--		--		
9	T16N R16W	F14880-C F14880-F F14880-X F14880-B2	7/11/74 11/14/74 11/14/74 12/18/75	-- -- F19154-58 F19154-58	 12/18/75 12/18/75	-- -- -- --		Rest of Tp I.C. W/Tp6 Sec. 18,19,30 Sec. 29,31,32 Sec. 29,31,32
10	T16N R15W	F14880-J	11/14/74	--		--		

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
11	T15N R18W	F14880-E	11/14/74	--		F44409	11/14/78	
12	T15N R17W	--		19154-22	11/14/74	--		
13	T15N R16W	F14880-X F14880-B2 F14880-C2	11/14/74 12/18/75 12/18/75	-- -- --		F44407 F44407 F44407	11/14/78 11/14/78 11/14/78	Rest of Tp Rest of Tp Sec. 26-29 & 33-35
14	T14N R16W	F14880-C2	12/18/75	F19154-69	12/18/75	F44406	11/14/78	Reg/Sel CS Apln Sec 12 (F22301)
15	T14N R15W	F14880-C2 F14880-C2	12/18/75 12/18/75	-- F32014 14 (h)(8)	12/15/77	F44406 F44406	11/14/78 11/14/78	Entire Tp Part of Sec. 32,33 (F-870 3(b) Area)

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
16	T13N R15W	F14880-C2 F14880-C2	12/18/75 12/18/75	-- F32014 14(h)(8)	12/15/77	F44803 F44803	11/14/78 11/14/78	Rest of Tp All Tp except sec. 25,36
17	T13N R14W	F14880-C2	12/18/75	--		F44803	11/14/78	
18	T13N R12W	F14880-C2	12/18/75	--		--		Reg/Sel HP Apln Sec. 15 F22184 Reg/Sel CS Apln Sec. 14 F22231
19	T13N R11W	F14880-C2	12/18/75	F19154-79	12/18/75	F44802	11/14/78	
20	T12N R15W	F14880-C2	12/18/75	--		F44800	11/14/78	Reg/Sel HP Apln Sec. 28 F22353

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
21	T12N R14W	F14880-C2	12/18/75	F19154-81 F32014 14 (h)(8)	12/18/75 12/15/77	F44800	11/14/78	Entire Tp Sec. 10,11,13,14, 15,22-27,32-36
22	T12N R13W	F14880-C2 F14880-C2	12/18/75 12/18/75	-- F32014 14 (h)(8)	12/15/77	F44799 F44799	11/14/78 11/14/78	Rest of Tp Sec. 18,19,30,31, 32
23	T12N R12W	F14880-C2	12/18/75	F19154-82	12/18/75	F44798	11/14/78	
24	T12N R11W	F14880-C2	12/18/75	--		--		
25	T12N R10W	F14880-C2	12/18/75	F19154-83	12/18/75	F44405	11/14/78	

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
26	T11N R13W	F14880-C2	12/18/75	F19154-87	12/18/75	F44799	11/14/78	
27	T11N R12W	F14880-C2	12/18/75	--		--		Reg/Sel HP Apln Sec 23 (F22267)
28	T11N R11W	F14880-C2	12/18/75	F19154-88	12/18/75	F44795	11/14/78	
29	T11N R10W	F14880-C2	12/18/75	--		F44794	11/14/78	
30	T11N R 9W	F14880-C2	12/18/75	F19154-89	12/18/75	F44793	11/14/78	

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
31	T10N R11W	14880-C2 14880-C2	12/18/75 12/18/75	-- F32014 14 (h)(8)	12/15/77	F44788 F44788	11/14/78 11/14/78	Rest of Tp All of Tp except 1,12,13,24,25.36
32	T10N R10W	--		--		--		
33	T10N R 9W	--		--		--		
34	T 9N R11W	--		F19154-16	11/14/74	F44402	11/14/78	
35	T 9N R10W	F14842-H	11/14/74	--		--		

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
36	T9N R9W	--		--		--		
37	T8N R12W	--		F19154-17	11/14/74	F44398	11/14/78	
38	T8N R11W	F14842-F F14842-K F14842-A2 F14842-B2	11/14/74 11/14/74 12/18/75 12/18/75	-- -- -- --		F44397 F44397 F44397 F44397	11/14/78 11/14/78 11/14/78 11/14/78	Sec. 5,6,7,18 Sec. 1,2,3,4,8,9, 17,19,20 Rest of Tp
39	T8N R10W	F14842-K F14842-A2 F14842-B2	11/14/74 12/18/75 12/18/75	-- -- F19154-97	 12/18/75	F44396 F44396 F44396	11/14/78 11/14/78 11/14/78	Sec. 1-6, 11, 12 Sec. 1-6, 11, 12 Rest of Tp
40	T8N R9W	--		--		--		

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
41	T 7 N R12W	F14842-A	1/03/74	--		F44389	11/14/78	
42	T 7 N R11W	F14842-B F14842-B2	11/14/74 12/18/75	-- F21870-1	12/18/75	F44388 F44388	11/14/78 11/14/78	Sec. 26-35 Rest of Tp
43	T 7 N R10W	F14842-B2	12/18/75	--		F44387	11/14/78	
44	T 6 N R10W	F14842-B2	12/18/75	F21870-6	12/18/75	F44368	11/14/78	
45	T 6 N R11W	F14842-C	11/14/74	--		F44369	11/14/78	Sec. 2-8,16,17,18, 20,21,28,29,32-34
		F14842-B2	12/18/75	--		F44369	11/14/78	Rest of Tp

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
46	T 6 N R12W	F14842-B2	12/18/75	F21870-5	12/18/75	F44370	11/14/78	
47	T 6 N R13W	F14842-I F14842-B2	11/14/75 12/18/75	-- --		F44371 F44371	11/14/78 11/14/78	Sec. 1,2,11,12,13 Rest of Tp
48	T 6 N R14W	F14842-B2	12/18/75	F21870-4	12/18/75	F44372	11/14/78	
49	T 5 N R10W	F14842-E F14842-K F14842-A2 --	11/14/74 11/14/74 12/18/75 --	-- -- -- --		F44351 F44351 F44351 F44351	11/14/78 11/14/78 11/14/78 11/14/78	Sec. 14-23 Sec. 13,24 Sec. 13,24 Rest of Tp
50	T 5 N R11W	F14842-D	11/14/74	--		F44352	11/14/78	Sec. 2,3,4,10,11, 13,14,15,22-24,26
		F14842-B2	12/18/75	F21870-8	12/18/75	F44352	11/14/78	Rest of Tp

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
51	T 5 N R12W	F14842-B2	12/18/75	--		F44353	11/14/78	
52	T 5 N R13W	F14842-B2	12/18/75	F21870-7	12/18/75	F44354	11/14/78	
53	T 5 N R14W	F14842-B2	12/18/75	--		F44355	11/14/78	
54	T 4 N R11W	--		--		F21018 SSTA	3/22/74 12/08/80	
55	T 4 N R12W	--		--		F21018 SSTA	3/22/74 12/08/80	

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
56	T 4 N R13W	--		--		F21019 SSTA	3/22/74 11/19/80	
57	T 4 N R14W	--		--		F21019 SSTA	3/22/74 11/19/80	
58	T 6 N R15W	--		--		F21017	3/22/74	
59	T 6 N R16W	--		--		F21017	3/22/74	
60	T 6 N R17W	F14851-B2	12/18/75	--		F44373	11/14/78	

Table 2-6

SELECTION STATUS

Tp No.	Township Description	V/Sel	Apln Date	Reg/Sel	Apln Date	SS	Apln Date	Remarks
61	T 6 N R18W	F14851-B	11/14/74	--		F44374	11/14/78	Sec. 19-22,27-30 33,34
		F14851-N	11/14/74	F21870-3	12/18/75	F44374	11/14/78	Sec.23,26,35
		F14851-A2	12/18/75	F21870-3	12/18/75	F44374	11/14/78	Sec.23,26,35
		F14851-B2	12/18/75	F21870-3	12/18/75	F44374	11/14/78	Rest of Tp
62	T 5 N R15W	--		--		F21017	3/22/74	
63	T 5 N R16W	--		--		F21017	3/22/74	
64	T 5 N R17W	--		--		F21021	3/22/74	
						SSTA	11/19/80	
65	T 5 N R18W	--		--		F21021	3/22/74	Entire Tp
						SSTA	11/19/80	Sec. 1,2,5-9,11,12 13,14,16-21,23-26, 28-33,35,36

2.7 ENVIRONMENTAL FEATURES

2.7.1. Wildlife

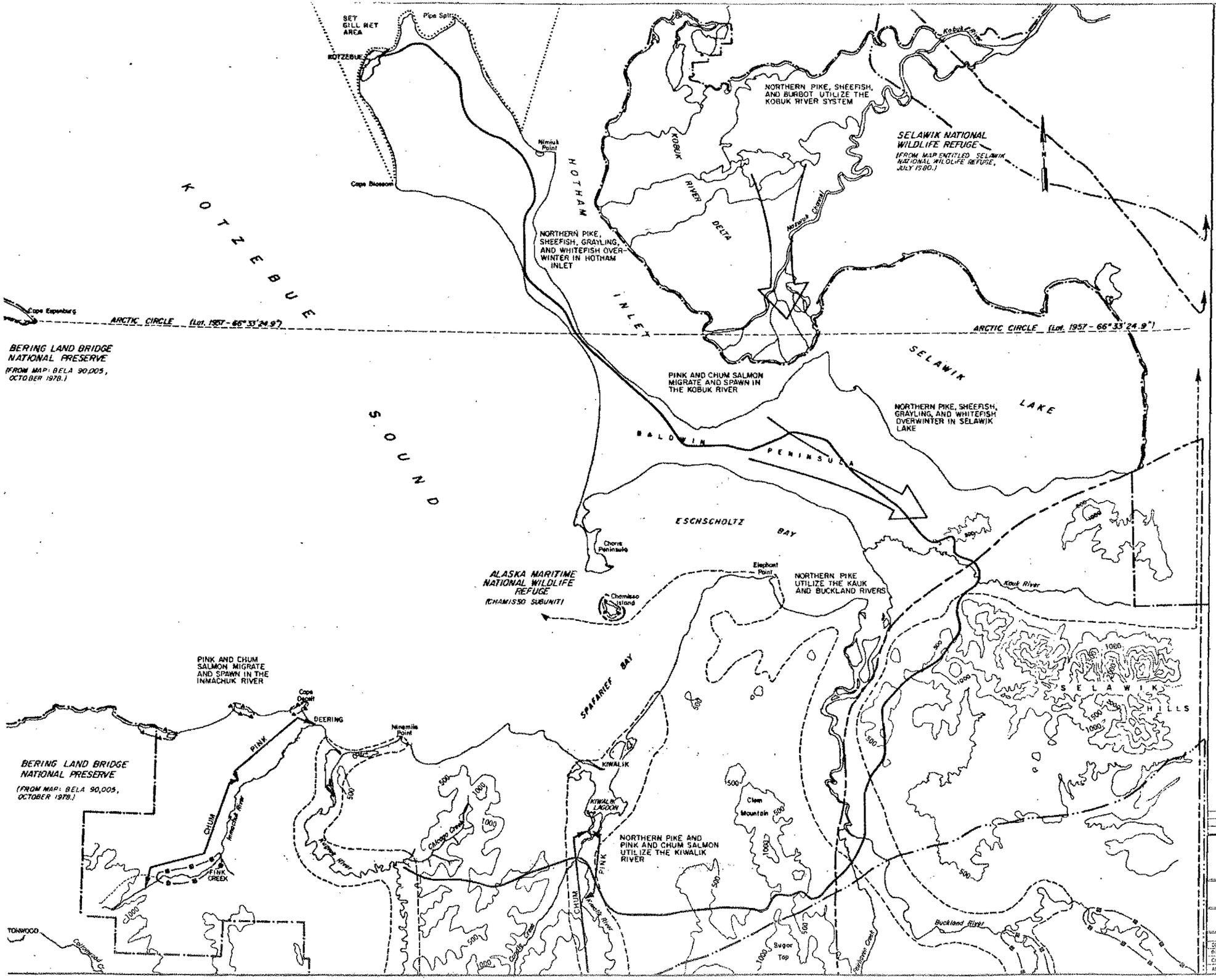
There is a great variety of wildlife in the reconnaissance area, some species are quite plentiful, some are sparse. The taking of many species of birds, fish, and large mammals by the people of the region supplements, in varying percentages, their food supply. The Alaska Department of Fish and Game (ADFG) has attempted to identify the ranges and locations of concentrations of many of the species important to the area. Figure 2-4 illustrates an abbreviated overview of these ranges.

The majority of the route down the Baldwin Peninsula traverses moist tundra and, to a lesser extent, wet tundra. The ponds, streams, and low lying wet areas are heavily utilized by a variety of ducks, geese, swans, and sandhill cranes. Caribou migrate down the Baldwin Peninsula from the Noatak and Kobuk drainages toward their winter range, which is generally east of the reconnaissance area.

Moose and grizzly bear are present throughout the reconnaissance area, although they are found less on the Baldwin Peninsula than elsewhere. Black bear range mostly to the southeast and northeast of the area.

Reindeer, which are herded by the people of the area, range over the entire reconnaissance corridor. Reindeer mix easily with caribou and many commercial animals are lost to caribou herds.

Arctic grayling, whitefish, and arctic char are found in many of the streams and rivers throughout the area. Northern pike are found in the Kauk, Buckland, and Kiwalik Rivers, as well as their associated streams. Pike, sheefish, grayling, and whitefish overwinter in Hotham Inlet (known locally as Kobuk



EXPLANATION

- Proposed Route
- Seabird Colonies
- Moose Overwintering Concentrations
- Black Bear Range
- Caribou Range
- Waterfowl and Seabird nesting and molting habitat.
- CHUM — Known Salmon spawning area with specie indicated.
- Caribou Migration

NOTE:

Moose, Grizzly Bear, Wolf, Wolverine, Arctic Grayling, Whitefish, and Arctic Char are present throughout the study area. No attempt has been made to indicate the range of these species, other than overwintering concentrations.

REFERENCES:

Le Resche, R.E., Hinman, R.A., (eds.)
ALASKA'S WILDLIFE AND HABITAT
Alaska Department of Fish and Game
Jan. 1973

McLean, R.F., Delaney, K.J.
ALASKA'S FISHERIES ATLAS - Volumes I & II
Alaska Department of Fish and Game
1978

SCALE 1 : 250,000

0 5 10 15 20 25 MILES

CONTOUR INTERVAL - 500 FEET
MAP TAKEN FROM U.S.G.S. TOPOGRAPHIC MAPS

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK HIGHWAY RECONNAISSANCE PROJECT WILDLIFE CONCENTRATION MAP

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MICHAEL BAKER, JR., INC. - ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9/81	DGB
DRAWN	9/81	ESA
CHECKED	9/81	REG
APPROVED	9/81	RHT

MAP NO 4

PROJECT NO A-80531

DRAWING NO.

SHEET 4 OF 4

Lake) and in Selawik Lake.

Pink and chum salmon are harvested by set gill nets in Kotzebue Sound off of the end of the Baldwin Peninsula and also make small runs into the Inmachuk, Kiwalik, and possibly Buckland ranges.

2.7.2 Cultural Resources

The historical and cultural resources of the area are found in the same location as the subsistence activities of today. Historic and ancient campsites, village sites, and gravesites have been found on or near the navigable waters of the area. NANA, Inc. has been inventorying historic and cultural resources of the area, and have these locations shown on 1:250,000 U.S.G.S. maps in their offices in Kotzebue. In addition to the locations, files are kept on each site containing interviews and historical records available. The methods available to the modern people have changed but the patterns of hunting, fishing, and gathering have remained relatively constant. The weather and patterns of animal concentrations and migrations still dictate where and when certain areas are utilized.

The proposed highway avoids all visable and identified areas of gravesites and campsites although it does intersect an identified ancient portage route. This portage route lies across the Baldwin Peninsula at its narrowest point, between Kotzebue Sound and Hotham Inlet. It is possible that items of historical interest may be found through this area.

Of more recent historical interest is the mining camp (formerly a town) of Candle. The proposed route crosses an area which was part of the old townsite until a fire in the 1960's destroyed 19 buildings.

Several sled trail routes were maintained throughout the area by the Alaska Road Commission to move mail and supplies. The highway intersects the Kotzebue-Shungnak Trail and the Kiwalik-Noorvik Trail on the Baldwin Peninsula. The route also follows the Bear Creek Trail and the Dahl Creek-Candle Trail for short distances.

3.0 DESIGN CRITERIA

3.1 DESIGN PARAMETERS

3.1.1 General

Design criteria presented in this section are based on traffic data published in the Western and Arctic Alaska Transportation Study, dated January 1981 and the Western Access Road Reconnaissance Study dated November 1973. Design criteria was taken from A POLICY ON GEOMETRIC DESIGN OF RURAL HIGHWAYS 1965, and GEOMETRIC DESIGN GUIDE FOR LOCAL ROADS AND STREETS 1970. Reference was made to GEOMETRIC DESIGN STANDARDS FOR ROADWAYS OTHER THAN FREEWAYS 1969. Recommendations for design standards presented in the Arctic Alaska Transportation Study and Western Access Road Reconnaissance Study were also considered, as well as engineering experience gained on other projects constructed in Alaska.

