NORTHWEST TERRITORIES

85 C NW

KAKISA LAKE

TWO ISLAND LAKE

Lady Evelyn Falls

MACKENZIE RIVER

HIGHWAY

Falls

KAKISA

RIVER

Thin

Falls Rapids

KAKISA

Gull Creek

RIVER

60°40'

60°40'

TATHLINA

LAKE

117°00'

117°15'

117°30'

117°45'

118°00'

60°30'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP

PROJECT No.	DATE: SEPTEMBER 1969
PLACID OIL COMPANY	
KAKISA LAKE	
OTTER PARK TO LONELY BAY ISOPACH	
CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED	
C.I. 50'	MAP NO 14 85-C/NW

331-6-4-15


OIL & GAS OPERATIONS UNIT
Oil and Mineral Division
DEC 11 1969
OTTAWA CANADA
Indian Affairs & Northern Development

REFLECTION SEISMOGRAPH SURVEY

of the

KAKISA-PROVIDENCE AREA

60° 50' N. Lat. to 61° 20' N. Lat.

117° 15' W. Long. to 118° 45' W. Long.

N.W.T.

for

PLACID OIL COMPANY

by

Beaver Geophysical Services Limited

March 17, 1969 to June 16, 1969

BEAVER

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14. Otter Park to Lonely Bay Isopach
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Sample Record Section:

300% stacked Variable Density-Galvanometer section of line #115 (partial)

Other Material:

Specimen Reflection Seismogram 121-409 N/S

LOCATION

The Kakisa-Providence prospect is located in the southwestern corner of the Northwest Territories, west of Great Slave Lake. The Mackenzie River flows westward along the northern edge of the area. The name is derived from Kakisa Lake, just south of the prospect, and from the village of Fort Providence, about 4½ miles north of the northernmost line shot.

Access to the area was via the Mackenzie Highway, which runs from Grimshaw, Alberta through the approximate centre of the prospect. Travel in the field was either on pre-existing trails or along lines being shot. Operations were conducted from one wheeled and one portable trailer camp; these were moved periodically to reduce travel time.

Surface coverage totalled 248.6 miles. Programme was assigned on 26 lines, numbered 101 to 126, and formed 4 distinct blocks.

The first of these consisted of lines 101, 102 and 103, and was located at the eastern end of Kakisa Lake. Line shot amounted to 15.4 miles.

The second block lay north of Kakisa Lake, and included lines 104, 105, 106, 107, 108, 109, 111 and 113. Surface coverage was 55.2 miles.

The third and largest block extended from the northwestern corner of block # 2 northward to the

Mackenzie River. Included were lines 110, 112, 114, 115, 116, 117, 118, 119 and 121. Coverage was 132.3 miles.

The fourth block, located about 8 miles southwest of block 3, consisted of lines 120, 122, 123, 124, 125 and 126. Line shot amounted to 45.7 miles.

Drilling was begun on March 17, 1969, and shooting was completed on June 16, 1969. Operations were suspended because of wet ground conditions from May 2, 1969 to May 23, 1969.

OBJECT

The prospect area lies within the northern part of the Elk Point basin. The Keg River carbonate bank, located immediately to the south, separates the area from the main Elk Point basin of the prairies.

The depositional environment during Keg River time was presumably similar to that which resulted in the Keg River patch reef development at Rainbow Lake. Additionally, if such reef growth occurred, its development would not have been terminated by Muskeg deposition resulting from the Presqu'ile reef barrier.

The survey was reconnaissance in nature; its purpose was to describe generally the Horn River basin, and in addition to determine, insofar as possible, the size and build-up of any Keg River (or Lonely Bay) patch reefs encountered.

SURFACE CONDITIONS

The Kakisa-Providence prospect lies within the forested area of the southern Mackenzie valley. Vegetation consists principally of spruce and poplar; muskeg spruce and scrub willow are common in the muskeg areas. Stands are generally light; the timber is presently of no commercial value.

Drainage is only fair; while considerable surface relief is present, many lakes or sloughs are formed in rocky cups. Most streams flow northward into the Mackenzie River, or, alternatively, into Kakisa Lake and thence, via Kakisa River into the Mackenzie system.

The northern part of the prospect area is covered by a glacial till of widely varying thickness.

The southern part of the westernmost block has no drift cover; the Hay River limestone outcrops. A similar situation exists immediately north of Kakisa Lake, where hard sandstones are encountered at a depth of ten to fifteen feet.

Muskegs are common in the northern portion of the prospect, near the Mackenzie River, while numerous small lakes or sloughs have formed in depressions of the hard rock surface to the south.

Weather conditions were favourable during March. Warmer weather during April lead to increasingly wet and muddy conditions, and eventually forced a change

from wheeled to tracked units. Operations were suspended from May 2 to May 23, during the worst part of the run-off.

Winds became increasingly strong during the period, as temperature rose, and created a minor noise problem.

PERMITS AND DAMAGES

No permits were required, and no damages were paid.

SURVEYING

A transit survey was conducted to establish both vertical and horizontal control.

Horizontal control for all lines except those in the southwest block was based on a quarter pin on the 6th Meridian. The pin is midway in section 1 of Township 139 Range 1 west of the 6th meridian and is 382' south of the intersection of line 112 with the meridian. Azimuth was checked at various locations by sun shots.

Elevations in this area were based on the same pin.

Horizontal control in the southwestern block was based on the Briggs NE Rabbit Lake # 1 well, and was tied into the Shell Imperial Foetus Lake F-60 well. Again, azimuth was established by sun shots.

Vertical control was taken from the Foetus

F-60 well, and tied into the Rabbit # 1 hole.

It should be noted that legal surveys are not required for dry holes in the Northwest Territories. This was not known at the time of the survey, being discovered during an attempt to reconcile the survey of line 101 with the published co-ordinates of the wells tied.

As a result, control in the southwestern block, while correct within itself, has no definitely established take-off point. Elevations and co-ordinates are both, therefore, subject to change. While the problem does not seriously affect the validity of the results presented in this report, a definite tie of the block to some known point should be established whenever it becomes feasible to do so.

Spreads were chained to a distance of 1800', with an interval of 150' between geophone stations. Shot points were spaced every 600', giving 300% sub-surface coverage.

BULLDOZING

Programme was laid out so as to take maximum advantage of existing trails. Of the 248.6 miles shot, 78 miles were along pre-cut lines, while only 170 miles of line was new cut.

Machines used were a 17A, a 7E and a 6C; these were double shifted as necessary and were owned by

Tompkins Contracting Ltd.

DRILLING

As noted earlier, the northern part of the area is covered by a glacial till, consisting of clays and containing varying amounts of sand, gravel and boulders. While conditions changed locally, this portion of the prospect was easily drilled by augers.

The southern area is however, definitely not suited to auger drilling. Conventional rotary drills are essential to penetrate the moderately hard limestone in the southwestern block and the even more resistant sandstones north of Kakisa Lake.

Machines used during the early part of the survey included 2 Sewell augers, a Norhill auger and 2 conventional rigs, all on wheels; these were subsequently replaced by one tracked Topdrive and two tracked conventionals. Extra water trucks were hired as needed to service the wheeled rigs, while one extra tracked water venicle was used with the tracked units.

Prior to break-up water was obtained from various lakes or the Mackenzie River, and hauls were often long. After break-up water was usually available within very short distance.

Rigs were normally double shifted.

Single hole patterns were standard. In the drift areas, these were normally drilled to 40', and pre-loaded with either 5/8 lb. or 1¼ lb. of powder.

In the sandstone area north of Kakisa Lake, the charge was 2½ lbs., preloaded at 40'; east of Kakisa Lake, 5 lbs. was preloaded at 50'. In the limestone zone of the west block, 5 lbs. was loaded at 50'.

No flowing holes or gas pockets were encountered.

RECORDING AND SHOOTING

Sixteen Hall-Sears HS-J 20 cps geophones were spaced equally over 150', centred on each geophone station. Signal from them was transmitted to 24 Geo Space GSC 111 amplifiers; after amplification and filtering, it was recorded simultaneously on a paper record and on magnetic tape, using a Geo Space FM 300 frequency modulation system.

Filter setting used was 1/25-1/125, giving a pass band at - 6 db of 18 to 152 cps. A.G.C. rate was fast, and gain settings were kept as high as allowed by noise conditions. Final suppression was normally between 1 and 50 microvolts.

No mixing was done.

As indicated earlier, charge size and hole depth varied, being based on several short experimental programmes. Depths were from 40' to a maximum of 75', while charges ranged from 5/8 lb. to 10 lbs. Only one shot per hole was normally taken.

Normal spread configuration was an 1800'-0-

1800' symmetrical split spread: this was varied at the ends of lines to a 0 - 1800' end-on. Geophone station interval was 150'; since shot points were spaced 600' apart, sub-surface coverage was 300%.

Analog field tapes were subsequently transcribed digitally by Canadian Magnetic Reduction Ltd, and stacked datum time record sections were produced, using data supplied by Beaver Geophysical Services Limited.

Processing sequence was as follows:

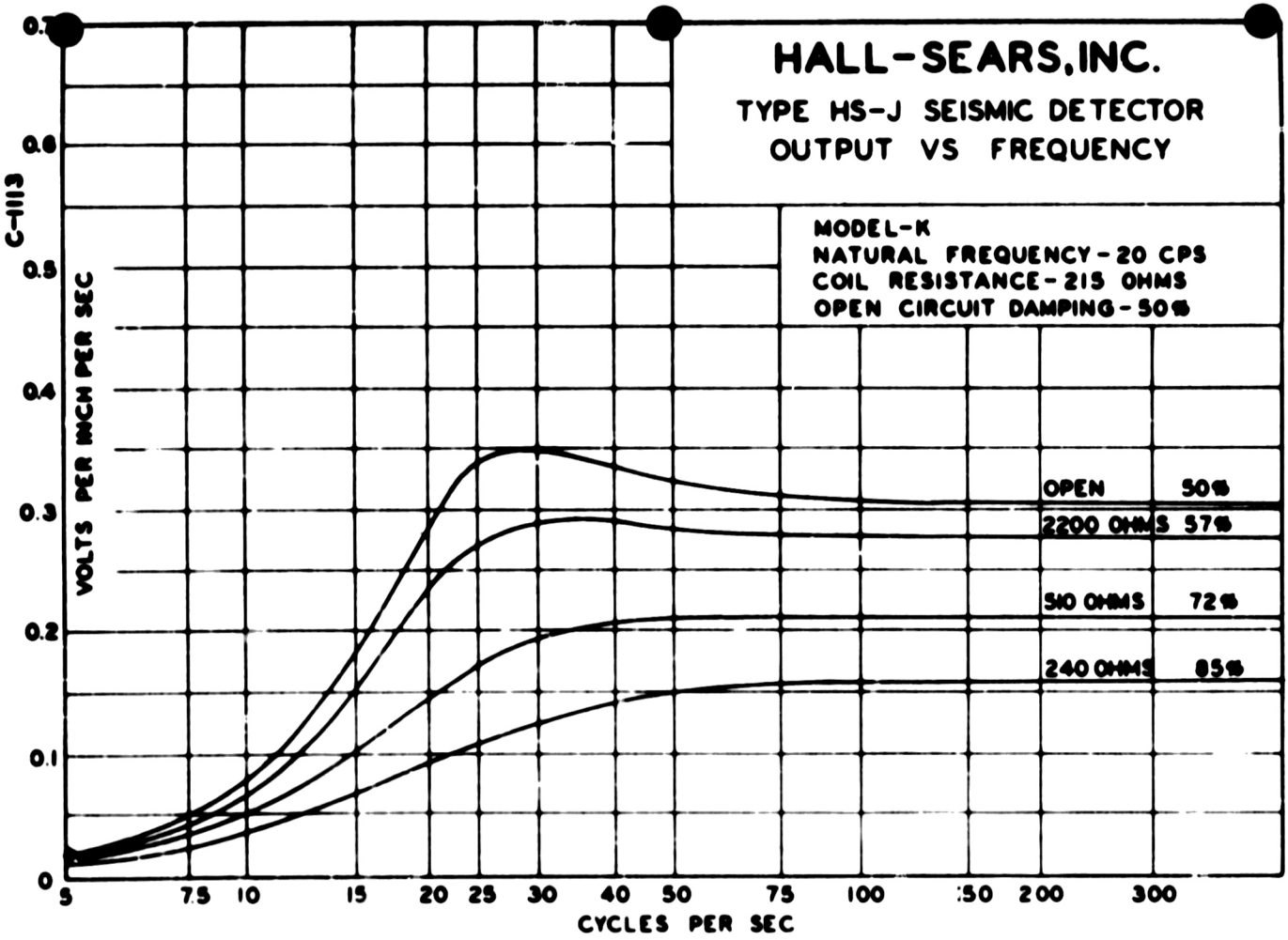
1. Normal Moveout Correction
2. Filter (28-30/100-120)
3. Deconvolution (28-30/70-76 spectrum)
4. Minimove (adjusted N.M.O. correction)
5. Fully corrected
6. Stack

Presentation was a combination of galvanometer with a light variable density background.

