Miles 0 1 2 3 4 5 6 7 8 9 10

Feet in thousands 0 5 10 20 30 40 50

118°00' 10' 20' 30' 40' 50' 119°00' 10' 20' 30' 40' 50' 120°00' 10' 20' 30' 40' 50' 121°00' 10' 20' 30' 40' 50' 122°00' 10' 20' 30' 40' 50' 123°00' 10' 20' 30' 40' 50' 124°00' 10' 20' 30'

60°15' 20' 25' 30' 35' 40' 45' 50' 55' 61°00' 05' 10' 15' 20'

Cameron River

TATHLINA LAKE

BLOCK-A

Kohlso River

Kohlso River

LAKE

KAKISA

BLOCK-B

RIVER

MACKENZIE

MACKENZIE RIVER

NWT Providence-2

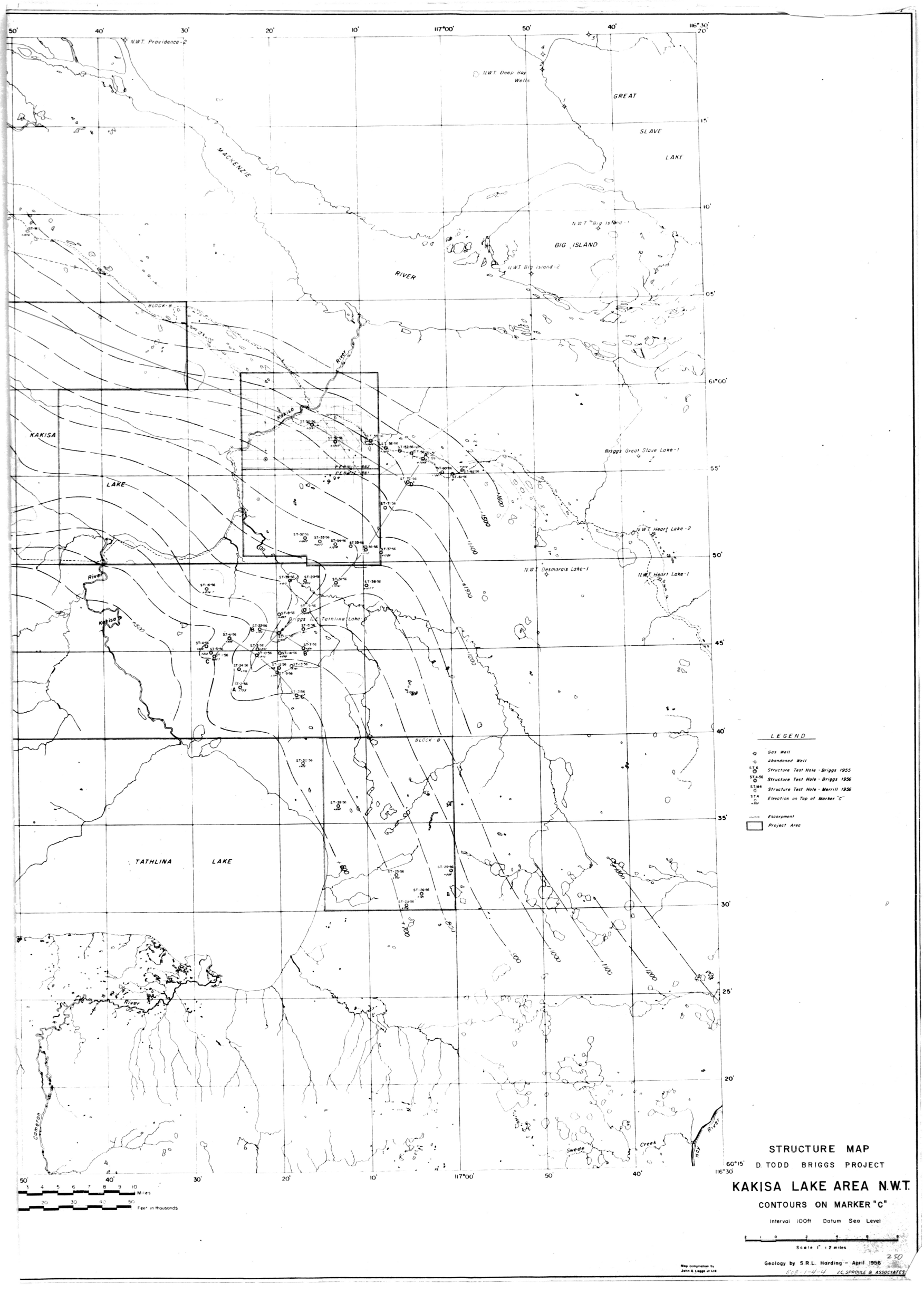
NWT Providence-1

Bigger Rabbit L.

Bigger Rabbit L.

+100 +200 +300 +400 +500 +600 +700 +800 +900 +1000 +1100 +1200 +1300 +1400 +1500

To accompany Report to A.M. Lloyd, April 30, 1956



STRUCTURE MAP

D. TODD BRIGGS PROJECT

KAKISA LAKE AREA N.W.T.

CONTOURS ON MARKER "C"

Interval 100ft Datum Sea Level

Scale 1" = 2 miles

Map compilation by John A. Legge Jr. Ltd

Geology by S.R.L. Harding – April 1956

250

EOE-1-4-4 J.C. SPROULE & ASSOCIATES

To accompany Report to A.M. Lloyd, April 30, 1956

FIGURE - VI

F

N.W.T. HEART LAKE NO. 1
KB 784'
T.D. 1757'

N.W.T. HEART LAKE NO. 2
KB 731'
T.D. 1648'

D. TODD BRIGGS GREAT SLAVE LAKE NO. 1
KB 565'
T.D. 1072'

N.W.T. BIG ISLAND NO. 1
KB 560'
T.D. 1351'

N.W.T. DEEP BAY NO. 1
KB 534'
T.D. 1321'

N.W.T. DEEP BAY NO. 2
KB 534'
T.D. 989'

NO. 4
KB 533'
T.D. 1054'

F'

N.W.T. DEEP BAY NO. 3
KB 538'
T.D. 1140'

+400
+300
+200
+100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000

HAY RIVER SHALE

SLAVE POINT FORMATION

PRESQU'ILE FORMATION

PINE POINT FORMATION

FITZGERALD FORMATION

?

LITHOLOGICAL LEGEND

- Green Shale
- Grey Brown Shale
- Brecciated Limestone
- Limestone
- Reef, Limestone
- Reef, Dolomite
- Possible Reef or Reef Wash
- Dolomite
- Brown Petroliferous Limestone
- Dolomite & Anhydrite

CROSS SECTION F-F'

LIARD RIVER-GREAT SLAVE LAKE AREA

HORIZONTAL SCALE 1" = 1 mile
VERTICAL SCALE 1" = 100 ft.

