

A REPORT OF THE
DINOSEIS SEISMOGRAPH SURVEY

OF THE
FORT NORMAN AREA SMG 70-1-1

GOV # 41-6-5-68-2

NORTHWEST TERRITORIES

LONGITUDE 124° 00' - 125° 00'

LATITUDE 65° 00' - 65° 45'

FOR THE FORMER

SINCLAIR CANADA OIL COMPANY

EXPLORATION LICENSE NO. 1120

OVER

PERMITS 4989-4991, 4996-4999, 5003-5005, 5008-5010

SHOT BY

COMPAGNIE GENERALE DE GEOPHYSIQUE

IN AUGUST 1968

APPROVED BY

J. P. Nelson

REPORT DATE

MARCH, 1970



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LOCATION MAP

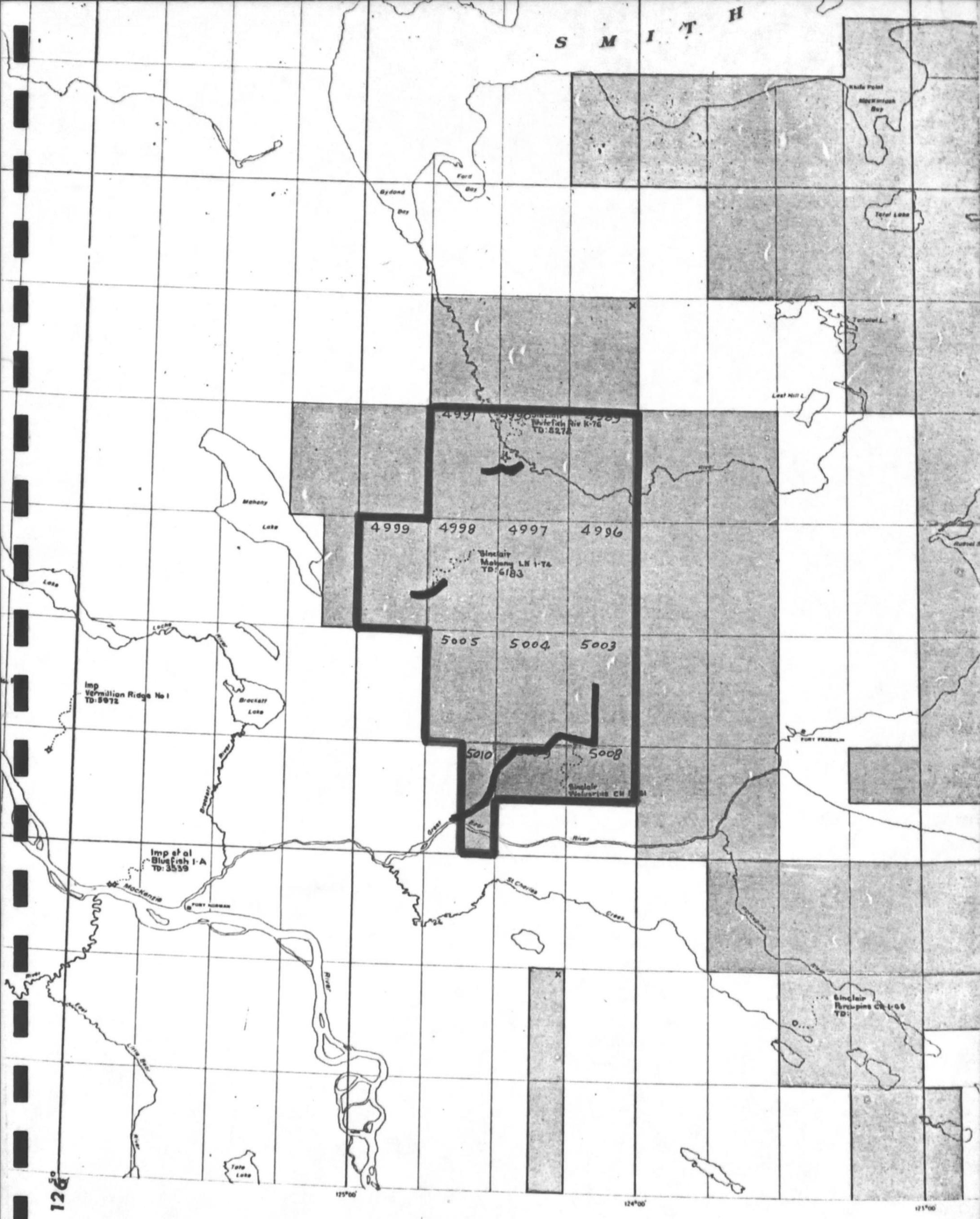
I Statistical Report

II List of Personnel

III Maps

1. Shot Point Map Enclosed

IV Results



SINCLAIR CANADA OIL COMPANY
DISTRICT OF MACKENZIE (N.W.T.)

STATISTICAL REPORT ON A HELIPORTABLE
DINOSEIS SURVEY
GREAT BEAR RIVER AREA

AUGUST 21 to SEPTEMBER 3, 1968

COMPAGNIE GENERALE DE GEOPHYSIQUE

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FOREWORD

Party S-909 of COMPAGNIE GENERALE DE GEOPHYSIQUE, on behalf of SINCLAIR CANADA OIL COMPANY, carried out a seismograph survey by the heliportable dinoseis method in the Great Bear River area of the Mackenzie district.

The survey was conducted between August 21st and September 3rd, 1968, according to the terms of the contract signed by SINCLAIR CANADA OIL COMPANY and COMPAGNIE GENERALE DE GEOPHYSIQUE on August 2nd, 1968.

The party was headed by Mr. J.C. Grosset, Party Chief, and Mr. J. Tarnowski, Party Manager.

The technical supervision was by the Research Department of SINCLAIR OIL AND GAS COMPANY.

This report is to present the statistical data.

A B S T R A C T

Out of the 14 days of heliportable dinoseis survey in the Great Bear River area, 10 days were for recording.

Three lines were surveyed, representing a total of 79 shot points or 37,99 miles.

Eight dinoseis exploders were used on this survey.

The recording instruments comprised AS 626X amplifiers working in conjunction with a GSC AM 280 microtrack magnetic recorder.

The two Bell 204B helicopters flew a total of 114:30 hours.

The seismic portion of the 1:26 hour per new shot point average was :50 minutes. This compares favourably with what is considered normal for dynamite shooting.

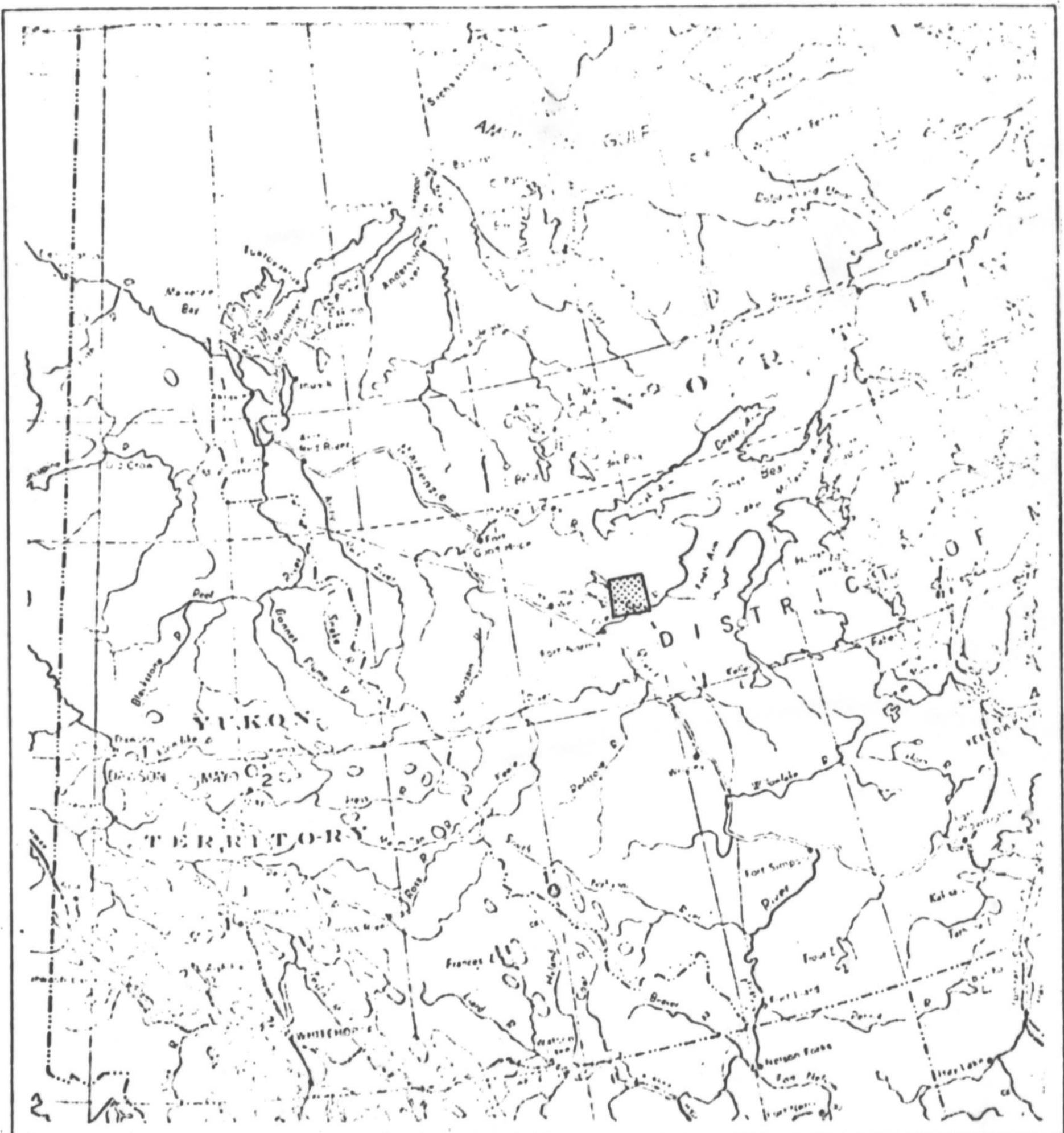
The seismic crew spent an average of 1:20 hour in the field per new shot point. This average could be substantially reduced by working with several sets of dinoseis exploders and a larger line crew.

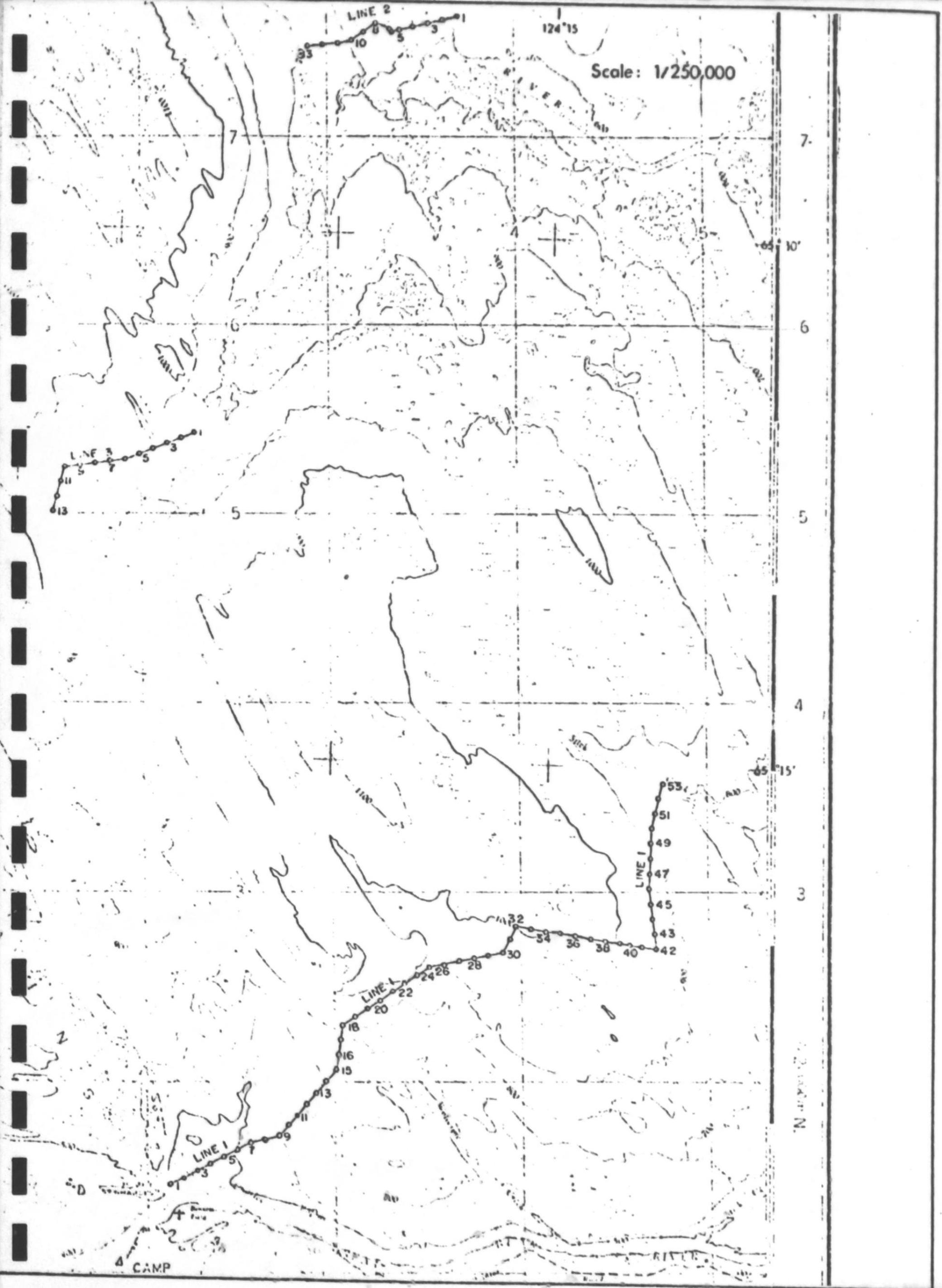
CGG Party 909
Bear River (N.W.T.)

SINCLAIR CANADA OIL COMPANY

Fig: 1

SCHEMATIC
LOCATION MAP





I GENERAL INFORMATION

1.1 Project location (figure 1)

The project was located in the Mackenzie district, north of the Great Bear River and east of the Franklin Mountains.

1.2 Program

The program comprised 3 lines representing 38 miles to be surveyed on permits held by Sinclair Canada Oil Company.

1.3 Surface conditions

The entire area was covered with timbers up to 40 feet tall except for a few patches of muskeg with few or no trees.

The top soil was spongelike, mainly consisting of moss in the treed areas and of grass and light mud in the muskeg patches.

The depth of the permafrost was very uneven. It was usually more than 2 or 3 feet deep except in some patches of muskeg, where ice or permafrost was sometimes encountered at about one foot depths.

1.4 Weather conditions

Fog and rain showers occurred frequently during the survey. At times the wind proved to be a problem for the helicopter pilots while maneuvering loads on approaching or leaving the clearings.

However, weather disturbances were not persistent and only one day was lost due to weather.

1.5 Personnel (figure 2)

The Research Department of Sinclair Oil and Gas Company was in charge of the technical supervision during the whole survey and also provided the technical personnel for operating the dinoseis.

The seismic, helicopter and catering personnel were provided by Compagnie Generale de Geophysique or its subcontractors: Bullock Helicopter Company and Foothills Catering Ltd.

The line cutters were hired in Norman Wells and Fort Norman by the surveyor and the party manager. Their number often proved to be insufficient and the line crew was used as a reinforcement when necessary.

1.6 Equipment (figure 2)

1.61 Dinoseis

The eight heliportable dinoseis exploders and the two heliportable control modules were provided by Sinclair Oil and Gas Company. This represented a total of ten helicopter loads, each weighing less than 3000 pounds.

1.62 Recording equipment

The recording equipment was mounted inside a heliportable cabin which had previously been used for conventional shooting. A GSC AM 280 microtrack recorder was added for the dinoseis operation. This recording cabin weighed less than 2000 pounds thus allowing extra loads to be carried inside the helicopter while moving along the seismic line.

Fig: 2

PARTY COMPOSITION

PERSONNEL

1 Party Chief
1 Party Manager
1 Surveyor
1 Rodman
2 Observers
7 Helpers

Extra:
3 Helpers
6 to 14 line cutters

EQUIPMENT

1 Heliportable recording cabin
AS 626X Amplifiers
1 AM 280 Recorder
1 VRO 6D Camera
568 Geophones, HJ 14-
Hz-L2
16 Reflection cables
14 pairs
3 Extension cables
14 pairs
12 Reflection cables
28 pairs
1 Roll-along switch
1 Patch panel
3 VHF radios
2 Transits, DKM 2U
2 Altimeters

Extra : 648 geophones,
HJ 14 Hz-L1

Seismic

Dinoseis

Helicopters

Camp

1 Supervisor
3 Technicians

1 Chief Pilot, 204B
1 Pilot, 204B
2 Engineers
1 Pilot, Alouette II
1 Engineer

1 Cook
2 Helpers

8 Heliportable
dinoseis units
2 Heliportable
control units

2 Bell 204 B
helicopters
Maximum capacity:
10 passengers
Maximum sling load:
3600 pounds
Cruising speed:
90 to 100 Knots
Consumption in
operation: 72 gal/Hr

Tent camp

1 Alouette II
Astazou
Maximum capacity:
4 passengers
Cruising speed:
80 Knots
Consumption in
operation: 29 gal/H

1.63 Helicopters

The Sud Aviation Alouette II "Astazou" helicopter has an endurance of up to $5\frac{1}{2}$ hours carrying 2 passengers and $2\frac{1}{2}$ hours carrying 4 passengers. Combined with a cruising speed of 80 knots, this makes it an ideal machine for reconnaissance and surveying purposes.

