

1-6-5-18

FORT NORMAN AREA, N.W.T.
MARINE SEISMIC IN MACKENZIE RIVER

FOR

AMERADA PETROLEUM CORPORATION

by

ACCURATE EXPLORATION LTD.

JOE NUMBER 2201

JULY 1-21, 1965

July 1965

Abstracted for
Geo-Science Data Index

Date _____

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Geo-Science Data Index

Date _____

FIELD OPERATIONS REPORT

FORT NORMAN AREA
N.W.T.

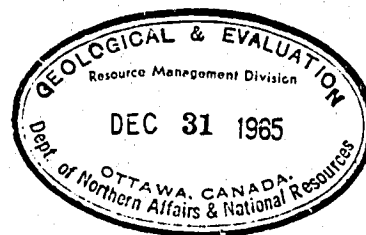
FOR

AMERADA PETROLEUM CORPORATION

ACCURATE EXPLORATION LTD.

by

M. W. Dewis, P.Eng.
Operations Manager.



Calgary, Alberta, Canada

July 1965
Project 2201

C O N T E N T S

P A R T I

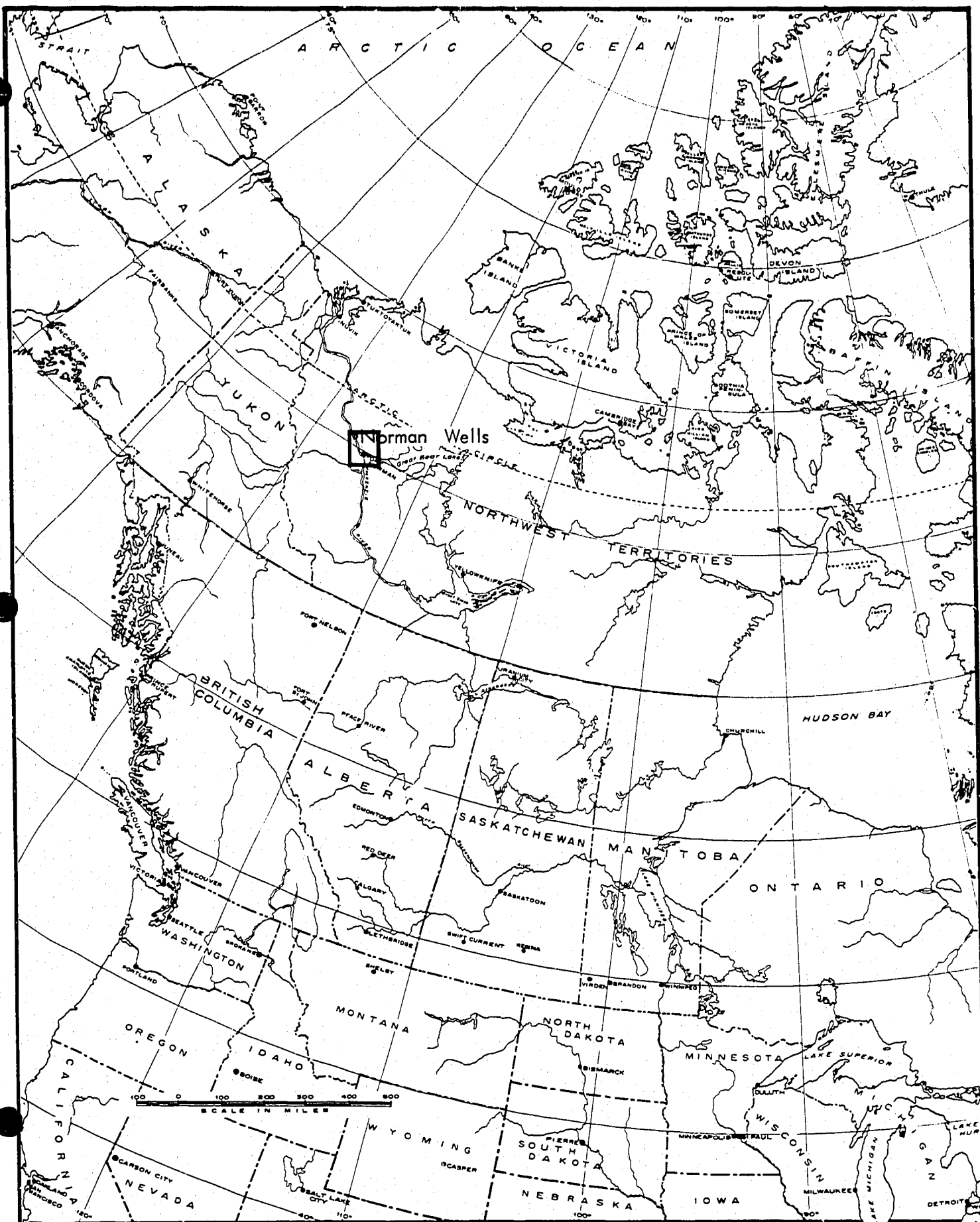
Report Area
Project Summary Statistics
Cable & Geophone Configuration

P A R T II

A - Prospect Area and Access
B - Recording
C - Surveying

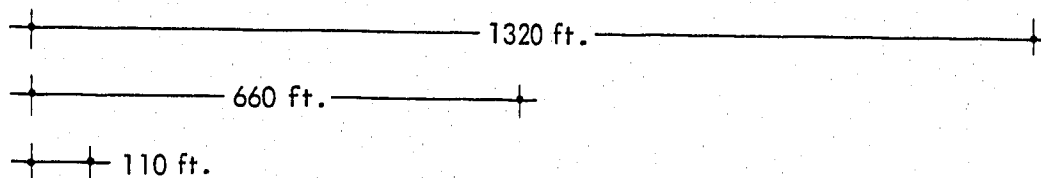
P A R T III

Discussion



CABLE AND GEOPHONE SCHEMATICS

Cable at rest



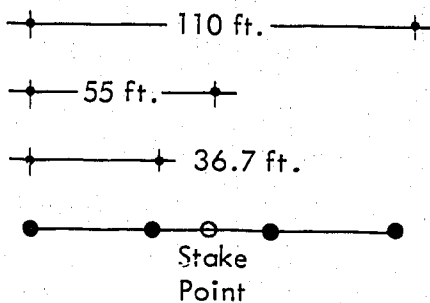
Stake Pts. 1 2 3 4 5 6 7 8 9 10 11 12



Legend

- Shot Point
- ⊖ Stake Points.

