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GRAVITY AND MAGNETIC SURVEY

OF BLACKWATER LAKE AREA

NORTHWEST TERRITORIES

September 1964 Velocity Surveys
Limited.



REPORT ON
GRAVITY SURVEY
BLACKWATER LAKE AREA
NORTHWEST TERRITORIES

FOR

TENNECO OIL AND MINERALS LTD.
CALGARY, ALBERTA

VELOCITY SURVEYS LIMITED, CALGARY
NOVEMBER 1964

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Introduction

The following report is based upon the results of a combined gravity and magnetic survey carried out by Velocity Surveys Limited in the Blackwater Lake Area of the Northwest Territories, which is located to the northeast of Ft. Wrigley. The survey covered areas between latitudes $62^{\circ}40'$ to the south - $64^{\circ}20'$ to the north, and longitudes $121^{\circ}45'$ to the east - $123^{\circ}15'$ to the west.

A camp was established initially at a lake near the junction of the Mackenzie and the river between two mountains and, as the survey progressed, was transferred first to the shore of Greasy Lake and finally to Wrigley Airport. Transportation for the supplies and camp moves was maintained by fixed wing air support, however for the actual survey a helicopter was employed.

Field Procedure

The combined gravity and magnetic survey was carried out along a predetermined grid consisting of lines of flight superimposed upon a photo-mosaic. The areas covered are situated between latitudes $62^{\circ}40'$ - $64^{\circ}20'$, and longitudes $121^{\circ}45'$ - $123^{\circ}15'$, large portions of which were inaccessible

by the helicopter due to either severe changes in surface topography or a dense growth of bush. These circumstances made it impossible to uphold a straight-line grid pattern and certain portions of the areas had to be abandoned entirely.

The procedure of the survey was to take readings simultaneously with the gravity meter and the magnetometer at intervals of approximately one mile along the flight traverses. Survey altimeters were employed for vertical control while accurate station positioning was carried out by flight navigation and pin-prick comparison between mosaic and ground. The gravity meter was checked back into pre-established base control points at intervals of two hours or less in order to make corrections of drift of the instrument. The magnetometer was looped to these base stations in order to correct for the diurnal variation. The survey altimeter was also tied back in the same manner. In order to continually record variations in the barometric pressure of the atmosphere and changes in air temperature and relative humidity, a Micro-Barograph together with a Hygrometer were set up at a convenient central location of the area to be investigated. These recorded variations were utilized to correct field altimeter observations.

Topography

The Mackenzie River flows along the western perimeter of the survey areas with fairly steep embankments. The general topography for most of the eastern and northern parts of the survey areas consists of an undulant landscape interspersed by moderately rolling hills. Through the western portion there is evidence of a mountainous ridge trending in a north-south direction. The areas also embrace three major sized lakes, while extensive swampy areas and floating muskeg were encountered throughout at all altitudes up to 2,000 feet A.S.L. A dense growth of vegetation, in various places ravished by recent forest fires, is evident across large parts of the central and southern sections of the survey areas.

Computations

A Sharpe A-2 magnetometer was employed to carry out the magnetic survey. This instrument measures the variations in the vertical component in the magnetic field. The instrument employed for this survey was calibrated to 20.2 gammas per scale division, and the magnetic results were corrected for diurnal variations, plotted and contoured every 25 gammas. The gravity survey was carried out using a Worden 'Pioneer' gravity meter having a scale constant of 0.0976 milligals per scale division. A combined

Free Air and Bouguer correction of 0.06854 milligals per foot was applied to all elevations based upon an average density of material of 2.0 grams per cubic centimeter. A latitude correction was also applied to all readings based upon the formula of the theoretical gravity on the International Ellipsoid. Finally, a correction for disturbances due to variations in surface terrain was added to all gravimetric observations, the results mapped and contoured at intervals of one gamma. The elevation control of the stations was obtained by tying the altimeter survey into five known wells located within the general area of the survey. Discrepancies, arising from the fact that the determination of precise elevations in this part of the Northwest Territories does somehow present a problem, made it necessary to choose among the well sites the one that is believed to contain the most reliable source of accuracy in elevation. The entire altimeter survey was then tied to that well site, results plotted and contoured at intervals of 100 feet.

Presentation of Results

The maps submitted with this report are the Surface Elevation Map, the corrected Bouguer Gravity Map and the Magnetic Relief Map.

Discussion of the Results

The gravity and magnetometer surveys were carried out over two areas. The main area shows considerable variation in both the magnetic and the Bouguer gravity relief. The survey of the other area, smaller in size and located to the north of the main survey area, indicated only minor variations in relief.

The magnetic survey of the northern area indicates that it is underlain by one rock-type, although in the south-eastern corner there is evidence that another formation may be nosing in. However, the data obtained is insufficient to form any definite conclusions. The gravity data over this area shows a regional gradient of approximately 0.6 milligals per mile in a west to east direction, however insufficient data was collected to establish this as a true gradient. As with the magnetic data, the gravity work does not indicate anything of significance in this area.