On this particular survey the Alouette II was also extensively used as a liaison vehicle for the surveyors and line cutters during the field hours.

The two Bell model 204B helicopters were not used to their full capacity during this dinoseis operation. However, as can be seen from the statistics, both machines flew more than the minimum guaranteed by contract. While only one machine was used to move the personnel and the equipment along the seismic lines, both machines were used to move the personnel from the camp to the field and back, as well as for moving the equipment from line to line.

1.64 Camp

The tent camp used for this survey was of a light type without double roofs or floors. It had been modified and improved during the survey at Shingle Point so as to be more suitable for subarctic conditions, and also for the size of a seismic crew.

Fig: 3

FIELD TECHNIQUES

Recording System

SERCEL AS 626X Amplifiers, GSC AM 280 recorder,
SIE VRO 6D camera

Geophones

HSJ 14 Hz-L1 in groups of 9

Cables

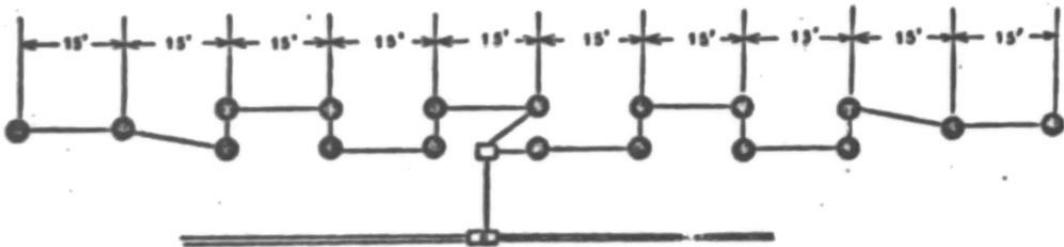
16 reflection cables 14 pairs

Spread

Distance between SP : 2640 feet
Station spacing : 200 feet
Distance between SP and first station : 220 feet
Noise spread : distance between station : 25 feet

Geophone arrangement

18 geophones per trace according to diagram



Noise arrangement : 9 geophones grouped

Dinoseis pattern

8 in line, approximately 25 foot spacing

Correction and Processing

SINCLAIR CANADA OIL COMPANY

II CHRONOLOGY AND STATISTICS

2.1 Positioning

The combination of a general shortage of empty turbofuel drums and the limited time in which to make fuel available in the field, made it necessary to fly a Hercules with 200 empty drums from Edmonton to Norman Wells. These drums were then filled in Norman Wells and barged to the Northern Transportation Company Ltd.'s Bear River Rapids camp, close to which the seismic camp was to be located.

The surveyor and the first line cutters arrived at the Bear River Rapids camp on August 12th with the Alouette II "Astazou" and started the line cutting the next day.

Most of the equipment, including the recording cabin, was moved from Shingle Point, some 425 miles to the North-west, to the Bear River Rapids airstrip: Bennett field, by Bristol freighter in 4 trips on August 18th and 19th.

Personnel, camp gear and some light equipment were moved in 4 DC3 trips between August 18th and 22nd.

The two Bell 204B helicopters arrived at Bear River Rapids on August 20th.

2.2 Operation

The line cutters started with the surveyor on August 13th. During the initial period, while the seismic crew was still operating at Shingle Point, they were accommodated at the Northern Transportation Company Ltd.'s camp near the Bear River Rapids.

On August 21st and 22nd, while the dinoseis and recording equipment were being reassembled and tested, the line crew was used for reinforcing the line cutters.

The first recording was made on August 23rd and the last, on September the 2nd.

During the operation the supplies were flown from Norman Wells by Beaver and Otter aircraft.

The field techniques are summarized on figure 3.

2.3 Depositioning

After the Bear River survey the crew and the equipment were to be brought back to Calgary.

A DC4 charter flew the crew and most of the recording equipment back to Calgary on the night of September 4th.

The dinoseis equipment was barged to Hay River and then trucked to Calgary.

The helicopters were released at the end of the survey and left at Bullock Helicopter Company disposal.

2.4 Statistics

The survey lasted 14 days comprising 2 days for positioning, 10 days of recording, 1 day for depositioning and 1 weather day.

The surveyor and the line cutters started 10 days ahead of the recorder. In spite of that early start, it was extremely difficult for the crew of 6 to 14 line cutters to keep ahead of the seismic crew.

Quite often the clearings were barely sufficient for the helicopters and the seismic crew had to help in the line cutting. A minimum of 18 line cutters would probably be required permanently to open the lines.

The seismic field hours are the hours the seismic crew and the dinoseis personnel actually spent in the field during the program. These hours, when averaged over the number of new shot points, are in excess of what is normally obtained by the helicopter crew on a conventional program.

All of the eight exploders were used at each shot point. Consequently, the minimum time required between two shots was increased by the time it would take the helicopter to move the ten loads of dinoseis equipment and set it up.

If enough exploders were available, one, or better still, two shot points could be prepared ahead of the recorders. This would result in a production comparable to that achieved by a conventional crew. The size of the line crew would then need to be the same as for a conventional crew.

The seismic hours for the Bell 204B helicopters are the hours flown by the helicopters moving equipment and personnel along the lines, and also in bringing the personnel from the camp to the field and back.

The seismic flying time will vary with the production and the type of work. The average of 50 minutes per new shot point indicates only the maximum to be expected. From our previous experience we note that this is about 20% lower than for conventional dynamite shooting. (drilling included)

The moving hours for the Bell 204B helicopters are the hours flown in transporting the equipment from one line to another during the operation, also the hours flown in transporting the equipment from the lines to camp and back for maintenance and repairs.

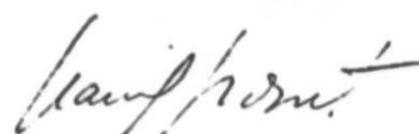
This flying time is not related to the production, or the type of work, but only to the amount of equipment used and to what extent the program is scattered.

Twenty hours of flying is a reasonable estimate of what would be required to move a crew, comprising 8 dinoseis exploders, 2 control modules and the recording equipment, over a 50 mile distance using Bell 204B helicopters.

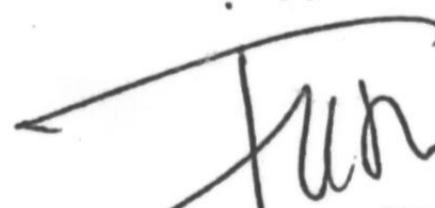
It is of interest to note that the seismic field hours and the seismic helicopter hours, when averaged over the number of new shot points, give exactly the same figures as on the Shingle Point survey.

The surveying and cutting of 38 miles of lines required 40:50 hours of Alouette II and 18:45 hours of Bell 204B. These hours were mainly flown in servicing and transporting the line cutters. This is far in excess of the 20:25 hours flown by the Alouette II at Shingle Point for surveying 33 miles of line with no line cutting.

Calgary, October 25, 1968



J.C. GROSSET
Party Chief



L.R. FRION
Canadian Branch Manager

COMPAGNIE GENERALE de GEOPHYSIQUE

TELEPHONE 592-5656

CANADA - BRITISH COLUMBIA

CANADIAN BRANCH

MANAGING OFFICE: 6204 - 2ND STREET S.E., CALGARY, ALBERTA, CANADA

C.G.G. PERSONNEL - SINCLAIR - DINOSEIS EXPERIMENT

Great Bear River - August 21 - September 3, 1968

October	J. Grosset - Party Chief	August 21 - September 3
	J. Tarnowski - Party Manager	August 21 - September 3
	H. Schwarz - Shooter	August 21 - September 3
	P. Grisi - Surveyor	August 21 - September 3
	J. Roy - Surveyor	August 21 - September 3
Atlantic	A. Bidou - Observer 650 Guinness House, Calgary, Alberta	August 21 - September 3
	T. Battles	
Attention	R. Snow - Surveyor	
	G. Beiswanger	
	J. Ohlsen	
Dear Sir	H. Pech - Helpers	August 21 - September 3
	T. Phillips	
As requested	T. Bullock	
personnel	J. Brindley	we attach hereto a list of
programs	W. Watson	various Dinoeis Experimental
	W. Klanten	
	M. O'Donnell	
		We hope this list will suffice your requirements.
		Yours very truly,

COMPAGNIE GENERALE de GEOPHYSIQUE

J. R. Hamilton,
Office Manager

J. Grosset

IV Results

The three line Dinoseis survey conducted by C.G.G. for Sinclair in the Great Bear Lake Area was experimental. Information gained from this survey was not subsurface in nature. The seismic sections are considered "No data"; however, we do believe that much was learned relative to operational techniques and some modifications have already been made to the Dinoseis guns to make them more functional under similar surface conditions.

9



TERRAIN ANALYSIS
of the
FORT FRANKLIN AREA
NORTHWEST TERRITORIES
1968

41-2-5-68-1
SINCLAIR CANADA OIL COMPANY
Operator

GEOPHOTO SERVICES LTD.
CALGARY, ALBERTA, CANADA
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5019	5456	6188
5020	5457	5959

Report Authors
R. C. Oburn
Paul Fuenning

Report Date: July, 1968
Project Number: 41-2-5-68-1

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Plate 2	Vegetation Categories	Facing Page 1

PLATE 2 - Showing vegetation categories used on Detailed Terrain Analysis Map.



Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief, moderate to fair drainage.



Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief, moderate to fair drainage.



Primarily scattered groves of medium-to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees. Includes areas of brush, grassland and minor muskeg. Moderate to low relief, fair to poor drainage.



Brush and meadows usually closely associated with muskeg areas; moderate to low relief, fair to poor drainage. Includes old burn regrowth areas of low trees and dense underbrush.



Muskeg or marsh with minor brush areas and scattered trees; low relief, water table at or near surface.



Undifferentiated vegetation associated with river flats and bottomlands; cover may range from muskeg to tall trees. Drainage generally poor.



Recent burn area; early regrowth of willows and aspen, dense underbrush and fallen timber. Ground conditions variable.

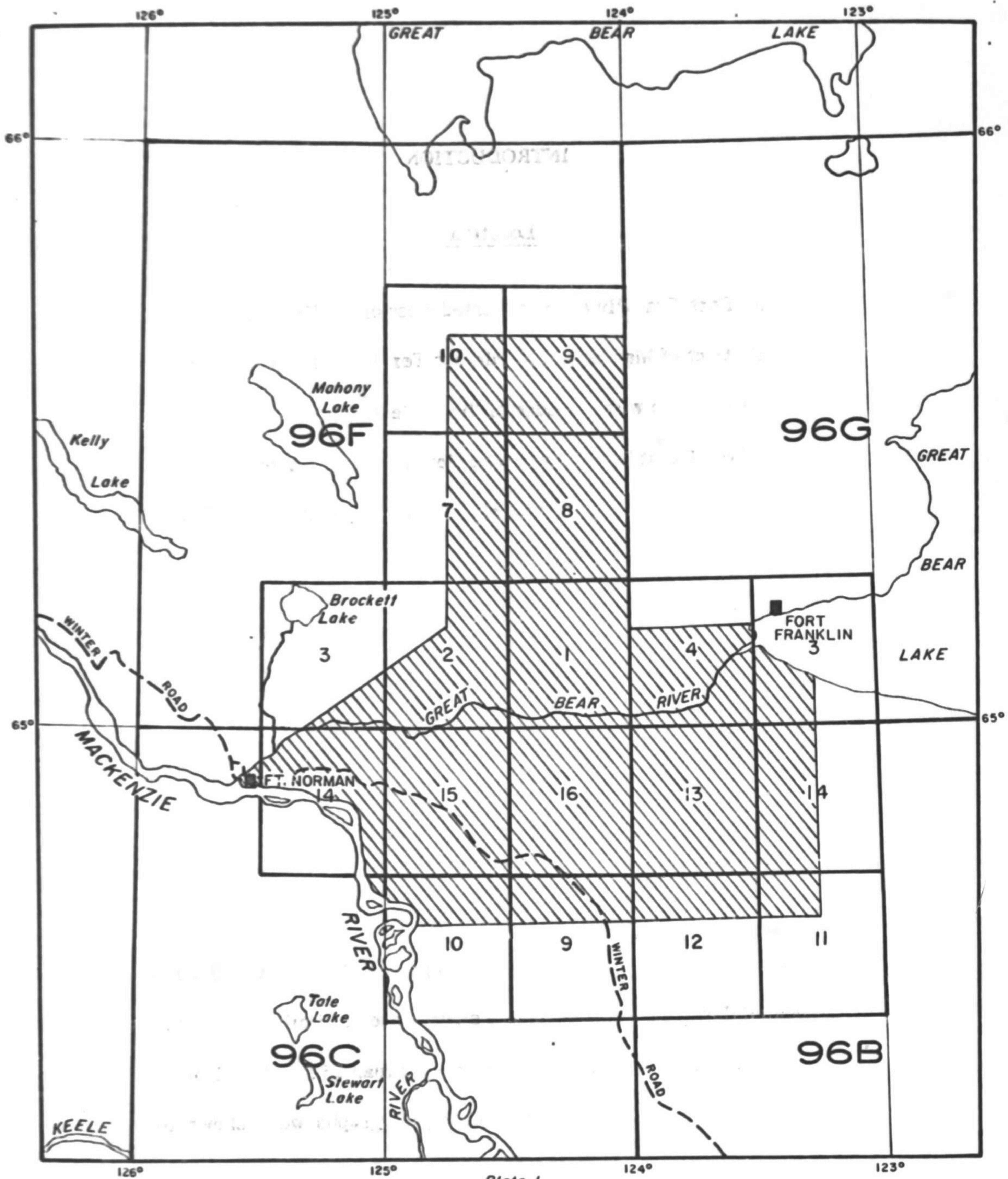


Plate 1
**INDEX MAP
OF
FORT FRANKLIN AREA, N.W.T.**

AREA OF DETAILED TERRAIN ANALYSIS

9

MAP SHEET AND NUMBER

INTRODUCTION

Location

The Fort Franklin area is located west of the Keith Arm of Great Bear Lake, District of Mackenzie, Northwest Territories. Fort Norman is situated on the extreme western edge of the project, at the confluence of the Mackenzie and the Great Bear River, with Fort Franklin located east of the project. The study covers approximately 2,650 square miles with irregular boundaries that extend from Latitude 64°40' to Latitude 65°40', and from Longitude 123°15' to 125°30' (see Plate 1).

Purpose of Study

This study was undertaken to delineate various terrain features which would affect trafficability in the region. Topography and vegetation were mapped to indicate the relative wetness conditions as well as the type of growth that covered the respective areas with vegetation types subdivided into seven categories (see Plate 2). Four categories of slope conditions have been delineated that range from gentle to steep slopes and minor escarpments less than 25 feet in height to escarpments greater than 25 feet in height. All trails or winter roads recognizable on the air photographs were shown to aid in local access.

Method of Study

The Terrain Analysis was accomplished by stereoscopic examination of air photographs. The appropriate symbols necessary to designate the vegetation types and slope conditions were annotated on the alternate air photographs. Map sheets from the Department of Energy, Mines and Resources, Ottawa, Ontario, at a scale of 1:250,000 were also utilized in the project analysis.

PHOTOGRAPHY AND MAP COMPILATION

Photography

The vertical air photographs used in the Terrain Analysis were flown for the Canadian Government in 1949, 1950, and 1951, and as 9 inch by 9 inch prints, have an effective focal length of six inches and a scale of approximately 1:35,000. The flight lines are oriented in a north-south direction. The photographs are of good to fair quality. The photography was furnished by Sinclair Canada Oil Company for use by Geophoto Services, Ltd.

Mosaics

Uncontrolled, stapled mosaics used in the compilation were from Geophoto file negatives. These mosaics were constructed by matching details of alternate photographs along flight lines using topographic and hydrographic features for control. The mosaics were reproduced photographically at a scale of 1:31,680 or 1 inch equals 1/2 mile and conform to the National Topographic System. Department of Energy, Mines and Resources 1:250,000 topographic maps were utilized as control in the mosaic construction with the mosaic accuracy considered satisfactory, although some planimetric inaccuracies are obvious and unavoidable. Latitude and longitude coordinates were positioned using hydrographic features.

Base Map and Map Compilation

The base map for each sheet was prepared by overlying each mosaic with a permascala and tracing the hydrographic features. All the data delineated on the air photographs comprising the Terrain Analysis was then drafted to these base maps with the ozalid prints of the permascala comprising the final maps at a scale of 1 inch equals 1/2 mile (1:31,680). A total of eighteen pencil colored ozalid prints are presented as the final interpretation.

TERRAIN ANALYSIS

Access to Area

The project area may be reached in the summer by traversing the Mackenzie River from Fort Providence downstream to Fort Norman or in the winter by winter tractor trail from Fort Providence to the project area. A 12,000 foot airstrip, named Bennett Field, is located on the south side of Great Bear River in the central-western portion of the project area, approximately 30 air miles north-northeast of Fort Norman.

Physiography

Drainage

The project area lies within the drainage system of the northwest-erly flowing Mackenzie River which forms the southwest boundary of the project. The project is bisected by the westward flowing Great Bear River which drains the Keith Arm of Great Bear Lake, and is a tributary of the Mackenzie River, which it joins at Fort Norman. The greatest terrain obstacle in crossing in a north-south direction through the project area, are the escarpments and steep slopes of this river. The extreme north portion of the area is drained by the Whitefish River and its tributaries. This river, with its main headwaters to the east, drains west and north through Sheets 9 and 10, and continues north to the south of Bydand Bay on the Smith Arm of

Great Bear Lake outside of the project. The valley floor of the Whitefish River is wide and the few escarpments along its course would not be a hinderance to traffic. The east flank of the north-central highland is drained by Stick Creek, a tributary of the Great Bear River, which in its upper reaches flows southeasterly and then turns abruptly to flow in a southwesterly direction. The main problem in crossing Stick Creek would be passage across the extensive muskeg areas along its course. The southern portion of the area is drained by the northwesterly flowing St. Charles Creek and its tributaries. This creek enters the Great Bear River 20 miles upstream from Ft. Norman. Extensive sections of scarps and steep slopes along various reaches of St. Charles Creek and its unnamed main tributary will require careful analysis in planning access into this area. The southeastern portion of the area is drained by the northwesterly flowing Porcupine River and several creeks that also have the same orientation. The continuity of the escarpments and slopes along Porcupine River are sufficiently broken to allow route selection to miss the steeper portions which would present obstacles to access.