REFLECTION IDENTIFICATION

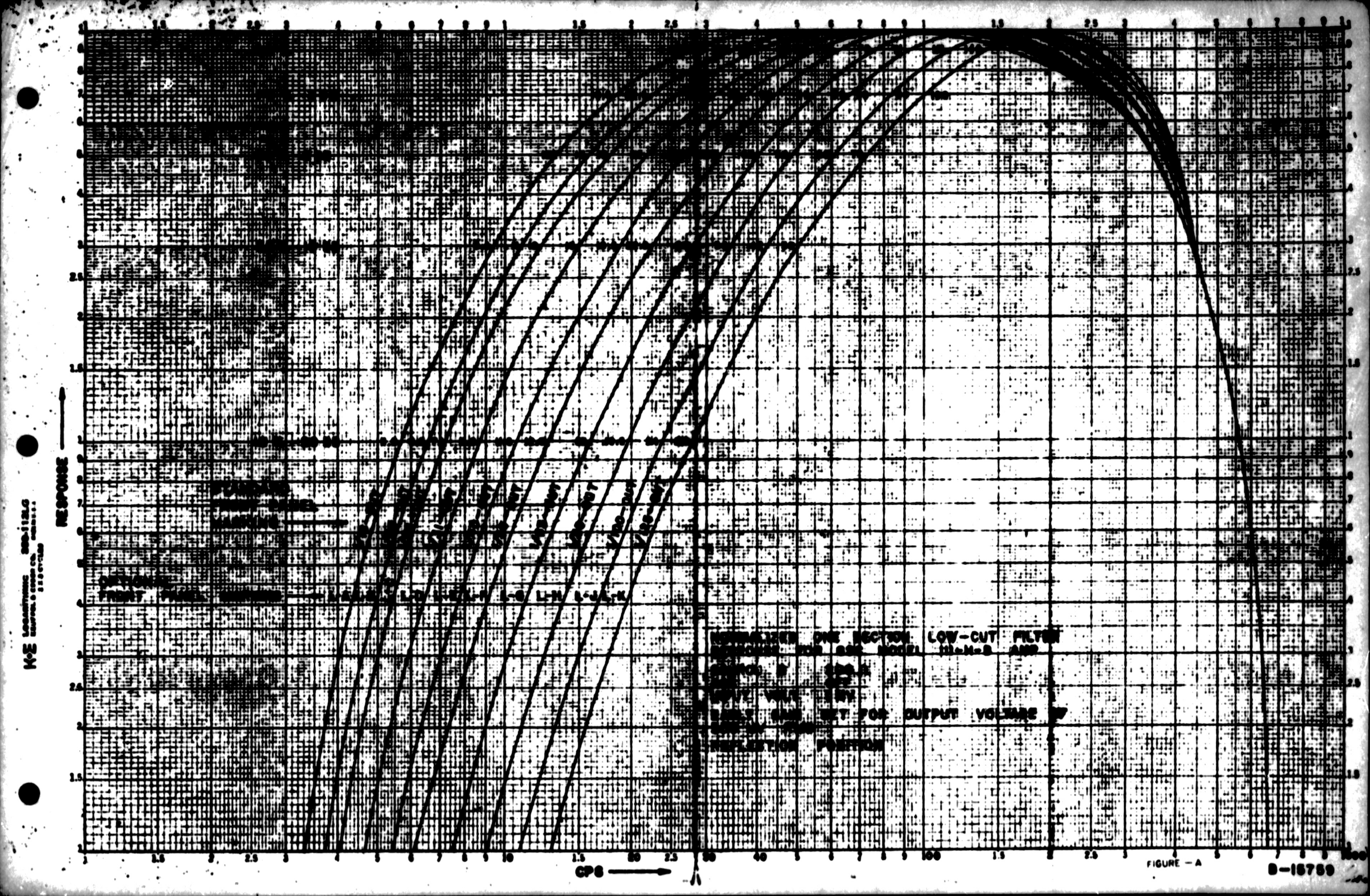
Eight sonigrams were available from wells in the area. Of these, the CDR CPOG Chevron Mills Lake J-74 was located closest to early shooting; its sonigram was used to establish reflection event identity, at shot point 121-409.

Events identified were: (1) the Otter Park (Slave Point equivalent), (2) the Lonely Bay (Keg