Based on earlier studies the following traffic projections were utilized for the proposed Kotzebue to Chicago Creek roadway:

ADT - 1984 10

ADT - 2004 70

DHV - 20% 14

D - 35-65

T - 10%

It was not the intent to set rigid design standards prior to alignment selection. It was the intent to utilize design standards as a guide, then take into account existing, and assumed conditions as well as a range of design values and sound engineering judgement in route selection. Items considered during route selection in addition to design criteria presented in this section are as follows:

- o Minimize alignment length
- o Consider material site availibility and haul
- o Consideration of future maintenance, including drifting snow
- o Consideration of construction problems and scheduling
- o Maintain fill section to the extent possible, avoiding problems associated with cuts in permafrost areas, especially on side hills
- o Minimize fill
- o Minimize environmental disturbance
- o Minimize potential problems with drainage, ground water flow and aufeis
- o Minimize roadway alignment on ice rich, high moisture content silts and organics
- o Provide adequate access without unnecessary disturbance to existing communities and facilities, taking into account future and/or proposed expansion
- o Avoid known areas of soil instabilities and/or movement
- o Efficient use of fill in areas of severe shortage

3.1.2 Geometrics

The following tables lists the range design values utilized in selecting alignments; and recommended for final design:

Table 3-1

MINIMUM DESIGN VALUES

	Design Speed	Curvature		Grade	
Terrain	Desirable	Desirable	Maximum	Desirable	Maximum
Flat	50 MPH	7°	12°	4%	6%
Rolling	45 MPH	10°	15°	5%	7%
Mountainous	40 MPH	12°	18°	7%	10%

ASSHTO GEOMETRIC DESIGN GUIDE FOR LOCAL ROADS AND STREETS indicates that, for roadways with ADT's below 250, grades of relatively short lengths may be increased to 150 per cent of the values shown in Table 3-1.

Table 3-2

NON-PASSING SIGHT DISTANCE (STOPPING)

	DESIRABLE		MINIMUM	
Terrain	Distance (Ft.)	Design Speed (MPH)	Distance (Ft.)	Design Speed (MPH)
Flat	475	60	350	50
Rolling	350	50	325	47
Mountainous	325	47	275	40

Table 3-2

NON-PASSING SIGHT DISTANCE (STOPPING) (Continued)

DESIRABLE

Terrain	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
Flat	160	105
Rolling	85	75
Mountainous	75	68

MINIMUM

Terrain	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
Flat	85	75
Rolling	75	68
Mountainous	55	55

Notes:

(1) K: A coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide minimum sight distance.

(2) K values indicated taken from Geometric Design Standards for Highways Other Than Freeways - 1969 AASHO.

MAXIMUM RATE OF ELEVATION SUPER Six per cent (6%)

MINIMUM DISTANCE BETWEEN REVERSING CURVES:

Desirable	Absolute
400'	100'

RIGHT OF WAY WIDTH: 200' Minimum

3.1.3 Roadway Widths

Upgrading existing streets in Kotzebue and proposed extensions of city streets was based on shoulder to shoulder width of 44 feet, a common urban standard, the elements as depicted in the following sketch.

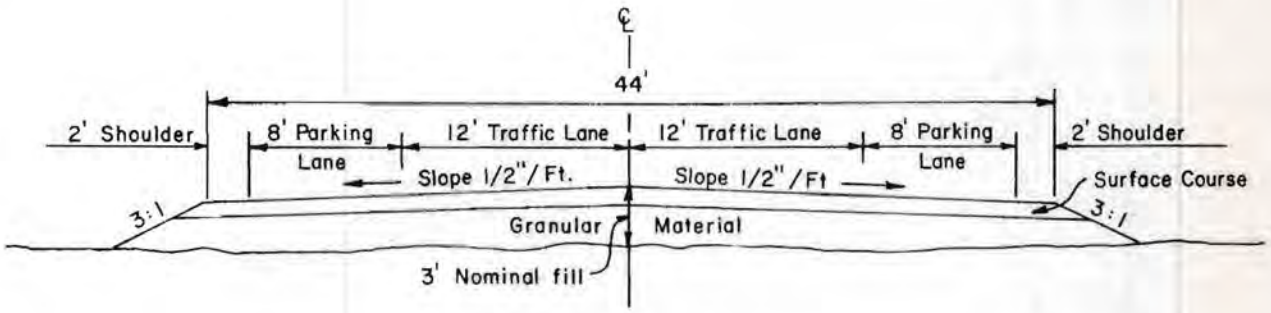


Figure 3-1

KOTZEBUE CITY STREET DIMENSIONS

This typical was used for Lagoon Street, Seventh Avenue, Seventh Avenue Extension and Grizzly Way. It will allow free movement of traffic and parking through the subdivided residential and recreation areas.

The rural highway width used for this study was 28 feet, shoulder to shoulder. It is the minimum width required for the passing of trucks and conforms to the State of Alaska secondary highway standards. A reduction of this width would require passing turnouts and extra widening on curves to accommodate the heavy trucks.

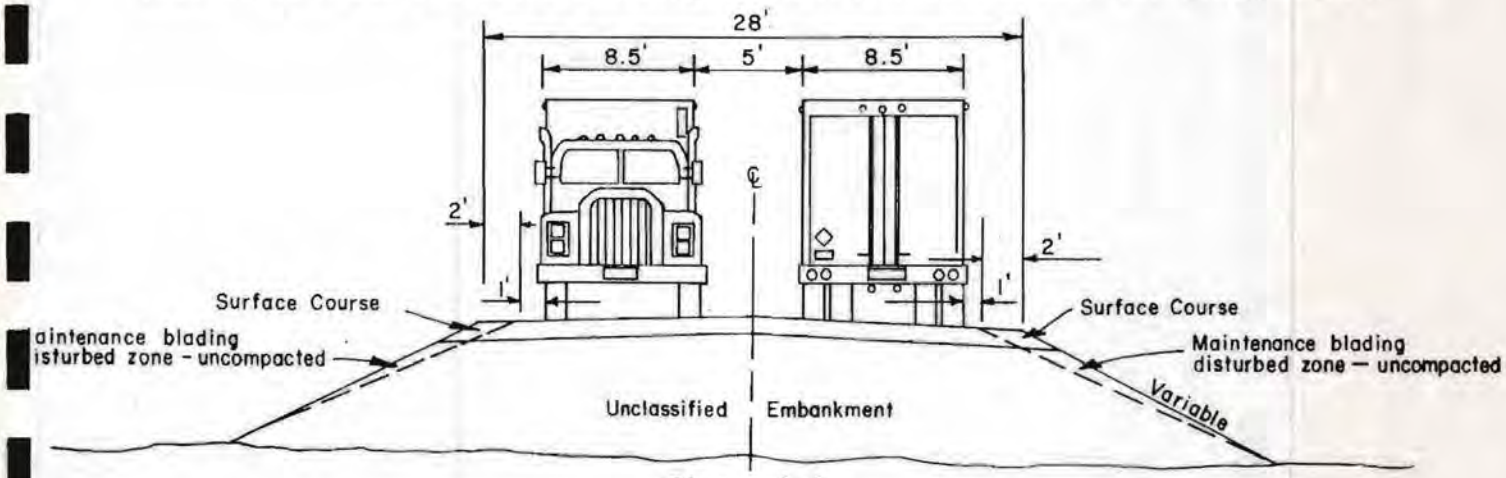


Figure 3-2

PROPOSED ROADWAY WIDTHS

and maintain a safe and functional highway. The forecasted average daily traffic of ten vehicles for the initial Kotzebue to Chicago Creek segment could justify the selection of a narrower width roadway. However, with the possible future expansion of the highway system, a major reconstruction of the highway would be necessary and at a much greater cost to the State.

3.1.4 Bridge Widths

The bridge widths were chosen to accomodate two 12 foot traffic lanes plus a two foot offset to the bridge parapets as recommended by AASHO.

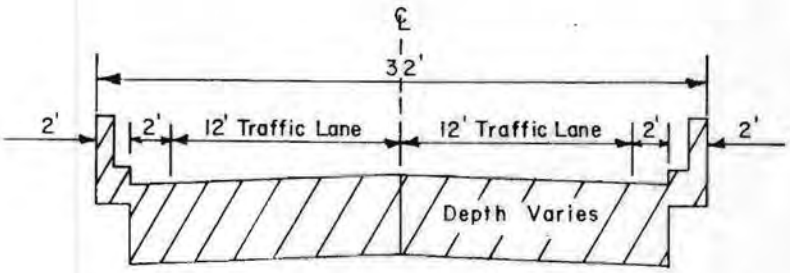


Figure 3-3

PROPOSED BRIDGE DIMENSIONS

3.2 DRAINAGE STRUCTURES

3.2.1 Culverts

Culverts should be designed to pass runoff from storms with return frequencies equals to the culvert's design life, without the headwater depth exceeding 1.5 times the culvert diameter (or rise, in the case of arches or pipe arches). Discharge velocities should be low enough to prevent downstream scour, stilling basins should be constructed where discharge velocities exceed the allowable velocity of the stream bed. Discharge velocities and invert elevations must allow fish passage on streams with fish populations. Provisions should be included for thawing of drains and culverts in areas susceptable to icing and be made accessible for thawing by installation of thaw pipes.

3.2.2 Ditches

The excavation of drainage ditches is generally to be avoided. Most longitudinal flow will occur along the roadway embankment toe. Small culverts are required to allow this water to flow to the downslope side of the embankment.

Where drainage ditches are required in cut areas, they should be of a capacity sufficient to handle the flow and the anticipated deposition of slough from cuts. Ditch checks and ditch armoring may be required to prevent erosion of the ditch.

3.2.3 Thermal Erosion Control

The largest threat to a highway in permafrost areas is that of thermal erosion. Constant and vigilant attention must be paid to thermal erosion prevention throughout the location, exploration, design, construction, and maintenance phases of the project. Stripping of organic layers, channelization of runoff flows, and cutting of ice-rich material is generally to be avoided. If these activities are necessary, the consequences must be anticipated and special designs prepared to mitigate potential problems.

3.3 TYPICAL SECTIONS

3.3.1 Embankment Sections

Three typical fill sections were developed for use during the route selection and refinement process of this project. These typical sections are shown on Figure 3-4 and are described more fully below. The design of these sections was based on field and office evaluation of probable subgrade conditions and on past engineering experience with roads constructed in Arctic terrain.

One of the primary sources of field data relating road performance to subgrade conditions for the project area, is the road from Nimiuk Point to a Standard Oil of California exploration well (Mile 22.9 on photo mosaic). This road was built to a minimum standard in 1974 and abandoned some time in 1975, after the well was completed. The roadway embankment and the drilling pad have undergone major differential settlements due to thawing of the subgrade soils. The depths of thaw at selected locations along the road and in adjacent undisturbed terrain were obtained as were gravel thicknesses. In addition, a profile of subgrade and embankment materials including type and thickness of organic material, soil type, and water contents was obtained at each location. The road from Kotzebue to the U. S. Air Force White Alice facility was also examined. This road is in good condition, but it, too, has undergone significant settlement (at least two feet) due to subgrade thaw and requires constant maintenance.

Typical embankment sections were selected in order to estimate required material quantities for various possible alignments and to determine the amount of material required from potential material sources. Three different depths of embankment Type I were used for estimation purposes. These depths were related to the terrain units mapped on aerial photographs as follows:

For terrain unit Bx (or other bedrock units) embankment thickness equaled 3.0 feet, for terrain unit C and portions of Fs, embankment thickness equaled 4.5 feet, and for terrain unit E, portions of Fs and portions of P thicknesses equaled 7.0 feet. These depths were assigned to reflect average subgrade conditions. Modifications can be expected during design based on the soil investigations described in Section 7.1.

The second type embankment (Type II) is a composite section with the lower portion constructed of fine sand and a covering layer of select gravel. This section was included in order to take advantage of a possible material source (KK-4) found on the Baldwin Peninsula. As discussed in Section 3.4 there is a severe shortage of aggregate on the peninsula and this type section incorporated material which is not commonly used where gravel is abundant. This type section can be used in place of any other section without an increase in depth.

Embankment Type III is a seven foot thick embankment containing two inches of expanded polystyrene insulation placed on a horizontal leveling course (nominally shown as one foot thick). This section is designed to prevent thaw of the subgrade, based on the Modified Breggen equation and a design thaw index of 2300 degree-days for Kotzebue. An embankment section which prevents subgrade thaw will eliminate nearly all differential settlement of the road surface and the consequent maintenance. However, due to the high cost of insulation such roads are usually uneconomic in areas, such as Kotzebue, with a substantial thaw index. This section was originally chosen only for areas in terrain unit P,, which are underlain by exceptionally icy and organic rich soils. Due to severe materials shortages and excessive haul desirability or all season construction

alternated for this section were utilized for estimating purposes, consisting of a three foot fill with five and one half inches of insulation or an uninsulated section eight and one half feet thick. The final design would probably consist of variations of these typical sections, depending on site specific design information, blowing snow and current economic factors.

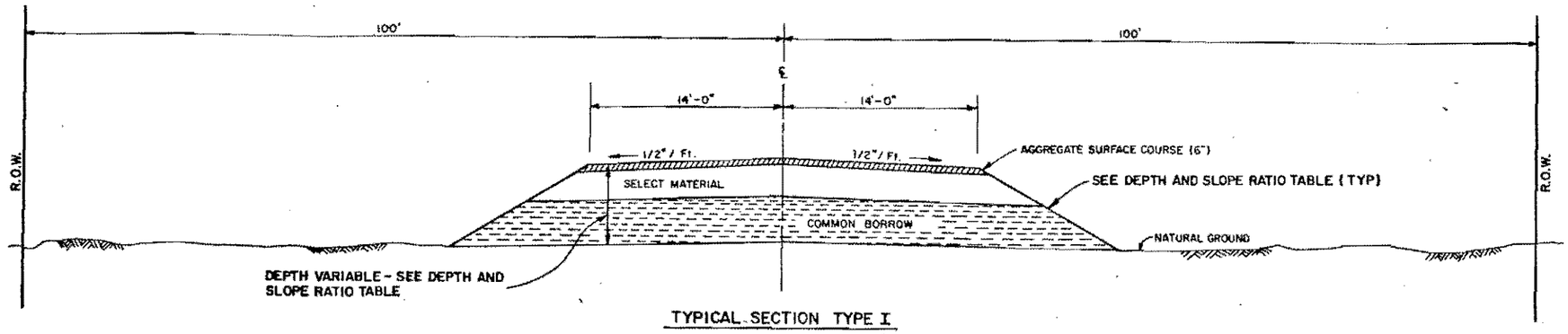
3.32 Cut Section and Cut Fill Sections

Typical cut and cut fill section are shown on Figure 3-5. The relatively gentle topography along the proposed alignment leads to a road design with a bare minimum of cut or cut-fill sections. In fact, the majority of cuts for the proposed route are along the bedrock ridgetops to take advantage of material proximity to the route. That is, cut sections are combined with material sources at these sites.

At the relatively few locations along the route where alignment, grade or side slope considerations dictate that cuts or cut-fills be used they should be designed in accordance with current best practice regarding cuts in permafrost. These are reflected in the typical sections presented, which are based on minimizing the disturbance to delicate soils and minimizing maintenance of the road. They are also designed to encourage stabilization of cut slopes through revegetation of sloughing banks. In some cases insulation of cutslopes to prevent thermal erosion has been used. This is expensive and would be a site specific, design phase option.

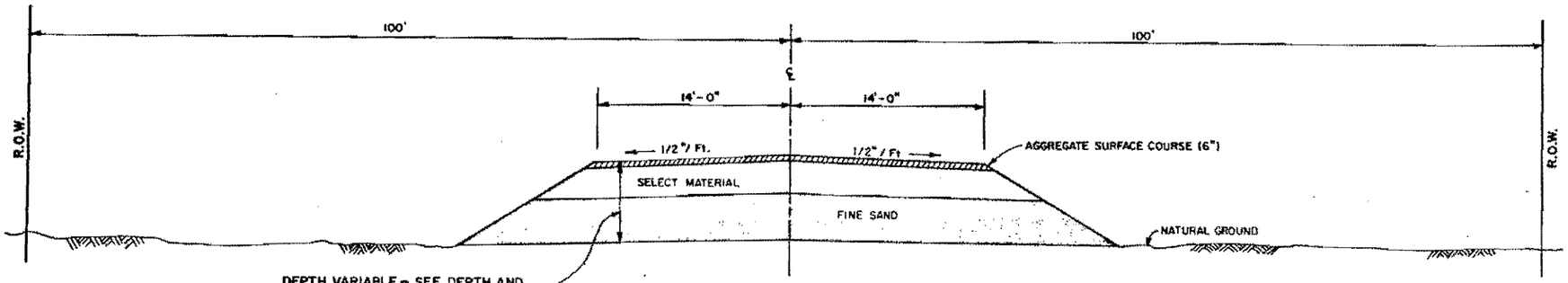
3.3.3 Miscellaneous Typical Sections

Typical sections for permanent and temporary access roads and the typical section used in the City of Kotzebue are shown in Figure 3-6. These sections were utilized for estimating purposes. Final design will be based on site specific information.



