DIGHEM^{III} SURVEY
OF THE
H-N PROJECT
COCHRANE AREA
ONTARIO

FOR

ESSO MINERALS CANADA

BY

DIGHEM SURVEYS & PROCESSING INC.

RECEIVED

[illegible]

SSISSAUGA, ONTARIO
NE 10, 1986

P.A. SMITH
GEOPHYSICIST

REPORT NO. 247

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AS-166

SUMMARY AND RECOMMENDATIONS

A total of 249 km (155 miles) of survey was flown with e DIGHEM^{III} system on May 12, 1986, approximately 70 km rtheast of Cochrane, Ontario, for Esso Minerals Canada. ee Figure 1).

The survey detected many strong bedrock conductors ich are typical of graphite and/or sulphides. In dition, there are numerous anomalies which reflect orly-conductive sources of possible bedrock origin. Most the conductors described in Section 1 of this report pear to warrant further investigation using appropriate rface exploration techniques. Areas of interest may be signed priorities for follow-up work on the basis of pporting geological and/or geochemical information. A mparison of the various geophysical parameters should be tremely valuable in mapping the geological units and ructural breaks within the survey area.

The entire survey area exhibits excellent potential as host for both strongly conductive massive sulphide posits and weakly conductive zones of auriferous neralization. Most of the interpreted bedrock conductors e considered to be of moderate to high priority as ploration targets.

LOCATION MAP

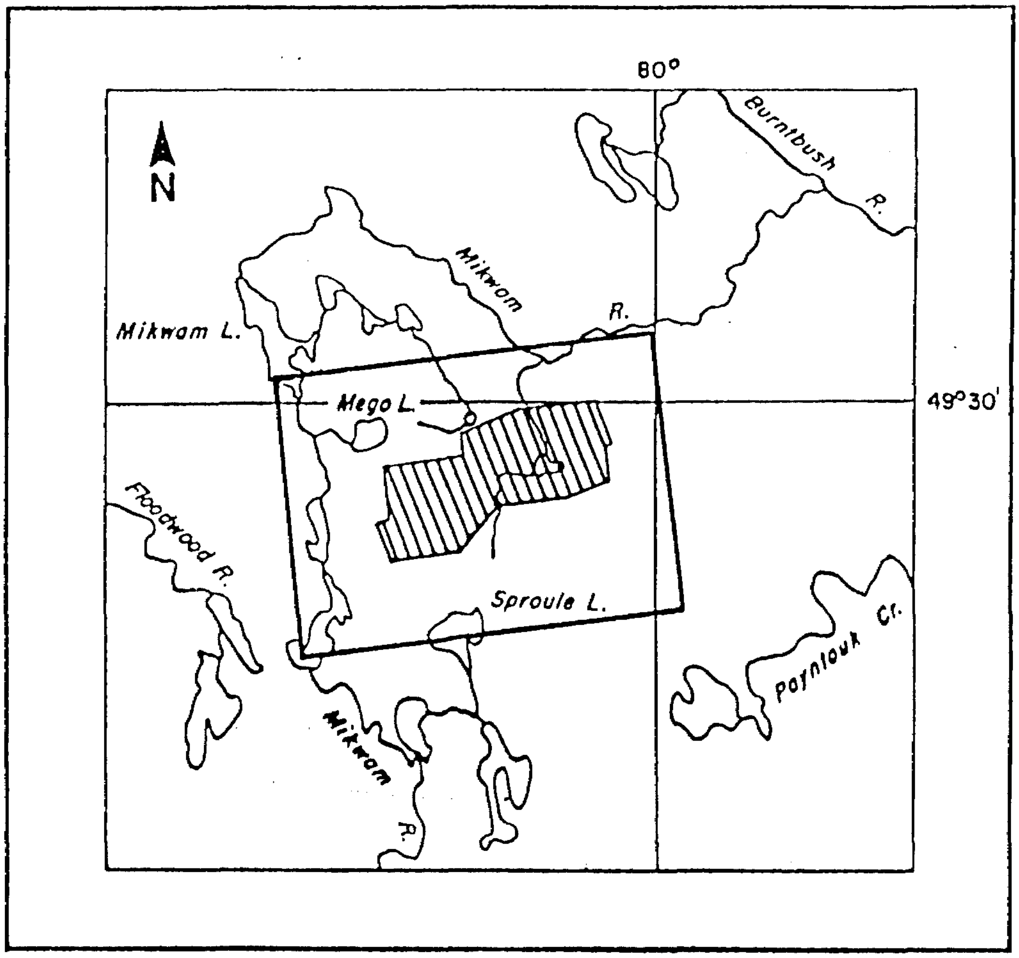

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FIGURE 1

THE SURVEY AREA

CONTENTS

S ACCOMPANYING THIS REPORT

ENDICES

INTRODUCTION

A DIGHEM^{III} electromagnetic/resistivity/magnetic/VLF rvey totalling approximately 249 line-km was flown with a 0 m line-spacing for Esso Minerals Canada, on May 12, 86. Survey coverage consisted of a single survey grid with averse lines flown in an azimuthal direction of 5°/345°. The 249 km total includes two tie lines.

The survey block is located on N.T.S. map sheet 42H/8. e approximate centre of the survey area occurs at latitude °28'48"N/longitude 80°04'00"W. The survey results have en presented on separate map sheets for each geophysical rameter.

An Aerospatiale Squirrel turbine helicopter egistration C-GFHP) was provided by Frontier Helicopters d. The helicopter flew at an average airspeed of 130 km/h th an EM bird height of approximately 33 m. Ancillary uipment consisted of a Sonotek PMH 5010 magnetometer with s bird at an average height of 48 m, a Sperry radio timeter, a Geocam sequence camera, an RMS GR33 digital aphics recorder, a Sonotek SDS 1200 digital data quisition system, a Herz Industries Totem-2A

F-electromagnetometer with its sensor towed at an average ight of 55 m, and a DigiData 1640 9-track 800-bpi magnetic pe recorder. The analog equipment recorded four channels EM data at approximately 900 Hz, two channels of EM data approximately 7200 Hz, four channels of VLF-EM (total eld and quadrature components for two frequencies, (two bient EM noise channels (for the coaxial and coplanar ceivers), two channels of magnetics (coarse and fine unt), and a channel of radio altitude. The digital uipment recorded the EM data with a sensitivity of 20 ppm at 900 Hz and 0.40 ppm at 7200 Hz, the VLF field to 1%, and the magnetic field to one nT (i.e., one gamma). e VLF-EM receivers were tuned to 24.8 kHz (Seattle, shington-NLK) as the primary station and 21.4 kHz nnapolis, Md.-NSS) as an alternate signal source. The ta shown on the VLF map were derived from the transmitter Seattle.

In addition to the above equipment, a Del Norte Flying agman navigation system was employed to track the rcraft's progress across the ground. This information was corded in a range-range mode to an accuracy of 5 metres th a once-per-second update.

Appendix A provides details on the data channels, their spective sensitivities, and the navigation/flight path covery procedure. Noise levels of less than 2 ppm are nerally maintained for wind speeds up to 35 km/h. Higher nds may cause the system to be grounded because excessive rd swinging produces difficulties in flying the licopter. The swinging results from the 5 m^2 of area ich is presented by the bird to broadside gusts. The GHEM system nevertheless can be flown under wind nditions that seriously degrade other AEM systems.

In areas where EM responses are evident primarily on e quadrature components, zones of poor conductivity are dicated. Where these responses are coincident with strong gnetic anomalies, it is possible that the inphase mponent amplitudes have been suppressed by the effects of gnetite. Most of these poorly-conductive magnetic atures give rise to resistivity anomalies which are only ightly below background. If it is expected that orly-conductive economic mineralization may be associated th magnetite-rich units, most of these weakly anomalous atures will be of interest. In areas where magnetite uses the inphase components to become negative, the parent conductance and depth of EM anomalies may be reliable.

Anomalies which occur near the ends of the survey nes, (i.e., outside the survey area), should be viewed th caution. Some of the weaker anomalies could be due to rodynamic noise, i.e., bird bending, which is created by normal stresses to which the bird is subjected during the imb and turn of the aircraft between lines. Such rodynamic noise is usually manifested by an anomaly on the axial inphase channel only, although severe stresses can fect the coplanar inphase channels as well.

SECTION I: SURVEY RESULTS

eral Discussion

The survey covered a single grid with 249 km of flying, results of which are shown on separate map sheets for h parameter. Table I-1 summarizes the EM responses in survey area, with respect to conductance grade and erpretation.

The anomalies shown on the electromagnetic anomaly maps based on a near-vertical, half plane model. This model t reflects "discrete" bedrock conductors. Wide bedrock ductors or flat-lying conductive units, whether from ficial or bedrock sources, may give rise to very broad malous responses on the EM profiles. These may not ear on the electromagnetic anomaly maps if they have a ional character rather than a locally anomalous racter. These broad conductors, which more closely roximate a half space model, will be maximum coupled to horizontal (coplanar) coil-pair and should be more dent on the resistivity parameter. The resistivity maps, refore, may be more valuable than the electromagnetic

TABLE I-1

EM ANOMALY STATISTICS - H-N PROJECT

CONDUCTOR GRADE	CONDUCTANCE RANGE	NUMBER OF RESPONSES
6	> 99 MHOS	0
5	50-99 MHOS	0
4	20-49 MHOS	0
3	10-19 MHOS	2
2	5- 9 MHOS	10
1	< 5 MHOS	163
X	INDETERMINATE	98
TOTAL		273

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
D	DISCRETE BEDROCK CONDUCTOR	25
B	DISCRETE BEDROCK CONDUCTOR	29
S	CONDUCTIVE COVER	211
E	EDGE OF WIDE CONDUCTOR	8
TOTAL		273

(SEE EM MAP LEGEND FOR EXPLANATIONS)

maly maps, in areas where broad or flat-lying conductors considered to be of importance. A contoured resistivity , based on the 7200 Hz coplanar data, is included with is report.

Excellent resolution and discrimination of conductors s made possible by using a relatively fast sampling rate 0.1 sec and by employing a common frequency (900 Hz) on orthogonal coil-pairs (coaxial and coplanar). The sulting "difference channel" parameter permits ferentiation of bedrock and surficial conductors, even ugh they exhibit extremely weak conductance in many ses.

As previously mentioned in the introduction to this port, the effects of magnetite can reduce the positive plitude of the inphase responses and can yield negative phase responses in poorly conductive areas. It should be iterated that the effects of magnetite can yield higher verstated) apparent resistivities, lower (understated) EM nductance values, and erroneously shallow depth estimates. rthermore, the apparent dips of conductors may also be correct if they are flanking, or contained within, gnetite-rich units.

There are some instances where the low frequency 00 Hz) inphase response is negative while the high equency (7200 Hz) inphase response is positive. Although e effects of magnetite are frequency independent, and ould therefore yield equal negative excursions for both equencies, the higher frequency will yield a more positive sponse over zones of poor conductivity.

F-EM

The VLF map shows the contoured results of the filtered al field parameter (Seattle). As the VLF method is quite sitive to the angle of coupling between the conductor and propogated EM field, conductors which strike towards the station will usually yield a stronger response than ductors which are nearly orthogonal to it. The general ike in the survey area is approximately east-northeast/ t-southwest and therefore provides good coupling with the signal source.

In general, the VLF trends over most of the survey area w moderately good correlation with the interpreted EM ductors and resistivity trends. VLF anomalies which ear to transect the local geologic strike inferred from magnetic, resistivity and EM data, and those VLF trends ich appear to be truncated or offset, are likely due to ults or shears. Lakes and swampy areas appear to have fluenced the VLF results.

The VLF parameter does not provide the same degree of solution available from the EM data. Closely-spaced nductors, conductors of short strike length or conductors ich are poorly coupled to the VLF field, may escape tection with this method. Erratic signals from the VLF ansmitters can also give rise to strong, isolated omalies which should be viewed with caution. Regardless these limitations, however, the VLF results have provided ditional structural information, particularly within the re resistive portions of the survey area.

gnetics

The total field magnetic map suggests the geology and ructure underlying the survey area is much more complex an is indicated on the O.G.S. Map 2410*.

At least two major magnetic units extend in an imuthal direction of 070° to 080° across the property.

Ontario Geological Survey, Map 2410, Twopeak Lake ese are intersected by two parallel linear features which rike roughly 005° and 002° respectively from the extreme uthern ends of lines 10070 and 10220. The former trends e attributed to relatively non-conductive, magnetite-rich cks (possibly iron formation), while the latter are obably due to cross-cutting diabase dikes.

In addition to the linear features, there are several ug-like magnetic anomalies of limited extent. The rongest of these is centered at fiducial 2622 on line 190, where values of more than 4,700 nT above background e evident. This interesting plug-like magnetic unit also sts one of the stronger bedrock conductors in the area, ich appears to have been drilled in previous years. alcopyrite was reportedly intersected in one of the drill les.

Magnetic relief varies from a low of 59,030 nT on line 80, to a high of about 63,700 nT at anomaly 10190F.**

The magnetic units shown on the total field contour map e more clearly resolved and defined on the enhanced netic map. Furthermore, there are several well-defined

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This refers to EM anomaly "F" on survey line 10190.

anced magnetic anomalies which are only weakly evident on e total field map. One example is the feature which tends from fiducial 1097 on line 10631 to the south end of ne 10770. The data enhancement technique is described in ction II of this report. It should be noted, however, at the algorithm used to enhance subtle positive magnetic omalies does not highlight magnetic lows which may be due faulting, alteration or non-magnetic intrusions.

The magnetic results, in conjunction with the other ophysical parameters, should provide information which can used to effectively map the geology and structure in the rvey area.

sistivity

The resistivity map shows the conductive properties of e survey area. Some of the resistivity lows (i.e., nductive areas) coincide with discrete bedrock conductors d others indicate weakly conductive overburden associated th water-covered areas. The resistivity patterns may aid ologic mapping and in extending the length of known zones.

The rocks and surficial cover underlying the survey ea are moderately resistive, usually yielding resistivity ues of more than 1,000 ohm-m. Some swamps, however, tain enough conductive material to lower the apparent istivity values to less than 1,000 ohm-m. Zones of less n 800 ohm-m resistivity, which do not occur in low-lying water-covered areas, are generally considered to be due bedrock conductors. The resistivity maps provide a quick easy method of outlining all the highly conductive gets in the survey area.

Although the host rocks are generally quite resistive, y contain numerous, clearly-defined, strong EM anomalies ch exhibit responses typical of graphite and/or highly ductive sulphides. There are several conductive zones lined by the 1,000 ohm-m resistivity contour. It is eresting to note that these zones do not appear to be tricted to a single geologic unit, but occur within the ped mafic metavolcanic flows as well as the asediments. There are broad resistivity lows overlying granodiorite intrusive in the west central portion of survey grid. Most of the EM anomalies in this area, ever, exhibit the characteristics of conductive rburden, suggesting that these resistivity lows may lect surficial cover.

One of the more interesting resistivity lows is a -shaped zone which extends southeast from anomaly 10440C

10480C, swinging west-southwest to anomaly 10390C and n south-southeast to 10430D. This feature may reflect a ded conductive unit or three intersecting conductive nds. The magnetic and VLF results suggest the latter othesis is more likely. In addition to the "Z"-shaped istivity low, there are at least six other lows which are ributed to bedrock conductors. These include the zones ociated with anomalies 10060C, 10120A, 10200B, 10430A, 00A and 10610B. These zones contain the most interesting physical targets in the survey area.

:tromagnetics

The electromagnetic profiles and the calculated istivity parameters for the 900 Hz and 7200 Hz juencies, suggest that most of the survey area is covered a moderately thin layer of weakly conductive overburden. :e are some anomalies, however, which indicate overburden :kness of up to 50 m. Surficial resistivities, based on 7200 Hz data, commonly yield values of more than 0 ohm-m.

Approximately 70% of the anomalous responses in the ey area consist of broad responses which exhibit the acteristics of a poorly-conductive half space, such as ht be expected from conductive overburden. The general k of anomalous responses on the difference channel ameters usually implies moderately broad or flat-lying rces. There are, however, some anomalies which yield erately narrow responses on the quadrature or high quency parameters and give rise to subtle responses on difference channels. Some of these coincide with netic (bedrock) features and have therefore been given a " or "S?" interpretive symbol. These classifications ote possible bedrock sources of weak conductance which be partially masked by the effects of magnetite and/or luctive overburden. Although the latter responses are sidered to be low priority targets on the basis of their physical signatures, they may reflect poorly-conductive izons (weakly mineralized faults or contacts?) which ld be of economic significance in the area. A more rough evaluation of these anomalies should therefore be ried out by one or more qualified professionals who have ess to, and can provide a meaningful compilation of, all ilable geophysical, geological and geochemical data for survey area.

The electromagnetic anomaly maps show the anomaly ations with the interpreted conductor type, dip, luctance and depth being indicated by symbols. Direct netic correlation is also shown if it exists. The strike ection and length of the conductors are indicated when malies can be correlated from line to line. When dying the map sheets for follow-up planning, consult the maly listings appended to this report to ensure that none the conductors are overlooked.

DUCTORS IN THE SURVEY AREA

It is beyond the scope of this report to describe all anomalous responses defined by the survey. The lowing text provides a brief description of the anomalies ch appear to be due to bedrock conductors. Although some the stronger anomalies may yield signatures which are racteristic of graphite and/or semi-massive to massive phides, they do not necessarily bear a direct ationship to economic mineralization. In areas where iferous mineralization is considered to be the primary loration target, some of the very weak or magnetite- ociated anomalies may be of greater importance than the onger, well defined conductors.

