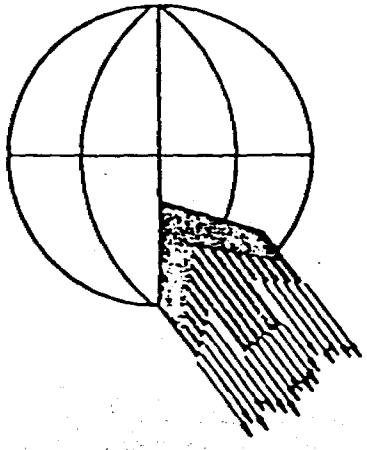
AIRBORNE ELECTROMAGNETIC SURVEY

HUDBAY MINING LIMITED

RHODES, ONTARIO

PROJECT #22082 FEBRUARY, 1981



Questor Surveys Limited, 6380 Viscount Road, Mississauga, Ontario L4V 1H3

CONTENTS

APPENDIX

MAP INDEX

Plate		Scale
1	Rhodes map 1 of 2 - Input Survey over Richardson Lake and Bennet Lake Groups	1:10 000
2	Location Map - Rhodes Township M-1077	1"= ½ mile

INTRODUCTION

This report contains our interpretation of the results of an airborne electromagnetic survey flown in the Rhodes area of Ontario in November, 1980.

A brief description of the survey procedure together with recommendations for follow-up is included.

The survey totalled 214 line kilometres and was performed by Questor Surveys Limited. The survey aircraft was a Britten Norman Trislander C-GNKW and the operating bases were Timmins and Sudbury, Ontario.

The area outlined is shown on the map at the end of this report. These are part of the 1:250,000 N.T.S. Map Series numbers 41 I.

MAP COMPILATION

The base maps are uncontrolled mosaics constructed from National Air Photo Library 0,000 scale photographs. The mosaics were reproduced at a scale of 1:10 on stable transparent film from which white prints can be made.

Flight path recovery was accomplished by comparison of the 35mm film with the mosaic in order to locate the fidu ial points. These points are approximately 1142 metres apart.

SURVEY PROCEDURE

Terrain clearance was maintained as close to 122 metres as possible, with the E.M. bird at approximatley 50 metres above the ground. Lines were flown consecutively in opposite directions, and tight keyhole turns were used. The equipment operator logged the flight details and monitored the instruments.

A line spacing of 200 metres was used.

INTERPRETATION & RECOMMENDATIONS

The Rhodes Area was flown over a section of Archean-age mafic and intermediate volcanics. The potential exists, in this type of geologic environment, for deposits of precious metals and Archean type copper-zinc sulphides.

This report has been set up in mostly table format. Where possible, each zone, or individual conductors within a zone, have been evaluated on the basis of strike length, dip, conductivity, magnetic correlation, and isolation. In addition, conductors have been given a priority for ground follow-up, which is broken down as follows:

1a	-	very high
1b	-	high
2	-	medium
3	-	low

RHODES

The survey of the Rhodes area totalled 214 line kilometres, and intersected 3 conductive zones. As most of the area was flown in 2 directions, anomaly responses may be stronger in one direction due to better coupling of the receiver and conductors.

Zone	-	1
Strike Length	-	1.3 kilometres
Dip	-	steep to the southwest
Conductivity	-	moderate to strong
Magnetic Correlation	-	flank of an 80 gamma peak
Priority	-	1a
Comments	-	There are definitely 2, and possible 3, parallel conductors on lines 10200 and 10210. The conductors were better profiled on map 1.

Zone	-	3
Strike Length	-	unknown, but probably less than 300 metres
Dip	-	possibly shallow to the east
Conductivity	-	low
Magnetic Correlation	-	flank
Priority	-	1b
Comments	-	There was a response to this zone on both line directions. The high priority is given mainly due to its short strike length.

ZONE 4

Zone 4 is composed of 2 anomaly intercepts, which may be related, that exhibit very high conductivity thickness products. No further evaluation can be made at this stage without a ground check. A priority of 'b should be given to this zone.

