

LEGEND

Shot by Kenting 1968  
Shot by Velocity Survey 1965  
Shot by Heiland 1961  
Shot by Teledyne 1968-1969

-CITIES SERVICE PETR.  
CORP.  
—  
CANADA

THE PROVIDENCE (N.W.T.)  
EDMAC AREA

### SURFACE ELEVATION

DATUM: Mean Sea Level  
ELOCITY SURVEYS LIMITED

62-6-4-22

Seismic Survey Report  
Redmac Area

Northwest Territories

Canada-Cities Service Petroleum Corp.

June, 1969



Abstracted for  
Geo-Science Data Index

Date \_\_\_\_\_

FINAL REPORT  
ON  
SEISMOGRAPH SURVEY  
IN  
REDMAC AREA  
NORTHWEST TERRITORIES  
FOR  
CANADA-CITIES SERVICE PETROLEUM CORPORATION  
BY  
VELOCITY SURVEYS LIMITED

June, 1969

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Calgary 67, Alberta.  
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J. Murchison

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FINAL REPORT  
REDMAC AREA  
NORTHWEST TERRITORIES

INTRODUCTION

In March and April 1969 a reflection seismograph survey in the Redmac area of the Northwest Territories was conducted for the Canada-Cities Service Petroleum Corporation by Velocity Surveys Limited.

The purpose of the survey was to provide additional reconnaissance and some detailing of previous shooting. It consisted of 72 miles of line between latitudes  $60^{\circ} 55'$  and  $61^{\circ} 10'$  north and longitudes  $118^{\circ} 40'$  and  $119^{\circ} 35'$  west.

SUMMARY

From an operational standpoint the survey was a success. Production was good and the quality of the field data was fair. Some poor data was recorded in the southeastern portion of the prospect, however with 600% subsurface coverage, the final stacked sections were of fair or good quality. The seismic field parameters used are well suited for the area.

Velocity Surveys mapped the surface elevation and the near surface low velocity layer. Final stacked structure sections were turned over to Canada-Cities Service for interpretation.

## GENERAL INFORMATION

### Geographic Location

The Redmac area is located 60 miles west-south-west of Fort Providence, Northwest Territories. It lies in Townships 137 to 140 and Ranges 5 to 9 West of the 6th meridian. The Mackenzie River runs east to west through the area (see Location Plat Fig. I).

### Purpose of Survey

The purpose of the survey was to extend the existing seismic control and to add detail in some areas of the previous work.