Where several conductors or conductive trends exhibit ilar characteristics, or appear to be related to a common logical unit or stratigraphic horizon, these have been uped into "Zones" for purposes of discussion. The zone lines shown on the EM map may approximate the limits of a ductive unit, a magnetic unit, or both.

maly: 10060C

This interesting anomaly gives rise to an isolated resistivity low of limited extent, located within a relative magnetic low. It reflects a strong, narrow bedrock conductor with a probable dip to the north. Although this non-magnetic conductor is not evident on adjacent lines, it is considered to be a high priority target. It is recommended that further investigation be carried out to check the causative source of this attractive anomaly.

malies: 10070A, 10110B-10120A

Anomaly 10070 is associated with a moderately strong magnetic anomaly, exhibiting a direct correlation of 430 nT. The effects of magnetite have suppressed the inphase responses and have probably yielded erroneously high resistivity values. The anomaly probably reflects conductive material associated with magnetite. It may be open to the west and could continue eastward through 10080A to 10120A.

Anomaly 10110B-10120A reflects a narrow, north-dipping conductor which is associated with the same magnetic trend which hosts 10070A, and may therefore be related to a similar causative source. The eastern portion, 10110B-10120A, does not appear to be as magnetic as the western portion, and probably reflects a higher concentration of conductive material within the magnetite-rich host rock. This conductor also correlates with a VLF anomaly and an isolated resistivity low which may enhance its significance. It is recommended that this area be subjected to further detailed investigation.

malies: 10100A-10130A, 10120B, 10120F

Anomalies in this group comprise broad, poorly-defined responses which are probably due to conductive overburden or a broad conductive rock unit. There are subtle inflections on the quadrature difference channels which may be indicative of weak, buried bedrock conductors. With the possible exception of 10120B, which denotes an "edge effect", all anomalies in this group are associated with a moderately strong resistivity low and a relative magnetic depression. This may reflect a felsic intrusion or a zone of alteration. These anomalies do not coincide with VLF anomalies, probably because of the attenuating effects of the conductive cover.

Most of the anomalies in this group are attributed primarily to conductive overburden and are therefore considered to be of moderately low priority.

malies: 10180xD-10220C, 10160xB, 10230A, 10230C

The anomalies in this group are contained in an area between two parallel north/south trending magnetic linears which are attributed to diabase dikes.

The conductor defined by 10180xD-10220C is the strongest feature in the survey area. It is associated with a very strong, plug-like magnetic anomaly, as evidenced by the 4,820 nT correlation with anomaly 10190F. This conductor reflects a narrow, north-dipping, highly conductive and magnetic source, with a probable strike length of about 400 m. Pyrrhotite is considered to be a likely cause although chalcopyrite was reportedly intersected in one of the drill holes in this vicinity. This conductor appears to have been drilled in the past but additional work may be warranted.

Anomalies 10160xB, 10230A and 10230C consist of isolated responses which may reflect bedrock conductors of short strike length. Poorly conductive material associated with magnetite is a likely cause of 10160xB. This anomaly, however, is located in close proximity to the northwestern flank of the strong magnetic plug, where it abuts a north/south trending diabase dike. This poorly-defined conductor is of interest because of the apparent structural deformation which may have influenced mineral deposition in the immediate area.

Anomaly 10230A is an interesting single-line response which occurs on the southern flank of a weak magnetic anomaly. The sharpness of this response suggests that a spheric noise spike may have been a contributing factor, although there is no supporting evidence on the spherics monitor. This anomaly, therefore, is considered to be due to a concentration of metallic sulphides of short strike extent. Its associated VLF anomaly may be due to a geological contact which occurs near the edge of a zone of conductive overburden. The coincident resistivity low, however, is more isolated in nature, and probably reflects the bedrock conductor. Further work is warranted to determine the causative source, the strike, and extent of this conductor.

Anomaly 10230C occurs at the northern edge of a well-defined magnetic anomaly and near the southern edge of a VLF anomaly. This weak anomaly is probably due to a partially masked, poorly-conductive bedrock feature which may be related to a (faulted?) contact.

malies: 10280A, 10300xA, 10320xB, 10390xD

Anomalies in this group consist of isolated responses which suggest "edge effects", i.e., resistivity contrasts at the edges of conductive units. It is difficult to ascertain whether the resistivity contrast occurs within the bedrock or is related to surficial cover.

Anomalies 10300xA and 10390xD both occur on the same east/west trending magnetic unit, yielding direct magnetic correlation of 180 nT and 310 nT respectively. Both may be due to weakly conductive, moderately broad bedrock units. The magnetic host appears to be an eastward continuation of the strong plug-dike unit which hosts conductor 10180xD-10220C, described previously. Response 10390xD is associated with negative inphase responses caused by magnetite and yields strong VLF correlation.

Anomaly 10280A is related to a diabase dike which is probably fault controlled. The anomaly occurs at a contact between resistive material to the west and more conductive material to the east. There is a possible sinistral offset of about 200 m associated with the inferred diabase.

Anomaly 10320xB probably reflects the northern edge of a zone of conductive overburden and is considered to be of very low priority.

maly: 10410B-10440C (Zone A)

This interesting zone comprises two intersecting conductors or a single folded conductive horizon which strikes east-northeast from 10410B to 10480D where it swings to the northwest to 10440C. The anomalies comprising this trend suggest a narrow, non-magnetic bedrock conductor which dips to the north. This conductor forms the north and central limbs of a "Z-shaped" resistivity low. All three limbs are associated with VLF anomalies. The central portion of the zone occurs on the north flank of a major east-northeast trending magnetic unit which may be loosely associated with a mapped iron formation. The southern limb also occurs on the north flank of a magnetic unit of similar intensity but shorter strike length. The magnetic contour patterns suggest that the north and south limbs may be separate from the central portion. The VLF results show the north and south limbs are associated with northwest/southeast trending linears, which may be due to faults or shears. The lack of any offsets in the central portion indicates that the major magnetic unit (and the conductive material?) either occurred post-faulting, or there was little or no lateral displacement during the faulting stage. It is recommended that this interesting zone be subjected to further investigation, if such work has not already been carried out.

Other anomalies in this area may also warrant follow-up, even if they have been given a "B?" or "S?" interpretive symbol. Such responses would include 10390xA, 10390C, 10400D, 10510xD and 10470D-10480E. Most of these anomalies are associated with resistivity lows and/or VLF anomalies.

alies: 10430A-10530B, 10570A-10640xA

These two anomalous trends reflect separate segments of an attractive narrow, north-dipping conductor which strikes approximately east/west. Both segments of the conductor are associated with a continuous VLF anomaly, and give rise to well-defined resistivity lows. The western segment occurs in a relatively non-magnetic area, with the exception of anomaly 10430A which yields a direct magnetic correlation of 30 nT. The eastern segment is situated near the northern flank of a strong magnetic unit. Offsets in magnetic contour patterns suggest the two conductive segments are separated by a probable structural break which extends in a northerly direction from the south end of line 10410 to the north end of line 10610. This inferred break may be paralleled by two other breaks which strike through 10490xB-10590B and 10520xE-10650A.

Conductors 10430A-10520B and 10570A-10640xB are attractive targets which should be followed up on a high priority basis. Initial attention may be focused on the more conductive portions (such as 10430A, 10500B and 10620B), anomalies which yield magnetic correlation

(10430A, 10590B and 10620B) and areas where the conductor appears to have been subjected to possible deformation.

In addition to the probable bedrock conductors scribed in the foregoing, there are several weaker malies which may be of interest. Most of these comprise rly-defined anomalies with an "S?" interpretive symbol, ch may reflect weak bedrock conductors masked by rburden. Such anomalies may be upgraded if they relate with magnetic and/or VLF anomalies, or yield istivity values which are lower than those observed in er overburden-covered areas. Examples would include malies 10400C, 10250xA, 10350xA, 10500A, 10510xE, 10550A, 31xE, 10670B and 10730B, for example. Most of these are ociated with magnetic/VLF trends and/or resistivity dients which indicate possible geological contacts or erately broad conductors. A detailed follow-up program l be required to investigate and properly assess the ative merits of the weak isolated responses as well as highly conductive trends.

Although at least one of the major conductors has been jected to drilling in previous years, there are numerous eresting conductors which apparently remain untested.

lti-frequency horizontal loop system (MaxMin) or a domain equivalent (PEM) should suffice as an effective w-up tool although VLF may be adequate to locate the ger conductors in most areas.

The entire property is considered to be a potential of both massive sulphides and weakly conductive erous mineralization.

SECTION II: BACKGROUND INFORMATION

Section II provides background information on products ich are available from your survey data. Those products obtained as part of the survey contract may be generated er from raw data which is available on your archive ital tape.

ELECTROMAGNETICS

DIGHEM electromagnetic responses fall into two general asses, discrete and broad. The discrete class consists of arp, well-defined anomalies from discrete conductors such sulfide lenses and steeply dipping sheets of graphite and lfides. The broad class consists of wide anomalies from nductors having a large horizontal surface such as flatly pping graphite or sulfide sheets, saline water-saturated limentary formations, conductive overburden and rock, and othermal zones. A vertical conductive slab with a width 200 m would straddle these two classes.

The vertical sheet (half plane) is the most common del used for the analysis of discrete conductors. All omalies plotted on the electromagnetic map are analyzed cording to this model. The following section entitled screte Conductor Analysis describes this model in detail,

:luding the effect of using it on anomalies caused by ›ad conductors such as conductive overburden.

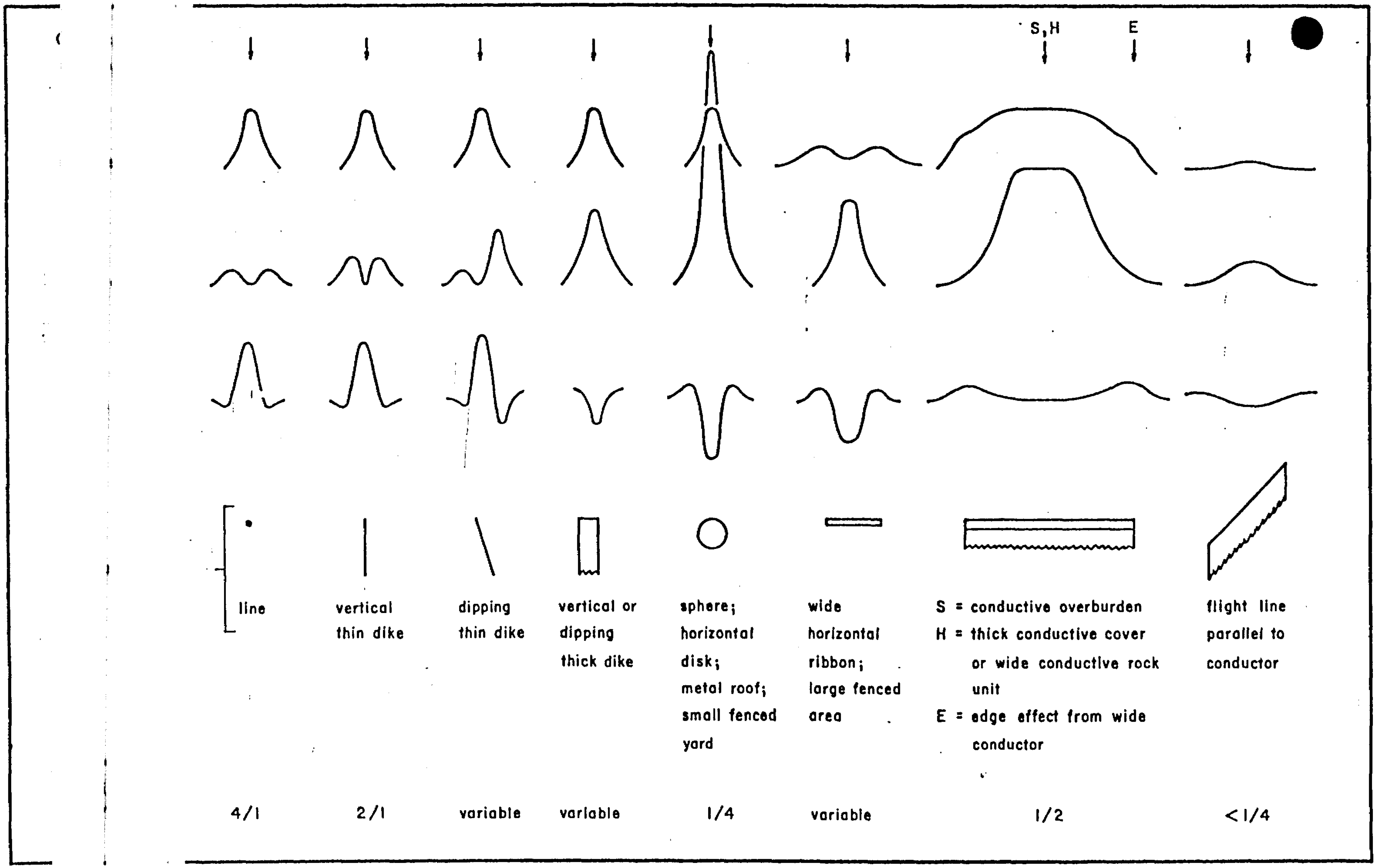
The conductive earth (half space) model is suitable for ›ad conductors. Resistivity contour maps result from the of this model. A later section entitled Resistivity ›ping describes the method further, including the effect using it on anomalies caused by discrete conductors such sulfide bodies.

metric interpretation

The geophysical interpreter attempts to determine the metric shape and dip of the conductor. Figure II-1 shows ical DIGHEM anomaly shapes which are used to guide the metric interpretation.

crete conductor analysis

The EM anomalies appearing on the electromagnetic map analyzed by computer to give the conductance (i.e., ductivity-thickness product) in mhos of a vertical sheet el. This is done regardless of the interpreted geometric pe of the conductor. This is not an unreasonable cedure, because the computed conductance increases as the



Typical DIGHEM anomaly shape

ectrical quality of the conductor increases, regardless of s true shape. DIGHEM anomalies are divided into six ades of conductance, as shown in Table II-1. The conducnce in mhos is the reciprocal of resistance in ohms.

Table II-1. EM Anomaly Grades

Anomaly Grade	Mho Range
6	> 99
5	50 - 99
4	20 - 49
3	10 - 19
2	5 - 9
1	< 5

The conductance value is a geological parameter because is a characteristic of the conductor alone. It generally independent of frequency, flying height or depth of rial, apart from the averaging over a greater portion of e conductor as height increases.[1] Small anomalies from eply buried strong conductors are not confused with small omalies from shallow weak conductors because the former ll have larger conductance values.

Conductive overburden generally produces broad EM sponses which may not be shown as anomalies on the EM ps. However, patchy conductive overburden in otherwise

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This statement is an approximation. DIGHEM, with its short coil separation, tends to yield larger and more accurate conductance values than airborne systems having a larger coil separation.

istive areas can yield discrete anomalies with a ductance grade (cf. Table II-1) of 1, or even of 2 for ducting clays which have resistivities as low as 50 -m. In areas where ground resistivities can be below 10 -m, anomalies caused by weathering variations and similar ses can have any conductance grade. The anomaly shapes m the multiple coils often allow such conductors to be ognized, and these are indicated by the letters S, H, G sometimes E on the map (see EM legend).

For bedrock conductors, the higher anomaly grades icate increasingly higher conductances. Examples: HEM's New Insco copper discovery (Noranda, Canada) lded a grade 4 anomaly, as did the neighbouring per-zinc Magusi River ore body; Mattabi (copper-zinc, rgeon Lake, Canada) and Whistle (nickel, Sudbury, ada) gave grade 5; and DIGHEM's Montcalm nickel-copper covery (Timmins, Canada) yielded a grade 6 anomaly. phite and sulfides can span all grades but, in any ticular survey area, field work may show that the ferent grades indicate different types of conductors.

Strong conductors (i.e., grades 5 and 6) are character- ic of massive sulfides or graphite. Moderate conductors ades 3 and 4) typically reflect graphite or sulfides of a s massive character, while weak bedrock conductors ades 1 and 2) can signify poorly connected graphite or vily disseminated sulfides. Grade 1 conductors may not pond to ground EM equipment using frequencies less than 0 Hz.

The presence of sphalerite or gangue can result in deposits having weak to moderate conductances. As example, the three million ton lead-zinc deposit of tigouche Mining Corporation near Bathurst, Canada, lded a well defined grade 1 conductor. The 10 percent volume of sphalerite occurs as a coating around the fine ined massive pyrite, thereby inhibiting electrical duction.

Faults, fractures and shear zones may produce anomalies ch typically have low conductances (e.g., grades 1 2). Conductive rock formations can yield anomalies of conductance grade. The conductive materials in such k formations can be salt water, weathered products such clays, original depositional clays, and carbonaceous erial.

On the electromagnetic map, a letter identifier and an erpretive symbol are plotted beside the EM grade symbol. horizontal rows of dots, under the interpretive symbol, icate the anomaly amplitude on the flight record. The rtical column of dots, under the anomaly letter, gives the timated depth. In areas where anomalies are crowded, the tter identifiers, interpretive symbols and dots may be literated. The EM grade symbols, however, will always be scernible, and the obliterated information can be obtained om the anomaly listing appended to this report.

The purpose of indicating the anomaly amplitude by dots to provide an estimate of the reliability of the conductance calculation. Thus, a conductance value obtained from large ppm anomaly (3 or 4 dots) will tend to be accurate ereas one obtained from a small ppm anomaly (no dots) uld be quite inaccurate. The absence of amplitude dots dicates that the anomaly from the coaxial coil-pair is 5 ppm or less on both the inphase and quadrature channels. ch small anomalies could reflect a weak conductor at the rface or a stronger conductor at depth. The conductance ade and depth estimate illustrates which of these ssibilities fits the recorded data best.