DATUM SEA LEVEL

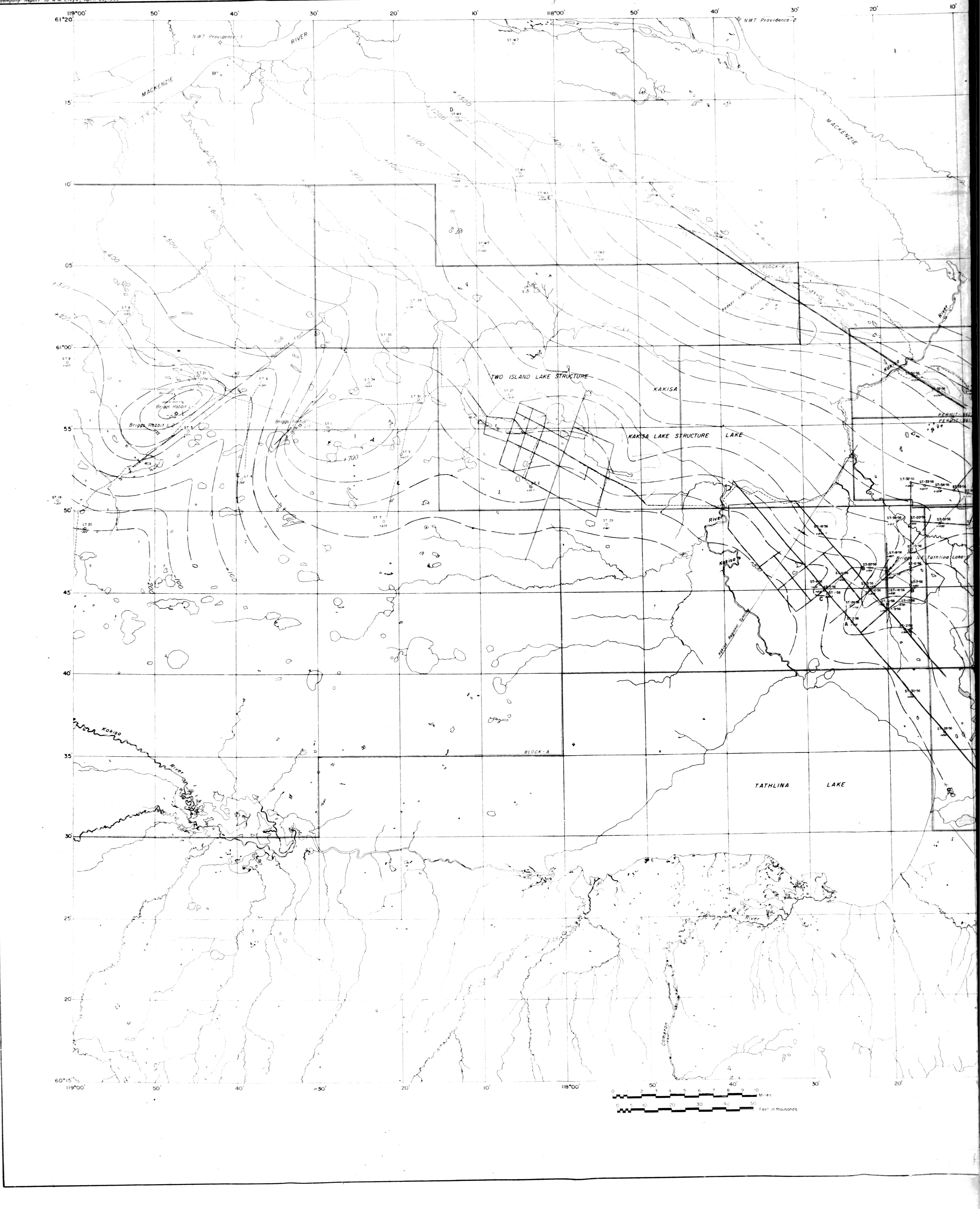
REVISED APRIL 30, 1956

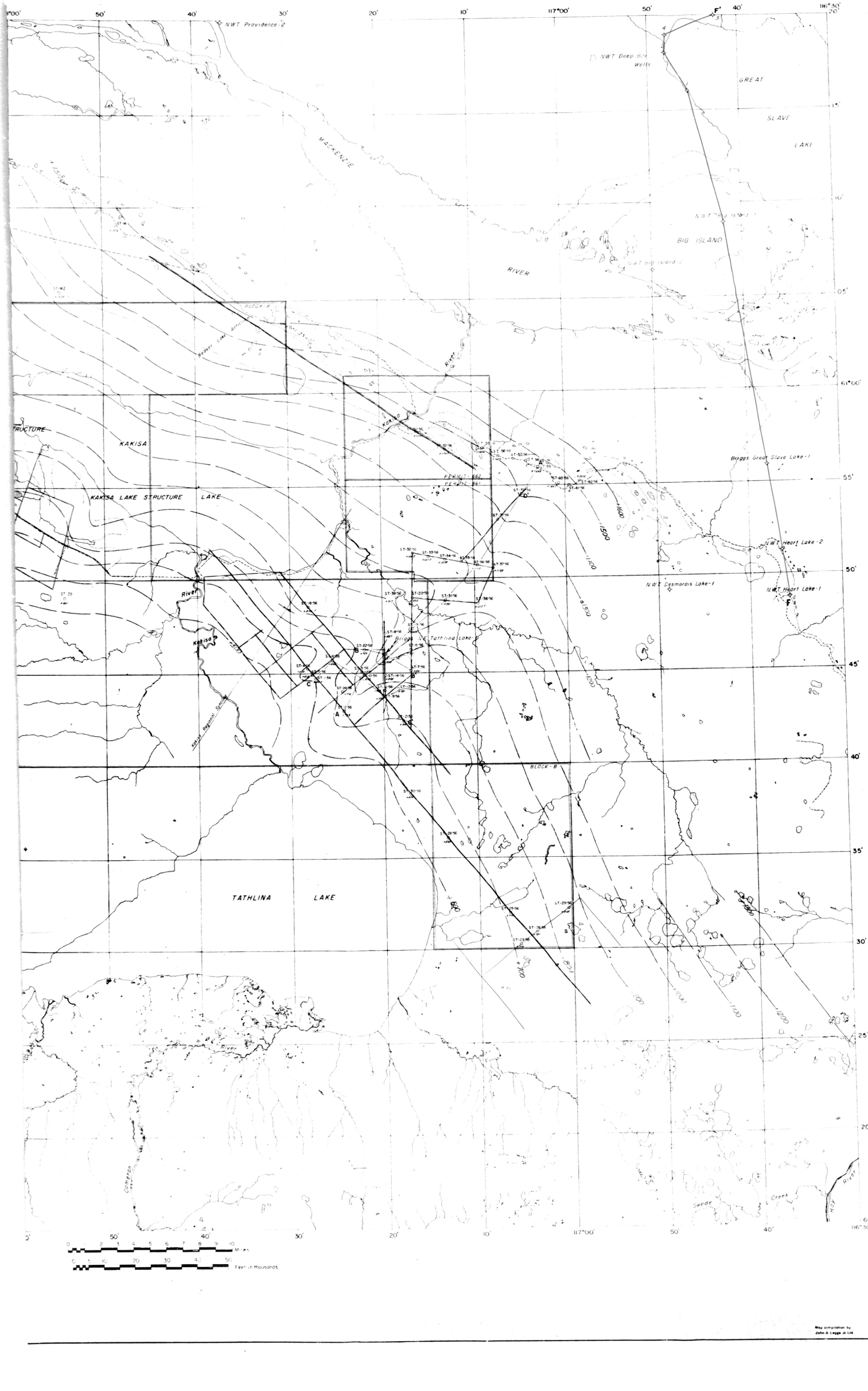
EOE - 1-4-4

W.C. Spence & Associates, Calgary

250

To accompany Report to A.M. Lloyd, April 30, 1956





LEGEND

- Gas Well
- Abandoned Well
- ST-6 — Structure Test Hole - Briggs 1955
- ST-4-56 — Structure Test Hole - Briggs 1956
- ST-M4 — Structure Test Hole - Merrill 1956
- ST-4 +Elev — Elevation on Top of Marker "C"
- Escarpment
- Project Area
- Seismic Refraction Line
- Seismic Reflection Line

0 10 20 30 40 50 Miles

0 5 10 20 30 40 50 Feet in thousands

STRUCTURE MAP

D. TODD BRIGGS PROJECT

KAKISA LAKE AREA N.W.T.

CONTOURS ON MARKER "C"

Interval 100ft Datum Sea Level

Scale 1" = 2 miles

606-1-44 250

Geology by S.R.L. Harding — April 1956

Map compilation by John A. Legge Jr. Ltd

J.C. SPROULE & ASSOCIATES

250

GEOLOGICAL PROGRESS REPORT

D. TODD BRIGGS PROJECT, N.W.T.

AS OF APRIL 30, 1956

With Particular Reference to Structure Test Results

In Relation to Overall Exploration Program

J. C. SPROULE & ASSOCIATES
GEOLOGICAL & EXPLORATION CONSULTANTS

901 EIGHTH AVENUE WEST
CALGARY — ALBERTA

TELEPHONES
24128 - 24374

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

Structure Test Logs:

GEOLOGICAL PROGRESS REPORT

D. TODD BRIGGS PROJECT, N.W.T.

AS OF APRIL 30, 1956

PART I - STRUCTURE TEST PROGRAM

INTRODUCTION

A structure test program was conducted on the eastern portions of "Block B" and on Petroleum and Natural Gas Permits Nos. 661 and 662 of the D. Todd Briggs Account Project in the Northwest Territories during a 31-day period from February 23rd to March 24th, 1956. This structure test program was conducted as a supplement to the geophysical program for the purpose of checking uncertain seismic records in a poor reflection area. Although geologist K. W. Lyle of J. C. Sproule & Associates was in charge of structure test correlation work, the selection of structure test locations was under the direction of the geophysical supervisor and of Mr. A. M. Lloyd, who was in the field during the latter part of the program.

Structure test holes were drilled by Geophysical Prospecting Company, Canada Ltd. and other contractors whose primary work in the area was the drilling of seismic shot holes. Altogether, 48 structure tests were drilled. Electric logs were run on 45 of these by Electronic Logging and Velocity Co. Ltd. Of the three relatively shallow unlogged holes which were drilled late in the season, one, No. 35-56, encountered artesian water and the other two, Nos. 57-56 and 61-56, had caved before the logging truck arrived. The 45 logged holes total 7,629 feet, for an average depth per hole of 169.5 feet. Correlations, based on electric logs supplemented by lithologic samples, have been made with confidence on all but three logs. The correlation of No. 16-56 is uncertain and the logs for Nos. 58-56 and 71-56, drilled to depths of 53 and 72 feet respectively, do not represent enough bedrock section to permit correlation.

The structure test work for the 1956 D. Todd Briggs Account is correlated with seven structure tests drilled north of Kakisa Lake this year by Merrill Petroleums Ltd., obtained on an exchange basis, and with the 1955 D. Todd Briggs structure test program.

This report is illustrated by a 2-mile to 1-inch map of the area from 60° 15' to 61° 20' North Latitude and 116° 30' to 119° West Longitude, showing geologic structure based on the structure test data. Other illustrations include four figures showing five cross-sections. Also included are prints of the 45 1956 Briggs structure test logs, the log for the upper portion of D. Todd Briggs Northeast Tathlina Lake No. 1 deep test, the seven Merrill logs and reprints of two of the 1955 Briggs structure test logs, all showing the markers used for correlation.

STRUCTURE TEST MARKERS IN RELATION TO STRATIGRAPHY

Useful structure test markers in the general Kakisa Lake area have from time to time over the past two years been designated by letters of the alphabet as found convenient. Because the order of discovery and use of such markers has not coincided with the stratigraphic succession, the order of markers as they now appear in the geologic section is not alphabetical. The order of structure test markers as used on the various logs and cross-sections accompanying this report are from top to bottom as follows: Markers E, D, F, A, B, W, C, M, Z, O, X, R, T, U, P, Y and Q. Particular letters designate the same markers for all projects in the area.

The approximate correlation of structure test markers with the stratigraphic nomenclature used in the "Report on Summer Geological Program, 1955, D. Todd Briggs Project, N.W.T." is as follows:

Marker "D" - Base of Wabamun Formation
Interval Marker "D" to Marker "F" - Trout River Formation
Interval Marker "F" to Marker "Q" - Grumbler Formation
Marker "Q" - Top of Alexandra Formation

The Kakisa Reef member which occupies the interval from Marker "F" to "B" in the upper part of the Grumbler Formation, includes two zones of major reef development. Marker "A" is at the base of the upper or "A" reef and Marker "B" is at the base of the lower or "B" reef.

The Lower Grumbler Reef member, which is shown in Figures II and IV, loses character to the south and west of Structure Test No. 70-56. This was to be expected from the results of the surface geological studies.

The most prominent limestone bed on Kakisa River below Kakisa Lake forms the Lady Evelyn Falls, from which it has been named the Lady Evelyn Falls member. Loose correlations previously made between the several Briggs deep tests and the outcropping Lady Evelyn member can now be revised (See Figures II and IV). Marker "P" marks the top of the Lady Evelyn Falls member.

Marker "Y" is believed to be the approximate equivalent of the limestone bed which weathered with a peculiar mottling, which made it useful as a marker bed for surface geological work.

A very limited lime section below Marker "Q" appears to be all that is left of the Alexandra formation, so-named from its complete exposure at Alexandra Falls on Hay River. There is no evidence of any development of the Heart Lake reef in any of the tests drilled this year. Nor is there any evidence of limestone beds equivalent to the Louise Falls reef member.

From the above paragraph it can be observed that, in general, the idea that the Upper Devonian becomes increasingly limy from west to east has been further confirmed. The following is additional evidence. In the area of 1955 structure test work, Marker "C" marked the transition to an essentially shale section and Marker "M" was well within the shale. In this year's work north of Tathlina Lake, Marker "M" was in a zone which had become so limy that due to loss of character it was no longer an ideal marker for correlation and mapping.

Although the total interval from the Kakisa Reef member to the top of the Slave Point formation shows an increase in thickness from west to east, the Grumbler formation shows an increase in thickness from east to west. This is evidenced by westward correlation from D. Todd Briggs Northeast Tathlina Lake No. 1 through Briggs Structure Tests Nos. 2 and 1 of the 1955 program and north as far as Briggs Structure Test No. 28 of the 1955 program. The interval from Marker "C" to Marker "Q" is calculated to increase approximately 170 feet in thickness from the Northeast Tathlina hole to last year's Structure Test No. 28. Locally, however, variations in stratigraphic intervals are slight and serve to assist in the structural interpretation.

Structure test data for the Kakisa Lake area for 1956 are shown in chart form in Appendix I. The chart includes data on the Merrill tests also.

GEOLOGICAL STRUCTURE

The geological structure based on the interpretation of the structure test results is shown on Figure I of the report. This figure is a structure map on Structure Test Marker "C". Structure Test Marker "C" is higher in the geologic section than any beds outcropping along the Mills Lake trail and for the more northerly structure tests, it has been necessary to obtain a value for "C" by the addition of suitable intervals to lower markers. Because of the gradual thickening of the interval "C" to "P" from east to west, the interval added to lower markers in the vicinity of the Merrill structure tests has been approximately 170 feet greater than that added for structure tests east of Lady Evelyn Falls. This has been necessary to get a relatively true structural relationship up-dip from the Rabbit Lake and Foetus Lake tests to the Merrill Permit area and up-dip from the Northeast Tathlina test to the Mills Lake trail. It has, however, had the effect of distorting slightly the regional structural strike between the area of the Merrill Project north of Kakisa Lake and the area east of Lady Evelyn Falls with respect to the strike indicated on the surface geological map accompanying the "Report on Summer Geological Program, 1955."

Cross-sections A-A', B-B', C-C', D-D' and E-E' are located as shown on Figure I and are the subjects of Figures II, III, IV and V.

The map Figure I shows a strong southwest-northeast ridge running northeast from the outlet of Tathlina Lake. The profile across this ridge in the vicinity of the Northeast Tathlina Lake No. 1 well shows it to be a couple of hundred feet high on the near-surface beds. It must be considerably higher on deeper horizons. This conclusion is supported by the thinning of beds penetrated by the structure tests over the structural high.