Other prominent hydrographic features that characterize the area are numerous lakes varying in size from small ponds to large lakes up to 4 miles in length. It should be noted that a considerable percentage of the area is muskeg covered and includes many unmapped small lakes and that much of the brush and meadow category, adjacent to the muskeg areas, might also be very wet. This latter condition is due to the presence of a muskeg area at

a higher elevation than a brush and meadow area with the consequent movement of water down the slope, through the meadow area.

Topography

The most prominent topographic feature in the area is the north-west trending Franklin Mountains which form a barrier to east-west traffic movement, although several passes exist in the mountains and several streams, such as St. Charles Creek, dissect the range. In the south part of the area, the topography of the Franklin Mountains is very subdued. Maximum relief in the vicinity of the Franklin Mountains on the north side of the Great Bear River is approximately 1,000 feet. The highest point in the area is in the Franklin Mountains where the elevation is in excess of 1,700 feet, and the lowest elevation is at Fort Norman at the mouth of the Great Bear River where the elevation is slightly over 200 feet; thus the maximum relief in the project area is approximately 1,500 feet.

General Remarks

The water table is at or near the surface over much of the project area as evidenced by the large areas of muskeg and brush and meadows that in all probability, are also quite wet in the summer months. Vehicular traffic during the summer months will be very restricted in this swampy terrain. The major exception to this is the Franklin Mountains and their adjacent highlands

where moderately to sparsely timbered areas and higher meadows are well drained. Areas exhibiting fair to good drainage conditions also exist in association with moderately to sparsely timbered areas and brush and meadow areas adjoining portions of several of the major rivers and creeks.

Eskers that might serve as a source for gravel were found in the southwest part of the area east of the Mackenzie River, and also in the northern part of the area southwest of the Whitefish River. River terraces along the larger streams may contain good quality sand and gravel.

In this study, the vegetation has been delineated in seven categories. Vegetation categories were distinguished on the air photographs by tonal pattern, tree heights, and topography. The symbol indicating vegetation cover is representative of the dominant vegetation characteristic in that area; for example, an area shown as primarily brush and meadows could contain medium to tall trees but the predominant cover will be brush and meadows (see Plate 2).

SUMMARY AND CONCLUSIONS

The Fort Franklin area of the Northwest Territories encompasses widely diverse types of terrain. The most obvious feature of the project is the extensive lake and poorly drained muskeg areas that would make movement difficult in the summer. Thus, much of the area would best be traversed in the winter months with route selections governed primarily by any local topographic problems.

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Spurr, S.H., 1948, Aerial photographs in forestry: New York, The Ronald Press Co., 340 p.

MAP REFERENCES

Scale 1:250,000

Department of Energy, Mines and Resources, 1953-1959, Topographic Sheet 96 B (Blackwater Lake): Dept. of Energy, Mines and Resources, Ottawa.

Department of Energy, Mines and Resources, 1959, Topographic Sheet 96 G (Fort Franklin): Dept. of Energy, Mines and Resources, Ottawa.

Department of Energy, Mines and Resources, 1956-1957, Topographic Sheet 96 C (Fort Norman): Dept. of Energy, Mines and Resources, Ottawa.

Department of Energy, Mines and Resources, 1960, Topographic Sheet 96 F (Mahony Lake): Dept. of Energy, Mines and Resources, Ottawa.

Scale 1:1,000,000

World Aeronautical Chart, 1961, Sheet WAC 79 (Great Bear Lake) Aeronautical Chart and Information Centre: U.S. Air Force, St. Louis, Missouri.



**TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES**

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)
1/2 1/4 0

TERRAIN SYMBOLS

Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.

Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief, moderate to fair drainage.

Primarily scattered groves of medium- to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees. Includes areas of brush, grassland and minor muskes. Moderate to low relief, fair to poor drainage.

Brush and meadows usually closely associated with muske areas; moderate to low relief, fair to poor drainage. Includes old burn regrowth areas of low trees and dense underbrush.

Muskes or marsh with minor brush areas and scattered trees; low relief, water table at or near surface.

Undifferentiated vegetation associated with river flats and bottomlands; cover may range from muskes to tall trees. Drainage generally poor.

Recent burn area; early regrowth of willows and aspen; dense underbrush and fallen timber. Ground conditions variable.

MODERATE SLOPE. Arrows indicate direction of slope.

STEEP SLOPE. Arrows indicate direction of slope.

Moderate escarpment 5 - 25 feet.

Prominent escarpment over 25 feet.

Ebker or glacial crevasse filling.

Representative glacial groove or ridged. Direction of glacial movement indicated.

Stream.

River.

Lake or standing water.

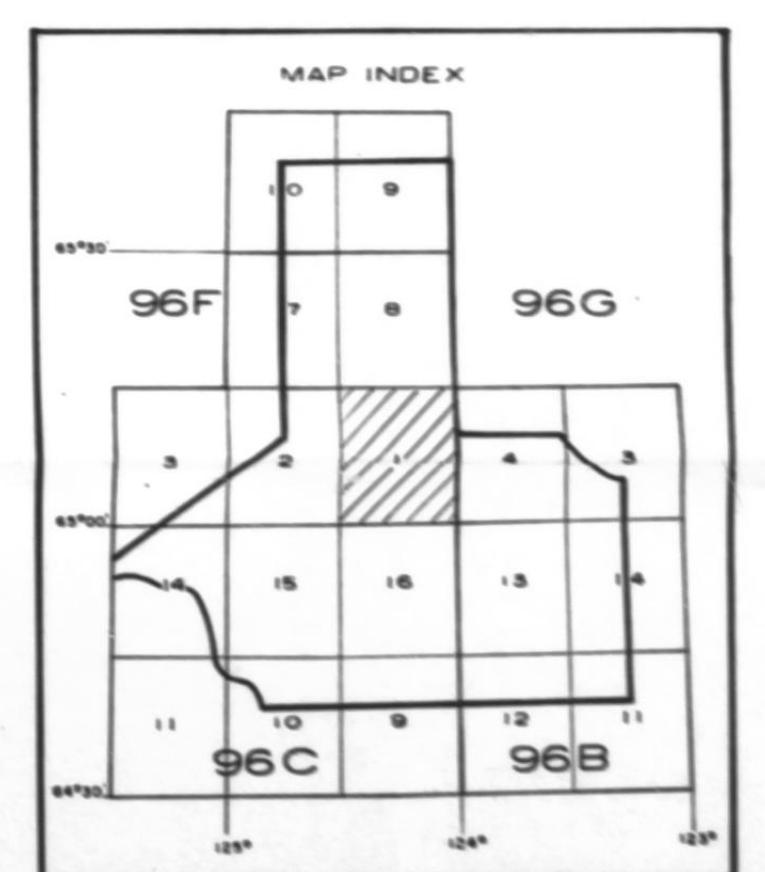
Identifies isolated segment with labelled area.

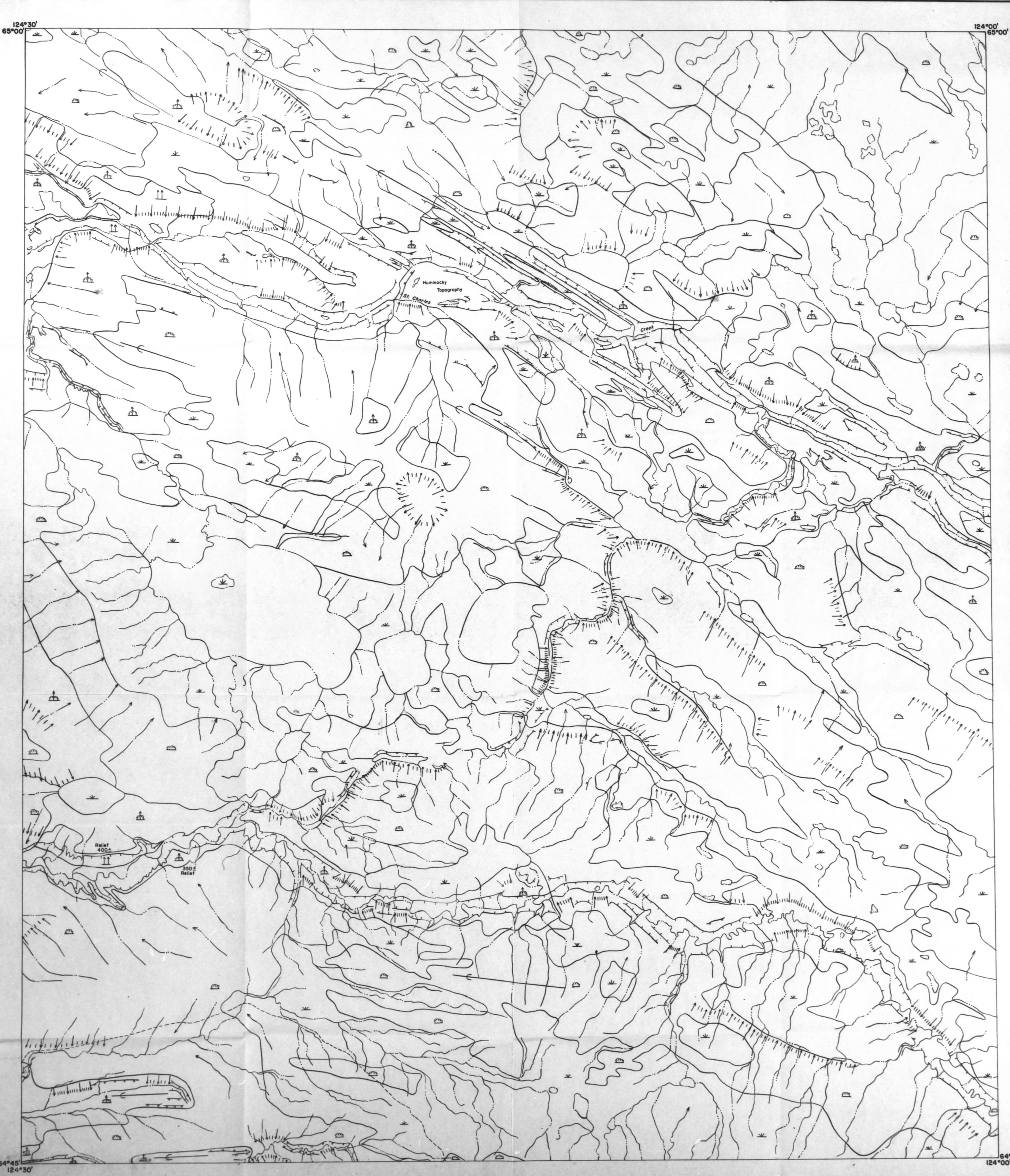
TOPOGRAPHIC AND CULTURAL SYMBOLS

Seismograph line or trail.

Clearing or landing strip. Surface condition unknown.

NOTE





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1988
SCALE:
2 inches = 1 mile (1:31,680)
1/2 1/4 0

TERRAIN SYMBOLS

PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.

PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.

PRIMARILY SCATTERED GROVES OF MEDIUM- TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED CLUMPS OF TALL TREES. INCLUDES AREAS OF BRUSH, GRASSLAND AND MINOR MUSKEG. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.

BRUSH AND MEADOWS USUALLY CLOSELY ASSOCIATED WITH MUSKEG AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REGROWTH AREAS OF LOW TREES AND DENSE UNDERBRUSH.

MUSKEG OR MARSH WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.

UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COVER MAY RANGE FROM MUSKEG TO TALL TREES. DRAINAGE GENERALLY POOR.

RECENT BURN AREA; EARLY REGROWTH OF WILLOWS AND ASPEN; DENSE UNDERBRUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.

MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

MODERATE ESCARPMENT 5 - 25 FEET.

PROMINENT ESCARPMENT OVER 25 FEET.

EBOKER OR GLACIAL CREVASSSE FILLING.

REPRESENTATIVE GLACIAL GROOVE OR RIDGE. DIRECTION OF GLACIAL MOVEMENT INDICATED.

STREAM.

RIVER.

LAKE OR STANDING WATER.

IDENTIFIES ISOLATED SEGMENT WITH LABELLED AREA.

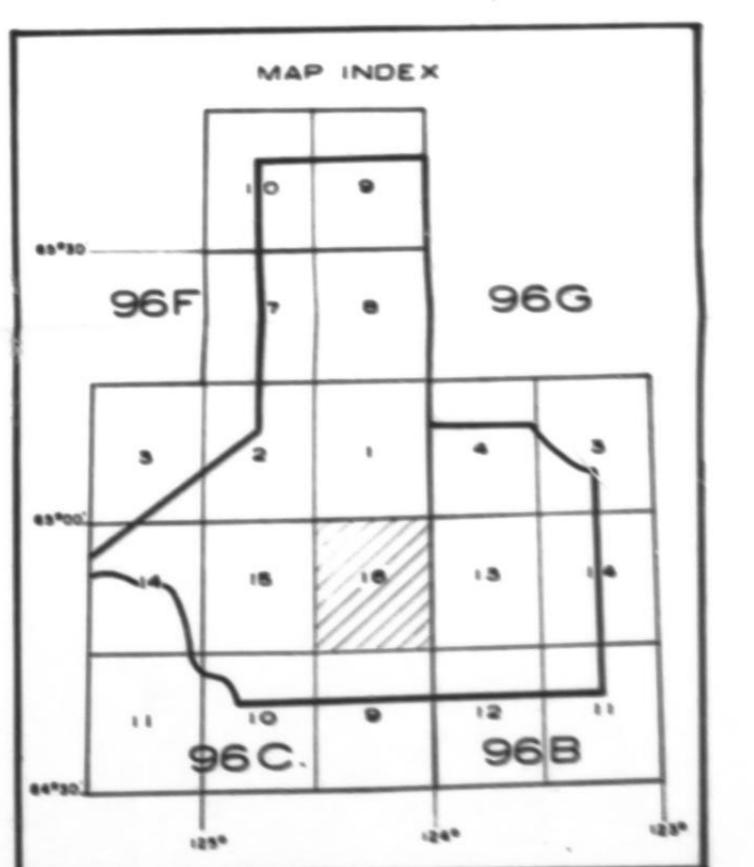
TOPOGRAPHIC AND CULTURAL SYMBOLS

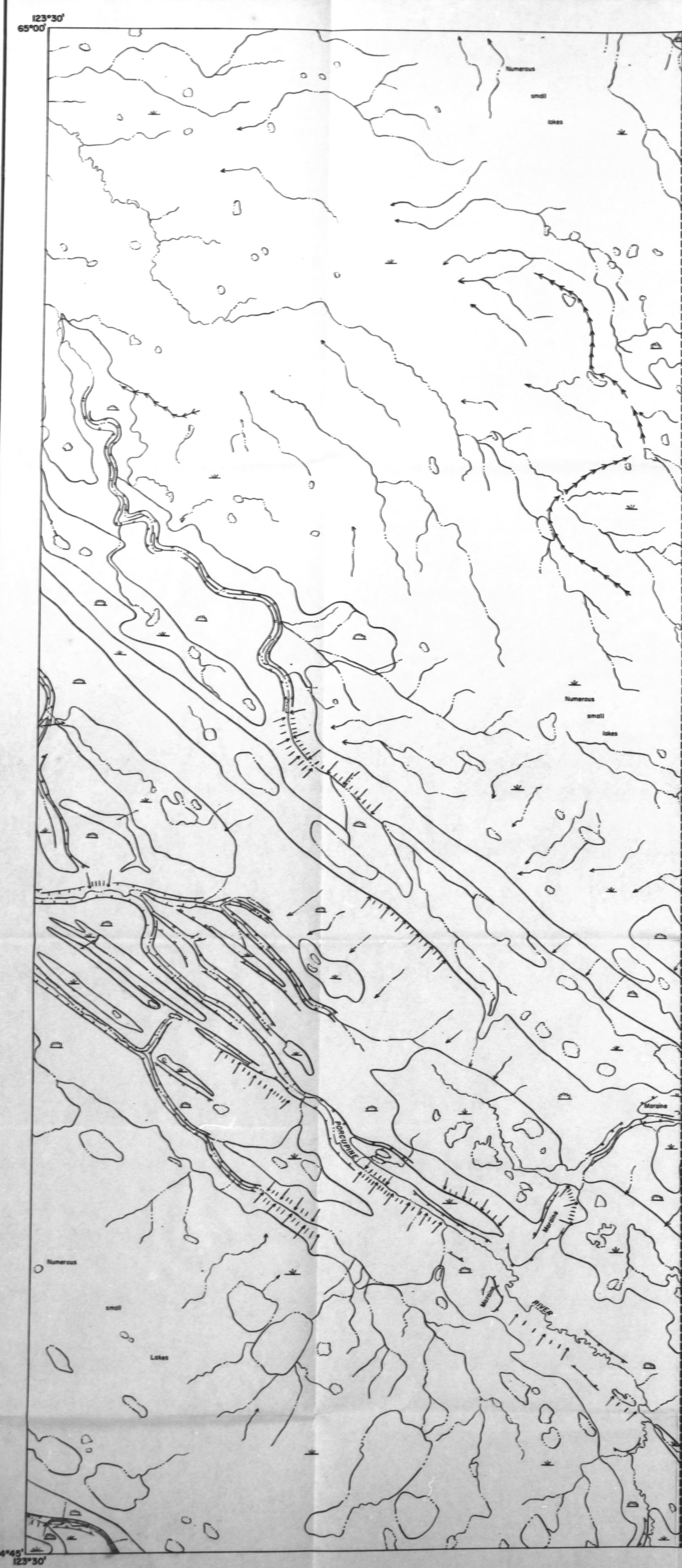
SEISMOGRAPH LINE OR TRAIL.

CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT
OF A FIELD CHECK AND SHOULD NOT BE CONSTRUED AS A FINAL
ANALYSIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LINES
ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC
HAZELS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:61,680)

123° 65°

TERRAIN SYMBOLS

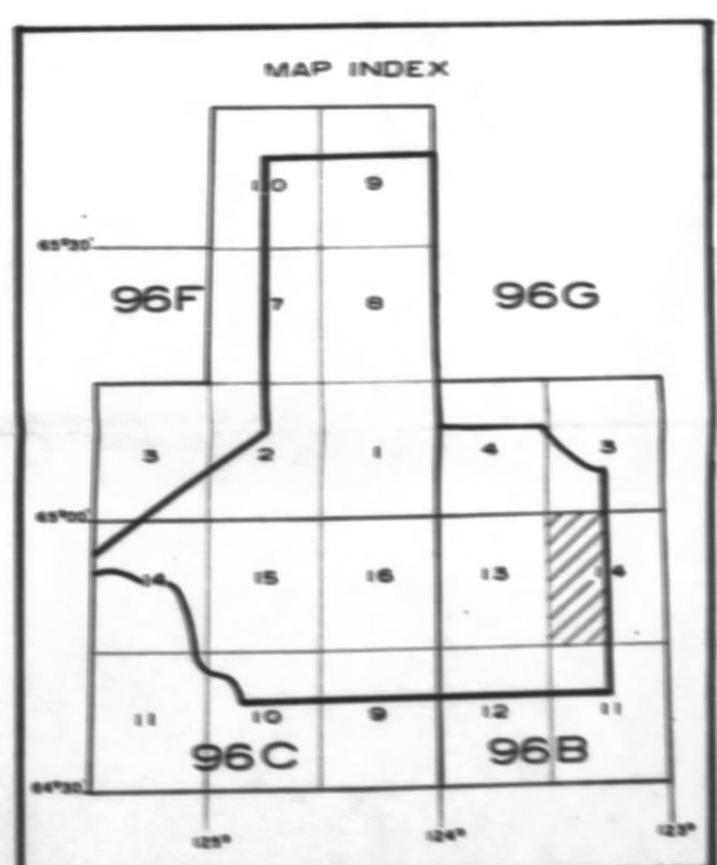
- 1 Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 2 Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 3 Primarily scattered areas of medium- to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees; includes areas of shrubs, grasses and other herbs; moderate to low relief; fair to poor drainage.
- 4 Shrub and heather usually closely associated with marshy areas; moderate to low relief; fair to poor drainage; includes old burn beneath areas of low trees and some undergrowth.
- 5 Marsh or marsh with minor shrub areas and scattered trees; low relief; water table at or near surface.
- 6 Undifferentiated vegetation associated with river flats and bottomlands; cover may range from marshes to tall trees; drainage generally poor.
- 7 Recent burn areas; early regrowth of willow and aspen; dense undergrowth and fallen timber; ground conditions variable.
- 8 Moderate slope. Arrows indicate direction of slope.
- 9 Steep slope. Arrows indicate direction of slope.
- 10 Moderate escarpment 5-25 feet.
- 11 Prominent escarpment over 25 feet.
- 12 Erosion or glacial crevace filling.
- 13 Representative glacial gully or ridge; direction of glacial movement indicated.
- 14 Stream.
- 15 River.
- 16 Lake or standing water.
- 17 Identifies isolated segment with labelled area.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- 18 Dashed line or trail.
- 19 Clearing or landing strip; surface condition unknown.
- 20 Project boundary.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHIC WITHOUT BENEFIT OF A FIELD CHECK AND MAY NOT BE REPRESENTATIVE OF A PERTINENT AREA. POSITION OF CONCRETE AND SOURCES OF LEADS ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING BEINGO TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHIC.



123°30'

65°15'

123°00'

65°00'

TERRAIN ANALYSIS MAP

OF
FORT FRANKLIN, NORTHWEST TERRITORIESPREPARED FOR
SINCLAIR CANADA OIL COMPANY

MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERRAIN SYMBOLS

1 PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

2 PRIMARILY TREES OF HEIGHTS OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

3 PRIMARILY SCATTERED GROUPS OF MEDIUM- TO SMALL-SIZE TREES, GENERALLY TO SPARSELY STOCKED; 1 BOLTED CLUMP OF TALL TREES. INCLUDES AREAS OF BUSH, GRASSLAND AND MEDIUM BURNED. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.

4 BUSH AND MEADOW, USUALLY CLOSELY ASSOCIATED WITH BURNED AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REBURN AREA OF LOW TREED AND DENSE UNDERBUSH.

5 BUSHES OR MARSH WITH MEDIUM BUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.

6 UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COULD MAY RANGE FROM MARSH TO TALL TREES. DRAINAGE GENERALLY POOR.

7 RECENT BURN AREA, EARLY REBURN OF WILLOW AND ASPIRE DENSE UNDERBUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.

8 MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

9 STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

10 MODERATE EMBANKMENT 5 - 25 FEET.

11 PREDOMINANT EMBANKMENT OVER 25 FEET.

12 ERODE OR GLACIAL CREVACE FILLING.

13 REPRESENTATIVE GLACIAL GROOVE OR RIDGE. DIRECTION OF GLACIAL MOVEMENT INDICATED.

14 STREAM.

15 RIVER.

16 LAKE OR STANDING WATER.

17 IDENTIFIED ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

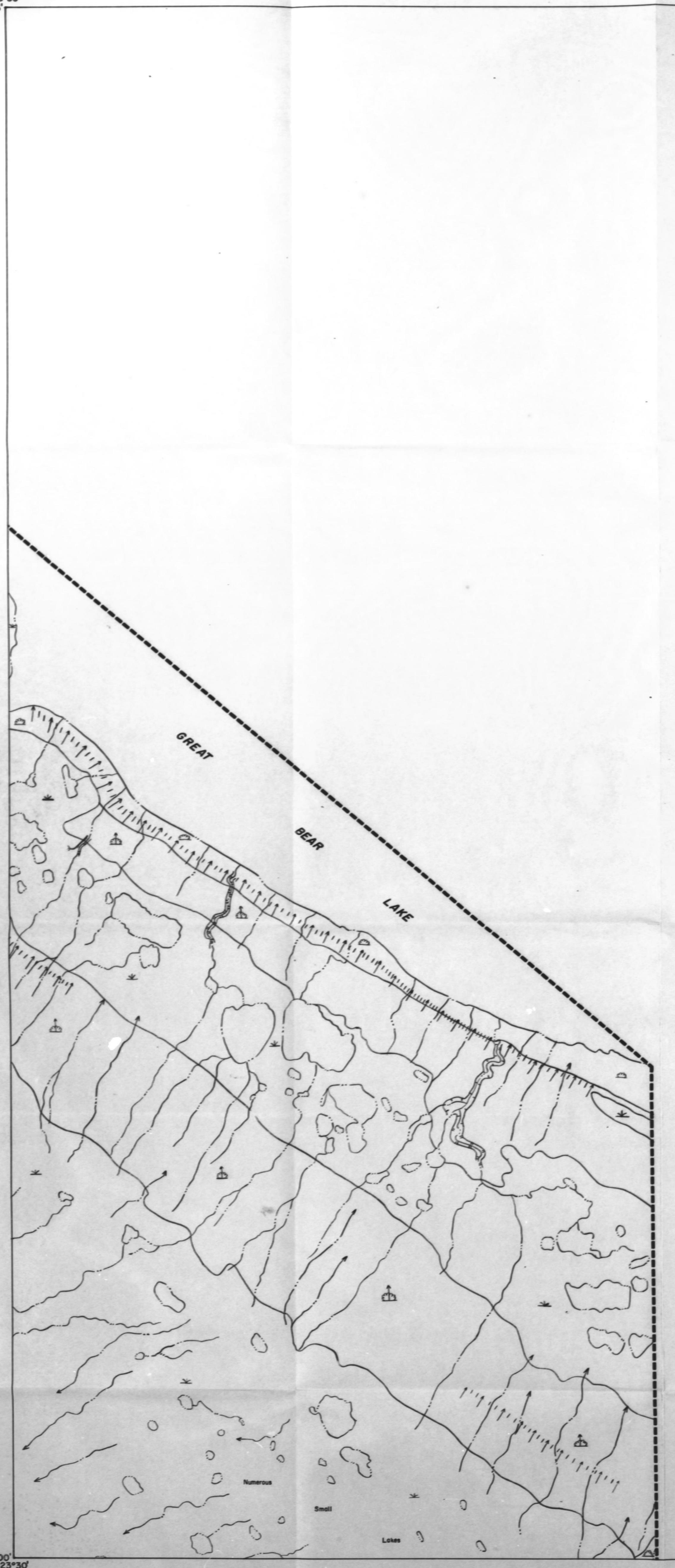
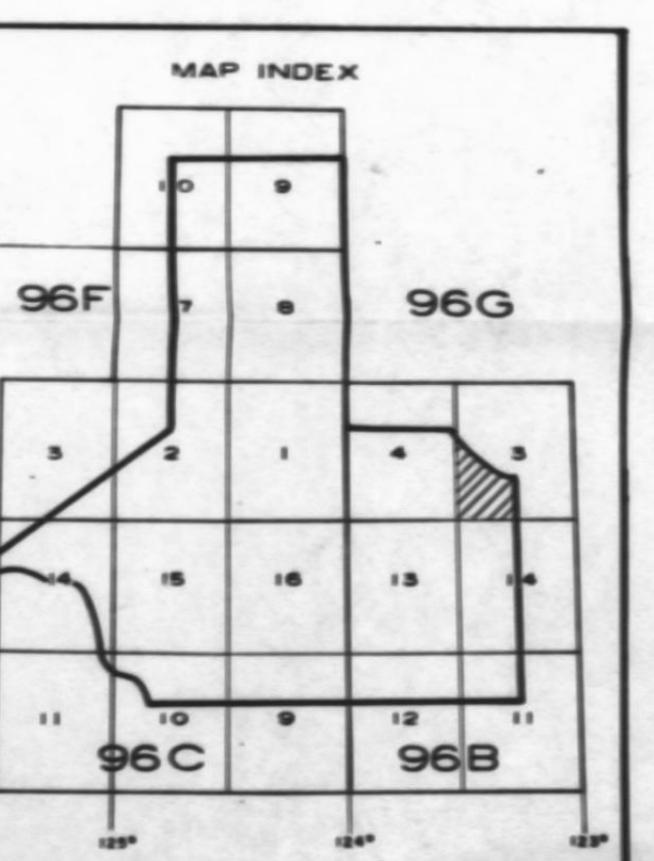
18 GEOPHYSICAL LINE OR TRAIL.

19 CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.

20 PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHY WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSIDERED AS A FINAL ANALYSIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LARGER AREAS ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.



124°00'
65°15'123°30'
65°15'TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIESPREPARED FOR
SINCLAIR CANADA OIL COMPANYMAY-JUNE 1968
SCALE:
2 miles = 1 mile (1:31,680)

12 14 16

TERRAIN SYMBOLS

1 PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

11 PRIMARILY THICK OR MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

2 PRIMARILY SCATTERED GROUPS OF MEDIUM TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED GROUPS OF TREES, INCLUDES BURN REGENERATION, BRASSLAND AND MINOR AREAS; MODERATE TO LOW RELIEF; FAIR TO POOR DRAINAGE.

3 BUSH AND HERBAGE, USUALLY CLOSELY ASSOCIATED WITH BURNED AREAS; MODERATE TO LOW RELIEF; FAIR TO POOR DRAINAGE; INCLUDES OLD BURN REGENERATION AREAS OF LOW TREES AND DENSE UNDERBRUSH.

4 MULDS OR MARSHES WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF; WATER TABLE AT OR NEAR SURFACE.

5 UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND ROTTINGLANDS; COVER MAY RANGE FROM BURNED TO TALL TREES; DRAINAGE GENERALLY POOR.

6 RECENT BURN AREA; EARLY REBIRTH OF WILLOWS AND ASPENS; DENSE UNDERBRUSH AND FALLEN TIMBER; GROUND CONDITIONS VARIABLE.

7 MODERATE SLOPE; ARROWS INDICATE DIRECTION OF SLOPE.

8 STEEP SLOPE; ARROWS INDICATE DIRECTION OF SLOPE.

9 MODERATE EMBANKMENT 5 - 20 FEET.

10 PROMINENT EMBANKMENT OVER 20 FEET.

11 EMBANKMENT OR GLACIAL CREVACE FILLING.

12 REPRESENTATIVE GLACIAL GROOVE OR RIDGE; DIRECTION OF GLACIAL MOVEMENT INDICATED.

13 STREAM.

14 RIVER.

15 LAKE OR STANDING WATER.

16 IDENTIFIED ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

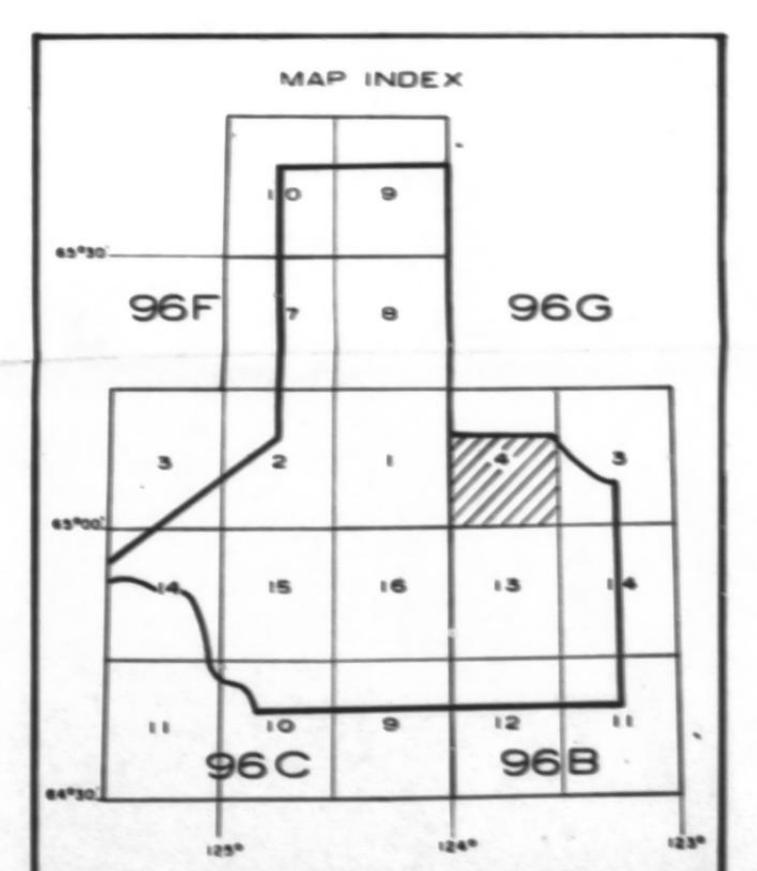
17 SEISMIC LINE OR TRAIL.

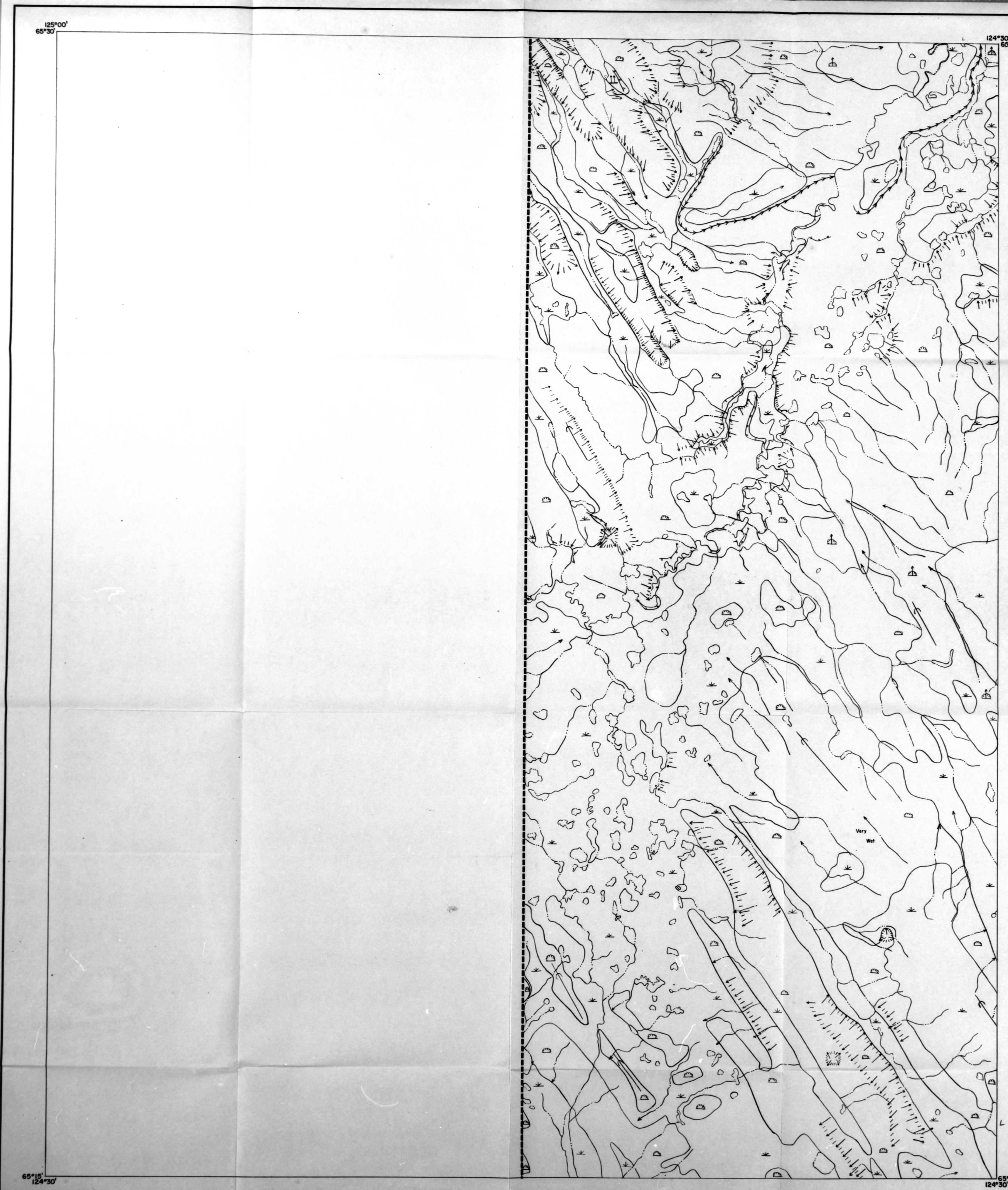
18 CLEARING OR LANDING STRIP; SURFACE CONDITION UNKNOWN.