Flight line deviations occasionally yield cases where vo anomalies, having similar conductance values but amatically different depth estimates, occur close together the same conductor. Such examples illustrate the liability of the conductance measurement while showing at the depth estimate can be unreliable. There are a mber of factors which can produce an error in the depth timate, including the averaging of topographic variations the altimeter, overlying conductive overburden, and the cation and attitude of the conductor relative to the ight line. Conductor location and attitude can provide an roneous depth estimate because the stronger part of the nductor may be deeper or to one side of the flight line, because it has a shallow dip. A heavy tree cover can so produce errors in depth estimates. This is because the pth estimate is computed as the distance of bird from nductor, minus the altimeter reading. The altimeter can ck onto the top of a dense forest canopy. This situation elds an erroneously large depth estimate but does not fect the conductance estimate.

Dip symbols are used to indicate the direction of dip conductors. These symbols are used only when the anomaly shapes are unambiguous, which usually requires a fairly sistive environment.

A further interpretation is presented on the EM map by ans of the line-to-line correlation of anomalies, which is sed on a comparison of anomaly shapes on adjacent lines. is provides conductor axes which may define the geological ructure over portions of the survey area. The absence of nductor axes in an area implies that anomalies could not correlated from line to line with reasonable confidence.

DIGHEM electromagnetic maps are designed to provide correct impression of conductor quality by means of the nductance grade symbols. The symbols can stand alone h geology when planning a follow-up program. The actual nductance values are printed in the attached anomaly list those who wish quantitative data. The anomaly ppm and pth are indicated by inconspicuous dots which should not stract from the conductor patterns, while being helpful those who wish this information. The map provides an terpretation of conductors in terms of length, strike and p, geometric shape, conductance, depth, and thickness (see low). The accuracy is comparable to an interpretation om a high quality ground EM survey having the same line acing.

The attached EM anomaly list provides a tabulation of omalies in ppm, conductance, and depth for the vertical eet model. The EM anomaly list also shows the conductance d depth for a thin horizontal sheet (whole plane) model, t only the vertical sheet parameters appear on the map. The horizontal sheet model is suitable for a flatly pping thin bedrock conductor such as a sulfide sheet ving a thickness less than 10 m. The list also shows the

istivity and depth for a conductive earth (half space)
el, which is suitable for thicker slabs such as thick
ductive overburden. In the EM anomaly list, a depth
ue of zero for the conductive earth model, in an area of
ck cover, warns that the anomaly may be caused by
ductive overburden.

Since discrete bodies normally are the targets of
surveys, local base (or zero) levels are used to compute
al anomaly amplitudes. This contrasts with the use
true zero levels which are used to compute true EM
litudes. Local anomaly amplitudes are shown in the
anomaly list and these are used to compute the vertical
et parameters of conductance and depth. Not shown in the
anomaly list are the true amplitudes which are used to
pute the horizontal sheet and conductive earth
ameters.

ype electromagnetic responses

DIGHEM maps contain x-type EM responses in addition
EM anomalies. An x-type response is below the noise
eshold of 3 ppm, and reflects one of the following: a
k conductor near the surface, a strong conductor at depth
g., 100 to 120 m below surface) or to one side of the
ght line, or aerodynamic noise. Those responses that

ve the appearance of valid bedrock anomalies on the flight ofiles are indicated by appropriate interpretive symbols ee EM map legend). The others probably do not warrant rther investigation unless their locations are of nsiderable geological interest.

e thickness parameter

DIGHEM can provide an indication of the thickness of steeply dipping conductor. The amplitude of the coplanar omaly (e.g., CPI channel on the digital profile) increases ative to the coaxial anomaly (e.g., CXI) as the apparent ckness increases, i.e., the thickness in the horizontal ine. (The thickness is equal to the conductor width if conductor dips at 90 degrees and strikes at right angles the flight line.) This report refers to a conductor as n when the thickness is likely to be less than 3 m, and ck when in excess of 10 m. Thick conductors are icated on the EM map by crescents. For base metal loration in steeply dipping geology, thick conductors can high priority targets because many massive sulfide ore ies are thick, whereas non-economic bedrock conductors often thin. The system cannot sense the thickness when strike of the conductor is subparallel to the flight e, when the conductor has a shallow dip, when the anomaly

litudes are small, or when the resistivity of the
ironment is below 100 ohm-m.

istivity mapping

Areas of widespread conductivity are commonly
ountered during surveys. In such areas, anomalies can
generated by decreases of only 5 m in survey altitude as
l as by increases in conductivity. The typical flight
ord in conductive areas is characterized by inphase and
drature channels which are continuously active. Local
peaks reflect either increases in conductivity of the
th or decreases in survey altitude. For such conductive
as, apparent resistivity profiles and contour maps are
essary for the correct interpretation of the airborne
a. The advantage of the resistivity parameter is
at anomalies caused by altitude changes are virtually
iminated, so the resistivity data reflect only those
malies caused by conductivity changes. The resistivity
alysis also helps the interpreter to differentiate between
nductive trends in the bedrock and those patterns typical
conductive overburden. For example, discrete conductors
ll generally appear as narrow lows on the contour map
d broad conductors (e.g., overburden) will appear as
de lows.

The resistivity profile (see table in Appendix A) and e resistivity contour map present the apparent resistivity ng the so-called pseudo-layer (or buried) half space el defined by Fraser (1978)[2]. This model consists of esistive layer overlying a conductive half space. The th channel (see Appendix A) gives the apparent depth ow surface of the conductive material. The apparent th is simply the apparent thickness of the overlying istive layer. The apparent depth (or thickness) ameter will be positive when the upper layer is more istive than the underlying material, in which case the arent depth may be quite close to the true depth.

The apparent depth will be negative when the upper er is more conductive than the underlying material, and l be zero when a homogeneous half space exists. The arent depth parameter must be interpreted cautiously ause it will contain any errors which may exist in the sured altitude of the EM bird (e.g., as caused by a dense e cover). The inputs to the resistivity algorithm are inphase and quadrature components of the coplanar l-pair. The outputs are the apparent resistivity of the

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esistivity mapping with an airborne multicoil electro-
agnetic system: Geophysics, v. 43, p. 144-172.

uctive half space (the source) and the sensor-source
ance. The flying height is not an input variable,
the output resistivity and sensor-source distance are
pendent of the flying height. The apparent depth,
ussed above, is simply the sensor-source distance minus
measured altitude or flying height. Consequently,
rs in the measured altitude will affect the apparent
h parameter but not the apparent resistivity parameter.

The apparent depth parameter is a useful indicator
simple layering in areas lacking a heavy tree cover.
DIGHEM system has been flown for purposes of permafrost
ping, where positive apparent depths were used as a
sure of permafrost thickness. However, little quantita-
e use has been made of negative apparent depths because
absolute value of the negative depth is not a measure of
thickness of the conductive upper layer and, therefore,
not meaningful physically. Qualitatively, a negative
arent depth estimate usually shows that the EM anomaly is
sed by conductive overburden. Consequently, the apparent
th channel can be of significant help in distinguishing
ween overburden and bedrock conductors.

The resistivity map often yields more useful informa-
n on conductivity distributions than the EM map. In

aring the EM and resistivity maps, keep in mind the owing:

(a) The resistivity map portrays the absolute value of the earth's resistivity.
(Resistivity = 1/conductivity.)

(b) The EM map portrays anomalies in the earth's resistivity. An anomaly by definition is a change from the norm and so the EM map displays anomalies, (i) over narrow, conductive bodies and (ii) over the boundary zone between two wide formations of differing conductivity.

The resistivity map might be likened to a total d map and the EM map to a horizontal gradient in the ction of flight[3]. Because gradient maps are usually sensitive than total field maps, the EM map therefore to be preferred in resistive areas. However, in conduc- areas, the absolute character of the resistivity map ally causes it to be more useful than the EM map.

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he gradient analogy is only valid with regard to he identification of anomalous locations.

retation in conductive environments

Environments having background resistivities below
m-m cause all airborne EM systems to yield very
responses from the conductive ground. This usually
bits the recognition of discrete bedrock conductors.
processing of DIGHEM data, however, produces six
els which contribute significantly to the recognition
drock conductors. These are the inphase and quadrature
rence channels (DIFI and DIFQ), and the resistivity and
channels (RES and DP) for each coplanar frequency; see
in Appendix A.

The EM difference channels (DIFI and DIFQ) eliminate
o 99% of the response of conductive ground, leaving
onses from bedrock conductors, cultural features (e.g.,
hone lines, fences, etc.) and edge effects. An edge
ct arises when the conductivity of the ground suddenly
ges, and this is a source of geologic noise. While edge
cts yield anomalies on the EM difference channels, they
not produce resistivity anomalies. Consequently, the
stivity channel aids in eliminating anomalies due to
effects. On the other hand, resistivity anomalies
coincide with the most highly conductive sections of
uctive ground, and this is another source of geologic

The recognition of a bedrock conductor in a tive environment therefore is based on the anomalous ses of the two difference channels (DIFI and DIFQ) e two resistivity channels (RES). The most favourable ion is where anomalies coincide on all four channels.

The DP channels, which give the apparent depth to the ctive material, also help to determine whether a ctive response arises from surficial material or from a ctive zone in the bedrock. When these channels ride the zero level on the digital profiles (i.e., depth is ive), it implies that the EM and resistivity profiles esponding primarily to a conductive upper layer, i.e., ctive overburden. If both DP channels are below the level, it indicates that a resistive upper layer s, and this usually implies the existence of a bedrock uctor. If the low frequency DP channel is below the level and the high frequency DP is above, this suggests a bedrock conductor occurs beneath conductive cover.

The conductance channel CDT identifies discrete uctors which have been selected by computer for aisal by the geophysicist. Some of these automatically cted anomalies on channel CDT are discarded by the hysicist. The automatic selection algorithm is ntionally oversensitive to assure that no meaningful onses are missed. The interpreter then classifies the alies according to their source and eliminates those are not substantiated by the data, such as those ing from geologic or aerodynamic noise.

ction of geologic noise

Geologic noise refers to unwanted geophysical onses. For purposes of airborne EM surveying, geologic e refers to EM responses caused by conductive overburden magnetic permeability. It was mentioned above that EM difference channels (i.e., channel DIFI for inphase DIFQ for quadrature) tend to eliminate the response of luctive overburden. This marked a unique development airborne EM technology, as DIGHEM is the only EM system h yields channels having an exceptionally high degree mmunity to conductive overburden.

Magnetite produces a form of geological noise on the hase channels of all EM systems. Rocks containing less 1% magnetite can yield negative inphase anomalies sed by magnetic permeability. When magnetite is widely

ibuted throughout a survey area, the inphase EM chan-
may continuously rise and fall reflecting variations
e magnetite percentage, flying height, and overburden
ness. This can lead to difficulties in recognizing
y buried bedrock conductors, particularly if conductive
urden also exists. However, the response of broadly
ibuted magnetite generally vanishes on the inphase
rence channel DIFI. This feature can be a significant
in the recognition of conductors which occur in rocks
aining accessory magnetite.

agnetite mapping

The information content of DIGHEM data consists of a
ination of conductive eddy current response and magnetic
eability response. The secondary field resulting from
luctive eddy current flow is frequency-dependent and
sists of both inphase and quadrature components, which
positive in sign. On the other hand, the secondary
ld resulting from magnetic permeability is independent
frequency and consists of only an inphase component which
negative in sign. When magnetic permeability manifests
elf by decreasing the measured amount of positive
hase, its presence may be difficult to recognize.
vever, when it manifests itself by yielding a negative

se anomaly (e.g., in the absence of eddy current flow), resence is assured. In this latter case, the negative nent can be used to estimate the percent magnetite nt.

A magnetite mapping technique was developed for the anar coil-pair of DIGHEM. The technique yields channel (see Appendix A) which displays apparent weight percent etite according to a homogeneous half space model.[4] The od can be complementary to magnetometer mapping in ain cases. Compared to magnetometry, it is far less itive but is more able to resolve closely spaced etite zones, as well as providing an estimate of the int of magnetite in the rock. The method is sensitive to % magnetite by weight when the EM sensor is at a height 30 m above a magnetitic half space. It can individually olve steeply dipping narrow magnetite-rich bands which separated by 60 m. Unlike magnetometry, the EM netite method is unaffected by remanent magnetism or netic latitude.

The EM magnetite mapping technique provides estimates magnetite content which are usually correct within a

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Refer to Fraser, 1981, Magnetite mapping with a multi-coil airborne electromagnetic system: Geophysics, v. 46, p. 1579-1594.

or of 2 when the magnetite is fairly uniformly ributed. EM magnetite maps can be generated when etic permeability is evident as indicated by anomalies he magnetite channel FEO.

Like magnetometry, the EM magnetite method maps bedrock features, provided that the overburden is acterized by a general lack of magnetite. This rasts with resistivity mapping which portrays the ined effect of bedrock and overburden.

ognition of culture

Cultural responses include all EM anomalies caused by -made metallic objects. Such anomalies may be caused by ıctive coupling or current gathering. The concern of the erpreter is to recognize when an EM response is due to ture. Points of consideration used by the interpreter, n coaxial and coplanar coil-pairs are operated at a mon frequency, are as follows:

Channels CXS and CPS (see Appendix A) measure 50 and 60 Hz radiation. An anomaly on these channels shows that the conductor is radiating cultural power. Such an indication is normally a guarantee that the conducor is cultural. However, care must be taken to ensure hat the conductor is not a geologic body which strikes cross a power line, carrying leakage currents.

flight which crosses a "line" (e.g., fence, telephone ine, etc.) yields a center-peaked coaxial anomaly and an m-shaped coplanar anomaly.[5] When the flight crosses the cultural line at a high angle of intersection, the amplitude ratio of coaxial/coplanar (e.g., CXI/CPI) is 4. Such an EM anomaly can only be caused by a line. The geologic body which yields anomalies most closely resembling a line is the vertically dipping thin dike. Such a body, however, yields an amplitude ratio of 2 rather than 4. Consequently, an m-shaped coplanar anomaly with a CXI/CPI amplitude ratio of 4 is virtually a guarantee that the source is a cultural line.

A flight which crosses a sphere or horizontal disk yields center-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of 1/4. In the absence of geologic bodies of this geometry, the most likely conductor is a metal roof or

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See Figure II-1 presented earlier.

small fenced yard.[6] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

A flight which crosses a horizontal rectangular body or wide ribbon yields an m-shaped coaxial anomaly and a center-peaked coplanar anomaly. In the absence of geologic bodies of this geometry, the most likely conductor is a large fenced area.[6] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

EM anomalies which coincide with culture, as seen on the camera film, are usually caused by culture. However, care is taken with such coincidences because a geologic conductor could occur beneath a fence, for example. In this example, the fence would be expected to yield an m-shaped coplanar anomaly as in case #2 above. If, instead, a center-peaked coplanar anomaly occurred, there would be concern that a thick geologic conductor coincided with the cultural line.

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t is a characteristic of EM that geometrically dentical anomalies are obtained from: (1) a planar onductor, and (2) a wire which forms a loop having imensions identical to the perimeter of the equivaent planar conductor.

The above description of anomaly shapes is valid when the culture is not conductively coupled to the environment. In this case, the anomalies arise from inductive coupling to the EM transmitter. However, when the environment is quite conductive (e.g., less than 100 ohm-m at 900 Hz), the cultural conductor may be conductively coupled to the environment. In this latter case, the anomaly shapes tend to be governed by current gathering. Current gathering can completely distort the anomaly shapes, thereby complicating the identification of cultural anomalies. In such circumstances, the interpreter can only rely on the radiation channels CXS and CPS, and on the camera film.