The Northeast Tathlina structural feature contours as a ridge and not as a fault. Our conclusion is that it must represent a linear reef development along a zone of faulting similar to the linear reef development on the fault zone at the Pine Point project. There is little evidence of such a feature crossing the Mills Lake road. Several of the bedding scarps which run northwest from the Heart Lake area cease to be expressed along the line northeast from Structure Test No. 61-56 (which incidentally was not logged). Also, the Lower Grumbler Reef development fades out to the west at this point (See last summer's report). Although there is a gap in outcrop of about a mile, no stratigraphic displacement across this gap has been recognized and furthermore Structure Test No. 60-56 is placed right in the middle of this gap and indicates little or no anomaly. Our conclusion is, therefore, that the structure is not uniform along the southwest-northeast trend and that a closure on this anomalous ridge might occur somewhere between the Northeast Tathlina well and the Mills Lake road. Structure Test No. 70-56 is the only control point in this area north of Structure Test No. 36-56. Structure Test No. 71-56 was not drilled deep enough for positive correlation.

The acquisition of the structure test data from Merrill Petroleums Ltd. has added to our knowledge of the geological structure west of Kakisa Lake. The log of Briggs Foetus Lake No. 1 showed that location to be a high point on the structure test markers, as well as seismically. Although the Briggs Foetus Lake No. 1 location is the highest point encountered to date in the Foetus Lake area, it should be noted that there is no more than three feet difference on near-surface structure markers between the Foetus Lake deep test location and the location of Briggs Structure Test No. 28, approximately 12 miles to the northeast. To the northeast of the Briggs Structure Test No. 28 location of the 1955 program the structure rises to the location of Merrill Structure Test No. 5 and then levels off somewhat again. The possibilities of locations structurally higher than the Foetus Lake well in the area southwest of Structure Test No. 28 have not been adequately explored by either structure test or seismograph methods.

The Merrill Structure Test results confirm the continued influence of the Providence Fault northeastward from the Rabbit Lake area. The possibilities for additional structural anomalies on the northwest side of the Providence Fault trend are considered excellent.

S.R.L. Harding

S.R.L. Harding, P.Eng.

PART II - SUPPLEMENTARY COMMENTS, CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

The remarks that follow are intended to knit together the principal strands of information of geological interest to the general Kakisa-Tathlina-Heart Lake area that have come to hand as a result of the last Summer Season's Surface Field work, and the past Winter Season's Structure Drilling, Deep Drilling and Seismograph operations.

The last Summer Season's Surface Field work and the Structure Drilling have been made the subject of special reports, so details having to do with those programs will not be repeated here, other than to include relevant comments in our Conclusions and Recommendations. Our Supplementary Comments will rather be confined to geological interpretations of Seismograph and Deep Drilling results. Thus:

GEOLOGICAL INTERPRETATION OF RECENT SEISMIC RESULTS

During the past season's seismic program by Seismograph Service Corporation both refraction and reflection work was carried out. Refraction lines were run from the east end of Kakisa Lake southeastward to a point a short distance southeast of Tathlina Lake and from the north side of Kakisa Lake southeastward to the southeast corner of Permit No. 662. Reflection work was carried out in the Two Island Lake area and the Northeast and Southeast Tathlina areas.

Refraction Seismic Surveys

The object of the refraction work was to make a quick preliminary evaluation of several indicated surface geological structural features.

Two of these are positive structur noses northeast of Kakisa Lake that may or may not continue to and be part of similar structural features to the south of Kakisa Lake. In both cases, incidentally, the surface structural features were southeast trending noses identified by surface outcrop work and although the intervening area was regarded as an extremely important exploration target, complete lack of surface outcrop prevented constructive surface work there, other than by the structure drill method.

The third of the surface structural features crossed by the Northeast Tathlina refraction line is a syncline that appears to trend from near Lady Evelyn Falls on the Kakisa River across the southeast end of Kakisa Lake.

One of two other (photogeological) features checked by refraction lines (RT and RT-1) is a postulated fault or tectonic line of weakness evidenced by the northwest shore of Tathlina Lake and an extension of this line that can be followed northeast in the direction of Mills Lake road. The second of the two photogeological features is a structurally high northeast-trending ridge that is suspected to extend from the southeast end of Tathlina Lake through the Heart Lake Reef structure.

Of the above surface features thus checked by refraction seismograph all were found to be present, but no other intermediate features of interest along these lines were identified. One of them, the Tathlina Lake fault, was subjected to reflection seismic work and structure drill work late in the season followed by the drilling of D. Todd Briggs Tathlina Lake No. 1 well.

In summary of the results of the above refraction work, it would appear that, despite the fact that it confirmed the presence of several known surface structural features the one feature that was further covered by reflection seismic and structure test work turned out to show that the displacement along the Tathlina "fault" or "line of weakness" is in the opposite direction to that shown by the refraction work. This, in our opinion, throws considerable doubt on the qualitative value of refraction seismograph work in this particular area.

Granted that refraction seismic work can identify the presence of abnormal structural features it would, in our opinion, have been more useful for Refraction Line RK to have been run parallel to its present course but along the north shore of Kakisa Lake. It might then have provided additional control for the several suspected reefoid highs indicated by surface work south of Kakisa Lake features that may or may not be connected to the "wrinkles" known along the Mills Lake road to the northeast. Previous seismic work in the area had already shown that it should confirm the existence of such "wrinkles" as were already known along the Mills Lake road. The almost continuous outcrop along the Mills Lake road left no room for significant structures not observed during the surface survey. (See for example Figure II of our Geological Report of February 1955 or Figure I of our Report of November, 1955.)

Reflection Seismic Surveys

During the past winter season reflection seismic work was carried out in three areas, the Two Island Lake area, the Northeast Tathlina area and the Southeast Tathlina area. We will refer only briefly to each of these surveys.

1. Two Island Lake Area

The S.S.C. report on the Two Island Lake area is stated in the Introduction to have been designed to check structural conditions indicated by structure test results, but reference to the area outlined by this survey on the accompanying Figure IA shows it to have been located midway between the Two Island Lake structure and the Kakisa Lake structure. Neither of these structurally high areas have, therefore, been checked by seismograph as yet. Incidentally, both these two structures are known in much more detail from surface outcrop information than from structure test data which latter is too sparse by itself to localise the two structures. In other words, these two structures as shown on the accompanying Figures I and IA are localized on it by detailed surface work, not by the few scattered test holes shown. They are well worthy of further attention.

2. Northeast Tathlina Prospect

The Introduction in the S.S.C. report on this prospect appears to contain a mis-statement of fact to the extent that the anomaly concerned was not

discovered by refraction shooting last winter but rather by previous photo-geological studies by the undersigned. It is pertinent, furthermore, that the high part of the anomaly shown by refraction shooting turn out to be the "low" part of the line when reflection work and structure test work was done.

We believe it to be very important to a proper understanding of the value of the seismic work done in this general area that, partly as a result of early recognition of the poor record quality that was the cause of these discrepancies, the Geophysical Consultant, Mr. Legge, agreed to use electric log records in structure test holes to check and to supplement the seismic results in this immediate area. Had this not been done the resultant seismic picture would have been a sad affair. We are not aware of the sequence of events that took place in arriving at final seismic interpretations during the latter part of this Northeast Tathlina Lake program but we do know that in the early stages of the program seismic control points were altered to conform to the structure test control data.

The above facts are no reflection on the seismic method as a tool or on the organization or the staff involved in the work. The seismic method is known to be the most useful tool known to the Petroleum Exploration Industry. Seismograph Service Corporation of Canada, the Company that carried out the work, are widely known to be one of the best, if not the best, consultants in the business. The Geophysical consultants concerned are also known to be the best available. The conclusion we are forced to arrive at is that record quality is so unreliable in this area that future seismic survey work should be used sparingly and only to check detail on structures that can be much cheaper and better outlined in preliminary fashion by surface geological and structure test work.

3. Southeast Tathlina Lake Prospect

The Southeast Tathlina Lake Prospect was subjected to a limited shooting program, calculated to check a refraction anomaly in the vicinity of a phtogeological anomaly, but the survey was too limited areally to be conclusive.

GEOLOGICAL INTERPRETATION OF RECENT DEEP DRILLING RESULTS

Three tes[t]s of the Slave Point-Presqu'ile group were completed during the past winter sea[son]. These wells are D. Todd Briggs Foetus Lake No. 1, D. Todd Briggs Northea[st] Tathlina Lake No. 1 and D. Todd Briggs Great Slave Lake No. 1. The location[s] of these three holes are shown on the accompanying Figure IA and completion reports on all three have previously been submitted. In the brief selected supplementary notes on each well that follow no attempt is made to do other than bring the results into focus from the standpoint of possible local and regional reservoirs.

D. Todd Briggs Foetus Lake No. 1

This well was drilled on a fairly large structure, the Foetus Lake structure, located on the east side of the Providence fault, on the opposite side from the Rabbit Lake structure, which was the first structure drilled in the area

and which yielded an indicated commercial flow of gas in excess of 17 million cubic feet open flow potential. The Foetus Lake well proved to be 180 feet higher than the Rabbit Lake well on the near-surface marker used for structure test control 118 feet higher on the Presqu'ile horizon and 114 feet higher on the Precambrian. These figures are, in our opinion, very significant, particularly when we consider that the two wells concerned are on approximately the same regional strike. We approached this problem three years ago with the idea that the surface features we were observing are probably reflections of basement features, and that the surface localizations of reefoid facies are related to other similar localizations of reefoid facies at the Presqu'ile horizon. On the Foetus Lake structure the Presqu'ile reservoir, which yielded only water in the test of the first well, has in our opinion an excellent potential. The Foetus Lake well was drilled on the highest known part of the structure but we do not believe it was by any means the highest part of the structure. At the "C" marker used in the structure test work the Foetus Lake well is level with structure test hole No. 28, approximately twelve miles to the northeast, in what should be an up-dip position on a fairly high angle regional slope. This leaves plenty of room for a "Foetus Lake" structure of major proportions, higher structurally than the well drilled. There is also room on this terrace for a stratigraphic trap of major proportions.

In conclusion, there is too much reason to believe in the probable presence of a large structure in the general Foetus Lake area, and there were too many shows of oil and gas in the wells drilled in this area of the Northwest Territories to allow us to believe that the Foetus Lake structure, or affiliates of the Rabbit Lake structure, have been satisfactorily tested as yet.

D. Todd Briggs Northeast Tathlina Lake No. 1

The Tathlina Lake well was drilled under the pressure of a shortage of time, near the end of the winter season and the location made before the combined Seismic and Structure Drill work had located the highest portions of the structure. The net result was that the hole was drilled possibly several hundred feet below the crest of the structure, work on which has still not been completed.

The fact that approximately 50 feet of water-free oil soaked limestone was cored in the Presqu'ile in this well is extremely significant. (See photographs of core in Well Report.) A recent inspection of the cores found no residual salt crystal "fuzzy" which is customarily present on salt water cores after they stand for a few weeks.

Core analyses of representative sections of the entire Presqu'ile have been analysed. The results of this analyses have not yet been received, but by telephone we have been advised that the weighted average porosity is 3.88%, the weighted average radial permeability is 1.45 millidarcys, and the weighted average vertical permeability is 0.26 millidarcys. Individual sample maximum porosity is 8.2% with quite a few running 4 to 6% and some between 6 and 8%. Individual sample maximum radial permeability is 11 millidarcys, and most are between 1 and 4 millidarcys.

Porosities and permeabilities are generally low, but on the credit side the limestone is a very clean lime rock, readily susceptible to acidization. Whether or not this section could be produced in this well is somewhat beside the main point, that oil of a light gravity is present in a water-free section, on a large structure that cannot be assumed to be of uniform porosity. It should not be forgotten that this is another photogeological feature that indicates basement origin and variable sedimentary and porosity conditions laterally at any or all levels.

D. Todd Briggs Great Slave Lake No. 1

The Great Slave Lake well was drilled on a seismic feature in the vicinity of the Heart Lake reef structure. This well, like N.W.T. Heart Lake No. 1 and No. 2 wells, yielded only salt water from the Slave Point-Presqu'ile group.