19 PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSIDERED AS A FINAL ANALYSIS. POSSIBLE ERROR COULD EXIST IN POSITION OF LEAVES AND APPROXIMATE CULTURE FEATURES, INCLUDING RECENT TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





**TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES**

PREPARED FOR
SINCLAIR CANADA OIL COMPANY

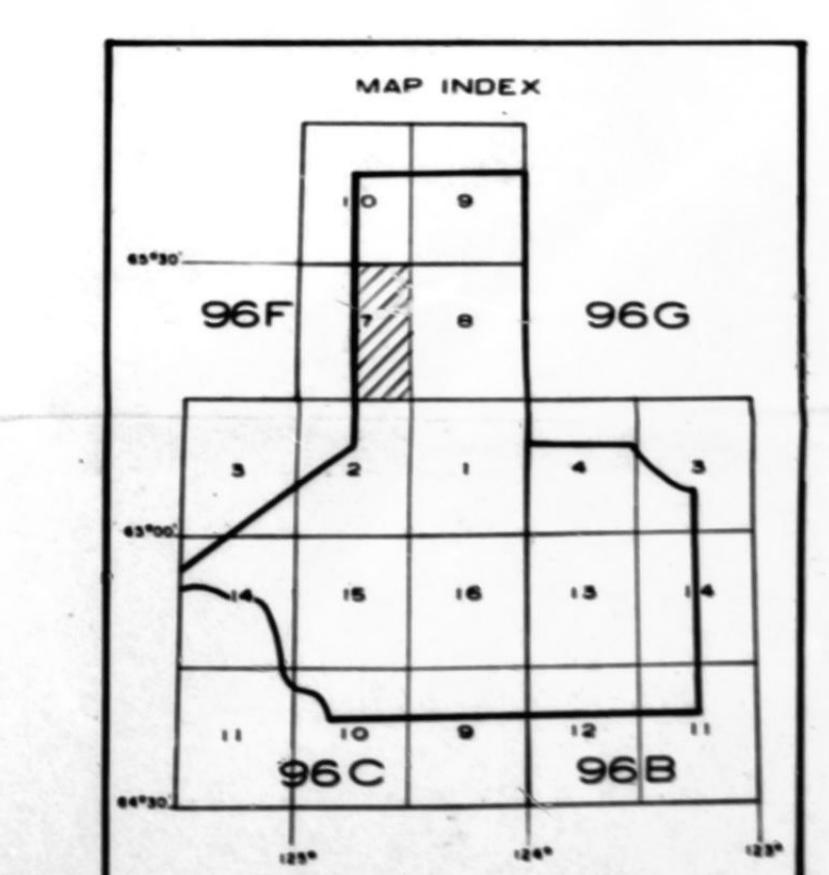


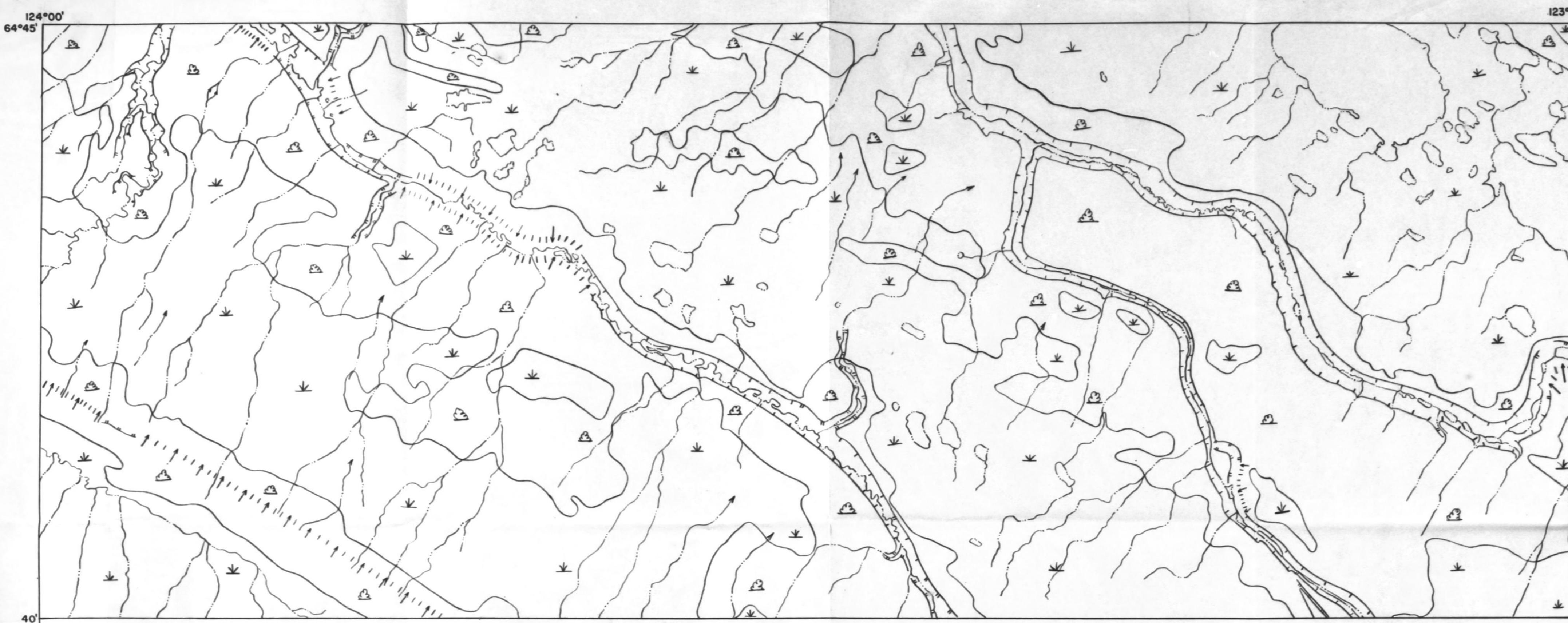
MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERRAIN SYMBOLS

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSTRUED AS A FINAL ANALYSIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LEASES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE
2 MILES TO 1 INCH (1:31,680)

TERRAIN SYMBOLS

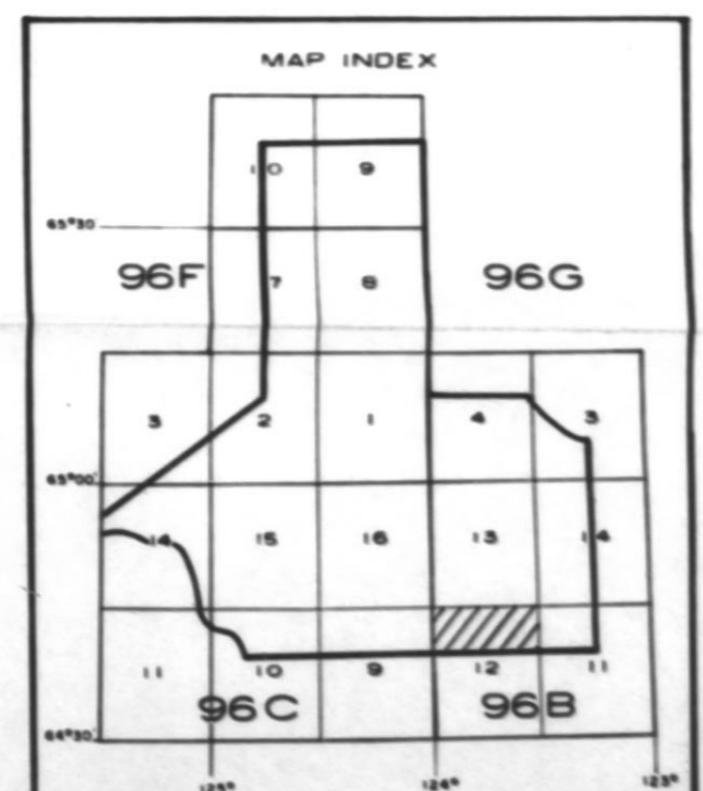
- 1 Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 2 Primarily scattered groves of medium- to small-size trees, generally fully stocked; scattered to isolated clumps of tall trees; includes areas of brush, grassland and minor timber; moderate to low relief; fair to poor drainage.
- 3 Burn and heador usually closely associated with burns areas; moderate to low relief; fair to poor drainage; includes old burn regrowth areas of low trees and dense underbrush.
- 4 Marsh or marsh with minor brush areas and scattered trees; low relief; water table at or near surface.
- 5 Undifferentiated vegetation associated with river flats and bottomlands; cover may range from brush to tall trees; drainage generally poor.
- 6 Recent burn areas; early regrowth of willow and aspen; dense underbrush and fallen timber; ground conditions variable.
- 7 Moderate slope. Arrows indicate direction of slope.
- 8 Steep bl. pe. Arrows indicate direction of slope.
- 9 Moderate escarpment 5 - 25 feet.
- 10 Prominent escarpment over 25 feet.
- 11 Erosion or glacial crevasse filling.
- 12 Representative glacial groove or ridge; direction of glacial movement indicated.
- 13 Stream.
- 14 River.
- 15 Lake or standing water.
- 16 Identified isolated segment with labelled area.

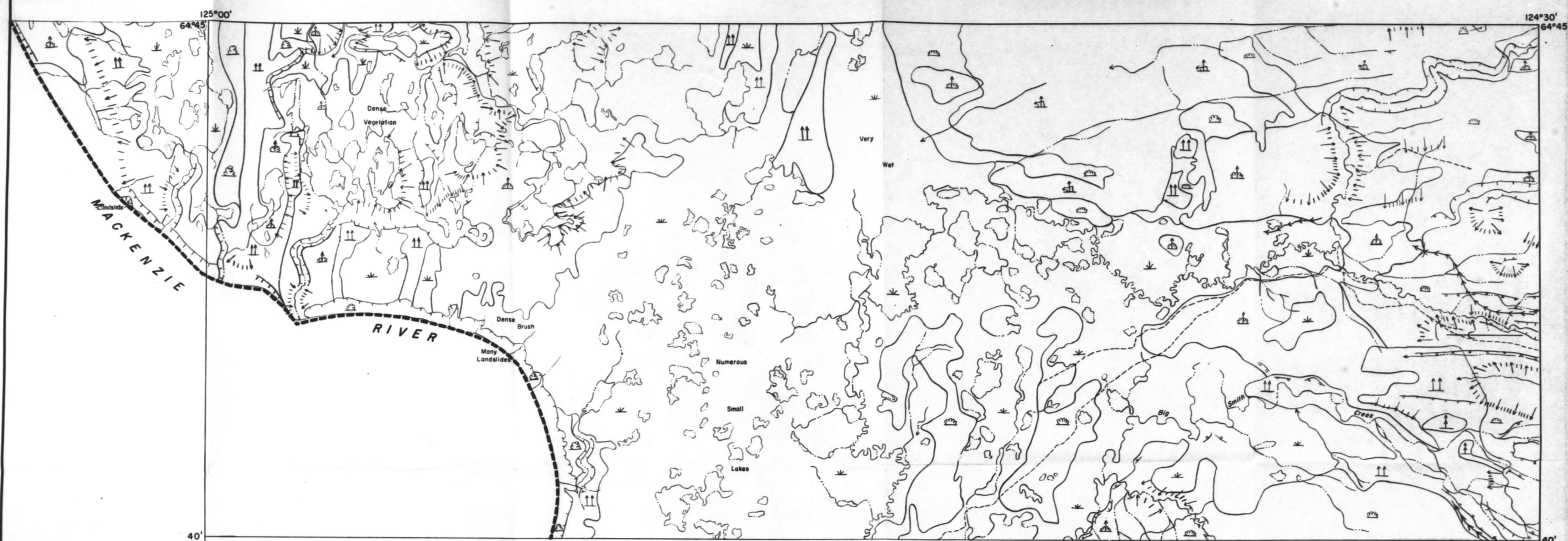
TOPOGRAPHIC AND CULTURAL SYMBOLS

- 17 Seismograph line or trail.
- 18 Clearing or landing strip. Surface condition unknown.
- 19 Project boundary.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF FIELD CHECKS. IT IS CONSIDERED AS A FIRST ANALYSIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LINES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERAIN SYMBOLS

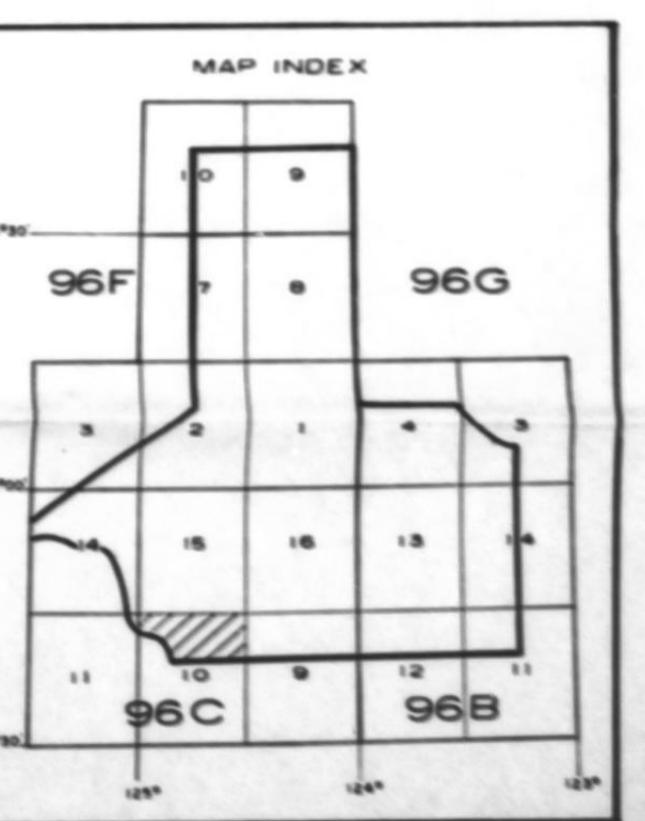
- Symbol 1: Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- Symbol 2: Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief; moderate to fair drainage.
- Symbol 3: Primarily scattered groves of medium to small-size trees, generally fully stocked; isolated clumps of tall trees. Includes areas of brush, grassland and minor burns. Moderate to low relief; fair to poor drainage.
- Symbol 4: Brush and meadows usually closely associated with burns; moderate to low relief; fair to poor drainage. Includes old burn remnant areas of low trees and dense undergrowth.
- Symbol 5: Burned or marsh with minor brush areas and scattered trees; low relief; water table at or near surface.
- Symbol 6: Undifferentiated vegetation associated with river flats and bottomlands; cover may range from burns to tall trees. Drainage generally poor.
- Symbol 7: Recent burn areas; early regrowth of willows and aspen; dense undergrowth and fallen timber. Ground conditions variable.
- Symbol 8: Moderate slope. Arrows indicate direction of slope.
- Symbol 9: Steep slope. Arrows indicate direction of slope.
- Symbol 10: Moderate escarpment 5 - 25 feet.
- Symbol 11: Prominent escarpment over 25 feet.
- Symbol 12: Eroded or glacial crevace filling.
- Symbol 13: Representative glacial groove or ridge. Direction of glacial movement indicated.
- Symbol 14: Stream.
- Symbol 15: River.
- Symbol 16: Lake or standing water.
- Symbol 17: Identified isolated segment with labelled area.