R.J. de Carle

for W.C. Kerr,
Geologist

GEOPHYSICAL TECHNICAL DATA

AIRBORNE SURVEYS

Type of Survey(s): E.M. AND MAG

Instruments(s): MARK VI INPUT: SONOTEK P.M.H. 5010 PROTON MAGNETOMETER
(Specify for Each Type of Survey)

Accuracy: SENSITIVITY OF 1 GAMMA, 2 PPM
(Specify for Each Type of Survey)

Aircraft Used: BRITTEN NORMAN TRISLANDER, C-GNKW

Sensor Altitude: 45 METRES

Navigation and Flight Recovery Method: AIRPHOTO MOSAICS, COMPARISON OF 35 MM FILM WITH MOSAIC IN ORDER TO LOCATE THE FIDUCIAL POINT

Aircraft Altitude: 122 m Line Spacing: 250 m

Kilometres Flown Over Total Area: 214 ln-km Kilometres Flown Over Claims Only: 6.8 ln-km


HANMER
Hanmer
Blezard Valley
Val Caron
RAYSIDE
Chelmsford
BALFOUR
Dowling
Phelan
CANADIAN
PACIFIC
Bradley
Azilda
Lake
Copper Cliff
Creighton
East Creighton
Lively
Garson Mine
Sand R.
Nickel
Minnow Lake
Coniston
McFarlane
Dill
Dill Siding
Boninville
Guilletville
River

APPENDIX

EQUIPMENT

The aircraft is equipped with a Mark VI INPUT (R) airborne E.M. system and Sonotek P.M.H. 5010 Proton Magnetometer. Radar altimeters are used for vertical control. The outputs of these instruments together with fiducial timing marks are recorded by means of galvanometer type recorders using light sensitive paper. Thirty-five millimeter continuous strip cameras are used to record the actual flight path.

(I) BARRINGER/QUESTOR MARK VI INPUT (R) SYSTEM

The Induced Pulse Transient (INPUT) system is particularly well suited to the problems of overburden penetration. Currents are induced into the ground by means of a pulsed primary electromagnetic field which is generated in a transmitting loop around the aircraft. By using half sine wave current pulses and a loop of large turns-area, the high output power needed for deep penetration is achieved.

The induced current in a conductor produces a secondary electromagnetic field which is detected and measured after the termination of each primary pulse. Detection is accomplished by means of a receiving coil towed behind the aircraft on four hundred feet of cable,

and the received signal is processed and recorded by equipment in the aircraft. Since the measurements are in the time domain rather than the frequency domain common to continuous wave systems, interference effects of the primary transmitted field are eliminated. The secondary field is in the form of a decaying voltage transient originating in time at the termination of the transmitted pulse. The amplitude of the transient is, of course, proportional to the amount of current induced into the conductor and, in turn, this current is proportional to the dimensions, the conductivity and the depth beneath the aircraft.

The rate of decay of the transient is inversely proportional to conductivity. By sampling the decay curve at six different time intervals, and recording the amplitude of each sample, an estimate of the relative conductivity can be obtained. By this means, it is possible to discriminate between the effects due to conductive near-surface materials such as swamps and lake bottom silts, and those due to genuine bedrock sources. The transients due to strong conductors such

and the received signal is processed and recorded by equipment in the aircraft. Since the measurements are in the time domain rather than the frequency domain common to continuous wave systems, interference effects of the primary transmitted field are eliminated. The secondary field is in the form of a decaying voltage transient originating in time at the termination of the transmitted pulse. The amplitude of the transient is, of course, proportional to the amount of current induced into the conductor and, in turn, this current is proportional to the dimensions, the conductivity and the depth beneath the aircraft.

The rate of decay of the transient is inversely proportional to conductivity. By sampling the decay curve at six different time intervals, and recording the amplitude of each sample, an estimate of the relative conductivity can be obtained. By this means, it is possible to discriminate between the effects due to conductive near-surface materials such as swamps and lake bottom silts, and those due to genuine bedrock sources. The transients due to strong conductors such as sulphides exhibit long decay curves and are therefore commonly recorded on all six channels. Sheet-like surface materials, on the other hand, have short decay curves and will normally only show a response in the first two or three channels.

The samples, or gates, are positioned at 310, 490, 760, 1120, 1570 and 2110 micro-seconds after the cessation of the pulse. The widths of the gates are 180, 180, 360, 360, 540, and 540 micro-seconds respectively.

For homogeneous conditions, the transient decay will be exponential and the time constant of decay is equal to the time difference at two successive sampling points divided by the log ratio of the amplitudes at these points.

(II) SONOTEK P.M.H. 5010 PROTON MAGNETOMETER

The magnetometers which measure the total magnetic field have a sensitivity of 1 gamma and a range from 20,000 gammas to 100,000 gammas.

Because of the high intensity field produced by the INPUT transmitter, the magnetometer results are recorded on a time-sharing basis. The magnetometer head is energized while the transmitter is on, but the read-out is obtained during a short period when the transmitter is off. Using this technique, the head is energized for 0.83 seconds while the precession frequency is being recorded and converted to gammas. Thus a magnetic reading is taken every 1.13 second.