TYPICAL SECTION TYPE I

0% TO 15% SIDE HILL SLOPE

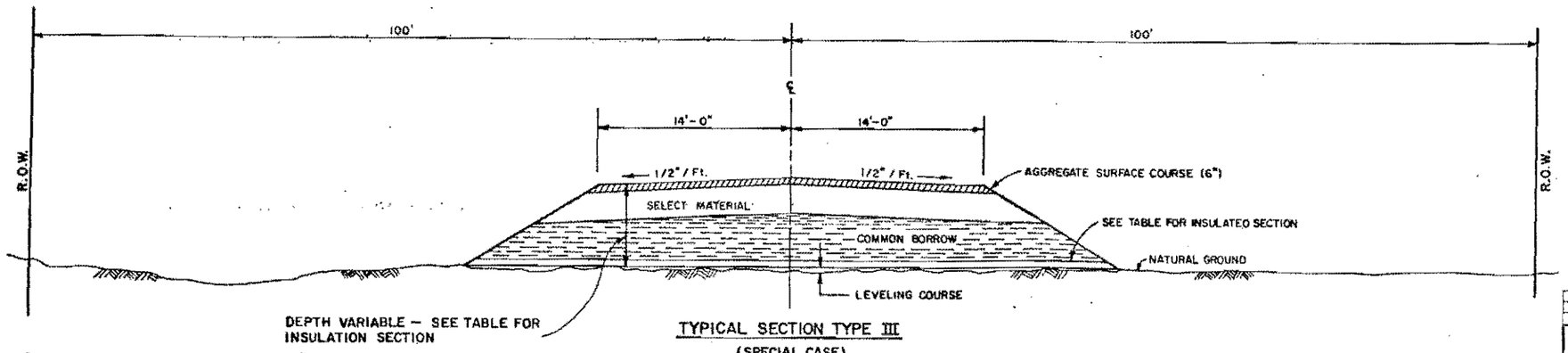


TYPICAL SECTION TYPE II

(SPECIAL CASE)

DEPTH AND SLOPE RATIO TABLE		
SUBGRADE MATERIAL	DEPTH OF FILL	SLOPE RATIO
BEDROCK OR OTHER COMPETENT SUBGRADE	3'	1:1
COLLUVIUM AND DRY SILT	VARIABLE BASED ON REDUCED SUBGRADE STRENGTH DESIGN (NOMINAL 4.5')	2 1/2:1
FROZEN ICY SILT	7'-8.5'	2:1

INSULATED TYPICAL SECTION ALTERNATES		
INSULATION THICKNESS	DEPTH OF FILL	COMMENTS
5 1/2"	3'	AREAS OF SEVERE MATERIAL SHORTAGE
2"	7'	ADEQUATE MATERIAL AVAILABLE
0"	8.5'	SUMMER CONSTRUCTION METHODS DESIRED



TYPICAL SECTION TYPE III

(SPECIAL CASE)

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK
HIGHWAY RECONNAISSANCE PROJECT
TYPICAL FILL SECTIONS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

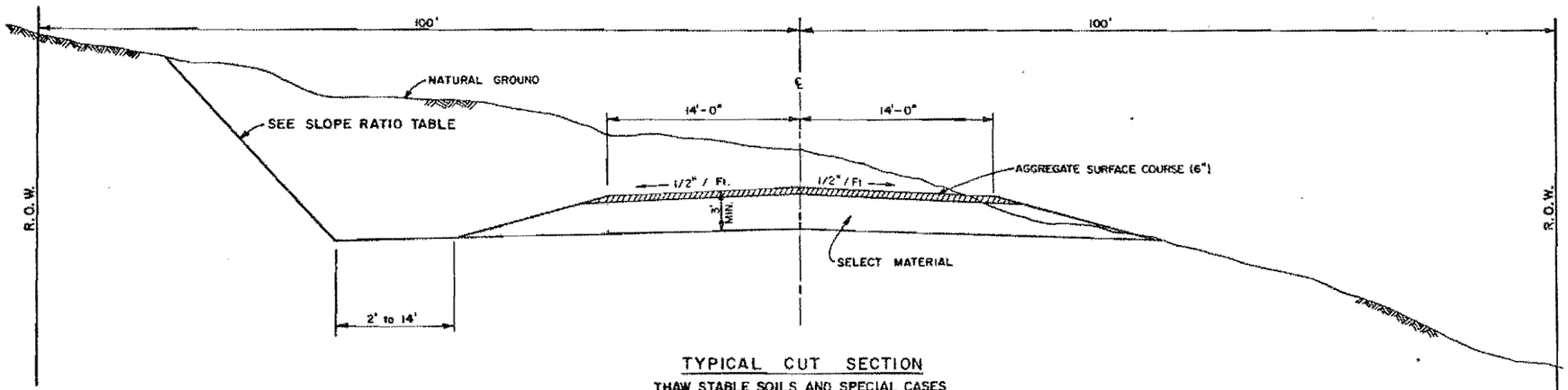
MICHAEL BAKER, JR., INC. - ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9/81	JP/TOS
DRAWN	9/81	SSA
CHECKED	9/81	RCD
APPROVED	9/81	RHT

PROJECT NO. A-80531

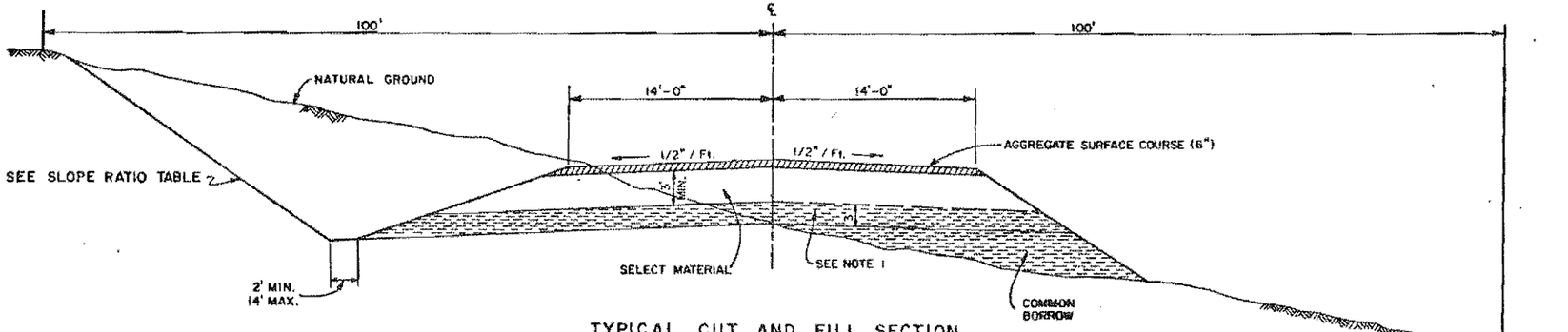
DRAWING NO.

SHEET 1 OF 3



TYPICAL CUT SECTION
THAW STABLE SOILS AND SPECIAL CASES

CUT SLOPE RATIO TABLE		
HEIGHT OF SLOPE	WIDTH OF DITCH	BACK-SLOPE
0 TO 5'	2'	1 1/2 : 1
5' TO 15'	8'	1 : 1
15' AND OVER	14'	1/4 : 1 (FROZEN SILTS) 1 1/2 : 1 (GRANULAR SOILS) 2 : 1 (THAWED SILTS)
	2' TO 14'	1/4 : 1 TO 2 : 1 (ROCK)



TYPICAL CUT AND FILL SECTION
15% AND GREATER SIDE HILL SLOPE, AND
AS NECESSARY IN TRANSITION AREAS.

NOTES:

1. WHERE SOIL CONDITIONS PERMIT, THE REQUIREMENT FOR 3' OF COMMON BORROW UNDERLYING THE LAYER OF SELECT MATERIAL MAY BE DELETED.

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK
HIGHWAY RECONNAISSANCE PROJECT
TYPICAL CUT SECTION

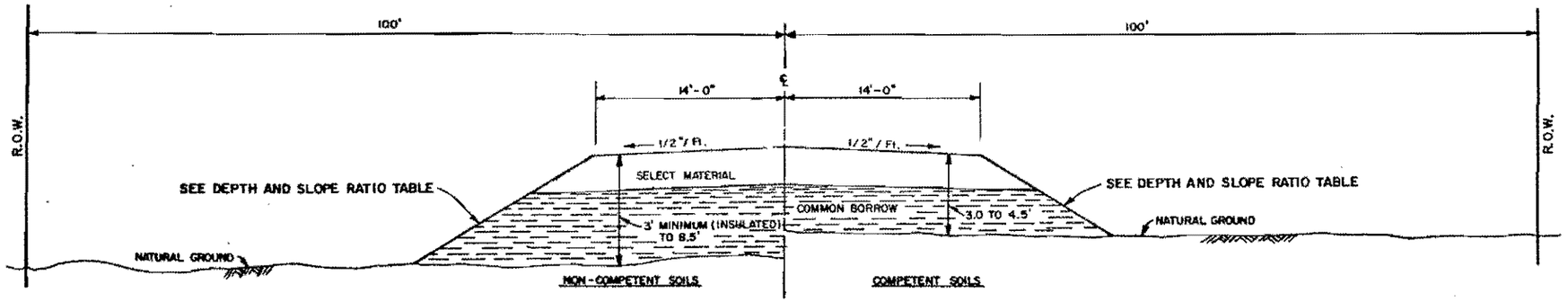
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
MICHAEL BAKER, JR., INC. – ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9/81	JA/RSS
DRAWN	9/81	ESA
CHECKED	9/81	REG
APPROVED	9/81	DHT

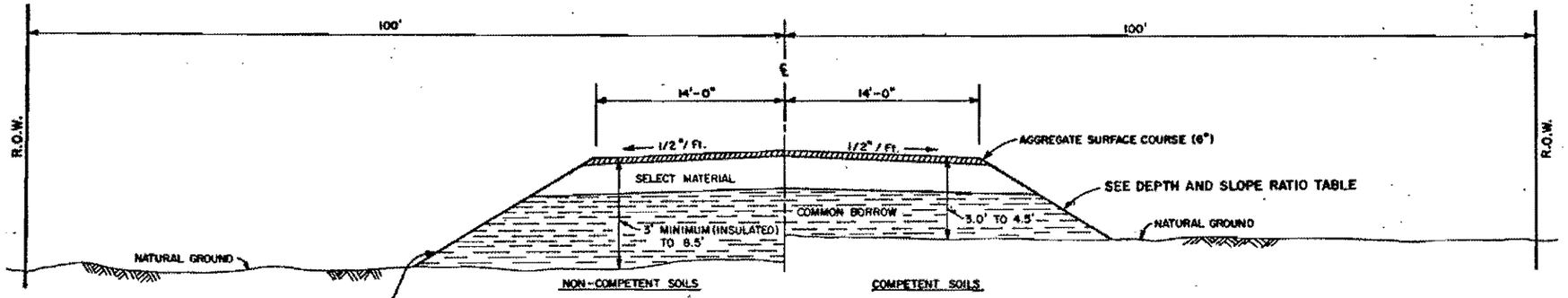
PROJECT NO
A-60331

DRAWING NO.

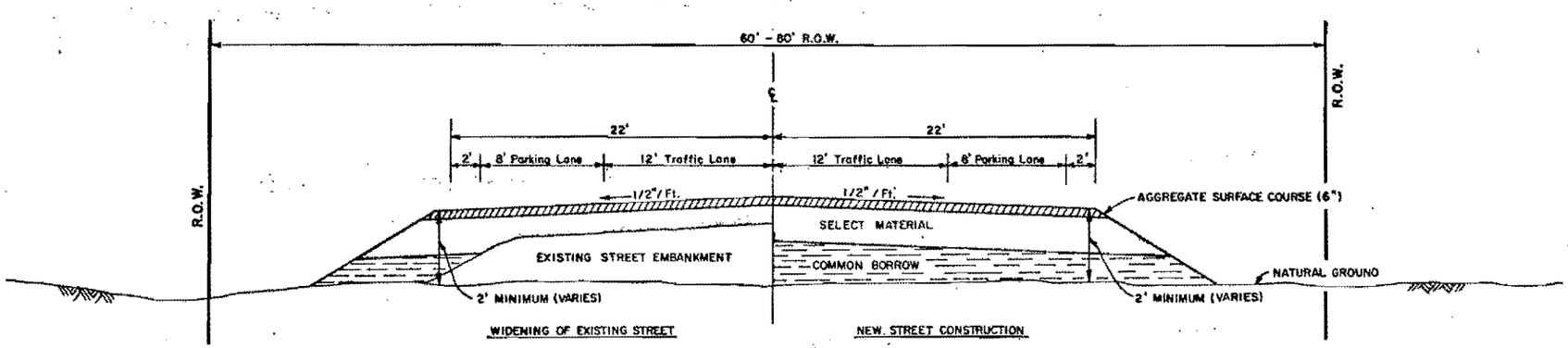
SHEET 2 OF 3



TEMPORARY ACCESS ROAD
TYPICAL SECTION



PERMANENT ACCESS ROAD
TYPICAL SECTION



KOTZEBUE CITY STREET
TYPICAL SECTION

DEPTH AND SLOPE RATIO TABLE		
SUBGRADE MATERIAL	DEPTH OF FILL	SLOPE RATIO
BEDROCK OR OTHER COMPETENT SUBGRADE	3'	3:1
COLLUVIUM AND DRY SILT	VARIABLE BASED ON REDUCED SUBGRADE STRENGTH DESIGN (NOMINAL 4.5')	2 1/2:1
FROZEN ICY SILT	7'-8.5	2:1

INSULATED TYPICAL SECTION ALTERNATES		
INSULATION THICKNESS	DEPTH OF FILL	COMMENTS
5 1/2"	3'	AREAS OF SEVERE MATERIAL SHORTAGE
2"	7'	ADEQUATE MATERIAL AVAILABLE
0"	8.5	SUMMER CONSTRUCTION METHODS DESIRED

REVISION	BY	DESCRIPTION	DATE

KOTZEBUE TO CHICAGO CREEK
HIGHWAY RECONNAISSANCE PROJECT
MISCELLANEOUS TYPICAL SECTIONS

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

MICHAEL BAKER, JR., INC. – ENGINEERS & SURVEYORS
FAIRBANKS, ALASKA

	DATE	BY
DESIGNED	9/61	JW/RGS
DRAWN	9/61	ESA
CHECKED	9/61	RSD
APPROVED	9/61	RNT

PROJECT NO. A-80531

DRAWING NO.

SHEET 3 OF 3

4.0 MATERIAL SOURCES

4.1 GENERAL

The identification and preliminary evaluation of potential material sources was an important element of the route selection, since the location of mineral materials in relation to a proposed road alignment has a large impact on the cost of construction. For this reason one of the main criteria in selecting among alternative alignments was their proximity to potential material sources. In addition to meeting favorable distance criteria, potential material sources should not have major adverse environmental impacts. Although it is properly a design function to assess site specific environmental impacts, a preliminary assessment of site suitability was made for each potential material source along the alignment.

The first step in the identification of material sources was to delineate on aerial photographs all features, such as gravel bars and rock outcrops, with potential for good quality material. The primary factors used during this identification phase and subsequent evaluations were; proximity to a proposed alignment, adequate quality of material, minimum overburden, and minimum environmental impact. The proposed source areas were then visually examined during the fixed wing overflight in order to verify the preliminary identification. During the subsequent helicopter reconnaissance phase, final examination of alternate alignments and nearby material sources took place simultaneously. In this way as alignments were adjusted, shifted or rejected the impact of material source location could be assessed and final selections made.

Throughout most of the route, material sources are adequate in terms of, quantity and quality of material; location and spacing along the route; and environmental acceptability. However, the major portion of the Baldwin Peninsula (M.P. 0 to

M.P. 62) is almost totally lacking in embankment materials. This is due to the thick covering of windblown silt over the underlying glacial till. As a result, heavy reliance must be placed on the one identified adequate source, at Nimiuk Point, to provide gravel material for the road.

4.2 LOCATION AND DESCRIPTION

In order to facilitate presentation of data on potential material sources the route has been broken into four sections. There is a short narrative paragraph describing each section, and in Appendix II are standarized data sheets on each potential source. The locations of these potential material sources are shown on the Reconnaissance Geology Map, Map No. 1.