MODEL-K

NATURAL FREQUENCY—20 cps


RESPONSE
CPS
FIGURE — A
B-15759

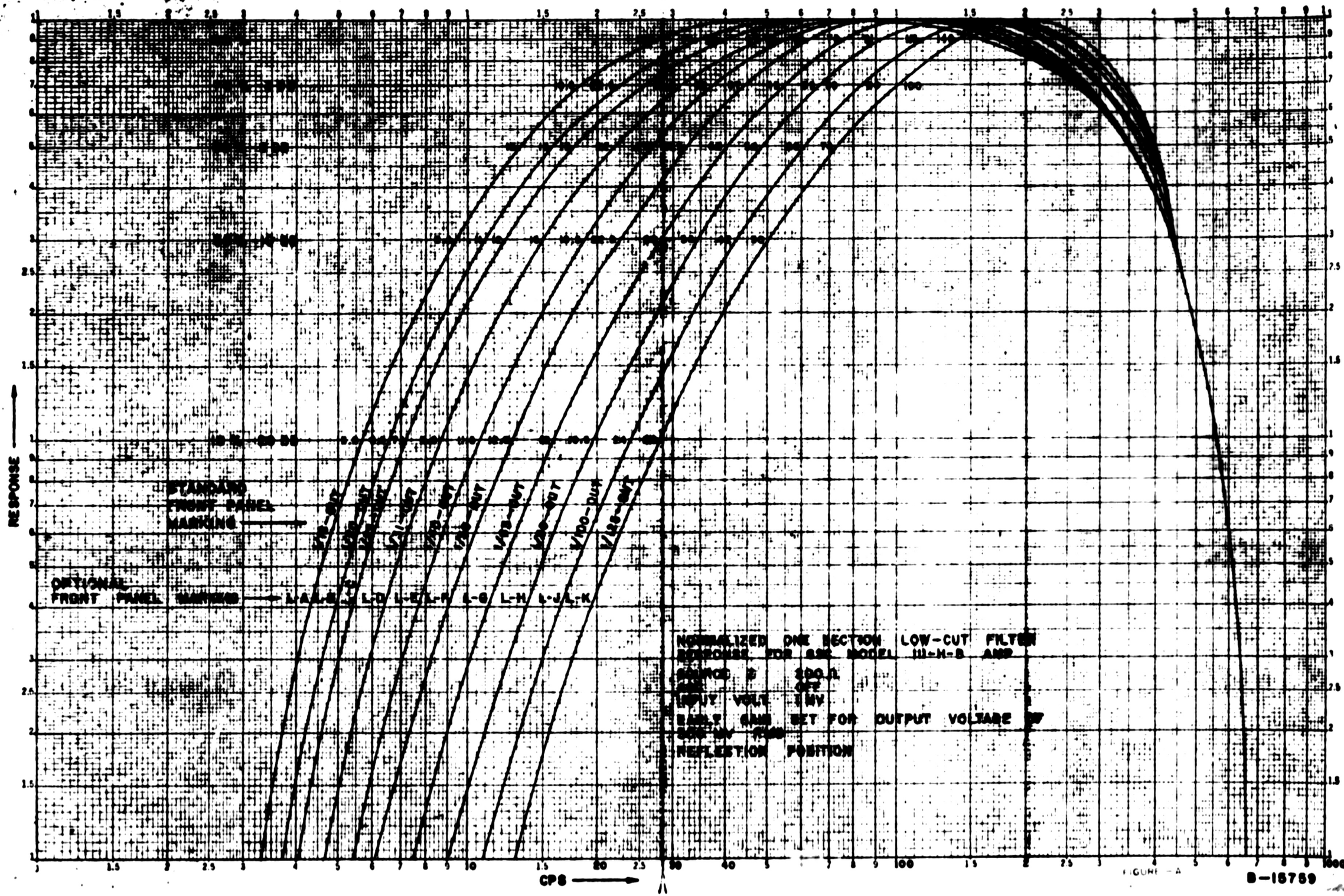


FIGURE A

B-15759

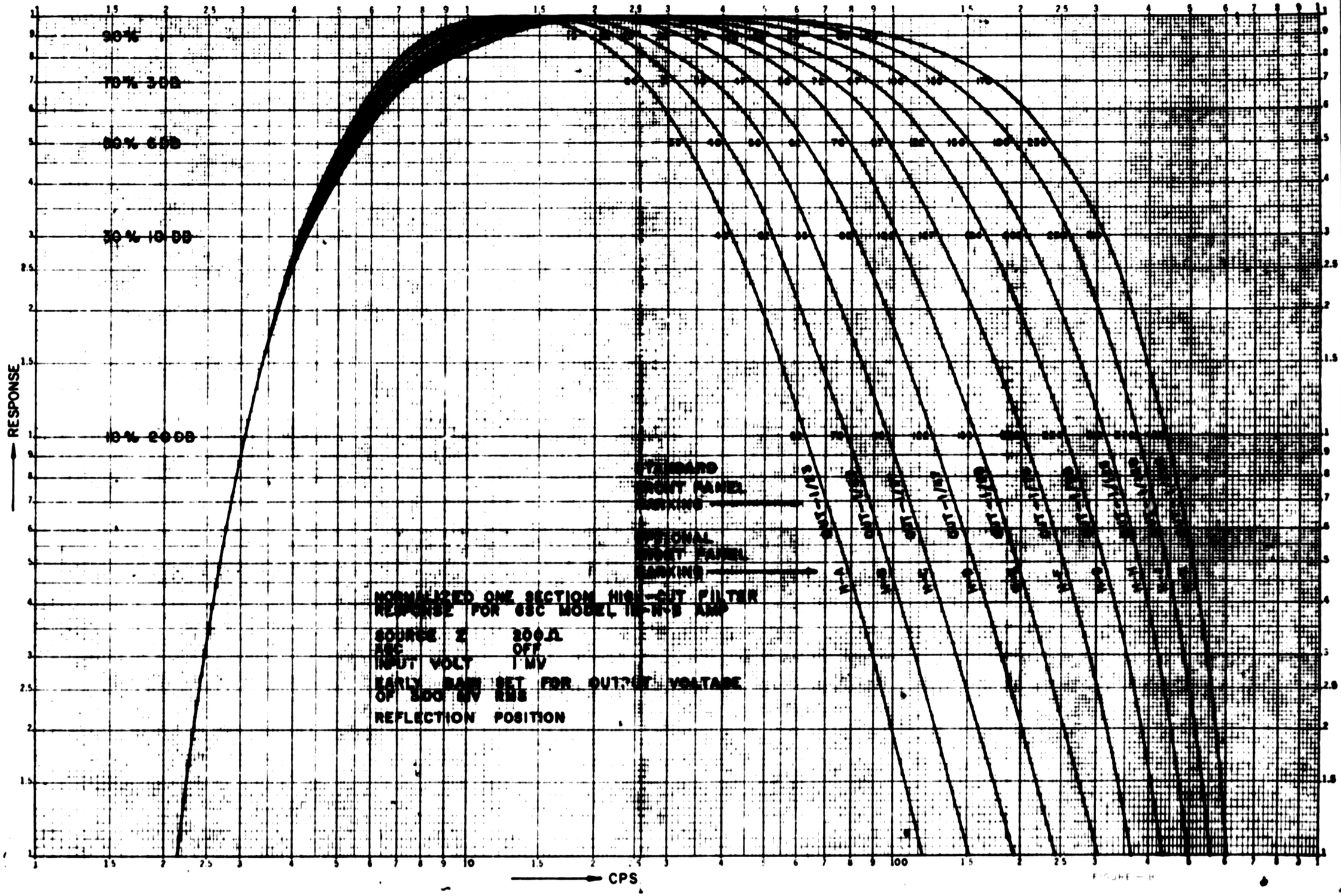

90%
70% 3DB
50% 6DB
30% 10 DB
10% 20DB
RESPONSE
CPS
NORMALIZED ONE SECTION HIGH-CUT FILTER
RESPONSE FOR 65C MODEL
SOURCE Z 200Ω
AGC OFF
INPUT VOLT 1 MV
EARLY BASS SET FOR OUTPUT VOLTAGE
OF 300 MV RMS
REFLECTION POSITION
KEYBOARD
FRONT PANEL
MARKING
OPTIONAL
FRONT PANEL
MARKING
K-S LOGARITHMIC

FIGURE — H

River equivalent) and (3) the Pre-Cambrian. These events were carried continuously throughout the survey, and tied well with the other sonigrams available. Identification is believed reliable, although the possibility exists that in areas of thin Lonely Bay to basement interval the event identified as the Pre-Cambrian may be merely the final leg of the Lonely Bay energy burst.

COMPUTING

First kick times were plotted at all shot points and the observed velocities and intercepts were used, in a modified cosine method, to determine the thickness of, and time in, the low velocity drift layer. The elevation of the base of drift was then computed, mapped and contoured.

Results indicated that it would be unwise to use a flat datum; calculated values of the elevation of base of drift varied from 966' A.S.L., on line 126 near the Foetus Lake F-60 well, to 114' A.S.L. on line # 16, near the Mackenzie River. It was therefore decided to use a contoured datum map, conforming in a smoothed approximate fashion to the base of drift map, to minimize datum corrections applied.

A map of the horizontal sub-drift velocities encountered was also prepared and contoured. Variation was again extremely wide, from over 17, 300'/s in the

limestone zone of the southwestern block to less than 10,000'/s on line 16, near the Mackenzie River, where no limestone is present. The decision was then made to use a variable datum correction velocity, taken from a smoothed version of the sub-drift velocity map.

Seismograms were then computed to the determined variable datum, using the determined variable datum velocity, and datum times were hand plotted, to serve as a check on the adequacy of the correction made. Records giving erratic values were then recomputed to improve results.

Results are considered good; datum times achieved are believed reliable.

stacked record sections are similar in the above parameters; section times must be interpreted in this light.

RECORD QUALITY

Record quality varied from good to N.G. Reflection energy was adequate down to and including the basement event, but the extremely shallow section resulted in first kick energy interfering with and often wiping out the Otter Park event on the outside traces. Similarly, the Hay River Shale event arrived too soon to be seen even on adjacent traces.

A more serious problem arose in the areas of little or no drift cover, where limestone or sandstone

was the shooting material. Ground roll was extremely strong, and effectively destroyed the reflection events as it passed through.

A further problem in the limestone and sandstone areas was the high frequency of reflected energy. Frequency recorded were effectively from 30 cps to 60 cps, with too little lower frequency energy to provide reflection character. Correlation between records was thus hindered, and corrections for stacking made necessarily very precise.

In the areas of glacial cover, shots of 5/8 lb. or 1¼ lb at 40' gave good results, with comparatively little ground roll. Frequencies were only moderately high, and some event character was apparent. These parameters are therefore considered satisfactory for this area.

In limestone and sandstone areas, results were much poorer, as indicated. Attempts were made to lower frequency and diminish ground roll by deepening holes and increasing charge size; these were not wholly successful, probably because the adjustments were not carried sufficiently far. Depths of 50' to 75' are probably not adequate nor is a charge of 10 lbs, to achieve any appreciable improvement in either frequency or ground roll problems.

RESULTS

(a) Geological Setting

The Kakisa-Providence area is located in the northern arm of the Elk Point basin; depositional conditions during Lonely Bay time should be very similar to those that prevailed in the Rainbow-Zama area during the period of Keg River reef development. Patch reef buildups might therefore be expected in the area.

(b) Features of Interest

Results obtained are presented on a suite of three structural maps and two isopachous maps. (Each 'map' consists of three map sheets).

Of these, the Lonely Bay (Keg River equivalent) structural map is by a wide margin the most reliable. The Lonely Bay seismic event was normally the strongest and most consistent energy band on the seismograms. Datum times of this event are considered reliable.

In addition, the datum to Lonely Bay average velocity distribution is believed to be essentially accurate, as calculated. This belief is supported by the surprisingly close agreement between calculated seismic depths and well tops at the various wells tied.

As presented, this map indicates that, to the north of the carbonate bank, the formation dips northward or northwestward, away from the bank, for a comparatively few miles. A reversal then occurs, and dip

becomes gently southwestward.

The Otter Park and Pre-Cambrian structure maps show the same general pattern; on both, a trough is indicated, cutting through the approximate centre of the southwestern block toward Makisa Lake, then re-appearing on line # 101.

The Otter Park to Lonely Bay interval appears to thicken gradually toward the northeast, reaching a maximum of slightly more than 400'.

Similarly, the Lonely Bay to basement interval, north of the carbonate bank, thickens generally northward.

The only promising anomalies are located in the southwestern block. The Lonely Bay structural map shows two pronounced high areas, one near the intersection of lines 122 and 125, and the other on line 120, just east of line 125. Both are believed to be Lonely Bay reefs.

Both areas are similarly high on the Otter Park and Pre-Cambrian maps, and show little or no evidence of either thinning over the highs or thickening under them. This absence of evidence supporting the interpretation presented is believed to result from inadequate velocity control in the Otter Park to Lonely Bay interval on the one hand, and the locally rather poor Pre-Cambrian event.

Minor highs appear in the other blocks, but are not sufficiently pronounced to overcome doubts as to their validity and importance.

CONCLUSIONS

Two reef developments are present in the southwestern block. Both are believed valid, despite the fact that some of the usual reef criteria are absent.

No promising locations appear in any other areas, possibly because of the very spare seismic grid.

RECOMMENDATIONS

If wells are to be drilled prior to further seismic investigation, it is recommended that the first two sites be chosen to evaluate the anomalies discussed. If results are favourable, two other minor features in the same area should be tested.

No other sites for drilling can be recommended.

Considerably more seismic coverage should be obtained. In the southwestern block, this should take the form of more closely spaced detail work, and should be concentrated north of line 124. Such shooting should be 400%, using the present 1800' spreads, and should be aligned at approximately 45° from existing lines.

Present shooting parameters are considered adequate in the drift area of the block, but to the south, in the limestone area, holes of up to 100', with

much heavier charges should be tried, in an attempt to lower reflection frequencies.

The only recommendation made for the other blocks is that seismic control be vastly expanded, to fill in blanks in present knowledge. Shooting parameters should remain those used in the present survey; 300% coverage is considered adequate.

Finally, it is strongly suggested that any wells drilled should have sonic logs run, and in addition check shots should be taken. This information would prove most valuable in interpreting seismic data.

Respectfully submitted,

BEAVER GEOPHYSICAL SERVICES LIMITED

Wm. Weatherson

Approved by:

D. G. D'Arcy, P. Geoph.

STATISTICAL SUMMARY

Recording:

Days worked	66
Hours worked	837.0
Hours in field	666.0
Hours driving	171.0
Profiles shot	2184
Av. No. profiles/day	33.1
Shots taken	2254

Drilling:

Shifts worked	396
Hours worked	4974.5
Hours in field	4314.5
Hours driving	670.0
Holes drilled	2249
Footage drilled	92,182
Average hole depth	41.0
Av. footage/hour	21.4
Av. footage/shift	232.8

NORTHWEST TERRITORIES

85 F SW

118°00'
61°30'
117°45'
117°30'
117°15'
117°00'
61°30'

MACKENZIE

MERIDIAN ISLAND

Mission Island

Green I.

FORT PROVIDENCE

BIG RIVER

Providence Rapids

Gravel I.

Ferry

THE BIG SNYE

500

525

550

575

600

625

650

675

700

725

750

775

800

825

MACKENZIE RIVER

Dory Pt.

Burnt Pt.

Pt Serriate

WINTER

BEAVER

61°20'

61°10'

THE BIG

SNYE

Providence Rapids

Gravel I.

Ferry

RIVER

Dory Pt.

Burnt Pt.

Pt Serrisio

MACKENZIE

BEAVER

LAKE

WINTER

KAKISA LAKE

KAKISA RIVER

61°20'

61°10'

61°00'

118°00'

117°45'

117°30'

117°15'

117°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP, MUSKEG

PROJECT NO.	DATE - SEPTEMBER 1969
PLACID OIL COMPANY	
BEAVER LAKE	
ELEVATION OF SURFACE	
CONTRACTOR: BEAVER GEOPHYSICAL SERVICES LIMITED	
C.I. 25' DATUM SEA LEVEL	MAP NO 2 85-F/SW

NORTHWEST TERRITORIES

85 C NW

118°00' 61°00'

117°45' 117°30' 117°15' 117°00'

60°50'

60°40'

KAKISA LAKE

TWO ISLAND LAKE

Lady Evelyn Falls

KAKISA

MACKENZIE RIVER

HIGHWAY

Falls Rapids

KAKISA

Gull Creek

RIVER

750 775 800 825 850 775 750 725 775 750

Falls Rapids

KAKISA

Gull Creek

RIVER

60°40'

60°40'

TATHLINA

LAKE

60°30'
117°00'

117°45'

117°30'

60°30'
117°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP

PROJECT No -	DATE: SEPTEMBER 1969

PLACID OIL COMPANY

KAKISA LAKE

ELEVATION OF SURFACE

Contractor: BEAVER GEOPHYSICAL SERVICES LIMITED

Interpretation by: [signature]

C.I. 25' DATUM: SEA LEVEL

MAP NO. 2
85-C/NW

NORTHWEST TERRITORIES

95 E SE

118°45'
118°30'
118°15'
118°00'
61°30'
61°20'
61°10'

MILLS LAKE

RIVER

MACKENZIE

Grosse

WINTER ROAD

WINTER ROAD

WINTER ROAD

WINTER ROAD

61°20'

