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# AIRBORNE GEOPHYSICS ASSESSMENT REPORT

## BIG BEAVER HOUSE PROPERTY

Kingfisher Lake First Nation, Northwestern Ontario, Canada
NTS: 53A13NW
Townships: Misamikwash Lake and Asinne Lake Areas

Kingfisher Lake First Nation


2609572 ONTARIO INC.
Kingfisher Lake First Nation
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Canada


Date: Dec. 3, 2021


Prepared By:
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## 1.0 SUMMARY

J-J Minerals of Sudbury, Ontario, Canada was contracted by 2609572 Ontario Inc. ("2609572 Ontario") of Kingfisher Lake First Nation, NW Ontario, Canada to write an assessment report for Terraquest Ltd's 2020 airborne geophysics survey on Big Beaver House Property (the "Property"). The airborne survey was completed over 3 flights all on Sept. 18, 2020. This Report interprets the results of the geophysics survey and makes recommendations for a future exploration program. The purpose of this Report is to file the Terraquest 2020 airborne geophysics survey for assessment credit.

Big Beaver House Property is located 12.5 km southwest of Kingfisher Lake FN community, 156 km north of Pickle Lake and 500 km north of Thunder Bay, northwestern Ontario. The center of the Property is located at 304092 m E, 5865465 m N, Zone 16, NAD 83.

Big Beaver House Property consists of 139 single cell mining claims in Misamikwash Lake and Asinne Lake Areas and NTS Sheet: 53A13NW. The claims are held 100% by 2609572 Ontario Inc. and are in good standing. The Property is approximately 5 km x 5 km.

Big Beaver House Carbonatite Complex is emplaced into granitic rocks within the Sachigo Subprovince, Superior Province. An isotopic age of 1109 ± 61 Ma was determined by K-Ar isotopic methods for the complex (Sage, 1987). Aeromagnetic data (ODM-GSC 1960, Map 939G) indicate that it may have been emplaced into an inferred northwest-trending fracture. From the aeromagnetic pattern, the complex is estimated to have a surface area of 16 $km^2$ (Sage, 1987).

Reconnaissance mapping along Misamikwash Lake, 3 km northeast of the complex, indicated that gneissic migmatitic host rocks are composed of massive to foliated biotite and biotite-hornblende trondhjemite to quartz monzonite (Sage 1987). The foliation within these rocks has a northwest strike and vertical to southerly dip.

The Big Beaver House Carbonatite Complex consists predominantly of pyroxenite, ijolite and silicocarbonatite cut by fractures filled with sövite (Sage, 1987). Pyroxenite is the dominant mafic lithology in the Carbonatite Complex.

The host rock for the Carbonatite Complex is **fenitized granitic gneiss** which is exposed only at Pyrochlore Point on Camp Lake (Sage, 1987). The rock consists of 5-10% quartz, 50-70% albite and trace amounts of secondary riebeckite, calcite, phlogopite and apatite and accessory magnetite and pyrite.

**Pyroxenite** is clinopyroxene and phlogopite-rich and some samples contain significant apatite and magnetite. Carbonate may compose up to 20% of the pyroxenite. With the addition of nepheline, the pyroxenite is gradational into ijolite and Sage (1987) noted that they can't be distinguished in outcrop.

**Ijolite** is a nepheline-clinopyroxene rock with minor phase of the pyroxenite.

**Silicocarbonatite** is similar to the sövite but contains less than 50% carbonate. While in some instances it clearly cuts the more mafic phases, in other cases, it may have formed by reaction between the intruding sövite and the more mafic rocks. In these cases, the rock appears gradational into the more mafic phases.

**Sövite** contains abundant calcite and accessory magnetite, apatite, phlogopite-biotite, perovskite, amphibole, and traces of sulphide. White sövite intrudes the mafic pyroxenites and ijolite.

The first mention of Niobium mineralization on the Big Beaver House Property was at Pyrochlore Point, along the south shore of Camp Lake in 1961. A carbonatite dyke was identified and was exposed in trenches and outcrops for a length of 130 ft (=39.6 m) and widths up to 30 ft (=9.1 m) (MNDM assessment report 53A12SE0002, 1961). The dyke strikes northwest-southeast and dips 35° to 60° to the northeast. The dyke's footwall or south contact is altered gneiss and the hanging wall or north contact is under Camp Lake.

The Niobium mineralization at Pyrochlore Point was reported from a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$ (MNDM assessment report 53A12SE0002, 1961). The composite was selected from highly radioactive pieces of carbonatite. The pyrochlore is light olive-green crystals to dark brown. Pyrochlore is fairly abundant along the apatite-amphibole seams which have weathered out to form depressions. Apatite-amphibole is more likely to occur in the border zone of a carbonatite complex.

Mapping in 1961 was followed up by a drill program in 1962. Hole 4 intersected Nb in three intervals: 1.46 % $Nb_2O_5$ over 0.4 ft (0.12 m), 3.05 % $Nb_2O_5$ over 1.0 ft (= 0.30 m) and 5.30% $Nb_2O_5$ over 5.5 ft (=1.7 m) (MNDM assessment report 53A12SE0002, 1962). The intervals contained pyrochlore in pink apatite-rich zones with actinolite and no magnetite. Narrow apatite zones have up to 10% pyrochlore which range in colour from light yellow to amber to olive green to dark brown. Most of the pyrochlore crystals appear to be octahedrons. Thus, the pyrochlore mineralization is associated with a low magnetic zone and topographic low. The intervals had radioactivity twice the background and contained minor to trace pyrrhotite, chalcopyrite and brown mica. Chalcopyrite was in the core immediately adjacent to the pyrochlore-rich mineralization.

A drill program in 1966 intersected Niobium mineralization in Hole 8 which was designed to test the downdip extension of Hole 4 (MNDM assessment report 53A12SE0002, 1966). The hole intersected 2.92 % $Nb_2O_5$ over 5 ft (=1.5 m) with a true width of 2 ft (0.6 m). This interval consists of brown pyrochlore (up to 10%), apatite, calcite, pyrrhotite, chalcopyrite and platy black non-magnetic metallic mineral and a section of magnetite within the pyrochlore zone.

In addition to Niobium mineralization, the Property also has potential for Phosphorus mineralization. In July 1976, the 1966 historic drill core was assayed for phosphorus and apatite-rich sample BB-4 contained 8.80% $P_2O_5$ and sample BB-6 contained 7.28 % $P_2O_5$.

The property also has the potential for rare-earth element mineralization. Partial Rare-Earth Elements analyses conducted by the Ontario Geological Survey on historical drill holes on the property in the 1980's has reported up to 3,200 ppm La+Ce+Nd in silicocarbonatite (Sage, 1982). Of significance is the documentation of loparite [(Ce, Na, Ca)$TiO_3$] in the Big Beaver House Carbonatite complex (Platt, 1994). Loparite may contain up to 34 wt.% total Rare-Earth Elements oxides (TREO) and is an important ore mineral for the Rare-Earth Elements in Russia (TNR Gold press release dated Oct. 14, 2009).