4.2.1 Material Sources Baldwin Peninsula Section (KK)

As mentioned previously, sources of mineral material on the Baldwin Peninsula are minimal. Thick deposits of frozen windblown silt cover the glacial till to depths which make mining uneconomic. The main source available, KK-2 is a large progressive point bar deposit at Nimiuk Point. Also listed are two sources, KK-1 and KK-3, with low probabilities of successful use. KK-1 is a glacially formed ridge probably consisting of sand and gravel. However, overburden depths are unknown and further exploration would be required to establish the economics of mining this source. KK-1A and KK-3 are potential offshore deposits of sand and gravel. Development of these sources, or any offshore source, would require dredging to produce the volumes of material required. The economics of dredging for aggregate will be highly dependent on the final design and on construction scheduling, and this can only be analyzed during the design phase of the project. The effects on beach stability at Kotzebue of removing very large quantities of near shore gravels is unknown, and potentially adverse. Before this source can

be included in design, such effects must be analyzed and any adverse impacts mitigated. Source KK-4 is a deposit of eolian sand. If used in a composite embankment section as described in Section 3.3, this material will provide adequate structural support.

From M.P. 62 to the Kauk River Hills there are numerous glacial till deposits of sand and sandy gravel. These form low hills, ridges and banks with minimal overburden. The sites, shown on the map and listed in the appendix sheets were chosen based on optimal haul location, but there are several other sites in this stretch which would also be adequate. The gravelly sand to sandy gravel contained in the till deposits and in the Nimiuk Point deposit are permanently frozen. However, they should be rippable especially if they are worked in the summer. The material will require only minimal processing to produce select aggregate.

4.2.2 Material Sources Kauk River Hills to Buckland River Section (KB)

The primary sources for material in this stretch of the route are bedrock outcrops on or near ridgecrests. These outcrops have minimal overburden, but the surface materials are frost riven, blocky rock to an unknown depth. Most sites are of relatively low relief and therefore will require fairly large operating areas to produce adequate quantities of material. The rock, either meta-volcanic or granitic, is generally of good quality, but blasting will be required for most excavation. Pit run material will be adequate for embankment material and crushing will be required to produce select material.

Source KB-2 is somewhat unique in this stretch of the route in that it is partially a glacial till deposit, consisting of sands and gravels. The sand

and gravel deposit directly overlies a gray vesicular basalt which will also provide adequate material. The basalt will require blasting for removal and crushing to provide select material.

4.2.3 Material Sources Buckland River to Candle (BC)

There are three possible source types for material between the Buckland River and Candle:

- o Floodplain of the Buckland River (Fluvial sands, gravels)
- o Basalts (At and near ridge tops)
- o Granites (On a short section of the route)

The floodplain of the Buckland River near the crossing is narrow and the material is primarily silt and sand. Down river near the confluence with Fairhaven Creek the floodplain is wider. The material is frozen and provisions for thawing would have to be made. Select aggregate production will require screening and/or crushing gravel that is present. The only other floodplain gravels are in Meinzer Creek, but the creek is narrow and mining could cause major stream disruptions.

Almost this entire segment crosses extensive basalt flows. These are generally overlain by deep eolian silt deposits and exposures occur only on ridge tops and along streams. The material is hard and blasting would be required. Select aggregates can be produced by crushing. Only a short section of this segment crosses granitic bedrock. The exposures are poor and the rock is apparently highly weathered with high ice contents. Due to the ready availability and superior quality of the basalt it is recommended that the granite not be utilized.

activities are necessary, the consequences must be anticipated and special designs prepared to mitigate potential problems.

4.2.4 Material Sources Candle to Chicago Creek (CC)

Between Candle and Chicago Creek there are two potential types of material:

1. Floodplain gravels
2. Bedrock (schist)

Placer tailings are available on both the Candle Creek and the Kiwalik River floodplains. Outside of these areas there is little available area for gravel removal. Select aggregates can be produced by screening and/or crushing. Between Candle and Chicago Creek the only apparent available sources are on bedrock outridges. The rock has infrequent exposures along the route but apprears to be similar to the "Birch Creek Schist" near Fairbanks. There is one placer operation on the Kugruk River floodplain (CC-7), at which cold water points are being used for thawing. Numerous meander cores are available downstream although they all are frozen and most would require access across the river. The meander cores available upstream are on unpatented claims.

5.0 ROUTE ALIGNMENT DESCRIPTION

5.1 GENERAL

The proposed route alignment is shown on the photo mosaics in Volume II of the Reconnaissance Study for Kotzebue to Chicago Creek. The mileposts on the mosaics are referred to in the following route alignment descriptions.

5.2 KOTZEBUE (MILE 0) TO KOTZEBUE LAGOON (MILE 1.2)

Kotzebue is located on a gravel spit which fronts on Kotzebue Sound to the west. Behind this spit is a series of small and large lagoons and lakes bounded by boggy tussock and grass tundra. The spit was formed as gravel and sand longshore storm deposits built seaward. Behind the expanding beach, lagoons were created which have been gradually filling with fine grained alluvial and marine sediments.

The proposed route begins at the intersection of Third Avenue and Lagoon Street, Mile 0, then follows Lagoon Street past the city power plant to Seventh Avenue. Lagoon Street is an existing street but will require upgrading. A 44 foot typical section is proposed for all existing and proposed extensions of city streets in Kotzebue. This roadway width would allow for two 12 foot traffic lanes, an eight foot parking lane on either side of the road and a two foot shoulder.

From Lagoon Street the proposed route then follows Seventh Avenue. Approximately 1150 feet of Seventh Avenue currently exists as a right-of-way only. The remaining 650 feet of Seventh Avenue is then proposed to be extended across private property to its intersection with Grizzly Way.

The proposed route then utilizes Grizzly Way, also unimproved, crossing the Swan Lake boat entrance at an existing small timber bridge location to the main Kotzebue Lagoon crossing.

The minimum depth of roadway recommended is two feet but will vary depending on the existing fill, final grades, and design flood levels in the lower areas. A three foot typical section was utilized for the quantity estimates, with the exception of the bridge approach areas.

5.2.1 Kotzebue Lagoon and Swan Lake Crossing

The general subsurface soil profile will be similar at the two bridge sites, but the thermal regimes will be quite different. The gravel fill at Swan Lake, placed on the approaches to the existing bridge, is probably 6 to 8 feet deep. Below this will be the recent lagoon deposits, fine sands and silts with some organic material and possibly some fine gravel to depths of 5 to 10 feet below original ground. Underlying the recent deposits are gray silts with a trace to some fine sand and zones of black organic silt. This material will extend to practical foundation depths. The near surface materials at the main crossing are recent lagoon deposits of silt and organics. These will be thinner (approximately five feet thick) than at Swan Lake and overlie similar gray silts to fine sands.

Permafrost is present at both bridge sites, but it will be significantly deeper at the main crossing. Previous soil borings in Kotzebue show permafrost at relatively shallow depths. Under the influence of the gravel fill and boat channel, the permafrost level at Swan Lake will be somewhat depressed, but can be expected at approximately ten feet below original ground.

Borings through the airport runway embankment, where it crosses Kotzebue Lagoon show thawed material to depths of at least 40 feet. The thaw bulb at the proposed main lagoon crossing can be on the same order of magnitude, and may be even deeper. Frozen soils at both locations probably contain zones which are thawed or only marginally frozen. These zones seem to be associated with high salinity pore waters and are due to freezing point depression. In order to determine exact permafrost depths and the extent of any thaw zones a detailed subsurface investigation will be required.

Pile foundations will be the most efficient structures for these crossings. At Swan Lake conventional shore pilings in permafrost will be adequate, although the presence of substantial thaw zones would require some type of passive refrigeration. The main crossing foundation may be quite complicated depending on the actual depth of thaw and the strengths of the underlying thawed silts. Very long piles in marginally frozen permafrost are a strong possibility.

The proposed bridge width is 32 feet as shown in Figure 3-3, which allows for two 12 foot traffic lanes and two foot shoulders on either side of the roadway. It is estimated that the Swan Lake bridge will be 40 feet in length with approximately 10 foot clearance similar to the existing bridge. The Kotzebue Lagoon crossing is estimated to require a 130 foot span with a clearance of 23 feet in height. Toe to toe distance between the approach fills would be approximately 50 feet. The existing water line crossing structure adjacent to the Kotzebue Lagoon crossing has a span of 300 feet equal to the lagoon width and a clearance of approximately 23 feet. The 130 foot span would be adequate for any of the small boats utilizing the lagoon. It may be advantageous to suspend the water

line crossing to the new bridge structure and remove the existing steel suspension bridge. If this is not accomplished, proper design and construction techniques must be utilized to protect the integrity of the existing structure.

Embankment materials to the midpoint of the proposed route from Kotzebue to Nimiuk Point should be obtained from sources offshore Kotzebue. Every effort should be made to conserve the source at Nimiuk Point. Estimated readily available mineral material available based on our reconnaissance on the Baldwin Peninsula is 4,600,000 cubic yards. Allowances should be made for future uses as well as maintenance. Although there are additional possibilities for mineral material including fine sand that should be explored, poor construction methods could easily exhaust the readily available mineral material supply.

There is currently a small private firm producing gravel with a dragline operation from the beach at Kotzebue; it is located in the vicinity of the City land fill. This operation is supplying all of the current gravel needs at Kotzebue. It has been permitted by ADL and covers about two miles of beach frontage. A deeper water permit should be obtainable to produce the volume of gravel needed to construct the proposed road from Kotzebue to Nimiuk Point. A dredging operation would be required. The dredge should be located approximately 500 feet offshore to avoid any possible damage to the existing shoreline. The gravel material should be available at this location but should be verified by borings. Any silt overlay could be stripped by dredging and deposited farther out into the Sound, beyond the present channel used by the lighterage barges. The gravel would be pumped and discharged to selected locations on shore through a floated flexible pipe which would provide for the stockpiling and drainage of the gravel. This source of

gravel is a high priority and should be pursued. The first sections of the road constructed should be from Kotzebue to Nimiuk Point. Depending on the amount of material available at Kotzebue, the haul would be one way to Nimiuk Point or to the halfway point. Depending on the volume of material available, Nimiuk Point will have to provide material for road construction to approximately Mile 40.

Kotzebue was listed as the prime source on the haul analysis and a construction sequence developed utilizing that material source.

5.3 KOTZEBUE LAGOON (MILE 1.2) TO NIMIUK POINT ACCESS ROAD (MILE 23.9)

After crossing the Kotzebue Lagoon the proposed route crosses approximately 1200 feet of very wet ice rich silts and organics, then crosses the city water supply main and power line at Mile 1.3. The water supply main is an insulated line from Vortac Reservoir, supported by steel, non-refrigerated piles approximately six feet in height. It will be necessary to encase the water main in the roadway embankment. The existing power line is also above ground and the design will have to provide for some type of power line crossing. Preliminary figures show a 2.8% grade descent to the lagoon then 2% approach to the bridge. The fill height from the bridge to the vicinity of the proposed water line crossing will range from 13 feet to a maximum of 28 feet due to the topography and bridge crossing elevation.

After negotiating a 2 degree curve to the north, the route follows the higher portions of the peninsula. The roadway embankment will consist of a three foot high insulated fill with rolling grades matching closely the existing topography. The route soils conditions to the Nimiuk Point access road consist of frozen ice

rich silts. The route avoids, to the extent possible, the low lying wetter areas and thaw lakes and stays on the higher ridges. Patterned ground and ice rich zones can be observed on the aerial photos throughout this area. Construction should be by end dump methods. Existing arctic tundra should be left in place.

The arctic tundra at the east end of Runway 8-26 at Ralph Wien Memorial Airport has apparently been stripped due to approach clearance problems, and severe degradation has resulted. Photos 1-3 and 1-4 show the results of the meeting of ice lenses, in the frozen ice rich silts.

There are several grave sites both to the north and south of the proposed route on the bluffs overlooking the City of Kotzebue. The route selection avoided these sites.

Embankment materials for the section of route to Mile 12 will come from offshore sources near Kotzebue, M.S. KK-1A. If there are adequate quantities this source should be utilized to Mile 23.9. M.S. KK-2 at Nimiuk was utilized as a source for embankment materials from Mile 12 to Mile 23.9.

Potential material site KK-1 lies to the north of the proposed route near Mile 5. This site has a low probability of use due to unknown overburden depths.

5.4 NIMIUK POINT ACCESS ROAD (MILE 22.9 TO MILE 64.9)

The proposed route crosses an existing access road at approximately Mile 22.9. This road was constructed from a gravel source at Nimiuk Point to a Standard Oil of California Well drilling pad in 1974. The Nimiuk Point gravel bar will be utilized as a material source to construct that portion of the proposed route from approximately Mile 12 to Mile 36. The access road to Nimiuk Point has undergone major settlement and substantial improvement will be necessary.

The proposed route continues utilizing the higher portions of the peninsula in a fairly direct route towards the Kauk River area. Thaw lakes, lower wetter areas, poorer soils conditions and drainages are avoided, to the extent possible. Soils consist of deep frozen, ice rich silts. The active layer is from one foot to eighteen inches in depth based on frost probe depths. The three foot insulated typical section is utilized. The terrain is fairly flat and the grades will closely match existing topography. Some steeper grades of fairly short duration (5-8%) may be required into and out of drainage areas. The maximum degree of curvature utilized is two degrees. The vegetation consists of arctic tundra, with scattered shrub thickets.

Embankment materials from Mile 35 to Mile 46.4 will come from Material Source KK-4 at Mile 35. This material is an eolian sand from low relief outcrops. This material is fine to very fine sand with some silt content. Surfacing material will be hauled from Nimiuk Point, Material Site KK-2. Embankment materials for that portion of proposed route from Mile 46.4 to Mile 64.9 will come from Material Site KK-5, at Mile 64.9 consisting of glacial till deposits of sand and sandy gravel.

The route crosses a reindeer fence at the neck of the peninsula at approximately Mile 40.3. This location on the peninsula has cultural significance as ancient portage route between Kotzebue Sound and Hotham Inlet. The neck of the peninsula at this location, its narrowest point is approximately 0.5 miles wide.

5.5 (MILE 64.9) TO KAUK RIVER CROSSING (MILE 88.8)

The proposed route gradually transitions from flat to gently rolling hills to rolling hills beginning at Mile 74 as several drainages are crossed. The proposed route location maximizes the length of roadway in terrain unit G, which consists of numerous glacial till deposits and outcrops of sand and sandy gravel on low hills, ridges and banks, extending from Mile 65 to Mile 81.

Route soils conditions consist of colluvium or bedrock from approximately Mile 81 to the Kauk River Flats at Mile 86. Route soils from Mile 86 to the crossing of the Kauk River, with the exception of the crossing consists of frozen silts.

The insulated three foot fill section was utilized to Mile 71.2, then with increasing amounts of material available from outcrops scattered along the proposed route and better soils conditions, a seven foot embankment section was utilized to Mile 81. Final design will consist of varied sections in this area with less depth of fill being required for short sections through the glacial till outcrop area.

A 4.5' fill section was utilized from 81 to Mile 81.3 through colluvial soils. The three foot fill section was utilized from Mile 81.3 to 84.0. A 4.5' fill was utilized for the colluvial soils from Mile 84.0 to 84.5. The seven foot fill section was used to the bedrock area near the Kauk River. The crossing area from Mile 88.5 to 88.8 consists of bedrock and a minimum three foot fill was utilized.

Material sources utilized were KK-5, KK-6 and KK-7 through the glacial till outcrop areas from Mile 64.9 to Mile 84. Material Site KB-1 consisting of bedrock exposures in the Kauk River Hills at Mile 84 was utilized from Mile 84 to Mile 88.5. Material Site KB-2 was utilized from Mile 88.5 to the proposed bridge at Mile 88.8.

Curvature was maintained no sharper than two degrees up to approximately Mile 80.5, where the proposed route begins crossing the Kauk River Hills. Two eight degree curves were necessary to maintain suitable grades. A short stretch of 10% grade (approximately 500 feet) near Mile 80.5 is followed by a 7% to 8% grade to the tops of the hills at elevation 700 feet. Grades dropping down to the Kauk River are milder, generally being from 5% to 7%. Signs will be required.

Vegetation along this portion of proposed route alignment consists of arctic tundra with areas of alder to four feet. Shrub thickets containing alder and willows are found along the Kauk River.

5.5.1 Kauk River Crossing (Mile 88.8)

The Kauk River at the proposed crossing is a relatively shallow, slightly incised stream. It is approximately 60 to 70 feet wide and two feet deep with active banks about six feet high. A channel configuration is generally meandering except at the proposed crossing where the river is much straighter. The channel in this reach is controlled by bedrock outcrops along the north bank. The rock is a gray vesicular basalt which shows significant frost riving at the surface, with blocks up to three by five feet.

The blocky basalt detritus from this frost action extends down slope to the north banks, were there are thin covering deposit is of overbank silts. The south bank is composed of frozen silts which are currently undergoing some active erosion. Foundation materials for both abutments should be inplace basalt bedrock at relatively shallow depth (less than 25 feet). The extent of the thaw bulb under the river is unknown but should have little effect on the foundation.