For this survey, a lag factor has been applied to the data. Magnetic data recorded on the analogue records at fiducial 10.00 for example would be plotted at fiducial 9.95 on the mosaics.

DATA PRESENTATION

The symbols used to designate the anomalies are shown in the legend on each map sheet, and the anomalies on each line are lettered in alphabetical order in the direction of flight. Their locations are plotted with reference to the fiducial numbers on the analog record.

A sample record is included to indicate the method used for correcting the position of the E.M. Bird and to identify the parameters that are recorded.

GENERAL INTERPRETATION

The INPUT system will respond to conductive overburden and near-surface horizontal conducting layers in addition to bedrock conductors. Differentiation is based on the rate of transient decay, magnetic correlation and the anomaly shape together with the conductor pattern and topography.

Power lines sometimes produce spurious anomalies but these can be identified by reference to the monitor channel.

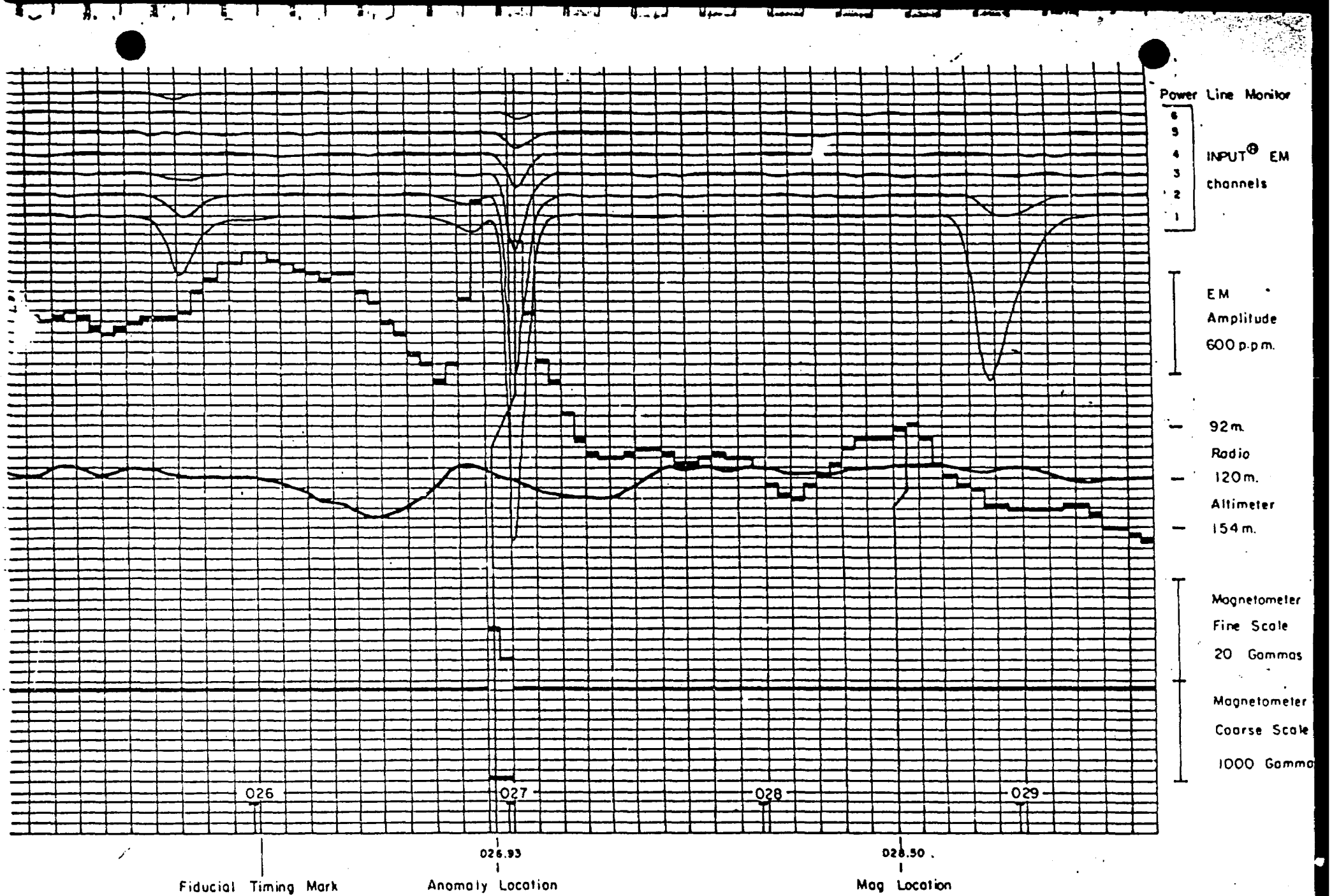
Railroad and pipeline responses are recognized by studying the film strips.