Terraquest Ltd., Markham, Ontario conducted a Tri-boom horizontal magnetic gradient, radiometric and VLF-EM and resistivity helicopter survey over the Big Beaver House Property in 2020 on behalf of 2609572 Ontario Inc (Figure 8-1). The purpose of the survey was to collect geophysical data that can be used to prospect for minerals characterized by anomalous magnetic and radiometric responses. Big Beaver House Property contains abundant magnetite and rare-earth minerals (e.g., apatite and loparite) which typically have a high radioactive response. Also, the geophysical signature can be used to show the geology including rock types, faults, shear zones, folding, alteration zones and other structures. The base of flight operations was Pickle Lake airport, but the refueling was done at Kingfisher First Nation community. The survey was completed over 3 flights all on Sept. 18, 2020.

Terraquest's survey covered all of the Big Beaver House claims as listed in Appendix 2 in Misamikwash Lake and Asinne Lake Areas. The Property was traversed by a helicopter along parallel flight lines over a rectangular block 4.8 km east-west and 5.0 km north-south. There was 48 traverse lines (N-S, 000°/180°) at 100 m spacing for a total of 240.1 line km and 5 tie lines (E-W, 90°/270°) at 1000 m spacing for a total of 24.0 line km. The total line km is 264.1. The mean terrain clearance for the survey was 24.9 m.

Terraquest produced a total of 20 maps from their survey results at a scale of 1:10,000 on the survey block. The Digital Terrain Model shows that the high ground is a ridge in the northwestern part of the Property. The total count radiometerics, Potassium, Thorium and Uranium maps are very similar with anomalies south of Camp Lake and along the ridge in the northwest part of the Carbonatite Complex. The radiometrics anomalies are likely due to the presence of apatite and rare-earth minerals which often contain trace amounts of Uranium and Thorium. The VLF Resistivity Depth Slice at 20 m shows anomalies very similar to the Radiometrics anomalies.

The total magnetic intensity map indicates that the southeast part of the Carbonatite Complex has magnetic anomalies likely due to the presence of magnetite. The map also indicates four possible NW-SE trending faults through the Carbonatite Complex. The radiometric and magnetic anomalies don't overlap except for one area between West and Zero Lakes.

The Qualified Person recommends that future drilling focuses on the areas with radiometric anomalies where Niobium, Phosphorus and Rare-Earth Element mineralization may all occur. Five drill targets have been identified and are shown in Figure 11-1.

- Target 1 is a radiometric high south of Camp Lake where a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$. The composite was selected from highly radioactive pieces of carbonatite. Target 1 is the outer part of the Carbonatite Complex.
- Targets 2 and 3 are similar radiometric anomalies along the outer part of the Carbonatite Complex.
- Targets 4 and 5 are radiometric anomalies closer to the center of the Carbonatite Complex to test if Niobium mineralization also occurs there. Historic Hole 4 is close to Target 4. Hole 4 intersected Nb in three intervals: 1.46 % $Nb_2O_5$ over 0.4 ft (0.12 m), 3.05 % $Nb_2O_5$ over 1.0 ft (=

0.30 m) and 5.30% $Nb_2O_5$ over 5.5 ft (=1.7 m). The intervals contained pyrochlore in pink apatite-rich zones with actinolite and no magnetite.

- Target 6 is a weaker radiometric anomaly also on outer part of the Carbonatite Complex.

It is recommended that the drill program be conducted in the winter for easy access along the winter road and frozen swamps. It is recommended that 5 drill holes 300 m each be drilled on each of the 6 target areas to evaluate to determine which one has the most potential for Niobium, Phosphorus and Rare-Earth Element mineralization. The recommended budget is $1,866,800.

# 2.0 INTRODUCTION

## 2.1 Introduction

J-J Minerals of Sudbury, Ontario, Canada was contracted by 2609572 Ontario Inc. ("2609572 Ontario") of Kingfisher Lake First Nation, NW Ontario, Canada to write an assessment report for Terraquest Ltd's 2020 airborne geophysics survey on Big Beaver House Property (the "Property"). This Report interprets the results of the airborne geophysics survey and make recommendations for a future exploration program. The purpose of this Report is to file an airborne geophysics survey for assessment credit.

Sources of information for this report include Ministry of Northern Development, Mines, Natural Resources and Forestry ("MNDM") assessment files listed in Appendix 3 and references listed in section 12.0. Tenure information was derived from MNDM's MLAS map viewer website (https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/mlas-map-viewer).

## 2.2 Terminology

**Carbonatite:** Carbonatites are defined by the International Union of Geological Sciences (IUGS) as igneous magmatic rocks containing more than 50% modal primary carbonates (Le Maitre, 2002). Depending on the predominant carbonate mineral, a carbonatite is referred to as a 'calcite carbonatite' (sövite), 'dolomite carbonatite' (beforsite) or 'ankerite carbonatite'.

**Ijolite:** An igneous rock consisting of mostly nepheline and augite with nepheline content between 30 and 70% (https://en.wikipedia.org/wiki/Ijolite).

**Pyrochlore:** $(Na,Ca)_2Nb_2O_6(OH,F)$ is a mineral group of the niobium end member of the pyrochlore supergroup (https://en.wikipedia.org/wiki/Pyrochlore). Pyrochlore is typically yellowish or brownish in colour with an octahedral shape. It is commonly found in nepheline syenites and carbonatites. Pyrochlore often contains radioactive uranium and thorium and is an ore mineral for niobium.

**MLAS:** Ontario's mining lands are registered and managed online with the Mining Lands Administration System.

**MNDM**: Ministry of Northern Development, Mines, Natural Resources and Forestry which is the provincial ministry responsible for managing mining claims (Mining Lands Section) and Ontario Geological Survey.

**Silicocarbonatite:** A carbonate-rich igneous rock composed of 50 % or more oxide and silicate minerals (Sage, 1987).

**Sövite:** carbonatite with calcite as the dominant carbonate mineral.

### 2.3 Units

The Metric System is the primary system of measure and length used in this Report and is generally expressed in kilometres (km), metres (m) and centimetres (cm); volume is expressed as cubic metres ($m^3$), mass expressed as metric tonnes (t), area as hectares (ha), and gold and silver concentrations as grams per tonne (g/t). Conversions from the Metric System to the Imperial System are provided below and quoted where practical. Many of the geologic publications and more recent documents now use the Metric System but older documents almost exclusively refer to the Imperial System. Metals and minerals acronyms in this report conform to mineral industry accepted usage and the reader is directed to www.maden.hacettepe.edu.tr/dmmrt/index.html for a glossary.

The term gram/tonne or g/t is expressed as "gram per tonne" where 1 gram/tonne = 1 ppm (part per million) = 1000 ppb (part per billion). The mineral industry accepted terms Au g/t and g/t Au are substituted for "grams gold per metric tonne" or "g Au/t". Other abbreviations include ppb = parts per billion; ppm = parts per million; oz/t = troy ounce per short ton; Moz = million ounces; Mt = million tonne; t = tonne (1000 kilograms); SG = specific gravity; lb/t = pound/ton; and, st = short ton (2000 pounds).

Dollars are expressed in Canadian currency (CAD$) unless otherwise noted. Where quoted, Universal Transverse Mercator (UTM) coordinates are provided in the datum of Canada, WGS 1984, Zone 16U North. Note: the property is very close to the boundary between UTM zone 16 and 15. The Property is within the Central Time Zone, but very close the boundary with Eastern Time Zone.