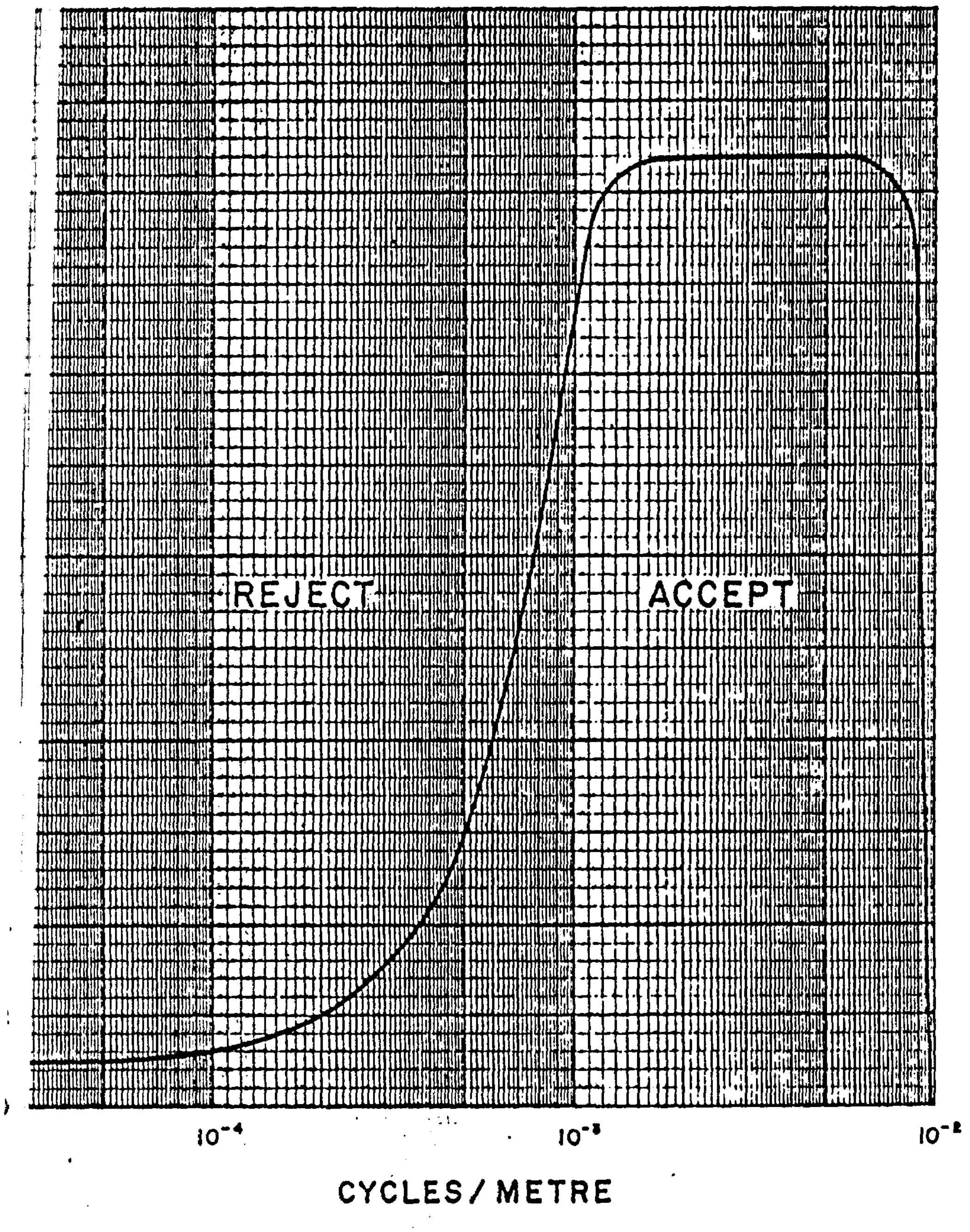
TOTAL FIELD MAGNETICS

The existence of a magnetic correlation with an EM maly is indicated directly on the EM map. An EM anomaly h magnetic correlation has a greater likelihood of ng produced by sulfides than one that is non-magnetic. ever, sulfide ore bodies may be non-magnetic (e.g., the d Creek deposit near Timmins, Canada) as well as magnetic g., the Mattabi deposit near Sturgeon Lake, Canada).

he magnetometer data are digitally recorded in ircraft to an accuracy of one nT (i.e., one gamma). igital tape is processed by computer to yield a field magnetic contour map. When warranted, the ic data also may be treated mathematically to enhance agnetic response of the near-surface geology, and an ed magnetic contour map is then produced. The se of the enhancement operator in the frequency domain lustrated in Figure II-2. This figure shows that the and components of the airborne data are amplified mes by the enhancement operator. This means, for le, that a 100 nT anomaly on the enhanced map reflects T anomaly for the passband components of the airborne

The enhanced map, which bears a resemblance to a ard continuation map, is produced by the digital ass filtering of the total field data. The enhancement uivalent to continuing the field downward to a level e the source) which is 1/20th of the actual sensor- e distance.

Because the enhanced magnetic map bears a resemblance ground magnetic map, it simplifies the recognition rends in the rock strata and the interpretation of



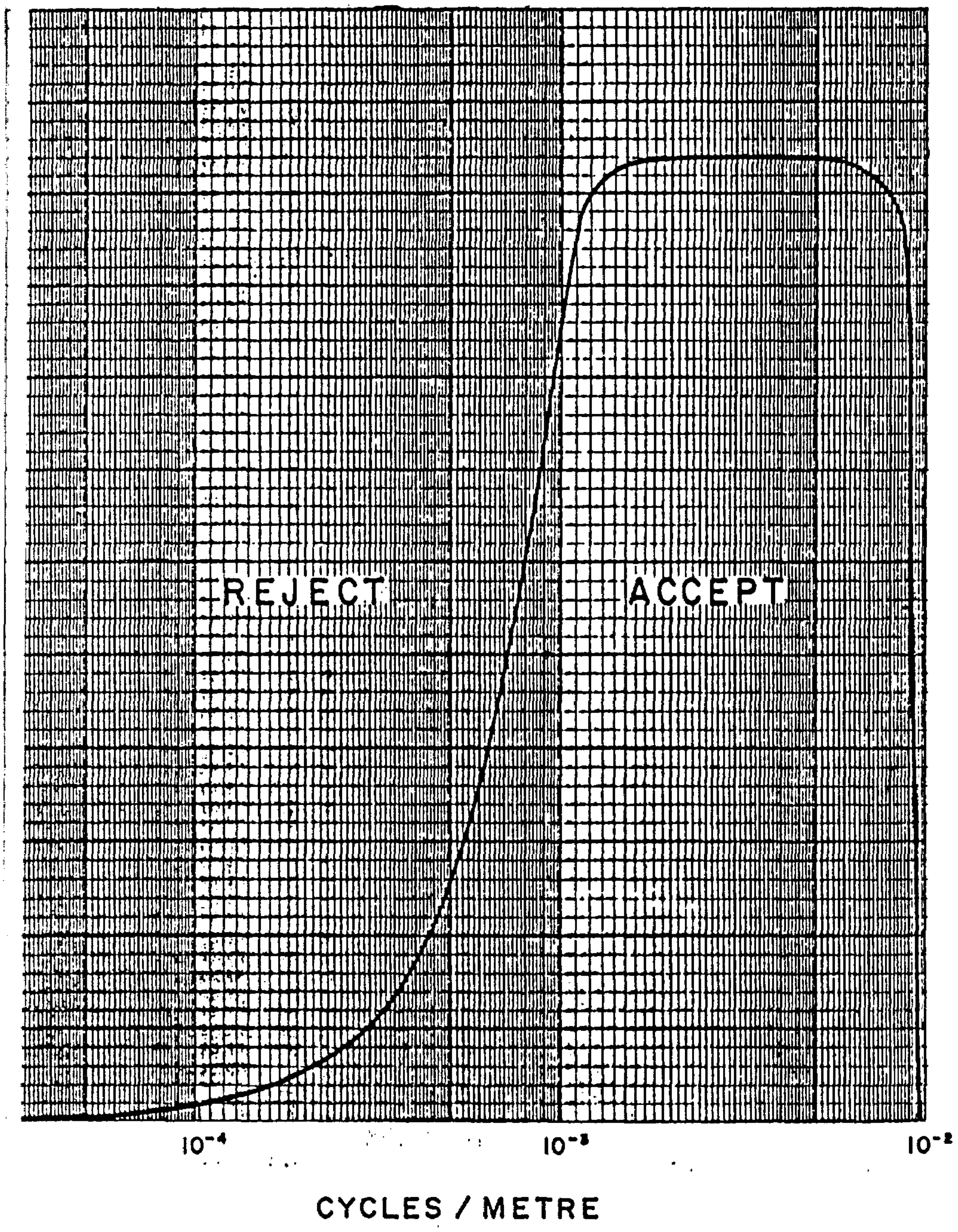
e 2 Frequency response of magnetic operator.

gical structure. It defines the near-surface local gy while de-emphasizing deep-seated regional features. imarily has application when the magnetic rock units teeply dipping and the earth's field dips in excess degrees.

VLF-EM

VLF-EM anomalies are not EM anomalies in the ntional sense. EM anomalies primarily reflect eddy nts flowing in conductors which have been energized tively by the primary field. In contrast, VLF-EM lies primarily reflect current gathering, which is a nductive phenomenon. The primary field sets up nts which flow weakly in rock and overburden, and these to collect in low resistivity zones. Such zones may be o massive sulfides, shears, river valleys and even formities.

The Herz Industries Ltd Totem VLF-electromagnetometer res the total field and vertical quadrature nents. Both these components are digitally recorded in ircraft with a sensitivity of 0.1 percent. The total yields peaks over VLF-EM current concentrations



re 3 Frequency response of VLF-EM operator.

the quadrature component tends to yield crossovers. ppear as traces on the profile records. The total data also are filtered digitally and displayed on a map, to facilitate the recognition of trends in the rata and the interpretation of geologic structure.

he response of the VLF-EM total field filter operator frequency domain (Figure II-3) is basically similar at used to produce the enhanced magnetic map e II-2). The two filters are identical along the sa but different along the ordinant. The VLF-EM removes long wavelengths such as those which reflect al and wave transmission variations. The filter ns short wavelength responses such as those which t local geological variations. The filtered total VLF-EM contour map is produced with a contour interval percent.

MAPS ACCOMPANYING THIS REPORT

p sheets accompany this report:

magnetic Anomalies	1 map sheet
vity (7200 Hz)	1 map sheet
ield Magnetics	1 map sheet
d Magnetics	1 map sheet
Total Field (Seattle)	1 map sheet

Respectfully submitted,
DIGHEM SURVEYS & PROCESSING INC.

Paul A Smith

Paul A. Smith
Geophysicist

APPENDIX A

THE FLIGHT RECORDS

analog and digital flight records were produced. og profiles were recorded on chart paper in the t during the survey. The digital profiles were l later by computer and plotted on electrostatic per at a scale of 1:10,000. The analog and digital are listed in Tables A-1 and A-2 respectively.

Table A-2, the log resistivity scale of 0.06 n means that the resistivity changes by an order tude in 16.5 mm. The resistivities at 0, 33 and from the bottom of the digital flight record are vely 1, 100 and 10,000 ohm-m.

FLIGHT PATH RECOVERY

craft positioning and post-survey recovery of position was accomplished through the use of a Del lying Flagman positioning system. This electronic on system operates in the 8 gHz band and is re range limited by hills and by the curvature of the

Table A-1. The Analog Profiles

l	Parameter	Sensitivity per mm	Designation on digital profile
	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
	coplanar inphase (7200 Hz)	5.0 ppm	CPI (7200 Hz)
	coplanar quad (7200 Hz)	5.0 ppm	CPQ (7200 Hz)
	coaxial monitor		CXS
	coplanar monitor		
	altimeter	3 m	ALT
)	magnetics, coarse	10 nT	MAG
	magnetics, fine	2 nT	
	VLF-total: Seattle	2%	
	VLF-quad: Seattle	2%	
	VLF-total: Annapolis	2%	
	VLF-quad: Annapolis	2%	

Table A-2. The Digital Profiles

	Observed parameters	Scale units/mm
	magnetics	20 nT
	bird height	6 m
Hz)	vertical coaxial coil-pair inphase	2 ppm
Hz)	vertical coaxial coil-pair quadrature	2 ppm
Hz)	ambient noise monitor (coaxial receiver)	2 ppm
Hz)	horizontal coplanar coil-pair inphase	2 ppm
Hz)	horizontal coplanar coil-pair quadrature	2 ppm
Hz)	horizontal coplanar coil-pair inphase	2 ppm
Hz)	horizontal coplanar coil-pair quadrature	2 ppm
	Computed Parameters	
Hz)	difference function inphase from CXI and CPI	2 ppm
Hz)	difference function quadrature from CXQ and CPQ	2 ppm
	conductance	1 grade
Hz)	log resistivity	.06 decade
Hz)	log resistivity	.06 decade
Hz)	apparent depth	6 m
Hz)	apparent depth	6 m

Flying Flagman uses two ground based transponder which transmit distance information back to the r. The onboard Central Processing Unit then takes distances and determines the helicopter position to the two ground stations. This is accomplished y second. The ground stations are set up well away survey area and are positioned such that the ross the survey blocks at an angle between 30° and fter site selection, a baseline is flown at right a line drawn through the transmitter sites to an arbitrary coordinate system for the survey The distance from each ground transmitter site nge) is continuously recorded digitally.

range-range data is transposed during data g into an arbitrary x-y coordinate system based on ion of the two transmitter sites. This x-y grid erred to the base map by correlating a number of topographical features to the navigational data The use of numerous visual tie-in points serves two to correct for distortions in the photomosaic (if to accurately relate the navigation data to the map

APPENDIX B

EM ANOMALY LIST

```
 OAXIAL   COPLANAR   COPLANAR  .  VERTICAL    . HORIZONTAL CONDUCTIVE
 900 HZ     900 HZ    7200 HZ  .    DIKE      .   SHEET       EARTH
                               .              .
AL QUAD REAL QUAD REAL QUAD  . COND  DEPTH*. COND DEPTH RESIS DEPTH
PM  PPM  PPM  PPM  PPM  PPM  . MHOS      M . MHOS     M OHM-M     M
                               .              .
 (FLIGHT    5)                 .              .
 0    11   -1   17   30   129  .   1       0  .   1    26   654     0
                               .              .
 (FLIGHT    5)                 .              .
 0     7    0   13   38    86  .   1       0  .   1    24   699     0
                               .              .
 (FLIGHT    5)                 .              .
 0     4    0    7    8    49  .   1       0  .   1    40   771     0
                               .              .
 (FLIGHT    5)                 .              .
 1    12    1   19   29   132  .   1       0  .   1    22   563     0
-1     9    0   15   28    96  .   1       1  .   1    26   591     0
                               .              .
 (FLIGHT    5)                 .              .
 0     7    1   11   17    70  .   1       0  .   1    39   550     0
 1     5    1    8   20    51  .   1       0  .   1    45   576     0
                               .              .
 (FLIGHT    5)                 .              .
 0     4    2    8   15    55  .   1       0  .   1    63   435     5
 0     4    1    4    3    26  .   1       0  .   1    10   817     0
 4     4    5    5   10    23  .   8      32  .   1   107   126    60
                               .              .
 (FLIGHT    5)                 .              .
-4     4   -9    4   -2    17  .   3      23  .   1   111  1035     0
-1     3    0    3   11    28  .   1       0  .   1     7  1128     0
                               .              .
 (FLIGHT    5)                 .              .
-8     3  -10    2   -9    21  .   1       0  .   1     4  3001     0
-2     9   -2   14   20   114  .   1       1  .   1    26   584     0
 0     2    1    5    3    31  .   1       0  .   1    10   863     0
                               .              .
 (FLIGHT    5)                 .              .
 1     6    1   12   22    79  .   1       0  .   1    31   687     0
 0     3    0    7   15    22  .   1       6  .   1    43   751     0
                               .              .
 (FLIGHT    5)                 .              .
 1     6    2   12   29    64  .   1       0  .   1    21   440     0
 0     4    1    9   18    58  .   1       0  .   1    34   562     0
                               .              .
 (FLIGHT    5)                 .              .
 0     2    0    3   10    24  .   1       0  .   1     9   748     0
-1     4   -1    3    6     8  .   3      28  .   1    93   972     0
                                                             .
MATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART .
HE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT .
, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.    .
```

OAXIAL		COPLANAR		COPLANAR		VERTICAL		HORIZONTAL		CONDUCTIVE	
900 HZ		900 HZ		7200 HZ		DIKE		SHEET		EARTH	
AL	QUAD	REAL	QUAD	REAL	QUAD	COND	DEPTH*	COND	DEPTH	RESIS	DEPTH
M	PPM	PPM	PPM	PPM	PPM	MHOS	M	MHOS	M	OHM-M	M
(FLIGHT	5)										
0	4	1	5	24	31	1	0	1	26	567	0
-1	4	0	8	16	58	1	1	1	35	695	0
0	7	1	13	4	58	1	0	1	27	641	0
(FLIGHT	5)										
2	5	1	9	21	12	2	12	1	64	843	0
-3	9	-3	16	15	118	1	1	1	30	606	0
1	4	2	8	36	47	1	17	1	19	479	0
0	4	-1	2	21	21	1	25	1	28	614	0
0	8	0	13	19	31	1	2	1	29	622	0
(FLIGHT	5)										
-1	10	0	16	23	119	1	1	1	27	614	0
0	5	0	12	12	20	1	1	1	40	713	0
(FLIGHT	5)										
0	4	0	6	10	29	1	0	1	61	819	0
-2	5	-4	7	2	26	1	0	1	58	806	0
(FLIGHT	4)										
-2	5	-1	6	6	52	1	2	1	54	783	0
-2	2	0	2	4	19	1	14	1	86	954	0
0	4	1	5	14	42	1	0	1	42	703	0
1	3	0	7	14	26	2	13	1	32	656	0
(FLIGHT	5)										
0	4	-1	6	6	23	1	9	1	61	806	0
0	1	0	3	5	20	1	2	1	78	863	1
2	3	1	3	13	24	1	0	1	15	497	0
(FLIGHT	4)										
-2	4	-1	5	11	43	1	0	1	51	801	0
(FLIGHT	5)										
1	5	1	6	16	39	1	0	1	45	662	0
(FLIGHT	4)										
0	4	1	6	5	16	1	0	1	60	755	0
1	6	2	12	15	82	1	0	1	21	455	0
0	7	1	12	14	38	1	0	1	17	529	0
3	21	-9	4	24	24	11	17	1	24	577	0

MATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART
HE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT
, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

```
OAXIAL   COPLANAR   COPLANAR  .   VERTICAL   .  HORIZONTAL CONDUCTIVE
900 HZ     900 HZ    7200 HZ  .     DIKE     .    SHEET       EARTH
                              .              .
L  QUAD REAL QUAD REAL  QUAD  .  COND DEPTH*.  COND DEPTH RESIS DEPTH
M   PPM  PPM  PPM  PPM   PPM  . MHOS      M .  MHOS     M OHM-M     M
                              .              .
(FLIGHT    5)                 .              .
2    19    3   31   77   232  .    1     0  .    1    15   365     0
1    42   22   22   60    66  .   18     5  .    2    64    54    33
                              .              .
(FLIGHT    4)                 .              .
0     5    1    5    8    44  .    1     0  .    1    59   633     0
1    15    3   27   72   194  .    1     0  .    1    16   360     0
9    16    3    4    9    29  .    4     9  .    1    67   333    17
0     4    1    8   19    88  .    1     0  .    1    28   516     0
                              .              .
(FLIGHT    5)                 .              .
1    10    3   17   54   125  .    1     0  .    1    22   372     0
4     4    2    2    4    15  .    6    36  .    1    86   564     9
1     5    2    9   20    73  .    1     0  .    1    35   457     0
                              .              .
(FLIGHT    4)                 .              .
1     6    1    8    5    61  .    2    16  .    1    68   819     0
-1    5    0   10   14    46  .    1     1  .    1    32   647     0
0     6   -1    7    6    60  .    1    10  .    1    45   721     0
2    10    2   21   43   153  .    1     0  .    1    18   519     0
2     6    1   10   25    37  .    1     2  .    1    28   630     0
1     5    0   10   20    77  .    1     0  .    1    33   707     0
1     3    0    4    6    31  .    1     0  .    1    13   912     0
                              .              .
(FLIGHT    5)                 .              .
-1   13    1   21   35   161  .    1     2  .    1    21   539     0
0     7   -1   10    6    46  .    1     2  .    1    31   693     0
0     5   -1    7   12    60  .    1     0  .    1    41   741     0
1     3    1    4    7    30  .    1     0  .    1    11   841     0
                              .              .
(FLIGHT    4)                 .              .
1     4    2    6   16    42  .    1    13  .    1    57   554     0
1     3    1    5   12    30  .    1     0  .    1    18   744     0
                              .              .
(FLIGHT    5)                 .              .
1     3    2    4   13    33  .    1     0  .    1    21   816     0
                              .              .
(FLIGHT    4)                 .              .
0     3    0    6   13    43  .    1     0  .    1    55   794     0
2     4    1    4   11    32  .    1     0  .    1     8   717     0
1     5    1    7    7     6  .    1    10  .    1    70   656     4
                              .              .
(FLIGHT    5)                 .              .
0     8   -2  -12   13    93  .    1     0  .    1    36   700     0
                                                          .
MATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART .
HE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT .
, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.    .
```

OAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
L M	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
(FLIGHT 5)											
1	8	0	13	25	63	1	0	1	30	663	0
1	6	1	10	11	76	1	0	1	46	649	0
(FLIGHT 4)											
1	3	1	5	6	39	1	0	1	7	1101	0
(FLIGHT 5)											
1	5	0	9	9	59	1	0	1	37	709	0
0	3	1	7	9	17	1	0	1	46	705	0
0	2	1	4	7	34	1	0	1	10	1071	0
(FLIGHT 4)											
2	8	-1	12	16	91	1	0	1	28	640	0
(FLIGHT 5)											
1	4	0	7	5	59	1	0	1	71	863	0
0	4	2	6	14	23	1	0	1	32	500	0
0	5	1	7	8	59	1	4	1	41	582	0
(FLIGHT 5)											
0	4	1	5	11	26	1	0	1	76	837	0
(FLIGHT 4)											
0	4	1	6	7	45	1	4	1	82	927	0
(FLIGHT 5)											
0	2	1	4	6	33	1	0	1	10	1549	0
(FLIGHT 4)											
0	6	0	8	9	63	1	0	1	46	761	0
2	2	1	4	11	29	1	0	1	11	945	0
2	7	1	8	15	37	1	8	1	32	649	0
0	9	0	14	19	9	1	0	1	33	685	0
(FLIGHT 5)											
1	4	2	8	15	29	1	3	1	50	378	4
2	5	2	5	16	30	1	0	1	17	574	0
2	4	3	2	16	17	4	38	1	61	318	13
0	6	1	3	16	71	1	0	1	7	800	0
0	8	-1	12	5	54	1	2	1	55	763	0
(FLIGHT 4)											
0	6	1	10	16	34	1	0	1	46	633	0

IATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART
IE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT
OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

	OAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
F	L M	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
L	(FLIGHT		4)									
	2	5	0	4	13	23	2	6	1	73	922	0
L	(FLIGHT		5)									
	0	7	1	11	15	80	1	0	1	45	607	0
	2	5	2	6	18	33	2	8	1	64	340	13
	0	3	1	5	11	40	1	0	1	67	671	0
L	(FLIGHT		4)									
	4	6	5	7	17	21	5	23	1	99	152	51
	4	7	3	5	19	17	4	20	1	71	306	20
	3	7	-4	10	4	81	1	3	1	33	647	0
	1	5	-1	10	9	79	1	0	1	41	730	0
L	(FLIGHT		5)									
	1	4	1	6	6	49	1	5	1	57	685	0
	3	8	1	4	6	24	2	9	1	106	571	19
	6	5	3	4	13	9	7	25	1	86	487	13
L	(FLIGHT		4)									
	0	4	1	2	6	30	1	0	1	21	1013	0
	1	3	4	4	14	6	1	0	1	69	165	43
	4	5	5	5	16	19	5	19	1	85	188	35
L	(FLIGHT		5)									
	3	4	6	11	30	25	4	18	1	77	98	37
	5	10	5	12	34	49	4	11	1	50	307	6
	1	4	1	9	8	73	1	10	1	52	700	0
L	(FLIGHT		4)									
	4	7	1	4	9	28	3	20	1	91	563	16
	3	6	5	8	5	24	3	19	1	87	118	44
	6	12	7	17	50	58	4	7	1	46	193	7
	0	3	2	3	10	21	1	19	1	53	506	0
L	(FLIGHT		5)									
	2	5	2	2	11	12	3	19	1	103	269	45
	3	3	4	2	7	8	8	53	1	137	140	85
	2	7	4	10	15	77	2	13	1	50	380	6
	1	6	2	8	15	62	1	0	1	34	516	0
	0	7	1	13	12	93	1	6	1	29	586	0
L	(FLIGHT		4)									
	8	17	4	17	37	73	3	4	1	42	225	4

IATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART
IE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT
OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

:OAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
L 'M	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
(FLIGHT 4)											
1	7	2	14	18	89	1	0	1	38	562	0
(FLIGHT 5)											
2	1	3	3	6	11	1	0	1	37	579	7
15	21	17	21	52	57	8	7	1	68	68	34
(FLIGHT 4)											
8	12	4	10	28	14	4	7	1	61	302	13
1	2	2	3	6	8	2	33	1	128	524	33
(FLIGHT 5)											
6	6	5	10	27	8	5	10	1	64	233	16
(FLIGHT 4)											
3	5	3	5	15	27	3	16	1	115	205	59
2	6	1	12	11	91	1	0	1	49	630	0
(FLIGHT 5)											
1	2	3	4	11	5	1	0	1	32	737	0
-1	8	2	17	25	134	1	0	1	28	503	0
(FLIGHT 4)											
1	10	1	20	20	157	1	0	1	25	602	0
(FLIGHT 5)											
0	7	1	12	6	94	1	2	1	54	749	0
(FLIGHT 4)											
2	4	2	4	21	21	1	0	1	59	280	32
(FLIGHT 5)											
3	5	4	5	20	13	4	23	1	109	162	58
(FLIGHT 4)											
3	8	1	4	14	10	2	16	1	142	1035	0
(FLIGHT 5)											
1	2	2	3	6	10	1	0	1	54	763	19
3	6	2	3	15	8	4	16	1	110	420	30
(FLIGHT 4)											
0	4	1	7	9	50	1	0	1	56	695	0

MATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART
HE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT
, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

	OAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
F	L M	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
I	(FLIGHT		4)									
	6	8	9	14	38	25	6	0	1	64	88	26
I	(FLIGHT		5)									
	2	7	0	14	18	103	1	0	1	35	671	0
	7	8	6	7	25	14	7	4	1	96	106	51
	0	5	1	9	9	37	1	0	1	66	695	0
I	(FLIGHT		4)									
	0	7	2	7	13	1	1	0	1	42	411	0
	3	5	1	3	11	9	3	21	1	107	803	4
	1	6	0	9	12	92	1	0	1	41	732	0
	0	7	0	11	4	87	1	0	1	50	759	0
I	(FLIGHT		5)									
	1	5	1	7	8	11	1	0	1	54	732	0
	2	1	2	2	15	3	1	0	1	48	534	18
	0	9	-2	16	11	127	1	0	1	33	678	0
I	(FLIGHT		4)									
	1	2	1	2	10	19	1	0	1	31	765	1
	2	8	-4	11	2	93	1	0	1	50	752	0
	1	12	-2	21	15	167	1	0	1	25	591	0
L	(FLIGHT		5)									
	0	8	-2	16	12	127	1	0	1	33	699	0
I	(FLIGHT		4)									
	2	7	-2	11	6	91	1	0	1	47	752	0
L	(FLIGHT		5)									
	1	7	-1	11	3	90	1	4	1	49	746	0
I	(FLIGHT		5)									
	2	4	1	6	15	39	2	9	1	57	682	0
L	(FLIGHT		4)									
	0	3	0	6	11	16	1	11	1	40	756	0
	1	10	2	19	39	136	1	0	1	19	487	0
L	(FLIGHT		5)									
	1	3	1	4	7	12	1	0	1	27	489	0

ATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART
E CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT
OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

```
OAXIAL   COPLANAR   COPLANAR .   VERTICAL   . HORIZONTAL CONDUCTIVE
900 HZ     900 HZ    7200 HZ .     DIKE     .   SHEET      EARTH
                             .              .
L QUAD REAL QUAD REAL QUAD . COND DEPTH*. COND DEPTH RESIS DEPTH
M  PPM  PPM  PPM  PPM  PPM . MHOS     M . MHOS     M OHM-M     M
                             .              .
(FLIGHT    5)                .              .
1    12    2   20   40  145 .    1      0 .    1    20   538     0
                             .              .
(FLIGHT    4)                .              .
2     4    2    5   11   27 .    2     18 .    1    88   266    34
1     4    2    7   17   47 .    1      0 .    1    54   529     0
                             .              .
(FLIGHT    5)                .              .
1     4    1    5   13   33 .    1      0 .    1    88   801     1
0     4    0    6   13   46 .    1      2 .    1    61   718     0
                             .              .
(FLIGHT    4)                .              .
2     5    1    8   14   60 .    1      2 .    1    44   754     0
                             .              .
(FLIGHT    5)                .              .
0     4    1    5    1   31 .    1      0 .    1    16   534     0
1     4    1    7   10   46 .    1      0 .    1    63   770     0
                             .              .
(FLIGHT    4)                .              .
1     6    2   11   25   71 .    1      0 .    1    28   485     0
                             .              .
(FLIGHT    5)                .              .
0     3    0    6    9   36 .    1      0 .    1    63   913     0
1     3    2    4    8   20 .    1      0 .    1    16  1167     0
                             .              .
(FLIGHT    5)                .              .
0     5    1    8   17   59 .    1      0 .    1    32   588     0
0     4   -2    6    6   48 .    1      1 .    1    69   878     0


                                                       .
ATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART .
E CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT .
  OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.   .
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Ontario

Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

Land 1
#189 1

42H09SE0009 2.10071 HOBLITZELL

900

Mining Act

– Do not use shaded areas below.

Type o Dighem III EM and Magnetic Survey	Township or Area Hoblitzell Twp
Claim ources Canada Limited	Prospector's Licence No. T872
Addre 4029, Terminal A, Toronto, Ontario, M5W 1K3	
Survey urveys and Processing Inc.	Date of Survey (from & to) 12 Day 05 Mo. 86 Yr. – 12 Day 05 Mo. 86 Yr.
	Total Miles of line Cut
Name or (of Geo-Technical report) th, Dighem Surveys, 228 Matheson Blvd. E. Mississauga, Ontario L4Z 1X1	

Credit
ach Claim in Columns at right

Specia		Days per Claim
For	Geophysical	
	- Electromagnetic	
	- Magnetometer	
For usi ey:	- Radiometric	
ach)	- Other	
	Geological	
	Geochemical	

Man D		Days per Claim
Co and	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

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Airbo		Days per Claim
No s ply eys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

Exper
power stripping)

Type

Perfor

Calcu
T
$ Days Credits ÷ 15 = Total Days Credits

Instru
To
ch
in
be apportioned at the claim holder's
f days credits per claim selected

Date
A

Recorded Holder or Agent (Signature)

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.	Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
L	871975		L	872010	
	871976			872011	
	871977			872012	
	871978			872013	
	871979			872014	
	871980			872015	
				872016	
**	871799**			872017	
				872018	
	871996			872019	
	871997			872020	
	871998			872021	
	871999			872022	
	872000			872023	
	872001			872024	
	872002			872025	
	872003			872026	
	872004			872027	
	872005			872028	
	872006			872029	
	872007			872030	
	872008			872031	
	872009				

** Relief from forfeiture has been requested.

Total number of mining claims covered by this report of work. 43

For Office Use Only		
Total Days Cr. Recorded 3440	Date Recorded April 24/87	Mining Recorder Act 1189
	Date Approved as Recorded 1987 04 18	Branch Director

③ DK.

Certi
Report of Work

I h
or
have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work
ng and/or after its completion and the annexed report is true.

Name
of Person Certifying
idge, Esso Minerals Canada, Box 290, Timmins, Ontario P4N 7N6

Date Certified
April 22, 1987

Certified by (Signature)

Ontario

Type

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Claim

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Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