Caissons or large diameter piers socketed into competent bedrock should be the most efficient type foundation for this site. However, the blocky nature of the basalt may present problems. If ice wedges have formed deeply into cracks in the basalt and are still frozen some type of refrigerated foundation may be necessary. Care must also be taken in placing approach fills and bridge superstructure on the frozen silts of the south bank. Thermal erosion is taking place here and the bank would be very sensitive to disturbance.

This estimated span length for this bridge is 120 feet with approach spans of 25 feet and a center span of 70 feet. The bridge width is estimated to be 32 feet.

5.6 KAUK RIVER (MILE 88.8) TO BUCKLAND RIVER TRIBUTARY (MILE 110.8)

After crossing the Kauk River the proposed route crosses a short portion of the Kauk River Flats where it begins transitioning to the Selawik Hills ridge tops. The route climbs gently at approximately five percent grades, passing above wet unsuitable slopes then following the contours prior to dropping down to cross a major drainage at Mile 94. Cross slopes are mild, ranging from less than 4% to approximately 10%. The route then climbs to the ridge tops reaching a maximum elevation of approximately 1000 feet. Maximum grades in this area are eight percent. Route curvature ranges from two degress to several four degree curves.

Soils are predominately colluvium and bedrock, with bedrock exposures scattered along the ridge tops. Typical fill sections, varying from 3 feet to 4.5 feet were utilized through this area for estimation purposes. Final design will call for cut sections at the material site locations possibly some other outcrops.

Material for this portion of the route will come from sources KB-3, KB-5, KB-6 and KB-7 consisting of bedrock outcrops along the ridge tops. Vegetation varies from arctic tundra to grass and lichen with brush up tc four feet in height.

The route follows the ridge to Mile 108 where the route begins its descent to the Buckland River Tributary.

5.6.1 Buckland River Tributary Crossing (Mile 110.8)

The Buckland River Tributary at the site of the proposed crossing is approximately 100 feet wide. A gravel bar approximately 70 feet wide occupies the center portion of the stream with two small channels on either side approximately 15 feet wide. Bedrock outcrops on either side of the river control the channel and extend

upstream from this location. The stream depth was approximately one and a half feet deep.

Basalt bedrock is exposed on both sides of the crossing and probably underlies it at shallow depths (about 15 feet). The floodplain material is a gravel with cobbles to 12 inches in diameter. The stream is fairly narrow and the extent of the thaw bulb is not expected to be very great. Southern slopes immediately downstream show evidence of solifluction. The estimated bridge length at this location is 120 feet, and will be 32 feet wide. Caissons or large diameter piers would most likely be utilized for the foundation.

The basis for crossing the Buckland Tributary at this point was the river alignment, good bedrock foundation, and shallow water depth. It is expected that basalt bedrock may be underlying the fluvial deposits.

5.7 BUCKLAND RIVER TRIBUTARY (MILE 110.8) TO BUCKLAND RIVER (MILE 116.3)

After crossing the Buckland River Tributary the route climbs out of the tributary drainage area. Depending on final fill depths and bridge elevations the initial grades for 500 feet to 700 feet of roadway will be approximately 7 to 8 percent. The proposed route will then traverse a 6 degree curve to the south avoiding drainages to the extent possible. Roadway grades will roll with the existing terrain. Several smaller drainages will be crossed. The larger of these are an unnamed drainage area at Mile 112.7 and Koobuk Creek at Mile 113.4. The vegetation along this portion of the proposed route consists mostly of arctic tundra.

The 8.5'fill depth section was utilized for this segment of route. Route soils conditions consist of frozen very ice-rich silts. Lower lying areas were avoided in route selection, to the extent possible. Polygons and ice-rich zones are present throughout this segment of route, with the exception of those outcrop areas near the Buckland River Tributary, and the Buckland River, with thinner overburden depths.

Materials for this segment of the route are from material source BC-2 near Buckland consisting of fluvial sands and gravels.

5.7.1 Buckland River Crossing (Mile 116.3)

The Buckland River rises in the Nulato Hills and flows approximately 100 miles to Eschscholtz Bay. It meanders through a narrow valley cut through basalt flows until it reaches the proposed crossing. The valley widens out for the lower 20 miles. Tidal action apparently reaches as far upstream as the village of Buckland, four mile downstream from the crossing.

Vegetation is alder with willow mix on both banks. High water is estimated to be ten feet above the existing water line at the time of reconnaissance.

Basalt bedrock is exposed on the north bank of the proposed crossing and large boulders were seen in the river bed. The south bank is composed of frozen sands and silts. Depth to bedrock under the river is expected to be shallow (about 15 feet).

The river width at the proposed crossing is approximately 320 feet. It is estimated that the length of bridge required would be approximately 440 feet and would be multi-span. It is estimated that the bridge gradient would be descending at approximately five percent. Large diameter piers socketed into competent bedrock should be the most efficient type foundation at this site.

5.8 BUCKLAND RIVER (MILE 116.3) TO FAIRHAVEN CREEK (MILE 118.7)

After crossing the Buckland River the proposed route crosses a short stretch of floodplain then traverses a 2 degree curve. The route crosses a beaded drainage area at Mile 117.4, crossing gently rolling terrain towards Fairhaven Creek. Roadway grades will roll with the existing topography. Access to Buckland will be provided at Mile 117.9.

Route soils conditions consist of deep frozen ice rich silts, with localized areas of frozen ice rich organics and silts. An 8.5 foot deep fill section was utilized in this area.

Vegetation consists of arctic tundra with willow and alders in the larger drainage areas.

Material for this section of route will be fluvial sands and gravels coming from Material Site BC-2.

5.8.1 Buckland Access Road (Mile 0) to Buckland (Mile 4.7)

Access to the village of Buckland begins at Mile 117.9 on the Chicago Creek road. The access road extends 4.7 miles into Buckland. The access road drops onto the floodplains at approximately Mile 1.2. Proposed access to Material Site BC-2 will be at Mile 2.4. The route crosses ground water at several locations. The roadway grades will be fairly flat.

The proposed access route ends at the existing airport just after passing new housing being constructed tc the east of the road. Current plans for Buckland call for a new airport to be constructed at the location shown on the plan sheets.

Route soils conditions consist of frozen ice-rich silts and frozen ice-rich silt

over organics at the beginning of the access road to silts over gravels on the flood plain.

Vegetation varies from arctic tundra at the higher elevations to willows and alder on the flood plain.

Embankment materials for the access road will come from Material Site BC-2.

The typical section depth will vary from a 8.5 foot fill section at the beginning of the route to elevations determined by flood levels on the flood plain but will be a minimum of 4.5 feet in depth.

Hydraulic studies will be required in this area due to potential flooding, aufeis and ice jamming. The hydraulic study should provide design recommendations so that the road will not adversedly effect the safety of the village. Extensive flooding and icing problems were experienced in Buckland in 1971 and 1972 and up to 70 percent of the village airport was reported to be under water. Training dikes and riprapping will probably be required along some portions of the access road.

5.8.2 Fairhaven Creek (Mile 118.7)

The proposed route, crosses Fairhaven Creek at Mile 118.7. The Fairhaven Creek channel was approximately 15 feet deep and approximately 60 feet wide. The water depth at the site of the crossing was approximately 30 inches deep with a water surface width of 4.5 feet. High water marks were observed at heights of six feet above the existing water surface. The vegetation was alder-willow mix, and is in an old burn area.

The riverbed is gravelly sand and gravels to one inch in diameter. The lower banks were silty sand. The upper banks are silt. It is estimated that the thaw bulb is from five to ten feet in depth.

Frost probes show the depth to frozen ground to be three feet, back from the banks and 3.5 deep in the smaller areas, along the creek. One or more multi-plate culverts should be adequate for this crossing.

5.9 FAIRHAVEN CREEK (MILE 118.7) TO MEINZER CREEK (MILE 121.0)

The proposed route parallels Meinzer Creek to the north until it crosses at Mile 121.0. The route stays on the higher ground avoiding thaw lakes, lower ground and wet areas to the north of the river. Grades will closely watch the existing topography. Roadway curvature was fairly mild, with the maximum curve being 4.5 degrees.

The foundation soils are deep ice rich frozen silt. Polygons can be observed along this section of the route.

The vegetation consists of arctic tundra. The material source utilized for this portion of the recommended route is BC-2, near the Buckland River access road.

A typical fill section 8.5 feet deep was utilized for this portion of the route.

A multiplate culvert is estimated to be adequate for the Fairhaven Creek Crossing.

5.9.1 Meinzer Creek (Mile 121.0)

The Meinzer Creek floodplain was approximately 200 feet wide at the sight of the proposed crossing. The water surface width was approximately ten feet wide. Depth of flow was approximately one foot. There was evidence of high water to 24 inches above the existing water surface elevation. The vegetation was alder willow mix, brush and grasses.

The river bed consists of sandy gravel to 12 inches in diameter, with approximately ten percent being greater than three inches in diameter. The thaw bulb depth is unknown. A multiplate culvert is estimated to be adequate at this crossing.

5.10 MEINZER CREEK (MILE 121.0) TO MIDDLE FORK DUCK CREEK (MILE 131.4)

After crossing Meinzer Creek, the route parallels Meinzer Creek to the south until it begins the ascent to the ridge tops at Mile 123, reaching approximately 700 feet in elevation at Mile 125. It is estimated that maximum grades will be 6 to 7 percent from Mile 123 to approximately Mile 125. The route will follow the contours then descend to the East Fork Duck Creek at approximately 4 percent grades. Vegetation consists of scattered moss and grasses and arctic tundra.

The route soils will transition from frozen ice rich silts to colluvium at approximately Mile 123. Route roils will consist of colluvium to the Middle Fork Duck Creek at Mile 131.4. Bedrock outcrops are scattered along the route.

Material Sites BC-6, BC-7 and BC-8 along the ridge tops were selected at optimum haul distances and take advantage of the vesicular basalt outcrops.

The typical section utilized was the three foot fill section in the exposed or shallow bedrock area, or a cut section as required to fully utilize the material sources and a 4.5 foot fill section in the colluvium soils.

Multiplate culverts will be utilized in the East and Middle Fork Duck Creek drainages.

The East Fork Duck Creek at Mile 129.4 was not visited but is estimated to have gravel and boulders in the river bed based on aerial observations. The Middle Fork Duck Creek is estimated to have a silt river bed with an estimated thaw bulb of five feet to ten feet in depth.

It should be noted that the dark areas on the photo mosaics (Mile 122.5 to 131.3) represent a burn area which occurred some time before June 1978. Some clouds are present and should not be mistaken for rock outcrops.

5.11 MIDDLE FORK DUCK CREEK (MILE 131.4) TO KIWALIK RIVER (MILE 148.7)

The proposed route avoids drainages to the north and south, then crosses the West Fork of Duck Creek after negotiating a 3 degree curve. After crossing the West Fork Duck Creek the proposed route avoids low drainages and thaw lakes to the north and intersects the Bear Creek-Candle tract near Mile 138. The route gradient is rolling closely matching existing topography with short stretches of steeper grades in and out of the drainage areas. The route follows the higher ridges. Vegetation consists of arctic tundra.

Route soils conditions consist of frozen ice rich silts, with localized areas of ice rich frozen organics over silts and lower wetter areas and thaw lakes. Bedrock outcrops appear at Mile 145 to 147 over looking the Kiwalik River where the route begins its descent into Candle.

The typical section used for this section of proposed route is an 8.5 foot fill section to Mile 142. A seven foot fill depth was utilized from 142 to Mile 145, and the 4.5. fill depth was utilized from Mile 145 to Candle. Final design will call for a cut section through Material Site BC-11 at Mile 147.

Materials for this section of route will come from BC-8 for the eastern portion of this stretch of route and BC-10 for the segment of route near Candle.

The Lava Creek crossing is at Mile 137.3. Lava Creek consists of a frozen silt bed with an estimated thaw bulb from five to ten feet. The flow was estimated to be less than five feet per second. High water was estimated to be approximately 18 inches above the existing water surface. Frost probes vary with a depth to frozen material being ten feet at the center of Lava Creek to a depth of four feet approximately ten feet away from the river banks and three feet to frozen

5.11.1 Kiwalik River

The Kiwalik River rises near Granite Mountain and flows north approximately 70 miles to Spafarief Bay. It meanders through a flat valley for the lower 30 miles except near Candle where the valley narrows to less than half a mile. Below Candle it widens into a lagoon and tidal flats. Tidal action apparently reaches as far upstream as Candle Creek. Aerial photos show the river to have stable channels with no significant movement over the previous 30 years.

The proposed crossing of the Kiwalik River at Candle is immediately down river from its confluence with Candle Creek. It crosses from the upstream end of a point bar to the downstream end of the Candle Creek delta. Here the floodplain is composed of sandy gravel with cobbles to six inches in diameter. On the east bank these gravels are overlain by six to eight feet of silt and sand. The west side of the crossing will be on fluvial gravels. Bedrock (schist) is exposed in the river bank downstream from the crossings and probably is no deeper than 50 feet underneath it. The extent of the thaw bulb under the river is unknown but is should be possible to set the foundation in unfrozen material. Conventional concrete spread footings or steel piles could be utilized for the bridge foundation.

5.12 KIWALIK RIVER (MILE 148.7) TO MINNEHAHA CREEK (MILE 157)

After crossing the Kiwalik River access will be provided to Candle at Mile 148.9. The route begins to ascend to the ridge tops immediately passing the Candle cemetary to the north and private Candle airstrip to the south. Access to Candle will be provided at an existing road at Mile 148.9. The route then crosses Minnehaha Creek near the existing cat trail. Grades are estimated to be six to eight percent in and out of the Minnehaha Creek drainage area.

Minnehaha Creek is approximately two feet deep and three and a half feet wide at the site of the proposed crossing, with high water marks being observed at approximately three feet above the existing water surface. Vegetation consists of grasses and willows. The river bed consists of silty sand with a trace of gravel to one inch in diameter. The estimated thaw bulb is five to ten feet in depth. Frost probes indicate the depth to frozen material was reduced to approximately three feet deep at a distance of 20 feet from the river banks. Frost probes along the proosed route vary from one foot to 18 inches in depth. Vegetation consists primarily of arctic tundra.

Route soil conditions vary from colluvium soils to area where the weathered schist is near the ground surface.

A typical fill section, 4.5 feet in depth, is recommended for this section of roadway.

Material Sources will be CC-2 near Candle consisting of placer tailings, Material Sites CC-2 and CC-3, consisting of weathered schist bedrock, will be utilized on the ridges.

A multiplate culvert should be adequate for the Minnehaha Creek drainage.

Snow drifting could be a problem in this vicinity and should receive further consideration during final design and route selection. Although approximately four to five miles longer in length, an alternate alignment exists to the south, which stays on the ridge tops. The alternate alignment leaves the recommended route to the south just prior to dropping into Minnehaha Creek at Mile 155.

5.13 MINNEHAHA CREEK (MILE 157) TO CHICAGO CREEK (MILE 165)

After crossing Minnehaha Creek the proposed route crosses Diamond Creek at Mile 158.1, then climbs to the ridges at approximately Mile 159. From this point the route follows an existing cat trail to approximately 163.5 where it drops down to the Chicago Creek and Kugruk River confulence. Route soil conditions consist of frozen silts and colluvium soils to the end of the proposed route at Mile 165.

The 4.5 foot fill depth was utilized for the colluvium areas and a seven foot depth of fill was utilized on the frozen silts.

6.0 PRELIMINARY HAUL ANALYSIS AND CONSTRUCTION COST ESTIMATE

6.1 CONSTRUCTION SEQUENCING

Construction sequencing, proposed construction camp locations and proposed use of material sites are shown on Table 6-1. The project was divided into five construction sections, with base camps at Kotzebue, Nimiuk, Point, Mile 64.9 Buckland and Candle.

Construction in each section is by segments, as numbered and shown in Table 6-1. Construction proceeds in the direction indicated by Mile Posts.

o Miscellaneous improvements estimated in addition to actual roadway construction costs are shown by an asterisk on Table 6-1 and indicated below:

Construction Section 1 - None

Construction Section 2 - Prepare landing strip, barge facilities, and rebuild Nimiuk Point access road.

Construction Section 3 - Widen roadway for landing strip

Construction Section 4 - None

Construction Section 5 - None

6.2 CONSTRUCTION COSTS

For the purposes of preparing a preliminary haul analysis and cost estimate the following assumptions or data were utilized:

- o A figure of $10.00 per cubic yard for embankment material was used. The $10.00 per cubic yard in place figure includes a two mile haul. Haul over two miles was estimated at $1.00 per cubic yard mile. These figures were arrived at from review of previous bid tabulations and in-house estimates prepared for other projects. A 15% contingency factor was added to neat line cubic yard quantities calculated. Additional quantities were estimated for bridge approaches. Preparation of the surface course material was estimated at $5.00 per cubic yard, in addition the $10.00 per cubic yard estimated for embankment.