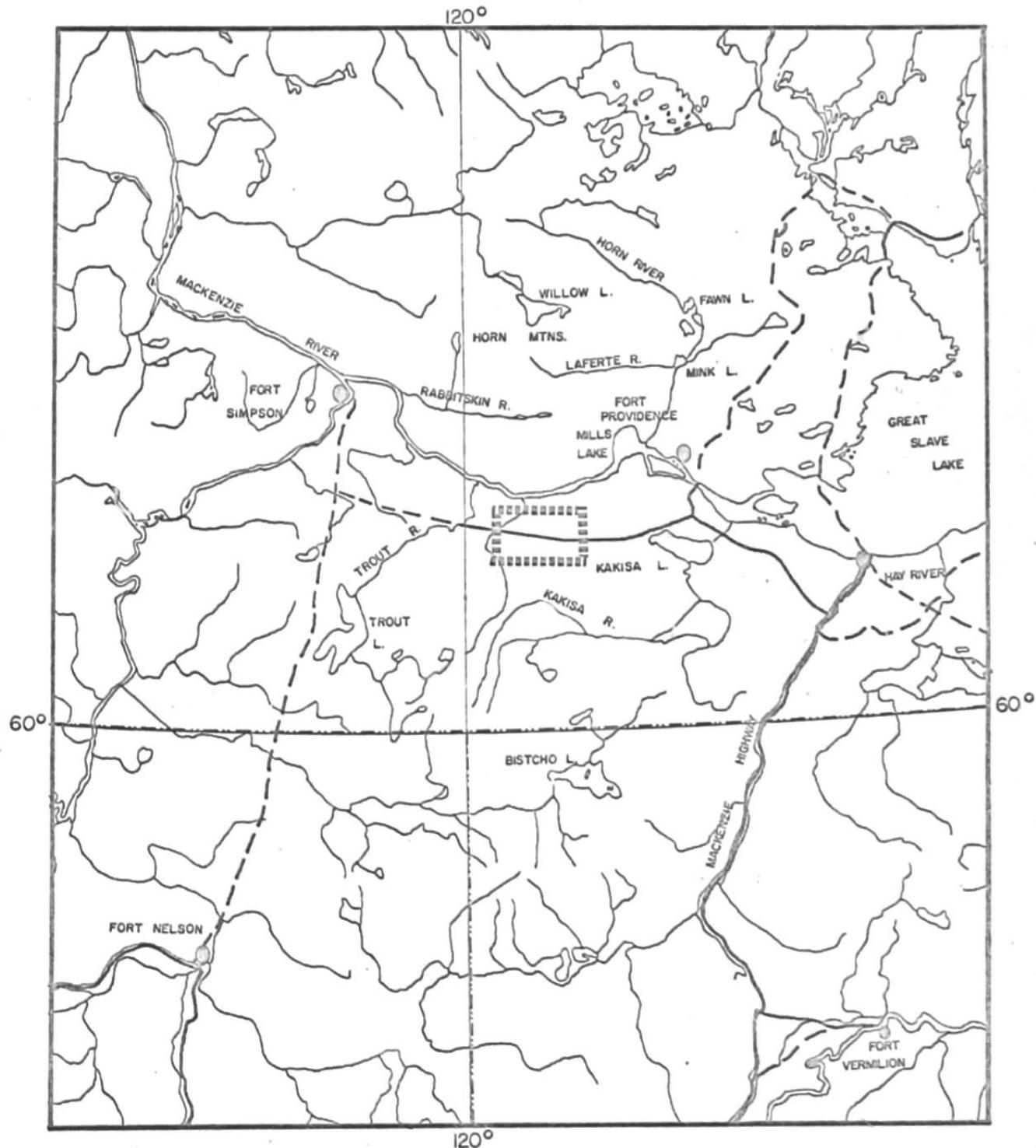
### Topography

The surface is gently rolling with a few small creek valleys running through the prospect. At shotpoints S-20, T-25 and V-120, a gentle ridge divides the higher plateau in the south from the Mackenzie River lowlands. On the plateau, muskeg terrain with few trees is predominant. Heavier timber is encountered near the drainage channels.

Surface elevations range from 1073 feet above sea level in the southeast to 612 feet above sea level at the north end of line T.

### Accessibility, Support and Weather

The camp was located near the Bouvier River along the highgrade road from Hay River. Good access to the seismic lines is provided by the road which runs through the prospect.



SCALE . 1 INCH. = 50 MILES.

LOCATION PLAT

FIGURE I

Cold weather kept the trails frozen.

Line Clearing

Since vegetation is fairly light and the surface relief not severe, few problems were encountered in clearing line.

Three bulldozers, one D-6, one D-6C and one D-7, double shifted, were used for the work.

Drilling

Six drilling rigs, three top drives, two Mayhew 1000's and one auger, all on wheels were used throughout the survey.

The Mayhew 1000 rigs were mainly used east of the Bouvier River where hard limestone and sandstone was encountered. Where this formation was encountered at depths of less than 40 feet, the shothole was drilled 10 feet into the formation.

A typical hole log for this area is:

S.P. U-71:	0 - 5	sandy clay and rock
	5 - 30	hard limestone

West of line A, drilling was fair, but surface gravel made loading of the charge to bottom difficult.

A hole log for this area shows:

S.P. Q-150:	0 - 15	muskeg
	15 - 30	clay and rock
	30 - 40	sandstone

Single holes were drilled throughout the prospect.

### Surveying

Vertical and horizontal survey control was run with a Wilde T1A theodolite.

The surveying was based on the Rabbit Lake #3 well in the southeast portion of the prospect. A tie was run to the Redknife I-24 well in the western part of the prospect. The elevations mistie the previous survey by -8 feet. Previous vertical control was based on the Mackenzie River ice level.

The line identification is a continuation of the previous survey. The letters Q to Y were used for the lines and the shotpoints were numbered consecutively.