The magnetic feature of the main survey area is the central magnetic 'low' flanked by 'highs'. The individual 'highs' and 'lows' within this central section are, in most cases, one station readings and therefore are probably due to local disturbances. It is thought that this central section is

underlain by one rock-type, the magnetic variations being due to undulations within the bedrock surface and local disturbances. The central low appears to be closing off to the south. A sharp magnetic ridge striking in a north-south direction is indicated on the west side of the area. The close contouring to the east of the magnetic highs indicates either a geological contact or structural changes.

These magnetic anomalies coincide with changes in the topography, indicating the changes may be due to variations in the basement. The eastern side of the central low shows as a much broader magnetic 'high'. However, the change is not as marked as on the western side. This anomalous zone is probably due to the same causes as the western ridge, however, the structural change will not be so great as a larger mass appears to be involved. A number of faults appear to be indicated by the magnetic data, particularly in the southern portion of the main area.

The Bouguer Gravity Map indicates a number of distinct features, the most noticeable being the gravity 'highs' and 'lows' coinciding with the topographic 'highs' and 'lows'. However, in general the survey indicated that the central part

of the area is associated with a gravity 'low' flanked on the east and west by a gravity 'high'. The gravity 'high' on the west is more pronounced than the one to the east but is associated with the high ridge running north and south through the western part of the surveyed area. This gravity 'high' is probably due to a structural movement, this is further substantiated by the fact that it is associated with a magnetic 'high'. The smaller gravity 'high' located to the east side of the area may be associated with a minor structural change or a lateral variation in the density. It must be stated that one density was used in all the gravity calculations.

The 'lows' found in the central part of the area are probably reflecting the variation in bedrock topography, and may be associated with the structural movements on either side. However, it must be pointed out that the 'lows' could be also attributed to the presence of alluvium.

Information available from known wells located in the general area indicates that gravity highs are indicative of a structural change, particularly if also associated with a magnetic 'high'.

A most interesting anomaly, and worthy of further consideration, located during the survey lies in the northwest corner of the main survey area at latitude 63° , longitude $123^{\circ}15'$. This anomaly is not very prominent as it is distorted by the effects of the large gravity 'low' to its west and the gravity 'high' to the east. Striking in a near east-west direction, this small anomaly may be an arm or extension of the large gravity anomaly located during a previous survey on the west bank of the Mackenzie River. In order to better define the zone it should be further investigated by seismics. The large gravity 'low' observed along the west boundary of the area surveyed is due to the large alluvium deposits along the Mackenzie River.

Conclusions

In conclusion, a number of gravity anomalies were indicated by the survey. Unfortunately they were also associated with topographic variations which may prove the controlling factor. Where magnetic 'highs' are associated with gravity 'highs' it is considered that structural changes have taken place. It is thought that the high to the west is due to structural movement, whereas the one to the east is

more probably due to topographic effects. Information available from wells in the general area appears to substantiate these facts.

Of the area surveyed, the area of most interest is centered at the small anomaly located at latitude 63° and longitude 123°15' in the northwest corner of the main area. This anomaly is not adequately defined as it is disturbed both to the east and west by large topographic expressions. This anomaly is worthy of further investigation as it could be associated with the anomaly found to the west of the Mackenzie River during a previous survey. However, due to the fairly heavy deposits along the Mackenzie River it is recommended that a seismic survey be carried out in order to ascertain whether or not this anomaly is part of the previously located anomaly. Should it be found to be part of the same anomaly then, of course, further work would be warranted.

