

GEOPHYSICAL REPORT

ON

VLF-EM AND MAGNETIC SURVEYS

TOBY CLAIMS

TOBY CREEK, INVERMERE AREA, GOLDEN M.D., B.C.

TOBY CLAIMS : 4 km W of Invermere, B.C.

: 50° 116° NE and SE

: N.T.S. 82K/8E and 9E

WRITTEN FOR : Core Resources Ltd.  
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GEOTRONICS SURVEYS LTD.  
Engineering & Mining Geophysicists  
VANCOUVER, CANADA



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## SUMMARY

During June and July, 1980, VLF-EM and magnetic surveys were carried out on the Toby claims located on Toby Creek near Invermere, B.C. The purpose was to map geological structure and lithology for the purpose of locating probable areas of sulphide mineralization.

The property has gentle to moderate slopes with an open coniferous forest and light underbrush. Access is by a 2-wheel drive vehicle only a few km out of Invermere. No other work has been done except for an adit completed prior to 1939.

"The claims cover metasediments of the Mt. Nelson Formation which includes dolomitic limestone and within which dioritic sills and dykes of the Moyie Intrusives may occur.

Mineral occurrences along Toby Creek are common. Most of the occurrences are of silver-lead-zinc associated with limy sediments. The more significant zone of mineralization in the area is that of the Paradise Mine and the Mineral King where silver-lead-zinc mineralization is associated with limy sediments.

The Toby claims cover reported pyrite occurrences containing gold in addition to an adit which explored a gold occurrence."

The VLF-EM and magnetic readings were taken every 25 meters on lines spaced 100 and 200 meters apart. The VLF-EM readings were then Fraser filtered, plotted, and contoured, while the magnetic readings were diurnally corrected, statistically analyzed, plotted and contoured.

## CONCLUSIONS

1. The VLF-EM survey revealed many conductive zones throughout the property. Most of these are undoubtedly caused by geological structure such as fault, shear, fracture, and/or contact zones. These zones may be associated with sulphide mineralization.
2. Anomaly c is the most promising anomaly because of its high conductivity. There is therefore an increased possibility of it being caused by sulphides.
3. Anomaly e appears to correlate with known mineralization. This anomaly also has fairly good conductivity.
4. The magnetic survey results were very flat indicating the property is underlain by sediments. No intrusives were mapped though geological mapping may change the interpretation.

## RECOMMENDATIONS

The VLF-EM survey results were quite encouraging. It is recommended therefore, to continue with Sookochoff's recommendations. Prospecting and geological mapping should be carried out first so that:

1. A better interpretation can be given to the VLF-EM and magnetic survey results. It may then be advisable to continue one or both of these surveys.
2. An idea of the overburden depth can be determined. If the overburden depth is not too great, then the soil geochemistry survey should be carried out. Some seismic refraction work may be recommended for overburden depth determinations.

### PROPERTY AND OWNERSHIP

The Toby property consists of 5 claims of 50 units grouped into the Toby Claims Group as shown on Figure 2 and as described below:

<u>Claim Name</u>	<u>Units</u>	<u>Record No.</u>	<u>Expiry Date</u>
Toby 1	8 (2 x 4)	607	March 11, 1981
Toby 2	6 (2 x 3)	608	March 11, 1981
Toby 3	15 (3 x 5)	609	March 11, 1981
Toby 4	9 (3 x 3)	610	March 11, 1981
Toby 5	<u>12</u> (3 x 4)	611	March 11, 1981
	50		

The claims are wholly owned by Core Resources Ltd. of Vancouver, B.C.

### LOCATION AND ACCESS

The property is located five km west of Invermere and centered on Toby Creek, an easterly flowing creek to Windermere Lake.

The geophysical coordinates for the center of the property are 50° 30' N latitude and 116° 07' W longitude.

Access is provided via secondary loose surface roads only a few km from Invermere to either the northern portion or the southern portion of the property. A 2-wheel drive vehicle is quite adequate.

### PHYIOGRAPHY

The property is located in the eastern part of the physiographic division known as the Purcell Mountains which is a unit of the Columbia Mountains system. The Purcell Mountains include some

high and rugged country with peaks frequently being well in excess of 3000 m.

However, much of the Toby property is located in a plateau area at the bottom of Mount Taynton to the southwest and Mount Bruce to the northwest. The terrain consists generally of gentle slopes except for the southwest corner where the elevation reaches 1450 meters. The lowest elevation of 850 m is at Toby Creek which flows easterly through the center of the property. However, much of the property averages about 1000 m.

Water sources on the property besides Toby Creek are its tributaries as well as Lillian Lake and Barbour Lake.

Vegetation consists of a coniferous forest relatively open with light underbrush.

#### HISTORY OF PREVIOUS WORK

The dates of work on the adit covered by the Toby claims is not known except that the work was reportedly completed prior to 1930.

No additional work on the ground is known of to the writer although old claim posts have been located.

#### GEOLOGY

The following is quoted from L. Sookochoff's engineering geology report on the property.

"The property is located along the eastern edge of a northwesterly trending belt of the Lower Cambrian and Pre-Cambrian sediments of the Purcell and Windermere systems. The sediments are predominantly comprised of limestone, argillites, quartzites and

grid units. The sediments are all lightly metamorphosed. Stocks of diorite and tonolite are exposed west of the Purcell divide, however, there are many dioritic sills and dykes of the Moyie Intrusions which are more common in the Lower Purcell.