Geophones at rest.



Legend

- ⊖ Stake Point
- Dual EVP. 1 Geophone

Note:

The cable is so designed that when it is at rest during the shot instant the schematic sketches as shown above are applicable.

The cable was constructed with takeouts between stake points 6 and 7. During the Mackenzie River shooting geophones were at these locations and recorded on number 2 trace on the Timefax playbacks.

PROJECT SUMMARY

Project FORT NORMAN

Project No. 2201
Contract No. 2201
Party No. 2201

PART I - FIELD (General)

DATE OF COMMENCEMENT July 1, 1965
DATE OF COMPLETION July 21, 1965
PARTY CHIEF G. Koenig
PERMITTEE N/A
PERMIT NO. N/A
LICENSEE Accurate
LICENSE NO. Bus.Lic. #A10287

DATES OF PLAN SUBMISSION

Dept. of Fisheries (Federal) April 14, 1965
Exploratory Work Permit June 25/65 (Amerada)

FIELD COSTS

Mobilization & Demobilization	<u>\$12,648.</u>
Explosives	<u>\$ 9,030.</u>
Field Operating Costs	<u>\$26,327.</u>
TOTAL	<u><u>\$48,005.</u></u>
 Total Miles Shot	 <u>101</u>
Cost per Mile	<u>\$476.</u>

NOTE: Above figures do not include anticipated credit on surplus powder being returned.

PROJECT SUMMARY

Project No. 2201
Party No. 2201

PART II - FIELD (Operating)

PARTY MANAGER G. Koenig SURVEYOR L. Barkett

SURVEYING

Instruments Sextant
Declination N/A
Shotpoint Interval 660'
Tie-In Control Government Topographical Elevation

RECORDING

OPERATOR O. Eggen, R. Ferguson
Av. Shot Depth 5' Charge Size 5 - 16-2/3
Special Shooting Procedure Marine Seismic using 1/4
mile cable with split shots every 660'.

Direction of Top of Record: #1 Trace upstream excepting
S.P.'s 1-133 inclusive.

Instruments Carter FR1 Serial No. 3100
Tape System Carter FR1 Serial No. 3100
Pre-amplifier Filter

Settings: Monitor
Filtering 20-1-64 on record
A.V.C. Fast
Mix N/A

Geophones:

Type EVP-1
In Groups of 4 duals over 110 feet
Hook-Up Series-Parallel

P A R T I I

A - PROSPECT AREA AND ACCESS

The prospect area is located on the Mackenzie River, N.W.T., between Norman Wells and the point at which Latitude 64° 30' crosses the river.

Norman Wells was used as a supply base. Pacific Western Airlines serves the Wells on a regular schedule thrice weekly.

Northern Transportation also operates river barges between Hay River on the south shore of Great Slave Lake and Norman Wells.

B - RECORDING

(a) Equipment

Instruments consisted of a bank of pre-amplifier filters and a set of Carter FR1 pulse width amplifiers and tape system.

A marine seismic cable equipped with 4 EVP-1's per trace, as per Cable Diagram, was towed by the Motor Vessel "Tilerak".

The "Tilerak" housed the personnel, instruments, galley and supplies.

A 30 foot Jet Shooting Boat, 40 foot Landing Craft (for emergency purposes only), and a Runabout completed the boat flotilla.

Radios in the Recording and Shooting Boats were used for communication and Time Break purposes.

(b) Personnel

The crew consisted of the following personnel:

- 1 Party Manager
- 2 Operators
- 1 Shooter
- 4 Pilots
- 1 Mechanic
- 1 Cook
- 1 Computer
- 1 Surveyor

(c) Shooting Procedure

Quarter mile splits were shot every 660 feet using 12 recording amplifiers.

All shooting was done in an upstream direction with No. 1 Station at the boat.

The following procedure was followed in carrying out the firing of a shot.

When the Recording Boat was on location as determined by the Surveyor, the boats were throttled back such that the boats were stationary relative to the ground. The Shooting Boat pulled into position opposite a marker on the cable. The dynamite charge, attached to a firing line and a balloon, was thrown overboard by the Shooter. The line to the balloon was such that as to suspend the charge on the average of 5 feet below the surface. This pre-determined depth was varied with the size of the charge. The firing line was of such a length that with the Shooting Boat opposite the marker on the cable, the charge would be midway between Stations 6 and 7.

The offset of the Shooting Boat was estimated by the Pilot of the boat.

At a signal from the Operator, the Recording Boat and Shooting Boat would cut throttle completely and drift back downstream until such time as the boats and cable were stationary relative to the water. At this instant, the shot was fired.

Following the shot, power would be applied to the boats and they would move up 660 feet to the next pre-determined shot point. The above procedure was then repeated.

Shooting in this manner enabled the recording crew to fire anywhere from 80 to 100 shots per 10 hour shift.

C - SURVEYING

The location of the shot points was determined visually by observing a position of a shot point as related to topographical features such as creeks, rivers, islands, sand bars, trees, etc. and then tying these features into aerial photographs of the area concerned.

The movement of the boat between each shot point was timed to the nearest second so that in the absence of any topographical feature, the location of the shot point could be determined by using the travel time between shot points.

The shot points were originally plotted on the aerial photos. These were later transferred to base maps

supplied by the Company.

No Geodetic Survey has been carried out in the area of the prospect.

The District Engineer, Calgary, Water Resources Branch, Department of Northern Affairs & National Resources, has supplied an elevation for the river at Norman Wells for mid-July 1964. This elevation is 139 feet above sea level. No other reliable elevations are available for points along the river.

The District Engineer has suggested that a change in elevation of one-half foot per mile of the river is a reasonable assumption to make in determining elevations for other points on the prospect.

P A R T III

DISCUSSION

OPERATIONS

Shooting commenced on July 1, 1965 at the Norman Wells Field. Between July 1 and July 7, 227 shot points were completed between Norman Wells and a point approximately 30 miles upstream from the wells. At this time the crew was shut down to try to improve an insensitive area on the records that was apparent following a strong burst of energy.

The crew returned to Norman Wells to carry out some experimental work. The results from varying, charge size, AGC, Fader Control, Constant Gain and Offset gave only minor variations in the zone concerned.