The structural relationships between the three Heart Lake wells is shown on the accompanying cross-section, Figure VI. As you will observe, there is considerable relief between Heart Lake No. 1 and No. 2 wells, the type of relief we would expect around this well developed reefoid feature.

In our opinion, the Heart Lake reef is the finest example in the entire Hay River area of a near-surface reef reflecting excessive reef conditions at depth. We do not know the outlines of this reef, but believe the outlines could be determined by a limited amount of structure test work.

The three holes already drilled must themselves be regarded as only structure tests. The two N.W.T. Heart Lake wells were drilled as structure tests. The Great Slave Lake well was drilled on a very doubtful seismic feature, part of a "broken glass" pattern of fault blocks that in our opinion makes no sense whatever in relation to the known geology of the area.

The conclusions we reach in relation to the Heart Lake structure are that the Presqu'ile horizon provides an excellent prospective reservoir, and that we have as yet no idea as to the outlines of the closed structure we believe to be present.

CONCLUSIONS AND RECOMMENDATIONS

The most important single conclusion to be drawn from the results of the past field season's surface survey is that near-surface limestone and reefoid horizons lower in the section, such as the Louise Falls member, fade out toward the Providence High and are followed at higher levels by reefoid horizons that shift progressively northwestward higher on the flank of the Providence High, thus proving the existence of a steadily foundering Late Devonian basin, on and around the foundering Providence High, on the flank of which our "Shelf" area is located.

The relatively short structure test program carried out on the Merrill Project (the results of which we obtained by exchange) and in the Tathlina area, showed conclusively that such exploratory work can be conducted in this area efficiently, economically and with most useful results.

The Rabbit Lake, Foetus Lake, Two Island Lake, Kakisa Lake and Northwest and Southeast Tathlina and the Heart Lake structures, are all features that have been detected by surface geological methods and partly refined by Seismic and/or structure test methods. They are all probably built on or around basement irregularities that are as yet imperfectly known. Further work on, or in the vicinity of, all these features and others, is desirable, with the Presqu'ile being the principal objective.

The deep test drilling in this general area has yielded sufficient shows of oil and gas (Rabbit Lake, Foetus Lake, Tathlina Lake, Heart Lake, Escarpment Lake, Deep Bay area, etc.) that we should be able to feel with assurance that all that is needed to yield hydrocarbons in commercial quantities is a satisfactory trap. We believe the Kakisa-Heart Lake Shelf area probably contains a number of such traps.

The deep drilling in the general area shows in general an increasing development of reefoid conditions from West to East. The fact remains, however, that the residual-type structures with which we are dealing will have variable reservoir conditions at the Presqu'ile horizon, on and around each structural feature.

No deep hole yet drilled in this general area can be regarded as a conclusive test of the Presqu'ile reservoir involved. Even the Rabbit Lake structure is one that has probably been tilted or fractured and the oil drained updip into other structural traps along the Providence "fault" zone.

We must conclude, in summary of the above, that the Kakisa-Tathlina-Heart Lake Shelf, or Terrace area is a highly promising one.

It is our recommendation that future exploratory work in the general area be largely confined initially to structure testing of the several untested features and areas now known and believed to be of paramount interest.

It is our further recommendation that seismic work in this area be reduced to problems of local refinement of structures outlined for drilling and that most of such refining of known structures be a selective process, after the bulk, at least, of the structure test work has been completed. It should be noted at the same time that there are several structures in the area now ready for seismic refinement.

J.C. Sproule, P. Eng.

901 - 8th Ave. West,
Calgary, Alberta
May 16, 1956.

STRUCTURE TEST DATA - KAKISA LAKE AREA, 1956

D. TODD BRIGGS PROJECT, N.W.T.

(Including Data Obtained from Merrill Petroleums)

S.T. No.:	1	2	3	4	5	6	7	8	9	10	11	N.E. Tath. L. No. 1	12	13	14	15	16	19
Elev. K.B. (Feet):	+882	+920	+873	+885	+883	+867	+860	+809	+886	+877	+844	+850	+883	+879	+873	+824	+865	+816
Total Depth (Feet):	374	295	132	147	130	114	124	321	103	161	265	2222	149	158	508	182	103	227
Marker "B" - Depth:	82			87	72	32												
Elev.:	+800			+798	+811	+835												
Marker "A" - Depth:	155	85				103			22									
Elev.:	+727	+835				+764			+864									
Marker "C" - Depth:	275	195	52				19			45			115	98	35			
Elev.:	+607	+725	+821	+605*	+618*	+644*	+841	+889*	+751*	+832	+949*	+949*	+768	+781	+838	+901*	+836?*	+1006*
Marker "M" - Depth:	336	253	119				82			110					100		827	
Elev.:	+546	+667	+754				+778			+767					+773		+7837	
Marker "Z" - Depth:								202			160				302	198		75
Elev.:								+607			+684				+571	+636		+741
Marker "O" - Depth:																		
Elev.:																		
Marker "X" - Depth:								317				280			413			182
Elev.:								+492				+570			+460			+634
Marker "R" - Depth:																		
Elev.:																		
Marker "T" - Depth:																		
Elev.:																		
Marker "U" - Depth:												486						
Elev.:												+365						
Marker "P" - Depth:												512						
Elev.:												+338						
Marker "Y" - Depth:												628						
Elev.:												+222						
Marker "Q" - Depth:												652						
Elev.:												+198						

* Interpolated value.

Note: Briggs S.T. Nos. 35, 57 and 61 were not logged.

S.T. No.:	20	21	22	23	24	25	26	28	29	30	31	32	33	34	36	37
Elev. K.B. (Feet):	+788	+907	+845	+944	+894	+967	+976	+956	+966	+938	+803	+794	+803	+809	+846	+856
Total Depth (Feet):	151	108	122	300	141	172	164	265	123 132	183	151	147	124	144	127	155
Marker "B" - Depth:		22		29		62		112		123						
Elev.:		+885		+915		+905		+844		+815						
Marker "A" - Depth:		92		102	65	129	67	180								
Elev.:		+815		+842	+829	+838	+909	+776								
Marker "C" - Depth:			120	230					108							
Elev.:	+939*	+700*	+725	+714	+714*	+710*	+781*	+648*	+858	+625*	+1050*	+1062*	+1077*	+1078*	+1110*	+1139*
Marker "M" - Depth:																
Elev.:																
Marker "Z" - Depth:	114															
Elev.:	+674															
Marker "O" - Depth:																
Elev.:																
Marker "X" - Depth:											129	108	102	107	112	93
Elev.:											+674	+686	+701	+702	+734	+763
Marker "R" - Depth:																
Elev.:																
Marker "T" - Depth:																
Elev.:																
Marker "U" - Depth:																
Elev.:																
Marker "P" - Depth:																
Elev.:																
Marker "Y" - Depth:																
Elev.:																
Marker "Q" - Depth:																
Elev.:																

See Report 008-1-45-5

S.T. No.:	38	39	50	52	55	56	58**	59	60	62	70	71**	2-55	28-55
Elev. K.B. (Feet):	+818	+787	+726	+801	+726	+717	+753	+799	+798	+807	+845	+888	+1035	+792
Total Depth (Feet):	161	144	203	102	124	85	53	97	102	164	252	72	1419	792
Marker "B" - Depth:													280	
Elev.:													+755	
Marker "M" - Depth:														
Elev.:														
Marker "C" - Depth:													478	53
Elev.:	+1027*	+917*	+1331*	+1345*	+1404*	+1403		+1468*	+1461*	+1519*	+1404*		+557	+739
Marker "H" - Depth:													540	123
Elev.:													+495	+669
Marker "Z" - Depth:		135												
Elev.:		+652												
Marker "O" - Depth:													840	430
Elev.:													+195	+362
Marker "X" - Depth:	167*													
Elev.:	+651													
Marker "R" - Depth:													989	648
Elev.:													+ 46	+144
Marker "T" - Depth:														
Elev.:														
Marker "U" - Depth:				38							23			
Elev.:				+763							+822			
Marker "P" - Depth:				61							47		1157?	
Elev.:				+740							+798		-122	
Marker "I" - Depth:			131		58	50		67	73	24	177		1267	
Elev.:			+595		+668	+667		+732	+725	+783	+668		-232	
Marker "Q" - Depth:			157		80	73		91	99	50	203		1313	
Elev.:			+569		+646	+644		+708	+699	+757	+642		-278	

** Not correlated.

S.T. No.:	M-1	M-2	M-3	M-4	M-5	M-6	M-10
Elev. K.B. (Feet):	+780	+812	+786	+738	+779	+600	+715
Total Depth (Feet):	425	614	592	342	403	1127	507
Marker "B" - Depth:							
Elev.:							
Marker "A" - Depth:							
Elev.:							
Marker "C" - Depth:							
Elev.:	+1574*	+1328*	+1254*	+1221*	+1080*	+1225*	+1088*
Marker "M" - Depth:							
Elev.:							
Marker "Z" - Depth:							
Elev.:							
Marker "Q" - Depth:							
Elev.:							
Marker "X" - Depth:							
Elev.:							
Marker "R" - Depth:		84	146	132	298		132
Elev.:		+728	+640	+606	+481		+583
Marker "T" - Depth:		186	232	211	392		
Elev.:		+626	+554	+527	+387		
Marker "U" - Depth:		244					
Elev.:		+568					
Marker "P" - Depth:		267	315	300		158	410
Elev.:		+545	+471	+438		+442	+305
Marker "Y" - Depth:	123	401	442			274	
Elev.:	+657	+411	+344			+326	
Marker "O" - Depth:	169	452	492			331	
Elev.:	+611	+360	+294			+269	

A

A'

ST 2-56
ELEV 920'

ST 10-56
ELEV 877

D TODD BRIGGS NE TATHLINA L-1
ST 11-56
ELEV 850'

ST 19-56
ELEV 816'

ST 31-56
ELEV 803'

ST 36-56
ELEV 846

ST 70-56
ELEV 845'

ST 59-56
ELEV 799

SP

R

MARKER "C"

MARKER "M"

LOG OF ST 14

LOG OF ST 11

MARKER "X"

LOWER GRUMBLER REEF

DATUM

+900'

+800'

+700'

+600'

+500'

+400'

+300'

+200'

+100'

MARKER "Z"

MARKER "X"

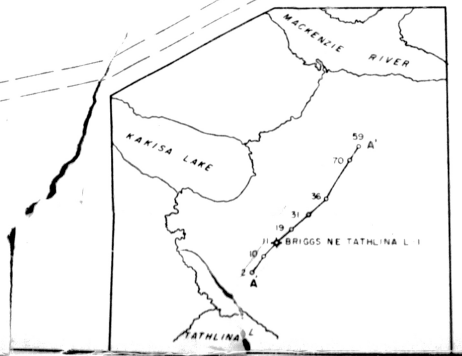
MARKER "U"

MARKER "U"

MARKER "D"

MARKER "Y"

MARKER "Q"



D TODD BRIGGS PROJECT

STRUCTURE CROSS SECTION A-A'

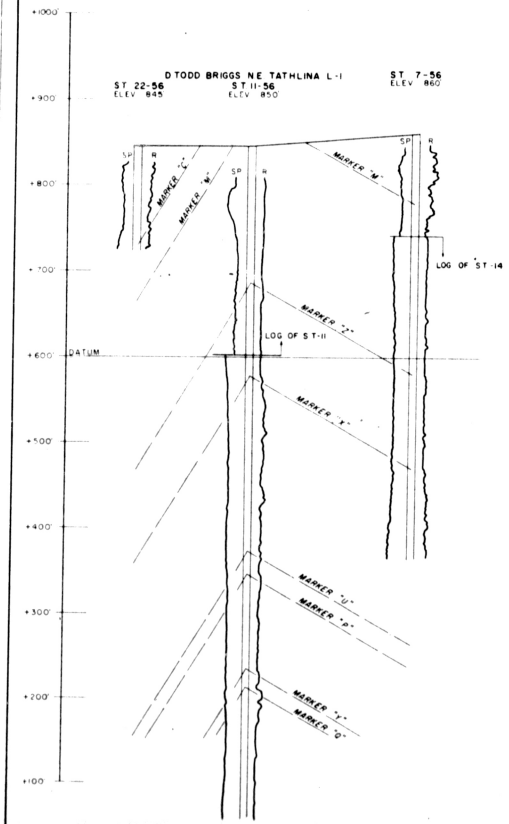
KAKISA LAKE AREA N.W.T.