Large scale northwesterly trending fault zones predominate and are evident topographically in the major river systems - the Columbia, Lardeau, and Duncan. Complimentary structures trend northerly.

The claim group is underlain by the Upper Purcell Mt. Nelson Formation comprised of buff weathering, grey dolomitic limestone, purple, grey and black argillite and slate and white and green quartzites.

On the south side of Toby Creek, outcrops along a road cut expose black argillites trending at  $360^{\circ}$  and dipping gently to the east. Fractures at  $155^{\circ}/90$  predominate with fissility at  $140/45^{\circ}$  W. Discontinuous thin lenses and concordant stringers of calcite are included in the thinly bedded sediments. Calcite is also prevalent with limonitic stain along fractures trending at  $155^{\circ}/90$ . The sediments are lightly metamorphosed with traces and light disseminations of pyrite.

Quartz and sulphides adjacent to Toby Creek and also in the vicinity of the included placer lease are reported.

A drift is located on the south side of Toby Creek and adjacent to the placer claim 415.



Mineralization in the area and more specifically along Toby Creek includes the following.

Workings on Delphide Creek with shipments prior to 1905 of 63 tons averaging 85 oz. silver, 30 per cent lead, and from 2 to 3 per cent copper.

The Lucky Boy Group is situated on Monroe Creek, a tributary of Toby, in a formation of limestone and shale; ledge about 16 feet wide and about a foot of ore assaying well in silver and lead. Work consists of a cross-cut tunnel 120 feet, with a drift south 14 feet, and numerous open cuts.

The Sultana Group on Michelson Creek, a tributary of Toby Creek, in a limestone formation contains a ledge three feet wide with a paystreak "10 inches wide assaying well in silver, copper and lead.

The Mineral King at the head waters of Toby Creek ~~was in production during a dolomitic and siliceous limestone of the Mount Nelson formation of Pre-Cambrian age.~~

Except for occasional pyrite disseminations, the writer has not observed any mineralization on the Toby claims."

### VLF-EM SURVEY

#### Instrumentation and Theory

A VLF-Em Receiver, model 27, manufactured by Sabre Electronics Instruments Ltd. of Burnaby, B.C. was used for the survey. This instrument is designed to measure the magnetic component of a very low frequency (VLF) electromagnetic field. The U.S. Navy submarine transmitter located at Annapolis, Maryland and transmitting at 21.4 KHz was used.

In all electromagnetic prospecting, a transmitter produces an alternating magnetic field (primary) by a strong alternating current usually through a coil of wire. If a conductive mass such as a sulphide body is within this magnetic field, a secondary alternating current is induced within it which in turn induces a secondary magnetic field that distorts the primary magnetic field. It is this distortion that the EM receiver measures. The VLF-EM uses a frequency range from 16 to 24 KHz whereas most EM instruments use frequencies ranging from a few hundred to a few thousand Hz. Because of its relatively high frequency, the VLF-EM can pick up bodies of a low conductivity and therefore is more susceptible to clay beds, electrolyte-filling fault or shear zones and porous horizons, graphite, carbonous sediments, lithological contacts as well as sulphide bodies of too low a conductivity for other EM methods to pick up.

Consequently, the VLF-EM has additional uses in mapping structure and in picking up sulphide bodies of too low a conductivity for conventional EM methods and too small for induced polarization (in places it can be used instead of IP). However, its susceptibility to lower conductive bodies results in a number of anomalies, many of them difficult to explain and, thus, VLF-EM preferably should not be interpreted without a good geological knowledge of the property and/or other geophysical and geochemical surveys.

#### Survey Procedure

The VLF-EM survey was run on a grid in which the lines run northeast-southwest at 100- and 200- meter intervals. Dip angle readings were taken every 25 meters with the instrument facing towards the transmitter at Annapolis. Fluorescent pink flagging was placed at each 25-meter station with the grid co-ordinates marked thereon.

### Compilation of Data

The readings were reduced by applying the Fraser Filter and plotted at a scale of 1:4,000. Filtered data, as shown on Sheet 1, are plotted between the reading stations. The positive filtered values were contoured at intervals of  $4^{\circ}$  starting at  $0^{\circ}$ .

The Fraser Filter is essentially a 4-point difference operator which transforms zero crossings into peaks, and a low pass smoothing operator which reduces the inherent high frequency noise in the data. Therefore, the noisy, non-contourable data are transformed into less noisy, contourable data. Another advantage of this filter is that a conductor that does not show up as a cross-over on the unfiltered data quite often will show up on the filtered data.

### MAGNETIC SURVEY

#### Instrumentation and Theory

The magnetic survey was carried out using a portable proton precession magnetometer, Model UM 220 manufactured by Urtec Limited of Markam, Ont. This instrument reads out directly in gammas on an LCD display. It has a range of  $\pm 100,000$  gammas and a reading accuracy of  $\pm 1$  gamma. The UM 220 has an operating temperature range of  $-35^{\circ}$  C to  $+60^{\circ}$  C. Its gradient tolerance is up to 5000 gammas/meter.

Only two commonly occurring minerals are strongly magnetic; magnetite and pyrrhotite, hence, magnetic surveys are used to detect the presence of these minerals in varying concentrations. Magnetic data are also useful as a reconnaissance tool for mapping geologic lithology and structure since different rock types have different background amounts of magnetite and/or pyrrhotite.