While experimental results were being studied in Calgary and Tulsa, the crew continued shooting for another client.

On July 17, the crew returned to complete Amerada's assignment. The shooting was completed on July 21, 1965. On the 22nd the crew returned to Norman Wells.

TIME BREAKS

Two methods were used to obtain a time break. In one case the shot was fired by the shooter and the time break was transmitted by radio to the recorder. This is referred to as "manual firing". In the other instance the firing was actually done at the recording position by a cam on the tape drum. Here again, radio was used to transmit the time break. This is referred to as "remote firing".

Lab tests prior to the shipping of the equipment to Norman Wells showed a time lag of 50 mills on the remote firing unit between the initiating firing pulse and the actual detonating of the shot. Tests on July 1, just prior to the commencement of the shooting, confirmed this delay of 50 mills.

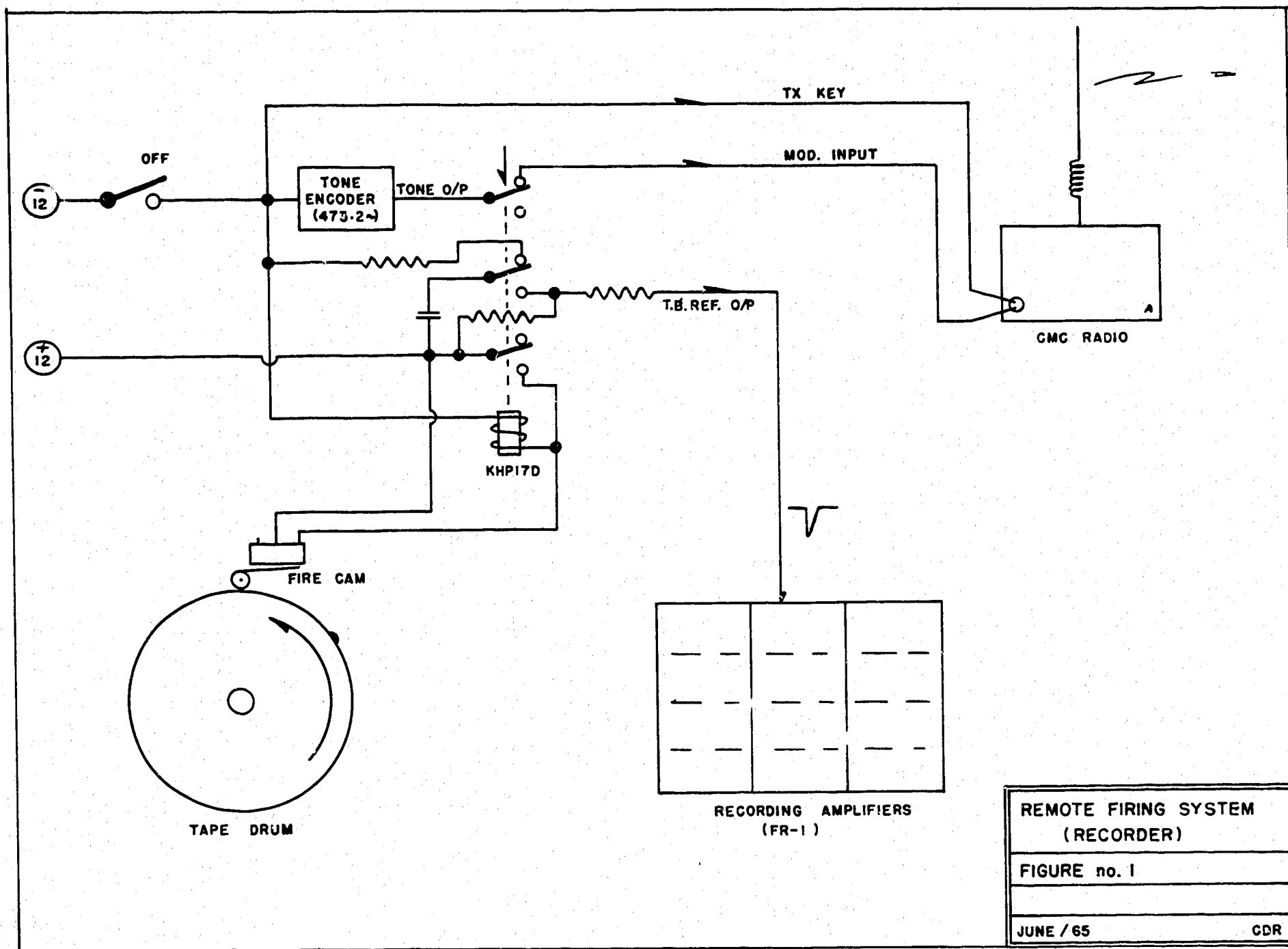
Following the completion of the shooting of the first 227 shot points, it was discovered through tests that there was a drift in the delay time between the pre-shot firing pulse and the detonating of the charge. At this point it was decided to discontinue using the remote firing unit and to use a manual type of firing. The latter type of firing has no delay. This method was used from Shot Point 228 to the completion of the job.