- o A figure of $0.50 per board foot of expanded polystyrene insulating board in place was used. This figure was arrived at as follows:

Quoted price F.O.B. Seattle	=	$0.288/BD FT
Estimated Shipping Costs	=	0.05/BD FT
Laydown Costs	=	0.16/BD FT
TOTAL	=	0.45/BD FT
USE	=	0.50/BD FT

- o Bridge costs were estimated at $200.00 per square foot. These costs are included in the construction costs per segments.

- o Drainage, guard rail and riprap are included in the total cost figure for each segment of roadway.

It must be recognized that the proposed haul analysis and cost estimate are preliminary in nature based on a reconnaissance level investigation. The proposed construction sequencing and haul analysis was conducted to perform a realistic approach to actual construction.

TABLE 6-1

PRELIMINARY HAUL ANALYSIS & COST ESTIMATE

KOTZEBUE TO CHICAGO CREEK

SEGMENT NO.	MATERIAL SITE	TYPICAL SECTION	STATION LIMITS (MILE POSTS)	LENGTH (MI)	EMBANKMENT (CY)	HAUL EFFORT (CY-MILES)	INSULATION (BD FT)	BRIDGES (SQ FT)	TOTAL COST	REMARKS
1	KK-1A	Urban and 3' Insulated	0 - 12.0	12.0	489,300	3,425,100	14,026,300	5,440	$16,580,200	CONST. SECT. 1
2A	KK-2	3' Insulated	22.9 - 12.0	10.9	336,700	2,255,900	16,564,400	—	13,819,700*	CONST. SECT. 2
2B	KK-2	3' Insulated	22.9 - 35.9	13.0	324,000	2,754,000	17,365,900	—	14,608,600	BASE CAMP AT
3	KK-2 KK-4	3' Insulated	35.9 - 47.3	11.4	307,800	3,293,500	15,228,600	—	13,000,000	NIMIUK POINT
4	KK-5	3' Insulated	64.9 - 47.3	17.6	475,200	4,181,800	23,510,800	—	20,801,000**	CONST. SECT. 3
4A	KK-5	3' Insulated	64.9 - 71.2	6.3	170,100	535,800	8,415,800	—	6,463,900	
5	KK-6	7' Embankment	71.2 - 74.5	3.3	231,000	381,200	—	—	2,569,000	
6	KK-7(A-C)	7' Embankment	74.5 - 81.0	6.5	455,000	910,000	—	—	4,664,400	
6A	KK-7C	4.5' Colluvial	81.0 - 81.3	0.3	12,600	25,200	—	—	133,400	
6B	KK-7D	3' Bedrock	81.3 - 84.0	2.7	72,900	98,400	—	—	781,000	
7	KB-1	4.5' Colluvial	84.0 - 84.5	0.5	21,000	5,300	—	—	225,800	
7A	KB-1	7' Embankment	84.5 - 88.5	4.0	280,000	560,000	—	—	2,935,800	
8	KB-2	3' Bedrock	88.5 - 88.8	0.3	10,800	1,600	—	3,840	885,900	

BASE CAMP AT MILE 64.9

* Includes Nimiuk Point access road, barge and airstrip improvements
** Includes widening roadway for airstrip @ Mile 64.9

TABLE 6-1

PRELIMINARY HAUL ANALYSIS & COST ESTIMATE

KOTZEBUE TO CHICAGO CREEK

SEGMENT NO.	MATERIAL SITE	TYPICAL SECTION	STATION LIMITS (MILE POSTS)	LENGTH (MI)	EMBANKMENT (CY)	HAUL EFFORT (CY-MILES)	INSULATION (BD FT)	BRIDGES (SQ FT)	TOTAL COST	REMARKS
9	BC-2	4.5' Colluvial	Buckland Ac.Rd.	3.2	134,400	215,040	–	–	$1,600,000	CONST. SECT. 4
9A	BC-2	8.5' Embankment	Buckland Ac.Rd.	1.5	132,000	198,000	–	–	1,416,000	
9B	BC-2	8.5' Embankment	117.9 - 116.3	1.6	140,800	464,640	–	14,080	4,467,200	
9C	BC-2	8.5' Embankment	116.3 - 110.8	5.5	484,000	3,315,400	–	3,840	3,430,000	
9D	BC-2	4.5' Colluvial	110.8 - 108.5	2.3	96,600	1,038,450	–	–	1,982,600	
10	KB-7	3' Bedrock	108.5 - 103.0	5.5	148,500	334,125	–	–	1,837,000	
11	KB-6	4.5' Colluvial	103.0 - 98.0	5.0	210,000	472,500	–	–	2,420,000	
12	KB-5	3' Bedrock	98.0 - 95.8	2.2	59,400	65,400	–	–	734,800	
13	KB-5	4.5' Colluvial	95.8 - 92.0	3.8	159,600	319,200	–	–	1,839,000	
14	KB-3	4.5' Colluvial	92.0 - 91.0	1.0	42,000	21,000	–	–	484,000	
14A	KB-3	7' Embankment	91.0 - 88.8	2.2	154,000	308,000	–	–	1,680,800	
15	BC-2	8.5' Embankment	117.9 - 122.9	5.0	440,000	2,200,000	–	–	6,040,000	
16	BC-5	4.5' Colluvial	122.9 - 125.0	2.1	88,200	176,400	–	–	1,016,400	
17	BC-6	4.5' Colluvial	125.0 - 127.0	2.0	84,000	84,000	–	–	974,400	
18	BC-7	4.5' Colluvial	127.0 - 130.0	3.0	126,000	189,000	–	–	1,452,000	

BASE CAMP AT BUCKLAND

NORTHERN LEG

SOUTHERN LEG

TABLE 6-1

PRELIMINARY HAUL ANALYSIS & COST ESTIMATE

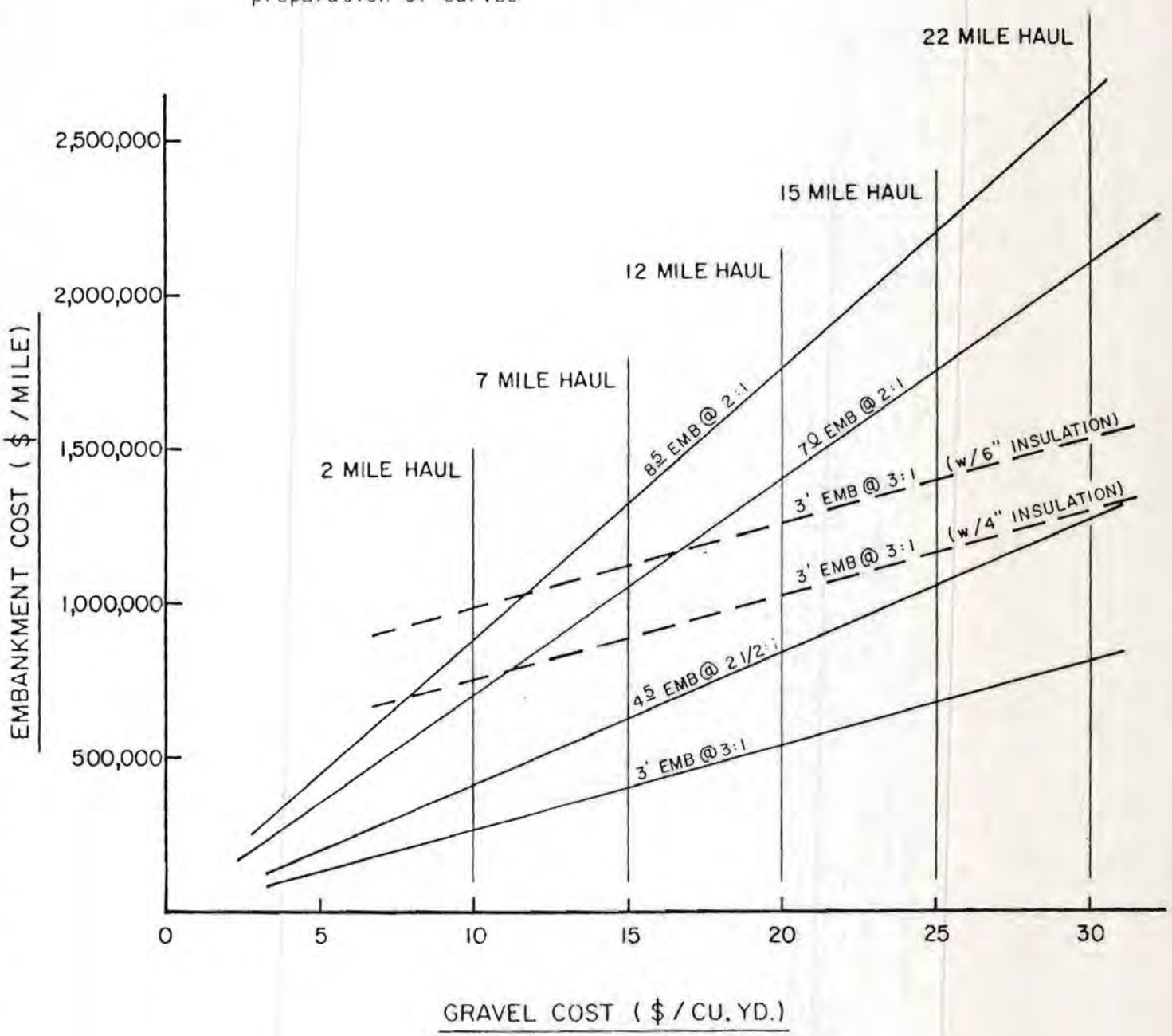
KOTZEBUE TO CHICAGO CREEK

SEGMENT NO.	MATERIAL SITE	TYPICAL SECTION	STATION LIMITS (MILE POSTS)	LENGTH (MI)	EMBANKMENT (CY)	HAUL EFFORT (CY-MILES)	INSULATION (BD FT)	BRIDGES (SQ FT)	TOTAL COST	REMARKS
19	BC-8	4.5' Colluvial	130.0 - 131.4	1.4	58,800	41,200	–	–	$ 677,600	CONST. SECT. 4 SOUTHERN LEG
19A	BC-8 & 9	8.5' Embankment	131.4 - 142.0	10.6	932,800	2,332,200	–	–	10,006,400	
20	CC-1 & 2	4.5' Colluvial	148.7 - 147.0	1.7	71,400	71,400	–	12,800	3,382,800	CONST. SECT. 5 EASTERN LEG
21	BC-11	7' Embankment	147.0 - 142.0	5.0	350,000	875,000	–	–	3,820,000	
22	CC-1 & 2	4.5' Colluvial	148.7 - 151.9	3.2	134,400	215,040	–	–	1,548,800	CONST. SECT. 5 WESTERN LEG
23	CC-3	4.5' Colluvial	151.9 - 156.1	4.2	176,400	352,800	–	–	2,032,800	
24	CC-4	4.5' Colluvial	156.1 - 159.0	2.9	121,800	176,600	–	–	1,403,600	
25	CC-5 & 6	7' Fill	159.0 - 165.0	6.0	420,000	840,000	–	–	4,584,000	
	SUB TOTAL			169.7*	7,951,500	32,733,195	95,111,800		161,798,900	
	CONSTRUCTION CONTINGENCIES, ENGINEERING (15%)								24,194,835	
	TOTAL								185,493,735	
									SAY 185,500,000	

@ $185,500,000 = $1,093,106/MILE

* Includes Buckland Access Road (5.7 miles)
** Excludes royalties, land acquisition

NOTE: See page 6-2 for costs used in preparation of curves



CONSTRUCTION COST COMPARISONS

NON INSULATED EMBANKMENT Vs INSULATED EMBANKMENT

Figure 6-1

7.0 RECOMMENDATIONS AND CONCLUSIONS

7.1 GENERAL

The Kotzebue to Chicago Creek study has culminated in the selection of a route and presentation of data regarding the selected route, including a preliminary cost estimate, haul analysis and recommended construction sequencing. Design level investigations will be required for all sections of proposed route. Information obtained during design phase including comments or objections by land owners or those groups who have selected lands in or near to the route corridor could have significant impact on the proposed cost routing and associated costs.

Design level investigations should include adequate allowances for hydraulic studies. In addition to hydraulic studies for all stream crossings and for culvert designs, microdrainage systems and potential auefis areas will have to be reviewed on a site specific basis. Further work will also have to be accomplished to minimize potential problems with blowing and drifting snow.

Standarized typical sections were utilized for preparation of the preliminary cost estimate and haul analysis. Additional data obtained during the design phase will allow for mile by mile design. Preliminary analysis indicated an insulated roadway to be the most cost effective approach to design on the peninsula. Design depths of embankment and insulation will have to be refined, based on current economic data and the results of additional soils work recommended in this section at the time of design. Minimum maintenance should also be a high priority due to the limited amount of mineral materials available and remoteness of the area.

7.2 SOILS INVESTIGATIONS

7.2.1 Route Soils Studies

The design phase of this project will require a detailed investigation of soil conditions along the route. The high cost of embankment material argues for as thin a road section as practicable. However, large potential settlments due to thawing of frozen fine grained subgrades can result in very high maintenance costs if embankments are too thin. In order to design the most efficient road system, precise knowledge of foundation soils and surface drainage conditions along the route is necessary.

The level of investigation necessary to obtain this data is variable, depending primarily on the terrain unit involved. All of the route should be walked by a geotechnical engineer or engineering geologist familiar with characteristics of permafrost soils and with road construction in permafrost terrain. Data on terrain unit, slopes, near surface soil types and surface drainage characteristics should be recorded. This level of information is sufficient for embankment design in bedrock terrain units, as the road can be built with a minimum thickness.

At least one additional level of investigation will be necessary for the rest of the route. This may be accomplished during the same walk through and involves making some measurement of in-place strengths of thawed subgrade soils. This can be accomplished using a cone penetrometer or vane shear device. Data collected on subsurface soil strengths can be used in two ways. First, those areas (primarily in terrain unit C) where embankment thickness will be based on reduced subgrade strength criteria, can be delineated and road sections designed.

Second, those areas which will require the final level of investigation can be accurately located.

The final level of data acquisition involves subsurface exploration borings to determine soil and ice conditions at depth. This will be necessary at selected locations where the added information will result in substantial savings from more efficient design sections. Such areas on this project are primarily in terrain unit P where insulated embankments should be considered.

7.2.2 Bridge Foundation Investigations

The proposed route has six sites where bridges are recommended and which will require subsurface exploration. Soil types and extent; the nature and amount of permafrost ice; and permafrost temperatures must all be obtained at each site. In addition, at all sites except the two at Kotzebue, bedrock is expected to be shallow, and rock coring will be necessary. The Kauk River, Buckland Tributary, and Buckland River crossings will all have foundations in basalt bedrock. This rock is very blocky and may have massive ice in open fractures. Those four crossings will require a careful and perhaps elaborate investigation in order to determine the extent and size of any such ice bodies.

The number and location of borings at each site should be determined after a detailed site reconniassance. This should be accomplished after preliminary bridge layouts have been prepared in order to concentrate the reconnaissance at abutment and pier locations. In general however, it can be expected that core boring will be required at each abutment and each pier with one or two thermistor strings to be installed at each site. If a suspension bridge is chosen for any of the sites a more extensive boring program will also be required.

At the anchor points, drill at least one deep boring and one or more shallow borings at each anchor. Depending on what the core borings show in terms of rock competence, seismic profiling of each bridge site might be accomplished to better define the bedrock surface.

Table 7-1

ESTIMATED ROUTE SOILS AND BRIDGE SITE EXPLORATION QUANTITIES

ROUTE SOILS

Exploration Borings = 50 miles @ 1 boring per 1/2 mile
= 100 borings. Estimate 25 foot depth.

Penetrometer or vane shear shallow explorations
= 120 miles @ 5 miles per day
= 24 days (2 person crew)

BRIDGE SITE

Kotzebue (Swan Lake)	= 2 borings to 50'
Kotzebue (main crossing)	= 4 borings to 120'
Kauk River	= 2 core borings to 80'
Buckland Tributary	= 2 core borings to 50'
Buckland River	= 4 core borings to 80-100'
Kiwalik River	= 2 borings to 100'
	+ 2 core borings to 100'

7.3 MATERIAL SOURCE INVESTIGATION

7.3.1 General

A preliminary reconnaissance of material sources was done during the field phases of this program. Emphasis was placed on locating sources on the Baldwin Peninsula due to the scarcity of material there. Otherwise only a cursory reconnaissance was done to determine relative availability on the various alternate routes. Outside of sites on beaches near Kotzebue and tailings at Candle, no existing sites are available. As part of the design phase an intensive helicopter reconnaissance must be done. This will involve landings on all of the sites and shallow subsurface exploration with hand tools. Data, pertinent to development, should also be collected. At this time the requirements for exploration and equipment access routes should be determined. This effort can be expected to take two to four weeks.

7.3.2 Baldwin Peninsula

Due to severe shortage of available sources on the Baldwin Peninsula the primary effort there will be locating additional areas. This has been and will be hindered by poor exposures of material in the interior of the Peninsula. Subsurface investigations on the route centerline will probably provide most of the information. Investigations of beach deposits will probably be required.