#190/87

2.10071

Mining Act

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.
Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

n III EM and Magnetic Survey

Township or Area: Blakelock Twp

s Canada Limited

Prospector's Licence No.: T872

, Terminal A, Toronto, Ontario, M5W 1K3

s and Processing Inc.

Date of Survey (from & to): 12 Day | 05 Mo. | 86 Yr. | 12 Day | 05 Mo. | 86 Yr.

Total Miles of line Cut

or (of Geo-Technical report)

ighem Surveys, 228 Matheson Blvd. E. Mississauga, Ontario L4Z 1X1

ch Claim in Columns at right

		Days per Claim
	Geophysical	
	- Electromagnetic	
	- Magnetometer	
ey:	- Radiometric	
ch)	- Other	
	Geological	
	Geochemical	

		Days per Claim
	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

R 24 1987

		Days per Claim
s	Electromagnetic	40
ply		
eys.	Magnetometer	40
	Radiometric	

power stripping)

Days Credits

÷ 15 = Total Days Credits

be apportioned at the claim holder's
t days credits per claim selected

Recorded Holder or Agent (Signature): Dom Bailey

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
L	872250	
	872251	
	872252	
	872253	
	872254	
	872255	
	872256	
	872257	
	872258	
	872259	
	872260	
	872261	
	872262	
	872263	
	872264	
	872265	
	872266	
	872267	
	872268	
	872269	
	872270	
	872271	
	872272	

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
L	872273	
	872274	
	872275	
	872276	
	872277	

Total number of mining claims covered by this report of work. 56

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
2240	April 24/87	Acting D. Bennett
	Date Approved as Recorded	Branch Director
	1987.09.18	

Report of Work

ave a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work ng and/or after its completion and the annexed report is true.

of Person Certifying

, Esso Minerals Canada, Box 290, Timmins, Ontario P4N 7N6

Date Certified: April 22, 1987

Certified by (Signature): Dom Bailey

Ontari

Type
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Claim
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Name
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Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

#191/87

Mining Act 2.10071

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.

Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

m III EM and Magnetic Survey

Township or Area: Blakelock Twp.

s Canada Limited

Prospector's Licence No.: T872

, Terminal A, Toronto, Ontario, M5W 1K3

s and Processing Inc.

Date of Survey (from & to): 12 05 86 | 12 05 86 (Day Mo. Yr.)

Total Miles of line Cut:

or (of Geo-Technical report)

ighem Surveys, 228 Matheson Blvd. E. Mississauga, Ont. L4Z 1X1

ach Claim in Columns at right

		Days per Claim
	Geophysical	
	- Electromagnetic	
	- Magnetometer	
ey:	- Radiometric	
ach)	- Other	
	Geological	
	Geochemical	

		Days per Claim
	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

R 21 1987

		Days per Claim
s	Electromagnetic	40
by		
eys.	Magnetometer	40
	Radiometric	

power stripping)

Days Credits

÷ 15 = Total Days Credits

be apportioned at the claim holder's
days credits per claim selected

Recorded Holder or Agent (Signature)

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
L	871903	
	871904	
	871905	
	871906	
	871907	
	871908	
	871909	
	871910	
	871911	
	871912	
	871913	
	871914	
	871915	
	871916	
	871917	
	871918	
	871919	
	871920	
	871921	
	871922	
	871923	
	871924	
	871925	

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
L	871926	
	871927	
	871928	
	871929	
	871930	

Total number of mining claims covered by this report of work. 28 ~~56~~

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder Acting
2240	April 24/87	
	Date Approved as Recorded	Branch Director
	1987 09.18	

Report of Work

ave a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work ng and/or after its completion and the annexed report is true.

of Person Certifying

Esso Minerals Canada, Box 290, Timmins, Ontario P4N 7N6.

Date Certified: April 22, 1987

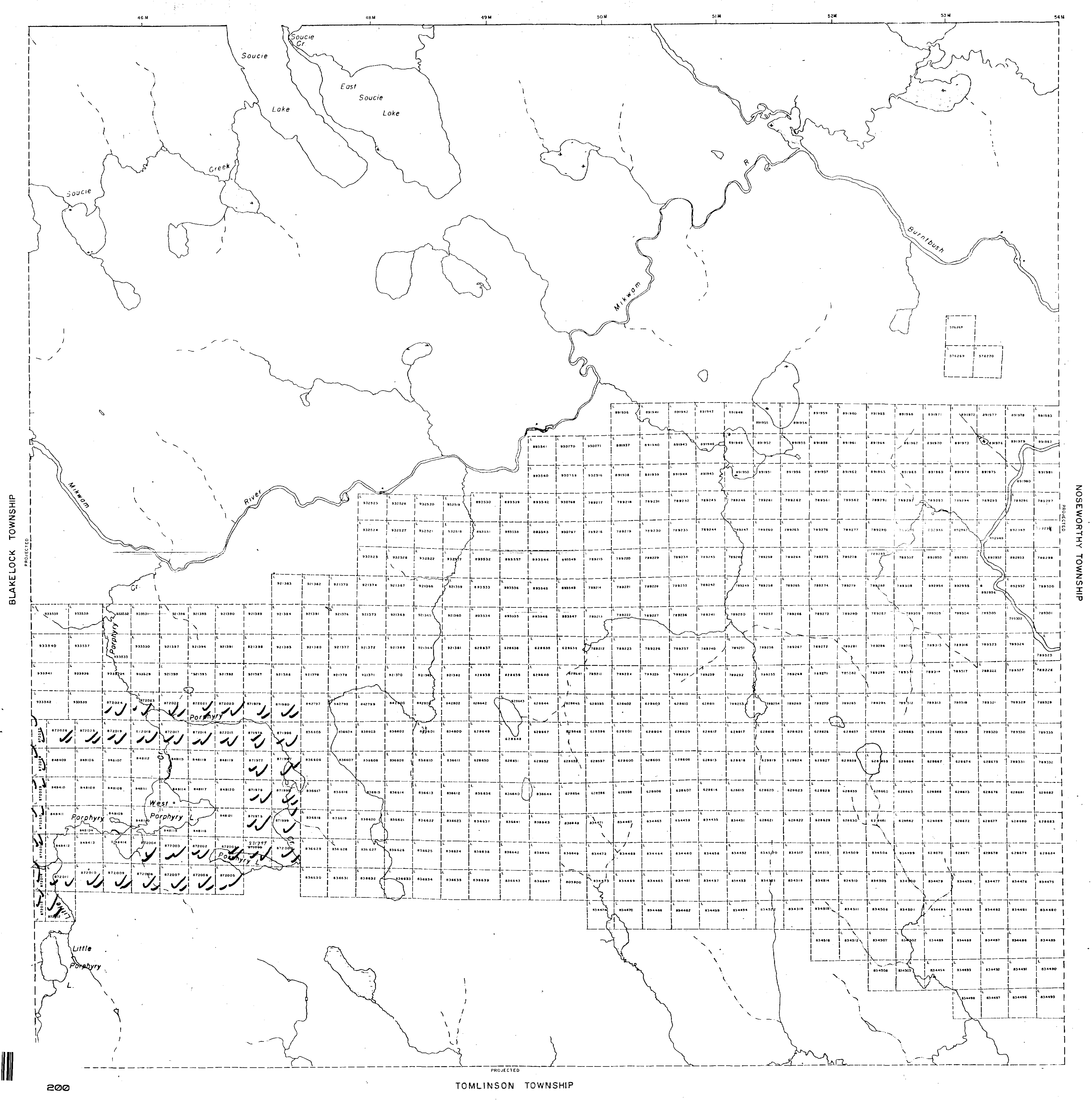
Certified by (Signature)

AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File

DATE OF ISSUE
MAY 2[illegible]
LARDER LAKE [illegible]



200

LEGEND

HIGHWAY AND ROUTE No.	
OTHER ROADS	
TRAILS	
SURVEYED LINES:	
TOWNSHIPS, BASE LINES, ETC.	
LOTS, MINING CLAIMS, PARCELS, ETC.	
UNSURVEYED LINES:	
LOT LINES	
PARCEL BOUNDARY	
MINING CLAIMS ETC.	
RAILWAY AND RIGHT OF WAY	
UTILITY LINES	
NON-PERENNIAL STREAM	
FLOODING OR FLOODING RIGHTS	
SUBDIVISION OR COMPOSITE PLAN	▨
RESERVATIONS	
ORIGINAL SHORELINE	
MARSH OR MUSKEG	
MINES	⚒
TRAVERSE MONUMENT	⌖

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◓
" , MINING RIGHTS ONLY	◒
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	⬒
" , MINING RIGHTS ONLY	⬓
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	Ⓡ
CANCELLED	⊗
SAND & GRAVEL	Ⓢ

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1.