### 2.4 Qualified Person

The Qualified Person and author for this Report is Dr. Julie Selway, Ph.D., P.Geo., Principal Geologist for J-J Minerals and a geologist in good standing with the Association of Professional Geoscientists of Ontario (APGO # 0738). She supervised a geological mapping program on the Prairie Lake Carbonatite, Good Hope Niobium Property, Northwestern Ontario in 2017 for Plato Gold Corp. She co-authored a NI 43-101 Technical Report on the Upper Fir Carbonatite, Blue River Tantalum and Niobium Property, British Columbia in 2010 for Commerce Resources Corp. She completed a QA/QC review for Niobium drill core assays on the Upper Fir Carbonatite in 2009. Dr. Selway has co-authored over 20 NI 43-101 Technical Reports.

The Certificate of Qualifications for the Qualified Person is given in Appendix 1.

## 3.0 Reliance on Other Experts

This Report was prepared on behalf of the Company and is directed solely for the development and presentation of data with recommendations to allow the Company and current or potential partners to reach informed decisions.

The information, conclusions and recommendations contained herein are based on a review of digital and hard copy data and information supplied to J-J Minerals by the Company, as well as various published geological reports, and discussions with representatives from the Company who are familiar with the Property and the area in general. J-J Minerals has assumed that the reports and other data listed in the "References" section of this report are substantially accurate and complete.

The dates, titles and authors of all reports that were used as a source of information for this Technical Report are listed in the "References" section of this report and MNDM assessment reports used in this Report are given in Appendix 3, Table 13-2. The dates and authors of these reports also appear in the text of this Report where relevant, indicating the extent of the reliance on these reports.

The author of this Report relied on Power Metals' legal counsel and tenure information was derived from MNDM's MLAS map viewer website (https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/mlas-map-viewer).

# 4.0 PROPERTY DESCRIPTION AND LOCATION

## 4.1 Location

Big Beaver House Property is located 12.5 km southwest of Kingfisher Lake FN community, 156 km north of Pickle Lake and 500 km north of Thunder Bay, northwestern Ontario (Figure 4-1). The center of the Property is located at 304092 m E, 5865465 m N, Zone 16, NAD 83.

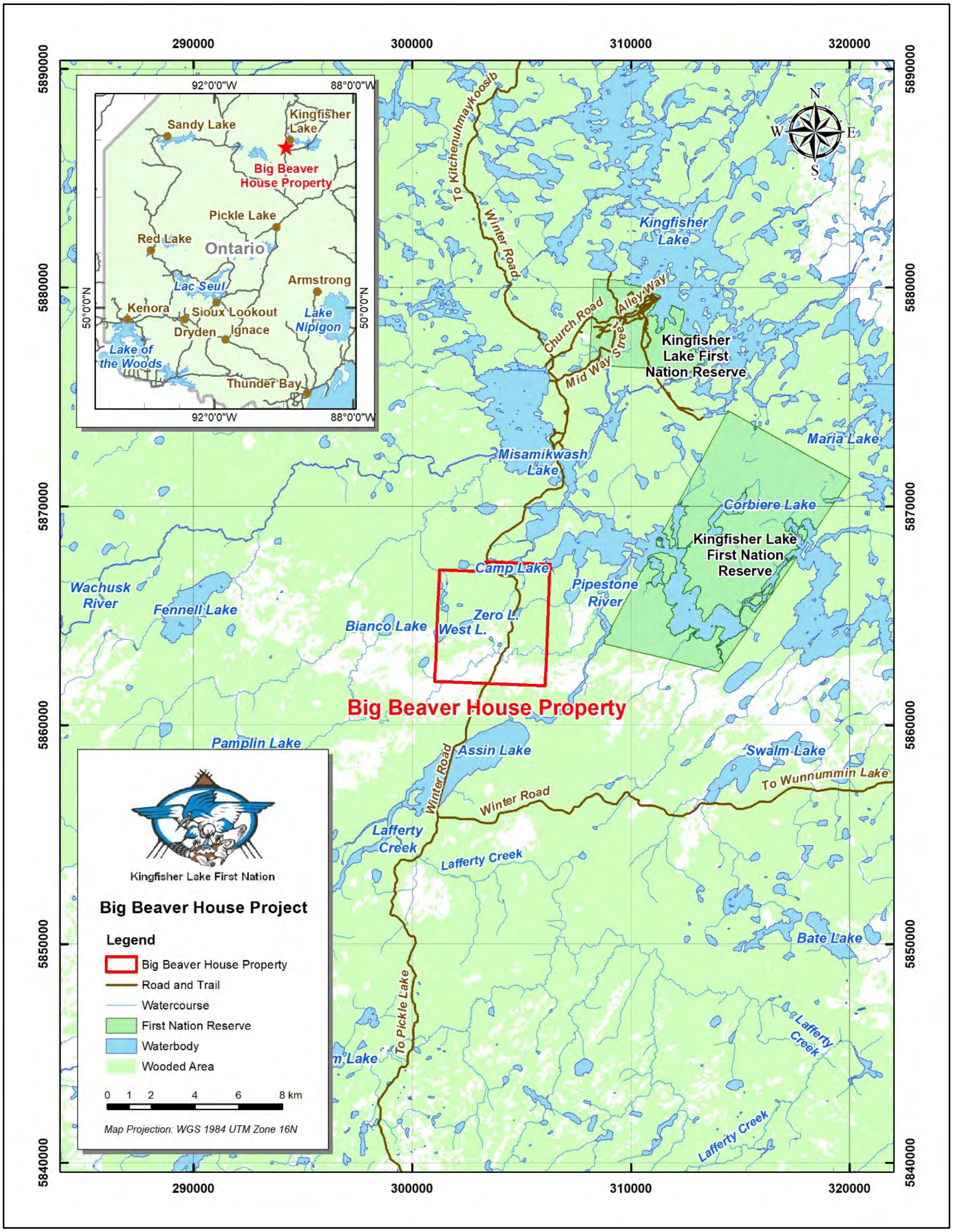



*Figure 4-1 Big Beaver House Property location, north of Pickle Lake, northwestern Ontario.*

### 4.2 Description and Ownership

Big Beaver House Property consists of 139 single cell mining claims in Misamikwash Lake and Asinne Lake Areas and NTS Sheet: 53A13NW (Figure 4-2, Appendix 2, Table 13-1). The claims are held 100% by 2609572 Ontario Inc. and are in good standing. The Property is approximately 5 km x 5 km. A request for a COVID exclusion of time was filed with MNDM and the status of the claims is “hold special circumstances apply” while the request is being processed. Once the request has been approved, the claims due date will be Aug. 20, 2022.

### 4.3 Requirements to Retain the Property and Exploration Plan and Permit

In Ontario, to retain a mining claim, companies must submit an assessment file to MNDM’s Geoscience Assessment Office showing that they have spent $400/per claim unit on exploration on each claim. One claim unit is equal to 16 hectares. The initial mining claim is issued for a term of 2 years and then renewed every year afterwards.

The Big Beaver House Property doesn’t have an Exploration Plan or Exploration Permit.

To the best of the QP’s knowledge, there is no significant factors and risks that may affect access, title or the right or ability to preform work on the Property.