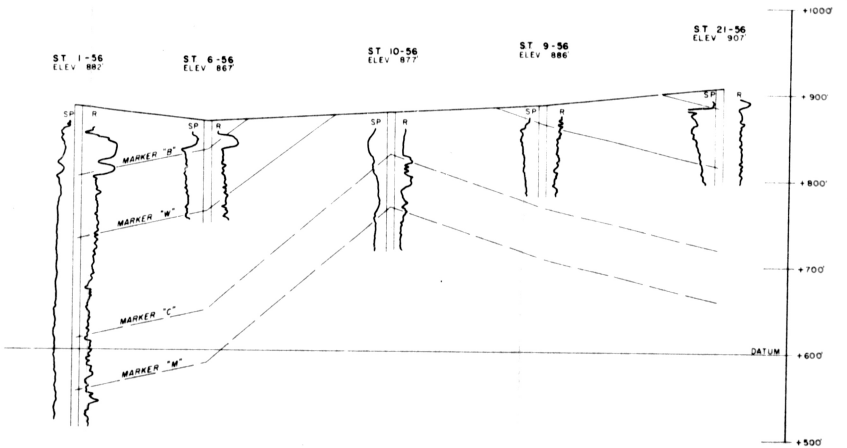
0 1 2 3

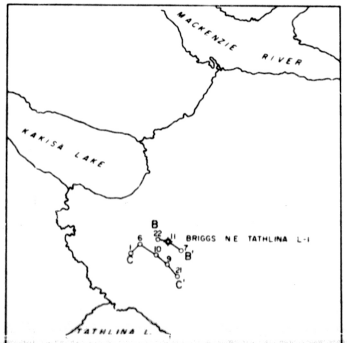
HORIZONTAL SCALE - MILES

J.G. STROULE & ASSOCIATES

B B' C C'







D. TODD BRIGGS PROJECT

STRUCTURE CROSS SECTIONS B-B' & C-C'

KAKISA LAKE AREA N.W.T.

0 1 2 3

HORIZONTAL SCALE - MILES

To accompany Report to A.M. Lloyd, April 30, 1956

FIGURE-17

250

D

D'

TRUE DISTANCE 236 MILES
(10 Miles Have Been Deleted Owing To Extensive Length of Cross Section)

+1000'
+900'
+800'
+700'
+600'
+500'
+400'
+300'
+200'
+100'

DATUM

ST - M6
ELEV. 600'

ST - M4
ELEV. 738'

ST - M3
ELEV. 786'

ST - M2
ELEV. 812'

S.T. 50-56
ELEV. 726'

S.T. 70-56
ELEV. 845'

SP

R

MARKER "R"

MARKER "T"

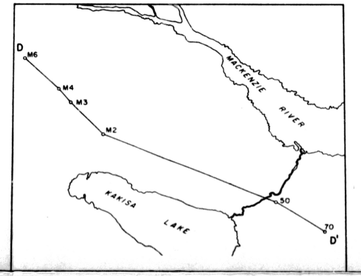
MARKER "U"

MARKER "P"

MARKER "Y"

MARKER "Q"

LOWER GRUMBLER REEF



D. TODD BRIGGS PROJECT

STRUCTURE CROSS SECTION D-D'

KAKISA LAKE AREA N.W.T.

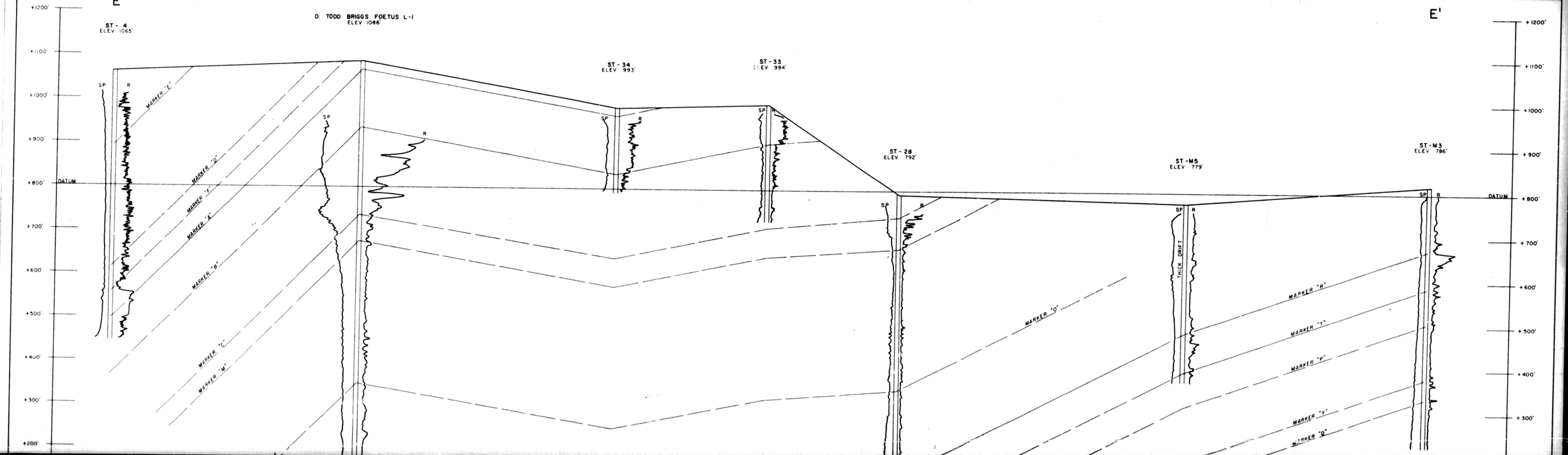
0 1 2 3

HORIZONTAL SCALE - MILES

J.C. SPROULE & ASSOCIATES

To accompany report to Gil Lloyd, April 30, 1956

FIGURE 8



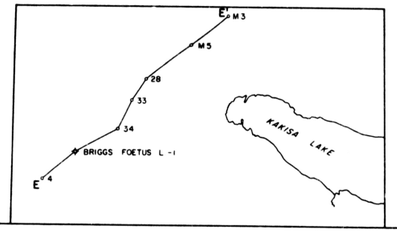
+100'

0'

-100'

-200'

MARKER "Q"?



D. TODD BRIGGS PROJECT

STRUCTURE CROSS SECTION E-E'

KAKISA LAKE AREA N.W.T.

0 1 2 3

HORIZONTAL SCALE - MILES

J.C SPROULE & ASSOCIATES

259

R E P O R T

ON A SEISMOGRAPH SURVEY

conducted in

NORTHWEST TERRITORIES, CANADA

TWO ISLAND LAKE PROSPECT

f o r

NEW D. TODD BRIGGS ACCOUNT

DALLAS, TEXAS, U.S.A.

Seismograph Service Corporation of Canada

Calgary, Alberta

CONTENTS

INTRODUCTION

A reflection seismograph survey was conducted in the Two Island Lake Area of the Northwest Territories for the D. Todd Briggs Account during December, January and February, 1956. The purpose of this survey was to check anomalous near surface structural conditions indicated by a slim hole program conducted during the Winter of 1954 - 1955. A further objective was to locate and determine, if possible, the subsurface expression of the Beaver Lake Anticline which is exposed to the north near the Mackenzie River.

DISCUSSION OF RESULTS

General

Two major features of interest are defined by the shooting on this prospect. The first of these is an anticlinal trend extending in a northwest-southeast direction across the southwestern part of the survey and exhibiting two closed features. The second is an anticlinal trend extending in a north-south direction through the central part of the prospect and containing one closure.

Two time data subsurface structural maps and one time interval map are submitted with this report. They are tentatively identified as:

Tentative Slave Point
Tentative Pre-Cambrian
Time Interval: Tentative Slave Point to
Tentative Pre-Cambrian

Tentative Slave Point

The reflection tentatively identified as originating from the Slave Point is the best reflection mapped and is believed to be most representative of a possible producing horizon in this area.

The most interesting features on this map are two closed highs located on the southeast trending anticline in the southwestern part of the survey. The first of these closed highs is centered near Shot Point 88 on Line K-11. This feature shows 12 milliseconds of north dip and 20 milliseconds of southeast dip. The second closed high is located immediately to the west of the first and is separated from it by a small saddle. This

feature shows about 20 milliseconds of north dip. Little west dip is defined by the data and further seismic control to the northwest would be desirable to determine the true nature and extent of closure in this direction.

A high feature with about 10 milliseconds of closure is present on the north-south trending anticline near the center of the prospect. This high is centered near Shot Point 94 on Line K-9 and extends through the intersection of Line K-1 with K-2.

A third anticlinal trend with no closure is contoured as branching off of the first anticlinal trend near the intersection of Lines K-8 and K-9. This weak feature lies between the previously mentioned highs and plunges north-northwest to the limits of the prospect.

There is a possibility of a fault downthrown to the north and extending in an east-west direction across the western half of the survey. This fault if present is located immediately to the north of the two closed highs contoured on the first anticlinal trend discussed.

Tentative Pre-Cambrian

The contour interpretation of the Pre-Cambrian map is closely conformable to that of the Slave Point map but reflection quality is not as good at this level.

Time Interval Map

The time interval map between the Slave Point and the Pre-Cambrian levels shows a slight thickening of interval to the northwest with local thinning of section on the structural highs and thickening of section in the lows.

CONCLUSIONS and RECOMMENDATIONS

The closures mapped on this prospect are seismically as satisfactory as any previously mapped. If porosity prospects are satisfactory, a drill test is believed justified.

Additional shooting following the high trends beyond the present limits of the survey can be recommended.