### Survey Procedure

The readings were taken on the same grid as that for the VLF-EM survey, that is, every 25 meters on northeast-southwest lines 100- and 200- meters apart.

The magnetic diurnal change was monitored in the field by the closed loop method and double checked by a series of base stations.

### Compilation of Data

The magnetic data were plotted on Sheet 2 at a scale of 1:4,000 (1 cm = 40 meters). For ease of plotting and discussion, 58,000 gammas was subtracted from all values and contours.

The contour interval was chosen to be 25 gammas. The contours below the mean background level, 625 gammas and lower, were dashed in, and the contours above, 675 gammas and higher, were drawn in solid. The mean background contour of 650 gammas was not drawn in.

## DISCUSSION OF RESULTS

### VLF-EM

As seen on Sheet 1, the survey was severely broken up by the Toby Creek canyon as well as several powerlines throughout the survey area and the Hydro sub-station. As a result, many anomalies are fragmented, and, no doubt, some that would have been picked up have not been picked up at all. Nevertheless, there are definite anomalous trends shown, some of which are quite strong.

The major cause of VLF-EM anomalies, as a rule, are geologic structures such as faults, shear and breccia zones. It is therefore logical to interpret VLF-EM anomalies to likely be caused

by these structural zones. Of course, the fact that sulphides may also be a causitive source should not be ruled out. But in the writer's experience, where VLF-EM anomalies correlate with sulphide mineralization, especially in the western Cordillera, the anomalies are usually reflecting the structure associated with the mineralization rather than the mineralization itself.

Some of the anomalies on the Toby claims are very long and linear in shape which is also suggestive of structure being the causitive source.

The major trend of the VLF-EM anomalies, as seen on Sheet 1, is primarily east with some southeast trends. Considering the VLF-EM anomalies are likely reflecting structure, the major strike of structure on this property is concluded to be in these directions. This is at least in partial agreement with the known geology of the area.

There is some variation in intensity from one VLF-EM anomaly to the next. This may not only be due to the conductivity of a causitive source, but also the direction it strikes relative to the direction to the transmitter. In other words, those conductors lying closer to the same direction as the direction to the transmitter (ESE in this case), can be picked up easier than those that are lying at a greater angle. Depending upon its conductivity, a conductor may not be picked up at all if it's at too great an angle.

For ease of identification, the anomalies have been labelled by the lower case letters a to k.

There is only a limited amount that can be said about the VLF-EM anomalies since there is no previous work on the property to correlate the results with.

Anomaly a is more aptly described an anomalous zone since it is caused by several conductors. The zone strikes northwest-southeast, has a minimum length of 600 m, and is open on both ends.

Anomaly b strikes in approximately the same direction, is also open on both ends, and has a minimum length of 300 m. It appears that it connects with anomaly k across Toby Creek, whereas the minimum length would then be 900 m.

Anomaly c is by far the most interesting anomaly because of its relatively high intensity. This means higher conductivity and therefore a higher possibility of sulphides. Its highest value is  $45^{\circ}$  with many other values above  $30^{\circ}$ . It consists of 2 arms, one that strikes east and one that strikes southeast. The east arm is open to the west and has a minimum length of 500 m. The southeast arm appears to cross the Hydro sub-station and is 800 m long.

Anomaly c to the southeast ends in a complex anomaly that has been labelled c'. It also is composed of several conductors and probably connects with anomaly i across Toby Creek. The minimum length would then be 900 m.

Anomaly d is also a multi-conductor anomaly with arms that have been labelled d' and d''. Its strike is easterly and its minimum length, 1200 m, being open mainly on the western end.

Anomaly e has a similar strike of easterly and a minimum length of 1800 m. It is open on both ends. Though the writer is unsure of the exact location, the known mineralization on the property probably correlates with this anomaly.


Anomaly f is a multi-conductor anomaly that probably connects with anomalies g and h. The strikes are both east and southeast and the combined minimum length, 1700 m.

Magnetic Survey

The results of the magnetic survey are quite flat with them varying from 554 gammas to 737 gammas giving only a range of 183 gammas. This is indicative of sedimentary rock-types and/or deep overburden. However, the VLF-EM response west of the sub-station indicates overburden to be not too deep.

The magnetic survey may have mapped lithological contacts, but this will not be known until some geological mapping has been done. Even if the overburden is not too thick, the magnetic variation may simply be a reflection of the variation in overburden thickness.

Respectfully submitted,  
GEOTRONICS SURVEYS LTD.



David G. Mark,  
Geophysicist

October 27, 1980

REFERENCES

Sookochoff, L. Geological Report on the Toby Property of Core Resources Ltd., Golden M.D., May 21, 1980

Minister of Mines, Annual Reports

1906, pp J 144 - 146

1930, p 9

1953, pp 151 - 156

1970, pp 470 - 471



GEOPHYSICIST'S CERTIFICATE

I, DAVID G. MARK, of the City of Vancouver, in the Province of British Columbia, do hereby certify:

THAT I am a Consulting Geophysicist of Geotronics Surveys Ltd. with offices at #403-750 West Pender Street, Vancouver, British Columbia.