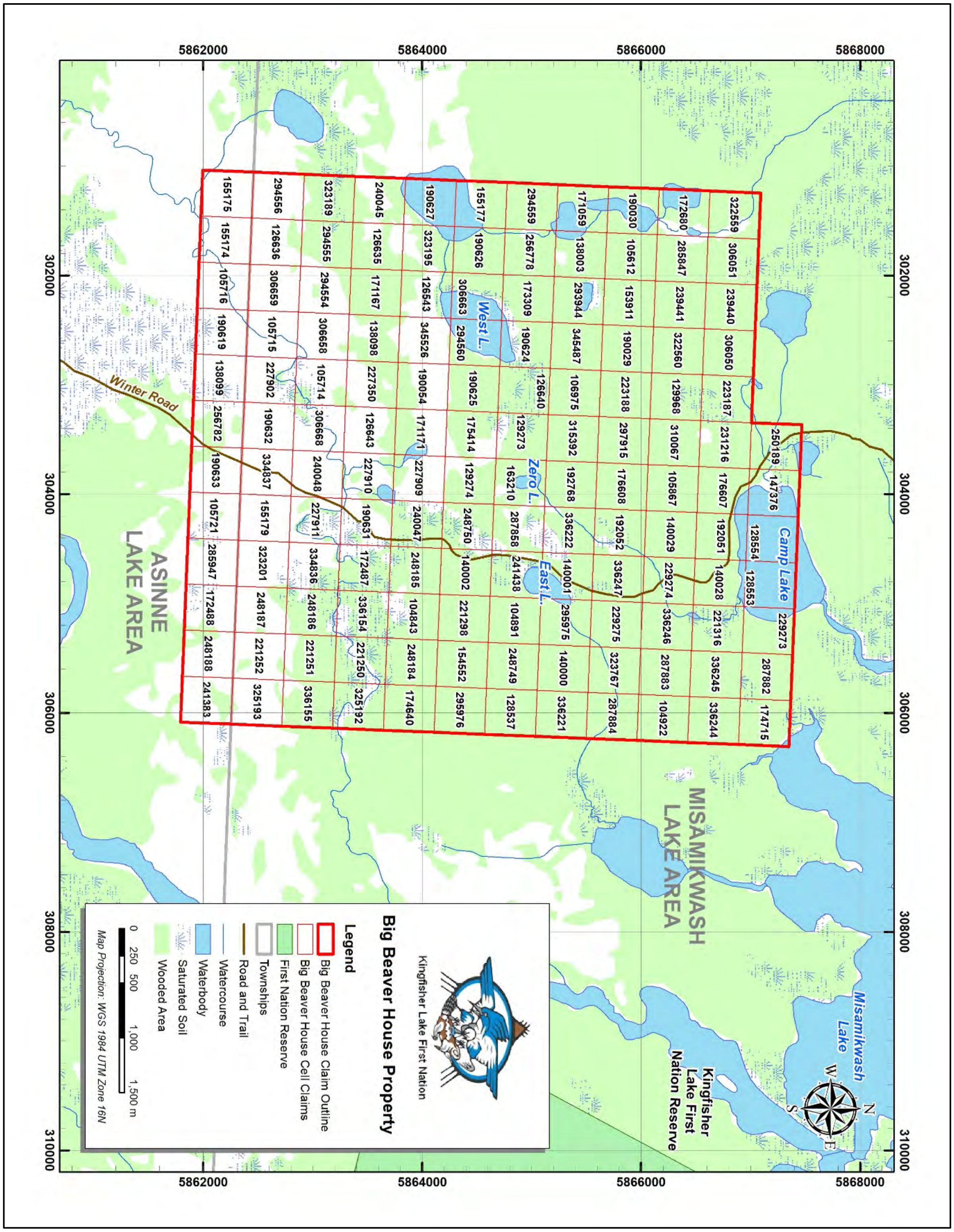



*Figure 4-2 Big Beaver House Property claim map.*

# 5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

## 5.1 Access

There are no provincial highways or year round roads to Kingfisher Lake FN. The main access is by taking Wasaya Airlines from Thunder Bay to Sioux Lookout and then to Kingfisher Lake (Figure 4-1). In the winter, there are winter roads that connect to an all-weather road to Pickle Lake and to other First Nation communities (Northern Ontario winter roads, http://www.mndm.gov.on.ca/sites/default/files/northern_ontario_winter_roads_map.pdf).

For the airborne geophysics survey, Terraquest was based at Pickle Lake and flew their helicopter to Big Beaver House Property. They refueled their helicopter during the survey at Kingfisher Lake.

The access from Kingfisher Lake FN to Big Beaver House Property is by float plane to Camp Lake or by winter road which goes through the middle of the Property.

## 5.2 Climate and Vegetation

The mean temperatures at Kingfisher Lake are -25 ºC to -20 ºC (winter) and 11 ºC to 18 ºC (summer) (http://www.kingfisherlake.ca/). The average historic climate averages for Kingfisher Lake indicates that the daily average temperature ranges from -21ºC in January to 24ºC in July (World Weather online: https://www.worldweatheronline.com/fishing/kingfisher-lake-weather-averages/ontario/ca.aspx). The highest monthly average rainfall is 150 mm in June. The highest monthly average snowfall is 68 cm in April.

The most common trees are balsam, jack pine, spruce and poplar as well as willows. The wildlife includes moose, bears, marten, goose, various ducks, birds, and some eagles.

Drilling can be conducted year-round except for spring thaw in April when it is too muddy in the bush. Geological mapping and outcrop sampling can be conducted mid-May to end of September when there is no snow on the ground. Lakes are free of ice from mid-May to mid-October (MNDM assessment report file 53A12SE0002, 1961).

### 5.3 Physiography

The elevation ranges from 300 m on the hill tops to 260 m around Camp Lake. Outcrops occur along the south shore of Camp Lake (MNDM assessment report 53A12SE0002, 1961). There is an esker ridge that runs N-S between West Lake and Zero Lake and rises 6 to 35 m above the surrounding low ground (Sage, 1997). Glacial deposits dominate the topography with high hills (terminal moraine) of boulders, gravel and sand above flat-lying terrain composted of till and clay deposits (MNDM assessment report 53A12SE0002, 1961).

### 5.4 Infrastructure and Local Resources

The current population for the First Nation is 411 residents (http://www.kingfisherlake.ca/).

The first language of Kingfisher Lake is termed Oji-Cree, which is a mixture of Cree and Ojibway (http://www.kingfisherlake.ca/). However, more then half of the community are able to communicate in English fluently.

Kingfisher Lake has an airport serviced by Wasaya Airlines with connections to Sioux Lookout and Thunder Bay. The nearest railway station is at Savant Lake 300 km south of the Property. There are no provincial highways or roads to the Property, but there is a winter road that goes through the middle of the Property and connects to Pickle Lake.

Sources of water on the Property includes Camp, East, Zero and West Lakes and many swamps.

The Property's surface rights are owned by the crown and they are sufficient for future mining operations.

2609572 Ontario's Big Beaver House project is in the exploration stage and does not yet have NI 43-101 compliant resource/reserve or a prefeasibility study; therefore, discussion on potential tailings storage areas, potential waste disposal areas, heap pad leach pad areas and potential processing tailings storage area for mining operations is not relevant.

