MAR 19790009: NORTHEASTERN ALBERTA

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GEOLOGICAL AND GEOPHYSICAL REPORT ON PERMIT 244, N.E. ALBERTA

Twp. 119 R 1 W4M Sections 22-27, 34-36
Twp. 120 R 1 W4M Sections 1-3, 10-15

by

D. B. Kilby, P. Geol.
G. I. Walker

Field work done between May 7, 1979, and May 31, 1979

19790009

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Report prepared in June, 1979

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SUMMARY

In May, 1979, an exploration program consisting of an airborne gamma spectrometry survey and ground electromagnetic, magnetic, induced polarization, prospecting and geological work was carried out on Permit 244, in northeastern Alberta along the Saskatchewan border.

Mapping on a grid established on the southeast portion of the property shows it to be underlain by quartz diorite or granodiorite probably of the Fishing Creek Quartz Diorite phase of the Wylie Lake Granitoid Complex. Sandstone and conglomerate boulders of the Athabasca Formation found in the grid area were mainly of low background radioactivity although several were highly anomalous. Airborne gamma spectrometry located five anomalies on Permit 244. Other geophysical methods yielded inconclusive results or anomalies associated with local topographic effects.

CONCLUSIONS

1. The Athabasca sandstone was not found in outcrop on Permit 244.

2. Except for several airborne gamma spectrometry anomalies, the other geophysical methods were unable to detect any major anomalies. This may be, in part, due to deep overburden.

RECOMMENDATIONS

1. Complete airborne and ground follow-up of anomalies located by airborne gamma spectrometry.

2. Drill test anomalous environments delineated.

INTRODUCTION

Quartz Mineral Permit 244 covers 4660 ha (11,510 acres). Hudson's Bay Oil and Gas Company Limited of 700 Second Street S. W., Calgary, Alberta, optioned an 83% interest in the property from C. & E. Explorations Ltd. of Calgary. Pacific Petroleums hold a further 12% working interest in the property.

Exploration in May, 1979, consisted of an airborne gamma spectrometry survey and ground electromagnetic, magnetic, induced polarization, prospecting and geological work.

LOCATION AND ACCESS

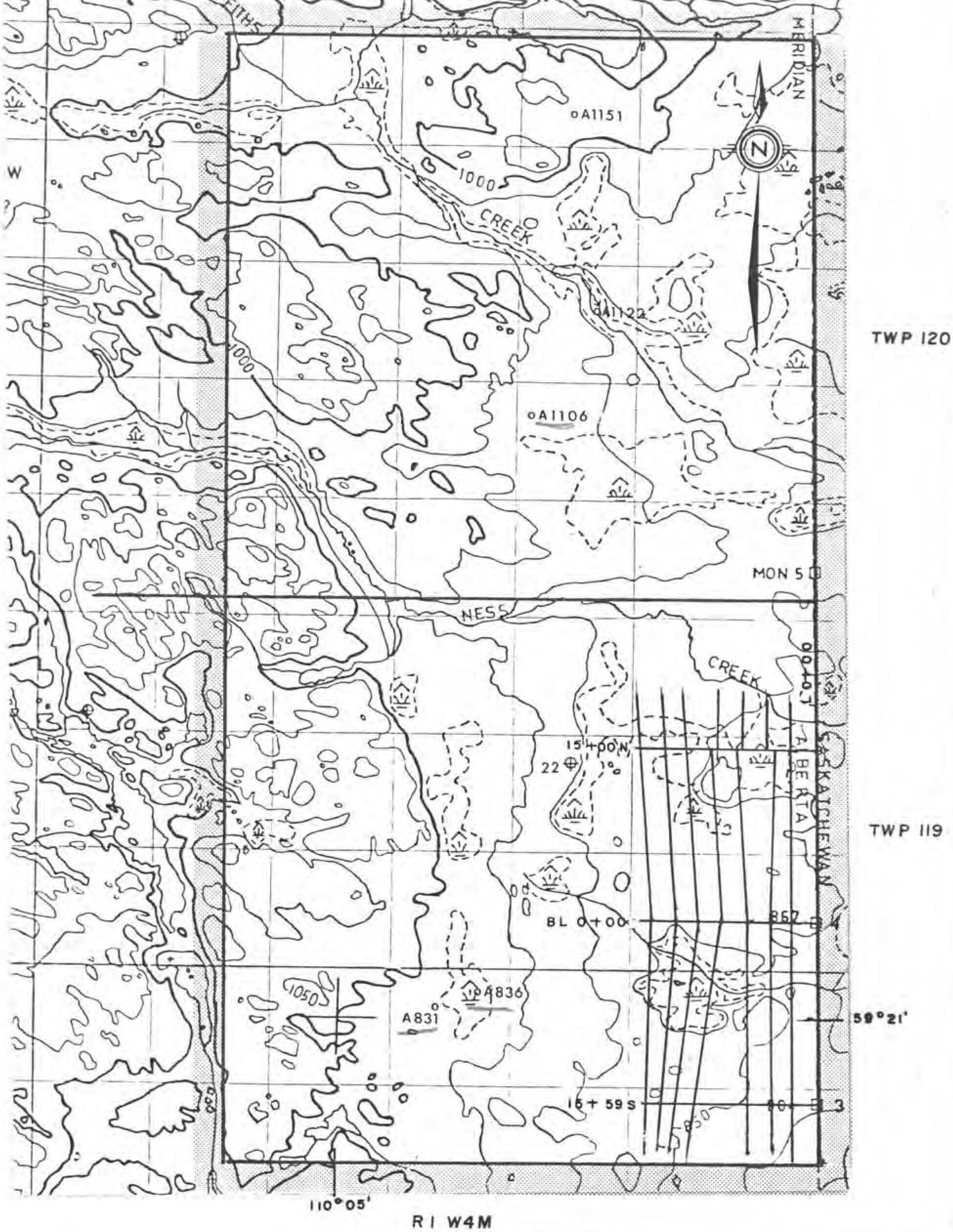
Permit 244 is located adjacent to the Alberta-Saskatchewan border (Figure 1) about 98 km northeast of Fort Chipewyan (latitude $59^{o}22'$N, longitude $110^{o}02'$W).

Access to the property is provided by float or ski equipped aircraft to Burstall Lake from Fort Smith, Fort Chipewyan or Uranium City. Equipment and personnel can be moved the nine kilometers from Burstall Lake to the property by helicopter.

PHYSIOGRAPHY

Harper, 1978, divided the Maurice Bay area into three main physiographic subdivisions that are apparently bedrock controlled.

1. A rocky upland 120-135 m above the level of Lake Athabasca, which is underlain by intrusive rocks of various compositions;
2. An intermediate zone 15-90 m above Lake Athabasca characterized by sandplain and muskeg with some raised storm beaches. This



o A 836 Airborne Anomaly

0 1 2
Kilometres

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

PERMIT 244

LOCATION MAP

MAP	DATE	BY	SCALE	N T S
FIG. I	JUNE '79	D.B.K.	1:50,000	74M/8

zone is underlain by the high grade gneisses that host the mineralization on the Maurice Bay property; and

3. A lowland zone, less than 15 m above Lake Athabasca, composed of muskeg, peat bog and raised storm beaches with scattered exposures of Athabasca sandstone.

The western portion of Permit 244 would be part of Harper's well drained, well exposed, rocky upland. The eastern portion, composed of muskeg and sand deposits drained by Ness Creek and a number of intermittent streams, has poor bedrock exposure. This area would probably fall into Harper's intermediate zone.

CLIMATE

In early May at the beginning of the project, temperatures were often below freezing and the ground was still snow covered. Toward the end of May, more seasonal temperatures were experienced and most of the snow had melted.

HISTORY

In 1976, C. & E. Explorations acquired the property and did a Landsat imagery study, followed by a short field examination. A number of small uranium showings were found, but work was restricted to the well exposed, rocky upland. In 1977, Pacific Petroleums earned their 12% interest by conducting a lake bottom sediment sampling program. A number of anomalies were detected, but were not followed up. Prospecting by Pacific personnel resulted in the discovery of a number of radioactive shear zones and quartz lenses which appear to be too small to be of further interest.

GEOLOGY

Godfrey (1978) indicates that the property is underlain mainly by the Fishing Creek Quartz Diorite and the Wylie Lake

Granodiorite phases of the Wylie Lake Granitoid Complex. These are probably in intrusive contact with biotite granite gneiss and metasediments on the north-central part of the property.

Harper (1978) divided the basement rocks at Maurice Bay into the Western Granodiorite Complex which correlates with Godfrey's Wylie Lake Granitoid Complex and the White Lake Complex which correlates with Godfrey's granite gneisses and metasediments. Mineralization at Maurice Bay is apparently concentrated at or near the unconformity between the White Lake Complex and the Athabasca sandstone.

Outcrops mapped in the grid area (Figure 2) were composed of a grey-weathering medium to coarse grained equigranular quartz diorite or granodiorite. Biotite is the predominant mafic mineral. Many outcrops have discontinuous lenses and bands containing feldspar megacrysts in a quartz, biotite matrix. Mafic lenses and bands composed of biotite and quartz are seen in some areas. These rocks would probably fall into the Fishing Creek Quartz Diorite phase of the Wylie Lake Granitoid Complex described by Godfrey (1978).

A large number of sandstone and conglomerate float boulders belonging to the Athabasca Formation were found in the grid area. Most had low background radioactivity but some had anomalously high uranium counts. These boulders could be divided into two main types:

1) A strongly hematitic quartz pebble conglomerate with a quartz rich matrix. These rocks may be originally from the Tazin Group, but it is thought that the high quartz content of the matrix indicates that they are part of the Athabasca.

2) A pinkish weathering medium grained quartzite with minor secondary uranium minerals is undoubtedly part of the Athabasca Formation.

3) A pink weathering, garnet-bearing, chlorite gneiss boulder was found which read up to 1400 cps with the Urtec spectrometer.

GEOPHYSICS

SURVEY METHODS

Control

A total of 36.2 line km of flag and compass line was established using a metric hip-chain for distance measurements (Figure 1). A base line 0+00N was established with its origin at monument #4 on the Alberta-Saskatchewan border. The southern tie line, established at 15+59S was located using monument #3 on the border. A northern tie line was established at 15+00N.

Magnetics

A Geometrics Model G-816 proton magnetometer was used to take readings at 25 m intervals on lines approximately 200 m apart along 31.5 km of grid. Diurnal drift was monitored and corrected for by surveying in loops that were closed within three hours. Readings were corrected for drift and plotted in stacked profiles on a 1:10,000 scale base map (Figures 3 and 4).

Results: Magnetometer readings range from 60644 to 60962 gammas. Several broad magnetic highs located on grid north (e.g. L 8+00W, L 12+00W and L 14+00W) are likely associated with shallow overburden and outcrop. Results are inconclusive.

Electromagnetics

i) VLF EM: A Crone Radem VLF EM instrument was used to take dip angle readings at 25 m intervals along 32 km of the grid lines (Figures 5 and 6). This spacing was later increased to 50 m when it was found that the additional readings were unnecessary. Results were plotted in section on a 1:10,000 scale map at a vertical scale of 1 cm = 20°.

Results: VLF EM dip angle readings range in value from +28° to -14°. Numerous weak cross-overs may be correlated with swamp-outcrop interfaces. One strong anomaly is located at 7+25S, Line 10+00W, and 7+25S, Line 12+00W. The anomaly strikes east-west and dips to the south. It correlates with a stream channel.

ii) Horizontal Loop EM: The Apex MaxMin II electromagnetic system was used in the horizontal loop mode with a 200 m cable. Surveys were conducted along 31.9 km of grid. Frequencies of 444 and 1777 Hz were used (Figures 7, 8, 9 and 10). Readings were taken at 50 m intervals and 25 m intervals in anomalous areas. Slope corrections were unnecessary because of the flat terrain. Results were plotted in profile on a 1:10,000 scale map using a vertical scale of 1 cm equals 10%.

Results: Two horizontal loop EM surveys were conducted at different frequencies. Response to the 444 Hz frequency ranged from +3 to -3 (In Phase) and +2 to -4 (out of Phase). Response to the 1777 Hz frequency ranged from +4 to -8 (In Phase) and +15 to -9 (Out of Phase).