I Further certify :

1. I am a graduate of the University of British Columbia (1968) and hold a B.Sc., degree in Geophysics.
2. I have been practising my profession for the past twelve years and have been active in the mining industry for the past fifteen years.
3. I am an active member of the Society of Exploration Geophysicists and a member of the European Association of Exploration Geophysicists.
4. This report is compiled from data obtained from VLF-EM and magnetic surveys carried out by R. Wood, a geophysical technician of Geotronics, from June 24th to July 10, 1980.
5. I hold no interest in Core Resources Ltd. nor any of its properties, nor do I expect to receive any interest as a result of writing this report.



David G. Mark,  
Geophysicist

October 27, 1980

AFFIDAVIT OF EXPENSES

The VLF-EM and magnetic surveys were carried out on the Toby Claims, Toby Creek, Invermere Area, Golden M.D., B.C. to the value of the following:

FIELD:

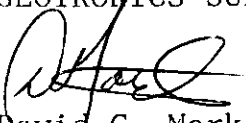
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Vehicle rental and gas	626
Airflight costs	302
Room and board	1,400
Survey supplies	85
Instrument rentals, 1 magnetometer, 1 VLF-EM, 2 weeks at \$100/week/instrument	<u>400</u>
	\$ 8,413

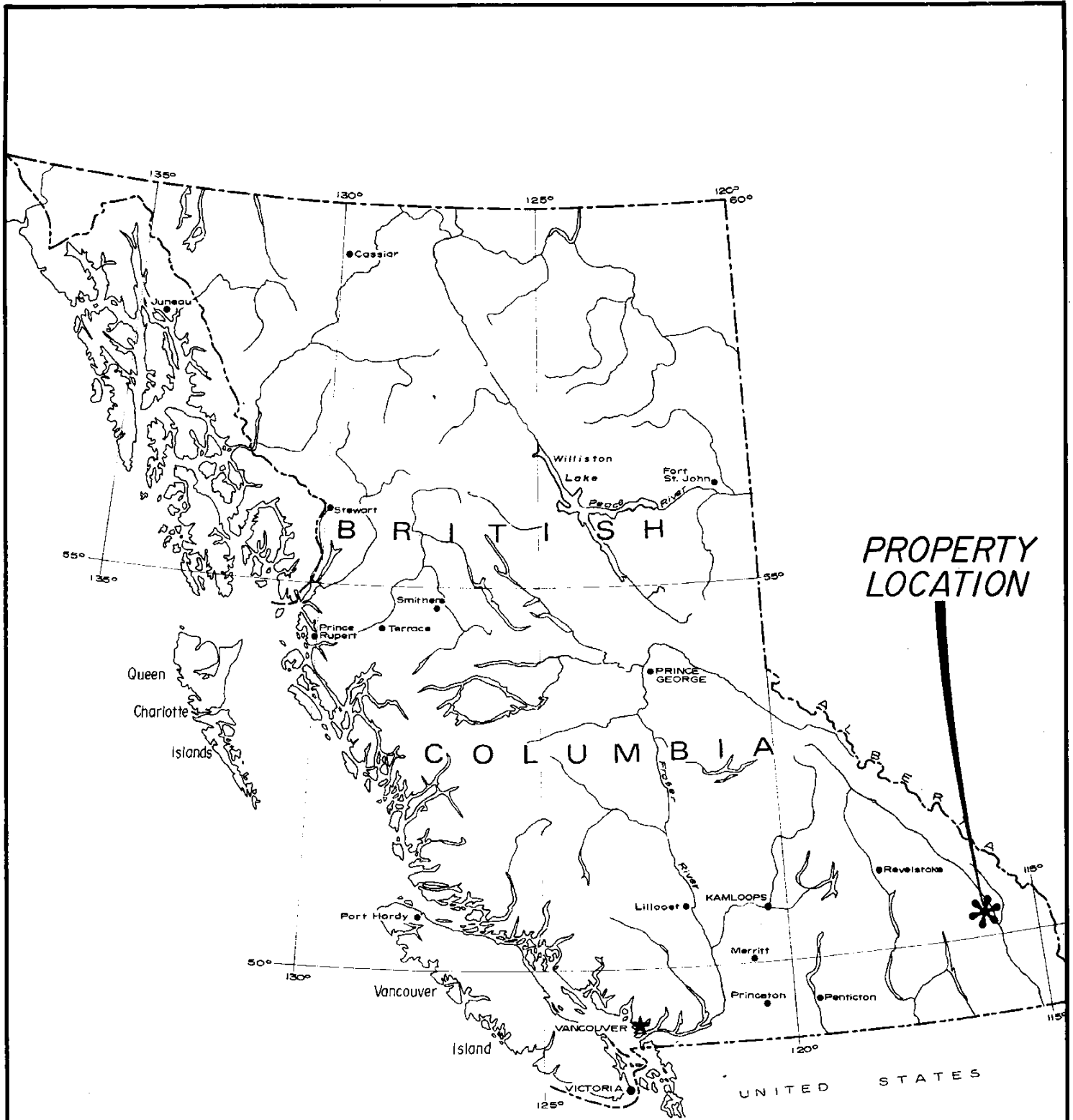
REPORT:

Geophysicist, 10 hours at \$37.50/hour	\$ 375
Geophysical technician, 50 hours at \$20/hour	1,000
Drafting and printing	1,147
Typing, photocopying and compilation	<u>150</u>
	\$ 2,672

TOTAL	<u>\$11,085</u>
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Respectfully submitted,  
GEOTRONICS SURVEYS LTD.