# 6.0 HISTORY

## 6.1 1960, Geological Survey of Canada and Ontario Department of Mines

Geological Survey of Canada and Ontario Department of Mines released Aeromagnetic Map No. 939G in 1960 on the Property (Geological Survey of Canada, 1960) (Figure 6-1). The map is based on flight data collected May 1959 to March 1960 by Spartan Air Services Ltd. The map shows a circular magnetic anomaly representing Big Beaver House Carbonatite Complex.

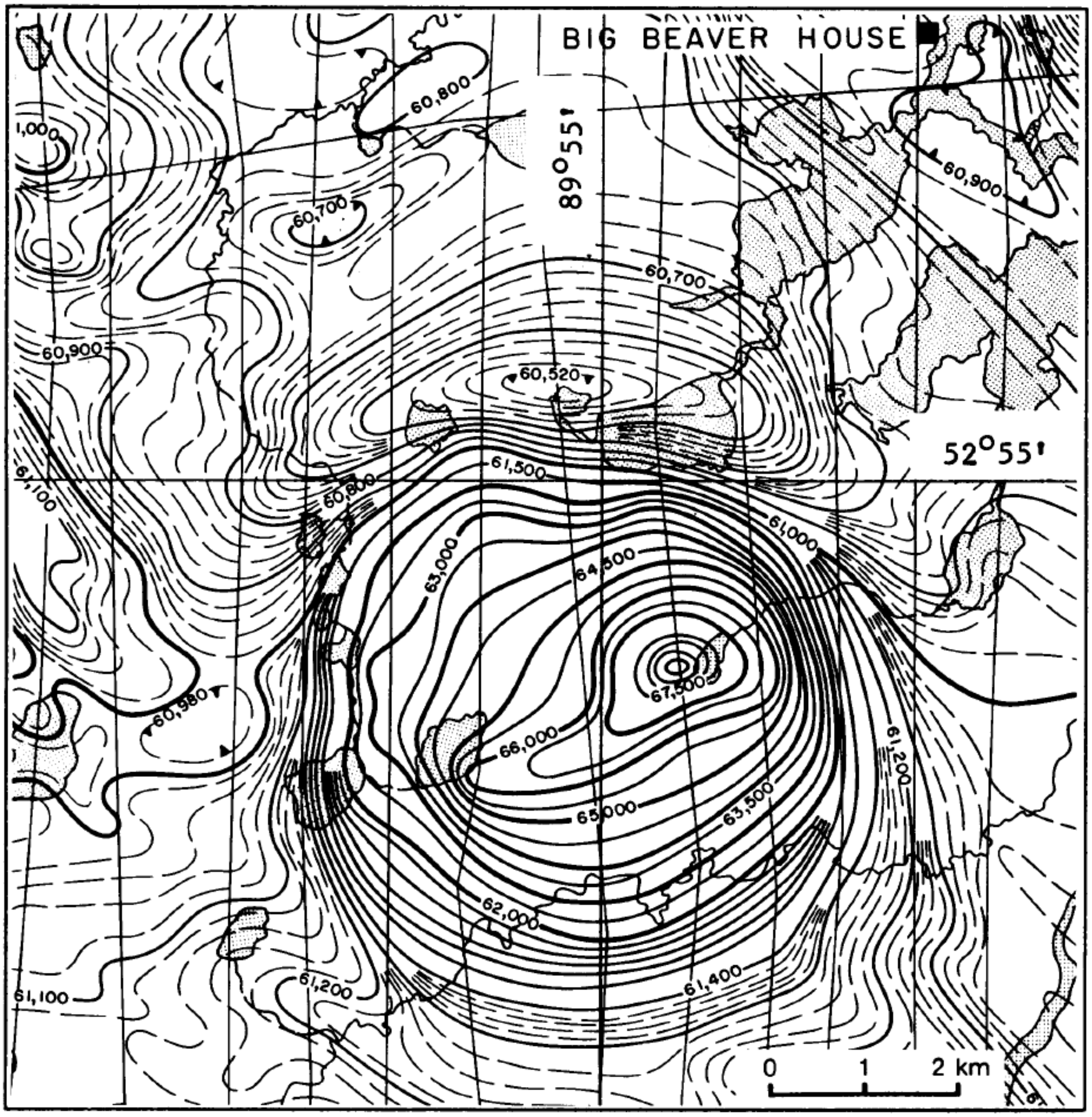



*Figure 6-1 Aeromagnetic map No. 939G of Big Beaver House Carbonatite Complex (Geological Survey of Canada, 1960).*

### 6.2 1961, Many Lakes Exploration Company Ltd.

Many Lakes Exploration Company staked claims on the Big Beaver House Carbonatite in December 1960 based on Aeromagnetic Map No. 939G (MNDM assessment report 53A12SE0002, 1961). Many

Lakes Exploration cut lines and did a ground magnetometer survey on the property in March and April 1961. The company spent May and June 1961 prospecting, mapping, line cutting and doing more magnetometer survey work. Outcrops were noted at Camp Lake. The company spent August 1961 trenching, geological mapping, and additional magnetometer work. The trenching was concentrated on Pyrochlore Point, Camp Lake.

The only outcrops that Many Lakes Exploration found on the Property was along the south shore of Camp Lake. The outcrops consist of carbonatite and gneiss. The gneiss contains pyroxene and biotite at the contact with the carbonatite. Pyrochlore was only found in carbonatite outcrops and boulders near Pyrochlore Point and in boulders on the east shore.

At Pyrochlore Point, along the south shore of Camp Lake, a carbonatite dyke was identified and was exposed in trenches and outcrops for a length of 130 ft (=39.6 m) and widths up to 30 ft (=9.1 m). The dyke strikes northwest-southeast and dips 35° to 60° to the northeast. The dyke's footwall or south contact is altered gneiss and the hanging wall or north contact is under Camp Lake.

Sampling and trenching at Pyrochlore Point indicated that the carbonatite consists of calcite, magnetite, apatite, mica, amphibole and accessory perovskite ($CaTiO_3$), fluorite, pyrochlore and sulphides. The carbonatite dyke consists of calcite, light bright green amphibole and colourless apatite along seams. Bands of nearly massive magnetite several feet across are also present and in some cases contains up to 10% perovskite. Magnetite is common in the east part of the dyke but absent in the west part.

Pyrochlore is fairly abundant along the apatite-amphibole seams which have weathered out to form depressions. Pyrochlore varies from light olive green to dark brown. A 7 ft (=2.1 m) wide sample BBH14 from Pyrochlore Point contained 0.47 % $Nb_2O_5$ in carbonatite. Pyrochlore was noted in three samples (pit No. 3, trench samples 21B and 28D). The assay **1.82 % $Nb_2O_5$** from trench sample 28D was a composite of highly radioactive pieces of carbonatite and was mostly composed of apatite. The sample was also in close proximity to a near massive magnetite band.

Outcrop west of Camp Point has less amphibole and more magnetite (5-10%) than the outcrops at Pyrochlore Point. Apatite is also common, but no pyrochlore was noted although the area was radioactive.

Many Lakes Exploration interpreted their ground magnetometer survey as indicating the pyrochlore can be expected with apatite-magnetite-pyroxene zones in carbonatite. It will not necessarily be in the peaks of the magnetic anomalies, but the peaks will likely be the core of such zones. Some or all of the magnetite highs could be magnetite veins in pyroxenite or ijolite and carry little pyrochlore. Sulphides will likely be associated with magnetic highs.