### RECORDING EQUIPMENT AND FIELD TECHNIQUES

Seismic data were recorded with an analog tape system using S.I.E. PT 100 amplifiers and an S.I.E. PMR 20 FM tape unit. A monitor record was taken at each shotpoint.

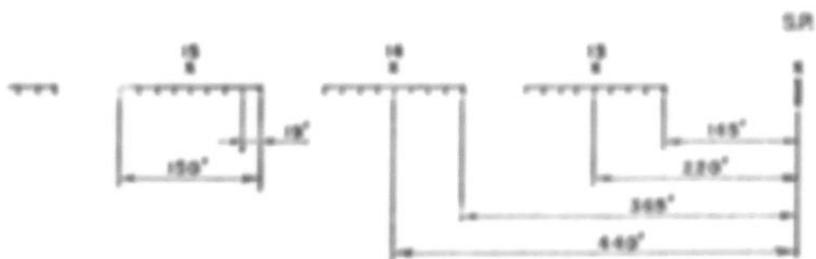
The monitor and tapes were recorded with a 1-16-100 filter and fast A.G.C. Playbacks of the tapes were made in the field with a 1-28-60 filter.

Electrotech EVS-2 geophones, 14 cps., were used in groups of nine per trace over 150 feet.

Half mile split spreads were used with a 220 feet trace interval. Shotpoints were spaced 440 feet apart to give 600% common depth point coverage (see Spread Diagram - Fig. II).

Single holes loaded with 1 1/4 lb. of dynamite were used throughout the area.

## SPREAD DIAGRAM



600 % coverage  
9 geophones cover 150 feet.  
Shotpoint distance is 440 feet.

REDMAC AREA - 1969

FIGURE II

### RECORD QUALITY

Record quality varied from poor to good. Poor record data were recorded in the southeastern portion while good data prevailed in the north. The muskeg type terrain in the south was the major reason for poor data. The charge depth, which varied considerably in the eastern half of the prospect, seemed to have little effect on the quality.

Stacking of the six fold data resulted in fair to good sections even where individual records were poor.

### DATA PROCESSING

#### Computation Procedure

A graphical plot of first refracted arrival times was made at each shotpoint. From the near-surface velocities shown by the plots correction for each shotpoint to a common datum plane was made using the high velocity time intercept and a velocity replacement K-factor.

The procedure makes use of the following formulae:

$$W_N = K(T_2 - T_{uh}) \quad K = \sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

$$E_c = \frac{E_d - E_h - D_s}{V_d}$$

$$T_c = 2E_c + W_N + T_{uh}$$

where

$W_N$  = reflection delay time due to near surface low velocities  
 $K$  = factor used to theoretically replace  $V_1$  material with  $V_2$  material.

Ec	=	elevation correction
Eh	=	surface elevation
Ds	=	depth of shot
Ed	=	elevation datum
Vd	=	datum correction velocity
T2	=	V2 time intercept
Tuh	=	uphole time
Tc	=	total correction

The V2 velocity was assumed to be the same as the datum velocity, 12,000 feet per second, and this velocity line applied as a constant high velocity to determine the V2 time intercept on the refraction plots. The datum used was 600 feet A.S.L.

Using the one-way correction to datum from the depth of the shot at each shotpoint, and the one-way correction to datum from the surface, the total correction at each shotpoint was made. Where local variation in weathering made individual trace static adjustments necessary, a weathering pattern was established by averaging plotted reflection times from different shotpoints at each geophone group.

#### Playback Data

Variable area six point stack structure sections for all seismic lines were made from the analog tapes. The normal moveout curve used was constructed empirically from an examination of the field playback records. NMO removed playbacks

were run and curve adjustments were based on these for the final stacked sections. A time lag of approximately .018 seconds in relation to the monitor record time was experienced through the use of the 1-27-65 playback filter. The sections match the sections of the previous year in polarity and time.