Graphite or carbonaceous material exhibits a wide range of conductivity. When long conductors without magnetic correlation are located on or parallel to known faults or photographic linears, graphite is most likely the cause.

Contact zones can often be predicted when anomaly trends coincide with the lines of maximum gradient along a flanking magnetic anomaly. It is unfortunate that graphite can also occur as relatively short conductors and produce attractive looking anomalies. With no other information than the airborne results, these must be examined on the ground.

Serpentinized peridotites often produce anomalies with a character that is fairly easy to recognize. The conductivity which is probably caused in part by magnetite, is fairly low so that the anomalies often have fairly large response on channel #1; they decay rapidly, and they have strong magnetic correlation. INPUT E.M. anomalies over massive magnetites show a relationship to the total Fe content. Below 25 - 30%, very little or no response at all is obtained, but as the percentage increases the anomalies become quite strong with a characteristic rate of decay which is usually greater than that produced by massive sulphides.

Commercial sulphide ore bodies are rare, and those that respond to airborne survey methods usually have medium to high conductivity. Limited lateral dimensions are to be expected and many have magnetic correlation caused by magnetite or pyrrhotite. Provided that the ore bodies do not occur within formational conductive zones as mentioned above, the anomalies caused by them will usually be recognized on an E.M. map as priority targets.



Representative INPUT®, Magnetometer and Altimeter Recording

Hudbay Mining Ltd.

A Subsidiary of Hudson's Bay Oil and Gas Company Limited
Telephone (416) 361-0272 - 1200, 10 King Street East - Toronto, Ontario, Canada M5C 1C3

REGISTERED MAIL

1981-06-02

Mr. E.F. Anderson
Director, Land Management Branch
Room 6450
Whitney Block
Parliament Buildings
Queen's Park
Toronto, Ontario.

900

Attn: Mr. Mathews.

Dear Mr. Mathews,

Please consider this application for an Airborne Geophysical Certificate covering 18 mining claims in Rhodes Twp., Sudbury Mining District, (Rhodes Project).

Attached please find a list of the mining claims to be covered under the certificate.

Enclosed please find two(2) copies of the airborne geophysical report and maps(Questor file 22082).

I trust you will find this material in order, please advise.

Yours very truly,

Karl Giesbrecht

KOG/nb
Encl:

Karl O. Giesbrecht
Senior Geologist.

c.c. J.T. Winter (Calgary).

HUDBAY MINING LTD

CLAIM SUMMARY SHEET

CLAIM GROUP NAME	TWP.	NO. OF CLAIMS	CLAIM NOS.	RECORDING DATE
Richardson Lake Group.	Rhodes	9	616178-616186	1981-04-21
Bennet Lake Group	Rhodes	9	616189-616197	1981-04-21

QUESTOR SURVEYS LIMITED

6380 Viscount Road
Mississauga, Ontario
L4V 1H3
Tel: 676-9880
Telex: 06-983611

June 4, 1981.

Mr. F. Matthews,
Lands Administration Branch,
Ontario Geological Survey,
Queen's Park,
TORONTO, Ontario,
M7A 2A9.

Dear Mr. Matthews:

This letter is a statement signifying that I, Robert J. deCarle; Chief Geophysicist of Questor Surveys Limited, take full responsibility for the contents, interpretation and final preparation for the following reports.

Project #22082 - Rhodes, Ontario by W. C. Kerr.

Project #22079 - Dobson Lake, Ontario by D. Isherwood.

Mr. W. C. Kerr is not with Questor any longer and D. Isherwood is in the field on a project and is not available to sign his reports. Therefore, as their immediate supervisor, I take responsibility for their work.

Yours sincerely,
QUESTOR SURVEYS LIMITED

R. J. de Carle

2.467

RJdC/wb

R. J. deCarle,
Chief Geophysicist.

Hudbay Mining Ltd.

A Subsidiary of Hudson's Bay Oil and Gas Company Limited
Telephone (416) 361-0272 - 1200, 10 King Street East - Toronto, Ontario, Canada M5C 1C3

REGISTERED MAIL

1981-06-05

Mr. E.F. Anderson
Director, Land Administration Branch
Room 6450
Whitney Block
Parliament Buildings
Queen's Park
Toronto, Ontario.

Attn: Mr. Mathews.