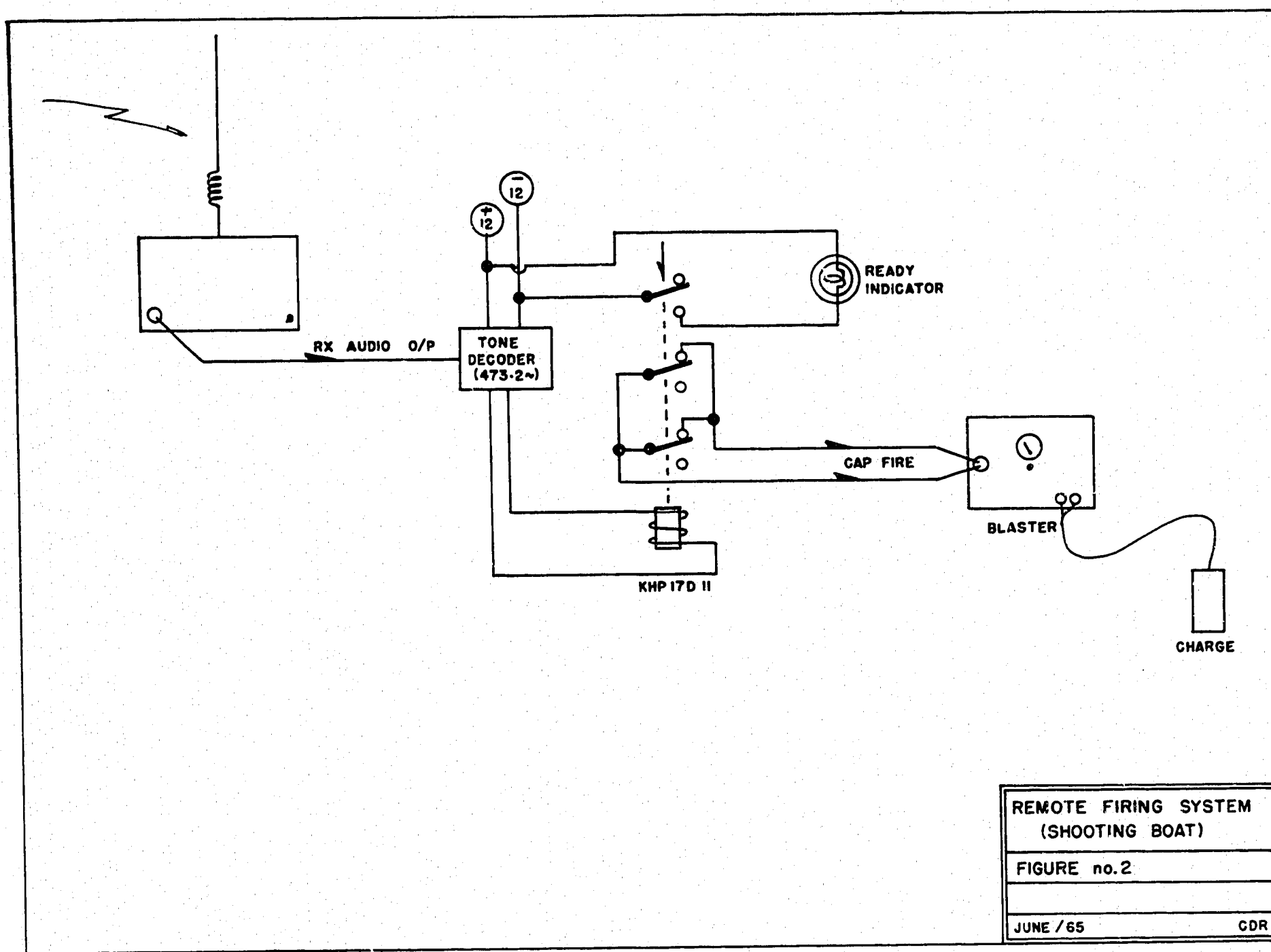
REMOTE FIRING UNITS

Figures 1 and 2 are schematics of the remote firing units.

Figure 1 represents the "Recorder" remote control system. Turning on the power keys the transmitter and tone encoder, thereby transmitting a 473.2-cycle tone. When the firing cam on the tape drum closes the microswitch, the KHP17D relay is latched down. This relay breaks the transmitted tone and simultaneously generates a T.B. reference pulse. This T.B. reference pulse is recorded on tape in the T.B. channel.

Figure 2 represents the "Shooting Boat" remote control system. The 473.2-cycle tone is received by the radio and its presence is detected by the tone decoder. If the tone frequency and level conditions are satisfied, the decoder pulls in the KHP17D relay. This then breaks the cap firing circuit and turns on the ready indicator lamp. The shooter then closes the safety switches on the blaster. When the transmitted tone is broken (Fig. 1 Fire Cam) the decoder then allows the cap relay to close and fire the charge.





TIME BREAK CALCULATIONS - SHOT POINTS 1 - 227

Due to the drift in the remote firing unit, some method of predicting the relationship between the pre-firing pulse and the actual firing of the shot was necessary. The following discussion is confined to the solution of this problem.

To demonstrate the relationship between the pre-shot pulse and the actual firing of the shot, three criteria are known. (1) the velocity of a compressional wave in water is approximately equal to 5,000 feet per second; (2) difference in time between two traces at the first break position is a function of the position of the shot; (3) by aligning the first breaks on the record, the intersection of the two alignments serve to approximate the skidded position of the shot, i.e., the position of the shot relative to the center of the spread in a parallel direction.

By the alignment process just mentioned, the skidded position of the shot was established at each shot point. The time difference between two traces at the first break position, or "Delta T", was then observed for each shot point, and this Delta T, along with the skidded position of the boat, was recorded. Using these two figures,

it is possible by a simple, but lengthy, mathematical process to establish the offset position of the boat.

Because of the length of the calculation involved in obtaining the offset position of each shot point, two graphs were prepared in order to simplify this process. These graphs are labelled No. 4 and No. 5 in the accompanying illustrations. Having obtained the skidded and offset positions of the shot relative to the center point on the line, it becomes an easy matter to calculate the hypotenuse distance to the nearest effective seismometer.

The graph labelled No. 6 in the accompanying illustrations was prepared for this purpose. This graph yields not only the hypotenuses to the nearest effective seismometer relative to the position of the shot, but also the length of time required for a wave to travel from the shot to the nearest effective seismometer.

In essence, the calculations outlined above established a true time break on each shot point. Having established a true time break, it was now possible to time all the events on the record in a straightforward normal manner. Each record was then examined to determine the length of time involved from the pre-shot pulse to the calculated time break, and this difference in time at each shot point was also recorded. A plot of this time difference was then made on millimeter paper and is labelled No. 8 in the

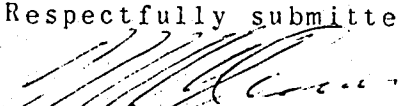
accompanying illustrations. This plot demonstrates that the difference in time from the pre-shot pulse to the calculated time break position was not a constant, but varying in a uniform manner, increasing as the shooting progressed. On the plot just mentioned, it is seen that only a very few points are not in alignment. This is undoubtedly due to having misinterpreted the basic data. On the basis that the overwhelming majority of these points do demonstrate a logical and uniform pattern, it is now possible to calculate the skidded and the offset positions of the shot, using the pre-shot pulse only.

A graph labelled No. 10 accompanying the illustrations was prepared for this purpose. This graph contains a detailed explanation of the theory, the mathematics, and the use of the graph.