Respectfully submitted,

VELOCITY SURVEYS LIMITED,

*H. de Boer*

H. de Boer - Party Chief

*J. Murchison*

J. Murchison - Operations Supervisor

APPROVED:

*G. Kostashuk*

G. Kostashuk  
General Manager.

## STATISTICAL SUMMARY

### Recorder

Days Worked	20
Shotpoints	894
Total Hours	264
Recording Hours	171.5
Travel Hours	84.5
Average Shotpoints/hr.	3.4
Total Dynamite Used( lbs.)	1275
Total Caps Used	974

### Drills

Total Footage	26,777
Total Hours	1137
Drilling Hours	873 1/4
Feet Drilled/hr.	31

RESULTS:

Preface: The results discussed in this report relate to the seismic program conducted under project number 62-6-4-69-1. The work consisted of 72 miles of CDP seismic program which was shot across permits numbers 4385, 4386, 4387, 4388 and 4049. The profiles of this work are indicated on the maps by red lines. The structural contour maps based on the reflection data show the interpretation made using all of the geophysical control available to Canada-Cities Service Petroleum Corporation. The portions of the data not discussed in this report will be reported upon in other written reports submitted by the operators of the respective projects. Canada-Cities Service Petroleum Corporation has acquired these additional data through farmout agreements or data exchanges.

General: (maps made, data quality, and well control)

The results of the seismic program are shown on four maps which are as follows:

Surface Elevation  
Weathering Corrections  
Top of Carbonate Structure  
Precambrian Structure

The quality of the reflection data varied from good to poor on the lines shot. After being processed into corrected record sections only a small portion of the data was not useable. The surface conditions along the lines are considered to be mainly responsible for most areas of poor record quality. It is felt that the poor record areas could be improved if pattern holes were used to reshoot the lines.

The seismic traverse was tied by use of the previously shot lines to the Wilkinson Redknife #1 well dug in February, 1961 and to the Cities Service Redknife I-24 and J-21 wells dug in January

and February, 1969. The sonic log information was used to make the synthetic seismograms on which the reflection identification for the program is based.

Regional Results: The new seismic control revealed three major geologic features. One of these features was partially indicated by the seismic control shot during 1968. It is the large low area located across the central part of this area of recent work. The second feature and probably the most important feature disclosed is the presence of a carbonate development of sizeable magnitude located in the southeast corner of permit 4385. The third major geologic feature is the appearance of what appears to be an isolated carbonate development located in the western part of permit 4049 and the northeast part of permit 4386.

It is altogether possible that the aforementioned carbonate reef front disclosed in the southeast corner of permit 4385 could be connected with other similar type events located to the west in the south part of permits 4386 and 4387.

Discussion of Subsurface Maps: The two time structure maps generally conform quite well with each other to show the general features of the area. The major low area extending east-west across the area of recent work is present on both maps. However, the amount of relief outlining this low is not as great on the "Precambrian" map as it is on the "Top of Carbonate" map. This difference in the amount of dip, is attributed to the fact that the "Top of Carbonate" reflection is influenced by the additional carbonate developments along the banks of the low area. The maps disclosed five anomalies of significant importance. As these anomalies are more pronounced on the "Top of Carbonate" map, each will be discussed relative to its

appearance on this map. A discussion of the results of the "Precambrian" structure map will note the differences in the anomalies as shown by this map.

Top of Carbonate Structure:

Anomaly "1": This anomaly was revealed by the 1968 shooting program and the Cities Service Redknife I-24 well was subsequently dug thereon. Two miles of 1200% CDP shooting was conducted on Line "C" on and near this anomaly. The results of the new shooting showed the anomaly to have greater relief on the "Top of Carbonate" structure than was previously mapped. The new values tie closely to the velocity survey information obtained from the wellbore. This feature shows a closed relief of 33 milliseconds. However the steep north dip shown by the data immediately north of the well site is the most important as it indicates a development of the carbonate reef section at this point. The well information showed the top of the carbonate to have a good porous section. The fact that the porous section was not filled with hydrocarbons but salt water indicates that a good potential reservoir is present but that a structural entrapment for hydrocarbons is not present at this location.

Anomaly "2": This anomaly also was indicated by Line "C" of the 1968 shooting program. Its presence is confirmed by the information on Line "S" from shot point S-1 through shot point S-40. The data from shot point S-20 to shot point S-35 appears similar on the record section to that data obtained further to the south which is associated

with the carbonate reef development in that locality. The maximum closure shown by this anomaly is approximately 20 milliseconds.