61°10'

61°00'
119°00'

118°45'

118°30'

118°15'

61°00'
118°00'

MACKENZIE RIVER

Gravel

WINTER ROAD

WINTER ROAD

WINTER ROAD

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

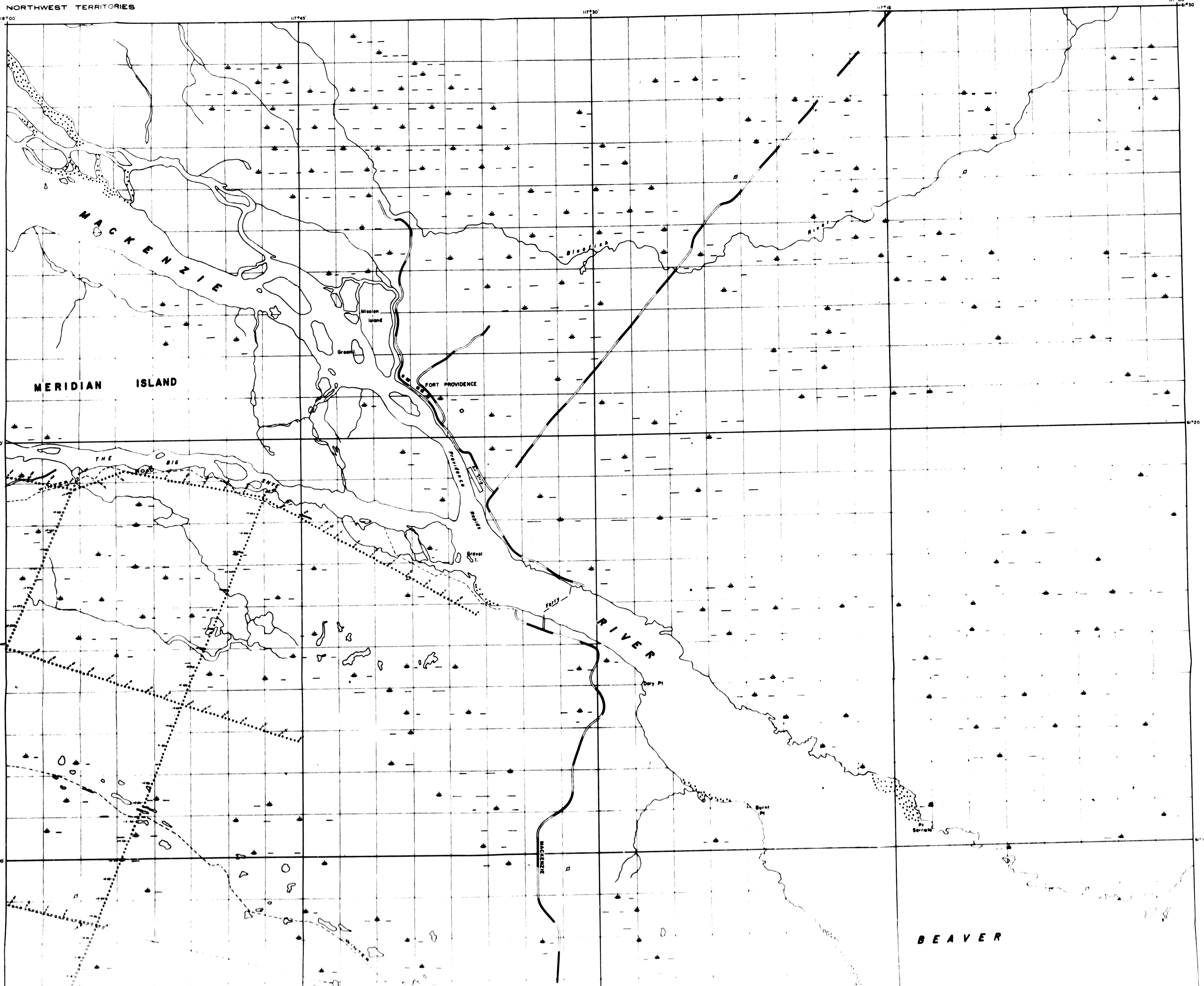
SWAMP, MUSKEG

PROJECT No.-	DATE- SEPTEMBER 1969
PLACID OIL COMPANY	
MILLS LAKE	
SHOT POINT LOCATION	
CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED	
Interpretation by [illegible]	MAP NO 1 85-F/SW

2

NORTHWEST TERRITORIES

85 F SW



61°20'

61°10'

61°00'
118°00'

117°40'

117°30'

117°20'

117°00'

THE BIG

WINTER

SNYE

Providence Rapids

R. Shute

Raval I.

Ferry

RIVER

Dory Pt.

Burnt Pt.

Pt. Serrant

MACKENZIE

BEAVER

LAKE

WINTER

HIGHWAY

KAKISA RIVER

KAKISA LAKE

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP, MUSKEG

PROJECT No.

DATE SEPTEMBER 1969

PLACID OIL COMPANY

BEAVER LAKE

SHOT POINT LOCATION

CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED

Interpreted by L. Fuller

MAP NO. 1
85-E-SW

NORTHWEST TERRITORIES

85 C NW

KAKISA LAKE

TWO ISLAND LAKE

KAKISA

Falls Rapids

KAKISA RIVER

Gull Creek

MACKENZIE RIVER

Lady Evelyn Falls

HIGHWAY

61°00'

60°50'

60°40'

117°45'

117°30'

117°15'

117°00'

60°50'

60°40'

Falls Rapids

KAKISA

Gull Creek

RIVER

TATHLINA

LAKE

117°45'

117°30'

117°15'

117°00'

60°30'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

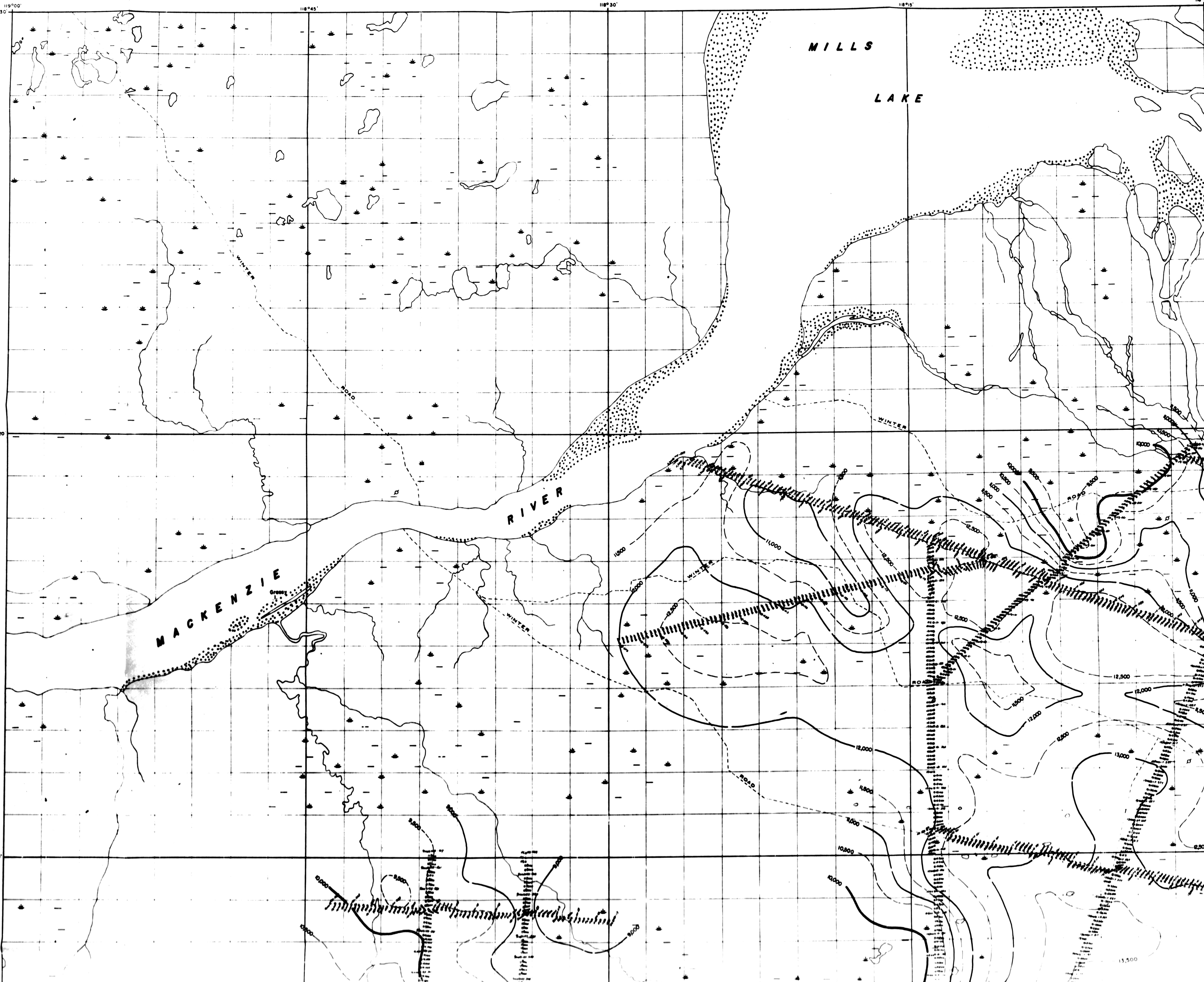
SAND OR MUD

SWAMP

PROJECT No -	DATE - SEPTEMBER 1969
PLACID OIL COMPANY	
KAKISA LAKE	
ELEVATION OF DATUM	
Contractor: BEAVER GEOPHYSICAL SERVICES LIMITED	
Interpretation by: [signature]	MAP NO. 5
CI 25' DATUM: SEA LEVEL	85 - C/NW

NORTHWEST TERRITORIES

85 E SE



MACKENZIE RIVER

Grassy

WINTER ROAD

61°10'

61°00'

118°00'

118°45'

118°30'

118°15'