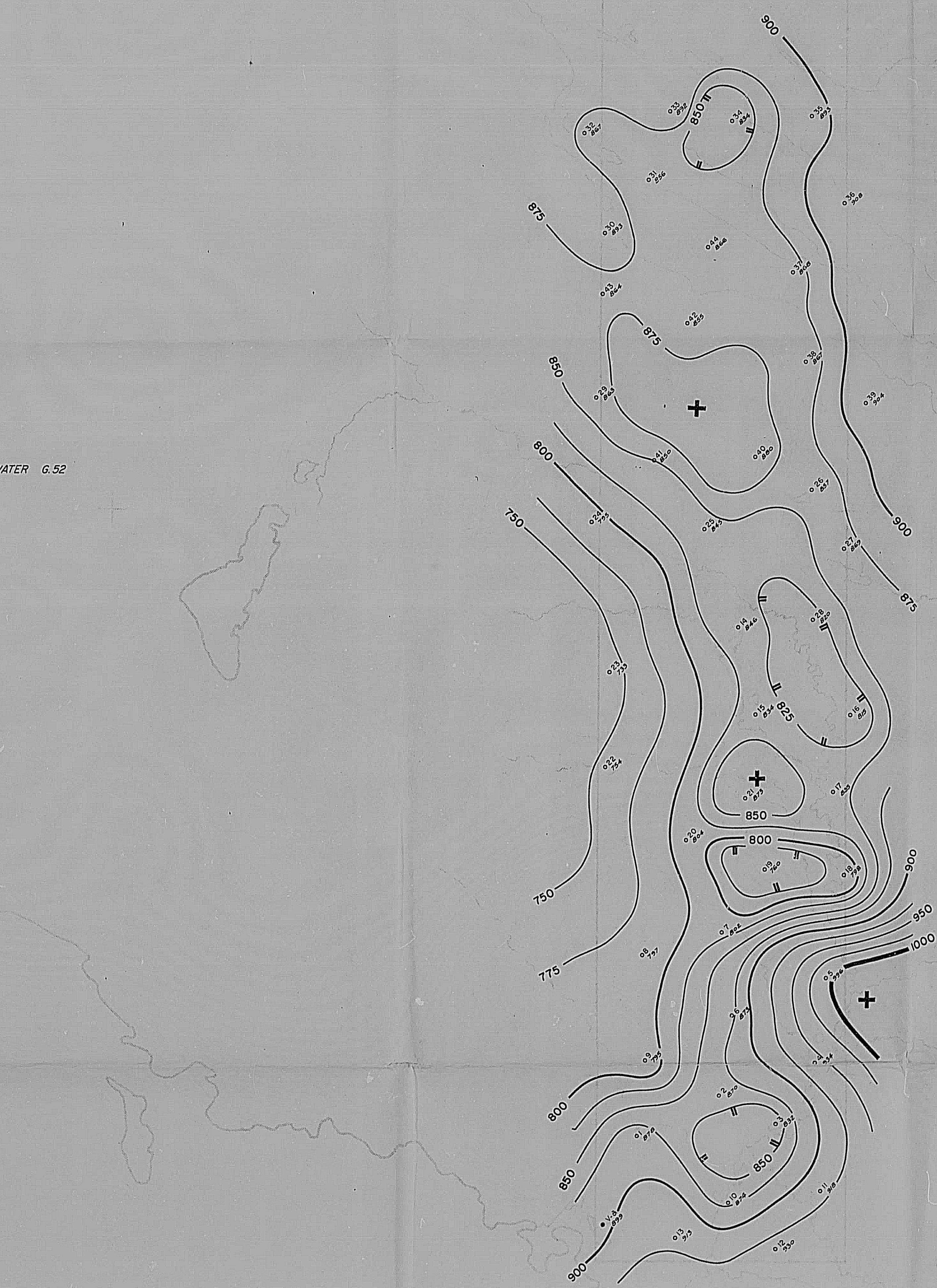
Respectfully submitted,
VELOCITY SURVEYS LIMITED