All of the onshore material sources are frozen and exploration can accomplished with solid stem auger. Some hollow stem work may be required if offshore deposits are investigated. Test pitting is not recommended as it will not confirm availability or condition at depth. Approximately 100 holes will be required and possibly as many as 250 if more prospects are identified.

7.3.3 Kauk River Hills to Chicago Creek

Most of the sources of material along this section of the proposed route are bedrock. Most of the rock is quite hard (basalt, etc.) with the exception of the schists between Candle and Chicago Creek, there are no bedrock exposures since the rock is covered by frost shattered rubble. Some river floodplain deposits can also be utlized in this stretch.

Due to the hardness of the rock, augers would be ineffective and test pitting with some coring is recommended. The size of the rubble would make small backhoes and dozers inefficient and larger dozers with rippers should be utilized. Augers will be required in the river floodplains, both solid and hollow stem. They may also be utilized in the schist if necessary. Exploration would include approximately 200 test pits and 125 borings (approximately 50 corings).

Table 7-2

ESTIMATED MATERIAL SITE EXPLORATION QUANTITIES

Estimate ten holes per site (includes contingencies)

BALDWIN PENINSULA

Estimate 10 sites to explore (Kotzebue to Kauk River)

Say 100 drill holes

(X 250% = 250 maximum if alternates are found or random prospecting is done.

KAUK RIVER TO CHICAGO CREEK

Kotzebue to Buckland	Buckland to Candle	Candle to Chicago Creek
80 Test Pits	80 Test Pits	40 Test Pits
0 Drill Holes	20 Drill Holes	30 Drill Holes
25 Cores	25 Cores	25 Cores

TOTAL ESTIMATED MATERIAL SITE EXPLORATION REQUIRED

Say 200 Test Pits
Say 50 Drill Holes
Say 75 Core Holes

7.4. RIGHT-OF-WAY AQUISITION

The following work remains to be done for right-of-way aquisition.

1. Update land status, checking data for accuracy and completeness. A legal review will be required.
2. Acquire Right-of Way across State, Federal, and Native Lands.
3. Acquire "wetlands" permits. As mapping has not been done in this area, sufficient lead time should be allowed.
4. Achieve compliance with Coastal Zone Management Programs.
5. Further research to assure completeness of Native allotment data, specifically check to make reasonably sure they all have been recorded accurately. Acquire Right-of-Way across them or determine if it is cost effective to avoid them.
6. Further research into mining claims to determine completeness and accuracy of data. Field locate corners of affected claims and mark so they can be tied to surveys if necessary.
7. Acquire Right-of-Way within City of Kotzebue, including easement across Mission Lands.
8. Sort out ownership problems at Candle townsite. As the information may create a situation where relocation would be considered, this should be a priority item.
9. Determine action necessary to cross Air Navigation Site at Candle.

7.5 ENVIRONMENTAL ASSESSMENT

7.5.1 Location and Design Phase

The lands traversed by the highway route are mostly public lands held under the jurisdiction of the federal government (BLM) as outlined in Section 2.6 of this report. Federal regulation 43 CFR 2802.1 allows a prospective applicant for a right-of-way grant to go upon the public lands to perform casual acts related to data collection necessary for the filing of an acceptable application. These acts include vehicle use on existing roads, sampling, marking of routes and sites, surveying, and other activities that do not unduly disturb the surface or require the removal of vegetation. The authorized federal officer may deem it necessary to provide a temporary use permit which stipulates limits of exploration, type of activities, and generally restricts the permitee to a certain level of surface and vegetative disturbance. A statement of the type and level of disturbance expected may be required of the applicant prior to issuance of a temporary use permit. The research and preparation of such a statement is probably the highest level of environmental assessment required upon public and private lands for the location and design phase of the project.

It should be noted that the BLM is now holding much of the affected lands in trust for several selectors. The various parties may or may not request that the federal government impose additional stipulations, restrictions, or require a higher level of environmental assessment by the applicant. It is reasonable to believe that the BLM will adhere to the selectors' requests to the extent that regulations allow.

Permission to explore and survey on patented lands and lands under interim conveyance must be obtained from the owner. The level of environmental assessment required will depend upon the stipulation of the owner.

7.5.2 Right-of-Way Grant

The state highway authority (ADOT/PF), in seeking to gain right-of-way through public lands will consult with the federal government to determine whether or not the granting of such right-of-way would be deemed a major or non-major federal action. Federal regulation 23 CFR 771.9 gives examples of major and non-major actions. Non-major actions include widening of existing highways, extension of highways into areas previously serviced by other roads, and construction of new interchanges. Major actions include new highways, highways which provide new access into an area that is likely to precipitate significant changes in land use or development patterns, and new access to areas containing significant amounts of exploitable natural resources. The granting of a highway right-of-way through these federal lands, even though the government acts now as a trustee for the various selectors, will probably be considered a major federal action. As such, the granting of a right-of-way would be subject to the National Environmental Policy Act of 1969 (NEPA; PL 91-190).

Section 102.(2)(C) of NEPA directs that:

> "...all agencies of the Federal Government shall include in every recommendation of report on proposals for legislation and other major Federal action significantly affecting the quality of the human environment, a detailed statement by the responsible official on--
>
> (i) the environmental impact of the proposed action,
> (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
> (iii) alternatives to the proposed action,
> (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
> (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

> Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by Section 552 of Title 5. United States Code, and shall accompany the proposal through the existing agency review processes;"

The scope of "the environmental impact of the proposed action" referred to in (i) is expanded in 23 CFR 771.18 to include but not be limited to discussions on:

- o relocation of individuals and families
- o social impacts
- o air quality impacts
- o water quality impacts
- o noise impacts
- o wetlands and coastal zones management
- o stream modification or impoundment impacts
- o flood hazard evaluation
- o construction impacts
- o historic and cultural resources impacts

If it is found that the highway will not significantly affect the quality of the environment, a finding of no significant impact is required, although all topics of an environmental impact statement must still be addressed individually.

APPENDIX I

SCOPE OF WORK

Kotzebue to Chicago Creek

Project A-80357

This project consists of the preliminary phases of development for a highway project from the town of Kotzebue to coal mines at Chicago Creek. The primary goal of this contract will be to complete a reconnaissance study, which will lead to a recommendation of a specific route for the proposed highway. The reconnaissance work will be accomplished under the first phase of the contract.

The reconnaissance work should begin with a broad view of the area between Kotzebue and Chicago Creek and systematically work toward a single route recommendation. The initial step should be a gathering of data to include any previous studies pertinent to the project as well as existing aerial photos, maps, land status plats, etc. The Department will provide copies of the Western Arctic Transportation Study, which includes a feasibility study of a road from Nome to Kotzebue. The Department does not have aerial photos of the project area, but these may be available from other sources.

The reconnaissance work will consist of identifying route possibilities and comparing these in terms of economics, environmental concerns, foundation conditions, highway design standards and other factors. Initial project alternatives should be reviewed by overflights with fixed-wing aircraft to verify basic assumptions and to familiarize the project team with the area so they can better relate maps and aerial photos to actual terrain conditions. At this stage of the study, it is expected that the number of route alternatives could be reduced to no more than two basic routes, which have obvious advantages over other options. (Segments of the basic routes might still have more than one possible routing.)

Once the number of routes is reduced to one or two, the consultant should undertake some limited on-the-ground inspections to aid in the final route selection. This is probably best accomplished by helicopter and should include numerous landings along the proposed routes to investigate river crossings, foundation conditions, material sources, grade and alignment possibilities and other conditions that can be observed in this manner. Photos taken by hand held camera during this phase of reconnaissance have proven to be of great value. The field party should take lots of pictures, which should later be dated and identified.

Once a single basic route has been chosen, the consultant should obtain new aerial photography along the route. Some alternative segments may still be included at this stage. We would prefer color photos at a scale of 1 inch = 1000 feet. These photos will be a valuable addition to the Department's aerial photo files and are considered one end product of this study. The photos will also be of use to the consultant for refining the proposed highway route and as a base for a mosaic to present the recommended route in the final report for the reconnaissance phase of the contract.

For this project, the reconnaissance study should show the status of all lands along the route. The study should also identify environmentally sensitive areas and environmental issue that would be encountered by a highway construction project. The reconnaissance phase should also identify the level of environmental assessment that would be necessary in order to obtain required permits and approvals for highway construction. The reconnaissance study should culminate in a report describing the preferred route and presenting methods, results, and recommendations of the study.

It is expected that the $500,000 appropriated for this project will be more than adequate to cover the reconnaissance phase. It is our intent to move into the location and design phases of project development to the extent that funding allows. Upon completion of the reconnaissance phase, the second contract phase will be negotiated (with the same firm) to conform to the recommendations of the reconnaissance study and the remaining funding.

The second contract phase will begin with producing the required environmental assessment as identified in the reconnaissance study. It is expected that the second contract phase will also include location and design of a segment of the Kotzebue to Chicago Creek route. This work will cover whatever segment the reconnaissance study recommends for initial construction.

Location work consists of the gathering of all data needed for road design and right-of-way acquisition. This can be accomplished either by photogrammetric mapping or by standard ground survey methods.

The design work consists of producing all plans, estimates, and specifications necessary for the awarding of a construction contract.

APPENDIX II

MATERIAL SITE DATA SHEETS

Appendix II contains data sheets with preliminary information regarding potential mineral material (borrow) sites along the proposed roadway alignment. Ownership is indicated by the following abbreviations:

VSK - Village Selection-Kotzebue (Kikitagruk Inupiat Corporation)

VSN - Village Selection-Buckland (Nunachiak Corporation)

VSD - Village Selection-Deering (Ignatchiak Corporation)

SS - State Selection

KIC - Kikitagruk Inupiat Coporation (Interim Conveyances)

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-1A

MILE POST N/A

OWNERSHIP: State, offshore.

FEATURE: Offshore gravel deposits.

MATERIALS: Gravel with some sand maximum size approximately three inches.

PROBABLE OVERBURDEN: None.

PERMAFROST: None.

GROUNDWATER: Underwater deposits will require dragline or dredge.

VEGETATION: None.

ENVIRONMENTAL CONCERNS: Potential for initiating beach erosion.

ACCESS: From beach near Kotzebue.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-1

MILE POST 6

OWNERSHIP: VSK,SS

FEATURE: Low relief glacial till ridge.

MATERIALS: Sandy to silty gravel?

PROBABLE OVERBURDEN: Greater than 10 feet of frozen, ice rich silt.

PERMAFROST: Present at one to two feet, ice content unknown.

GROUNDWATER: None.

VEGETATION: Low (less than one foot) shrub tundra with few grass tussocks.

ENVIRONMENTAL CONCERNS: Excessive erosion from deep cuts in frozen silt and from overburden disposal.

ACCESS: On route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-2

MILE POST 22.9

OWNERSHIP: KIC

FEATURE: Beach deposits.

MATERIALS: Sand with gravel, maximum size two inches.

PROBABLE OVERBURDEN: One foot of organics.

PERMAFROST: Present, maximum thaw where stripped three and one half feet.

GROUNDWATER: Present, probable depth two to three feet.

VEGETATION: Moderately dense brush to five feet (30%) and light low shrub. Tundra (50%) with some areas cleared.

ENVIRONMENTAL CONCERNS: Loss of habitat, possible archeologic site.

ACCESS: Approximately three and one half miles of existing road which will require reconstruction.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-3

MILE POST 22.9

OWNERSHIP: State, offshore.

FEATURE: Offshore gravel deposits.

MATERIALS: Gravel with some sand maximum size approximately three inches.

PROBABLE OVERBURDEN: None.

PERMAFROST: None.

GROUNDWATER: Underwater deposits will require dragline or dredge.

VEGETATION: None.

ENVIRONMENTAL CONCERNS: Potential for initiating beach erosion.

ACCESS: Approximately four miles, will require three miles of new road from beach to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-4

MILE POST 35.9

OWNERSHIP: VSK

FEATURE: Eolian sand, low relief outcrops, probable dune feature.

MATERIALS: Fine to very fine sand with silt.

PROBABLE OVERBURDEN: Zero to one and one half feet organics and silt.

PERMAFROST: Present, frozen at one to four feet. Ice content unknown.

GROUNDWATER: None.

VEGETATION: Low shrub tundra approximately 30%. Grass tussock tundra 70%.

ENVIRONMENTAL CONCERNS: Possible erosion from ice rich cuts, possible wind erosion from exposed areas.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-5

MILE POST 64.9

OWNERSHIP: VSK, RS, SS

FEATURE: Glacial till, high relief drumlin type feature.

MATERIALS: Sand with gravel to gravel, maximum size six inches, most in one to two inch size range.

PROBABLE OVERBURDEN: Zero to ten feet or organics and silt.

PERMAFROST: Present at one and one half feet in overburden areas. Thaw depths unknown in exposed gravel areas. Ice content unknown.

GROUNDWATER: None.

VEGETATION: Low shrub tundra on exposed gravel (50% of area) grass tundra where overburden is present.

ENVIRONMENTAL CONCERNS: Possible erosion from silt overburden cuts and waste area.

ACCESS: Approximately one half mile with one large culvert.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-6

MILE POST 71.2

OWNERSHIP: VSK

FEATURE: Glacial till sheet.

MATERIALS: Sand with gravel, maximum size two inches.

PROBABLE OVERBURDEN: Zero to one foot of organics and silt.

PERMAFROST: Present, thaw depth unknown, ice content unknown.

GROUNDWATER: None.

VEGETATION: Low shrub and lichen tundra grading to grass tussocks.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KK-7

MILE POST 74 - 81.6

OWNERSHIP: VSK, SS

FEATURE: Glacial till sheet.

MATERIALS: Sand with gravel, maximum size two inches.

PROBABLE OVERBURDEN: Zero to five feet of organics and silt.

PERMAFROST: Present, thaw depths unknown, ice content unknown.

GROUNDWATER: Some groundwater present over permafrost, minimal amount.

VEGETATION: Low shrub tundra with small area of alder to four feet.

ENVIRONMENTAL CONCERNS: Possible erosion from silt overburden cuts or waste areas.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-1

MILE POST 81.6

OWNERSHIP: VSK, SS - FED

FEATURE: A series of bedrock exposures on the Kauk River Hills.

MATERIALS: Frost shattered, weathered rock of volcanic origin, fragments to three inches in diameter on surface.

PROBABLE OVERBURDEN: Two to four feet of colluvium with a thin organic mat.

PERMAFROST: Near surface, little ice anticipated.

GROUNDWATER: None.

VEGETATION: Scattered alder to six feet in height.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-2

MILE POST 88.7

OWNERSHIP: FED

FEATURE: Glacial till sheet overlying basalt.

MATERIALS: Sandy gravel, maximum size gravel in till six inches, basalt bedrock blocks up to three feet by five feet.

PROBABLE OVERBURDEN: None.

PERMAFROST: Probably present but should have no effect on bedrock mining.

GROUNDWATER: None.

VEGETATION: Low shrub vegetation.

ENVIRONMENTAL CONCERNS: Possible erosion and siltation into Kauk River from working area. Possible archeology site.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-3

MILE POST 92

OWNERSHIP: FED

FEATURE: Bedrock outcrop.

MATERIALS: Coarse grained pink to gray monzonite, dark minerals approximately 20%, maximum size blocks at surface one and one half feet.

PROBABLE OVERBURDEN: None.

PERMAFROST: Probably frozen but should have no effect on mining.

GROUNDWATER: None.

VEGETATION: Sparse grass and lichen.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Approximately one half mile access road required.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-4

MILE POST 94.5

OWNERSHIP: VSN

FEATURE: Bedrock ridgetop.

MATERIALS: Coarse grained granitic, probably monzonite.

PROBABLE OVERBURDEN: None.

PERMAFROST: Probably present, should have no effect on mining.

GROUNDWATER: None.

VEGETATION: Sparse brush to four feet.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Approximately 1000 feet off alignment.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-5

MILE POST 96.5

OWNERSHIP: VSN

FEATURE: Bedrock outcrop.

MATERIALS: Coarse grained granitic, blocks at surface to three feet.

PROBABLE OVERBURDEN: None.

PERMAFROST: Present, but should have no effect on mining.

GROUNDWATER: None.

VEGETATION: Light, low shrub tundra.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-6

MILE POST 102.5

OWNERSHIP: VSN, SS

FEATURE: Bedrock outcrops.

MATERIALS: Green-gray meta-volcanic (andesite) with approximatly 20% feldspar phenocrysts in green matrix, blocks at surface predominately in one foot size range.

PROBABLE OVERBURDEN: Zero to three feet of gravelly colluvium.

PERMAFROST: Probably frozen but should have no effect on mining.

GROUNDWATER: Some groundwater present over permafrost on mining.

VEGETATION: Sparse grass and lichen with a few shrubs to three feet.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-7

MILE POST 106

OWNERSHIP: VSN, SS, two unpatented mining claims in vicinity

FEATURE: Bedrock outcrops.

MATERIALS: Medium grained meta-volcanic, maximum size blocks at surface one to two feet.

PROBABLE OVERBURDEN: Zero to five feet of rock colluvium.