Anomaly A

L 10+00W	Dip 79°S, Response Parameter 0.2
6+50S	Depth 4 m, Conductivity Thickness 0.07

Anomaly A corresponds to a VLF cross-over and stream channel.

Anomaly B

L 6+00W	Dip 77°S, Response Parameter 1.1
6+00S	Depth 22 m, Conductivity Thickness 0.39

Anomaly B corresponds to a stream channel.

Anomaly C

L4 + 00W   Dip 77°S, Response Parameter   1.0

6 + 00S   Depth 40 m, Conductivity Thickness 0.36

Anomaly C corresponds to a stream channel.

Induced Polarization-Resistivity

A Crone "Newmont Designed" IP-IV pulse type receiver and a Scintrex IPC-8 250W Transmitter were used in a 200 m square array. Readings were taken at 50 m and 100 m intervals on lines approximately 200 m apart along 11.5 km of grid. Chargeability and resistivity values were plotted, contoured and profiled on 1:10,000 scale base maps (Figures 11, 12, 13 14, 15 and 16).

Results: Resistivity ranges from 209 to 12066 ohm-meters and chargeability ranges from 8 to 48 milliseconds. There is a rough correlation between chargeability lows of less than 15 milliseconds and resistivity highs of more than 5000 ohm-meters. This is probably indicative of deep overburden.

Airborne Gamma Spectrometry

An airborne radiometric survey was flown over the permit area using a Hughes 500D helicopter chartered from Viking Helicopters Limited of Ottawa. A 1:25,000 scale airphoto mosaic was used for control of E-W flight lines approximately 200 m apart. A total of 232 line kilometers were flown in 3.3 hours of flight time. A mean ground clearance of approximately 35 m was maintained as closely as possible at a speed of 125 km/h. Profiles of uranium, thorium, potassium and total count were produced.

Results: Five anomalies were located on the permit area (see Table 1 and Figure 17). No follow-up work has yet been carried out on any of them.

TABLE I

AIRBORNE SUMMARY

Flight Date Time	Anomaly No.	ET (cps)	X BKG	K (cps)	X BKG	Bi (cps)	X BKG	Th (cps)	X BKG	
ALTA 8 79-05-26 1.4 hr.	A831	250	2X	125	2X	90	1.5X	40	2X	Net Bi = 78.8 Net K = 64.2
	A836	250	2X	165	2.2X	100	2X	40	2X	Net Bi = 88.8 Net K = 95.8
ALTA 9 79-05-27 0.4 hr.	–	–	–	–	–	–	–	–	–	
ALTA 11 79-05-31 1.5 hr.	A1106	350	2X	155	1X	90	3X	20	1X	Net Bi = 84.4 Net K = 26.8
	A1122	200	2X	95	1X	75	2X	40	1X	Net Bi = 63.8 Net K = 46.8
	A1151	200	2.5X	115	1X	60	1.5X	20	1X	Net Bi = 54.4 Net K = 72.0

ET = Enhanced Total Count

X BKG = Amount reading is above background levels

Net Bi = Bi(raw) - 0.28 Th

Net K = K(raw) - (Bi(raw) x 0.84 - Th(raw) x 0.37)

Respectfully submitted,

[redacted]

Daniel B. Kilby, P. Geol.
Senior Geologist

[redacted]

Grant I. Walker
Geologist

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Godfrey, J. D. 1958

Aerial Photographic Interpretation of Precambrian Structures North of Lake Athabasca; Research Council of Alberta; Geological Division Bulletin 1.

Godfrey, J. D. 1978

Geology of the Wylie Lake District, Alberta; Alberta Research Council Report 78-1.

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Uranium Metallogenic Studies: Maurice Bay; Summary of Investigations 1978; Sask. Geol. Survey (Rept. 78-10) pp 74-83.

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APPENDIX I

Instrumentation

Magnetics

A Model G-816 portable proton magnetometer, manufactured by Geometrics of Palo Alto, California, was used for the magnetic survey.

GEOMETRICS MODEL G-816 PROTON MAGNETOMETER

SPECIFICATIONS

SENSITIVITY:	±1 gamma throughout range
RANGE:	20,000 to 90,000 gammas
GRADIENT TOLERANCE:	Exceeds 150 gammas/foot
OUTPUT:	5 digit numerical display with readout directly in gammas.
TEMPERATURE RANGE:	Console and sensor -40^{o} to $+85^{o}C$
ACCURACY (Total Field):	±1 gamma through 0^{o} to $50^{o}C$ range.
SENSOR:	High signal, noise cancelling, interchangeably mounted on separate staff or attached to back pack.

APEX MAXMIN II EM SYSTEM SPECIFICATIONS

OPERATING FREQUENCIES:	222, 444, 888, 1777 and 3555 Hz
COIL SEPARATIONS:	50, 100, 150, 200 m
MODES OF OPERATION:	(a) Tx coil plane and Rx coil plane horizontal (Horizontal loop mode). (b) Tx coil plane horizontal and Rx coil plane vertical (Minimum coupled mode).
PARAMETERS MEASURED:	In-Phase and Quadrature component of the secondary field.
READOUTS:	Automatic, direct readout on 3½" size meters.
SCALE RANGES:	In-Phase: ±20% normal, ±100% by switch. Quadrature: ±20% normal, ±100% by switch. Inclinometers: ±50% tilt.
READING REPEATABILITY:	±½% to ±1%

CRONE RADEM EM INSTRUMENT SPECIFICATIONS

Source of Primary Field:	VLF Communication Stations 12 to 24 KHz
Number of Stations:	7 switch selectable
Stations Available:	The seven standard stations are Cutler, Maine, 17.8; Seattle, Washington, 18.6; Collins, Colorado, 20.0; Annapolic, Md, 21.4; Panama, 24.0; Hawaii, 23-4; England, 16.0. Alternative stations which may be substituted are: Gorki, Russia, 17.1; Japan, 17.4; England, 19.6; Australia, NWC, 22.3 KHz.
Check that Station is Transmitting:	Audible signal from speaker.
Parameters Measured and Means:	1. DIP ANGLE in degrees, from the horizontal of the magnetic component of the VLF field. Detected by minimum on the field strength meter and read from an inclinometer with a range of $\pm 80^{\circ}$ and an accuracy of $\pm \frac{1}{2}^{\circ}$.
	2. Field Strength (total or horizontal component) of the magnetic component of the VLF field. Measured as a percent of normal field strength established at a base station. Accuracy $\pm 2\%$ dependent on signal. Meter has two ranges: 0-300% and 0-600%. Switch for "keyed" or "F.S." (steady) signal.
	3. Out of Phase component of the magnetic field, perpendicular in direction to the resultant field, measured without sign, as a percent of normal field strength. This is the minimum reading of the Field Strength meter obtained when measuring the dip angle. Accuracy $\pm 2\%$.
Operating Temperature Range:	-20° to $+110^{\circ}$F.

Instrumentation

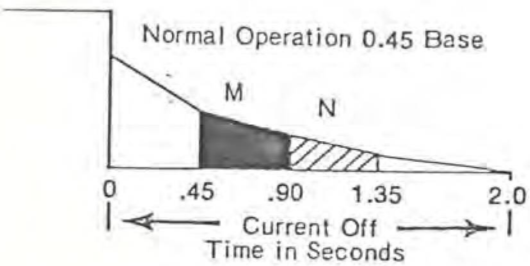
Induced Polarization

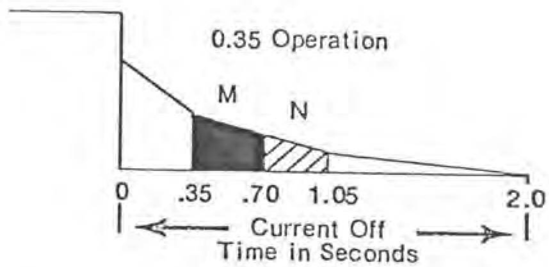
The Crone "Newmont Type" I.P.-IV receiver, manufactured by Crone Geophysics Limited of Mississauga, Ontario, and the Scintrex IPC-8 250W Transmitter, manufactured by Scintrex Limited of Concord, Ontario, were used for the induced polarization survey.

CRONE "NEWMONT DESIGNED" I.P.-IV PULSE TYPE RECEIVER

SPECIFICATIONS

- Primary Voltage "Vp": .0005 to 60 volts, accuracy ±5%
- Standard receivers set for 2.0 seconds on, 2.0 seconds off current cycle. Off period must be greater than 1.8 seconds.
- Chargeability M and N readings directly in milliseconds





- Both M and N readings are automatically corrected to the Newmont 33M1 Standard. M and N readings should be the same with a normal polarization decay. Unequal readings indicates the presence of inductive coupling and then the N reading should be used.

- Both M and N readings are taken for 3 current cycles (6 samples) then they are automatically averaged and stored for direct read out.

- Self Potential: Automatic buckout effective when SP less than .6 Vp
  Manual buckout - 0 to 1.0 volts calibrated (1.0 volts uncalibrated)
  Fine SP buckout for low signal levels

- Pot Resistance Check: Check of potential contacts on millisecond meter; Green - good contact; Orange - marginal contact (M-N readings are accurate, Vp and resistivity readings have error); Red - nil or unacceptable contact.

- Input Impedance: 300,000 Ohms
- Noise Filters: 30 DB at 50 or 60 Hz (factory set)
  30 DB/Octave above 8 Hz
  6 CB/Octave above 35 Hz
- Automatic Time Lock to ground signal
- Amplifier drift correction by one control

SCINTREX IPC-8 250W TRANSMITTER

SPECIFICATIONS

POWER:	250W max.
OUTPUT VOLTAGE:	150V to 850V in 5 steps 1.4 ratio
OUTPUT CURRENT:	1.5A max.
METRE RANGES:	0-0.5 A.F.S. and 0-1.5 A.F.S. $\pm 3\%$
CYCLE:	1:1:1:1 on:off:reverse:off
PULSE DURATIONS:	1, 2, 4 seconds
OPERATING TEMPERATURE:	$-30^{o}C$ to $+55^{o}C$

URTEC MODEL UG-130 SCINTILLOMETER SPECIFICATIONS

Selectable Energy Levels:	Calibration	-All energy above 0.30 MEV
	Total Count I	-All energy above 0.08 MEV
	Total Count II	-All energy above 0.40 MEV
	Potassium	-All energy above 1.36 MEV
	Uranium	-All energy above 1.66 MEV
	Thorium	-All energy above 2.46 MEV
Detector:	NaI (Tl) crystal, volume 4.0 Cu. inhes (66 c.c.) mechanically ruggedized.	
Spectral Shift as a function of count rate:	3% or less from 0 to 15000 CPS	
Energy Response Linearity error:	Less than 2%	
Sample Rate:	1.0 or 10.0 seconds continuous, for all energy levels.	
Audio Time Response:	0.5 seconds from 0 to 2500 CPS	
Temperature Range:	Minus $25^{o}C$ to plus $60^{o}C$.	

URTEC MODEL UG-135 DIFFERENTIAL SPECTROMETER

SPECIFICATIONS

Selectable Energy Levels:	Calibration	-Energy from 0.3 to 0.4 MEV
	Total Count I	-All energy above 0.08 MEV
	Total Count II	-All energy above 0.4 MEV
	Potassium	-Energy from 1.36 to 1.58 MEV
	Uranium	-Energy from 1.66 to 1.86 MEV
	Thorium	-Energy from 2.46 to 2.78 MEV
Detector:	NaI (Tl) crystal, volume 4.0 Cu. inches (66 c.c.) mechanically ruggedized.	
Spectral Shift as a Function of Count Rate:	2% or less from 0 to 15000 CPS	
Energy Response Linearity error:	Less than 2%	
Sample Rate:	1.0 or 10.0 seconds continuous, for all energy levels	
Calibration:	Switch Selectable using self contained Ba 133 source	
Audio Time Response:	0.5 seconds from 0 to 2500 CPS	
Temperature Range:	Minus 25°C to plus 60°C.	