118°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP, MUSKEG

PROJECT No -	DATE - SEPTEMBER 1960

PLACID OIL COMPANY

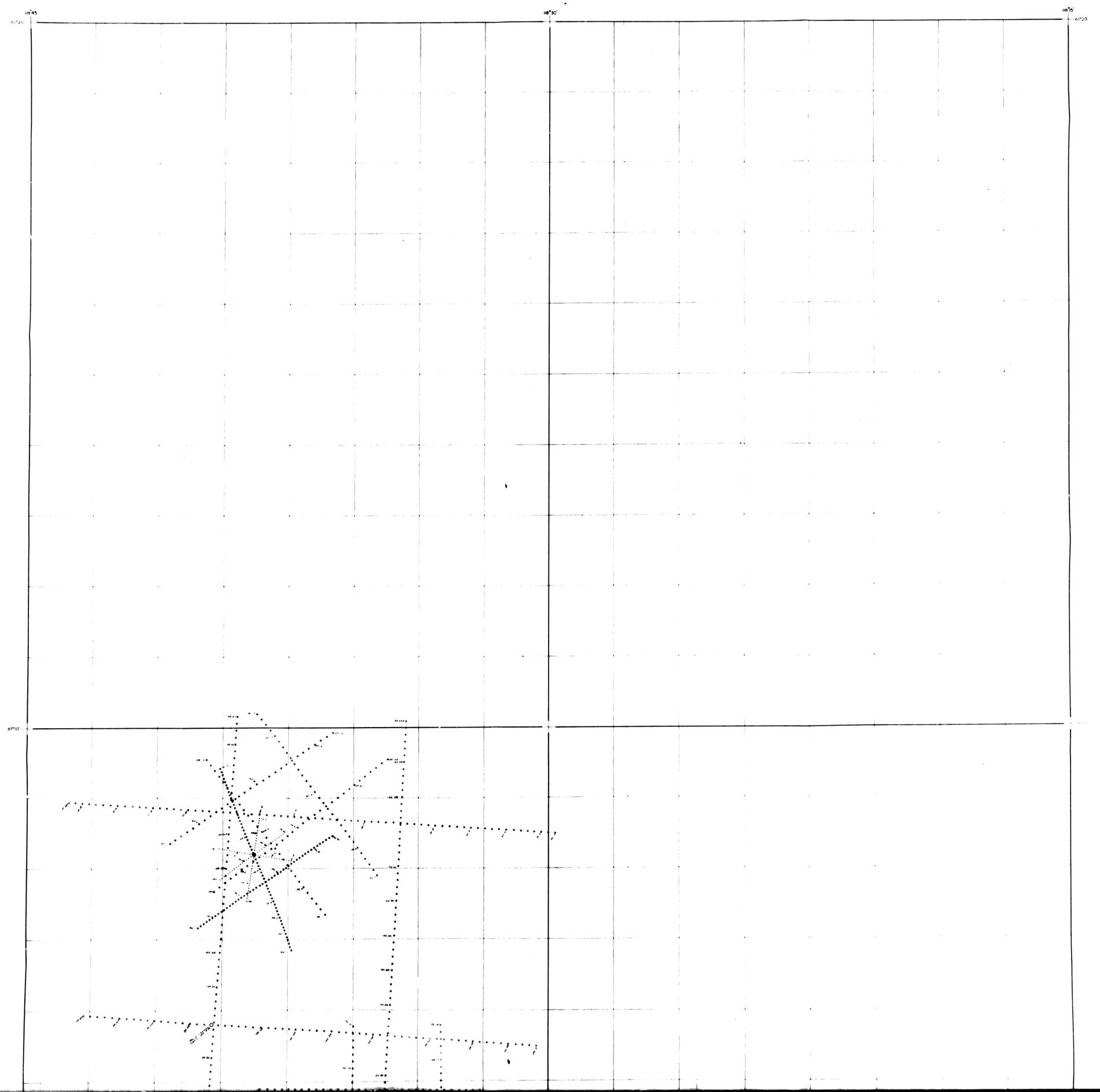
MILLS LAKE

DISTRIBUTION OF HORIZONTAL SUB-DRIFT VELOCITIES

CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED

C.I. 500 ft

MAP NO 6
85-F/SW


118°45'
118°30'
118°15'
61°20'
61°10'

PROJECT No.	DATE
PLACID OIL COMPANY	
MILLS LAKE	
LOCATION	
DATUM, ELLIPSOID, PROJECTION, CONTOUR INTERVAL	SCALE 1" = 1 MILE
Surveyed by Geodetic Surveys Limited	MAP NO. 85-F/SW

BEAVER

REFLECTION SEISMOGRAPH SURVEY

of the

KAKISA - PROVIDENCE AREA

60° 00' N. Lat. to 61° 20' N. Lat.

117° 30' W. Long. to 118° 45' W. Long.

N. W. T.

for

PLACID OIL COMPANY

by

Beaver Geophysical Services

December 8, 1969 to January 22, 1970

and

February 17, 1970 to March 4, 1970

BEAVER

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FIGURES OR PLATS

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(Beaver Lake - 1 sheet, scale 1" = 1 mile)

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3. Thickness of Drift
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13. Pre-Cambrian Structure
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15. Lonely Bay to Pre-Cambrian Isopach

Other Material:

Specimen Reflection Seismogram 140-53/ N/S
Normal Moveout Curve List
Normal Moveout Curve Distribution

LOCATION

The Kakisa-Providence prospect lies north and northwest of Kakisa Lake, in the southern part of the Northwest Territories. The Mackenzie River forms the northern boundary of the area surveyed.

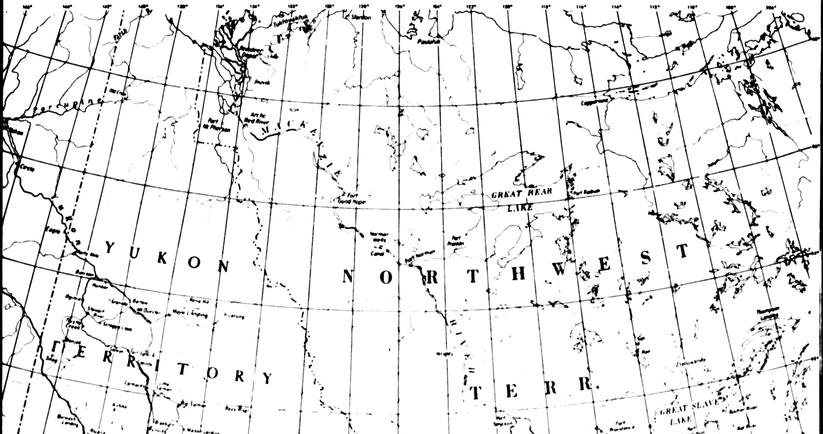
Drilling operations were begun on December 8, 1969, and recording was completed on January 22, 1970. A second period of operations began on February 17, 1970 and continued until March 4, 1970. Teledyne Exploration Ltd. subsequently surveyed three short lines between April 3 and April 11, 1970.

Beaver Geophysical Services used a wheeled trailer camp, while Teledyne Exploration were based in Ft. Providence.

Total mileage shot by Beaver amounted to 93.8 miles. Lines 127 to 134 inclusive, and lines 145 and 146, were in the southwestern Mills Lake block, and totalled 33.1 miles. Lines 135 to 144 were in the eastern Mills Lake block, and amounted to 31.4 miles of coverage. Lines 147 and 148 were in the Beaver Lake area, and were 29.3 miles in combined length.

Pertinent data is given in the following table:

Line #	Map Sheet	Spread	% Coverage	Mileage
127	Mills L. West	1800'	300%	3.18
128	Mills L. West	1800'	300%	3.18
129	Mills L. West	1800'	300%	3.52


YUKON
TERRITORY
NORTHWEST
TERR.
MACKENZIE
GREAT BEAR
LAKE
GREAT SLAVE
LAKE
WHITEHORSE
Tuktoyaktuk
Stanton
Paulatuk
Inuvik
Arctic Red River
Fort McPherson
Fort Good Hope
Norman Wells
Canol
Fort Norman
Fort Franklin
Port Radium
Coppermine
Circle
Eagle
Dawson
Mayo Landing
Carcross
Yellowknife
Thompson Landing
Fort Simpson
Fort Providence
Fort Smith
Fort Liard

Line #	Map Sheet	Spread	% Coverage	Mileage
130	Mills L. West	1800'	300%	3.30
131	Mills L. West	1800'	300%	3.52
132	Mills L. West	1800'	600%	3.24
133	Mills L. West	1800'	300%	3.64
134	Mills L. West	1800'	300%	3.75
135	Mills L. East	1800'	600%	3.18
136	Mills L. East	1800'	600%	3.18
137	Mills L. East	1800'	300%	3.64
138	L. East	1800'	300%	2.73
139	Mills L. East	1800'	300%	2.61
140	Mills L. East	1800'	300%	2.96
141	Mills L. East	1800'	300%	3.64
142	Mills L. East	1800'	300%	3.30
143	Mills L. East	1800'	300%	2.84
144	Mills L. East	1800'	300%	3.30
145	Mills L. West	1800'	600%	3.18
146	Mills L. West	1800'	600%	2.61
147	Beaver Lake	1320'	300%	17.33
148	Beaver Lake	1320'	300%	12.00

Lines shot by Teledyne Exploration Ltd. were as follows:

149	Mills L. West	1320'	600%	1.38
150	Mills L. West	1320'	600%	1.29
151	Mills L. West	1320'	600%	1.67

OBJECT

A reconnaissance seismic survey of the area had been conducted during the spring and summer of 1969.

The present programme was therefore designed to give improved general coverage, as well as to further investigate several minor anomalies previously encountered.

The basic purpose of the survey was to determine whether small Lonely Bay (Keg River) reefs, similar to those of the Rainbow Lake area, had developed in the area.

SURFACE CONDITIONS

The area surveyed lies immediately north of Kakisa Lake, and south of the Mackenzie River. Drainage is only fair, and is either northward directly into the Mackenzie River or alternatively into Kakisa Lake, and thence into Great Slave Lake and the Mackenzie system.

Muskegs are common in the northern part of the prospect, and small lakes or sloughs are numerous throughout. Muskeg, spruce and willow predominate in marshy areas, while spruce and poplar cover the better-drained areas to the south.

A glacial till is present over most of the area, but north of Kakisa Lake sandstones are encountered at about fifteen feet, and the Hay River limestone outcrops in the southwestern part of the Mills Lake West area.

Weather conditions were good throughout the period. Muskegs were frozen; and only one day was lost due to blizzard conditions.

PERMITS AND DAMAGES

A permit authorizing the cutting of timber was obtained from Forestry officials in Hay River. Since no lands in the area are privately owned, no private entry permits were required, and no damages were paid.

SURVEYING

Both horizontal and vertical control were established by transit survey, and were based on and tied into the grid of existing seismic lines. Ties were uniformly good.

In addition, a fly line was run from line 121, in the eastern Mills Lake area westward along the Mackenzie Highway into the western Mills Lake block, where no legally surveyed tie point was available. Results were good, and no adjustments to previously established values were required.

Spreads were chained to the required distance of either 1800' or 1320', the geophone station interval being respectively either 150' or 110'. Shot point spacing was dependent upon the spread used, as well as the sub-surface coverage desired.

BULLDOZING

All lines shot required the cutting of new trails, although existing trails were used for access.

Machines used in the Beaver Geophysical operation

were two 6 C's and one 7E; these were double shifted as necessary. The owner and operator was Hackwell Construction.

DRILLING

Required holes were drilled by three conventional rotary drills and one Sewell auger. All were normally double shifted, and one, or occasionally two, extra water trucks were used.

On lines 147 and 148, in the Beaver Lake area, single holes were drilled to 45'. Preloads were 2 1/2 lbs. at the western end of both lines, and 5 lbs. in the eastern part of the area.