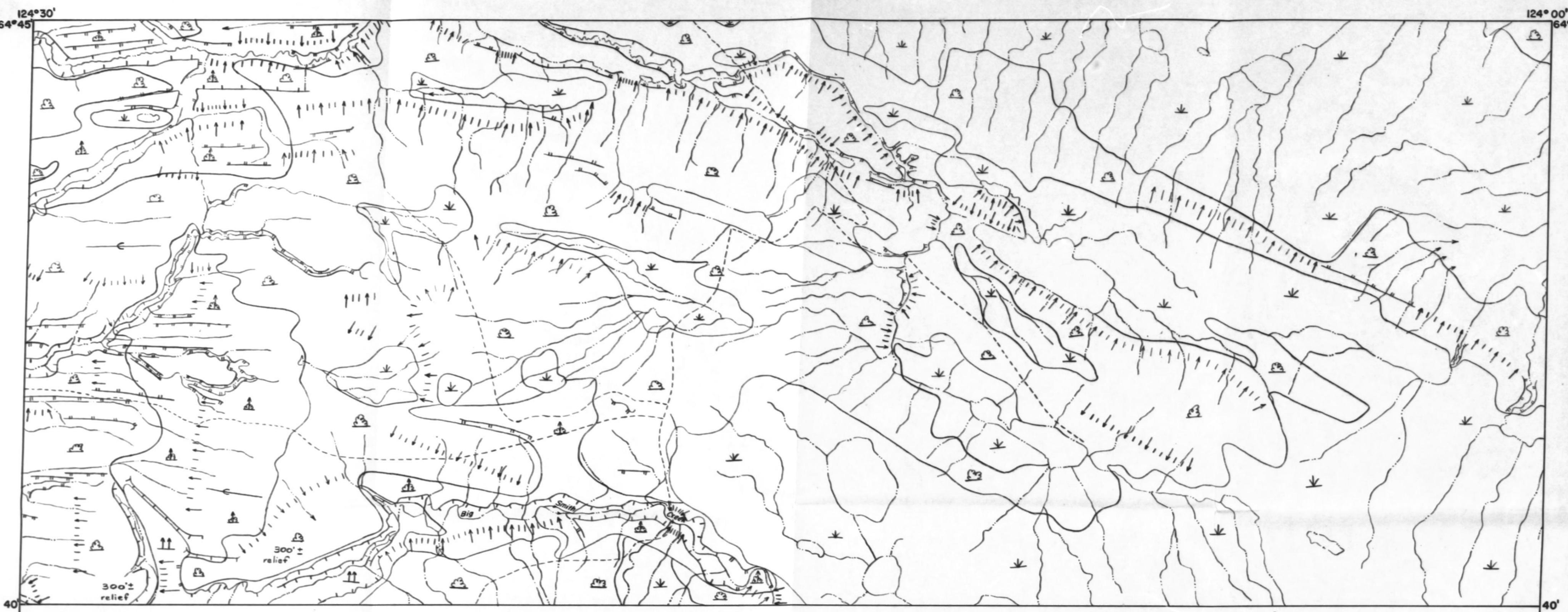
TOPOGRAPHIC AND CULTURAL SYMBOLS

- Symbol 18: Seismograph line or trail.
- Symbol 19: Clearing or landing strip. Surface condition unknown.
- Symbol 20: Project boundary.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK. IT IS NOT A SURVEY MAP. POSITIONS OF CONDOMINUMS AND BOUNDARIES OF LEASES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

1/2 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

TERRAIN SYMBOLS

(1) PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

(2) PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.

(3) PRIMARILY SCATTERED GROUPS OF MEDIUM- TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; INCLUDES CLUMPED FORESTS. INCLUDES AREAS OF BROWN, GRASSLAND AND HIGH MURK. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.

(4) BUSH AND MEADOW (USUALLY CLOSELY ASSOCIATED WITH MURK AREAS) MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REBURN AREA OF LOW TREES AND DENSE UNDERBUSH.

(5) BUSHED OR MARSH WITH MINOR BUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.

(6) UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COVER MAY RANGE FROM MURK TO TALL TREES. DRAINAGE GENERALLY POOR.

(7) RECENT BURN AREA; EARLY REBURN OF BILLOWS AND ASPEN; DENSE UNDERBUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.

(8) MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

(9) STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

(10) MODERATE ESCARPMENT OVER 20 FEET.

(11) PROMINENT ESCARPMENT OVER 20 FEET.

(12) ERIC OR GLACIAL CREEVAGE FILLING.

(13) REPRESENTATIVE GLACIAL GROOVE OR RIBBON. DIRECTION OF GLACIAL MOVEMENT INDICATED.

(14) STREAM.

(15) RIVER.

(16) LAKE OR STANDING WATER.

(17) IDENTIFIED ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

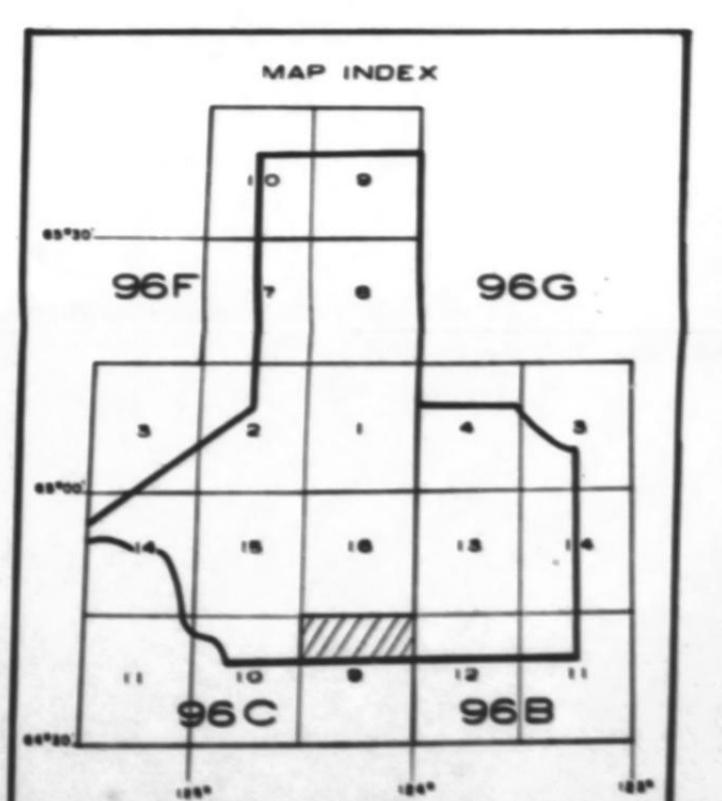
(18) TOPOGRAPHIC LINE OR TRAIL.

(19) CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.

(20) PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHIC MATERIALS FOR THE BENEFIT OF SINCLAIR CANADA OIL COMPANY IN CONDUCTING AN AREA ANALYSIS. POSITIONING OF COORDINATES AND BOUNDARIES OF LACED AREAS ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





**TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES**

PREPARED FOR



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)
1/2 1/4 0

ERRA IN SYMBOLS

 **PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.**

 **PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.**

 **PRIMARILY SCATTERED GROVES OF MEDIUM- TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED CLUMPS OF TALL TREES. INCLUDES AREAS OF BRUSH, GRASSLAND AND MINOR MUSKEGS. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.**

 **BRUSH AND MEADOWS USUALLY CLOSELY ASSOCIATED WITH MUSKEGS AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REGROWTH AREAS OF LOW TREES AND DENSE UNDERBRUSH.**

 **MUSKEGS OR MARSH WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.**

 **UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COVER MAY RANGE FROM MUSKEGS TO TALL TREES. DRAINAGE GENERALLY POOR.**

 **RECENT BURN AREA; EARLY REGROWTH OF BILLOWS AND ASPEN; DENSE UNDERBRUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.**

 **Moderate slope. Arrows indicate direction of slope.**

 **Steep slope. Arrows indicate direction of slope.**

 **Moderate escarpment 5 - 25 feet.**

 **Prominent escarpment over 25 feet.**

 **Esker or glacial crevasse filling.**

 **Representative glacial groove or ridge. Direction of glacial movement indicated.**

 **Stream.**

 **River.**

 **Lake or standing water.**

 **Identified isolated segment with labelled area.**

TOPOGRAPHIC AND CULTURAL SYMBOLS

 **Seismograph line or trail.**

 **Clearing or landing strip. Surface condition unknown.**

 **Project boundary.**

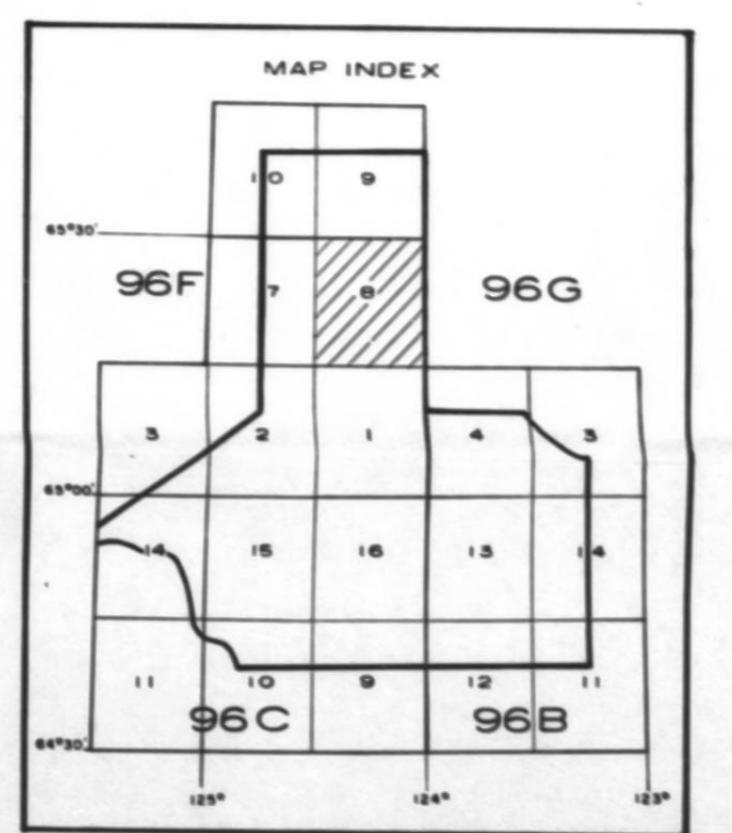
TOPOGRAPHIC AND CULTURAL SYMBOLS

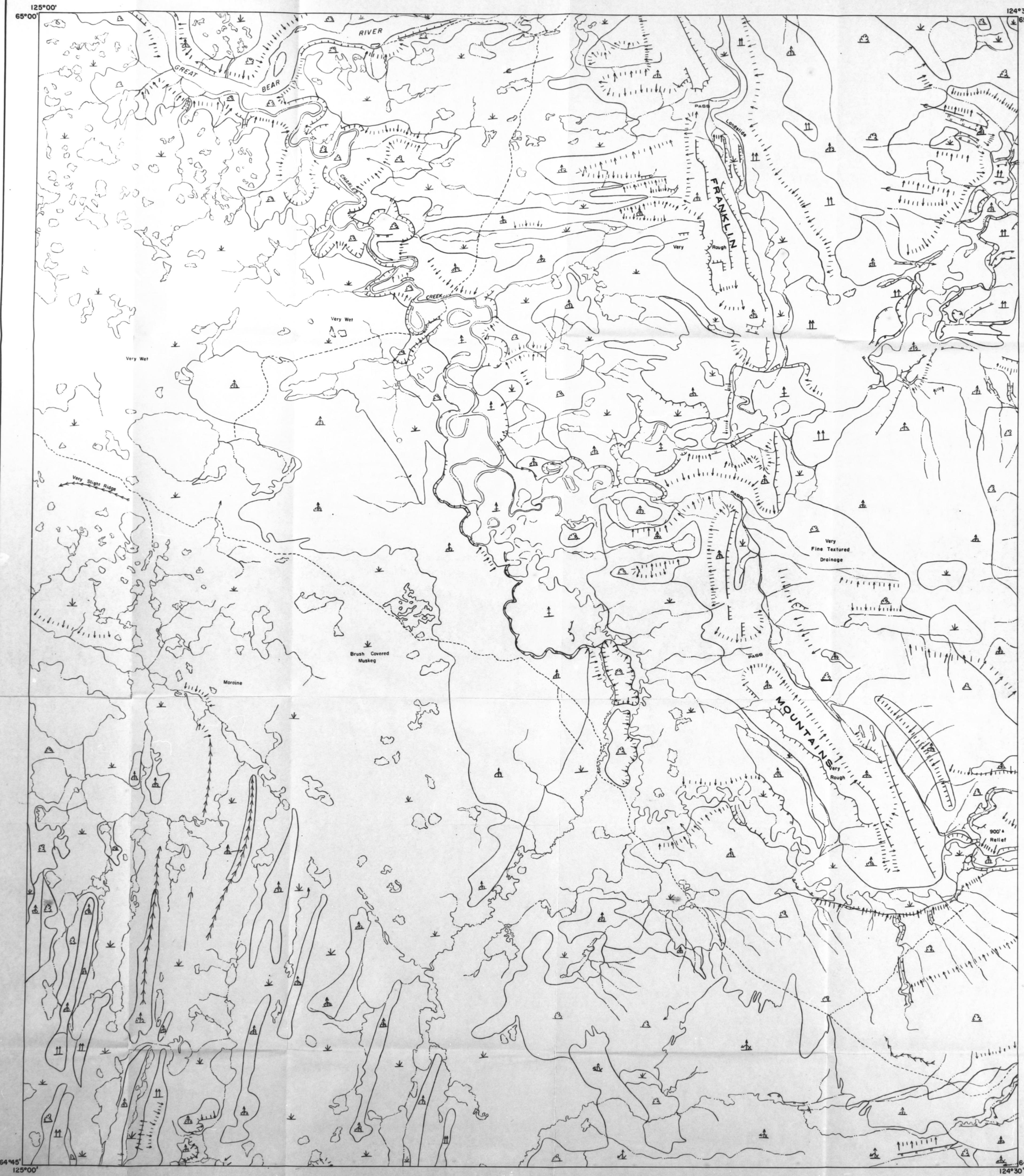
----- SEISMOGRAPH LINE OR TRAIL.

 CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.

----- PROJECT BOUNDARY.

NOTE





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERRAIN SYMBOLS

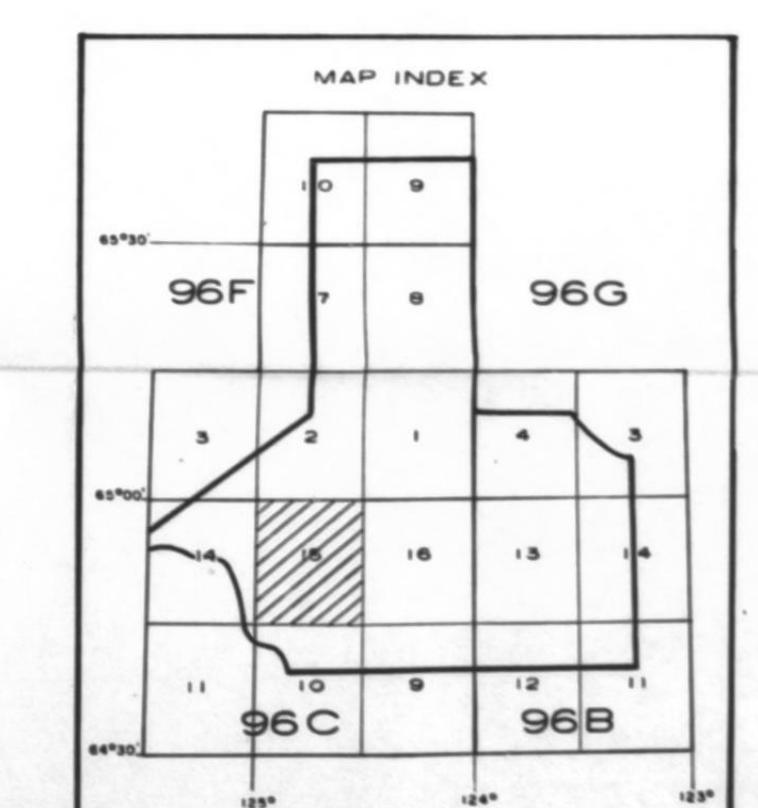
- ↑ PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES OVER 40 FEET IN HEIGHT, MODERATE TO FAIR RELIEF, MOUNTAINS TO FAIR DRAINAGE.
- ↑ PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT, MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.
- ↑ PRIMARILY SCATTERED GROVES OF MEDIUM-TO-SMALL-BI-ZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED CLOUDS OF TREES. INCLUDES AREAS OF BRUSH, GRASSLAND AND MINOR MUSKEG. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.
- ↑ BRUSH AND MUSKEG USUALLY CLOSERLY ASSOCIATED WITH MUSKEG AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REBURNED AREAS OF LOW TREES AND DENSE UNDERBRUSH.
- ↑ MUSKEG OR MARSH WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.
- ↑ UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COVER MAY RANGE FROM MUSKEG TO TALL TREES. DRAINAGE GENERALLY POOR.
- ↑ RECENT BURN AREA; EARLY REBURN OF WILLOWS AND ASPENS; DENSE UNDERBRUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.
- ↑ MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- ↑ STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- ↑ MODERATE ESCARPMENT 5 - 25 FEET.
- ↑ PROMINENT ESCARPMENT OVER 25 FEET.
- ↑ ERKER OR GLACIAL CREVASSA FILLING.
- ↑ REPRESENTATIVE GLACIAL GROOVE OR RIDGE. DIRECTION OF GLACIAL MOVEMENT INDICATED.
- STREAM.
- RIVER.
- LAKE OR STANDING WATER.
- IDENTIFIES ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- SEISMOPHORE LINE OR TRAIL.
- CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.
- PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSTRUED AS A FINAL AND POSITIVE MAP. IT IS NOT A SERIES OF LEAVES AND APPROXIMATE CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERRAIN SYMBOLS

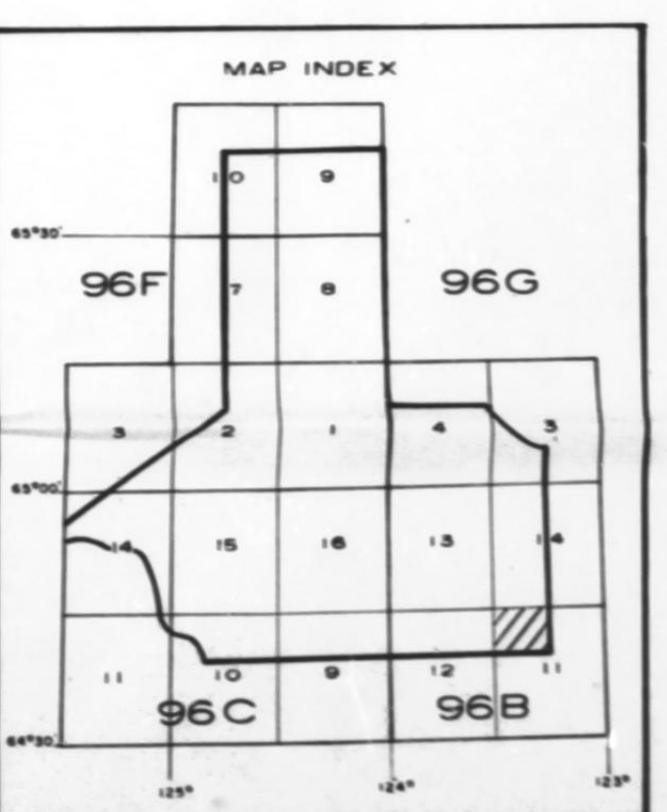
- 1. PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF; MODERATE TO FAIR DRAINAGE.
- 2. PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.
- 3. PRIMARILY SCATTERED GROUPS OF MEDIUM TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED CLUMPS OF TALL TREES. INCLUDES AREAS OF BRUSH, BRASSLINE AND HIGH BURN. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.
- 4. BRUSH AND MEADOWS USUALLY CLOSELY ASSOCIATED WITH WILDERNESS AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REMNANT AREAS OF LOW TREES AND DENSE UNDERGROWTH.
- 5. BRUSH OR MEADOW WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.
- 6. UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BUTTONGRASS; COVER MAY RANGE FROM BURRS TO TALL TREES. DRAINAGE GENERALLY POOR.
- 7. RECENT BURN AREA; EARLY REBIRTH OF WILLOW AND ASPEN. DENSE UNDERGROWTH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.
- 8. MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- 9. STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- 10. MODERATE EMBANKMENT 5 - 25 FEET.
- 11. PROMINENT EMBANKMENT OVER 25 FEET.
- 12. EROSION OR GLACIAL CREEVAGE FILLING.
- 13. REPRESENTATIVE GLACIAL GROOVE OR RIDGE. DIRECTION OF GLACIAL MIGRATION INDICATED.
- 14. STREAM.
- 15. RIVER.
- 16. LAKE OR STANDING WATER.
- 17. IDENTIFIED ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- 18. TOPOGRAPHIC LINE OR TRAIL.
- 19. CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.
- 20. PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSTRUED AS A FINAL ANALYSIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LAKES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.