AIRBORNE GAMMA SPECTROMETRY & VLF & MAGNETOMETER INSTALLATION

Aircraft: Hughes 500-D

Instrumentation

Gamma Spectrometer:	HUDCAN-I
Detector:	4 x (10.2 x 10.2 x 40.8 cm) NaI(Tl) X-square crystals, total 17 l (1,000 cu. in.)
Console:	Microprocessor-based (TI 9900) 1024 channels
Analog Recorder: (digital printer)	9 channels - total count "Bi-214 enhanced" total count K-40 1.46 MeV window Bi-214 1.76 MeV window Tl-208 2.615 MeV window Altimeter VLF-phase total field Magnetometer
Magnetic Tape Deck Recorder:	Pertec, 900 bpi Recording interval 1 sec. 256 channels of full spectrum and all analog channels
VLF:	Herz "TOTEM", 1 phase and total field Station used: Washington
Magnetometer:	Proton Precision, 1 γ (Geometrics) Flown on 8 m cable
Altimeter:	Honeywell

APPENDIX II

CALCULATIONS FOR INDUCED POLARIZATION

Measurements on Receiver

M = Chargeability (channel 1)-measurement plotted (microseconds)

N = Chargeability (channel 2 - microseconds)

Vp = Voltage (volts)

K = Array Coefficient (dependent on array used) - for 200 m x 200 m square array K = 217.5

I = Current (amps)

Sp = Self Potential Gradient (microvolts)

$$\text{Resistivity} = Vp \times \frac{K}{I}$$

APPENDIX III

List of Personnel

Name	Position	Days on Project (Field & Office Work)	Rate
[redacted]	Senior Geologist	23	142.56/day
[redacted]	Temporary Geologist	15	59.62/day
[redacted]	Geophysical Technologist	41	75.94/day
[redacted]	Geophysical Technologist	25	75.94/day
[redacted]	Geophysical Assistant	24	51.26/day
[redacted]	Geophysical Assistant	24	39.86/day
[redacted]	Geophysical Assistant	24	44.48/day
[redacted]	Geophysical Consultant	1	300.00/day
[redacted]	Geologist	13	92.00/day
Drafting Service HBOG		11	120.00/day
[redacted]	Sr. Staff Geol.	2	143.00/day

APPENDIX IV

HUDSON'S BAY OIL AND GAS COMPANY LIMITED

PERMIT 244

I, ALFRED RAYMOND TRAVERS, of the City of Calgary, in the Province of Alberta, HEREBY CERTIFY:

1. THAT I am Controller for HUDSON'S BAY OIL AND GAS COMPANY LIMITED and as such have a personal knowledge of the matters herein contained.

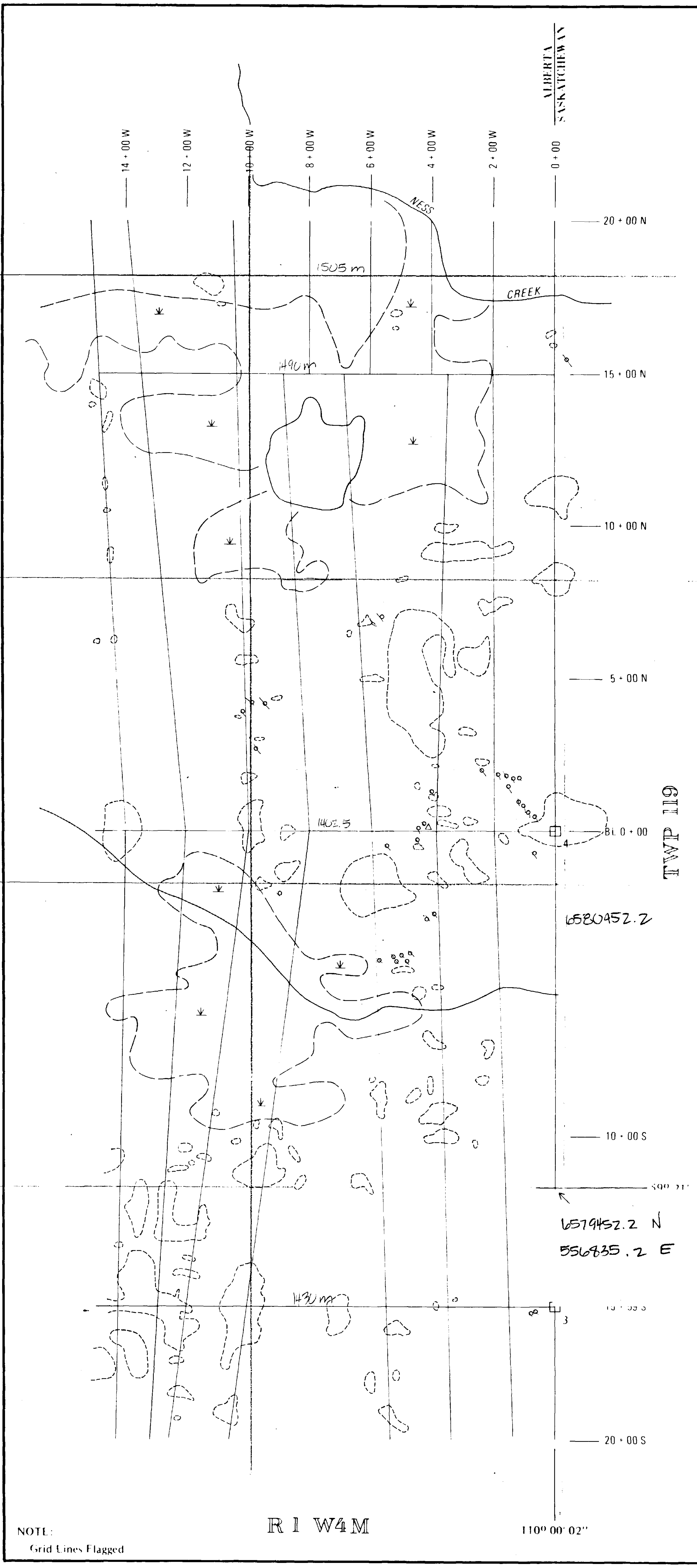
2. THAT HUDSON'S BAY OIL AND GAS COMPANY LIMITED has incurred costs for mineral exploration work relating to the above permit area, pursuant to the Alberta Quartz Mining Regulations, during the period January 9, 1979, to July 13, 1979, as follows:

STATEMENT OF COSTS

Fixed Wing (Chartered Flights)	$ 2,955.58
Helicopter Costs	6,202.41
Salaries (to July 13)	12,829.85
Drafting	1,320.00
AGS Surveying & Consulting	4,241.06
Field Operating Costs	5,801.53
Travel Expenses	3,347.94
TOTAL	$36,698.37

3. I hereby certify that the above statements are true.

[redacted]



LEGEND

Grey weathering, equigranular quartz diorite to granodiorite with lenses and bands containing feldspar megacrysts in a quartz biotite matrix and bands of biotite rich mafic material

Outcrop

o Radioactive pink weathering sandstone or hematitic quartz pebble conglomerate boulder

Δ Radioactive basement boulder - pink weathering garnet - bearing gneiss

NOTE: Geology by D. B. Kilby, Hudbay Uranium Company May 16 - 22, 1979

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

PERMIT 244

GEOLOGY MAP

MAP	DATE	BY	SCALE	N.T.S.
Fig. 2	June/79	D.B. KILBY	1:10 000	74M/8

MD 393 C 827

1cm = 100m
10 cm = 1000m

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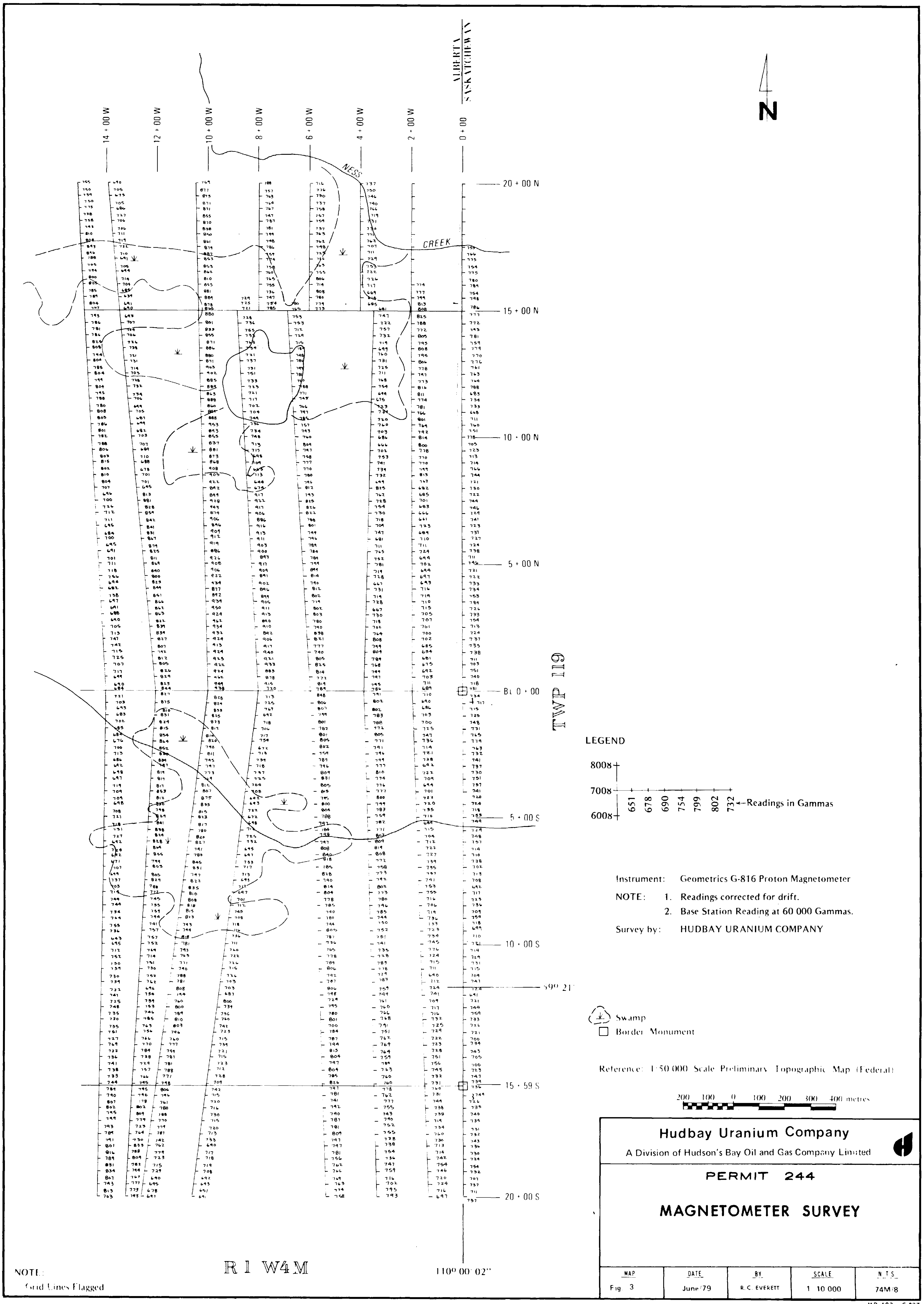
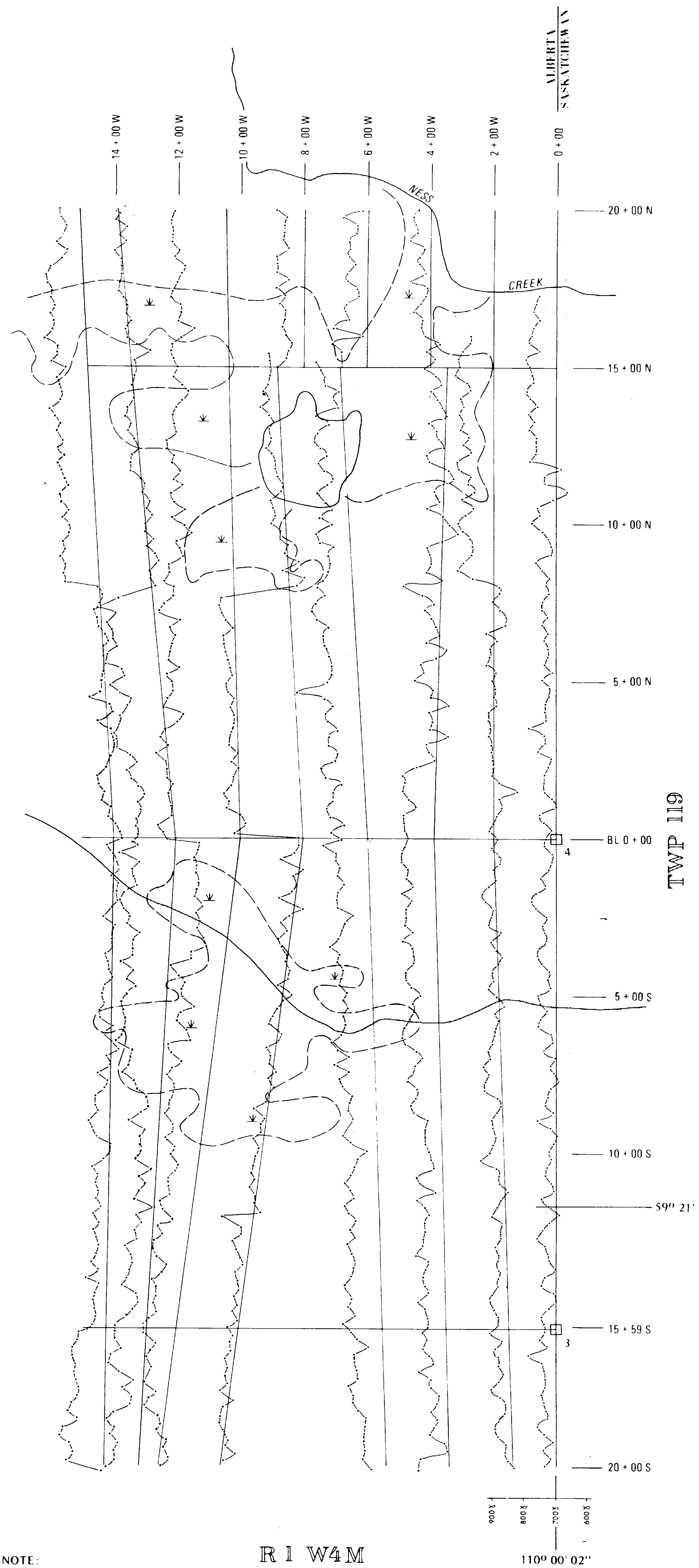