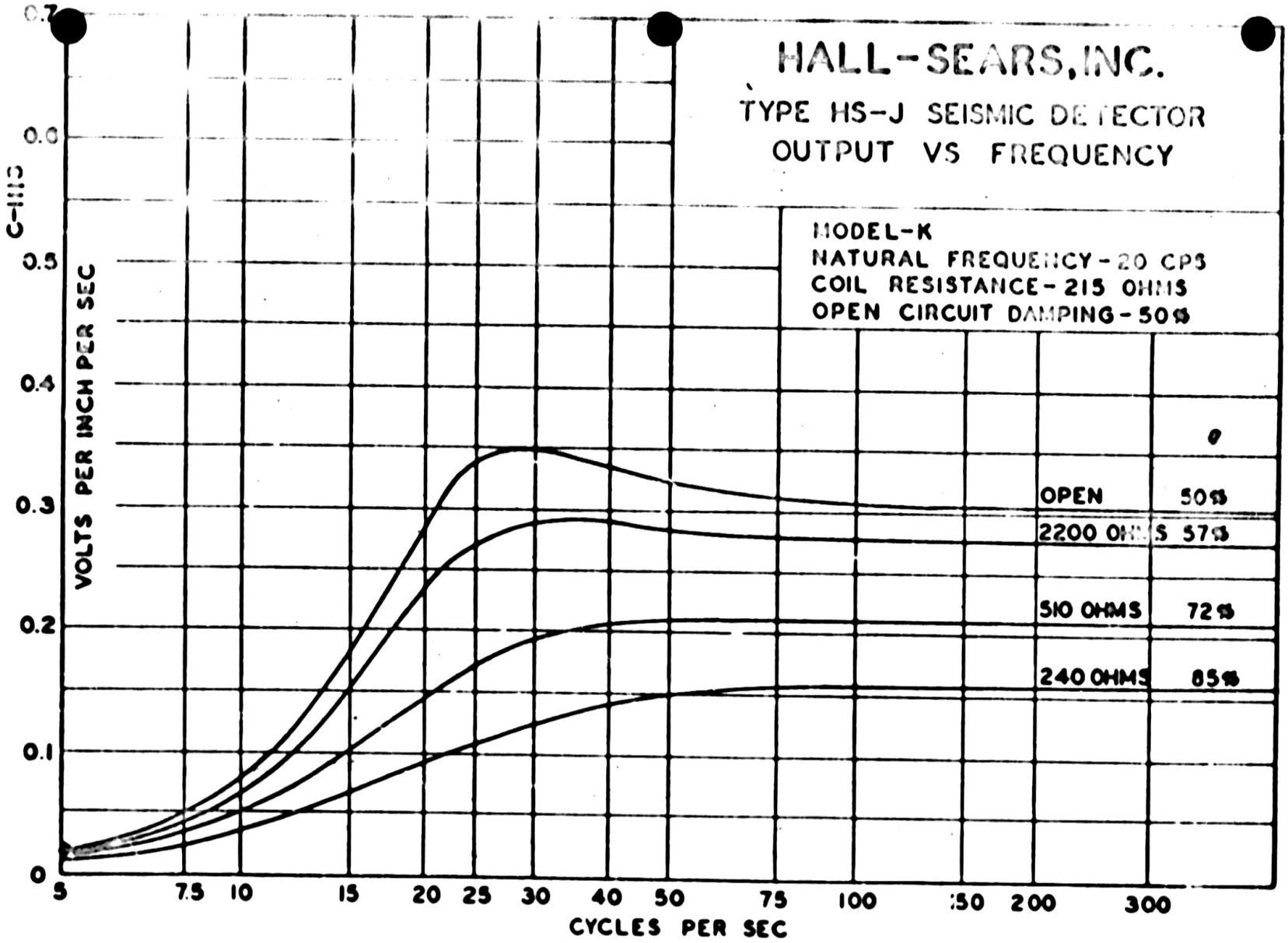
In the Mills Lake areas, hole depth was normally 50'. Charge size was either 1 1/4 or 2 1/2 lbs., although 5 lbs. was loaded when limestone was encountered.

Single hole patterns were standard.

One flowing hole was encountered, but was successfully plugged. There were no gas occurrences.

RECORDING AND SHOOTING

Sixteen Hall-Sears HS-J 20 cps geophones were spaced equally over the geophone interval, centered on the flag. Signal was fed from them into 24 S I E PT 800 amplifiers. After amplification, filtering and multiplexing, it was recorded digitally on magnetic tape; a write-read sequence provided a paper record of the recording. Sample interval was 2 milliseconds and the binary gain setting was



MODEL-K

NATURAL FREQUENCY—20 cps

15, giving 90 decibels of ranging.

Field filtering was as mild as possible; setting used was 16 - 125, the high side cut-off being dictated by the 2 millisecond sampling rate.

Tape format was S E G 'A'.

Charge size and hole depth were as outlined earlier, and only one shot per hole was taken.

Instruments used by Teledyne Exploration Ltd. on lines 149, 150 and 151 were SDS - 1010 (binary gain digital), together with EVS - II 14 cps geophones. On all three lines, 2 1/2 lbs. charges were loaded to 45' in single holes.

Horizontally stacked datum time record sections were later produced by Canadian Magnetic Reduction Ltd. (Teledyne Explorations Ltd.), using data supplied by Beaver Geophysical Services.

Order of processing was as indicated:

1. Normal Moveout Correction
2. Filter (28-30/100-120)
3. Deconvolution (28-30/70-76 spectrum, least squares.
4. Fully corrected (minimove and statics)
5. Stack

Presentation mode was a combination of galvanometer with a medium variable density background.

REFLECTION IDENTIFICATION

In the Beaver Lake and Mills Lake East areas, event identification was based upon previous seismic work. Original identifications had been made from available sonigrams.

Two deep tests were drilled in the western Mills Lake area during and shortly following the period of the survey. Velocity surveys, complete with check shots, were available from both; these were used to determine reflection identity in this area.

Reflection events identified were the Otter Park, Lonely Bay and Pre-Cambrian. These were carried continuously, and identification is considered reliable.

COMPUTING

First arrival times were used, in a modified cosine method, to calculate drift thickness and times.

Reflection event times were then corrected to a previously established variable datum, using a variable datum velocity, also determined by previous work. Corrected datum times were then hand plotted as a check on the accuracy of the corrections made. Results were good, and event times are believed reliable.

RECORD QUALITY

While quality was variable, ranging from good to poor, records were much better than those obtained in the

earlier survey. The improvement was no doubt partially due to improved surface and weather conditions, but a much more important factor was the change in recording instruments.

As well, the use of 1320' spreads on lines 147 and 148 largely eliminated the ground roll problem previously encountered.

Overall, reflection energy was at least adequate and in most areas good. Event frequencies remained rather high, but the amplifiers used gave much better resolution and character than had the analog amplifiers used in the reconnaissance survey.

RESULTS

(a) Geological Setting

Situated as it is in the northern part of the Elk Point basin, the prospect area presumably experienced during Lonely Bay depositional time an environment similar to that which in the Rainbow Lake area led to the Keg River reef development.

Similar Lonely Bay build-up might therefore be possible in the Kakisa-Providence area.

(b) Features of Interest

Results are presented on a suite of three structural and two interval maps.

These are as follows:

1. Otter Park Structure

2. Lonely Bay Structure

3. Pre-Cambrian Structure

4. Otter Park to Lonely Bay Isopach

5. Lonely Bay to Pre-Cambrian Isopach

The regional picture established by the earlier reconnaissance survey has changed only slightly. Formations mapped dip northeastward from the carbonate bank for a short distance, then rise gently northeastward. The axis of the trough appears to curve southeastward through the centre of the Mills Lake West block, toward Kakisa Lake.

Some local features have been modified. Higher quality results on lines 147 and 148 indicated the presence of two separate normal faults, both having very slight throw. The more prominent of the two trends first NE and then ENE cutting in sequence lines 148, 106, 147, 109, 107, 108 and 104. Throw is down to the southeast, and appears to vary between 15' and 95'.

The second fault can be seen only on line 148. Throw is down to the west or northwest, and is approximately 105' at the point where it cuts line 148.

Both faults are apparently younger than Lonely Bay despositional time, but older than Otter Park time, since there is no evidence of displacement on the Otter Park seismic event.

No suggestion of reef development can be seen in the Beaver Lake map area.

The eastern Mills Lake block is similarly unpromising. The three areas investigated yield no evidence of reef development; the minor anomalies suggested by previous shooting are outlined in considerably more detail, but are apparently a result of basement structure.

The two most promising highs encountered in the reconnaissance programme were in the Mills Lake West area. The more attractive of the two was tested by the P - 56 well, which did not encounter reef.

The second anomaly was outlined in detail by the present programme. It is now shown to form part of a narrow but prominent nose plunging south-southwesterly toward the P - 56 location, but separated from the P - 56 structural high by a deep narrow trough.

During the detailed investigation of this second feature, on line 129, a strong event appeared approximately .080 sec. above the normal Lonely Bay time. Lines 145 and 146 were later shot to confirm its existence and outline; the anomalous reflection was seen on line 145, but was absent on line 146.

The C - 49 well was then drilled near the intersection of lines 129 and 145, but no reef build-up was encountered.

Teledyne Exploration Ltd. then shot lines 149, 150, and 151 in a star pattern, intersecting at the

C - 49 site. The event concerned appears on all three lines.

The velocity survey and check shots at the C - 49 well show that the Lonely Bay event is correctly identified, and that the anomalous reflection, which had been believed to represent a Lonely Bay development originates at or near the Spence River Top, where a velocity decrease occurs. It should, however, be pointed out that the same velocity break is present on the P - 56 velocity log, and that no similar energy burst appears on adjacent seismograms.

The Pre-Cambrian event over most of this area is now one leg higher than previously mapped; the change was dictated by the velocity surveys from the new wells.

CONCLUSION

The present survey has failed to uncover any promising features in either the Beaver Lake area or the Mills Lake East block. Control is, however still rather loose.

The features tested by the P - 56 and C - 49 wells are by a wide margin the most attractive in the Mills Lake West area. Since both wells failed to find reef, other anomalies mapped offer little likelihood of success.

RECOMMENDATIONS

While other seismic anomalies might be encountered by an extended seismic programme, it is unlikely that they would be more promising than those tested. As well, extremely

close coverage would be required to find features as small as that tested by the C - 49 well.

Further seismic work can therefore not be justified.

No other structural features mapped warrant drilling.

It is therefore recommended that the area be abandonned.

Respectfully submitted,

BEAVER GEOPHYSICAL SERVICES LIMITED

Wm. Weatherson

Approved:

D. G. D'Arcy, P. Geol.

STATISTICAL SUMMARY - BEAVER

Recording:

Days Worked	33
Hours Worked	491
Hours in Field	359
Hours Driving	132
Profiles Shot	1059
Av. No. Profiles/day	32.1
Shots Taken	1072

Drilling:

Shifts Worked	263
Hours Worked	3980.5
Hours in Field	3073.5
Hours Driving	907
Holes Drilled	1086
Footage Drilled	50,443
Average Hole Depth	46.4
Average footage/hour	12.6
Average footage/shift	191.8

STATISTICAL SUMMARY - TELEDYNE

Recording:

Days Worked	1
Hours Worked	13.25
Hours in Field	9.25
Hours Driving	4
Profiles Shot	94
Av. No. Profiles/day	94
Shots Taken	96

Drilling:

Shifts Worked	12
Hours Worked	156
Hours in Field	
Hours Driving	
Holes Drilled	95
Footage Drilled	4430
Average Hole Depth	46.6
Average footage/hour	28.39
Average footage/shift	369.1

SH LOG	DIR N	TIES TO 140-65		
S	1	1800	1725	746
	2			
	3			
	4			
	5			748
	6			
	7		525	
	8			
	9			750
	10			
	11			
	12	150	75	
	STA No	STA DIST	F.K. DIST	ELEV

COORDS: N 39.425 / W 15.483

SP No: 140-53

17				753
18				
19				
20				756
21				
22				
23				
24	1840	1725	763	
DIR. S	TIES TO 140-41			

LINE No. 140 INST. TYPE PT 800

DATE JANUARY 11, 1970 TAPE No 038

LOCALE KAKISA - PROVIDENCE PU/TRACE 16/150

FOR PLACID OIL COMPANY

BY BEAVER GEOPHYSICAL SERVICES LIMITED

REC No A CHG 1½ SHD 50'