Respectfully submitted,

Seismograph Service Corporation
of Canada

By - J. G. Bunker - Party Chief

By L. G. Morris

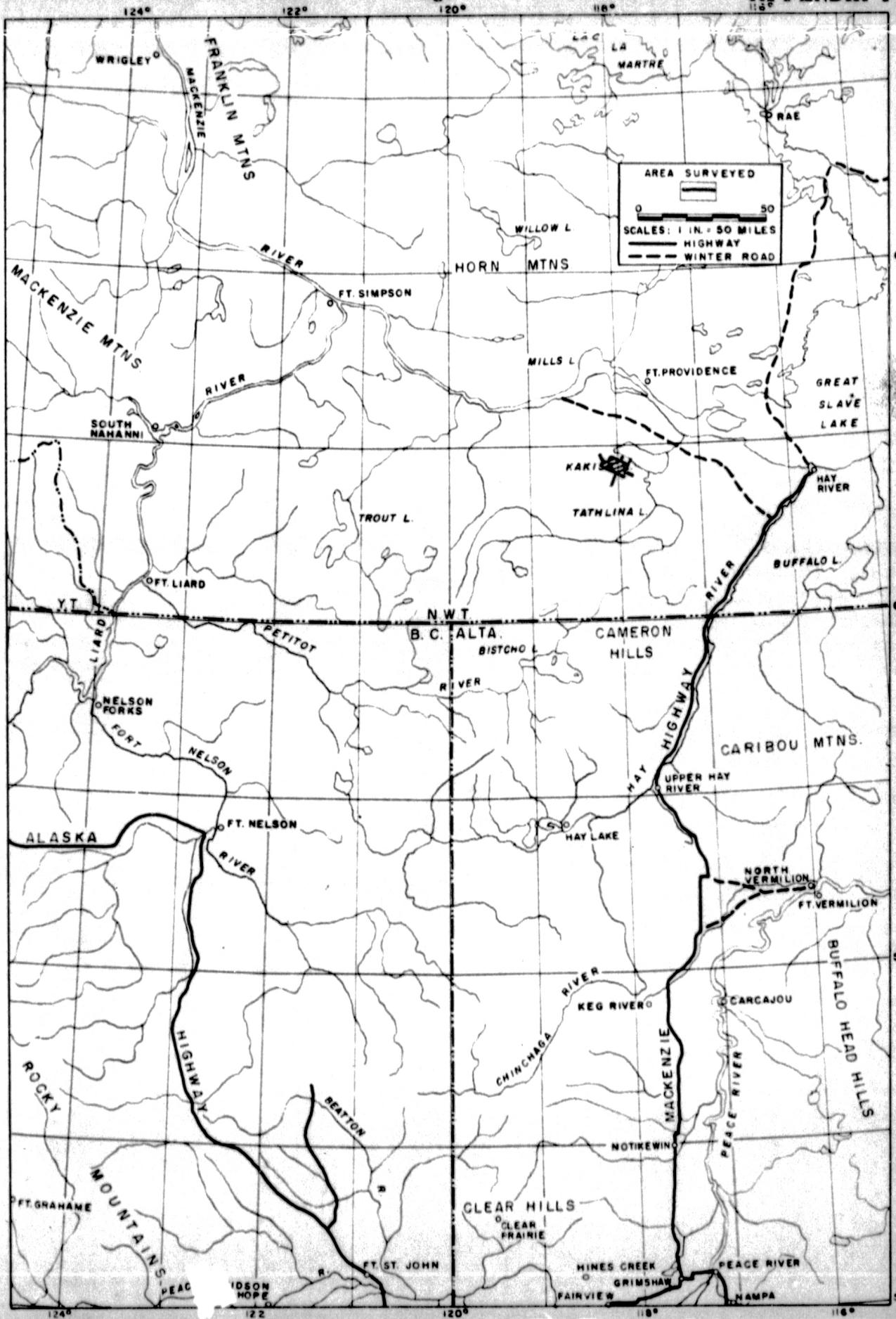
May 3, 1956 L. G. Morris - Supervisor

APPROVED:

By H C Bickel

H. C. Bickel - Vice-President

LGM/pk


124°
122°
120°
118°
116°
WRIGLEY
MACKENZIE
FRANKLIN MTNS
LAC LA MARTRE
RAE
AREA SURVEYED
0
50
SCALES: 1 IN. = 50 MILES
HIGHWAY
WINTER ROAD
WILLOW L
RIVER
HORN MTNS
62
MACKENZIE MTNS
FT. SIMPSON
MILLS L
FT. PROVIDENCE
GREAT SLAVE LAKE
RIVER
SOUTH NAHANNI
KAKI L
HAY RIVER
TROUT L.
TATHLINA L
BUFFALO L.
FT. LIARD
YT
N.W.T.
60°
B.C.
ALTA.
CAMERON HILLS
LIARD
PETITOT
BISTCHO L
RIVER
NELSON FORKS
FORT NELSON
CARIBOU MTNS.
HAY RIVER HIGHWAY
UPPER HAY RIVER
ALASKA
FT. NELSON
RIVER
HAY LAKE
NORTH VERMILION
FT. VERMILION
58°
BUFFALO HEAD HILLS
KEG RIVER
CARCAJOU
CHINCHAGA RIVER
MACKENZIE
PEACE RIVER
HIGHWAY
ROCKY
BEATTON R.
NOTIKEWIN
MOUNTAINS
FT. GRAHAME
CLEAR HILLS
CLEAR PRAIRIE
FT. ST. JOHN
HINES CREEK
PEACE RIVER
GRIMSHAW
FAIRVIEW
NAMPA
56°
124°
122°
120°
118°
116°

APPENDIX II

PHYSIOGRAPHY

Terrain:	Level to gently rolling
Population:	None
Culture:	None
Drainage:	Poorly drained to the north into Kakisa Lake
Soil:	Muskeg
Weather:	Cold
Roads:	Bulldozed trails
Access to Area:	Via bulldozed trails from Mile 28 south of Hay River, N.W.T.
Traverse Difficulties:	Rough trails

APPENDIX III

GEOLOGY

Surface Formation:	Upper Devonian covered in some places by Pleistocene glacial deposits.
Subsurface Log:	None
Unconformities:	Top of Middle Devonian
Regional Dip:	Estimated southwest
Potential Producing Horizons:	Presquile
Type Structures Expected:	Reefs, fault traps, anticlinal structures
Well Control:	None

APPENDIX IV

OPERATION METHODS

Method Used:	Continuous Reflection Profiling, Straddle Spreads.
Hole Spacing:	Normal - 1320 feet
Cross Spreads:	None
No. of Channels:	24
Spacing of Geophone Stations:	110 feet
No. of Geophones per Channel:	1
Distance from Shot Hole to Adjacent Geophones:	110 feet
Relation of Far Geophones to Interlock Holes:	At interlock hole
Shot Hole Depths:	Range: 10 to 100 feet Normal: 40 feet
Formations Encountered:	Muskeg, clay, sand, gravel, shale and limestone
Dynamite Charges:	Range: 5/8 to 15 pounds Normal: 2 1/2 pounds
Elevation Survey:	Control: Government Benchmarks Accuracy: All shot points on closed traverse properly tied.
Operational Difficulties Encountered:	Rough trails, cold weather, drifting snow and difficult drilling conditions.

GEOPHONE AND SHOT HOLE ARRANGEMENT

LEGEND

Shot Hole Under Test

Adjoining Shot Hole

Geophone and Number

Line of Profile

APPENDIX V

OPERATION STATISTICS

Basic Crew:

Crew Headquarters:	Party "F" camp
Starting Date:	December 10, 1955
Completion Date:	February 16, 1956
No. of Working Hours:	514.1
No. of Profiles Shot:	614
No. of Linear Miles of Profile:	81 1/2
Dynamite Used:	2703 3/8 pounds
No. of Caps Used:	872

Drilling:

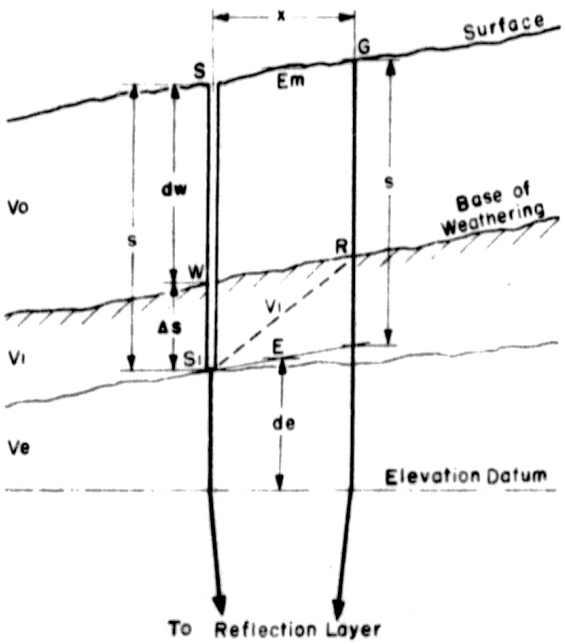
No. of Drills Used:	2
No. of Drill Hours:	1381
No. of Holes Drilled:	388
Total Footage Drilled:	15,514
Casing Used:	1200 feet
Bran Used:	2225 pounds
Mud Used:	11,025 pounds

APPENDIX VI

CALCULATION and INTERPRETATION METHODS

Record Quality:	Poor to fair
Type Correction Used:	Modified Uphole
Other Corrections Worked:	Normal Uphole - Summation Weathering - Drift Correction
Last Trace Ties:	Surface to surface
Elevation Datum:	+950 feet
Weathering Velocity (Vo).	2500 feet per second
Elevation Velocity (Ve):	14,000 feet per second
Horizontal Velocity (Vh):	Variable
Horizons Mapped:	
Tentative Slave Point	
Time Range	435 - 482 milliseconds
Tentative Pre-Cambrian	
Time Range	504 - 553 milliseconds

MODIFIED UP-HOLE CORRECTIONS



LEGEND

S – SHOT POINT
G – GEOPHONE LOCATION
Em – AV. ELEVATION OF S AND G
E – Em – s
x – DISTANCE FROM S TO G
dw – THICKNESS OF WEATHERING AT S
s – DEPTH OF CHARGE
Δs – s – dw
de – (Em – s) – ELEVATION DATUM
Vo – AV. VELOCITY IN WEATHERED LAYER
Vl – AV. VELOCITY IN SECOND WEATHERED LAYER
Ve – ELEVATION VELOCITY
tr – REFRACTION TIME SlRG
ts – UP-HOLE TIME RECORDED
$\bar{t}_s$ – UP-HOLE TIME CALCULATED
Δt_h – HORIZONTAL CORRECTION

DETERMINATION OF d_w AND Δt_h VALUES

$$d_w = (V_l\, t_s - s)\,\frac{V_o}{V_l - V_o}$$

$$\Delta t_h = \frac{1}{V_l}(S_lR - S_lW) = \frac{1}{V_l}\left(\sqrt{\Delta s^2 + x^2} - \Delta s\right)$$

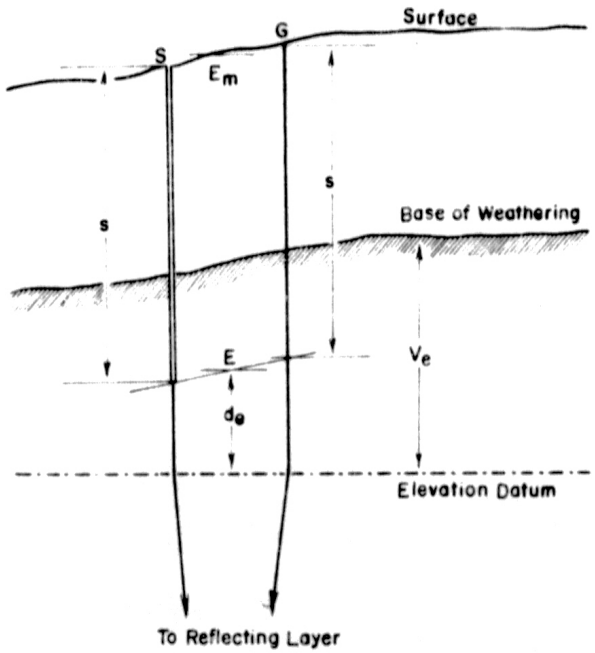
CORRECTIONS

Calculated Up-Hole Correction $\quad \bar{t}_s = t_r - \Delta t_h$

Elevation Correction $\quad t_e = \frac{2\,d_e}{V_e}$

Total Corrections $\quad \overline{\Sigma t} = t_s + t_e$

NORMAL UP-HOLE CORRECTIONS



LEGEND:

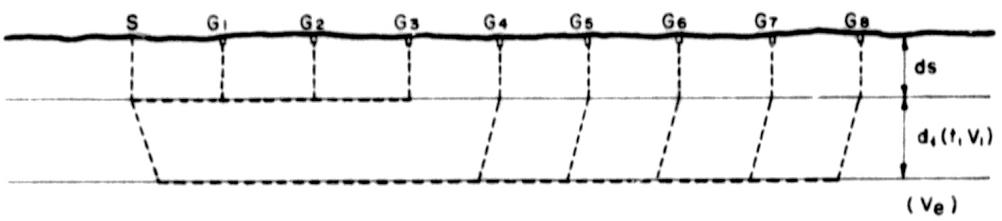
S = Shot Point
G = Geophone Location
E_m = Av. Elevation of S and G
$E = E_m - s$
s = Depth of Charge
$d_e = (E_m - s)$ - Elevation Datum
V_e = Elevation Velocity
t_s = Uphole Time
t_r = Recorded Reflection Time
t_c = Reflection Time Corrected to Datum

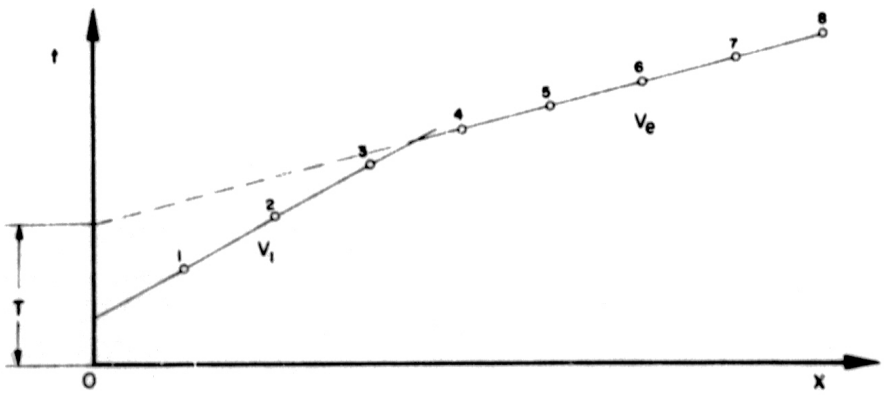
CORRECTIONS

TOTAL CORRECTION, $\Sigma t = \frac{2d_e}{V_e} + t_s$

CORRECTED TIME, $t_c = t_r - \Sigma t$

WEATHERING CALCULATION FOR DRIFT CORRECTION





GENERAL REFRACTION FORMULA FOR (N-L) LAYERS

$$t = \frac{2d_1}{V_1 V_n}\sqrt{V_n^2 - V_1^2} + \frac{2d_2}{V_2 V_n}\sqrt{V_n^2 - V_2^2} + \frac{2d_{n-1}}{V_{n-1} V_n}\sqrt{V_n^2 - V_{n-1}^2} + \frac{x}{V_n}$$

$$T = \frac{2d_1}{V_1 V_e}\sqrt{V_e^2 - V_1^2}$$

BASIC REFRACTION FORMULA FOR SURFACE SHOT, WHERE T = INTERCEPT OF THE V_e REFRACTOR.

$$T - t_s = \frac{2 t_1}{V_e}\sqrt{V_e^2 - V_1^2}$$

SIMILAR FORMULA FOR SHOT AT DEPTH ASSUMING VERTICAL TRAVEL IN MATERIAL ABOVE SHOT LEVEL. WHERE t_1 = VERTICAL TRAVEL TIME FROM SHOT TO V_e VELOCITY BED.

$$2t_1 = \frac{(T - t_s)\, V_e}{\sqrt{V_e^2 - V_1^2}}$$

DRIFT CORRECTION

$$= 2 t_1 \frac{V_e - V_1}{V_e}$$

$$= \frac{(T - t_s)}{\sqrt{V_e^2 - V_1^2}} \frac{V_e}{1} \frac{V_e - V_1}{V_e}$$

$$= \frac{(T - t_s)}{\sqrt{V_e - V_1}} \frac{\sqrt{V_e - V_1}}{\sqrt{V_e + V_1}} \sqrt{V_e - V_1} = T - t_s \frac{\sqrt{V_e - V_1}}{\sqrt{V_e + V_1}}$$

APPENDIX VII

FIELD MATERIAL SUBMITTED SEPARATELY

All Records for the Survey

Large Cross Sections

Plane Table Sheets

Surveyor's Field Notes

Driller's Reports

Calculation Book containing:

- Velocity Determinations
- Time Data Tables
- Weathering Graph Sheets
- Summation Weatherings
- Elevation Map
- Work Cross Sections
- Observer's Reports
- Shooter's Reports

R E P O R T

ON A SEISMOGRAPH SURVEY

conducted in

NORTHWEST TERRITORIES, CANADA

SOUTHEAST TATHLINA LAKE PROSPECT

f o r

NEW D. TODD BRIGGS ACCOUNT

DALLAS, TEXAS, U.S.A.

Seismograph Service Corporation of Canada

Calgary, Alberta

CONTENTS

INTRODUCTION

A reflection seismograph survey was conducted to the east of Tathlina Lake for the D. Todd Briggs Account. It was desired to investigate subsurface structural conditions along the southeastern half of the R-T refraction line, and to verify data obtained by refraction shooting.

DISCUSSION OF RESULTS

One time data structural map is submitted with this report. This map is tentatively identified as originating from the Slave Point level. Record quality over the major portion of the prospect varies from questionable to poor and it would be quite easy to change the present interpretation by one or more legs in different parts of the prospect area. However, the interpretation presented is believed to be generally correct.

The contours along the T-A line are essentially the same as those shown by the refraction line R-T, except in the northwestern portion where the reflection data may be one leg higher.

The contour interpretation shows a general southwest dip interrupted by minor and incompletely established high and low trends. One of these is a high nose trending generally west near the intersection of the T-A and T-49 lines. This trend passes near Shot Point 97 on Line T-49 where a surface outcrop of reef material has been observed.

This reconnaissance survey has permitted a preliminary outline of subsurface structural conditions, but additional shooting would be necessary to adequately investigate the anomalies shown.

Respectfully submitted,

Seismograph Service Corporation
of Canada

By - A. V. Lakatos - Party Chief

By L. G. Morris

May 3, 1956

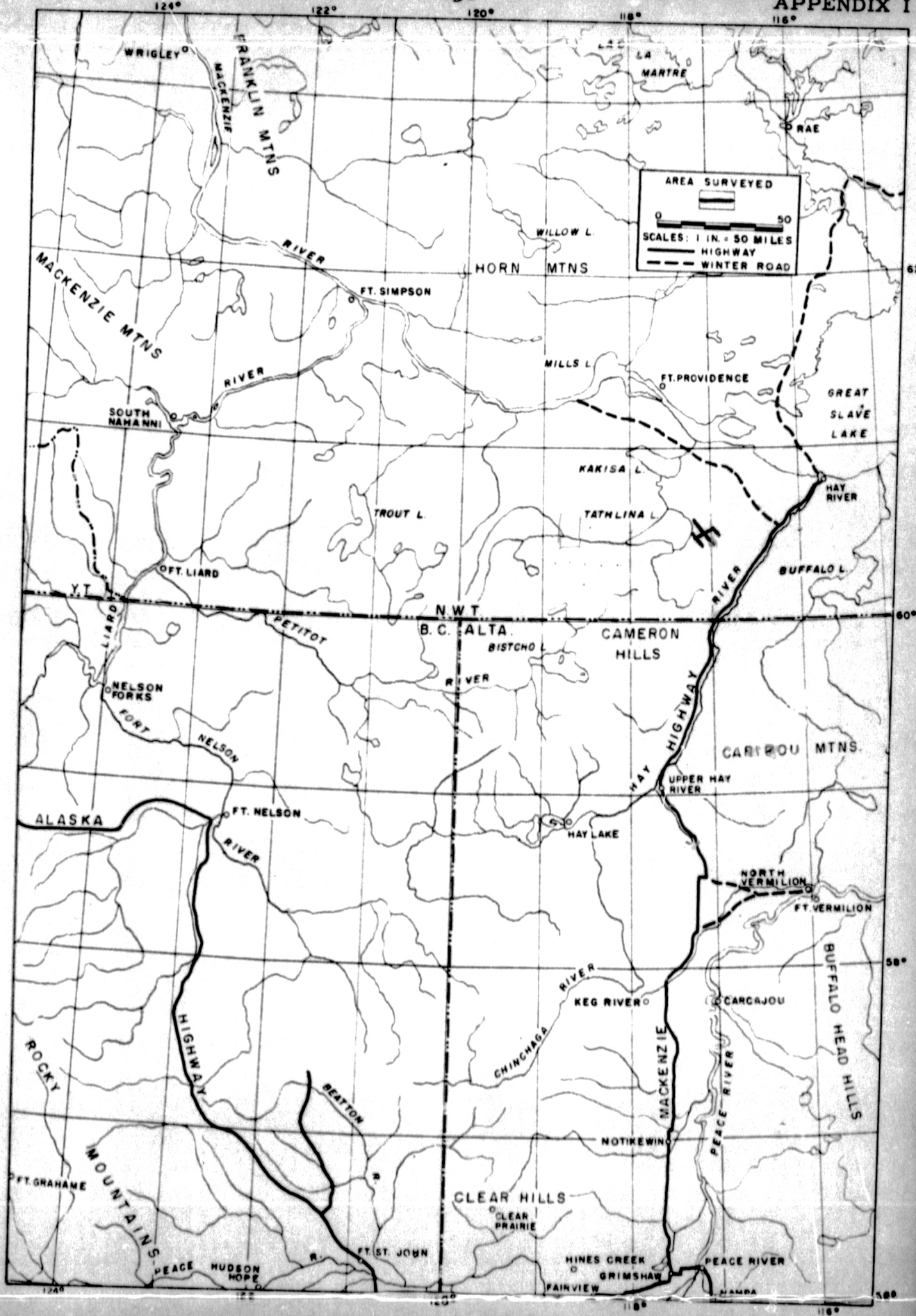
L. G. Morris - Supervisor

APPROVED:

By H C Bickel

H. C. Bickel - Vice-President

LGM/pk


124°
122°
120°
118°
116°
WRIGLEY
MACKENZIE
FRANKLIN MTNS
LAC LA MARTRE
RAE
AREA SURVEYED
0
50
SCALES: 1 IN. = 50 MILES
HIGHWAY
WINTER ROAD
WILLOW L.
RIVER
HORN MTNS
62
MACKENZIE MTNS
FT. SIMPSON
MILLS L.
FT. PROVIDENCE
GREAT SLAVE LAKE
RIVER
SOUTH NAHANNI
KAKISA L.
HAY RIVER
TROUT L.
TATHLINA L.
FT. LIARD
BUFFALO L.
Y.T.
N.W.T.
RIVER
60°
LIARD
PETITOT
B.C.
ALTA.
BISTCHO L.
CAMERON HILLS
NELSON FORKS
RIVER
FORT NELSON
HAY HIGHWAY
CARIBOU MTNS.
UPPER HAY RIVER
ALASKA
FT. NELSON
HAY LAKE
RIVER
NORTH VERMILION
FT. VERMILION
59°
KEG RIVER
CARCAJOU
BUFFALO HEAD HILLS
CHINCHAGA RIVER
HIGHWAY
ROCKY
BEATTON
MACKENZIE
PEACE RIVER
NOTIKEWIN
FT. GRAHAME
MOUNTAINS
R.
CLEAR HILLS
CLEAR PRAIRIE
PEACE
HUDSON HOPE
FT. ST. JOHN
HINES CREEK
GRIMSHAW
PEACE RIVER
FAIRVIEW
NAMPA
58°
124°
122°
120°
118°
116°

APPENDIX II

PHYSIOGRAPHY

Terrain:	Muskeg and timber land
Population:	None
Culture:	None
Drainage:	Poorly drained in a northwesterly direction
Soil:	Clay, rock and limestone
Weather:	Cold. Snow except second half of March when thawing occurred.
Roads:	"Bush" trails
Access to Area:	28 miles southwest of Hay River on Mackenzie Highway and then west via "bush" trails.
Traverse Difficulties:	Rough trails, drifting snow