ALBERTA
SASKATCHEWAN
N
14 + 00 W
12 + 00 W
10 + 00 W
8 + 00 W
6 + 00 W
4 + 00 W
2 + 00 W
0 + 00
NESS
CREEK
20 + 00 N
15 + 00 N
10 + 00 N
5 + 00 N
BL 0 + 00
5 + 00 S
10 + 00 S
59° 21'
15 + 59 S
20 + 00 S
TWP 119
R 1 W4M
110° 00' 02"
LEGEND
800δ
700δ
600δ
651 678 690 754 799 802 732
←Readings in Gammas
Instrument: Geometrics G-816 Proton Magnetometer
NOTE: 1. Readings corrected for drift.
2. Base Station Reading at 60 000 Gammas.
Survey by: HUDBAY URANIUM COMPANY
Swamp
Border Monument
Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)
200 100 0 100 200 300 400 metres
Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited
PERMIT 244
MAGNETOMETER SURVEY
MAP Fig 3
DATE June '79
BY R.C. EVERETT
SCALE 1 10 000
N.T.S. 74M/8
NOTE:
Grid Lines Flagged
MD 403 C 827

19790009



LEGEND

800γ
700γ
600γ

Instrument: Geometrics G-816 Proton Magnetometer

Notes:
1. Readings corrected for diurnal drift.
2. Base Station Reading of 60 000 gammas.
3. Range of values from 60962 to 60644 gammas.