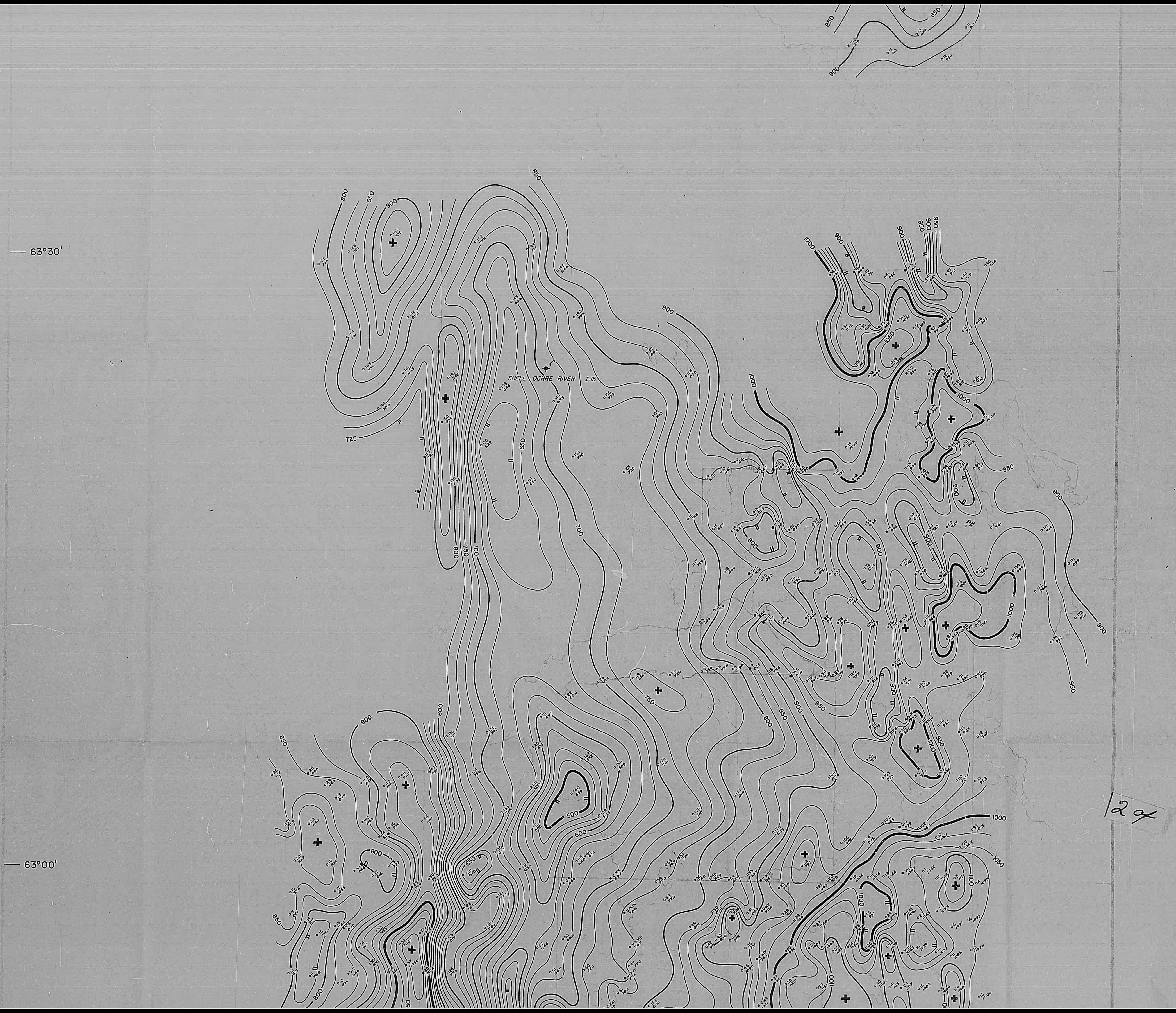


November 1964

64°00'

SHELL BLACKWATER G.52



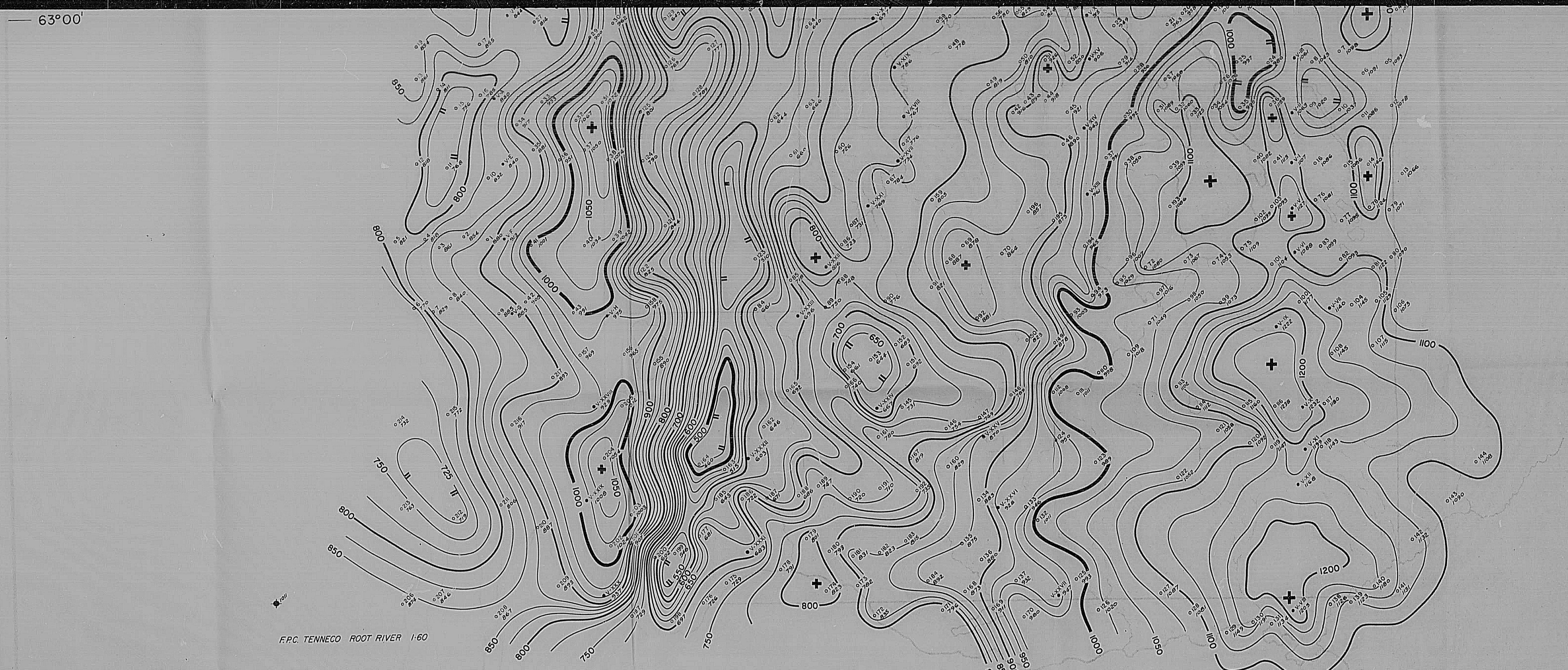


63°00'

F.P.C. TENNECO ROOT RIVER 1:60

304





62°30'

GRAVITY AND MAGNETIC SURVEY

MAGNETIC RELIEF

BLACKWATER LAKE AREA, N.W.T.

TENNECO OIL AND MINERALS LTD,
CALGARY, ALBERTA.