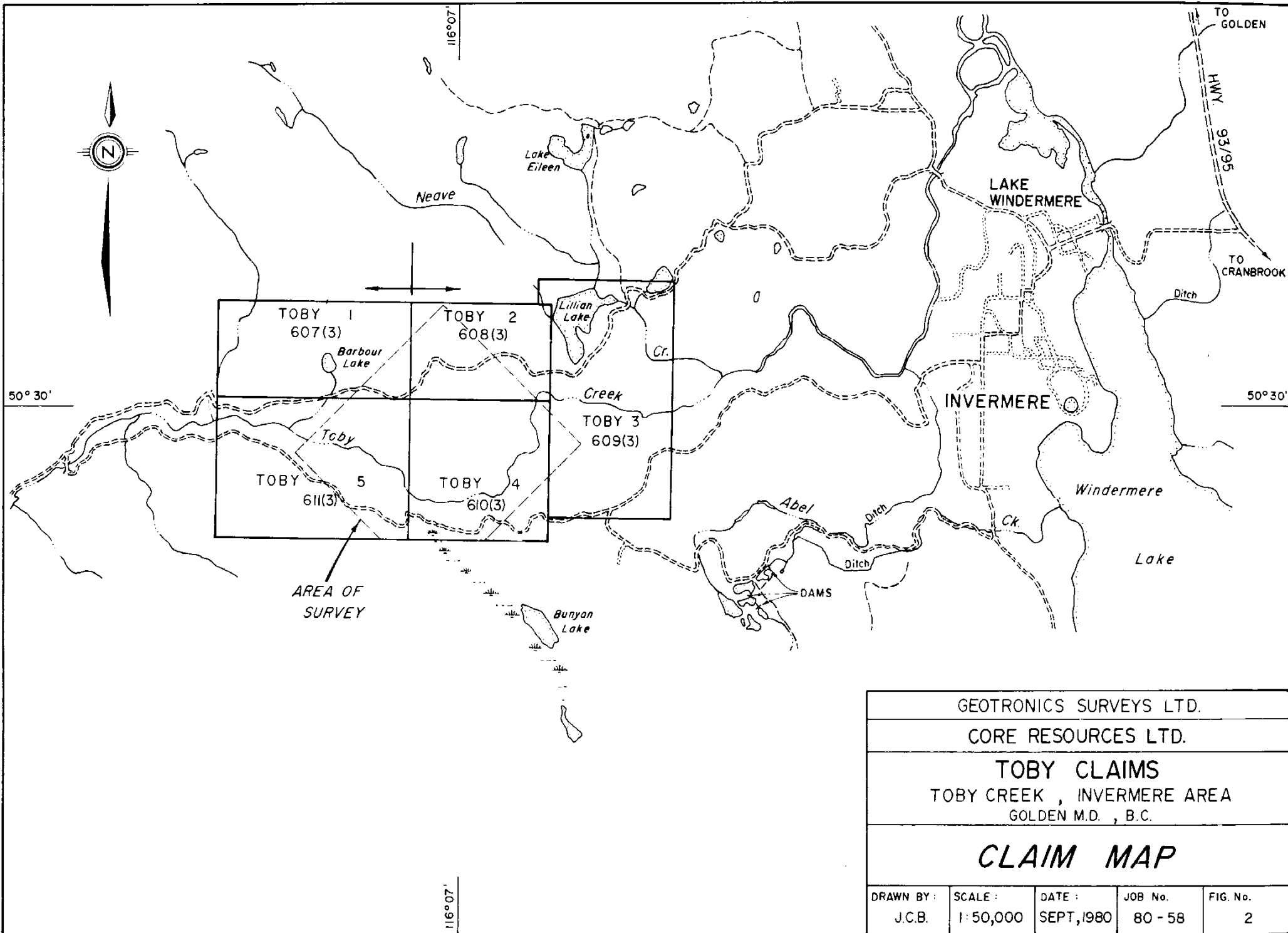
  
David G. Mark,  
Geophysicist



**PROPERTY  
LOCATION**

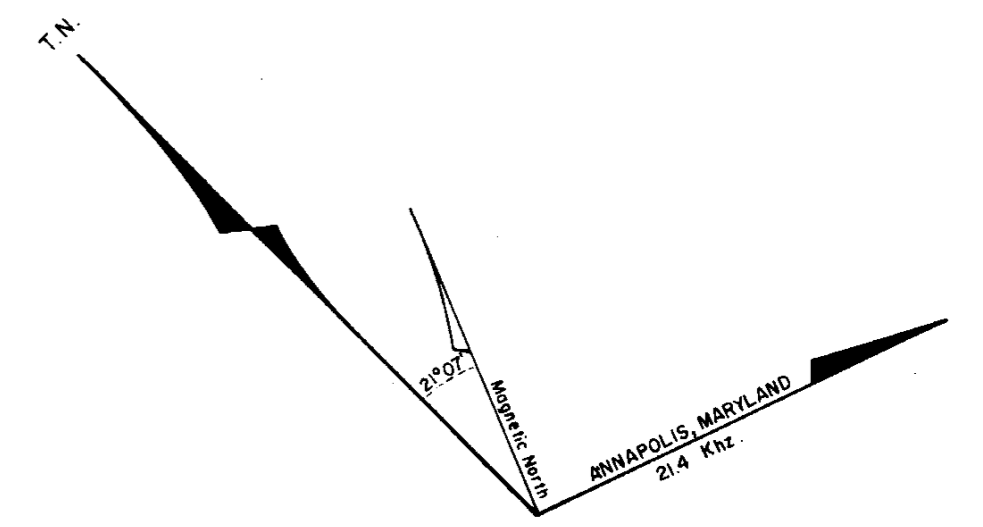
GEOTRONICS SURVEYS LTD.  
 CORE RESOURCES LTD.  
**TOBY CLAIMS**  
 TOBY CREEK , INVERMERE AREA  
 GOLDEN M.D. , B.C.  
**LOCATION MAP**