Survey by: HUDBAY URANIUM COMPANY

Swamp
Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

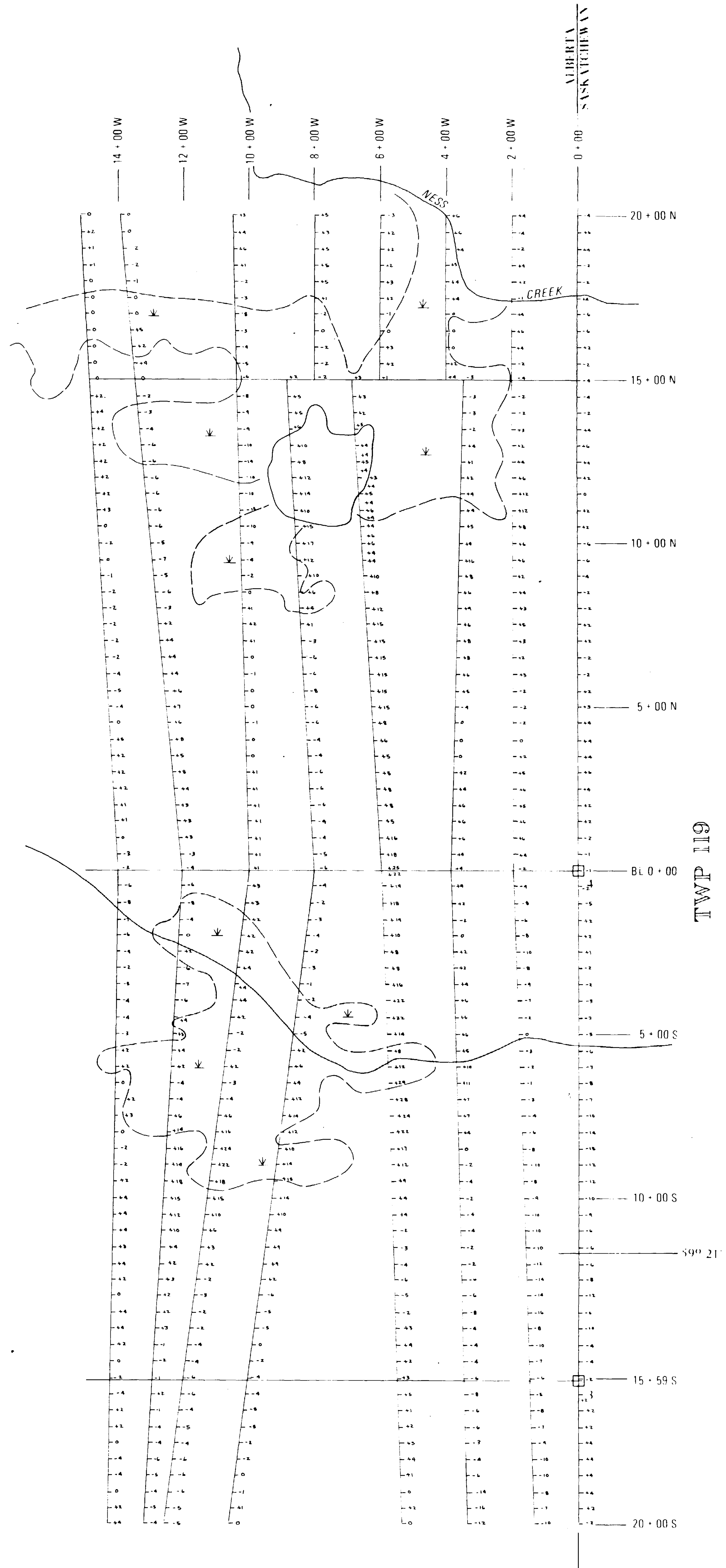
PERMIT 244

MAGNETOMETER SURVEY PROFILE

MAP	DATE	BY	SCALE	N.T.S.
Fig. 4	June/79	G. WALKER	1: 10 000	74M/8

MD 402 C 827

19790009



LEGEND

+20°

-20°

+2 +3 +12 ← Dip Angle

+ve Dip Angle: North Facing

- ve Dip Angle: South Facing

Instrument: CRONE RADEM

Survey by: HUDBAY URANIUM COMPANY

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

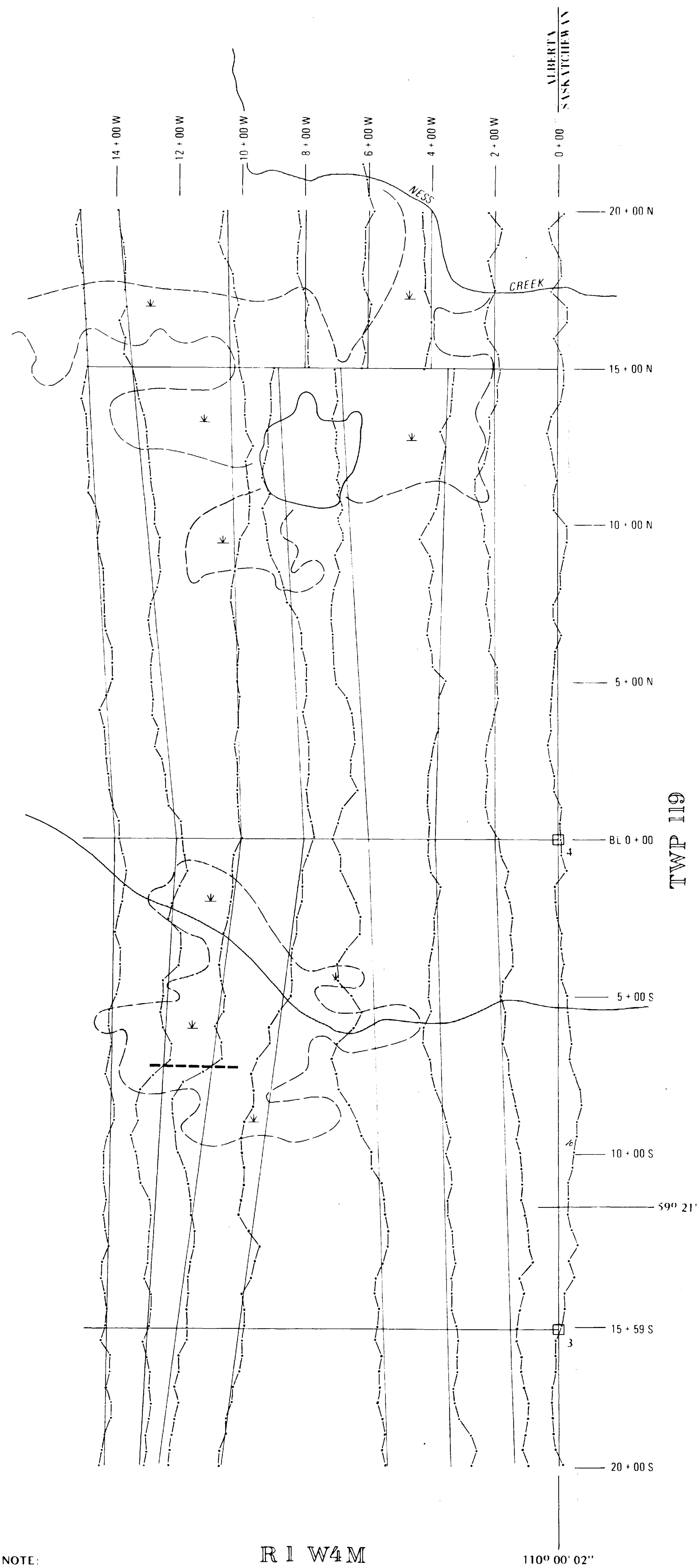
PERMIT 244

VLF DIP ANGLE SURVEY

MAP	DATE	BY	SCALE	N.T.S.
Fig. 5	June '79	R. C. EVERETT	1: 10 000	74M/8

MD 396 C 827

19790009



LEGEND

+20°
0
-20°

+ve Dip Angle: North Facing
-ve Dip Angle: South Facing
Conductor Trace

Instrument: CRONE RADEM
Survey by: HUDBAY URANIUM COMPANY

Swamp
Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

PERMIT 244

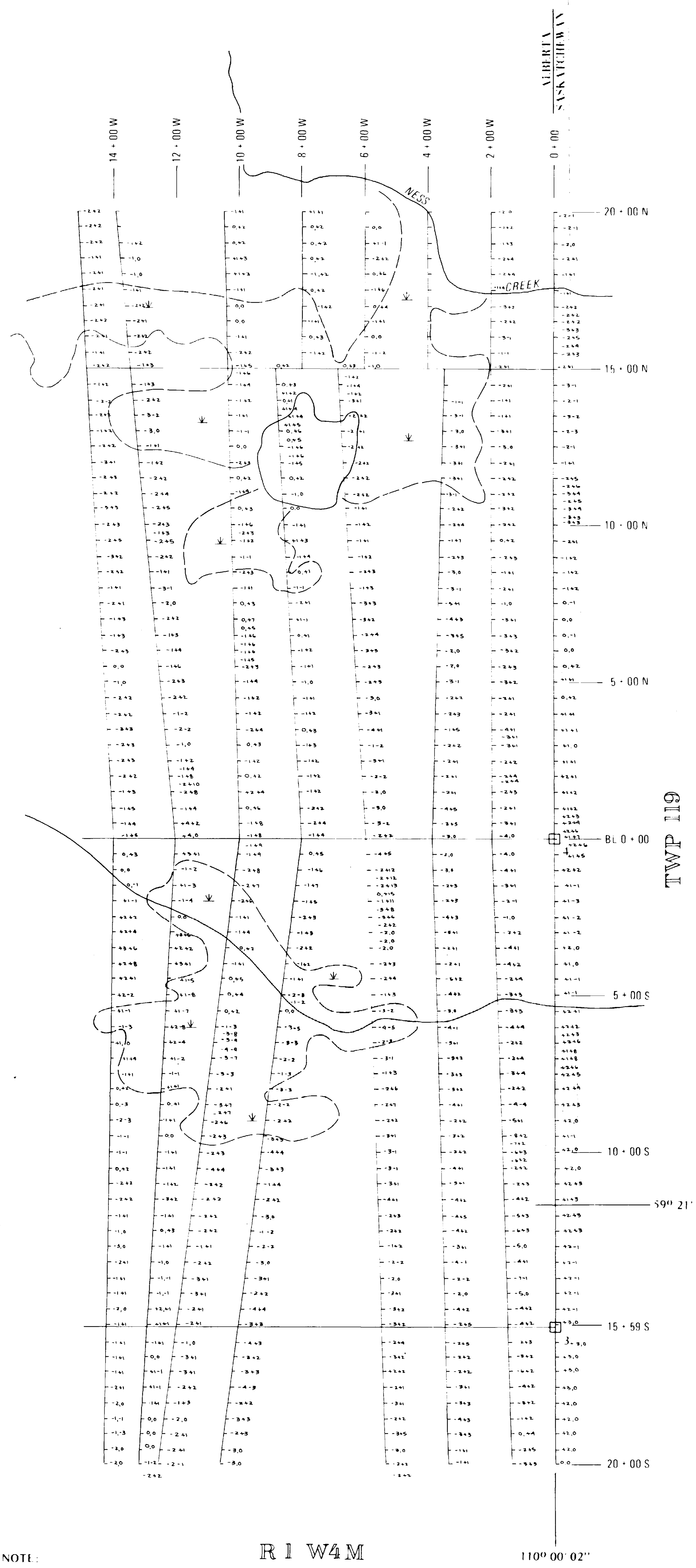
VLF DIP ANGLE SURVEY PROFILE

MAP	DATE	BY	SCALE	N T S
Fig. 6	June/79	R.C. EVERETT	1: 10 000	74M/8

MD 397 C 827

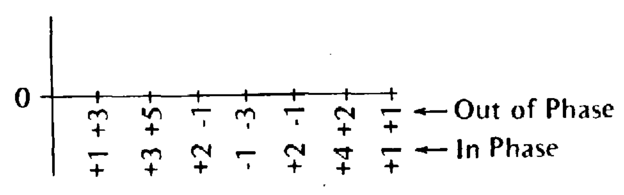
NOTE:
Grid Lines Flagged

19790009



NOTE:
Grid Lines Flagged

LEGEND



Instrument: APEX MAXMIN II
Frequency: 1777 Hz
Separation: 200 metres
Survey by: HUDBAY URANIUM COMPANY

Swamp
☐ Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

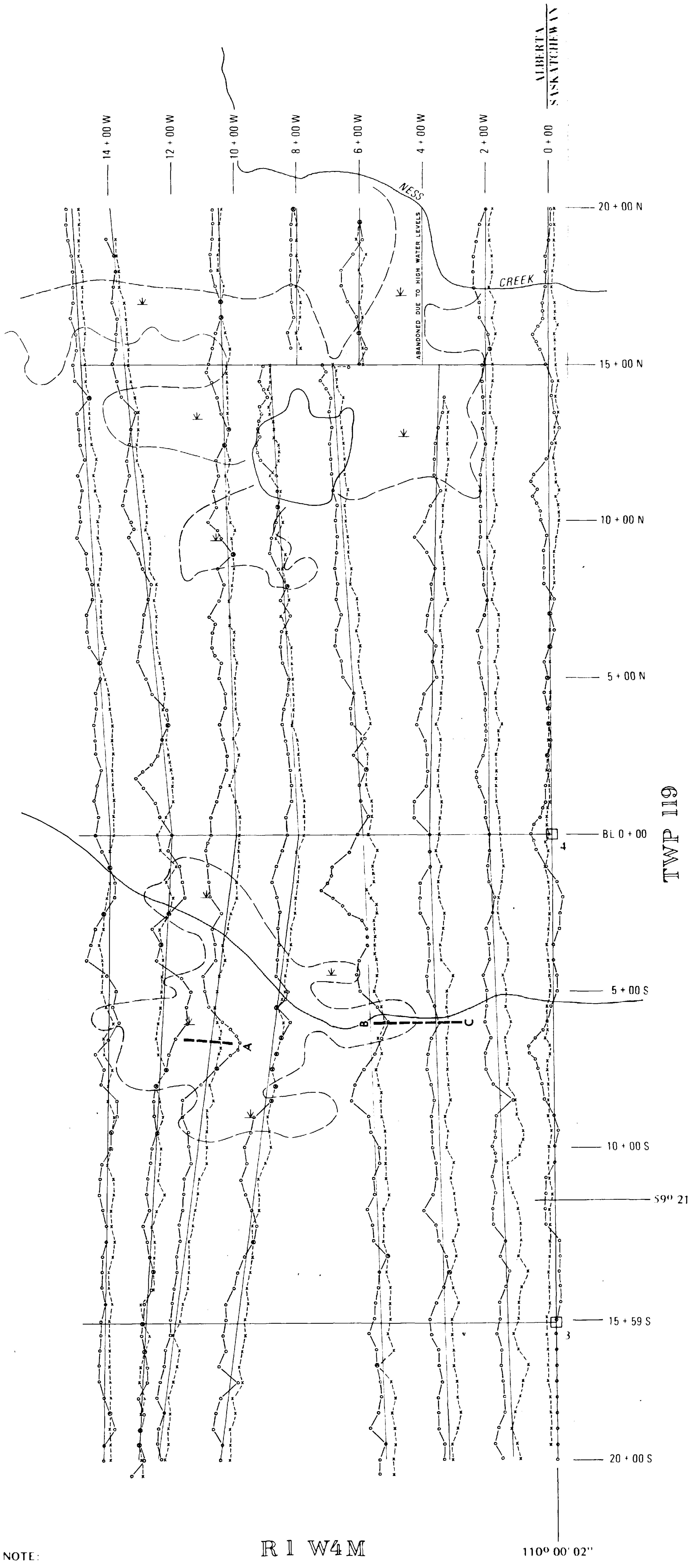
PERMIT 244

HORIZONTAL LOOP EM SURVEY
Frequency : 1777 Hz

MAP	DATE	BY	SCALE	N T S
Fig. 7	June/79	R.C. EVERETT	1 10 000	74M/8

MD 401 C 827

19790009



LEGEND

+10%
0
-10%
In Phase
Out of Phase

Instrument: APEX MAXMIN II
Frequency: 1777 Hz
Separation: 200 metres
Conductor Axis
Survey by: HUDBAY URANIUM COMPANY