VELOCITY SURVEYS LIMITED, CALGARY

Scale 1 inch = 2 miles

Date: September 1964

Contour Interval 25 GAMMAS

123°30'

123°00'

122°30'

122°00'

14 of 4

1000 1100 1200
1000 1100 1200
1000 1100 1200

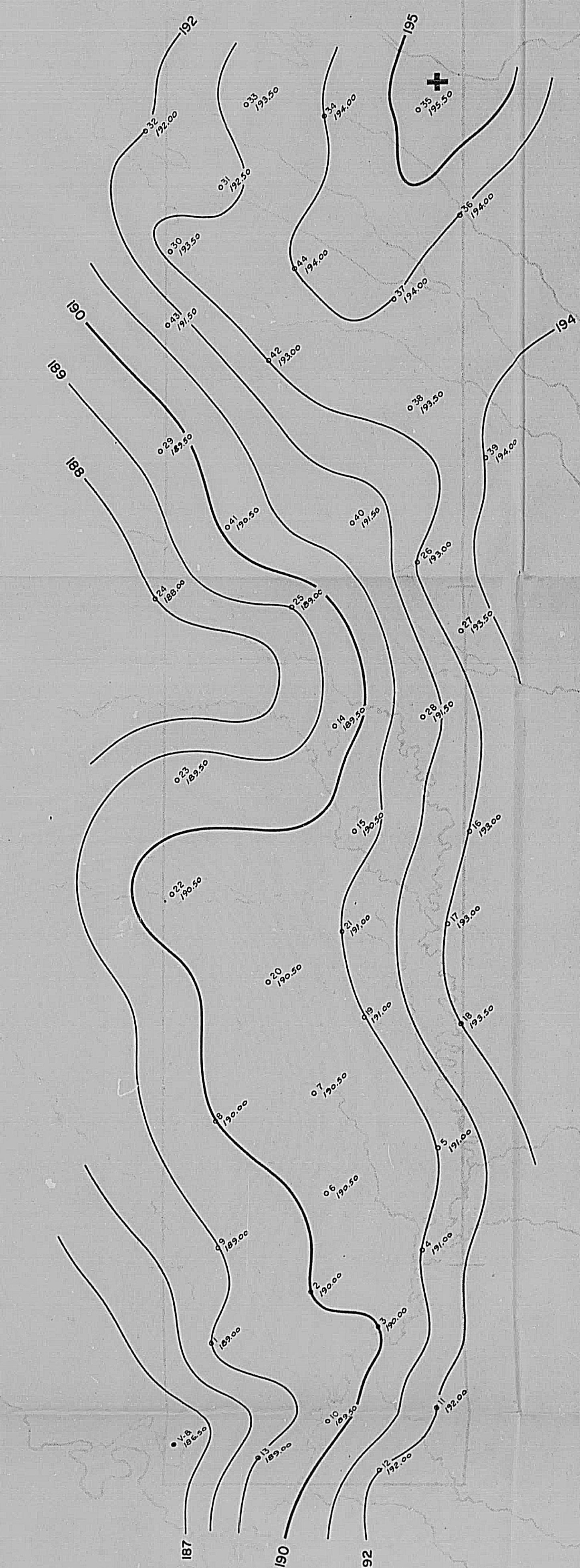
I.O.E. TRIAD EBBUTT D-50

1000 1100 1200
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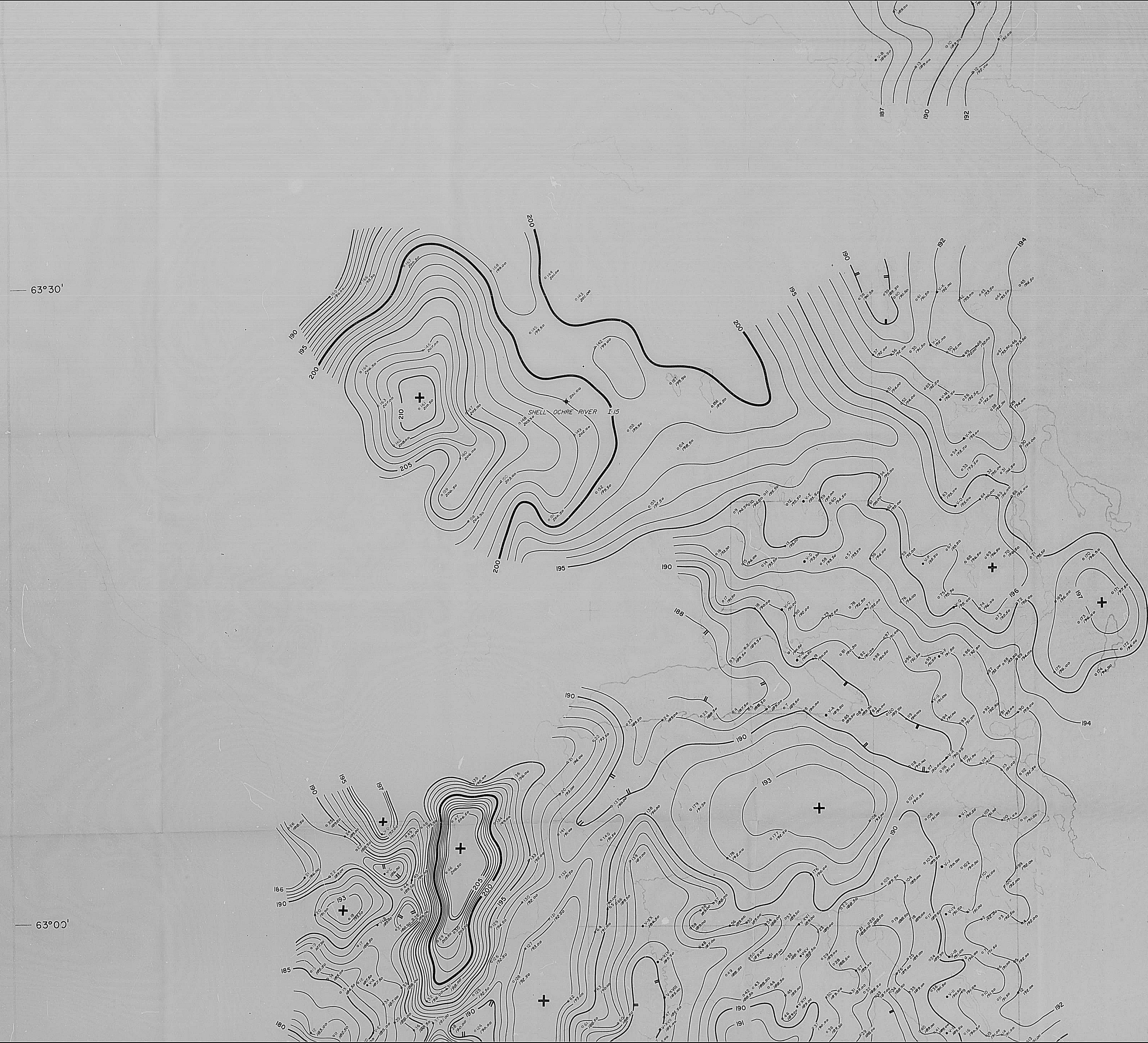
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— 64°00'