DRAWN BY :	SCALE :	DATE :	JOB No.	FIG. No.
J.C.B.	1"=150 miles	SEPT,1980	80 - 58	3

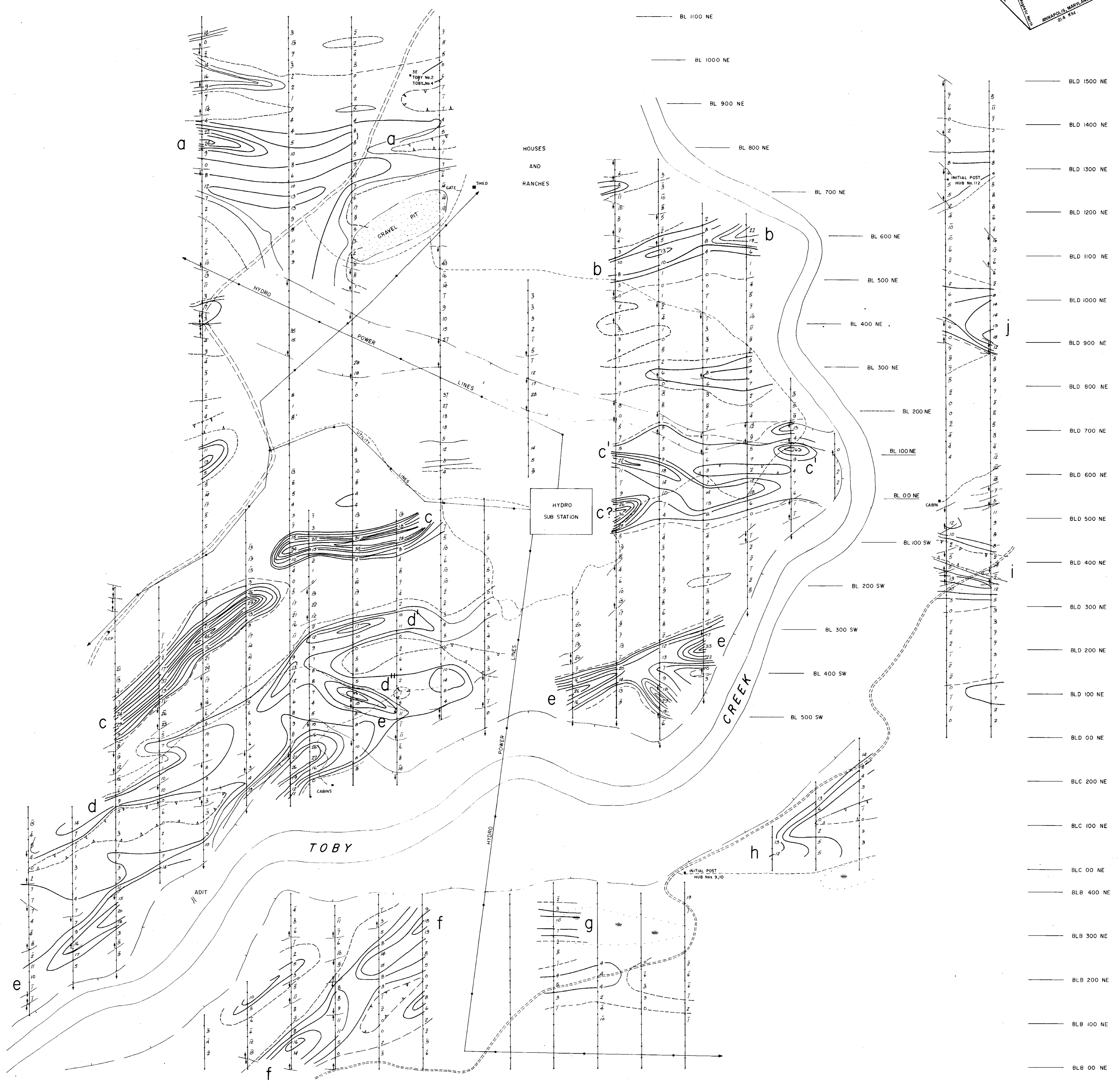


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CORE RESOURCES LTD.				
<b>TOBY CLAIMS</b>				
TOBY CREEK , INVERMERE AREA GOLDEN M.D. , B.C.				
<b>CLAIM MAP</b>				
DRAWN BY :	SCALE :	DATE :	JOB No.	FIG. No.
J.C.B.	1:50,000	SEPT,1980	80 - 58	2