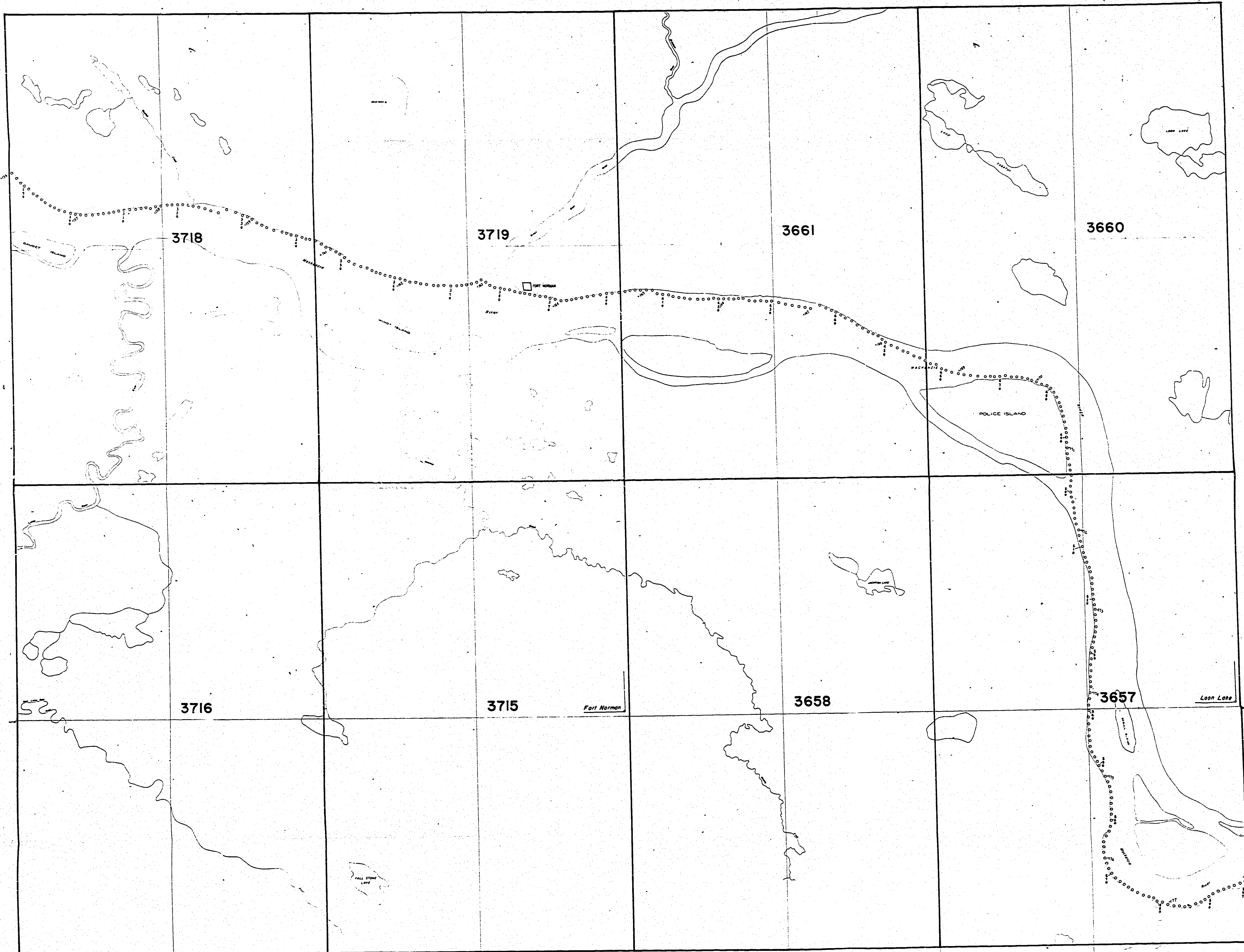
Several other illustrations accompany this report. Those labelled Nos. 1, 2, 3 and 9 serve as background material only, and are self-explanatory. The plot labelled No. 7 is a plot of the time difference between a pre-shot pulse and Trace No. 6. It is seen on the plot that this time difference varies greatly from shot point to shot point. By referring to Illustration 8, mentioned above, the effectiveness of all the preceding calculations is demonstrated.

The actual time break and delay times have been marked on the field playback records for Shot Points Nos. 1-227, inclusive.