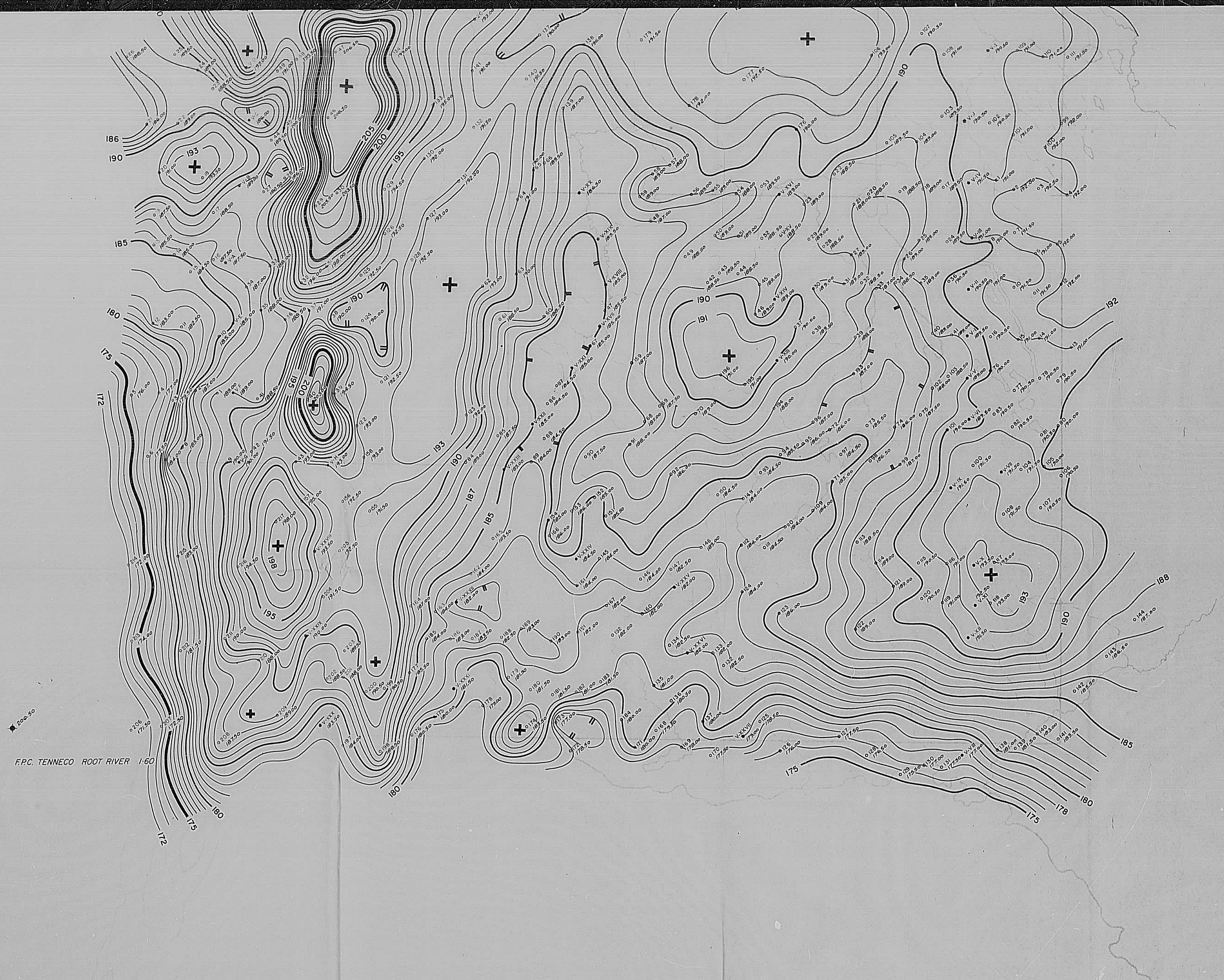
○ 20850
SHELL BLACKWATER G.5



10f



63°00'



62°30'