### 6.3 1962, Many Lakes Exploration Company Ltd.

Many Lakes Exploration Company Ltd. completed a drill program in January and February 1962. The drill program consisted of 9 drill holes and totaled 3207 ft (=977.5 m) (Holes 1 to 7), of which 736 ft (=224.3 m) was overburden and 2471 ft (=753.2 m) was rock (MNDM assessment report 53A12SE0002, 1962) (Figure 6-3). The overburden depth varied from 40-75 ft (=12.2-22.9 m) and averaged 58 ft (17.7 m). The drilling focused on magnetic highs. Holes 3 and 6A were abandoned in overburden (Figure 6-2). Hole 4 had 54 ft (=16.5 m) of overburden consisting of silt, sand and boulders. Additional ground magnetometer surveys were conducted near the drill program.

Drilling intersected vertically-dipping zones of calcite carbonatite interbanded with mafic zones consisting of magnetite, apatite, bronze to green mica and calcite with disseminated pyrrhotite and blebs of chalcopyrite and mafic rock fragments (Ferguson, 1971).

Hole 1 was designed to test the strongest magnetic anomaly on the Property. The hole indicated that the anomaly was caused by apatite-magnetite rock and the adjacent lower magnetic signature was caused by carbonatite. No significant Niobium mineralization was intersected in this hole.

Hole 4 was designed to test the border phase of the carbonatite complex. Hole 4 intersected Nb in three intervals:

- **1.46 % $Nb_2O_5$** over 0.4 ft (0.12 m) (215.9-216.3 ft),
- **3.05 % $Nb_2O_5$** over 1.0 ft (= 0.30 m) (229.5-230.5 ft) and
- **5.30% $Nb_2O_5$** over 5.5 ft (=1.7 m) (234.5-240 ft) (Figure 6-2).

The intervals contained pyrochlore in pink apatite-rich seems with actinolite and no magnetite. Narrow apatite zones have up to 10% pyrochlore which range in colour from light yellow to amber to olive green to dark brown. Most of the pyrochlore crystals appear to be octahedrons. Thus, the pyrochlore mineralization is associated with a low magnetic zone and topographic low. The intervals had radioactivity twice the background and contained minor to trace pyrrhotite, chalcopyrite and brown mica.

Chalcopyrite was in the core immediately adjacent to the pyrochlore-rich mineralization. Many Lakes Exploration recommended that mineralogical studies be completed to determine if some the pyrochlore crystals are actually zircon and to identify the platy black metallic mineral (possible ilmenite).

### 6.4 1966, Teck Corporation

Teck Corporation completed a drill program on claims held by Many Lakes Exploration Company Ltd. in February and March 1966. The drill program consisted of 7 holes and totaled 3002 ft (=915.0 m) (holes T-8 to 14) (MNDM assessment report 53A12SE0002, 1966) (Figure 6-3). Teck entered into an option agreement with Many Lakes Exploration.

Hole 8 was designed to test the downdip extension of hole 4 in an attempt to target the Niobium mineralization (Figure 6-2). The hole intersected **2.92 % $Nb_2O_5$** over 5 ft (=1.5 m) with a true width of 2 ft (0.6 m) from 113.0 to 118.0 ft. This interval consists of brown pyrochlore (up to 10%), apatite, calcite, pyrrhotite, chalcopyrite and platy black non-magnetic metallic mineral and a section of magnetite.

Hole 9 was designed to test the down dip of hole 4 (Figure 6-2). Hole 9 intersected **1.06 % $Nb_2O_5$** over 1.5 ft (=0.5 m) in a carbonatite dyke. This intersection contained streaks of actinolite, apatite, about 5% brown pyrochlore and/or zircon, and pyrrhotite.

Teck concluded that pyrochlore mineralization during drilling was concentrated in streaks and patches in the border phase of the carbonatite dykes in close association with actinolite and apatite. They also suggested that Niobium mineralization might occur towards the center and more carbonate-rich core of the complex.

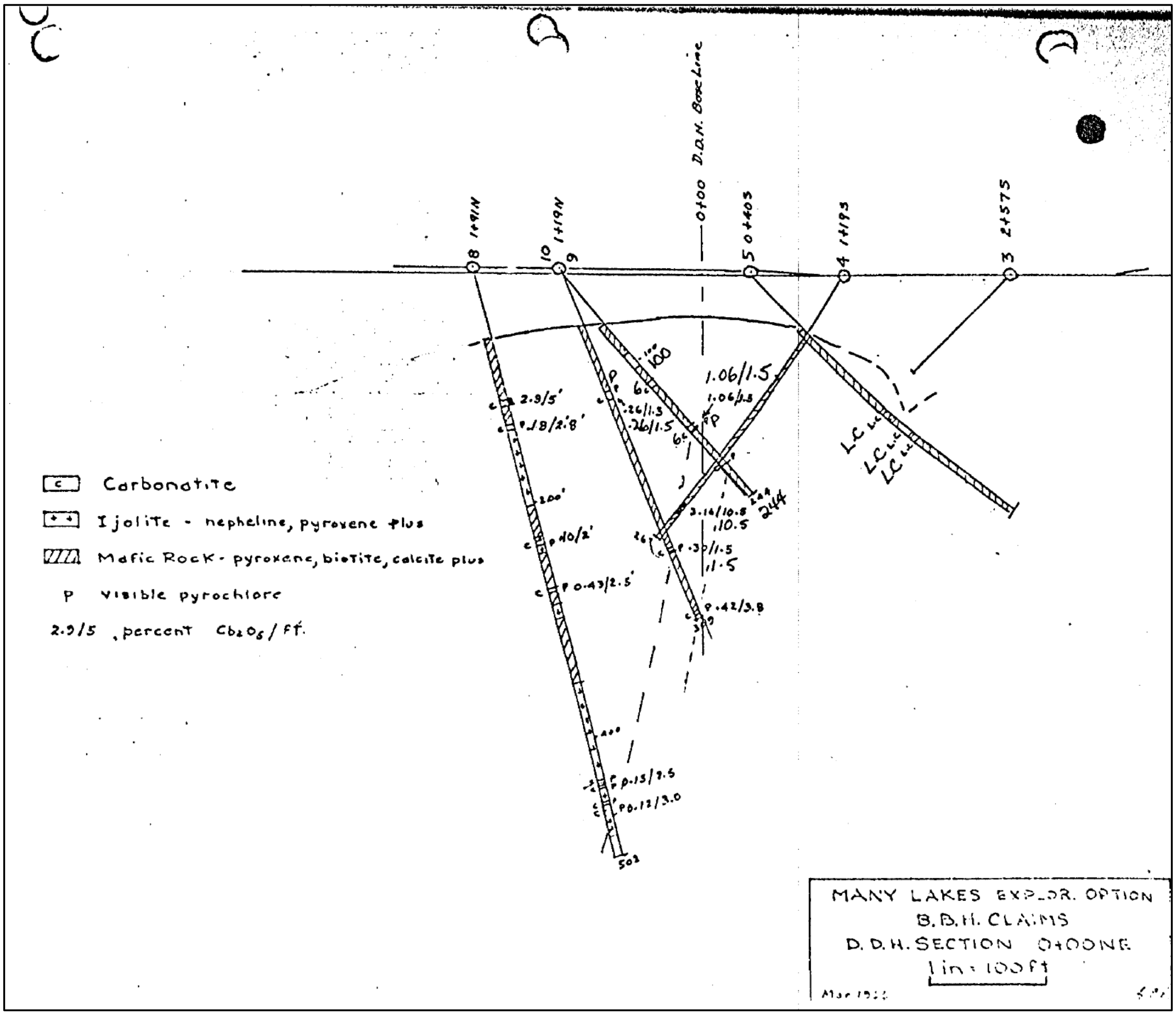



*Figure 6-2 Cross section of holes 3, 4, 5, 8, 9 and 10 (MNDM assessment report 53A12SE0002, 1966).*