125°30'
65°15'125°00'
65°15'65°00'
125°30'TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIESPREPARED FOR
SINCLAIR CANADA OIL COMPANY

MAY-JUNE 1968
SCALE:
2 INCHES = 1 MILE (1:31,680)

TERRAIN SYMBOLS

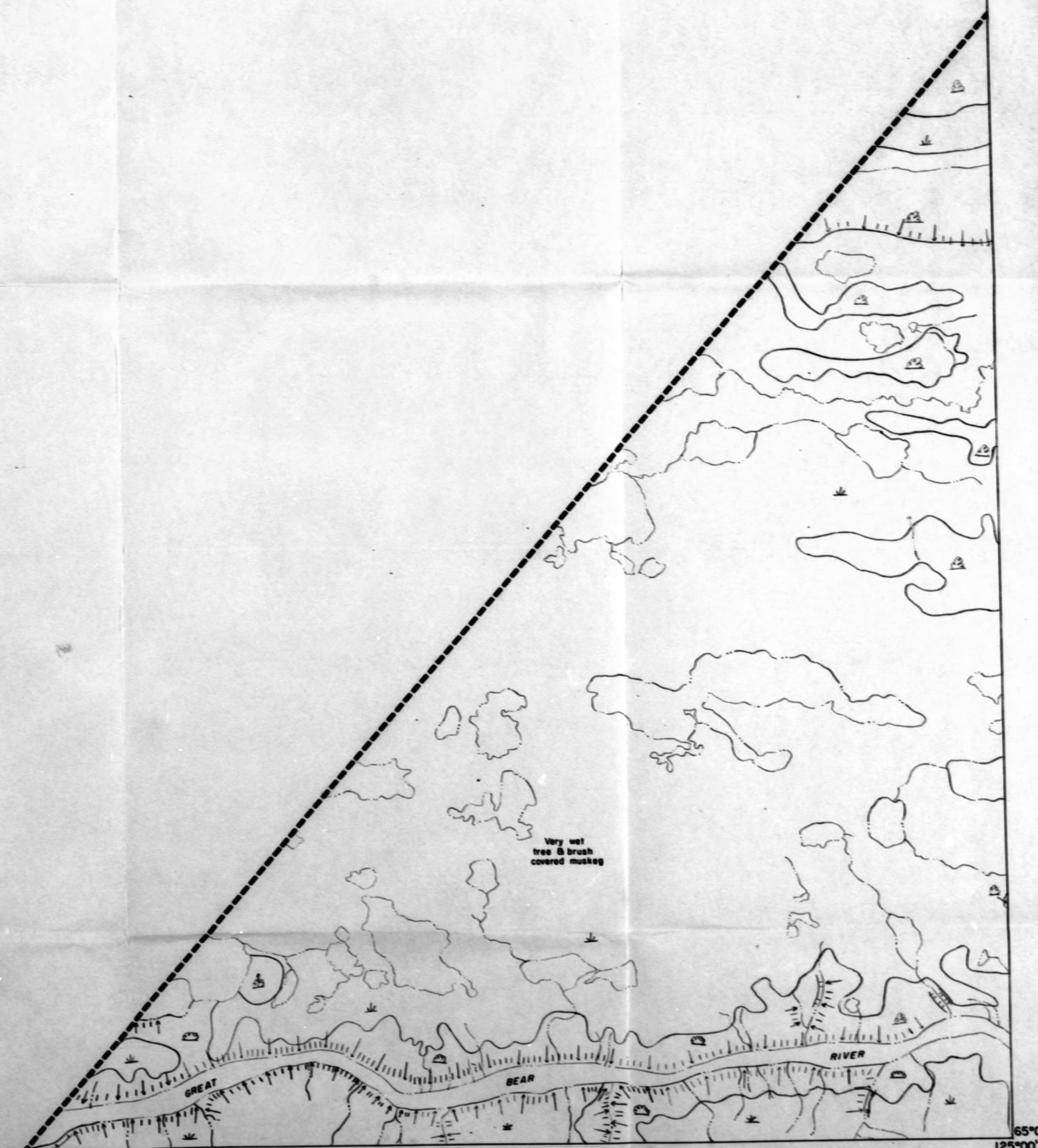
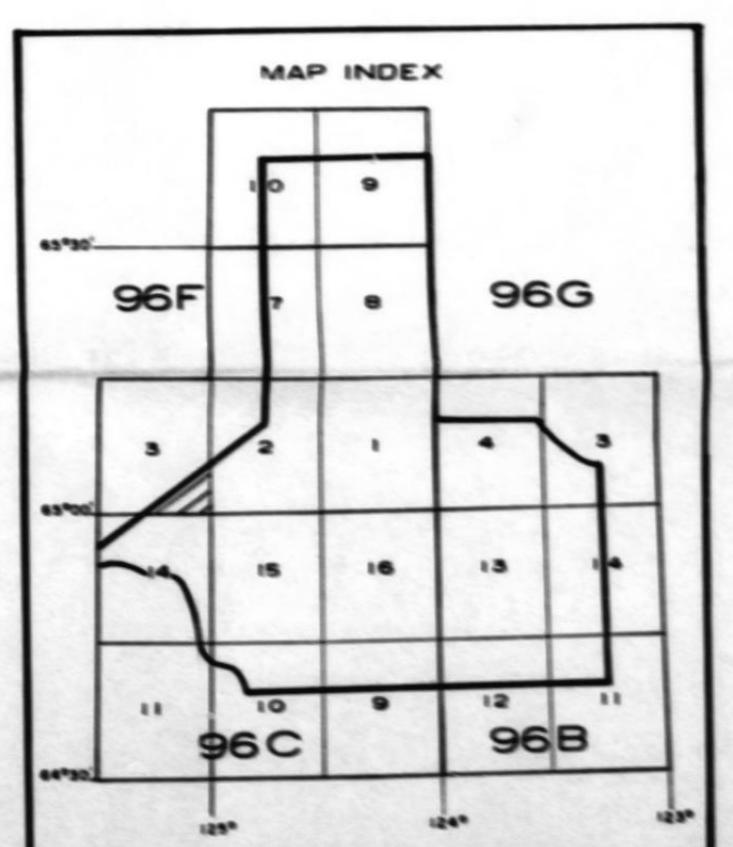
- 1 PRIMARILY TALL TREES, GENERALLY FULLY STOCKED TREES
AVERAGE OVER 40 FEET IN HEIGHT. MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.
- 11 PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED TREES AVERAGE LESS THAN 40 FEET IN HEIGHT. MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.
- 12 PRIMARILY SCATTERED GROUPS OF MEDIUM TO SMALL-SIZE TREES, MODERATE TO SPARSELY STOCKED TREES, CLUMPED TREES. INCLUDES AREAS OF BROWN, GRASSLAND AND MINOR BUSHES. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.
- 13 BUSH AND REACHES USUALLY CLOSELY ASSOCIATED WITH BROWN AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REBIRTH AREAS OF LOW TREES AND DENSE UNDERBRUSH.
- 14 BROWN OR BROWN WITH MINOR BUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.
- 15 UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND ROTTOLANDS; COVER MAY RANGE FROM BROWN TO TALL TREES. DRAINAGE GENERALLY POOR.
- 16 RECENT BURN AREA; EARLY REBIRTH OF WILLOWS AND ASPIRE, SOME UNDERBRUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.
- 17 MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- 18 STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.
- 19 MODERATE ENCAMPMENT 5 - 25 FEET.
- 20 PROFOUND ENCAMPMENT OVER 25 FEET.
- 21 ESKER OR GLACIAL CREEVAGE FILLING.
- 22 REPRESENTATIVE GLACIAL GROOVE OR RIDGE. DIRECTION OF GLACIAL MOVEMENT INDICATED.
- 23 STREAM.
- 24 RIVER.
- 25 LAKE OR STANDING WATER.
- 26 IDENTIFIED ISOLATED SEGMENT WITH LABELLED AREA.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- 27 SEISMIC LINE OR TRAIL.
- 28 CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.
- 29 PROJECT BOUNDARY.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHIC WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSIDERED AS A FINAL MAP. POSITION, SIZE AND COORDINATES AND BOUNDARIES OF LINES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.



124°30'
65°45'124°00'
65°45'TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIESPREPARED FOR
SINCLAIR CANADA OIL COMPANYMAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

1/2 1/4 1/8 0

TERRAIN SYMBOLS

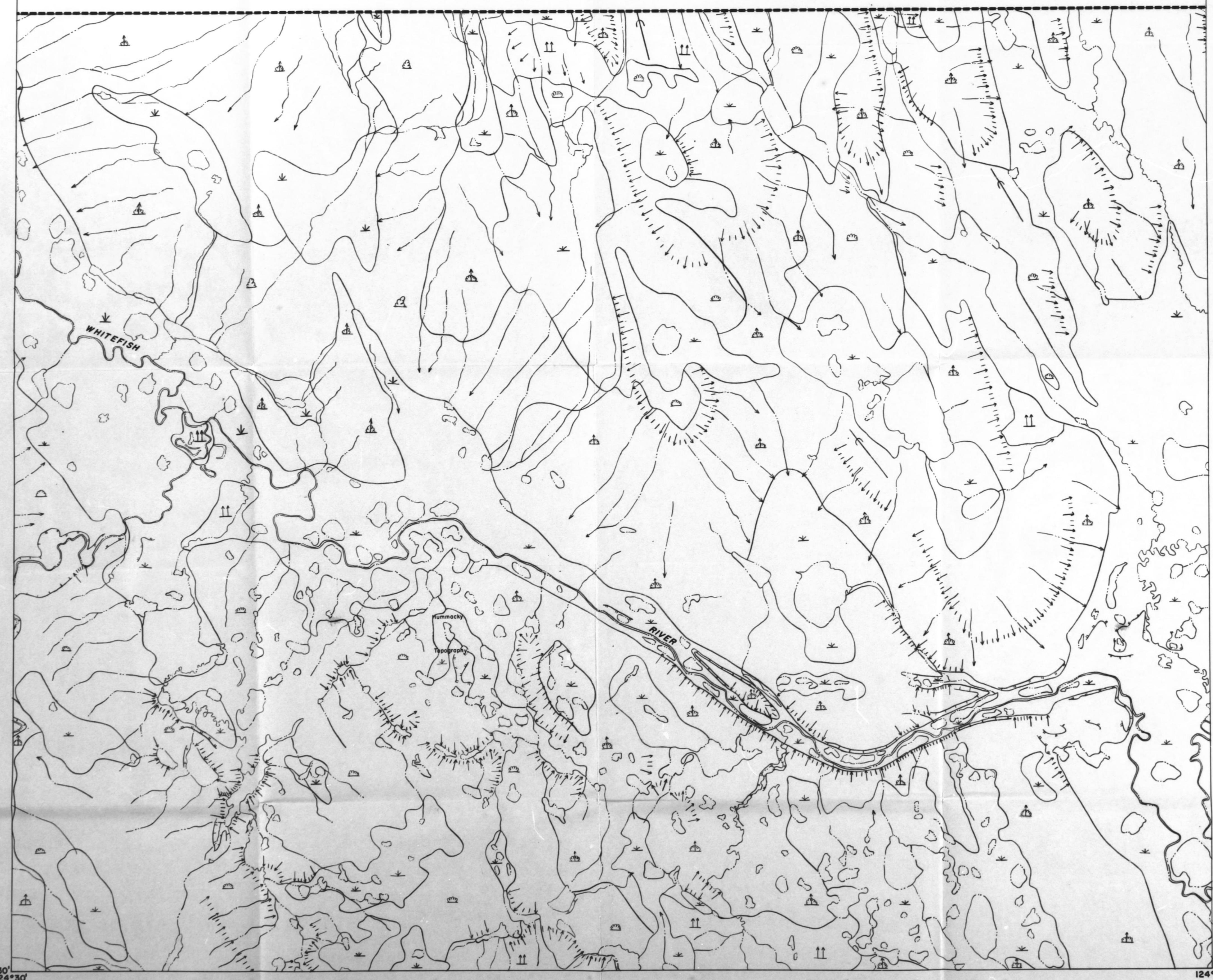
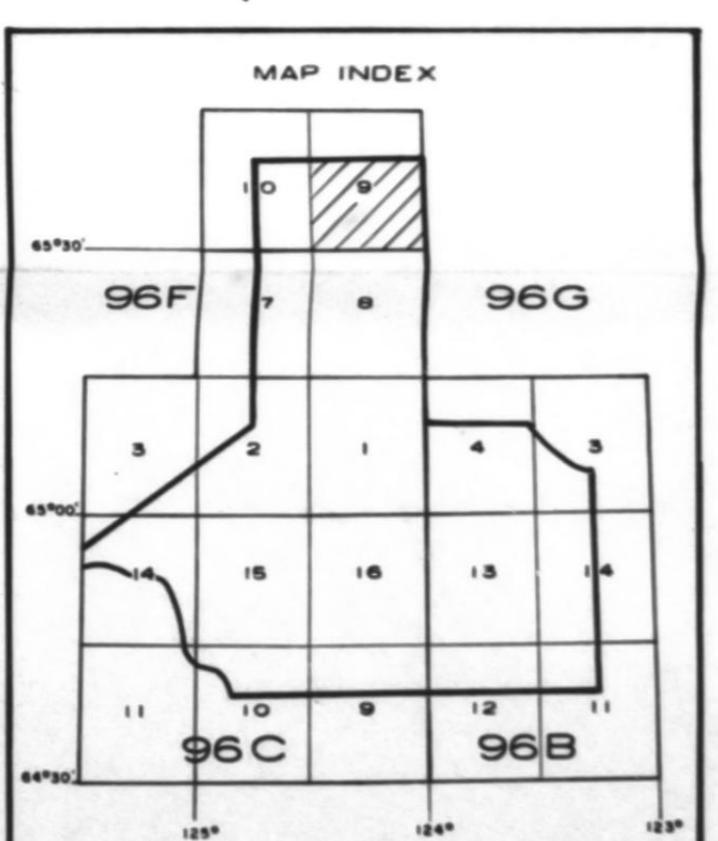
- 1 Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 2 Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 3 Primarily scattered groves of medium- to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees, including areas of brush, shrubs and talus. Moderate to low relief; fair to poor drainage.
- 4 Brush and meadow usually closely associated with lakes; moderate to low relief; fair to poor drainage; includes old burn rerowth areas of low trees and dense undergrowth.
- 5 Lakes or marsh with minor brush areas and scattered trees; low relief; water table at or near surface.
- 6 Undifferentiated vegetation associated with river flats and bottomlands; cover may range from marsh to tall trees; drainage generally poor.
- 7 Recent burn area; early regrowth of willows and aspen; dense underbrush and fallen timber; ground conditions variable.
- 8 Moderate slope. Arrows indicate direction of slope.
- 9 Steep slope. Arrows indicate direction of slope.
- 10 Moderate escarpment 5 - 20 feet.
- 11 Prolinent escarpment over 20 feet.
- 12 Erosion or glacial crevace filling.
- 13 Representative glacial groove or ridge; direction of glacial movement indicated.
- 14 Stream.
- 15 River.
- 16 Lake or standing water.
- 17 Identifies isolated segment with labelled area.