GRAVITY AND MAGNETIC SURVEY

BOUGUER GRAVITY

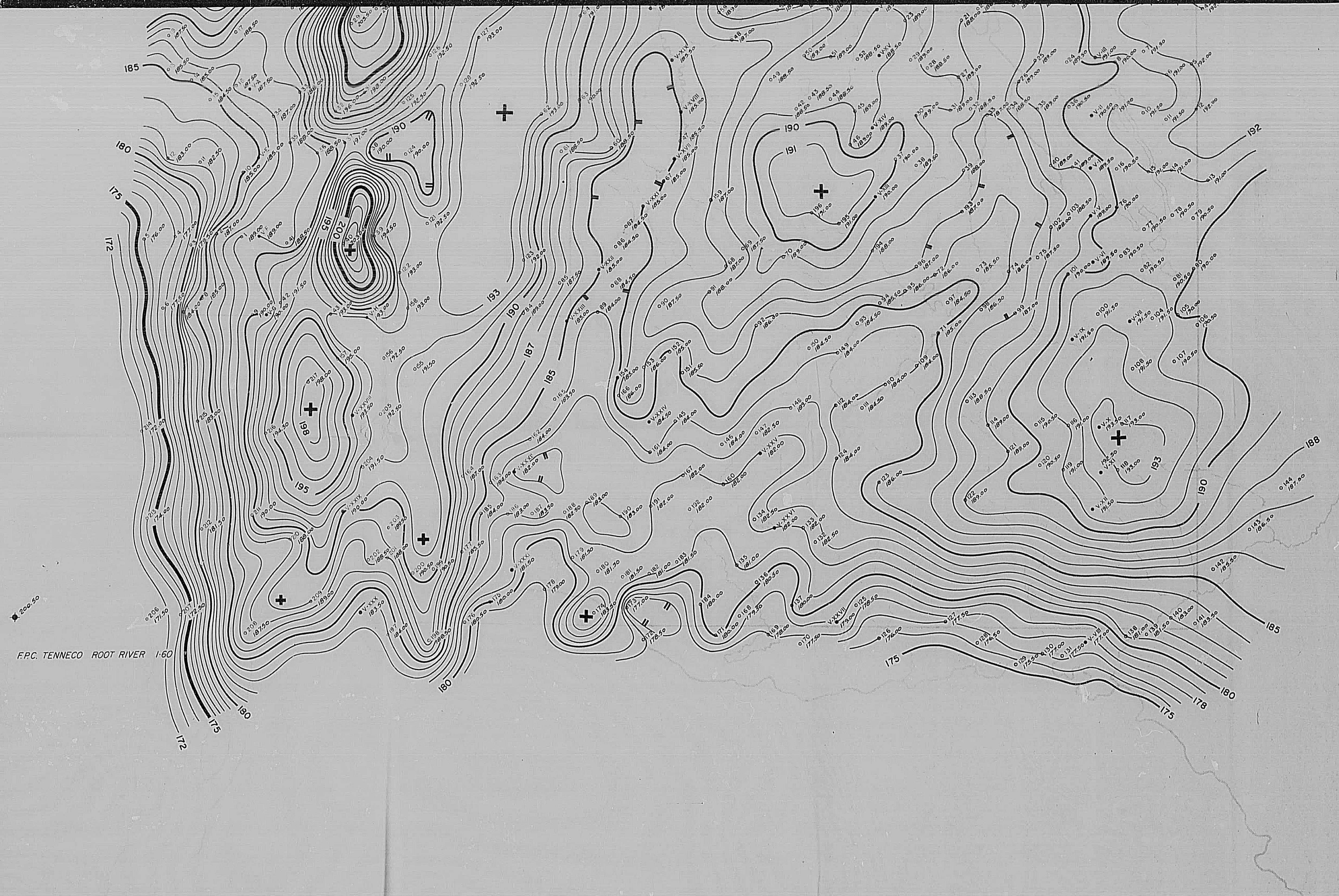
BLACKWATER LAKE AREA, N.W.T.