Swamp
Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

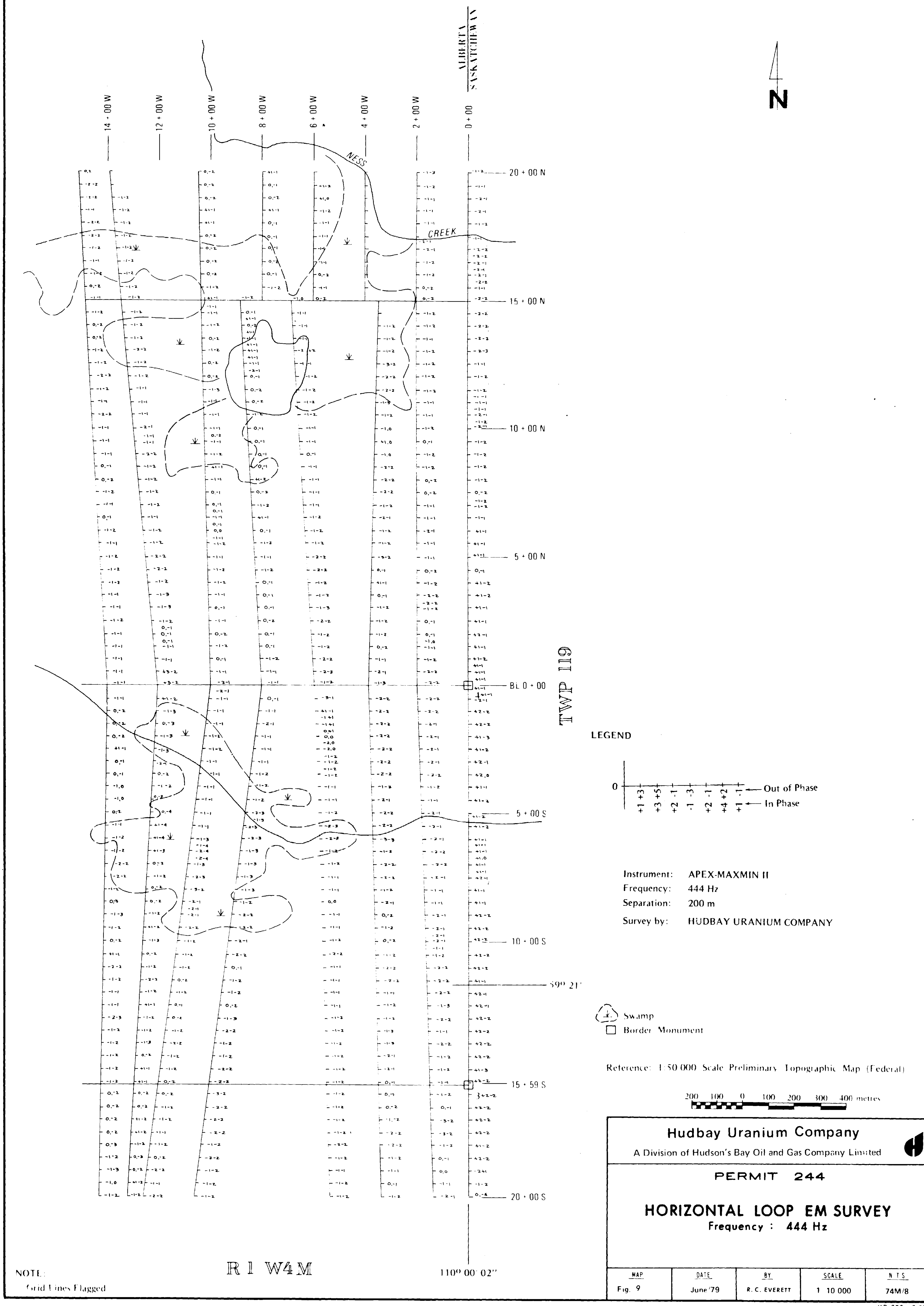
PERMIT 244

HORIZONTAL LOOP EM SURVEY
Frequency : 1777 Hz
PROFILE

MAP	DATE	BY	SCALE	N.T.S.
Fig. 8	June/79	R. C. EVERETT	1: 10 000	74M/8

MD 400 C 827

19790009



NOTE:
Grid Lines Flagged

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

PERMIT 244

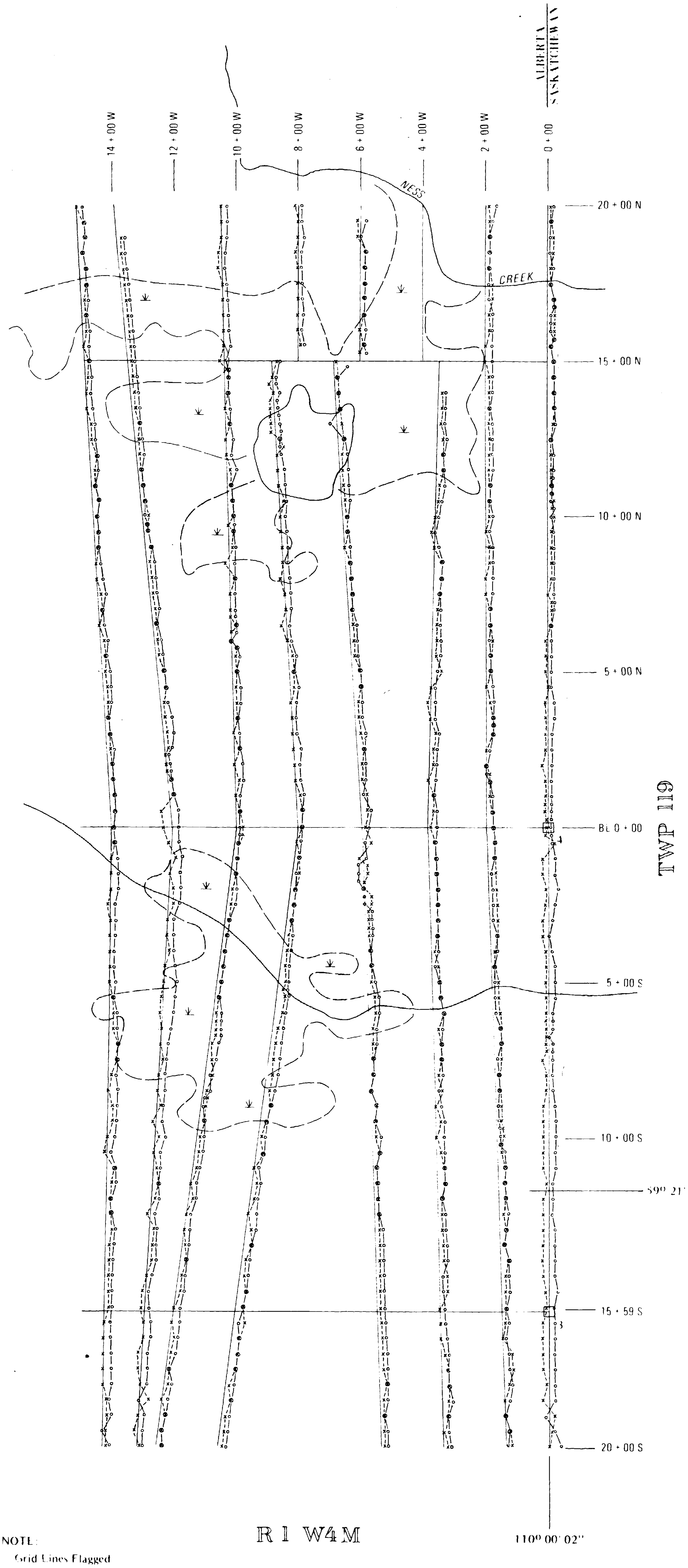
HORIZONTAL LOOP EM SURVEY

Frequency : 444 Hz

MAP	DATE	BY	SCALE	N.T.S.
Fig. 9	June '79	R. C. EVERETT	1 10 000	74M/8

MD 392 C 827

19790009



LEGEND

+10%
0
-10%
In Phase
Out of Phase

Instrument: APEX-MAXMIN II
Frequency: 444 Hz
Separation: 200 metres
Survey by: HUDBAY URANIUM COMPANY