Anomaly "3": This anomaly is indicated by fair to poor data located on Lines "R", "U", and "Y". Approximately 60 milliseconds of north dip is shown from the crest of the anomaly north into the low which runs regionally east-west across the area. Additional seismic control with somewhat better quality could well enhance the attractiveness of this feature. Being located on the carbonate reef front and somewhat similar to Anomaly "1" it could be an area of entrapment of hydrocarbons.

Anomaly "4": This anomaly is located on the north side of the regional low which has been previously mentioned. Approximately 40 milliseconds of dip defines the anomaly on old Line "A" and recently shot Lines "U" and "V". This feature may possibly be part of a large carbonate development separated from the main carbonate reef development to the south. There is also inference that it may be connected to Anomaly "2". Additional seismic control will be necessary to fully outline the extent of this anomaly.

Anomaly "5": This anomaly is considered to potentially be the most outstanding feature revealed by the recent shooting program, although its full extent and limits are unknown and future control will be necessary. The important fact is that it shows the carbonate reef front to be

located approximately 6 miles north of the wells dug in the Rabbit Lake gas field. Line "W" shows 80 milliseconds of north dip between shot points W-60 and W-90. A portion of this dip may be due to an uplift of the entire section, (Precambrian included). However at least 20 milliseconds is due to additional carbonate development. Should the "Top of Carbonate" section have porosity on this anomaly similar to Anomaly "1" a substantial amount of hydrocarbons could be trapped by this feature. Additional seismic control will be necessary to define the limits of this anomaly.

Precambrian Structure: As this map generally conforms with the "Top of Carbonate" map only the outstanding Precambrian irregularities will be discussed.

Anomaly "1": No closure on this anomaly is seen at the Precambrian level. Approximately 25 milliseconds of north dip is indicated from the Cities Service I-24 well site to shot point C-385. This small amount of dip suggests that the carbonate development has taken place on an uplifted Precambrian promontory.

Anomaly "3": Gentle north dip is shown across this anomaly at the Precambrian level. This dip contoured on sparse data suggests that the carbonate section is developed on top of a gentle sloping Precambrian uplift.

CONCLUSIONS AND RECOMMENDATIONS:

The recent seismic program disclosed three regional features of interest and five anomalies which are considered to be significant.

One of the anomalies (Anomaly 1) was tested and found to have a porous top of carbonate section. The promising section found on this anomaly indicates that Anomalies "3" and "5" may possibly be worthy of test wells, provided that additional seismic control is obtained to show that the respective anomalies form hydrocarbon entrapments.

It is recommended that additional control be shot to better define Anomalies "3", "4", and "5".

It is recommended that future work in localities of poor record quality make use of three hole patterns to improve the data.