Respectfully submitted,

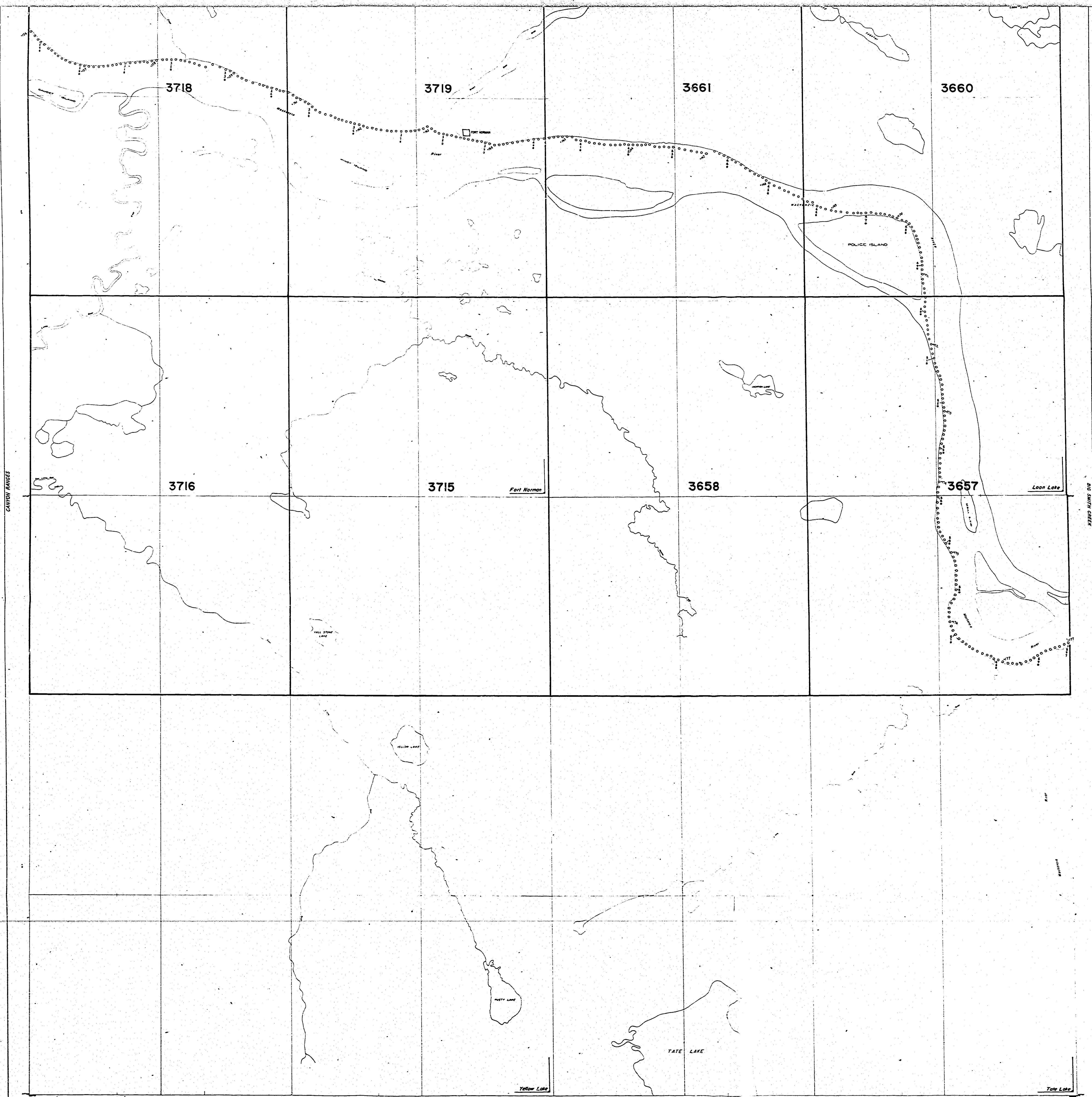

M. W. Dewis, P. Eng.
Operations Manager.

BRACKETT RIVER



BIG SMITH CREEK

TATE LAKE

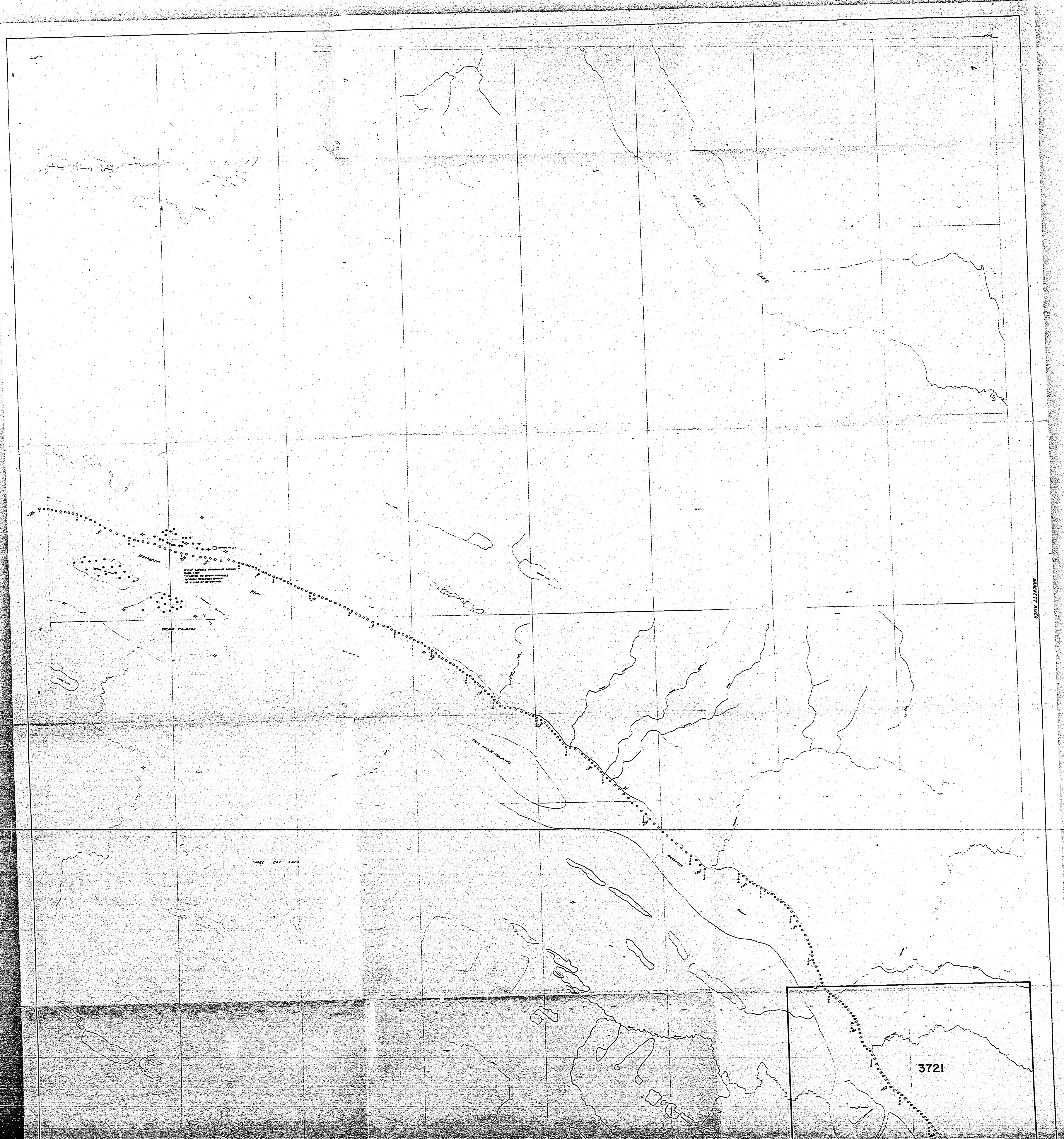


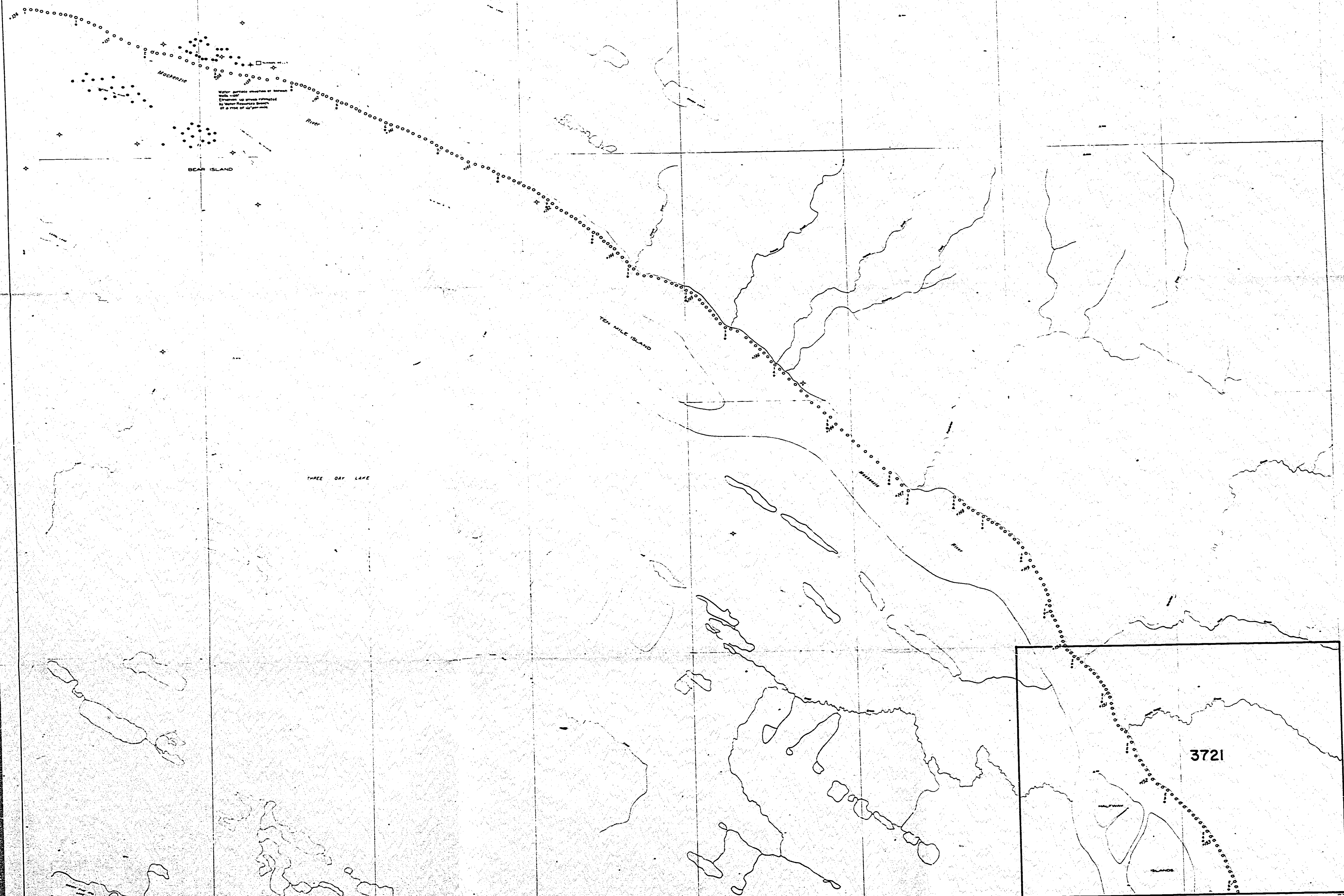
Permits No.	Effective Date