TENNECO OIL AND MINERALS LTD,
CALGARY, ALBERTA.

VELOCITY SURVEYS LIMITED, CALGARY

O 194.00
10.E. TRIAD EBBUTT D.50

O 198.50
10.E. TRIAD EBBUTT J.70



— $62^{\circ}30'$

GRAVITY AND MAGNETIC SURVEY

BLACKWATER LAKE AREA, N.W.T.

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<div[](https://i.imgur.com/3Q1GZtD.jpg)

I.O.E. TRIAD EBBUTT D.50

I.O.E. TRIAD EBBUTT J-70

123°30'

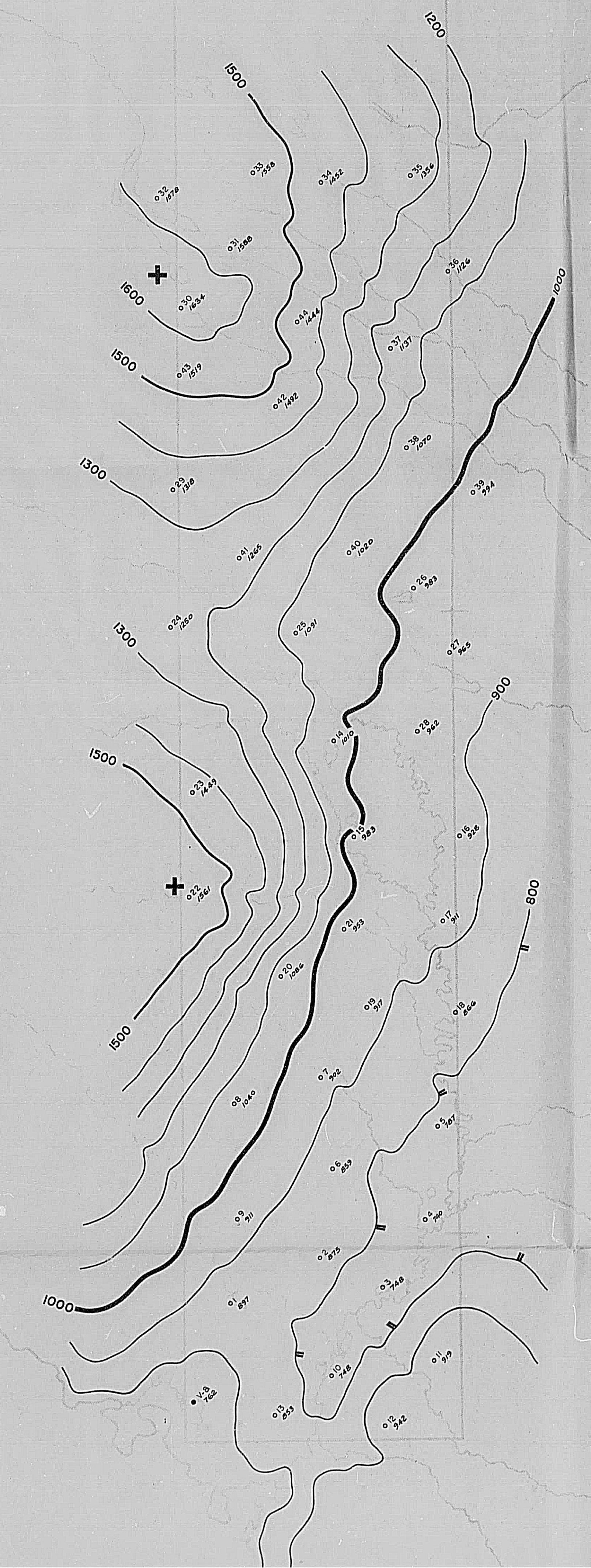
— 123°00'

1000

4 of 4

— 64°00'

010°
SHELL BLACKWATER G.52





— 63°00'



— 62°30'

GRAVITY AND MAGNETIC SURVEY
SURFACE ELEVATION
BLACKWATER LAKE AREA, N.W.T.

TENNECO OIL AND MINERALS LTD,
CALGARY, ALBERTA.

VELOCITY SURVEYS LIMITED, CALGARY

Scale 1 inch = 2 miles Date: September 1964

Contour Interval 100 FEET

122°00'

122°00'

O.056
I.O.E. TRIAD EBBUTT D-50

O.015
I.O.E. TRIAD EBBUTT J-70

130X



— 62°30'

GRAVITY AND MAGNETIC SURVEY
SURFACE ELEVATION

BLACKWATER LAKE AREA, N.W.T.

TENNECO OIL AND MINERALS LTD,
CALGARY, ALBERTA.

VELOCITY SURVEYS LIMITED, CALGARY

Scale 1 inch = 2 miles Date: September 1964

Contour Interval 100 FEET

— 123°30'

— 123°00'

I.O.E. TRIAD EBBUTT D-50

I.O.E. TRIAD EBBUTT J-70

14 of 4

— 122°30'

— 122°00'