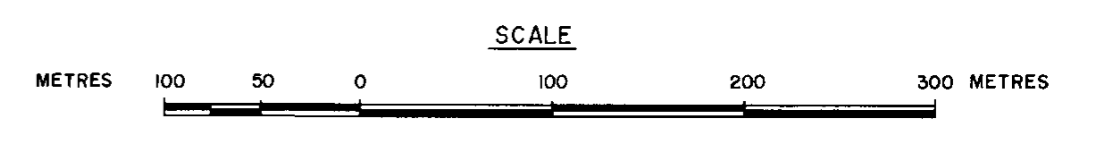
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BLA 50 NW  
BLA 40 NW  
BLA 30 NW  
BLA 20 NW  
BLA 10 NW  
BLA 00 NW  
BL 120 NW  
BL 100 NW  
BL 80 NW  
BL 60 NW  
BL 40 NW  
BL 20 NW  
BL 00 NW  
BL 80 NW  
BL 70 NW  
BL 60 NW  
BL 50 NW  
BL 40 NW  
BL 30 NW  
BL 20 NW  
BL 10 NW  
BL 00 NW



BLA 1800 NE  
BLA 1700 NE  
BLA 1600 NE  
BLA 1500 NE  
BLA 1400 NE  
BLA 1300 NE  
BLA 1200 NE  
BLA 1100 NE  
BLA 1000 NE  
BLA 900 NE  
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BLA 300 NE  
BLA 200 NE  
BLA 100 NE  
BLA 00 NE  
BLA 100 SW  
BLA 200 SW  
BLA 300 SW  
BLA 400 SW  
BLA 500 SW



MINERAL RESOURCES BRANCH  
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**8897**



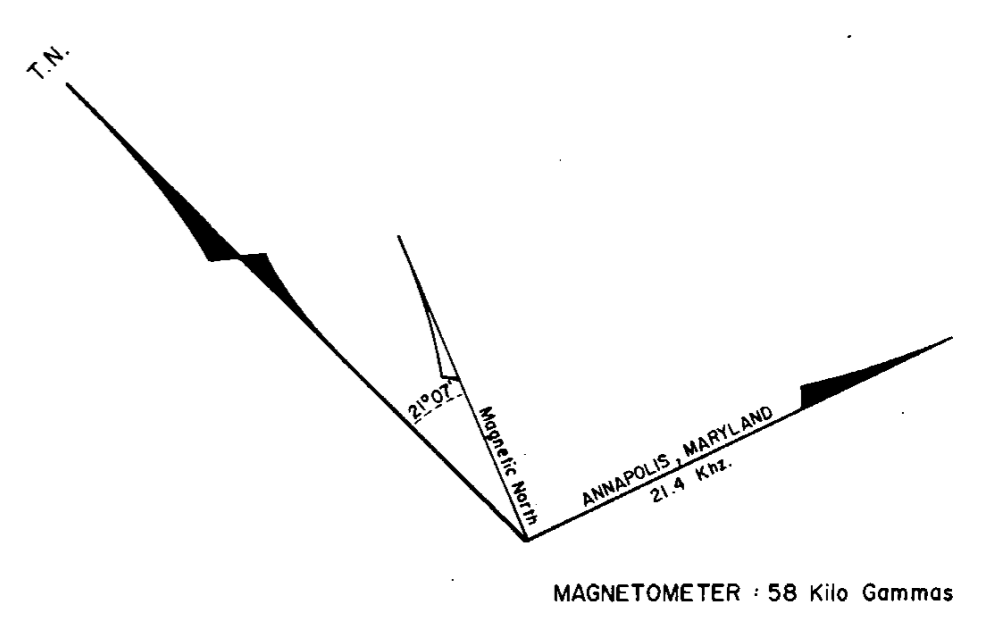
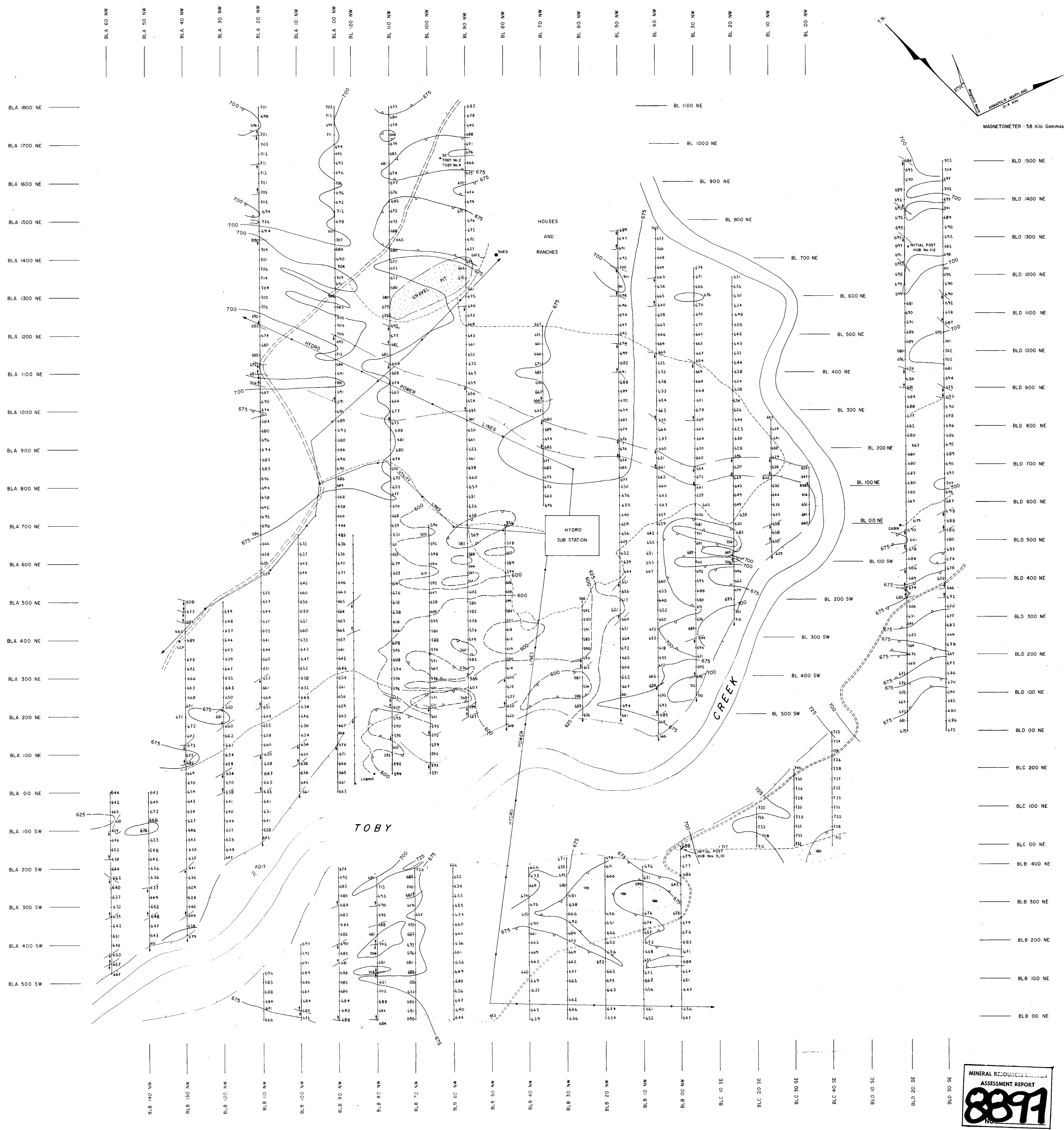
**CONTOURS**  
 CONTOUR INTERVAL - 4'  
 - 0'  
 - 4' AND ABOVE  
 INSTRUMENT - SABRE MODEL 27