Swamp
Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

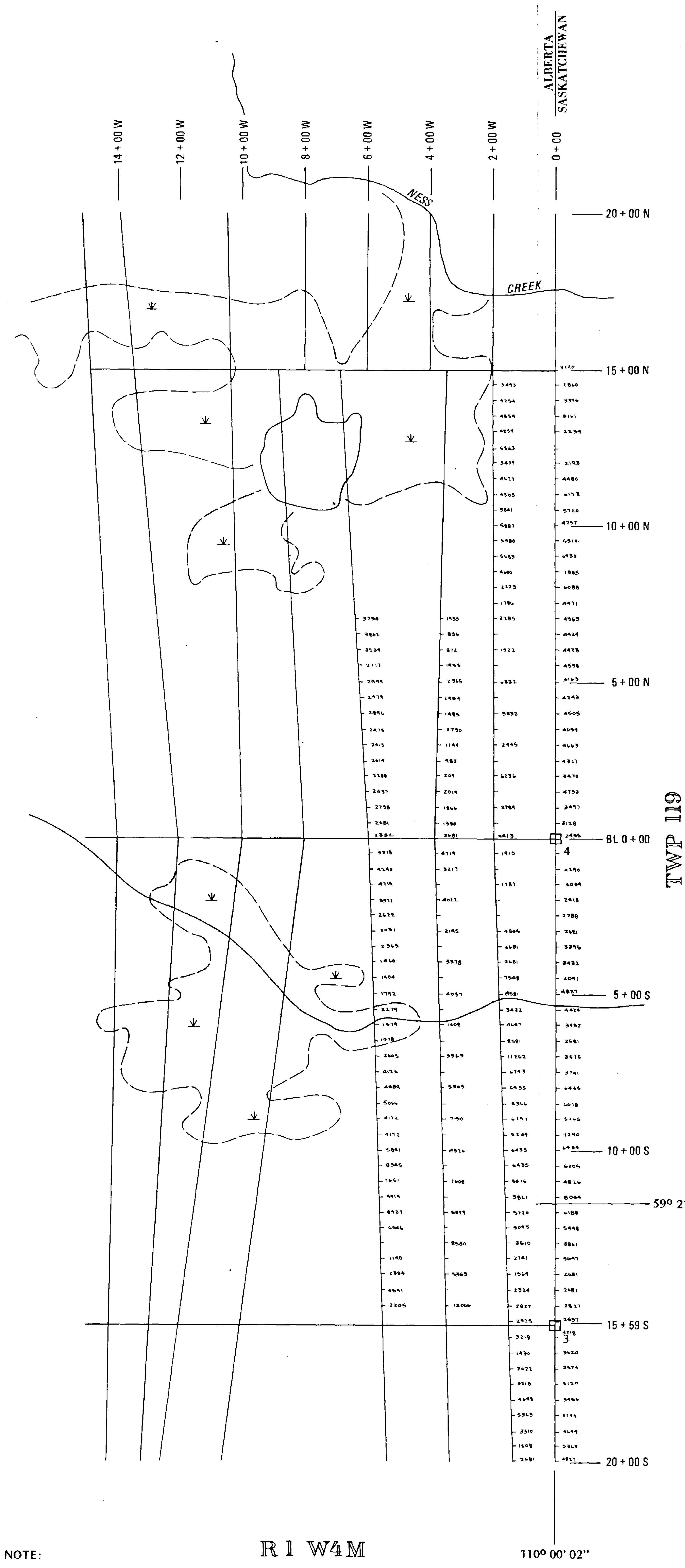
PERMIT 244

HORIZONTAL LOOP EM SURVEY
Frequency : 444 Hz
PROFILE

MAP	DATE	BY	SCALE	N.T.S.
Fig. 10	June '79	R.C. EVERETT	1: 10 000	74M/8

19790009

MD 391 C 827



LEGEND

5720 Resistivity in ohm - meters

Instrument: Crone "Newmont Type" IP-IV Receiver
Scintrex IPC-8 250 W Transmitter

Array: 200 m Square Array

Survey by: HUDBAY URANIUM COMPANY

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

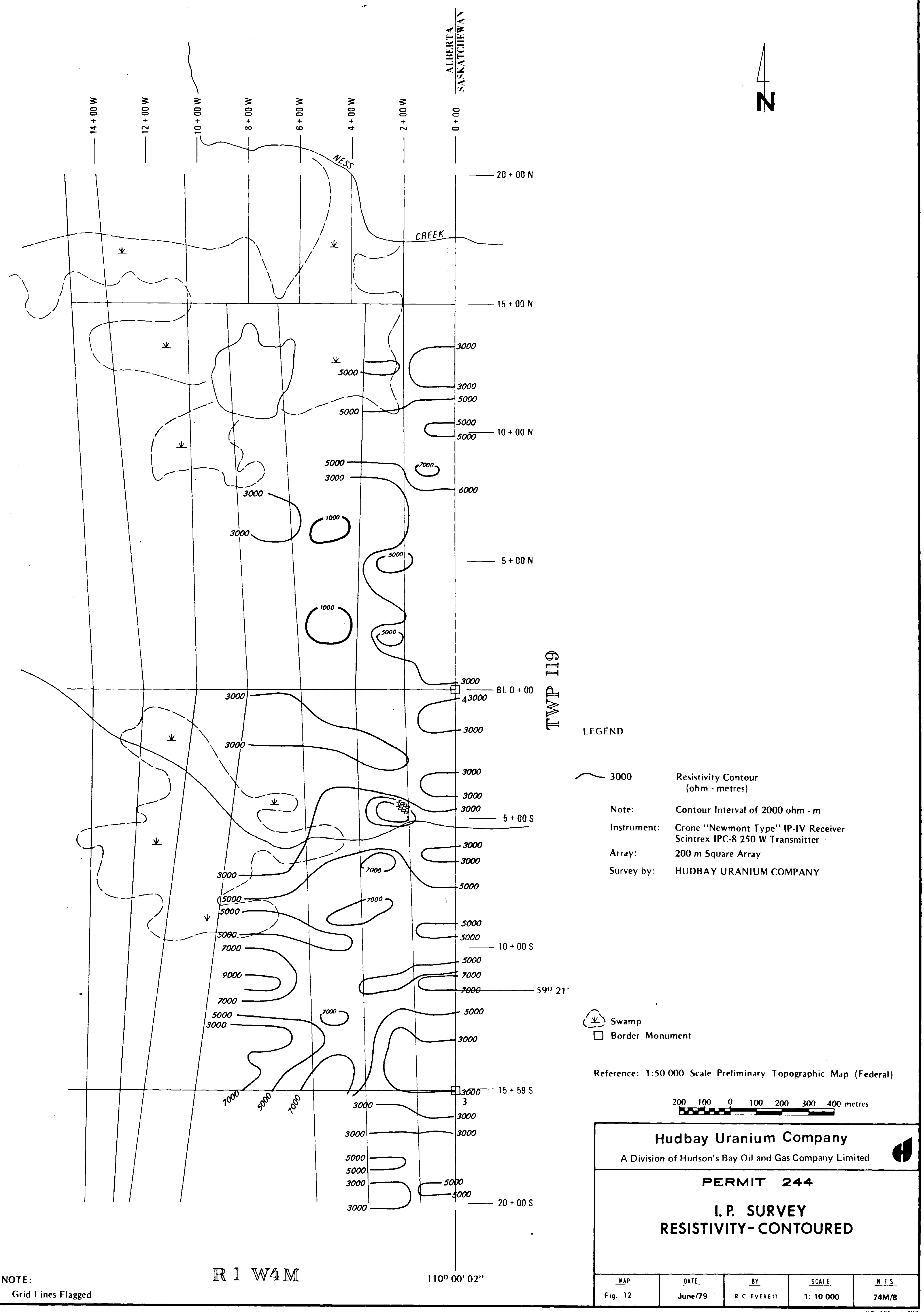
PERMIT 244

I.P. SURVEY
RESISTIVITY

MAP	DATE	BY	SCALE	N T S
Fig. 11	June/79	R. C. EVERETT	1: 10 000	74M/8

MD 398 C 827

19790009



NOTE:
Grid Lines Flagged

Hudbay Uranium Company
A Division of Hudson's Bay Oil and Gas Company Limited

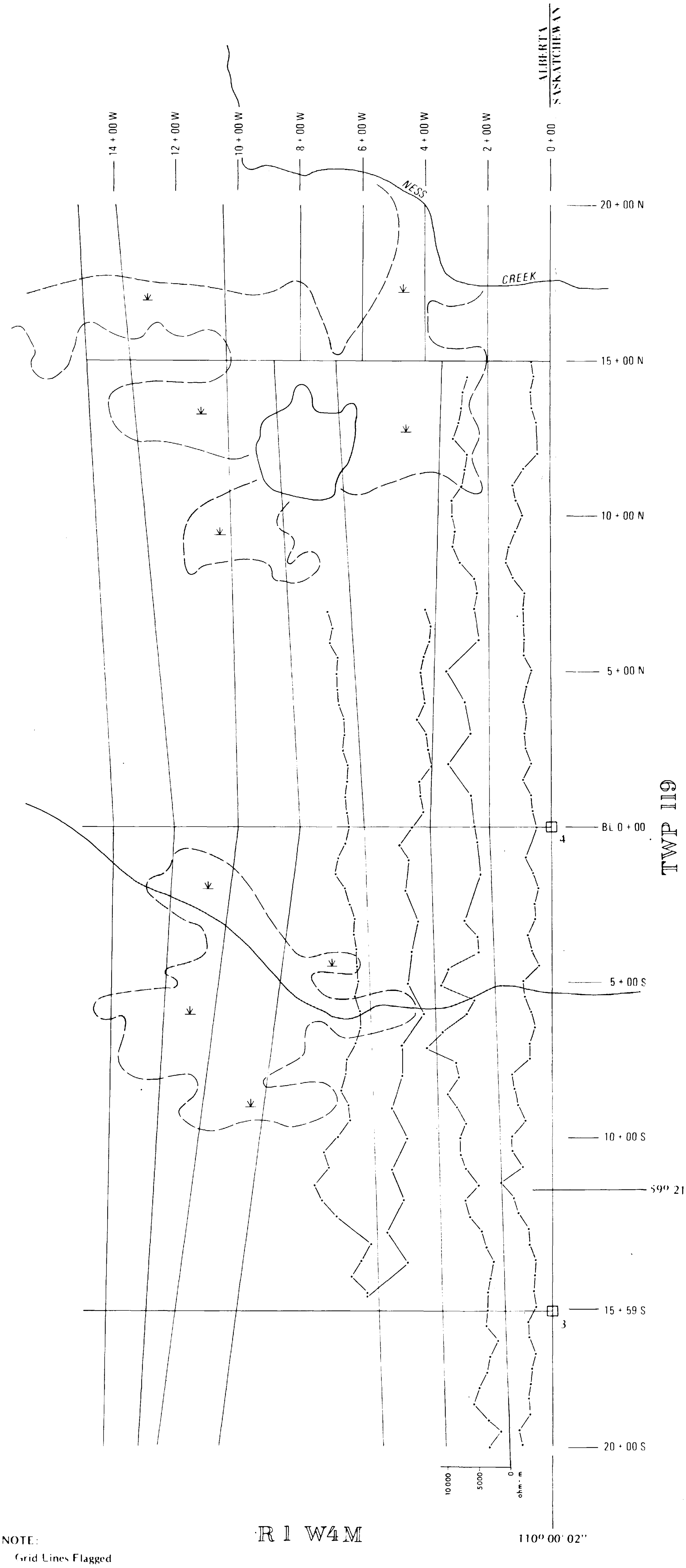
PERMIT 244

I. P. SURVEY
RESISTIVITY-CONTOURED

MAP	DATE	BY	SCALE	N.T.S.
Fig. 12	June/79	R. C. EVERETT	1: 10 000	74M/8

MD 405 C 827

19790009



NOTE:
Grid Lines Flagged

LEGEND

10 000
5 000
0
Resistivity in ohm - meters

Instrument: Crone "Newmont Type" IP-IV Receiver
Scintrex IPC-8 250 W Transmitter

Array: 200 m Square Array

Survey by: HUDBAY URANIUM COMPANY

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

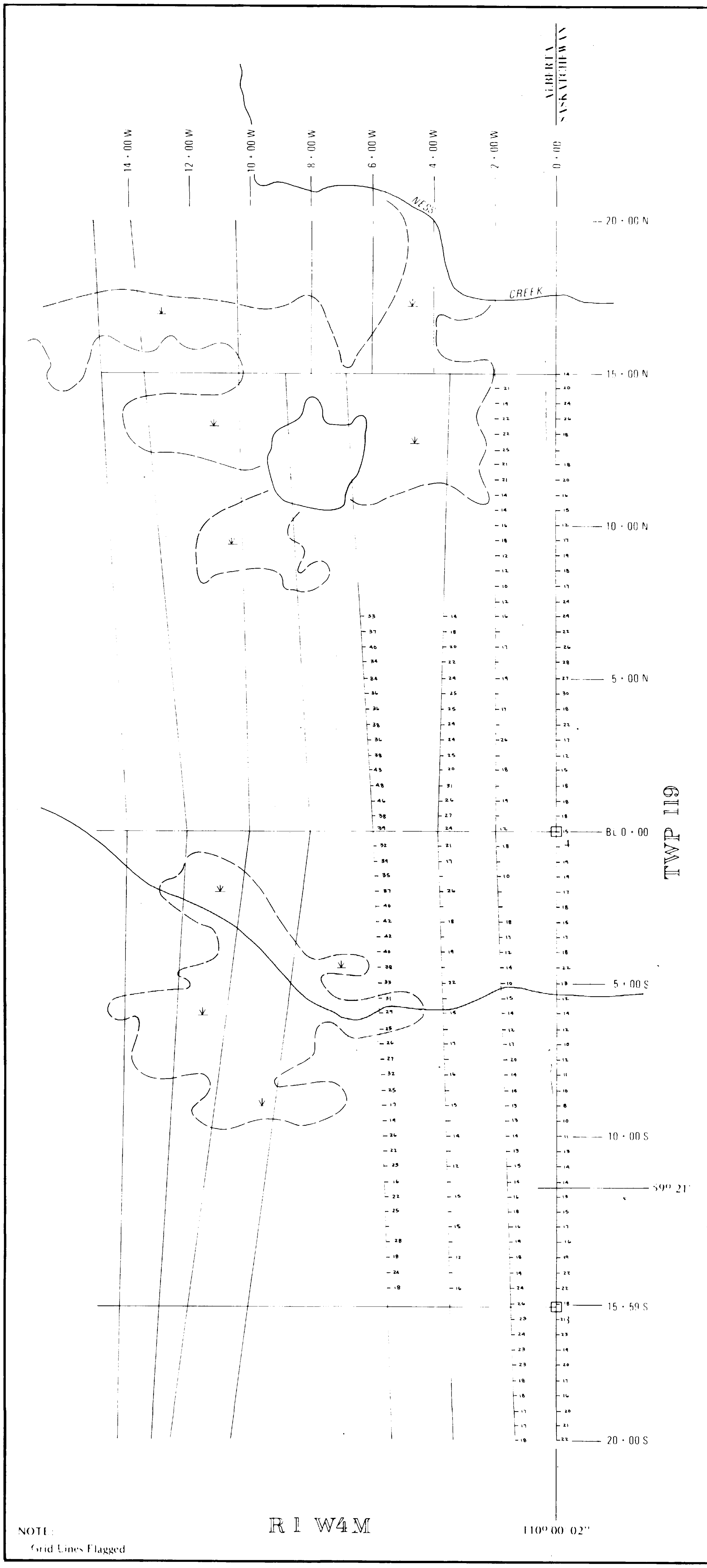
PERMIT 244

I.P. SURVEY
RESISTIVITY - PROFILE

MAP	DATE	BY	SCALE	N.T.S.
Fig. 13	June/79	G. WALKER	1 10 000	74M/8

MD 394 C 827

19790009



LEGEND

├15 Chargeability in milliseconds

Instrument: Crone "Newmont Type" IP-IV Receiver
Scintrex IPC-8 250 W Transmitter

Array: 200 m Square Array

Survey by: HUDBAY URANIUM COMPANY

Swamp

☐ Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company

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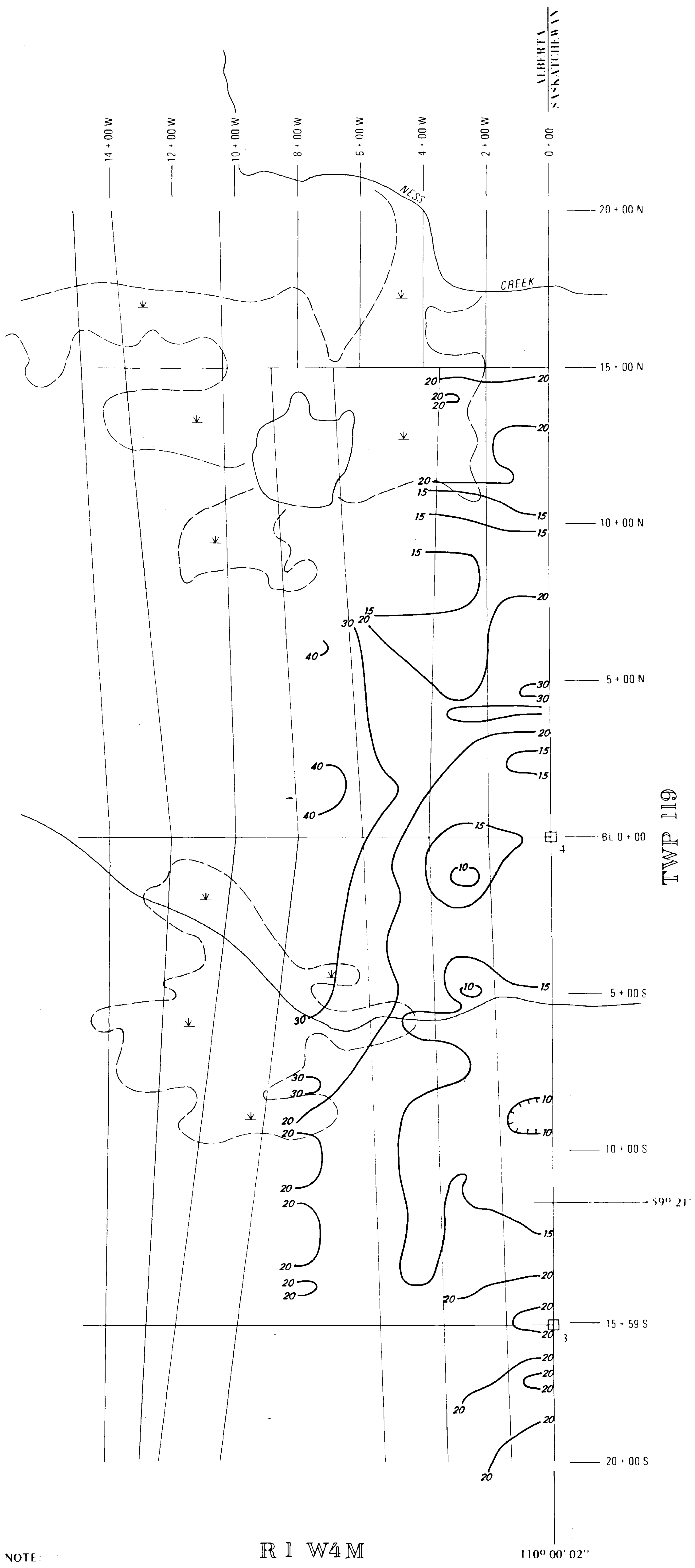
PERMIT 244