Dear Mr. Mathews,

Attached please find Mr. R.J. deCarle's letter of June 4, 1981 accepting responsibility for the interpretation preparation and contents of two (2) reports submitted to you June 2, 1981 for an Airborne Geophysical Certificate. The reports were signed by Mr. deCarle and are as follows:

Project 22082 - Rhodes Ont., by W.C. Kerr

Project 22079 - Dobson Lake Ont., by D. Isherwood

I trust this will be acceptable to the department.

Thanking you in advance.

KOG/nb

Sincerely,

Karl Giesbrecht

Karl O. Giesbrecht,
Senior Geologist.

Attach:(1)

1981 06 08

2.3934

V.C. Miller
Mining Recorder
Ministry of Natural Resources
199 Larch Street
Sudbury, Ontario
P3E 5P9

Dear Sir;

We have received reports and maps for an Airborne Geophysical Certificate (Electromagnetic) submitted on mining claims S 616178 et al in the Township of Rhodes.

This material will be examined and assessed and a Certificate will be issued.

Yours very truly

E.F. Anderson
Director
Land Management Branch

Whitney Block, Room 6450
Queen's Park
Toronto, Ontario
M7A 1W3
Phone 416/965-1316

js

cc: Hudbay Mining Ltd.,
Toronto, Ontario
cc: Questor Surveys Limited
Mississauga, Ontario

FILE: 2.3934

GEOLOGICAL BRANCH

MR. R. BARLOW DATE OF APPROVAL Nov. 11 19 81

SIGNATURE Roger Barlow

COMMENTS:

Approved

MR. C. KUSTRA DATE OF APPROVAL: 19

SIGNATURE:

COMMENTS:

DR. I. THOMSON DATE OF APPROVAL 19

SIGNATURE:

L.D

RETURN TO- MR. FRED MATTHEWS, MINING LANDS SECTION - WHITNEY BLOCK, ROOM 6452

S. Halperin 5-1380 81.07.24

Mining Recorder
Sudbury

Please inform us of the name of the recorded holder and the recording dates for the following:

S 616189 to 95 inclusive. Apr. 21/81 called Nov. 20th/81
S 616178 to 88 inclusive. Apr 21/81

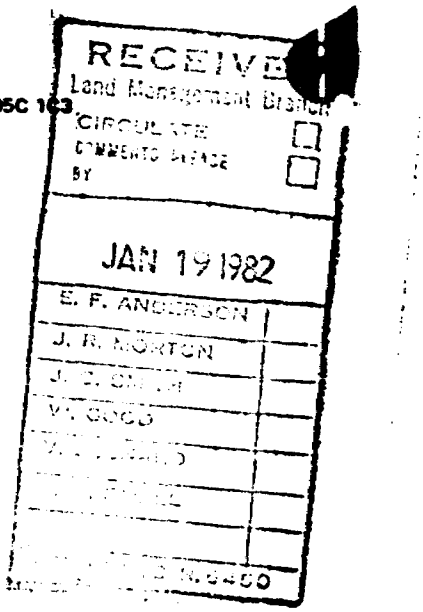
P. W. Matthews
Mining Lands

Checked at Library
O.K. Dec 15

2.3934

Hudbay Mining Ltd.

A Subsidiary of Hudson's Bay Oil and Gas Company Limited
Telephone (416) 361-0272 - 1200, 10 King Street East - Toronto, Ontario, Canada M5C 1C3



1982-01-15

Mr. E.F. Anderson
Director, Land Administration Branch
Room 6450
Whitney Block
Parliament Buildings
Queen's Park
Toronto, Ontario.

Your File 2.3934.

Attn: Mr. Mathews.

Dear Mr. Mathews,

I would like to point out a typographical error on a geophysical certificate (copy attached) issued to Hudbay Mining, on 18 claims located in Rhodes Twp, Sudbury Mining Division. The claim #'s, should read 616189-97.

I trust this error can be quickly corrected with minimum inconvenience to your department.

Yours truly,

K.O. Giesbrecht
Senior Geologist.

KOG/nb
Encl:

cc V.C. Miller
Mining Recorder
Ministry of Natural Resources
199 Larch Street
Sudbury, Ontario
P3E 5P9

Ministry of Natural Resources
Ontario

Airborne Geophysical Certificate

The Mining Act

2.3934

This is to certify that Hudbay Mining Ltd. has met the requirements of Section 78 of The Mining Act, with respect to the following mining claims in the Township ~~(or Area)~~ of Rhodes.