Respectfully submitted,

CANADA-CITIES SERVICE PETROLEUM CORPORATION

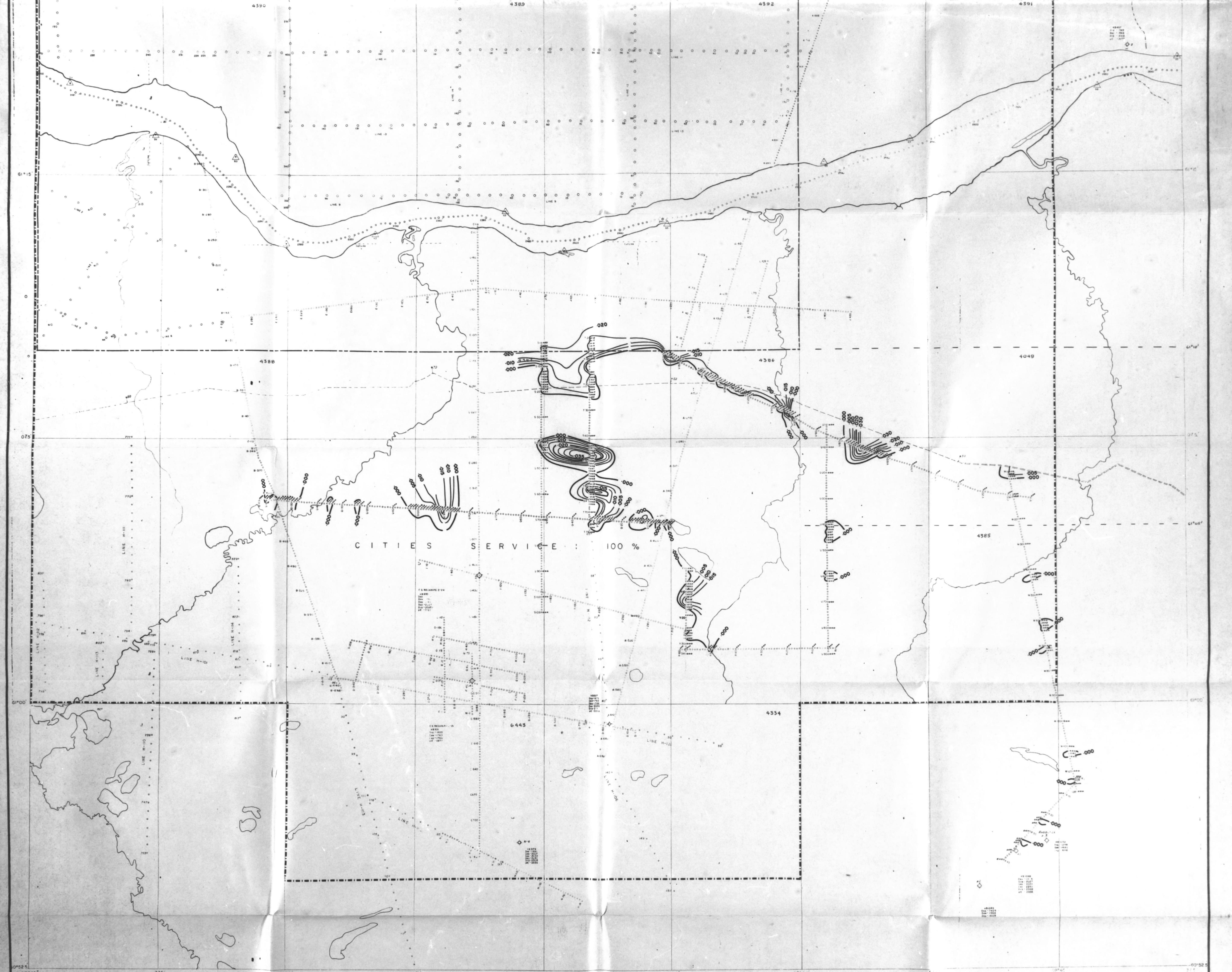
*E.B. Claunch*  
E. B. Claunch, P. Geoph.,  
Chief Geophysicist.



Calgary, Alberta,

August 7, 1969.





LEGEND

2800 ft Shot by Vistech 1965  
 2400 ft Shot by Velocity Survey 1968  
 1400 ft Shot by Helitron 1961  
 1000 ft Shot by Telezyne 1968-1969

	CAN-CITIES SERVICE PETR. CORP. CALGARY
CANADA	
FORT PROVIDENCE (N.W.T.) REDMAC AREA	
WEATHERING CORRECTIONS	
VELOCITY SURVEYS LIMITED C+.008 s.	
Survey by	Approved by
Approved by	Drafted by
Log by	Scale
Log by	Miles