APPENDIX III

GEOLOGY

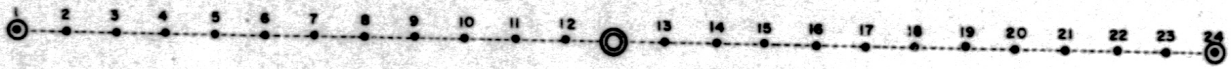
Surface Formation:	Cretaceous (Glacial Drift) Devonian Outcrops
Subsurface Log:	None available
Unconformities:	Cretaceous to Devonian
Regional Dip:	Estimated southwest
Potential Producing Horizons:	Presquile of Middle Devonian
Type Structures Expected:	Fault traps, anticlines and reefs
Well Control:	None

APPENDIX IV

OPERATION METHODS

Method Used:	Continuous Profiling
Hole Spacing:	Normal - 1320 feet
No. of Channels:	24
Spacing of Geophone Stations:	110 feet
No. of Geophones per Channel:	One
Distance from Shot Hole to Adjacent Geophones:	110 feet
Relation of Far Geophones to Interlock Holes:	At hole
Shot Hole Depths:	Range: 20 - 130 feet Normal: 30 feet
Formations Encountered:	Gravel, clay, shale and limestone
Dynamite Charges:	Range: 5/8 - 10 pounds Normal: 1 1/2 pounds
Elevation Survey:	Control: Vertical SSC bench-marks Accuracy: All seismic stations tied
Operational Difficulties Encountered:	Difficult drilling

GEOPHONE AND SHOT HOLE ARRANGEMENT



LEGEND

Shot Hole Under Test

Adjoining Shot Hole

Geophone and Number

Line of Profile

APPENDIX V

OPERATION STATISTICS

Basic Crew:

Crew Headquarters:	Party "I" Camp
Starting Date:	March 1, 1956
Completion Date:	March 19, 1956
No. of Working Hours:	233.9
No. of Profiles Shot:	262
No. of Linear Miles of Profile:	33
Dynamite Used:	494 5/8 pounds
No. of Caps Used:	254

Drilling:

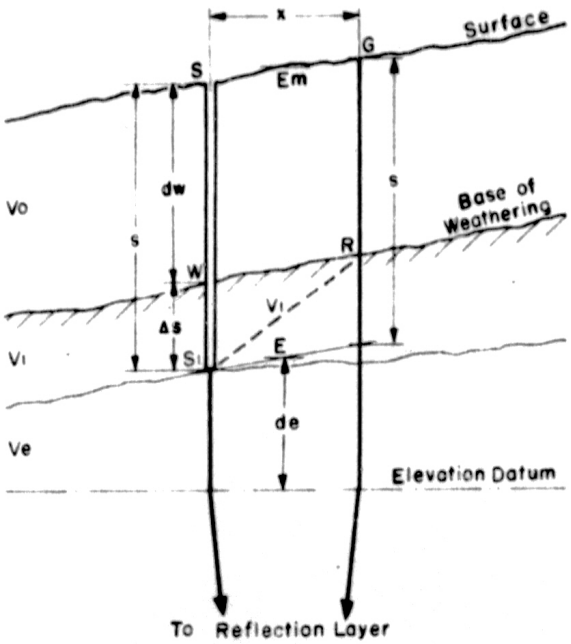
No. of Drills Used:	2
No. of Drill Hours:	412.2
No. of Holes Drilled:	137
Total Footage Drilled:	8373 (3 core holes included)
Casing Used:	None
Bran Used:	4300 pounds
Mud Used:	3700 pounds

APPENDIX VI

CALCULATION and INTERPRETATION METHODS

Record Quality:	Questionable to poor
Type Correction Used:	Modified Uphole
Other Corrections Worked:	Normal Uphole, Drift Correction and Summation Weathering on separate sheets.
Last Trace Ties:	Surface to Surface
Spread Correction:	None applied
Elevation Datum:	+950 feet
Weathering Velocity (Vo):	2000 feet per second
Elevation Velocity (Ve):	14,000 feet per second
Horizontal Velocity (Vh):	Variable
Horizons Mapped:	
Tentative Slave Point	
Time Range	400 - 465 milliseconds

MODIFIED UP-HOLE CORRECTIONS



LEGEND

S	—	SHOT POINT
G	—	GEOPHONE LOCATION
Em	—	AV. ELEVATION OF S AND G
E	—	Em - s
x	—	DISTANCE FROM S TO G
dw	—	THICKNESS OF WEATHERING AT S
s	—	DEPTH OF CHARGE
Δs	—	s - dw
de	—	(Em - s) - ELEVATION DATUM
Vo	—	AV. VELOCITY IN WEATHERED LAYER
Vi	—	AV. VELOCITY IN SECOND WEATHERED LAYER
Ve	—	ELEVATION VELOCITY
tr	—	REFRACTION TIME SiRG
ts	—	UP-HOLE TIME RECORDED
is	—	UP-HOLE TIME CALCULATED
Δt_h	—	HORIZONTAL CORRECTION

DETERMINATION OF d_w AND Δt_h VALUES

$$d_w = (V_i\, t_s - s)\,\frac{V_o}{V_i - V_o}$$

$$\Delta t_h = \frac{1}{V_i}\,(S_iR - S_iW) = \frac{1}{V_i}\,(\sqrt{\Delta s^2 + x^2} - \Delta s)$$

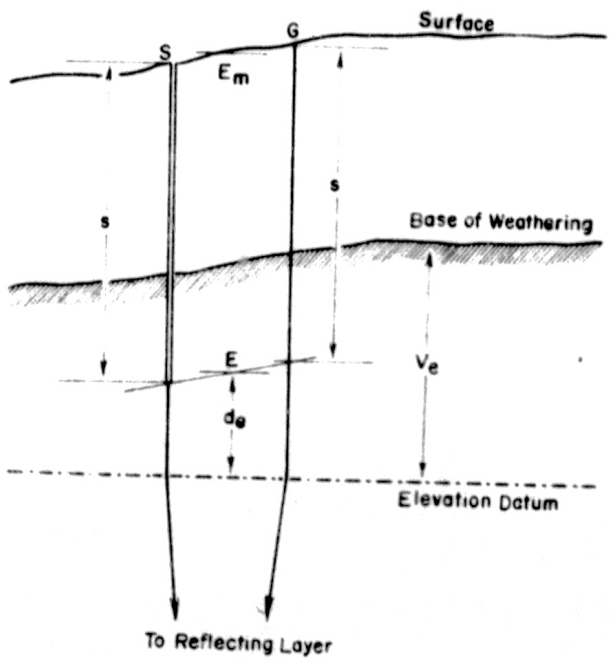
CORRECTIONS

Calculated Up-Hole Correction $\quad \bar{t}_s = t_r - \Delta t_h$

Elevation Correction $\quad t_e = \frac{2\,d_e}{V_e}$

Total Corrections $\quad \overline{\Sigma t} = t_s + t_e$

NORMAL UP-HOLE CORRECTIONS



LEGEND:

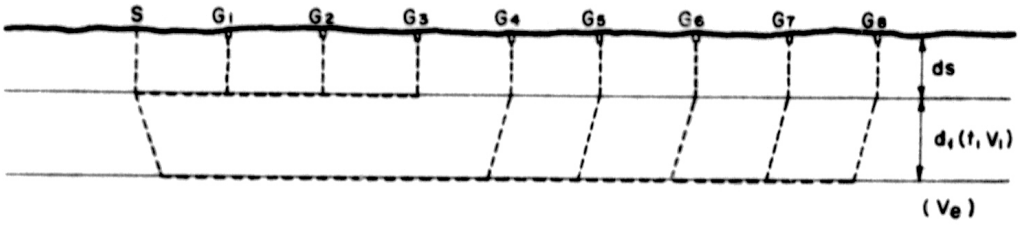
S = Shot Point
G = Geophone Location
E_m = Av. Elevation of S and G
$E = E_m - s$
s = Depth of Charge
$d_e = (E_m - s)$ – Elevation Datum
V_e = Elevation Velocity
t_s = Uphole Time
t_r = Recorded Reflection Time
t_c = Reflection Time Corrected to Datum

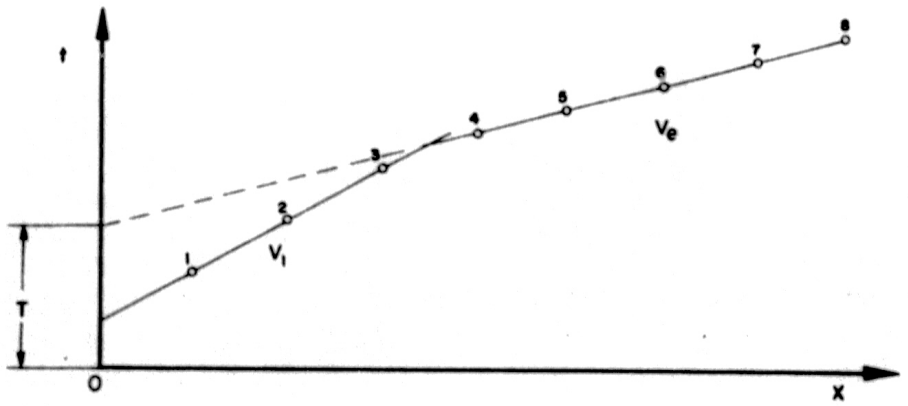
CORRECTIONS

TOTAL CORRECTION, $\Sigma t = \frac{2d_e}{V_e} + t_s$

CORRECTED TIME, $t_c = t_r - \Sigma t$

WEATHERING CALCULATION FOR DRIFT CORRECTION





GENERAL REFRACTION FORMULA FOR (N-L) LAYERS

$$t = \frac{2d_1}{V_1 V_n}\sqrt{V_n^2 - V_1^2} + \frac{2d_2}{V_2 V_n}\sqrt{V_n^2 - V_2^2} + \frac{2d_{n-1}}{V_{n-1} V_n}\sqrt{V_n^2 - V_{n-1}^2} + \frac{X}{V_n}$$

$$T = \frac{2d_1}{V_1 V_e}\sqrt{V_e^2 - V_1^2}$$

$$T - t_s = \frac{2 t_1}{V_e}\sqrt{V_e^2 - V_1^2}$$

BASIC REFRACTION FORMULA FOR SURFACE SHOT, WHERE T = INTERCEPT OF THE V_e REFRACTOR.

SIMILAR FORMULA FOR SHOT AT DEPTH ASSUMING VERTICAL TRAVEL IN MATERIAL ABOVE SHOT LEVEL. WHERE t_1 = VERTICAL TRAVEL TIME FROM SHOT TO V_e VELOCITY BED.

$$2t_1 = \frac{(T - t_s) V_e}{\sqrt{V_e^2 - V_1^2}}$$

DRIFT CORRECTION

$$= 2t_1 \frac{V_e - V_1}{V_e}$$

$$= \frac{(T - t_s)}{\sqrt{V_e^2 - V_1^2}} \cancel{V_e} \frac{V_e - V_1}{\cancel{V_e}}$$

$$= \frac{(T - t_s)}{\sqrt{V_e - V_1}} \frac{\sqrt{V_e - V_1}}{\sqrt{V_e + V_1}} \sqrt{V_e - V_1} = T - t_s \frac{\sqrt{V_e - V_1}}{\sqrt{V_e + V_1}}$$

APPENDIX VII

FIELD MATERIAL SUBMITTED SEPARATELY

All Records for the Survey

Large Cross Sections

Plane Table Sheets

Surveyor's Field Notes

Driller's Reports

Calculation Report containing:

- Calculation Methods
- Time Data Tables
- Summation Weathering
- Elevation Map
- Observer's Reports
- Shooter's Reports