PERMAFROST: Present, but should have minimal effect on mining.

GROUNDWATER: None.

VEGETATION: Sparse grass and lichen.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. KB-8

MILE POST 110.8

OWNERSHIP: VSN, RS, SS

FEATURE: Bedrock exposures overlooking Buckland Tributary Creek.

MATERIALS: Weathered visicular basalt, blocks to 36 inches diameter on surfaces.

PROBABLE OVERBURDEN: Silt, deepening away from creek.

PERMAFROST: Near surface.

GROUNDWATER: None.

VEGETATION: Scattered mosses, grasses, and brush.

ENVIRONMENTAL CONCERNS: Siltation of Buckland Tributary Creek.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-1

MILE POST 116.3

OWNERSHIP: VSN-RS

FEATURE: Floodplain of Buckland River, northeast side.

MATERIALS: Sandy gravel, maximum size three inches.

PROBABLE OVERBURDEN: Four to eight feet silt.

PERMAFROST: At approximately two feet.

GROUNDWATER: At approximately four feet where thawed.

VEGETATION: Dense alder and willow.

ENVIRONMENTAL CONCERNS: Siltation of Buckland River and removal of riparian vegetation.

ACCESS: Approximately 8000 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-2

MILE POST 117.9

OWNERSHIP: VSN/RS

FEATURE: Fossil point bar of the Buckland River at confluence of Fairhaven Creek.

MATERIALS: Sandy gravel with interlayered sands, maximum size three inches.

PROBABLE OVERBURDEN: Five to eight feet of sandy silt.

PERMAFROST: Within two feet of surface.

GROUNDWATER: Near surface when thawed.

VEGETATION: Scattered patches of alder.

ENVIRONMENTAL CONCERNS: Siltation of Buckland River and removal of riparian vegetation.

ACCESS: Approximately 10,000 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-3

MILE POST 116.3

OWNERSHIP: VSN/RS

FEATURE: Bedrock exposure north side of Buckland River.

MATERIALS: Weathered basalt bedrock, frost shattered rock on surface to 48 inches in diameter.

PROBABLE OVERBURDEN: Silt becoming deeper away from river.

PERMAFROST: Near surface.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of Buckland River.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-4

MILE POST 121

OWNERSHIP: VSN/RS/SS

FEATURE: Bedrock ridge.

MATERIALS: Weathered, vesicular basalt, frost shattered rock on surface to 36 inches in diameter.

PROBABLE OVERBURDEN: About four to six feet of silt.

PERMAFROST: Near surface.

GROUNDWATER: None.

VEGETATION: Moss and grasses, scattered brush.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Approximately 6500 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-5

MILE POST 122

OVERBURDEN: VSN/RS/SS

FEATURE: Toe of bedrock ridge, overlooking Meinzer Creek to the north.

MATERIALS: Weathered vesicular basalt.

PROBABLE OVERBURDEN: Silt, becoming deeper to the south.

PERMAFROST: Near surface.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of Meinzer Creek.

ACCESS: Approximately 600 feet, will require crossing Meinzer Creek.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-6

MILE POST 125

OWNERSHIP: VSN/RS/SS

FEATURE: Bedrock ridge.

MATERIALS: Weathered vesicular basalt.

PROBABLE OVERBURDEN: Thin scattered organic mat.

PERMAFROST: Near surface, problems with ice not anticipated.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of nearby drainage.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-7

MILE POST 127

OWNERSHIP: VSN/RS/SS

FEATURE: Bedrock ridge.

MATERIALS: Weathered vesicular basalt.

PROBABLE OVERBURDEN: Thin scattered organic material.

PERMAFROST: Near surface, problems with ice not anticipated.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of nearby drainage.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-8

MILE POST 130

OWNERSHIP: VSN/RS/SS

FEATURE: Bedrock ridge.

MATERIALS: Weathered vesicular basalt, frost shattered rock on surface to 36 inches in diameter.

PROBABLE OVERBURDEN: None.

PERMAFROST: Near surface, ice content unknown.

GROUNDWATER: None.

VEGETATION: Scattered moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of Duck Creek.

ACCESS: Approximately 1500 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-9

MILE POST 137.5

OWNERSHIP: VSN/SS

FEATURE: Bedrock bluffs on both sides Lava Creek.

MATERIALS: Weathered vesicular basalt.

PROBABLE OVERBURDEN: Silt becoming deeper away from creek.

PERMAFROST: Near surface.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of Lava Creek.

ACCESS: Approximately 5000 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-10

MILE POST 137.5

OWNERSHIP: VSN/SS

FEATURE: Bedrock knob.

MATERIALS: Weathered vesicular basalt a few blocks on surface to 48 inches in diameter.

PROBABLE OVERBURDEN: Between five and ten feet of organic silt and colluvium.

PERMAFROST: At one foot, ice content suspected to be high.

GROUNDWATER: None.

VEGETATION: Moss and grasses.

ENVIRONMENTAL CONCERNS: Siltation of surrounding drainages.

ACCESS: Approximately 6000 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. BC-11

MILE POST 147

OWNERSHIP: SS

FEATURE: A series of bedrock bluffs overlooking the Kiwalik River to the west.

MATERIALS: Weathered vesicular basalt, blocks on surface to 36 inches in diameter river, rounded material on surface.

PROBABLE OVERBURDEN: Three to five feet of silty material, deeper away from river.

PERMAFROST: Near surface, deeper near the river.

GROUNDWATER: None.

VEGETATION: Moss and grasses with occassional alder.

ENVIRONMENTAL CONCERNS: Siltation of Kiwalik River.

ACCESS: Varies from adjacent to the route to 2000 feet away.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-1

MILE POST 148.7

OWNERSHIP: SS, unpatented mining claims

FEATURE: Kiwalik River, floodplains, placer tailings.

MATERIALS: Sandy gravel, maximum size 18 inches.

PROBABLE OVERBURDEN: None

PERMAFROST: None.

GROUNDWATER: About six feet below original ground surface.

VEGETATION: None.

ENVIRONMENTAL CONCERNS: Possible siltation of Kiwalik River.

ACCESS: Approximately 500 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-2

MILE POST 148.7

OWNERSHIP: SS, unpatented mining claims

FEATURE: Floodplain of Candle Creek, placer tailings.

MATERIALS: Sandy gravel, maximum size 18 inches.

PROBABLE OVERBURDEN: None.

PERMAFROST: None.

GROUNDWATER: Variable

VEGETATION: Scattered brush.

ENVIRONMENTAL CONCERNS: Possible siltation of Kiwalik River and Candle Creek.

ACCESS: Approximately 1000-2000 feet, may require temporary crossing of Candle Creek.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-3

MILE POST 152

OWNERSHIP: SS

FEATURE: Bedrock ridge.

MATERIALS: Highly weathered schist maximum three inches in diameter on surface, soft, platy.

PROBABLE OVERBURDEN: Four feet of gravelly silt (colluvium).

PERMAFROST: At approximately four feet, ice content unknown.

GROUNDWATER: None.

VEGETATION: Scattered alder.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-4

MILE POST 156

OWNERSHIP: SS

FEATURE: Bedrock ridge.

MATERIALS: Highly weathered schist, maximum three inches in diameter on surface, soft, platy.

PROBABLE OVERBURDEN: Four feet of gravelly silt (colluvium).

PERMAFROST: At approximately four feet, ice content unknown.

GROUNDWATER: None.

VEGETATION: Scattered alder.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-5

MILE POST 159

OWNERSHIP: SS

FEATURE: Bedrock ridge.

MATERIALS: Highly weathered schist, maximum three inches in diameter on surface, soft, platy.

PROBABLE OVERBURDEN: Four feet of gravelly silt (colluvium).

PERMAFROST: At approximately four feet, ice content unknown.

GROUNDWATER: None.

VEGETATION: Scattered alder.

ENVIRONMENTAL CONCERNS: None.

ACCESS: Adjacent to route.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-6

MILE POST 165

OVERBURDEN: VSD/SS

FEATURE: Kugruk River floodplain meander cores.

MATERIALS: Sandy gravel, maximum size eight inches.

PROBABLE OVERBURDEN: Three feet of silt.

PERMAFROST: At approximately 2.5 feet

GROUNDWATER: Estimated six feet from surface when thawed.

VEGETATION: Dense willow.

ENVIRONMENTAL CONCERNS: Siltation of Kugruk River and removal of riparian vegetation.

ACCESS: Approximately 1500 feet.

PRELIMINARY MATERIAL SITE DATA SHEET

M.S. CC-7

MILE POST 165

OWNERSHIP: VSD/SS unpatented mining claims, mineral survey applied for

FEATURE: Floodplain of Kugruk River, placer tailings on meander core and point bar.

MATERIALS: Sandy gravel, maximum size 12 inches.

PROBABLE OVERBURDEN: None.

PERMAFROST: None. Cold water points are being used to thaw the gravels.

GROUNDWATER: Three to four feet below surface when thawed.

VEGETATION: Dense willow.

ENVIRONMENTAL CONCERNS: Siltation of Kugruk River.

ACCESS: Approximately 2500 feet.

SELECTED REFERENCES

Alaska, State of, Department of Fish and Game, Catolog of Waters Important for Spawning and Migration of Anadromous Fishes, 3 Volumes, March 1978.

Alaska, State of, Office of Coastal Management; State of Alaska Coastal Management Program and Final Environmental Impact Statement, 1979.

Alaska, State of, Office of Coastal Managment; Alaska Coastal Management Program, First Year 306 Grant Application, July 1979

Alaska, State of, Department of Highways, Western Access Road Reconnaissance Study, November 1973.

Alaska, State of, Department of Highways, Western Access Road Reconnaissance Soils Study, December 1973.

American Association of State Highway Officials, A Policy on Geometric Design of Rural Highways, 1965.

American Association of State Highway Officials, Geometric Design Guide for Local Roads and Streets, 1970.

American Association of State Highway Officials, Geometric Design Standards for Highways other than Freeways, 1969.

Arnold, Robert D.; Alaska Native Land Claims, 1978, 367 pp.

Arnold, Robert D.; Alaska Native Land Claims, The Alaska Native Foundation Anchorage, 1976.

Berger, Louis, & Associates, Inc. and Philleo Engineering & Architectural Service, Inc.; Western and Arctic Alaska Transportation Study, Nome-Kotzebue Road, January 1980.

Brown, J., Berg, R.L.; "Environmental Engineerings and Ecological Baseline Investigations along the Yukon River-Prudhoe Bay Haul Road", CRREL Report 80-19, September 1980.

Cederstrum, D.J.; Origin of A Salt-Water Lens in Permafrost at Kotzebue, Alaska", Geologic Society of American Bulletin, V. 72. No. 9, pp. 1426-1431, 1961.

Center of Northern Educational Research University of Alaska (Fairbanks); New School Districts in Rural Alaska; A Report on the REAA's After One Year, 1978.

Cobb, Edward H.; Metallic Mineral Resources Map of the Candle Quadrangle, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map M-F 389, 1972.

Cobb, Edward, H,;Metallic Mineral Resources Map of the Bendeleben Quadrangle, Alaska. U.S. Geological Survey Miscellaneous Field Studies Map M-F 417, 1972.

Coulter, H. W. et al.; Map showing extent of Glaciations in Alaska. U.S. Geological Survey Miscellaneous, Geological Investigations Map I-415.

Crory, F.E.; "The Kotzebue Hospital-A Case Study", Proceedings of the Conference on Applied Techniques for Cold Environments, Vol. I, pp. 342-359, 1978.

Darbyshire and Associates; NANA Coastal Resource Service Area, Proposed Work Program, July 1980.

Esch, D.C., Rhode, J.J.; "Kotzebue Airport Runways Insulation Over Permafrost", Second International Symposium on Cold Regions Engineering, University of Alaska.

Gault, H.R. et al.; Reconnaissance for Radioactive Deposits in the Northeastern part of the Seward Peninsula, Alaska. 1945-47 and 1951. U.S. Geological Survey Circular, 250, 1953.

Giddings, J.L.; "Special Study-Alaska Aboriginal Culture", National Survey of Historic Sites and Buildings, U.S. Department of the Interior, National Park Service, 1962.

Giddings, J.L.; "Round Houses in the Western Arctic", American Antiquity, 23 (2), pp. 121-5, 1957.

Hartman, Charles, W. and Johnson, Philip R.; Environmental Atlas of Alaska, University of Alaska, 1978.

Henning, F.F. et al. (eds.),; The Kotzebue Basin, The Alaska Geographic Society, 1981.

Henshaw, F.F. et al.; Surface Water Supply of Seward Peninaula, Alaska. U.S. Geological Survey Water Supply Paper, 314, p.317, 1913.

Hershey, Oscar H., The Ancient Kobuk Glacier of Alaska, Journal of Geology, Vol. 17,; 83-91, 1909.

Holmes, Charles R.; Antiquities Resources, Resources Inventory, Northwest Palnnin Planning Region, Joint Federal State Land Use Planning Commission, March 1974.

Hopkins, David M.; Thaw Lakes and Thaw Sinks in the Imuruk Lake Area, Seward Peninsuls, Alaska. Journal of Geology, VOl. 57, pp. 119-131, 1949.

Hulten, Eric; Flora of Alaska and Neighboring Territories, Stanford University Press, Stanford, CA., 1968.

Klein, D.R.; "Tundra Ranges North of the Boreal Forest", Journal of Range Management, 23 (1), pp 8-14, 1970.

_____; "Reaction of Reindeer to Obstructions and Disturbances", Science , 173 (3995) pp. 393-8, July 30, 1971.

Lomen, C.J.; Fifty Years in Alaska, D. McKay Company, New York, 1954.

Manueluk Assoication, Inc.; The NANA Region, Its Resources and Development Potential, 1974.

Miller, Thomas P. et al.; Preliminary Report on a Plutonic Belt in West-Central Alaska. U.S. Geological Survey Prof. Paper 550-D, 1966.

Moffit, Fred H.; The Fairhaven Gold Placers, Seward Peninsula, Alaska. U.S. Geological Survey Bulletin, 247, 1905.

Murfitt, A. W., McMullen, W.B., McPhail, J.F.; "Design and Construction of Roads on Muskeg in Arctic and Sub-Arctic Regions", Proceedings 16th Annual Muskeg Conference, Montreal, 1975.

Naylor, Larry L., et al., Socioeconomic Evaluation of Reindeer Herding in Northwest Alaska", Arctic, 33 (2), June 1980.

Parker, W., Swanson, D., Fischer, V., and Christian, J.; "Northwest Alaska Economic and Transportation Prospects", 1972. Prepared for U.S. Army Corps of Engineers by the Institute of Social, Economic and Government Research, University of Alaska.

Patton, Jr., William W.; Regional Geologic Map of the Candle Quadrangle, Alaska U.S. Geological Survey Miscellaneoud Geological Investigation, Map I-492, 1967.

Patton, Jr., W.W., et al.; Regional Geologic Map of the Selawik and Southeastern Baird Mountains Quadrangles, Alaska. U.S. Geological Survey, Miscellaneous Geological Investigations, Map I-530, 1968.

Patton, Jr. W.W.; Reconnaissance Geology of the Northern Yukon-Koyukuk Province, Alaska. U.S. Geological Survey Paper, 774-A, 1973.

Proceedings,Wetlands Conference, Anchorage, Alaska February 5, 1979.

Sainsbury C. L., Geologic Map of Bendeleben 1:250,000 Quadrangle, p.38, 1974.

Selkregg, Lidia, et al.; Buckland, a village profile, University of Alaska Arctic Environmental Information and Data Center for the Alaska Department of Community and Regional Affairs, December 1976.

_____; Deering, a village profile,....

_____; Kotzebue, a village profile,....

Stern, Richard O., et al., Eskimos, Reindeer and Land, Bulletin 59, Agricultural Experiment Station, School of Agriculture and Land Resources Management University of Alaska, December 1980.

Toenges, Albert L., and Jolley, T.R.; Investigation of Coal Deposits for Local Use in the Arctic Regions of Alaska and Proposed Mine Development. U.S. Bureau of Mines Report of Investigation, 1947.

U.S. Alaska Road Commission Annual Reports. Those available between 1905 and 1955.

Department of the Air Force Technical Manual, 5-852-6, AFM 88-19, Chapter 6, "Calculation Methods for Determination of Freeze and Thaw In Soils", January 1966.

Department of the Army Technical Manual, 5-818-2. "Pavement Design for Frost Conditions", July 1965.

Wilson, C.; Cold Regions in Research and Engineering Laboratory, Climatology of the Cold Regions, Northern Hemisphere II, Cold Regions Science and Engineering Monograph I-A3b, August 1969.

Wolff, E.N.,Johansen, N.I., Lambert C., Rhoads, E.M., and Solie, R.J.; "Optimum Transportation Systems to Serve the Mineral Industry North of the Yukon Basin in Alaska", 1973. Prepared for the U.S. Bureau of Mines, M.I.R.L. Report No. 29, by Mineral Industry Research Laboratory, University of Alaska.

Personal Conversations with Thor Wettleson of Candle.