Cos i	UHT	V_1	V_2	T_1	T_0
.828	010	7500	13400	041	012

1 $(T_1 - T_0)/\cos i$ 2 $(T_1 T_0) \cos i$ (UHT T_0) B BT A: +046

4 $H = V_1 (T_1 T_0) \cos$ UHT T_0 3 ½ $(T_1 T_0) \cos$ UHT T_0 = H/V_1 B: -019

5 Esp (SHD + H) = E_{V_2} 6 $(E_D E_{V_2})/V_D$ $(E_D E_{V_2})/V_D$ C: ±000

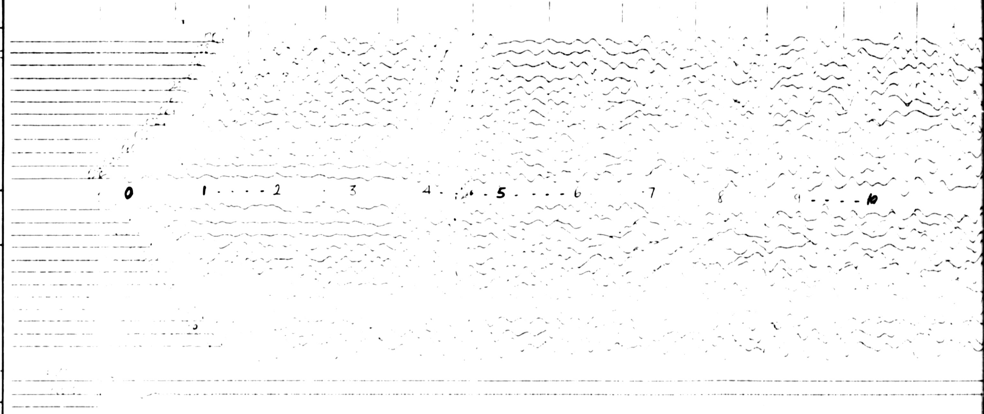
V_D 12100' FILTER CORR S = +021 A + B + C

E_D 560' PHASE CORR I = -029 UHT D -010

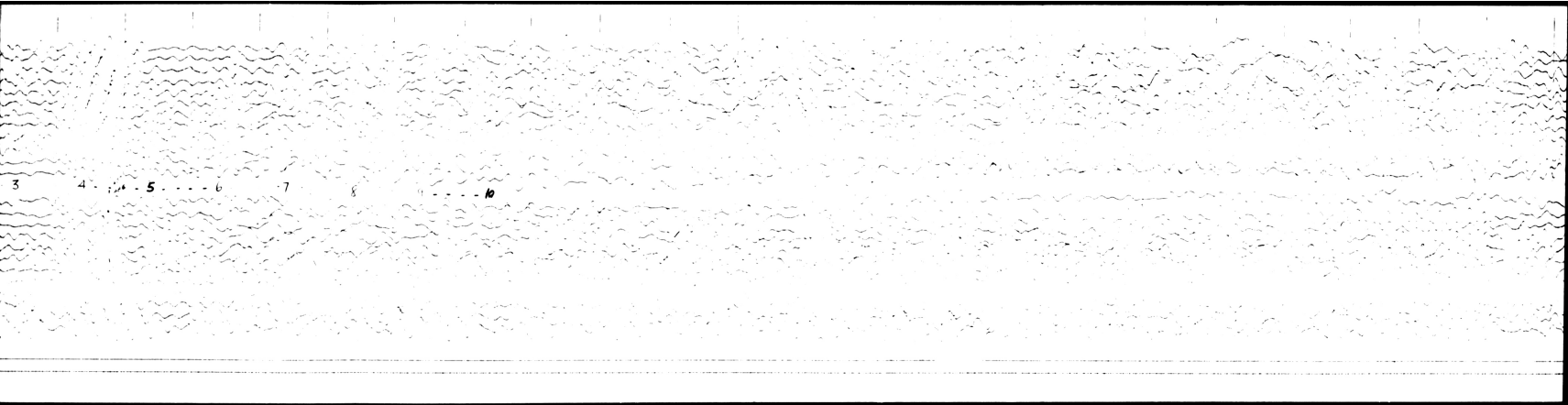
T CORR = -002 B + C - D

SURVEYOR

S + I =
FILTER 16-125
[redacted]
STR
~~MONITOR~~ PLAYBACK
GAIN 15% AGC BG
ET CORR -002
GAIN % AGC
MIX
STR
FILTER
S + I =



1 of 2


3
4
5
6
7
8
10

NORMAL MOVEOUT CURVE LIST

N. M. O. Curve Distance 1800'

2 Way Record Time	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.90
Curve E -	.172	.114	.078	.058	.046	.038	.032	.028	.025	.022	.020	.019	.018	.018	.017	.017
D -	.174	.116	.080	.060	.048	.040	.034	.030	.027	.024	.022	.021	.020	.019	.018	.017
C -	.175	.117	.081	.061	.049	.041	.035	.031	.028	.025	.023	.021	.020	.019	.018	.017
B -	.176	.118	.082	.061	.050	.042	.036	.032	.029	.026	.024	.022	.021	.020	.019	.018
A -	.176	.118	.082	.062	.051	.043	.037	.033	.030	.027	.025	.023	.022	.021	.020	.019
BASE	.182	.124	.088	.067	.054	.045	.038	.034	.031	.028	.026	.024	.023	.022	.021	.020
Mod. Base	.176	.118	.082	.062	.051	.044	.038	.034	.031	.028	.026	.024	.023	.022	.021	.020
A +	.176	.118	.082	.062	.051	.045	.039	.035	.033	.030	.028	.026	.025	.024	.023	.022
B +	.176	.118	.082	.063	.052	.046	.040	.036	.034	.031	.029	.027	.026	.025	.024	.023
C +	.177	.119	.083	.065	.055	.048	.042	.038	.035	.032	.030	.028	.027	.026	.025	.024
D +	.178	.121	.086	.068	.059	.051	.044	.040	.037	.034	.032	.030	.029	.028	.027	.026

NORMAL MOVEOUT CURVE DISTRIBUTION

Line	S. P.	Curve
127	113-17	B-
	17-1	A-
128	113-1	B-
129	125-1	B-
130	117-5	B-
	1	A-
131	1-125	Mod. Base
132	1-115	Mod. Base
133	137-21	Mod. Base
	17-9	A-
134	137-57	Mod. Base
	53-33	A-
	29-21	B-
	17-5	C-
135	1-113	A+
136	1-73	B+
	75-113	A+
137	129-1	A+
138	97-1	B+
139	1-93	B+
140	105-1	B+
141	1-21	B+
	25-129	A+
142	117-81	B+
	77-1	A+
143	101-1	A+
144	1-41	B+
	45 - 117	A+
145	113-1	B-
146	93-1	B-
147	13-193	B-
	197-297	A-
	301-593	B-
	597-629	A-
	633-653	Mod. Base
	657-717	A+
	721-845	B+
148	21-285	C-
	289-597	D-
149	67-1	B-
150	63-1	B-
151	57-1	B-

NORTHWEST TERRITORIES

85 E SE

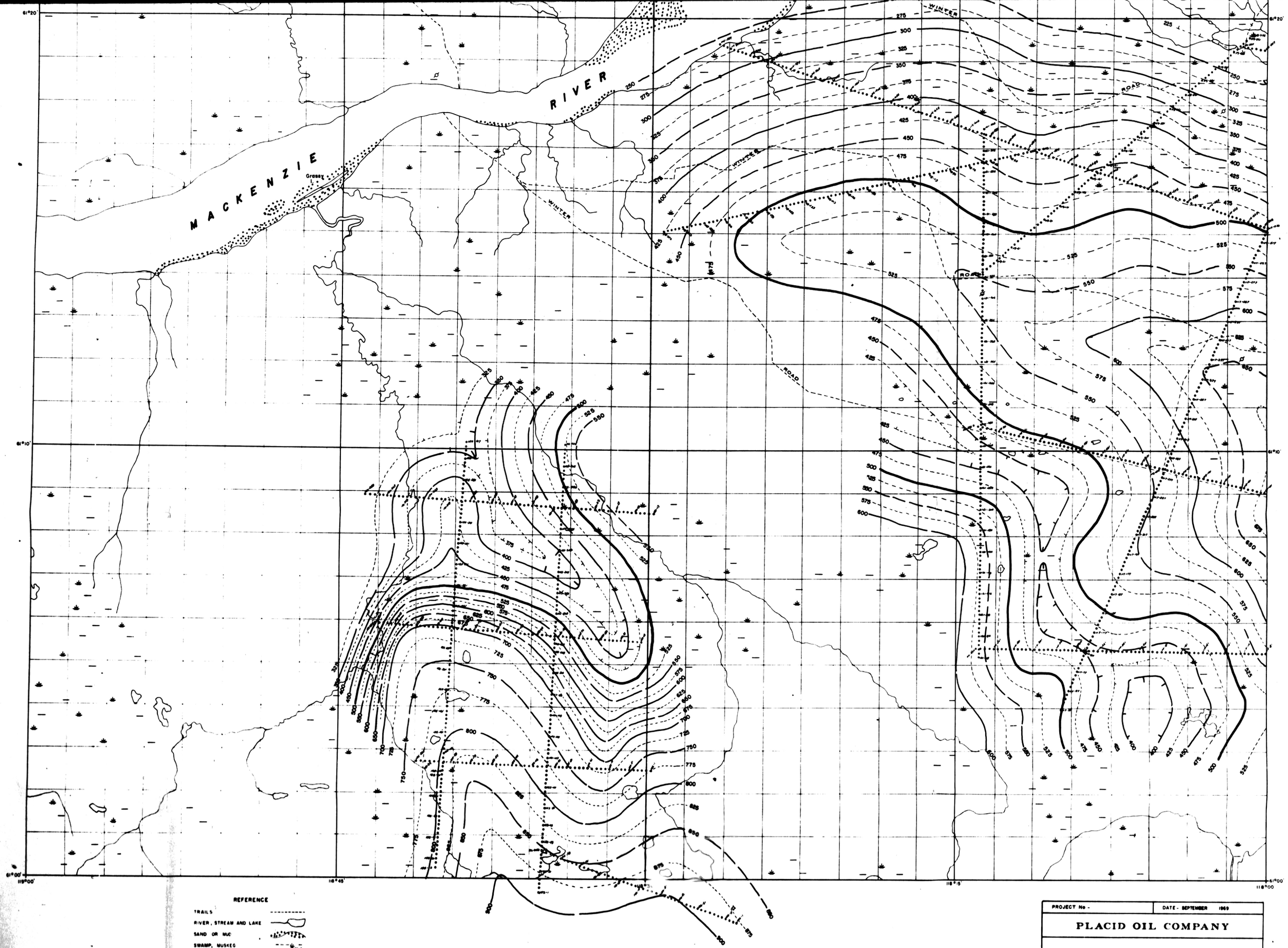
119°00'
61°30'
118°45'
118°30'
118°15'
118°00'
61°30'
61°20'
61°10'

MILLS LAKE

MACKENZIE RIVER

WINTER ROAD

Grosey Island



REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUC

SWAMP, MUSKEG

PROJECT No -	DATE - SEPTEMBER 1969
PLACID OIL COMPANY	
MILLS LAKE	
ELEVATION OF DATUM	
CONTRACTOR BEAVER GEOPHYSICAL SERVICES, LIMITED	
C.I. 25' DATUM SEA LEVEL	MAP NO 5 85-F/SW

NORTHWEST TERRITORIES

85 F SW

118°00' 117°45' 117°30' 117°15' 117°00' 61°30'

MACKENZIE

MERIDIAN ISLAND

Mission Island

Green I.

FORT PROVIDENCE

BIVOUAC

RIVER

Providence

Rapids

Gravel I.

Ferry

61°20'

THE BIG

SNYE

RIVER

Dory Pt.

Burnt Pt.

Pt Serrate

MACKENZIE

BEAVER

WINTER

61°10'

RIVER

MACKENZIE

BEAVER

LAKE

Providence Rapids

Gravel I.

Ferry

Dory Pt.

Burnt Pt.

Pt Serrate

HIGHWAY

KAKISA LAKE

KAKISA RIVER

T.N.E.