**CAN-CITIES SERVICE PETR. CORP. CALGARY CANADA**

**FORT PROVIDENCE (N.W.T.) REDMAC AREA**

**- TOP OF CARBONATE STRUCTURE -**

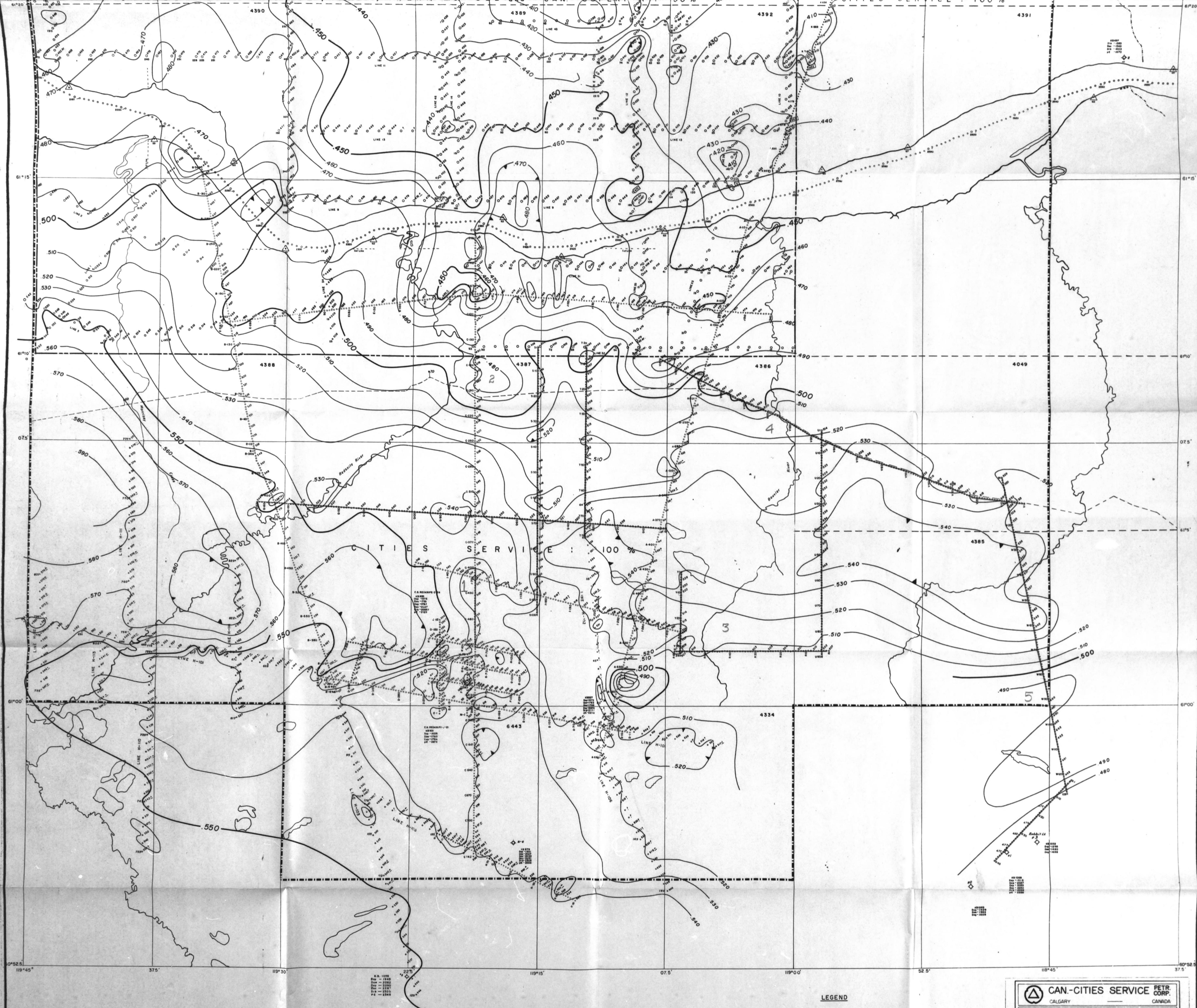
DATUM = 600' A.S.L.  $V_g = 12000$  ft./sec.

JULY 1969

Graphed by E.B.C. Drifted by

Scale: 1 mile





LEGEND

4390 • Shot by Kenting 1968  
 4391 • Shot by Velocity Survey 1968  
 4388 • Shot by Heiland 1961  
 4387 • Shot by Teledyne 1968-1969  
 4334 • Shot by Kenting 1969  
 6443 • Shot by Velocity Survey 1969

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 <b>CAN-CITIES SERVICE PETRO. CORP.</b> <b>CALGARY</b> ————— <b>CANADA</b>	
<b>FORT PROVIDENCE (N.W.T.)</b> <b>REDMAC AREA</b>	
<b>STRUCTURE MAP</b> <b>PRE-CAMBRIAN</b> <b>C.I. = .010 SECS</b>	
DATUM = 600' A.S.L.      Scale: 1:200000      Vp = 12000 FT/SEC JULY 1/69      Drawn by: J.H.H.      Approved by: _____ H.V.      Dated: _____      Drawn by: _____ Mins	