I. P. SURVEY CHARGEABILITY

MAP	DATE	BY	SCALE	N.T.S.
Fig. 14	June 79	R. C. EVERETT	1:10 000	74M/8

MD 399 C 827

19790009



LEGEND

30 Chargeability Contour (milliseconds)

Instrument: Crone "Newmont Type" IP-IV Receiver
Scintrex IPC-8 250 W Transmitter

Array: 200 m Square Array

Survey by: HUDBAY URANIUM COMPANY

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

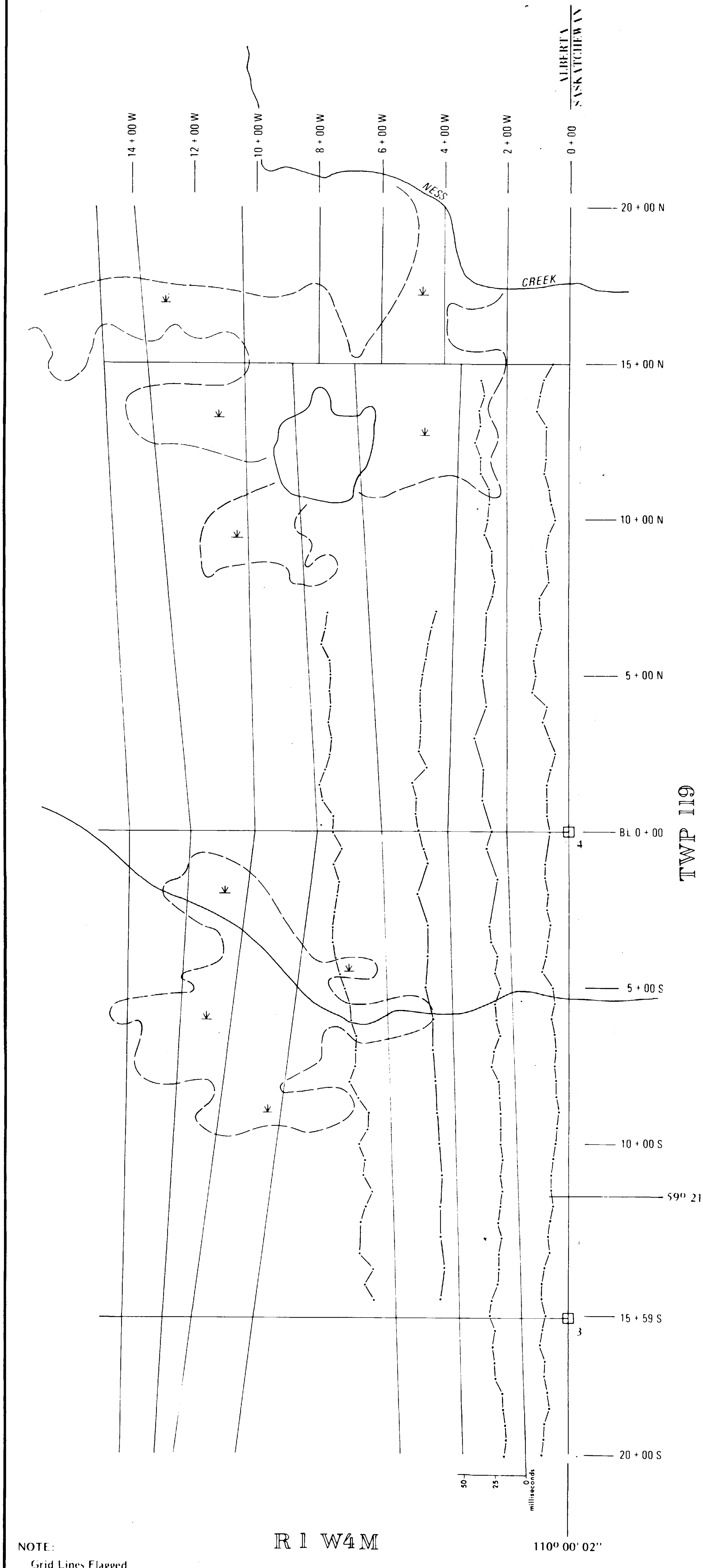
PERMIT 244

I. P. SURVEY
CHARGEABILITY-CONTOURED

MAP	DATE	BY	SCALE	N.T.S.
Fig. 15	June '79	R. C. EVERETT	1: 10 000	74M/8

MD 404 C 827

19790009



LEGEND

Instrument: Crone "Newmont Type" IP-IV Receiver
Scintrex IPC-8 250 W Transmitter

Array: 200 m Square Array

Survey by: HUDBAY URANIUM COMPANY

Swamp

Border Monument

Reference: 1:50 000 Scale Preliminary Topographic Map (Federal)

200 100 0 100 200 300 400 metres

NOTE:
Grid Lines Flagged

Hudbay Uranium Company

A Division of Hudson's Bay Oil and Gas Company Limited

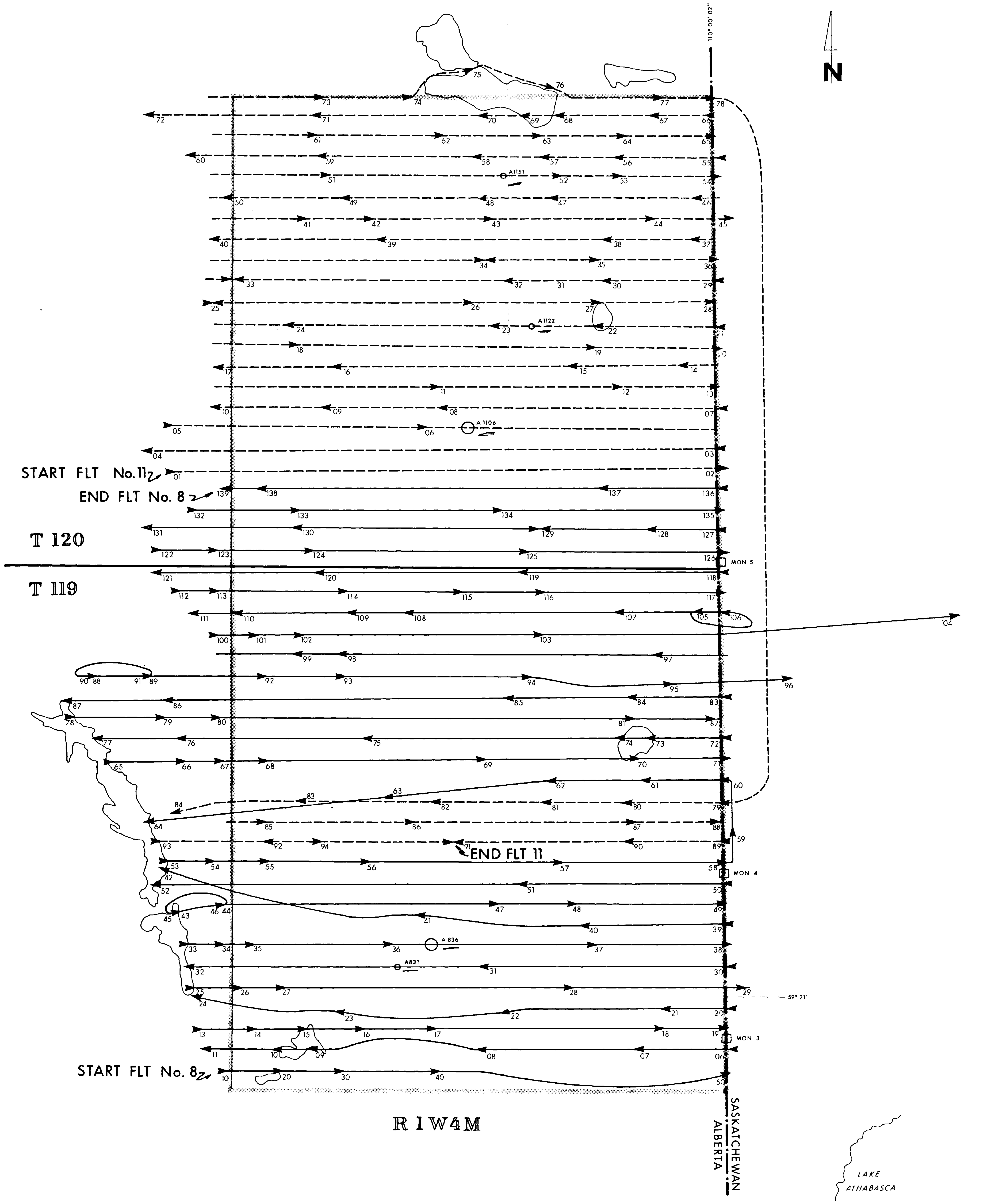
PERMIT 244

I. P. SURVEY
CHARGEABILITY - PROFILE

MAP	DATE	BY	SCALE	N T S
Fig. 16	June/79	G. WALKER	1: 10 000	74M/8

19790009

MD 395 C 827



LEGEND:

- SURVEY MONUMENTS
- PERMIT 244 BOUNDARY
- 73 DIRECTION FLOWN AND FIDUCIAL No.
- UNCERTAIN OF FID LOCATION / NO FID LOCATION 31
- ANOMALIES FAIR
- POOR

SCALE 1: 25,000

0 ½ 1 1.5 Mi.

0 500 1000 1500 2000 metres

Hudbay Uranium Company

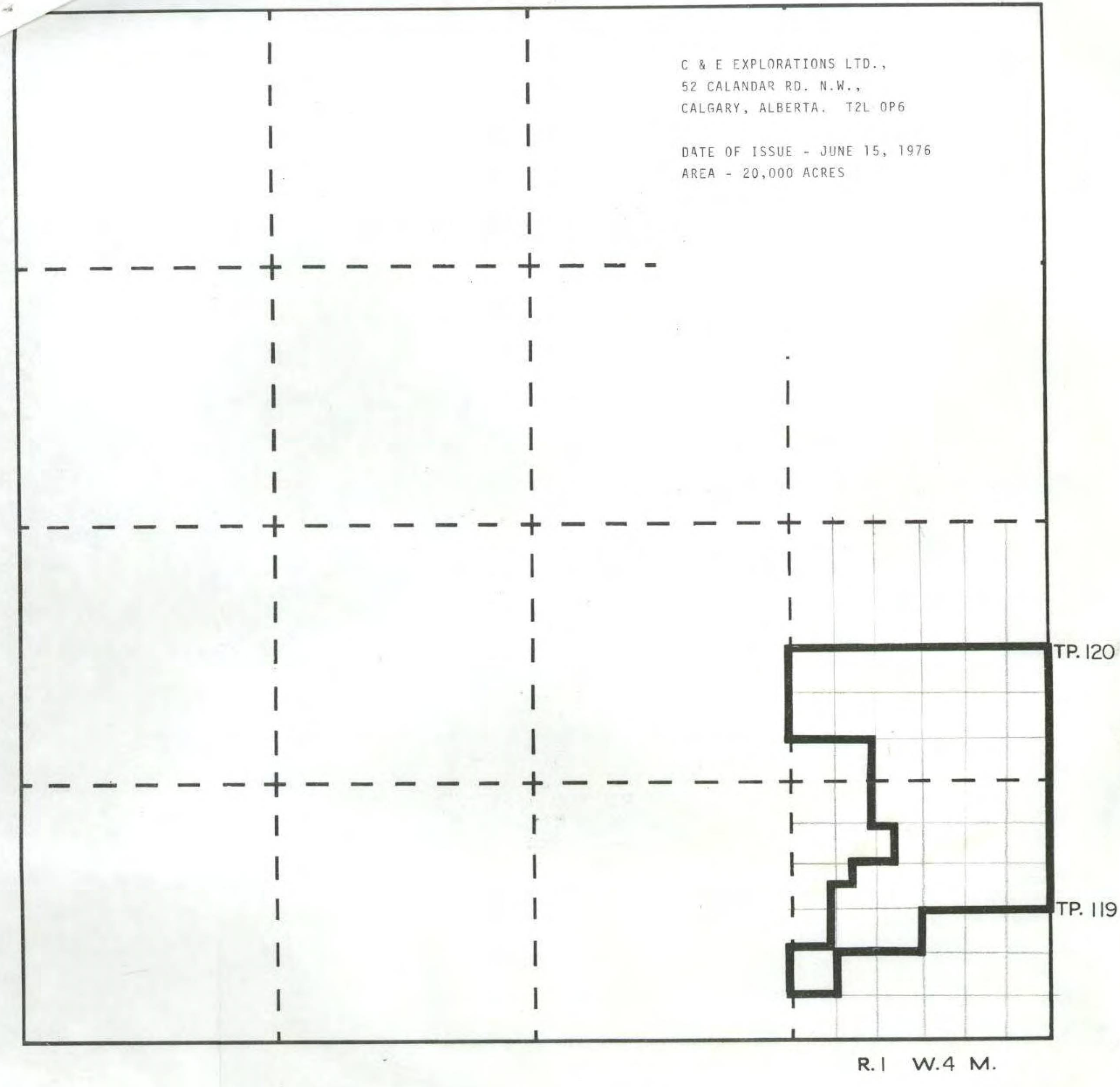
A Division of Hudson's Bay Oil and Gas Company Limited

PERMIT 244

AIRBORNE GAMMA RAY SPECTROMETER SURVEY

MAP	DATE	BY	SCALE	N.T.S.
Fig 17	JULY 1979	M. Moltzan G. Walker	1 : 25 000	74M/8

19790009


C & E EXPLORATIONS LTD.,
52 CALANDAR RD. N.W.,
CALGARY, ALBERTA. T2L 0P6
DATE OF ISSUE - JUNE 15, 1976
AREA - 20,000 ACRES
TP. 120
TP. 119
R.1 W.4 M.

QUARTZ MINERAL EXPLORATION PERMIT NO. 244