Mining Claims (Please list)

S.616178 to 86 incl.
S.616189 to 95 incl.

over

7

January 22, 1982

2.3934
2.3932
2.3931

Hudbay Mining Ltd.
Suite 1200
10 King Street East
Toronto, Ontario
M5C 1C3
Attention: K.O. Giesbrecht

Dear Sir:

Thank you for your letter of January 15, 1982 concerning your Airborne Certificate, however, there are actually two matters in error.

First, the claim numbers should be S.616178 to 86 inclusive and S.616189 to 94 inclusive. Mining Claims S.616195-96-97 do not have any flight lines traversing them, therefore, they are not eligible.

Second, the original copies of this and two other certificates were given to you in error. You should only have been given photocopies.

Please return all three certificates (Files 2.3931, 2.3932 and 2.3934). Photocopies will be returned to you and the originals will be sent to the Mining Recorder for registration.

Yours very truly,

E.F. Anderson
Director
Land Management Branch

Whitney Block, Room 6450
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: 416/965-1380

F.W. Matthews/bk

2.3934

February 3, 1982 2.3934

Office of the Mining Recorder
Ministry of Natural Resources
60 Wilson Avenue
Timmins, Ontario
P4N 2S7

Dear Sir:

Re: Airborne Geophysical Certificate (Electromagnetic) submitted on Mining Claims P.616178 et al, in the Township of Rhodes.

Enclosed is an Airborne Geophysical Certificate issued under Section 78 of the Mining Act R.S.O. 1980.

Please indicate on your records that the time for performing the first and all subsequent periods of work for the claims listed shall fall due one year later than the times prescribed in subsection 1 of Section 76.

Yours very truly,

E.F. Anderson
Director
Land Management Branch

Whitney Block, Room 6450
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: 416/965-1380

A. Kerr/bk

Encl.

cc: Budbay Mining Ltd.
Toronto, Ontario
Attention: Karl O. Giesbrecht

cc: Questor Surveys Limited
Mississauga, Ontario
Attention: R.J. deCarle

cc: Resident Geologist
Timmins, Ontario

Ontario Ministry of Natural Resources

Airborne Geophysical Certificate

The Mining Act

2.3934

This is to certify that Hudbay Mining Ltd. has met the requirements of Section 78 of The Mining Act, with respect to the following mining claims in the Township ~~(or Area)~~ of Rhodes.

Mining Claims (Please list)

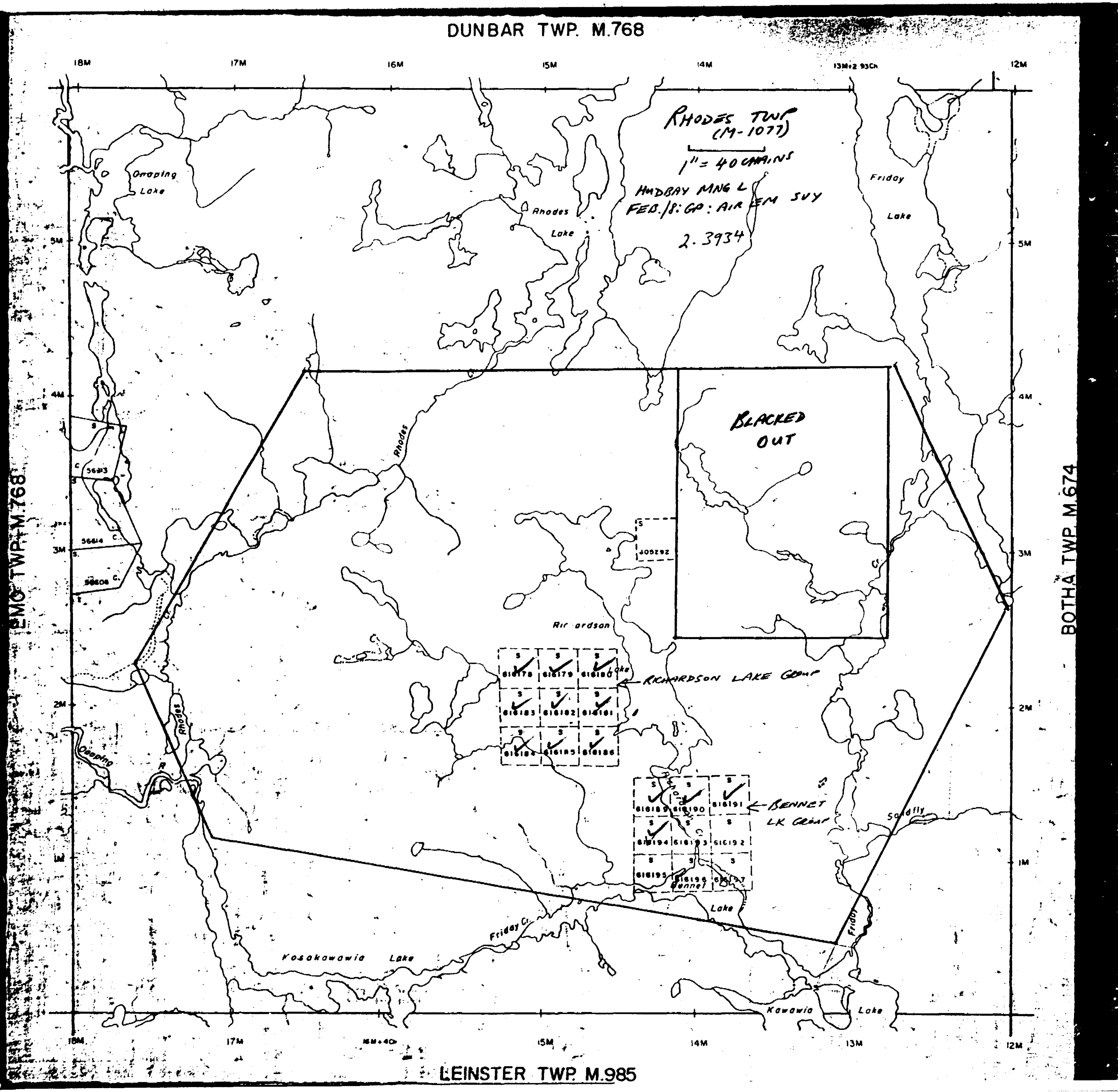
S.616178 to 86 incl.
S.616189 to 97 incl.