SCALE

500 Metres 0 1000 Metres

1:20 000

Rec'd Nov. 13, 1986

TOWNSHIP

HOBLITZELL

M.N.R. ADMINISTRATIVE DISTRICT

COCHRANE

MINING DIVISION

LARDER LAKE

LAND TITLES / REGISTRY DIVISION

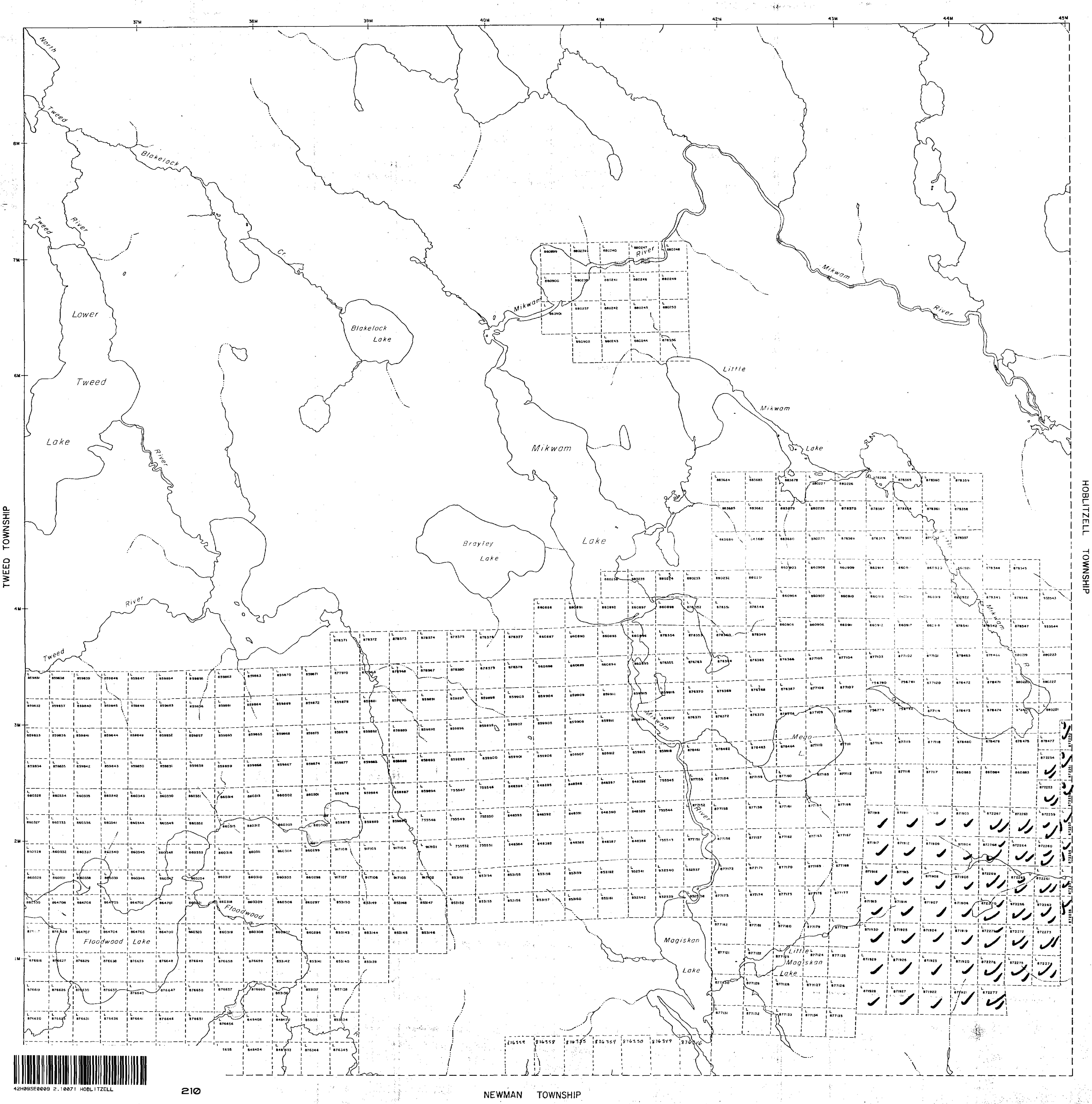
COCHRANE

Ontario Ministry of Natural Resources

Date OCTOBER 1986

Number G-3513

42H09SE0009 2.10871 HOBLITZELL



42H08SE0009 2.10071 HOBLITZELL

210

LEGEND

HIGHWAY AND ROUTE No.	
OTHER ROADS	
TRAILS	
SURVEYED LINES:	
TOWNSHIPS, BASE LINES, ETC.	
LOTS, MINING CLAIMS, PARCELS, ETC.	
UNSURVEYED LINES:	
LOT LINES	
PARCEL BOUNDARY	
MINING CLAIMS ETC.	
RAILWAY AND RIGHT OF WAY	
UTILITY LINES	
NON-PERENNIAL STREAM	
FLOODING OR FLOODING RIGHTS	
SUBDIVISION OR COMPOSITE PLAN	
RESERVATIONS	▨
ORIGINAL SHORELINE	
MARSH OR MUSKEG	
MINES	⚒
TRAVERSE MONUMENT	⊕

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◓
" , MINING RIGHTS ONLY	◒
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	⬒
" , MINING RIGHTS ONLY	⬓
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	Ⓡ
CANCELLED	⊗
SAND & GRAVEL	Ⓢ

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

Metres 500 0 1000 Metres

SCALE 1:20 000

NOV 14 1986

TOWNSHIP

BLAKELOCK

M.N.R. ADMINISTRATIVE DISTRICT

COCHRANE

MINING DIVISION

LARDER LAKE

LAND TITLES / REGISTRY DIVISION

COCHRANE

Ontario

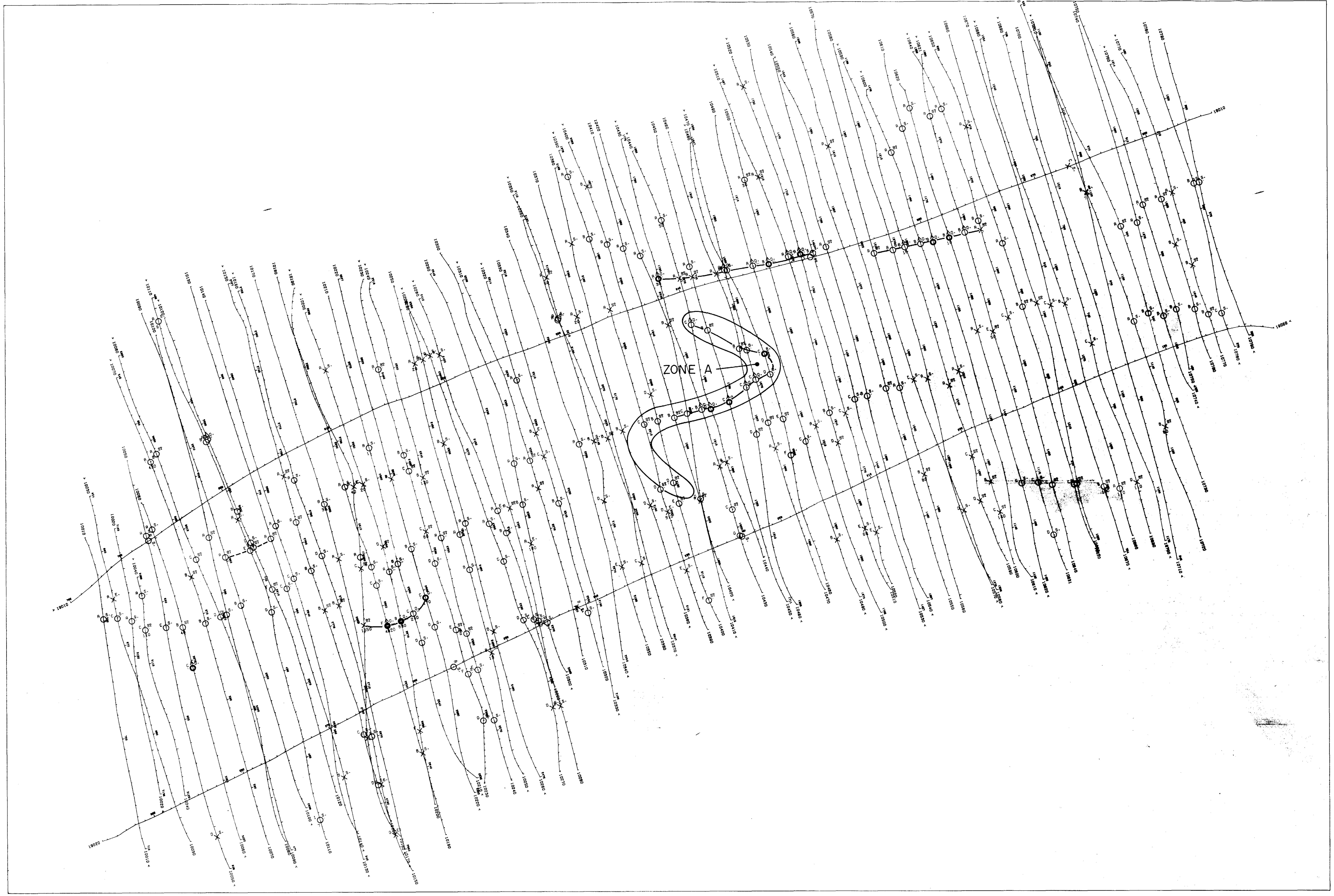
Ministry of Natural Resources

Ministry of Northern Development and Mines

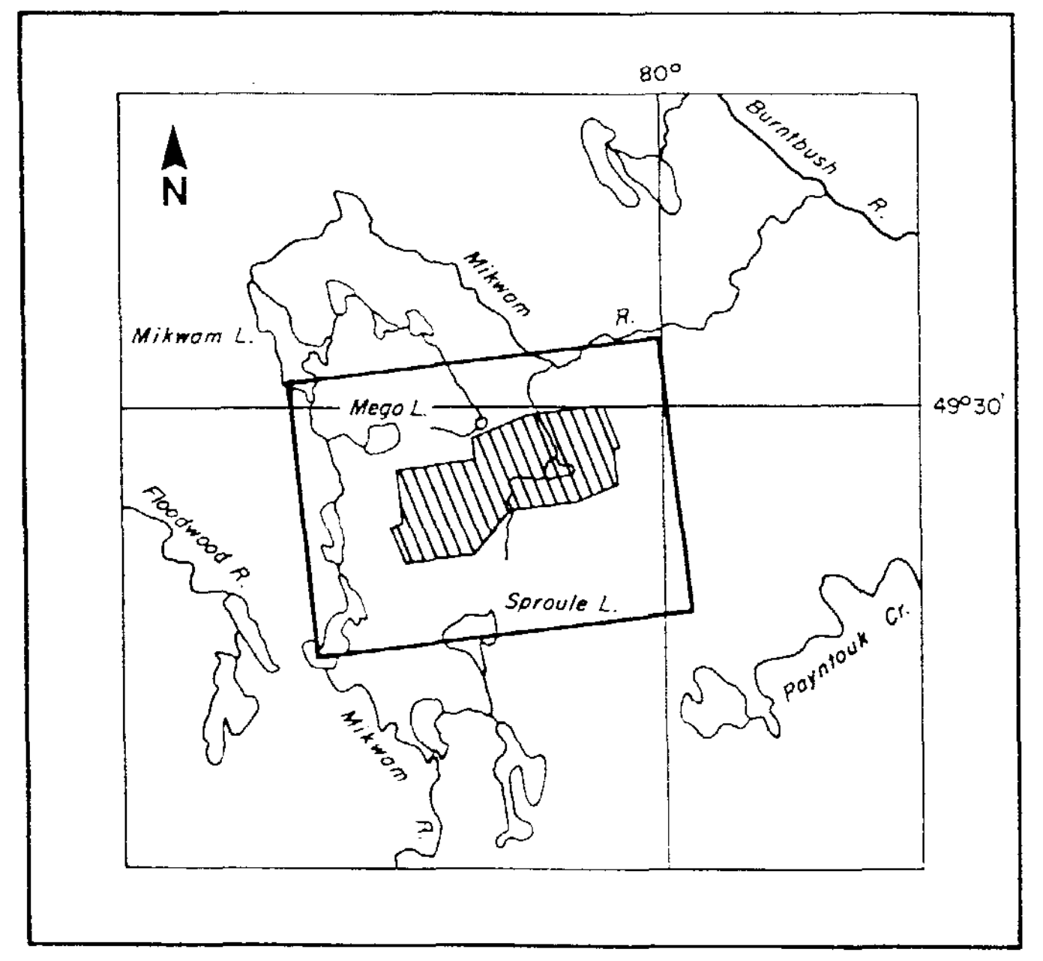
Date	Number
OCTOBER/1986	G-3474

H-N PROJECT
CLAIM MAP
SCALE: 1 inch = 1/2 mile

MAP 1



LOCATION MAP



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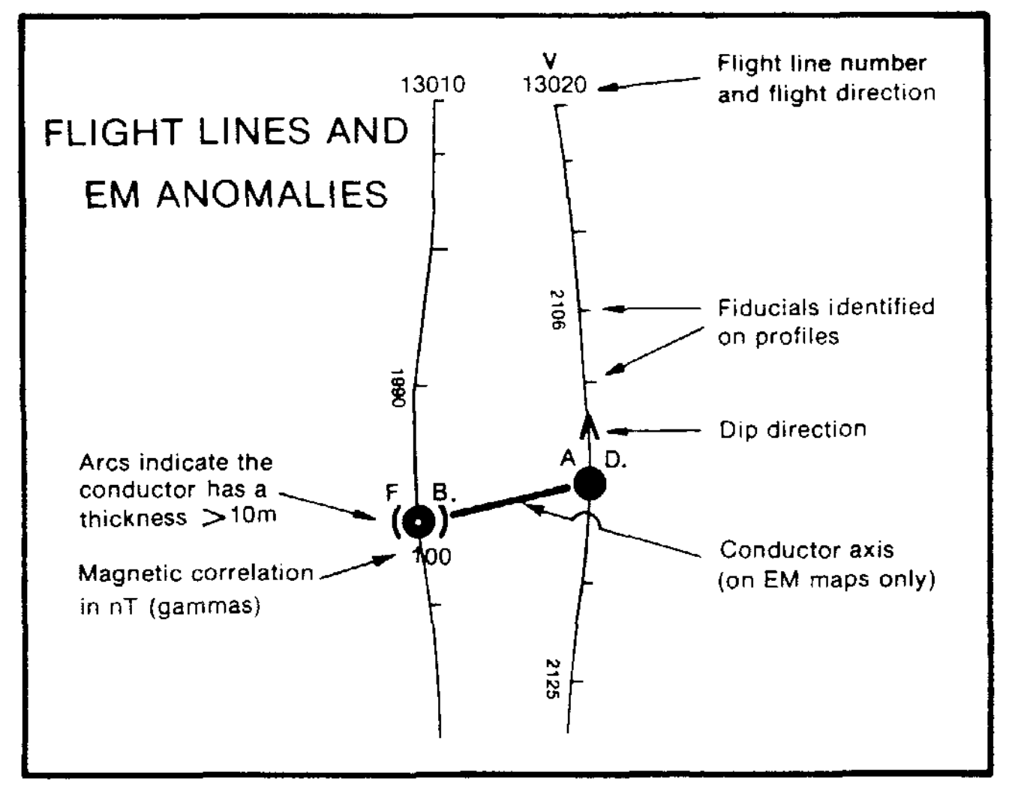
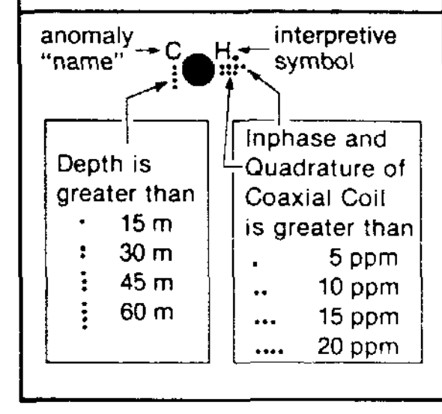


ANOMALY GRADE	EM GRADE SYMBOL	CONDUCTANCE RANGE (MHOS)
6	●	> 99
5	✹	50—99
4	●	20—49
3	◉	10—19
2	○	5— 9
1	○	< 5
—	X	Indeterminate

DIGHEM anomalies are divided into six grades of conductivity-thickness product. This product in mhos is a measure of conductance.



Depth is greater than
- · 15 m
- : 30 m
- ⋮ 45 m
- ⁞ 60 m

Inphase and Quadrature of Coaxial Coil is greater than
- . 5 ppm
- .. 10 ppm
- ... 15 ppm
- .... 20 ppm

Interpretive symbol	Conductor ("model")
B.	Bedrock conductor
D.	Narrow bedrock conductor ("thin dike")
S.	Conductive cover ("horizontal thin sheet")
H.	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E.	Edge of broad conductor ("edge of half space")
L.	Culture, e.g. power line, building, fence

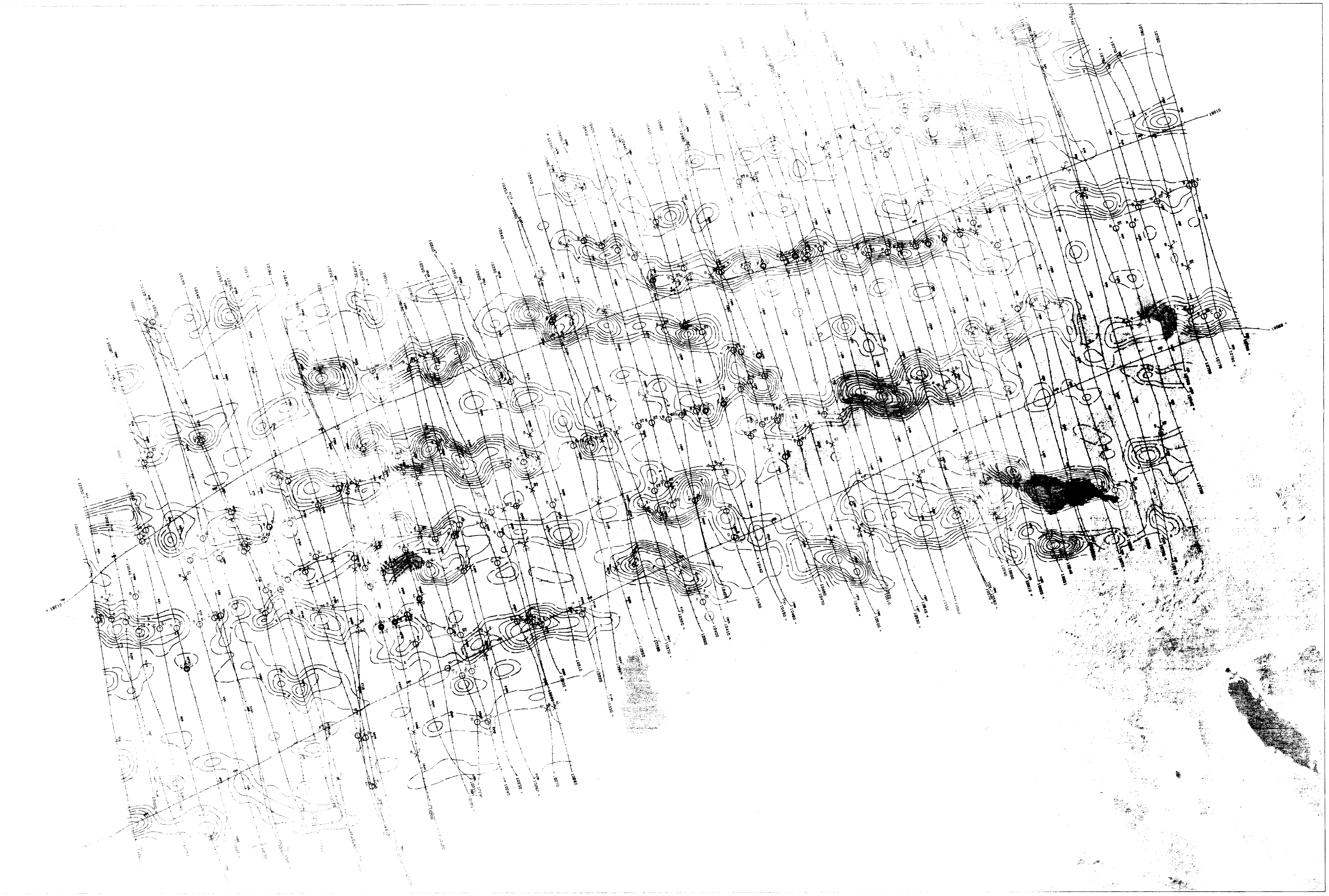
2 10071

ESSO MINERALS CANADA
H-N PROJECT

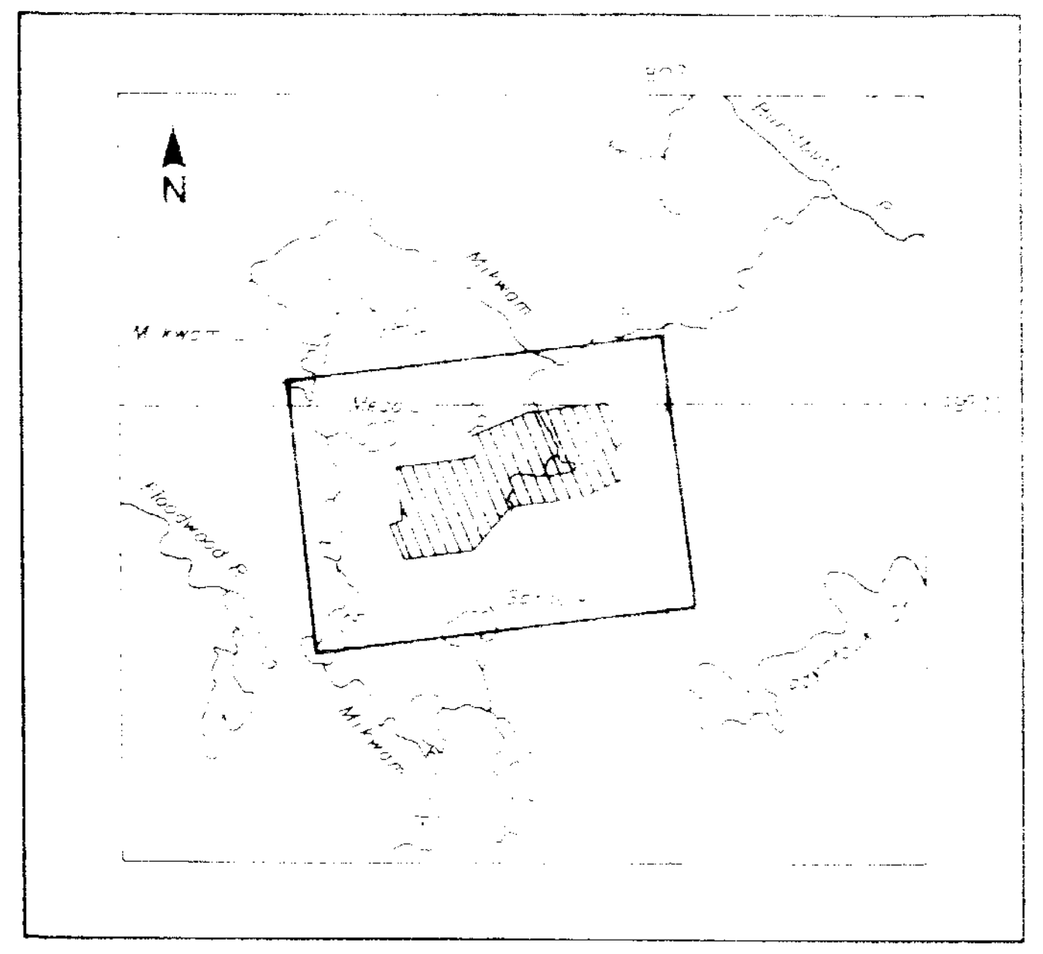
ELECTROMAGNETIC ANOMALIES
BY DIGHEM SURVEYS & PROCESSING INC.

DIGHEM^{III} SURVEY	GEOPHYSICIST:	DRAFTING By: R.Z.
DATE: JUNE 86	JOB: 247	SHEET:

Scale 1:10000
0 — 1 Km
0 — 0.5 Miles



LOCATION MAP



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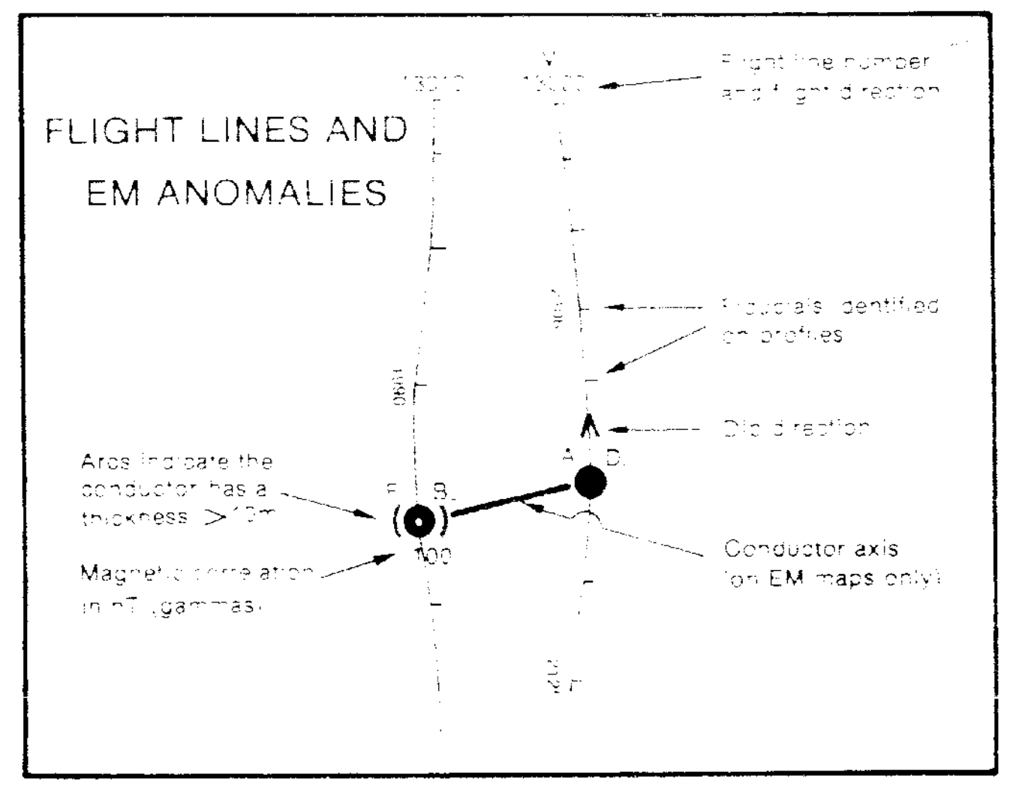
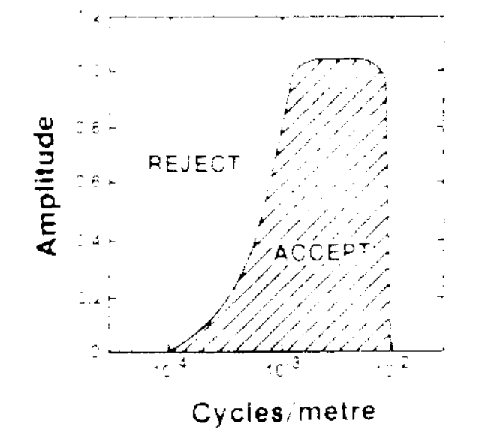


LEGEND

Contours in percent

— 10 —
— 2 —
— 1 —

The numbers face in the direction of increasing value



Cycles/metre
Frequency response
of VLF-EM filter

Tx: NLK Seattle, Wa
f: 24.8 kHz

ANOMALY GRADE	EM GRADE SYMBOL	CONDUCTANCE RANGE (MHOS)
6	●	> 99
5	✹	50 - 99
4	●	20 - 49
3	◉	10 - 19
2	○	5 - 9
1	○	< 5
—	×	indeterminate

DIGHEM anomalies are divided into six grades of conductivity-thickness product. This product in mhos is a measure of conductance.

anomaly "name" — interpretive symbol

Depth is greater than	Inphase and Quadrature of Coaxial Coil is greater than
	5 ppm
15 m	10 ppm
30 m	15 ppm
45 m	20 ppm
60 m	

Interpretive symbol	Conductor ("model")
B.	Bedrock conductor
D.	Narrow bedrock conductor ("thin dike")
S.	Conductive cover ("horizontal thin sheet")
H.	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E.	Edge of broad conductor ("edge of half space")
L.	Culture, e.g. power line, building, fence

2.10071

ESSO MINERALS CANADA

H-N PROJECT

FILTERED TOTAL VLF-EM FIELD

BY DIGHEM SURVEYS & PROCESSING INC.

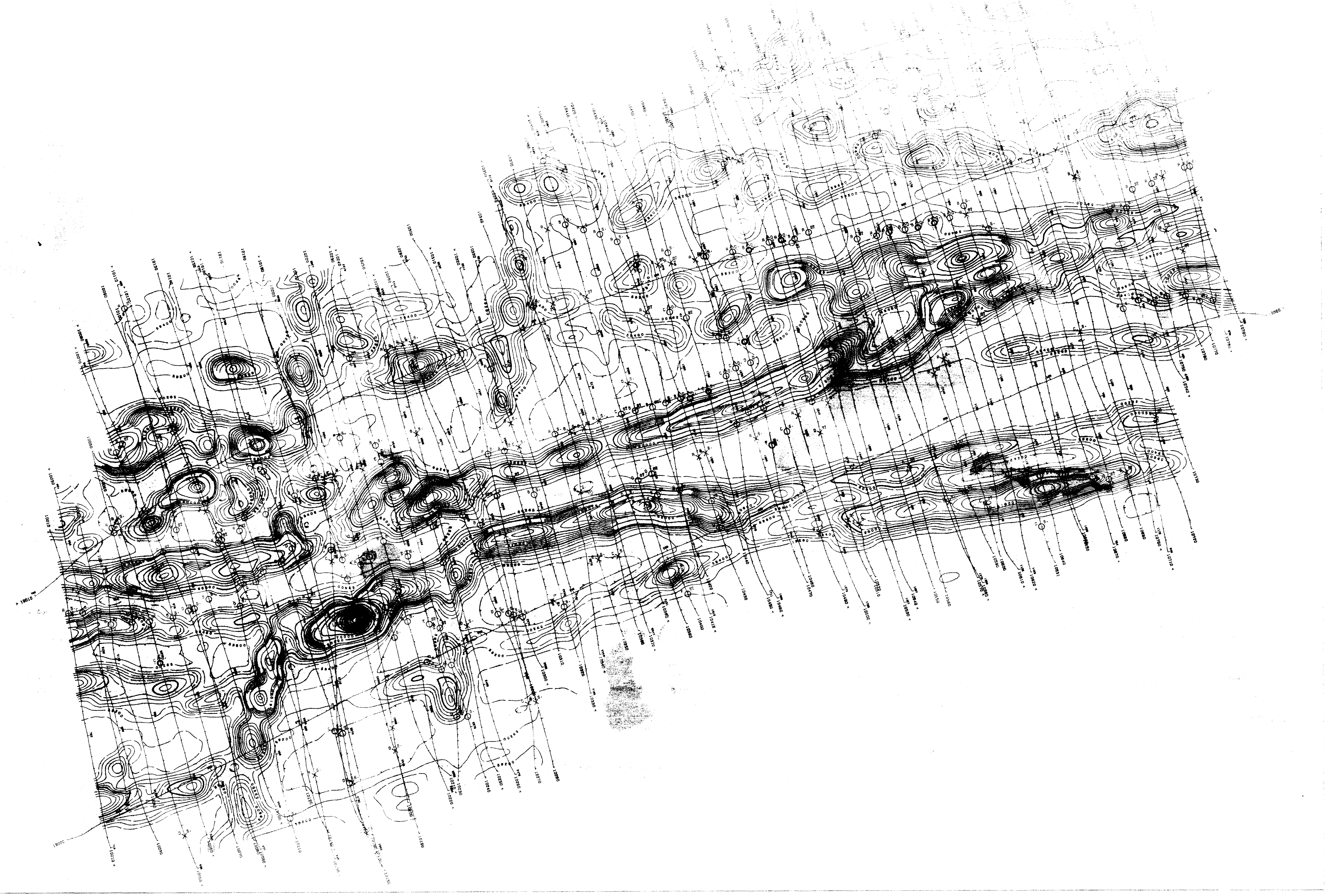
DIGHEM III SURVEY	GEOPHYSICIST:	DRAFTING By: R.L.
DATE: JUNE 86	JOB: 247	SHEET:

Scale 1:10000

0 — 1 Km

0 — 0.5 Miles

240



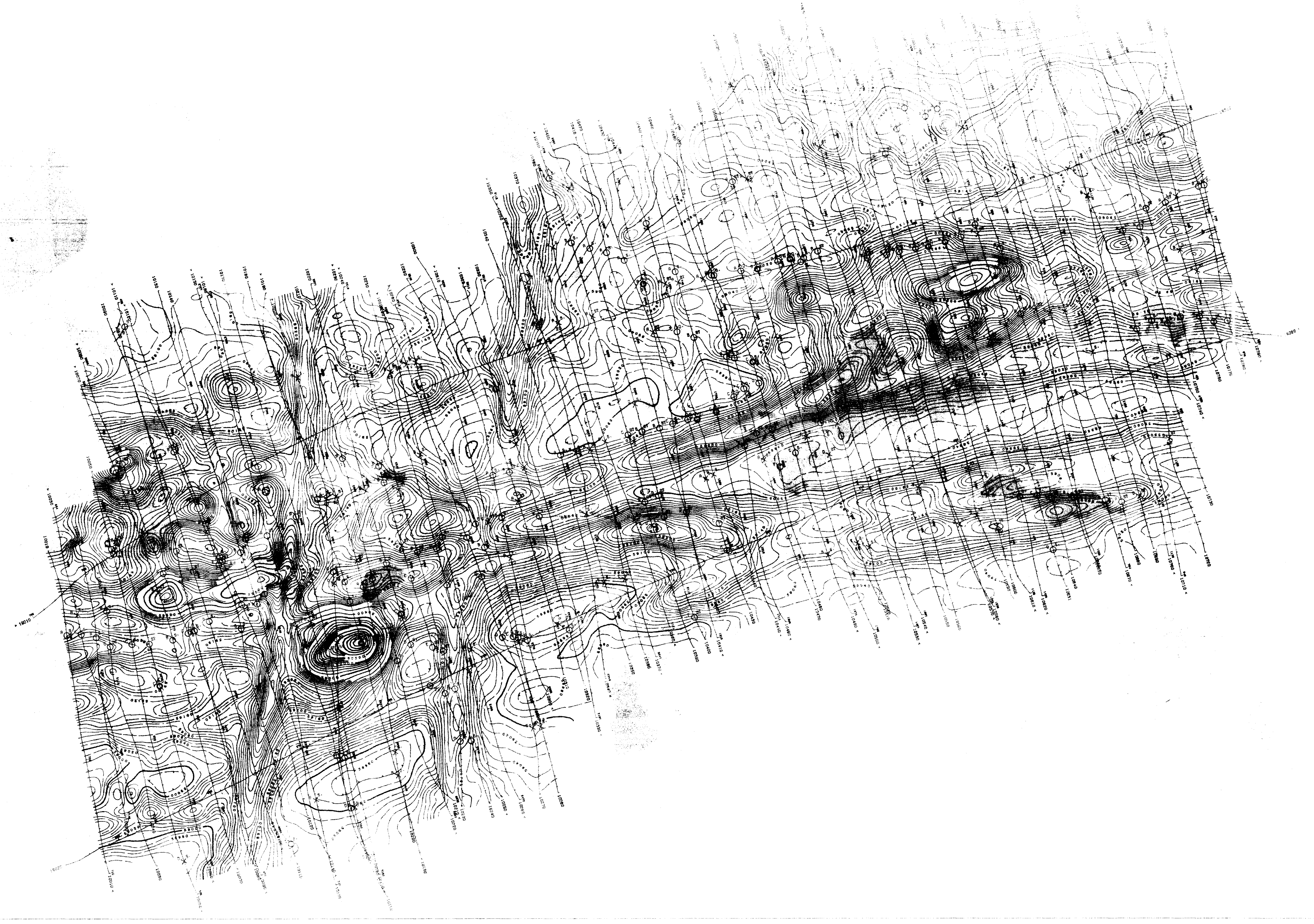
ESSO MINERALS CANADA
H-N PROJECT

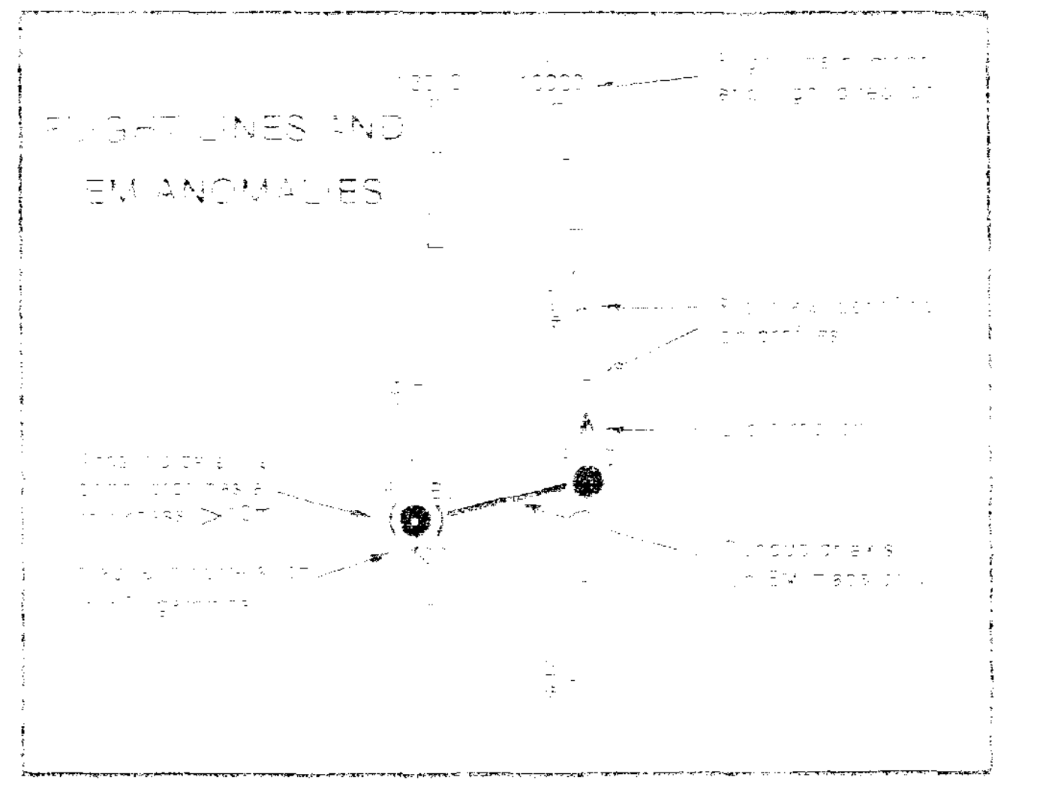
ENHANCED MAGNETICS

BY DIGHEM SURVEYS & PROCESSING INC

DIGHEM SURVEY
DATE: JUNE 88

250





ESSO MINERALS CANADA

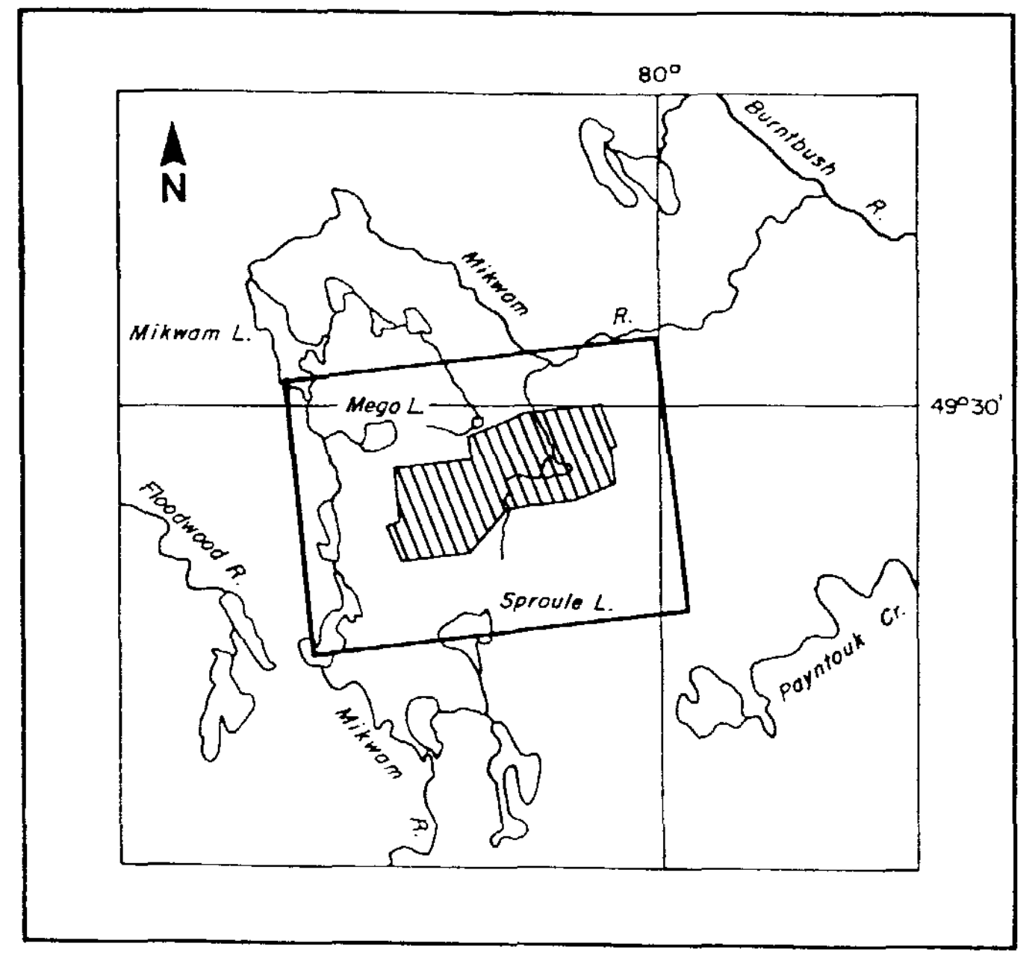
H-N PROJECT

TOTAL FIELD MAGNETICS

BY DIGHEM SURVEYS & PROCESSING INC.

260

LOCATION MAP



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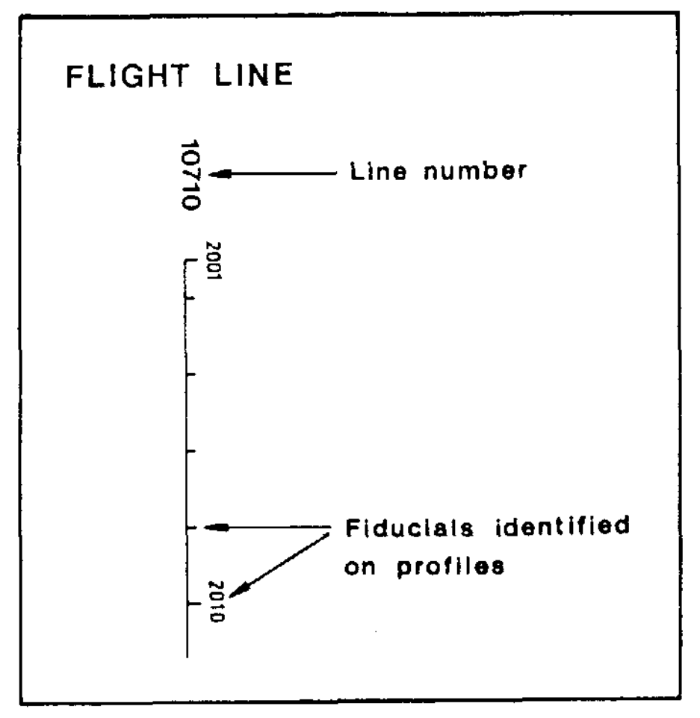

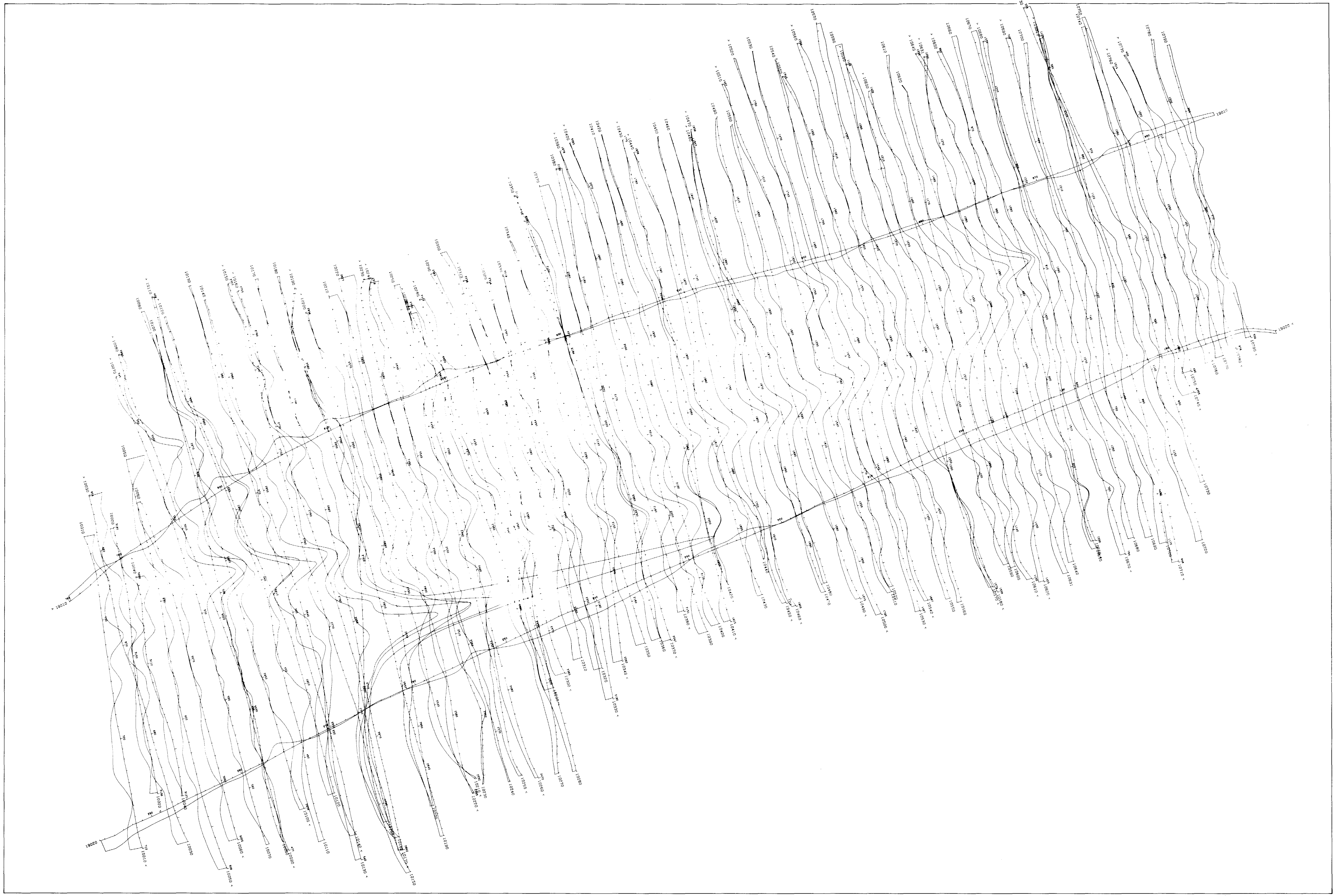

LEGEND

PROFILE SCALE: 20 nT per mm

2.10071

ESSO MINERALS CANADA
H-N PROJECT

TOTAL FIELD MAGNETIC PROFILES
BY DIGHEM SURVEYS & PROCESSING INC.

DIGHEM^{III} SURVEY	GEOPHYSICIST:	DRAFTING By: R.Z.
DATE: JUNE 86	JOB: 247	SHEET:

Scale 1:10000

0 — 1 Km

0 — 0.5 Miles

270