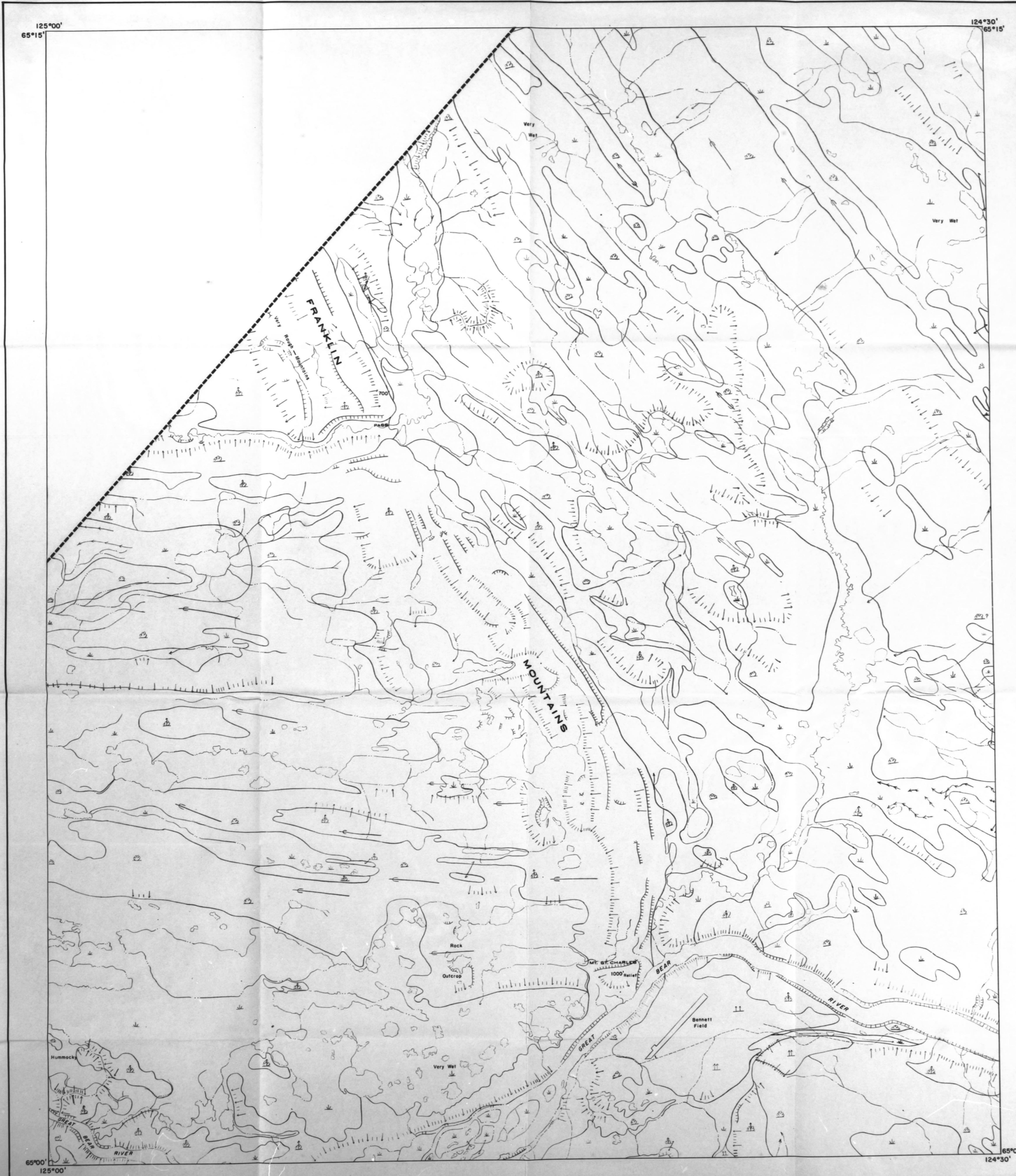
TOPOGRAPHIC AND CULTURAL SYMBOLS

- 18 Seismograph line or trail.
- 19 Clearing or landing strip. Surface condition unknown.
- 20 Project boundary.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSIDERED AS A FINER SCALE MAP. THE COORDINATES AND BOUNDARIES OF LEASES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING INDIAN TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE
2 inches = 1 mile (1:31,680)

TERRAIN SYMBOLS

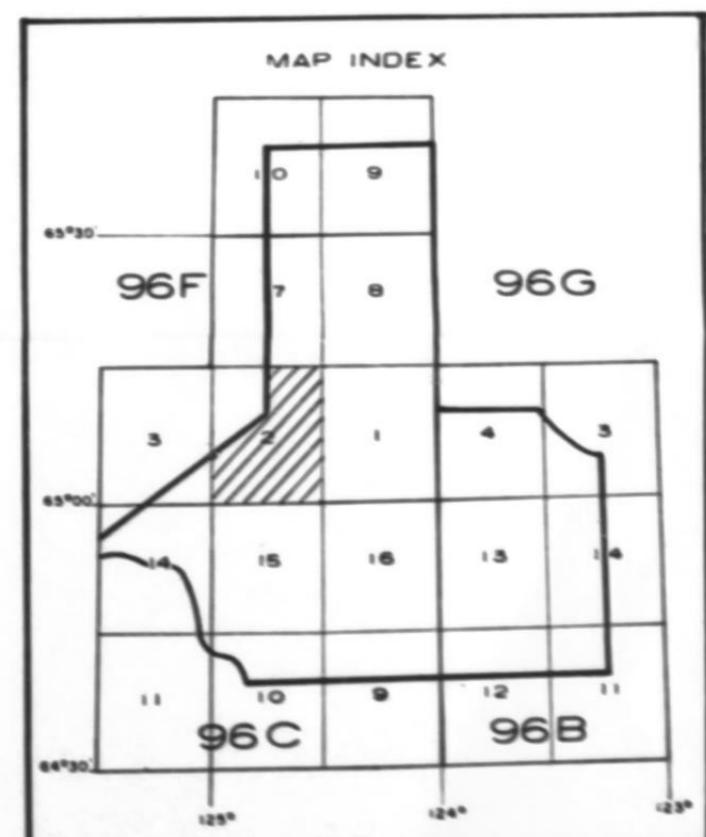
- 1 Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 2 Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 3 Primarily scattered groves of medium- to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees. Includes areas of brush, shrubs and dense undergrowth. Moderate to low relief; fair to poor drainage.
- 4 Brush and meadows usually closely associated with mixed areas; moderate to low relief; fair to poor drainage; includes some marshy areas of low trees and dense underbrush.
- 5 Mixed or marsh with minor brush areas and scattered trees; low relief; water table at or near surface.
- 6 Undifferentiated vegetation associated with river flats and bottomlands; cover may range from mixed to tall trees. Drainage generally poor.
- 7 Recent burn areas; early regrowth of willow and aspen; dense underbrush and fallen timber. Ground conditions variable.
- 8 Moderate slope. Arrows indicate direction of slope.
- 9 Steep slope. Arrows indicate direction of slope.
- 10 Moderate escarpment 5 - 25 feet.
- 11 Prominent escarpment over 25 feet.
- 12 Eroded or glacial crevare filling.
- 13 Representative glacial groove or ridge. Direction of glacial movement indicated.
- 14 Stream.
- 15 River.
- 16 Lake or standing water.
- 17 Identifies isolated segment with labelled area.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- 1 Seismograph line or trail.
- 2 Clearing or landing strip. Surface condition unknown.
- 3 Project boundary.

NOTE

This map was prepared from air photographs without benefit of a field check and should not be construed as a final analysis. Positions of coordinates and boundaries of leases are approximate. Cultural features, including seismic trails, are accurate to date of photographic.







**TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES**

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY - JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)

TERRA IN SYMBOLS

PRIMARILY TALL TREES, GENERALLY FULLY STOCKED; TREES AVERAGE OVER 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.

PRIMARILY TREES OF MEDIUM OR LESS HEIGHT, GENERALLY FULLY STOCKED; TREES AVERAGE LESS THAN 40 FEET IN HEIGHT; MODERATE TO FAIR RELIEF, MODERATE TO FAIR DRAINAGE.

PRIMARILY SCATTERED GROVES OF MEDIUM- TO SMALL-SIZE TREES, MODERATELY TO SPARSELY STOCKED; ISOLATED CLUMPS OF TALL TREES. INCLUDES AREAS OF BRUSH, GRASSLAND AND MINOR MUSKES. MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE.

BRUSH AND MEADOWS USUALLY CLOSELY ASSOCIATED WITH MUSKES AREAS; MODERATE TO LOW RELIEF, FAIR TO POOR DRAINAGE. INCLUDES OLD BURN REGROWTH AREAS OF LOW TREES AND DENSE UNDERBRUSH.

MUSKES OR MARSH WITH MINOR BRUSH AREAS AND SCATTERED TREES; LOW RELIEF, WATER TABLE AT OR NEAR SURFACE.

UNDIFFERENTIATED VEGETATION ASSOCIATED WITH RIVER FLATS AND BOTTOMLANDS; COVER MAY RANGE FROM MUSKES TO TALL TREES. DRAINAGE GENERALLY POOR.

RECENT BURN AREA; EARLY REGROWTH OF BIRCHES AND ASPENS; DENSE UNDERBRUSH AND FALLEN TIMBER. GROUND CONDITIONS VARIABLE.

MODERATE SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

STEEP SLOPE. ARROWS INDICATE DIRECTION OF SLOPE.

MODERATE ESCARPMENT 5 - 25 FEET.

PROMINENT ESCARPMENT OVER 25 FEET.

ESKER OR GLACIAL CREVABBE FILLING.

REPRESENTATIVE GLACIAL GROOVE OR RIDGES. DIRECTION OF GLACIAL MOVEMENT INDICATED.

STREAM.

RIVER.

LAKE OR STANDING WATER.

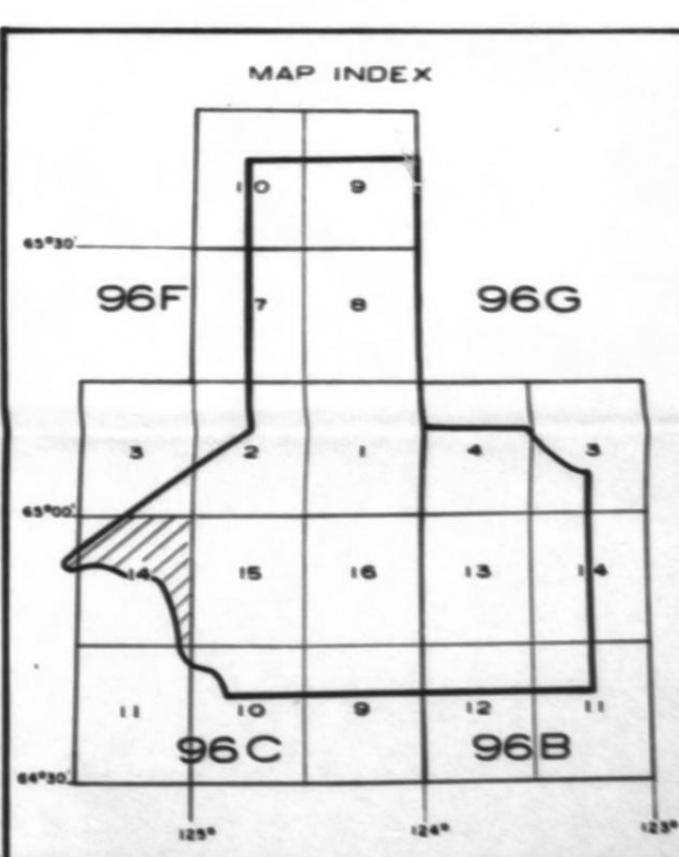
IDENTIFIES ISOLATED SEGMENT WITH LABELLED AREA.

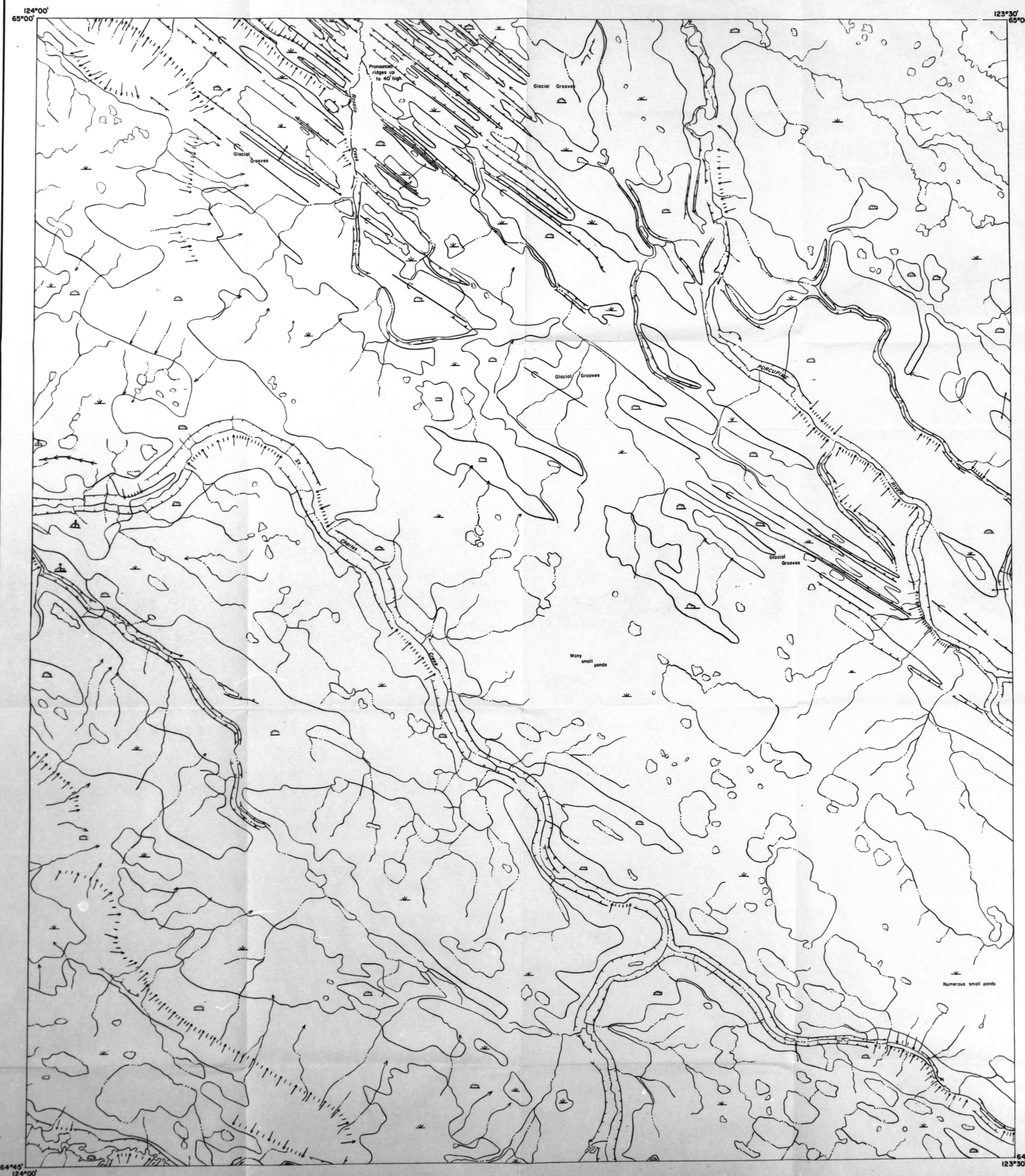
TOPOGRAPHIC AND CULTURAL SYMBOLS

SEISMOGRAPH LINE OR TRAIL.

CLEARING OR LANDING STRIP. SURFACE CONDITION UNKNOWN.

MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF FIELD CHECK AND SHOULD NOT BE CONSTRUED AS A FINAL SIS. POSITIONS OF COORDINATES AND BOUNDARIES OF LEASES APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC S., ARE ACCURATE TO DATE OF PHOTOGRAPHY.





TERRAIN ANALYSIS MAP
OF
FORT FRANKLIN, NORTHWEST TERRITORIES

PREPARED FOR
SINCLAIR CANADA OIL COMPANY



MAY-JUNE 1968
SCALE:
2 inches = 1 mile (1:31,680)
1/2 1/4 1/8

TERRAIN SYMBOLS

- 1 Primarily tall trees, generally fully stocked; trees average over 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 2 Primarily trees of medium or less height, generally fully stocked; trees average less than 40 feet in height; moderate to fair relief; moderate to fair drainage.
- 3 Primarily scattered groves of medium- to small-size trees, moderately to sparsely stocked; isolated clumps of tall trees. Includes areas of brush, shrubs and talus areas; moderate to low relief; fair to poor drainage.
- 4 Brush and meadows usually closely associated with marsh areas; moderate to low relief; fair to poor drainage. Includes old burn rerowth areas of low trees and dense underbrush.
- 5 Marsh or marsh with minor brush areas and scattered trees; low relief; water table at or near surface.
- 6 Undifferentiated vegetation associated with river flats and bottomlands; cover may range from brush to tall trees; drainage generally poor.
- 7 Recent burn area; early regrowth of willow and aspen; dense underbrush and fallen timber; ground conditions variable.
- 8 Moderate slope. Arrows indicate direction of slope.
- 9 Steep slope. Arrows indicate direction of slope.
- 10 Moderate escarpment 5 - 20 feet.
- 11 Prominent escarpment over 20 feet.
- 12 Erosion or glacial crevasse filling.
- 13 Representative glacial groove or ridge; direction of glacial movement indicated.
- 14 Stream.
- 15 River.
- 16 Lake or standing water.
- 17 Identifies isolated segment with labelled area.

TOPOGRAPHIC AND CULTURAL SYMBOLS

- 18 Seismograph line or trail.
- 19 Clearing or landing strip; surface condition unknown.

NOTE

THIS MAP WAS PREPARED FROM AIR PHOTOGRAPHS WITHOUT BENEFIT OF A FIELD CHECK AND SHOULD NOT BE CONSIDERED AS A FINAL MAP. LATITUDE AND LONGITUDE COORDINATES AND BOUNDARIES OF LINES ARE APPROXIMATE. CULTURAL FEATURES, INCLUDING SEISMIC TRAILS, ARE ACCURATE TO DATE OF PHOTOGRAPHY.