Block A 3655-3663	10-11-63
Block B 3715-3721	1-30-64

MACKAY RANGE
NORTHWEST TERRITORIES
CANADA

SHOT HOLE LOCATION
&
ELEVATION

SCALE: 1 INCH = 1 MILE





Effective Date
Block B 1-30-64

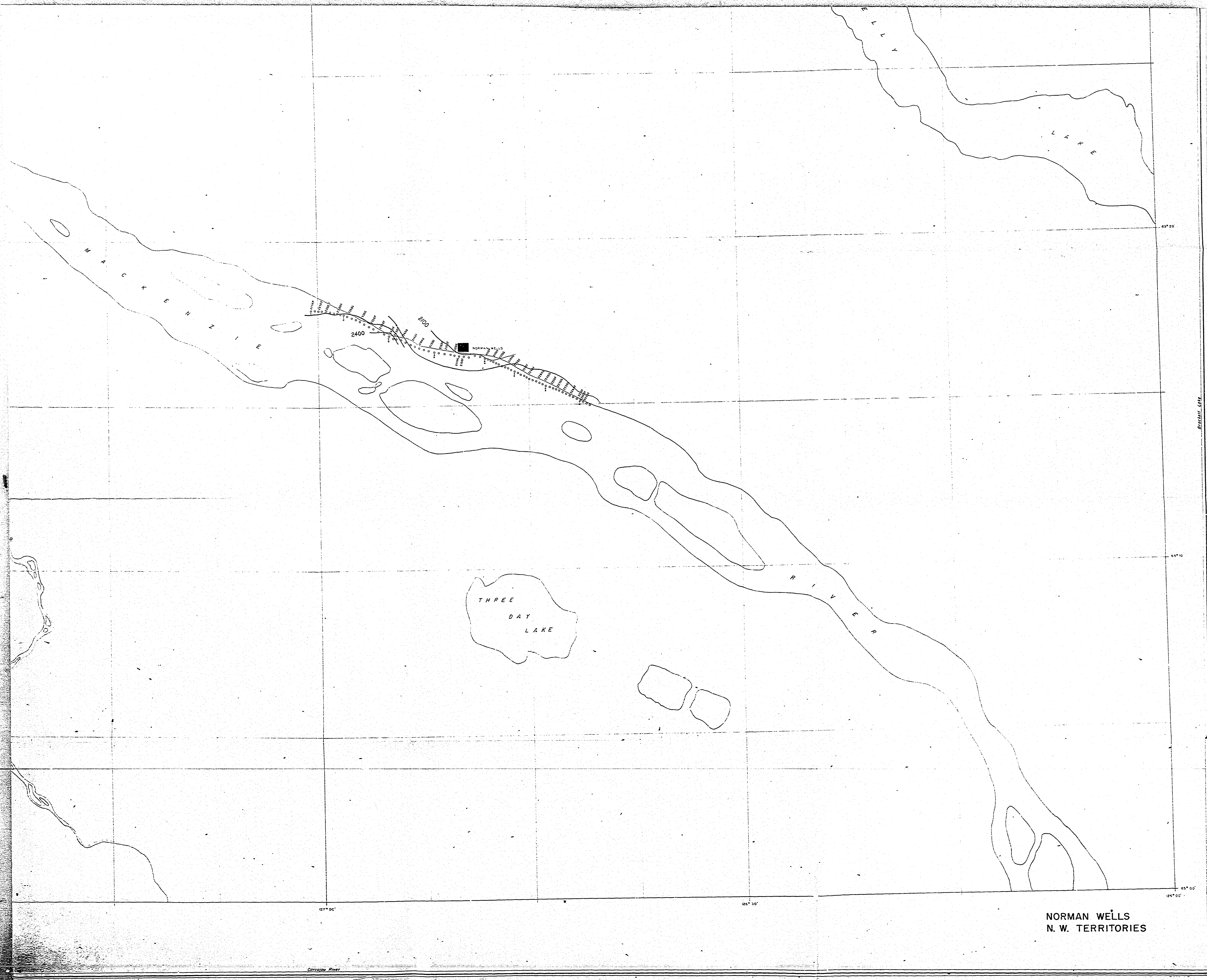
TEN MILE ISLAND
NORTHWEST TERRITORIES
CANADA