### 6.5 1977, International Minerals & Chemical Corporation

International Minerals & Chemical Corporation (Canada) Ltd. staked claims covering the Big Beaver House Carbonatite Complex in October 1975 (MNDM assessment report 53A13NW0001, 1977). International Minerals examined existing drill core in the summer 1976 and conducted mineralogical studies, X-ray analysis and scintillation measurements. They examined the drill core from Teck's 1966 drill program which was left at an old core shack near East Lake. The lithology of the drill core examined was 75% biotite-magnetite calcite carbonatite and 25% is white calcite carbonatite. A minor amount of apatite-biotite rock is interbanded with these rocks. In July 1976, the historic drill core was assayed for phosphorus and apatite-rich sample BB-4 contained 8.80% $P_2O_5$ and sample BB-6 contained 7.28 % $P_2O_5$.

In February 1977, International Minerals drilled 5 holes totaling 630 ft (=192.0 m) (BH-1 to BH-5 series), but significant Niobium mineralization was not intersected (Figure 6-3). International Minerals drill program tested to look for pyrochlore, apatite and magnetite. They chose reverse circulation drilling instead of diamond drilling to improve recovery. They targeted low topography and deep overburden as an indicator of carbonate-rich rocks. The overburden consisted of sand and gravel.

International Minerals drill program mainly intersected dark green biotite pyroxenite with 10-20% magnetite, 5-10% apatite and 5-15% calcite. The predominate dark green pyroxene was determined to be clinopyroxene by x-ray diffraction. Bands of white calcite carbonatite intruded the pyroxenite. The calcite carbonatite contains 5% each of magnetite, phlogopite, apatite and pyrite. Phlogopite and/or magnetite rich bands were common. In March 1977, five samples of core were further examined from their drill program. Assays from drill hole BH-2, 55-60 ft contained 2.80 % $P_2O_5$ within biotite pyroxenite with 5-20% apatite. Drill hole BH-4, 60-65 ft contained 3.60 % $P_2O_5$ within amphibolite with 5-8% apatite and 115-120 ft contained 2.90 % $P_2O_5$ within calcite carbonatite with 5% apatite. X-ray diffraction identified major amounts of andradite (Ca-Fe-garnet) in biotite pyroxenite in hole BH-5.

### 6.6 2009-2012, TNR Gold Corp

TNR Gold Corp staked claims covering the Big Beaver House carbonatite complex in October 2009 (TNR Gold press release dated Oct. 14, 2009). TNR Gold completed a compilation of historic data on the property and presented it a corporate presentation (TNR Gold, 2012). TNR Gold abandoned Big Beaver House Property in 2013 (TNR Gold Management and Discussion Analysis for Dec. 2013).

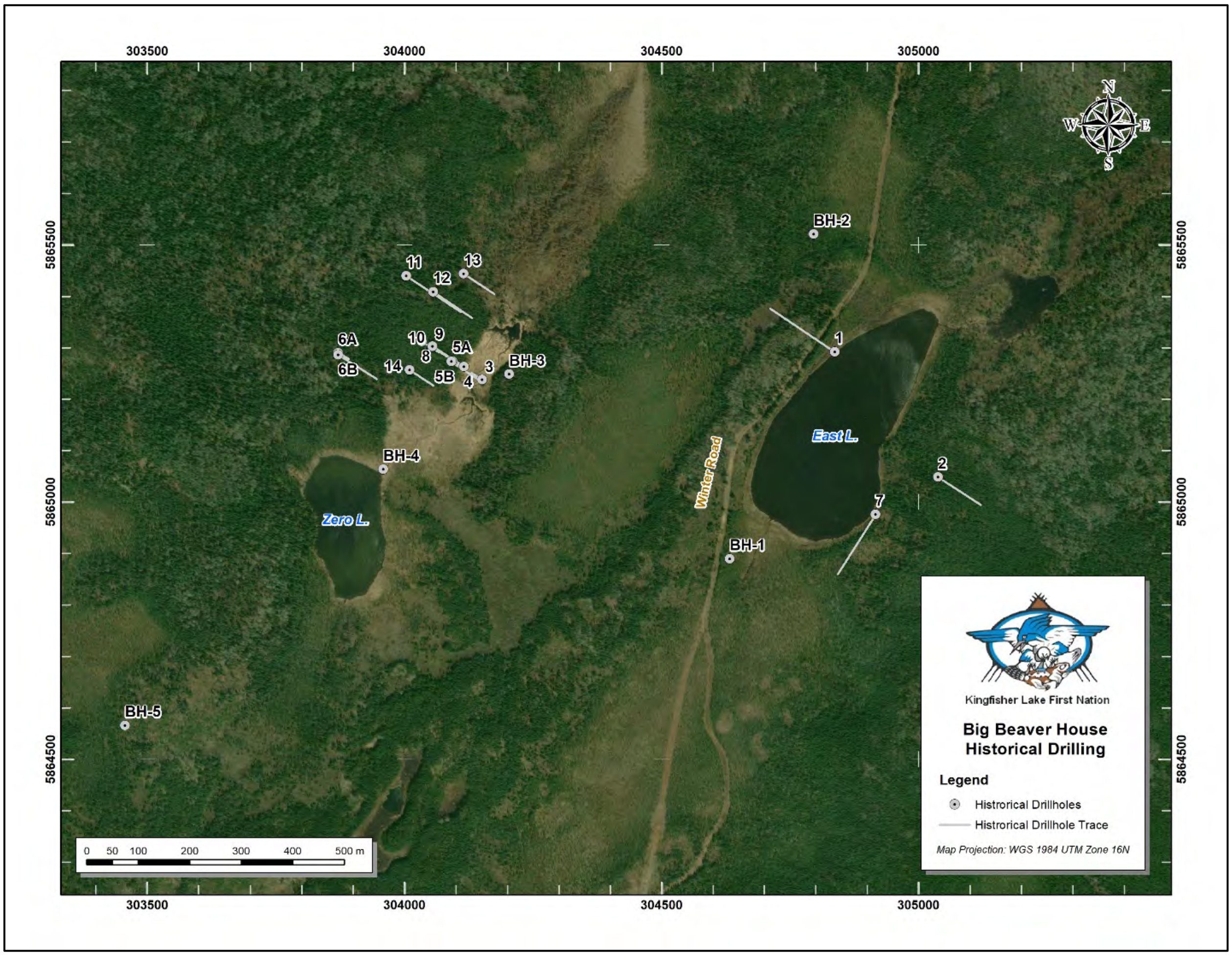



*Figure 6-3 Historical drill hole locations on Big Beaver House Property with satellite image background.*

# 7.0 Geological Setting and Mineralization

## 7.1 Regional Geology

Big Beaver House Carbonatite Complex is emplaced into granitic rocks within the Sachigo Subprovince, Superior Province. An isotopic age of 1109 ± 61 Ma was determined by K-Ar isotopic methods for the complex (Sage, 1987). Aeromagnetic data (ODM-GSC 1960, Map 939G) indicate that it may have been emplaced into an inferred northwest-trending fracture. From the aeromagnetic pattern, the complex is estimated to have a surface area of 16 $km^2$ (Sage, 1987).