S.N.E.

S.S.W.

N.N.W.

61°10'

61°00'

118°00'

117°45'

117°30'

117°15'

117°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP, MUSKEG

DATE: SEPTEMBER 1969

PLACID OIL COMPANY

BEAVER LAKE

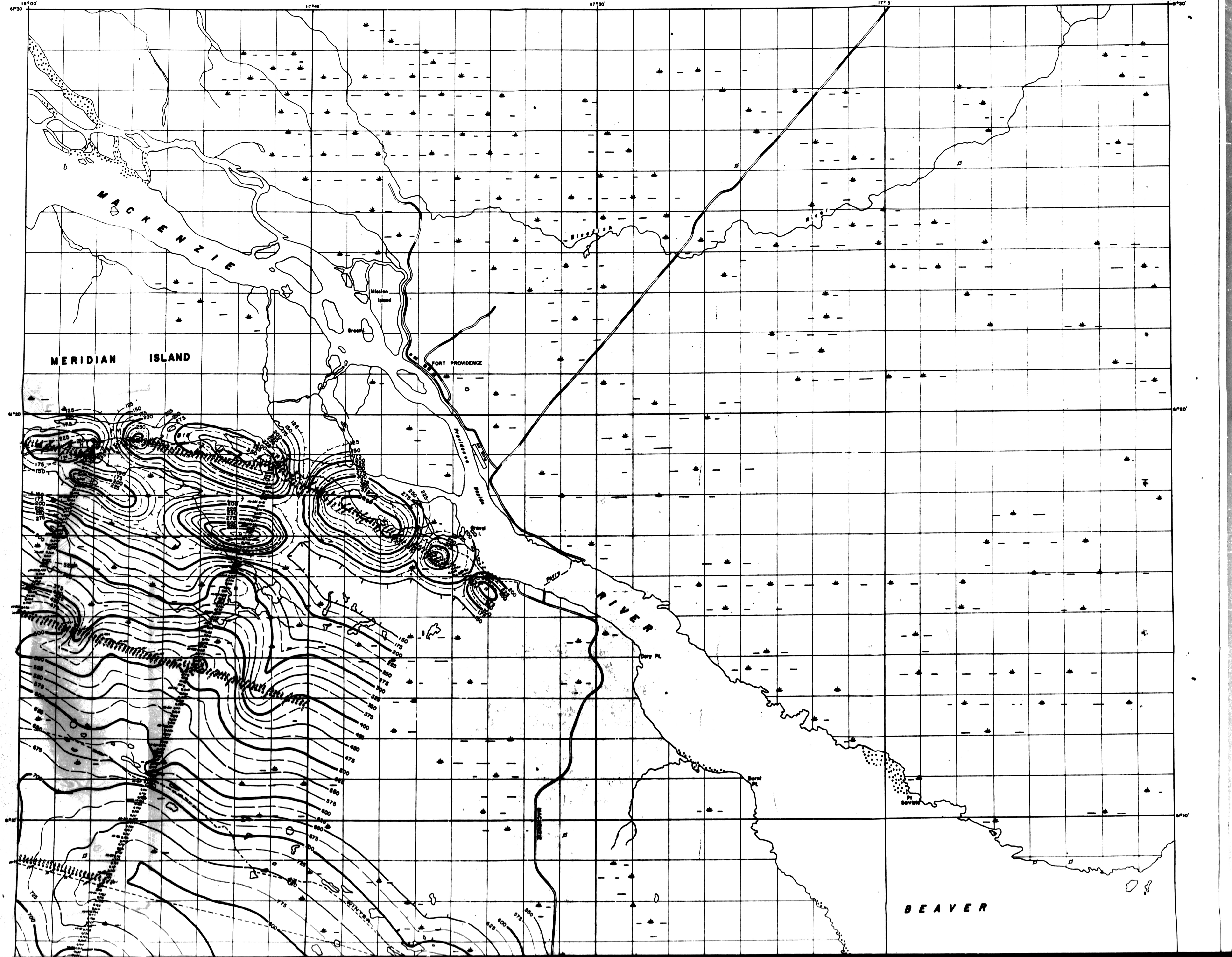
ELEVATION OF DATUM

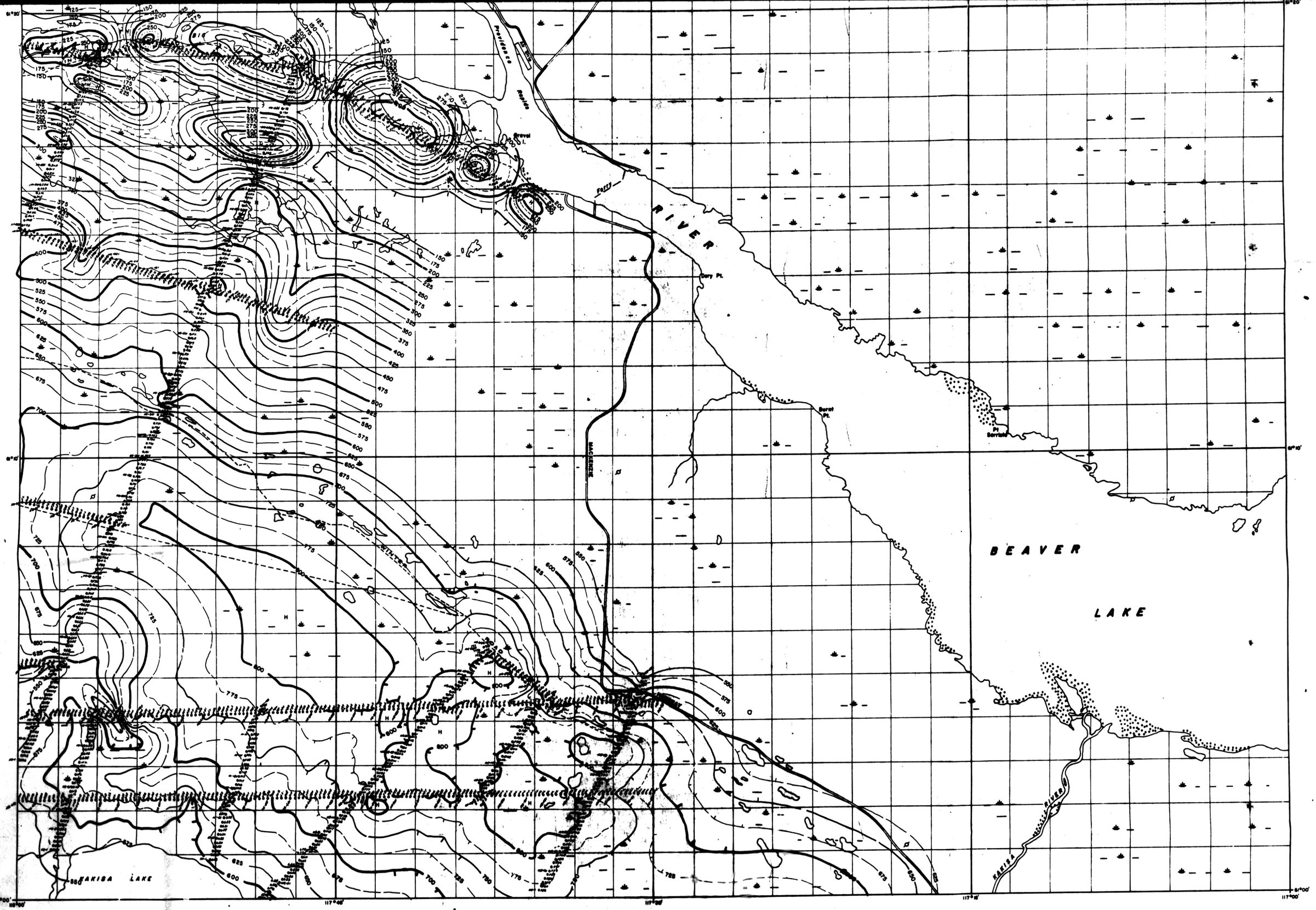
CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED

C.I. 25' DATUM SEA LEVEL

MAP NO 8

85 E/SW


118°00'
117°45'
117°30'
117°15'
117°00'
61°30'
61°20'
61°10'
MACKENZIE
RIVER
MERIDIAN ISLAND
Mission Island
Green I.
FORT PROVIDENCE
Providence
Rapids
Gravel I.
Ferry
Dory Pt.
Burnt Pt.
BEAVER



REFERENCE

- TRAILS
- RIVER, STREAM AND LAKE
- SAND OR MUD
- SWAMP, MUSKEG

PROJECT No.-	DATE - SEPTEMBER 1969

PLACID OIL COMPANY

BEAVER LAKE

ELEVATION OF BASE OF DRIFT

CONTRACTOR: BEAVER GEOPHYSICAL SERVICES LIMITED

Interpretation by: R. Leathem

C.I. 25' DATUM: SEA LEVEL

MAP NO. 4
86-E/SW

85 C NW

NORTHWEST TERRITORIES

KAKISA LAKE

TWO ISLAND LAKE

Falls Rapids

KAKISA

Gull Creek

RIVER

MACKENZIE RIVER

HIGHWAY

Lady Evelyn Falls

KAKISA

117°45'

117°30'

117°15'

117°00'

61°00'

60°50'

60°40'

600 625 650 675 700 725 750 775 H

Falls
Rapids

KAKISA

Gull
Creek

RIVER

60°40'

60°40'

TATHLINA

LAKE

60°30'
118°00'

117°45'

117°30'

117°15'

60°30
117°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP

PROJECT No -	DATE - SEPTEMBER 1959
PLACID OIL COMPANY	
KAKISA LAKE	
ELEVATION OF BASE OF DRIFT	
Contractor BEAVER GEOPHYSICAL SERVICES LIMITED	
Interpretation by [signature]	MAP NO 4
C.I. 25' DATUM SEA LEVEL	85 - C/NW

NORTHWEST TERRITORIES

85 C NW

118°00'

117°46'

117°30'

117°15'

117°00'

61°00'

60°50'

60°40'

KAKISA LAKE

TWO ISLAND LAKE

MACKENZIE RIVER

Lady Evelyn Falls

KAKISA

HIGHWAY

Falls

Rapids

KAKISA

Gull Creek

RIVER

Falls
Rapids

KAKISA

Gill
Creek

RIVER

TATHLINA

LAKE

60°30'

60°00'

117°45'

117°15'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP

PROJECT No. :

DATE : SEPTEMBER 1960

PLACID OIL COMPANY

KAKISA LAKE

SHOT POINT LOCATION

CONTRACTOR BEAVER GEOPHYSICAL SERVICES LIMITED

MAP NO 1
85-C/NW

NORTHWEST TERRITORIES

85 E SE

MILLS LAKE

MACKENZIE RIVER

WINTER ROAD

ROAD

WINTER

WINTER

ROAD

ROAD

118°00'
118°15'
118°30'
118°45'
119°00'
61°30'
61°20'
61°10'
475
500
525
550
575
600
625
650
675
700
725
750
775

MACKENZIE RIVER

Grassy

WINTER ROAD

61°10'

61°00'
119°00'

118°45'

118°30'

118°15'

61°10'
118°00'

REFERENCE

TRAILS

RIVER, STREAM AND LAKE

SAND OR MUD

SWAMP, MUSKEG

PROJECT No. -	DATE - SEPTEMBER 1969
PLACID OIL COMPANY	
MILLS LAKE	
ELEVATION OF SURFACE	
CONTRACTOR: BEAVER GEOPHYSICAL SERVICES LIMITED	
C.I. 25 DATUM SEA LEVEL	MAP NO. 2 85-F/SW