SHOT HOLE LOCATION
ELEVATION

SCALE: 1 INCH = 1 MILE



BRITISH LIAISON



NORMAN WELLS
N. W. TERRITORIES

3659

3656

3655

MACAP RANGES

3659

3656

3655

Effective Date

Block A

10-11-63

BIG SMITH CREEK
NORTHWEST TERRITORIES
CANADA

SHOT HOLE LOCATION
ELEVATION

SCALE: 1 INCH = 1 MILE

TEN MILE ISLAND

3720

3714

Mirror Lake

3713

3717

Slater River

3712

3711

3710

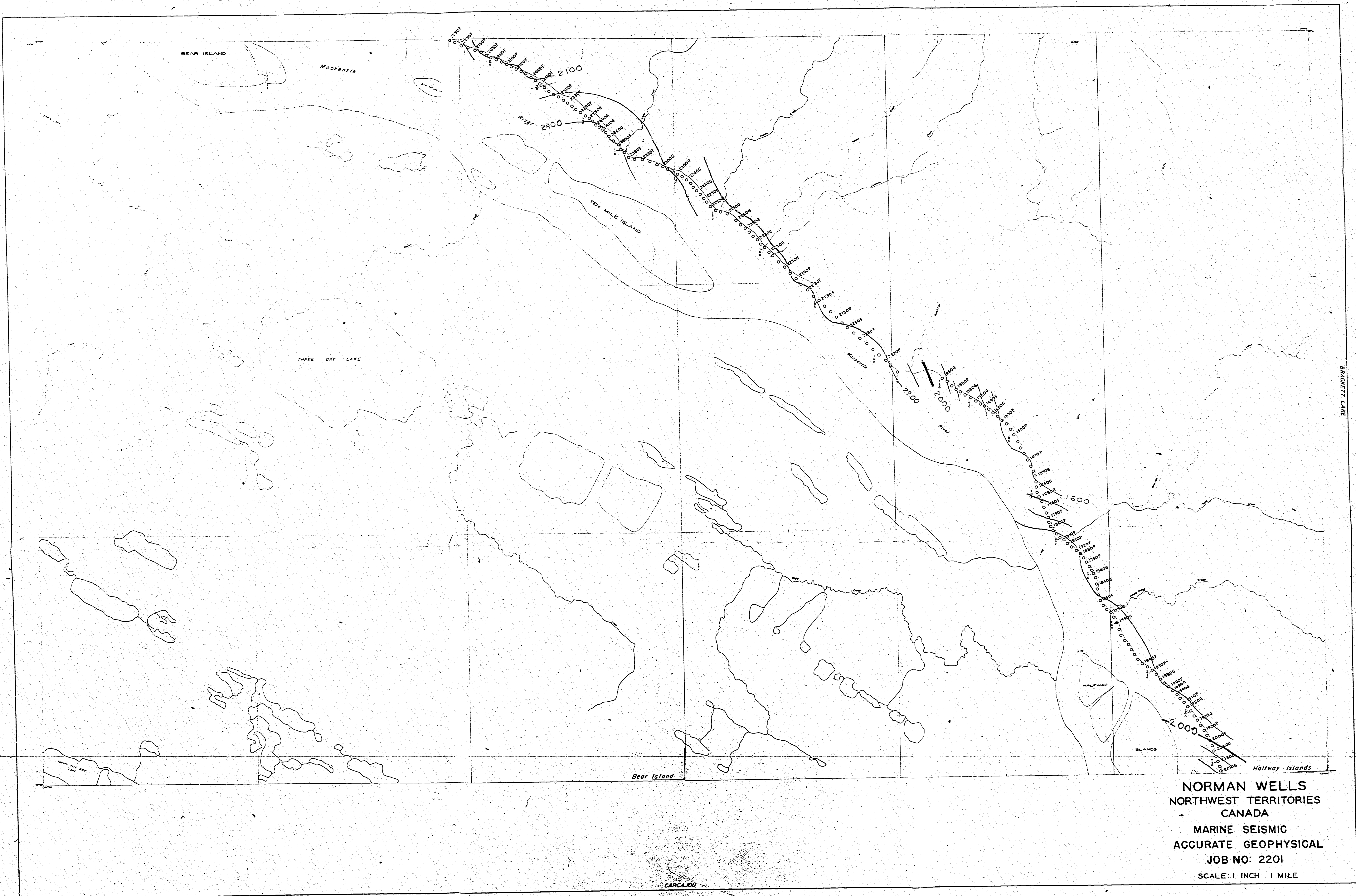
Little Bear River

CANYON RANGES



	Permit No.	Effective Date
Block C	3707-3714	1-30-64
Block B	3715-3721	1-30-64

CANYON RANGES
NORTHWEST TERRITORIES
CANADA
SHOT HOLE LOCATION
ELEVATION
SCALE: 1 INCH = 1 MILE



CANYON RANGES