Date 82:02:03

Branch Director

No coverage on bottom group of claims

(NO COVERAGE ON BOTTOM GROUP OF CLAIMS)



DUNBAR TWP. M.768
18M
17M
16M
15M
14M
13M+2 93Ch
12M
RHODES TWP
(M-1077)
1" = 40 CHAINS
HUDBAY MNG L
FEB./8: GP: AIR EM SVY
2.3934
Onaping Lake
Rhodes Lake
Friday Lake
5M
4M
3M
2M
1M
BLACKED OUT
Rhodes
56813
405292
Rir ardson
Lake
616178
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RICHARDSON LAKE GROUP
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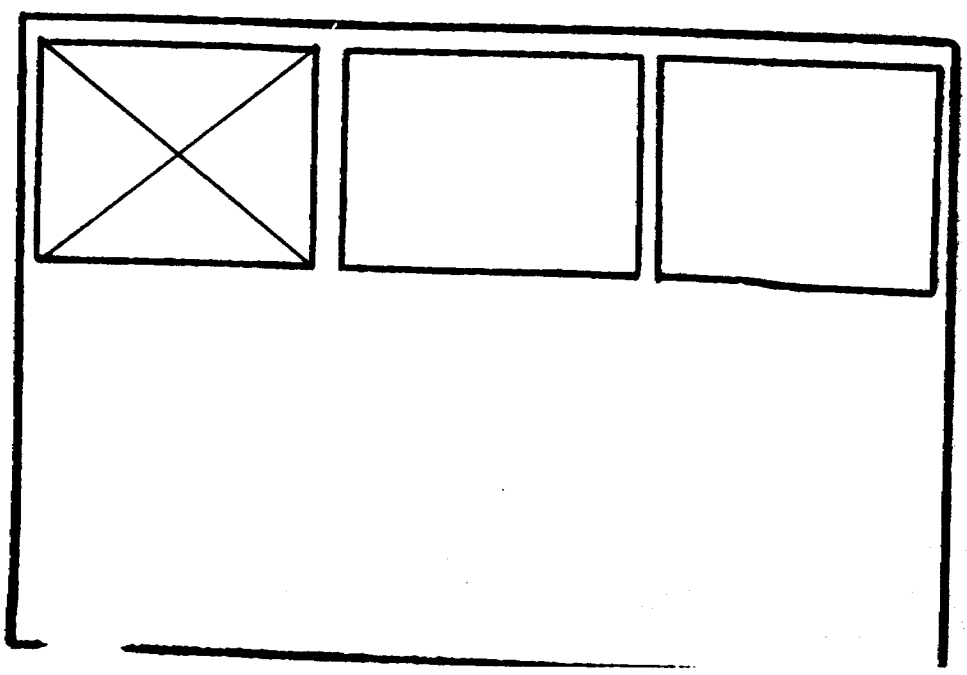
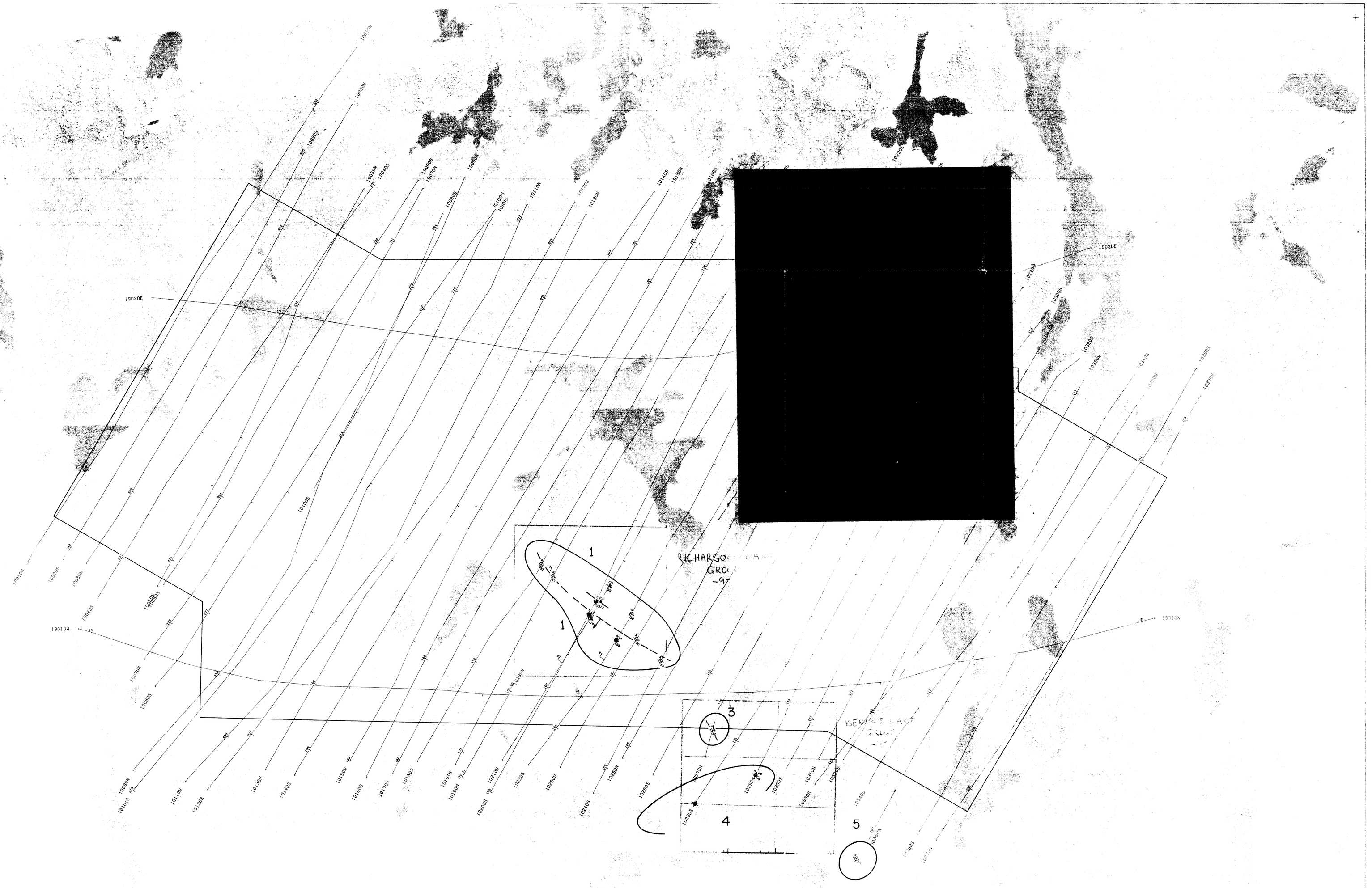
616197
BENNET LK GROUP
Bennet Lake
Sa dfly
Onaping
Friday Cr.
Friday
Kosakawawia Lake
Kawawia Lake
BOTHA TWP. M.674
18M
17M
16M+40
15M
14M
13M
12M
LEINSTER TWP. M.985

SEE ACCOMPANYING MAP(S) IDENTIFIED AS

RHODES-0011-B1,#1

LOCATED IN THE MAP CHANNEL IN THE FOLLOWING SEQUENCE (X)





INTERPRETATION LEGEND

QUESTOR SURVEYS LIMITED

RHODES PROJECT

RHODES-001-C1 #1