To Accompany Geophysical Report by DAVID G. MARK, Geophysicist October 20, 1980

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**CORE RESOURCES LTD.**  
**TOBY CLAIMS**  
 TOBY CREEK, INVERMERE AREA  
 GOLDEN M.D., B.C.

**VL F-EM SURVEY**  
**FRASER FILTER**  
**DATA & CONTOURS**

DRAWN BY: J.C.B.	SCALE: 1:4000	DATE: SEPT, 1980	JOB No. 80-58	SHEET No. 1
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BLA 1800 NE  
BLA 1700 NE  
BLA 1600 NE  
BLA 1500 NE  
BLA 1400 NE  
BLA 1300 NE  
BLA 1200 NE  
BLA 1100 NE  
BLA 1000 NE  
BLA 900 NE  
BLA 800 NE  
BLA 700 NE  
BLA 600 NE  
BLA 500 NE  
BLA 400 NE  
BLA 300 NE  
BLA 200 NE  
BLA 100 NE  
BLA 00 NE  
BLA 100 SW  
BLA 200 SW  
BLA 300 SW  
BLA 400 SW  
BLA 500 SW

BL 1100 NE  
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BLD 1000 NE  
BLD 900 NE  
BLD 800 NE  
BLD 700 NE  
BLD 600 NE  
BLD 500 NE  
BLD 400 NE  
BLD 300 NE  
BLD 200 NE  
BLD 100 NE  
BLC 200 NE  
BLC 100 NE  
BLC 00 NE  
BLB 400 NE  
BLB 300 NE  
BLB 200 NE  
BLB 100 NE  
BLB 00 NE

BLB 140 NW  
BLB 130 NW  
BLB 120 NW  
BLB 110 NW  
BLB 100 NW  
BLB 90 NW  
BLB 80 NW  
BLB 70 NW  
BLB 60 NW  
BLB 50 NW  
BLB 40 NW  
BLB 30 NW  
BLB 20 NW  
BLB 10 NW  
BLB 00 NW  
BLC 10 SE  
BLC 20 SE  
BLC 30 SE  
BLC 40 SE  
BLC 50 SE  
BLC 60 SE  
BLC 70 SE  
BLC 80 SE  
BLC 90 SE

**LEGEND**

- CONTOUR INTERVAL - 25 GAMMAS
- 625 - 625 GAMMAS AND LOWER
- 675 - 675 GAMMAS AND HIGHER
- ESTIMATED MEAN VALUE - 650 GAMMAS (NOT CONTOURED)

Instrument : proton precession Urtec Model UM 220

MINERAL RESOURCES  
ASSESSMENT REPORT  
**88971**

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TOBY CLAIMS  
TOBY CREEK, INVERMERE AREA  
GOLDEN M.D., B.C.

**MAGNETIC SURVEY  
DATA & CONTOURS**

DRAWN BY: J.C.B.	SCALE: 1:4000	DATE: SEPT, 1980	JOB No. 80-58	SHEET No. 2
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