Reconnaissance mapping along Misamikwash Lake, 3 km northeast of the complex, indicated that gneissic migmatitic host rocks are composed of massive to foliated biotite and biotite-hornblende trondhjemite to quartz monzonite (Sage 1987). The foliation within these rocks has a northwest strike and vertical to southerly dip.

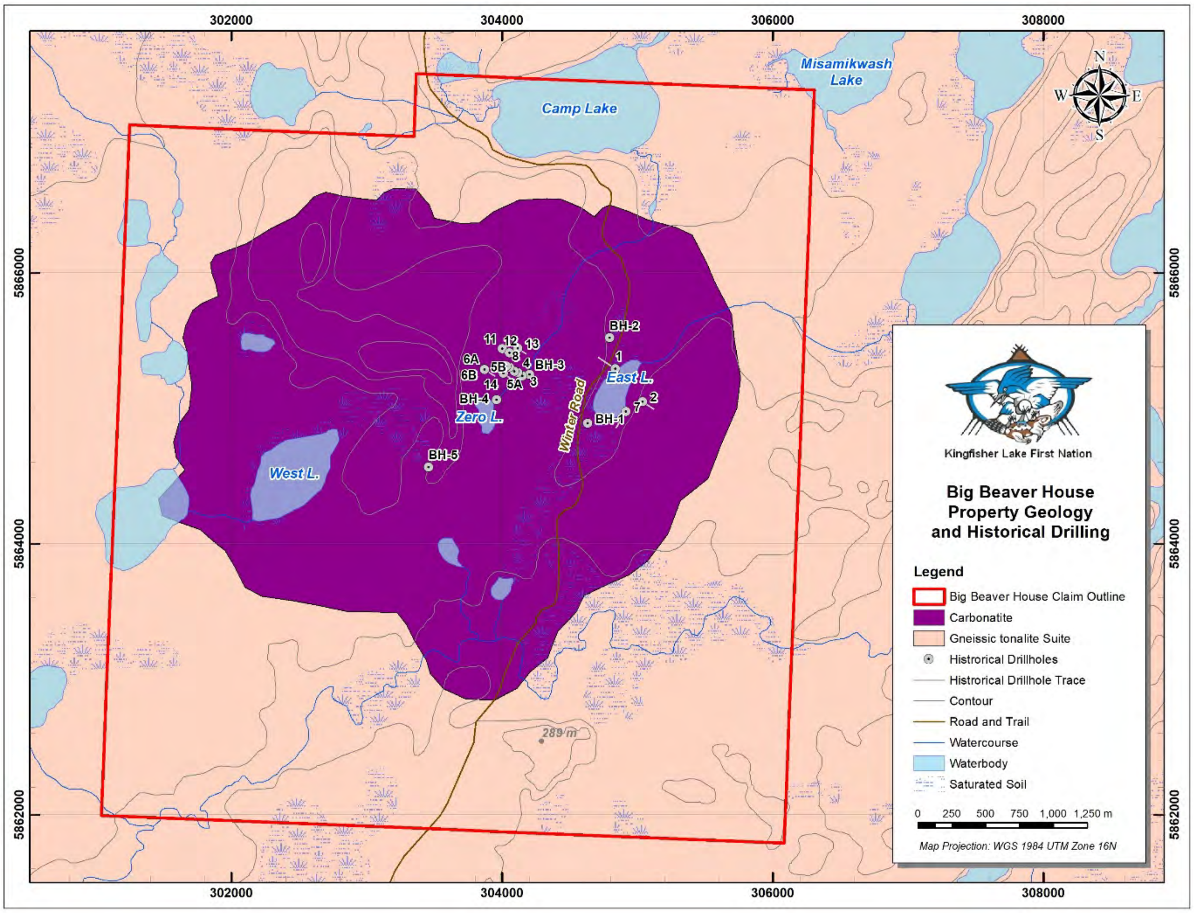



*Figure 7-1 Big Beaver House Property geology historic drill holes map. The outline of the Carbonatite Complex has been modified to match the 2018 total magnetic map.*

### 7.2 Property Geology

The Big Beaver House Carbonatite Complex consists predominantly of pyroxenite, ijolite and silicocarbonatite cut by fractures filled with sövite (Sage, 1987) (Figure 7-2). Pyroxenite is the dominant mafic lithology in the Carbonatite Complex. Minor amounts of magnetite-apatite rock are present. Lithologic and structural mapping have been limited because of the almost complete absence of outcrop and because the activities of exploration companies have been confined to a relatively small area of the complex. The presence of niobium in the Big Beaver House Carbonatite Complex is well documented, however, the complex has not been sufficiently tested to evaluate its potential for rare earth elements, uranium, and primary apatite deposits.

The host rock for the Carbonatite Complex is **fenitized granitic gneiss** which is exposed only at Pyrochlore Point on Camp Lake (Sage, 1987). The fenitized granitic gneiss is patchy pink to blue-green colour depending on the amount of amphiboles present. The rock consists of 5-10% quartz, 50-70% albite and trace amounts of secondary riebeckite, calcite, phlogopite and apatite and accessory magnetite and pyrite.

Based on a thin section study of samples from Big Beaver House Carbonatite Complex, Sage (1987) summarized the lithology units as follows.

**Pyroxenite** is clinopyroxene and phlogopite-rich and some samples contain significant apatite and magnetite. Carbonate may compose up to 20% of the pyroxenite. Minor minerals include garnet, amphibole, perovskite ($CaTiO_3$) and titanite. With the addition of nepheline, the pyroxenite is gradational into ijolite and Sage (1987) noted that they can't be distinguished in outcrop. Whole rock geochemistry indicates that the pyroxenites are dominantly Si, Ca, Mg and Fe.

**Ijolite** is a nepheline-clinopyroxene rock with minor phase of the pyroxenite. Minor minerals include phlogopite, magnetite and carbonate. Whole rock geochemistry indicates that the ijolite is dominantly Si, Ca, Fe and Mg.

**Silicocarbonatite** is similar to the sövite but contains less than 50% carbonate. While in some instances it clearly cuts the more mafic phases, in other cases, it may have formed by reaction between the intruding sövite and the more mafic rocks. In these cases, the rock appears gradational into the more mafic phases. Whole rock geochemistry indicates that the silicocarbonate is dominantly Ca, $CO_2$ and Si.

**Sövite** contains abundant calcite and accessory magnetite, apatite, phlogopite-biotite, perovskite, amphibole, and traces of sulphide. White sövite intrudes the mafic pyroxenites and ijolite (Figure 7-2). Whole rock geochemistry indicates that the sövite is dominantly Ca, $CO_2$ and Si.

**Magnetite-apatite rock** forms a minor phase which was intersected in Hole 1 (MNDM assessment report 53A12SE0002, 1962). In addition to magnetite and apatite, this assessment report reported the presence of minor mica, pyroxene, and calcite and disseminated pyrrhotite.

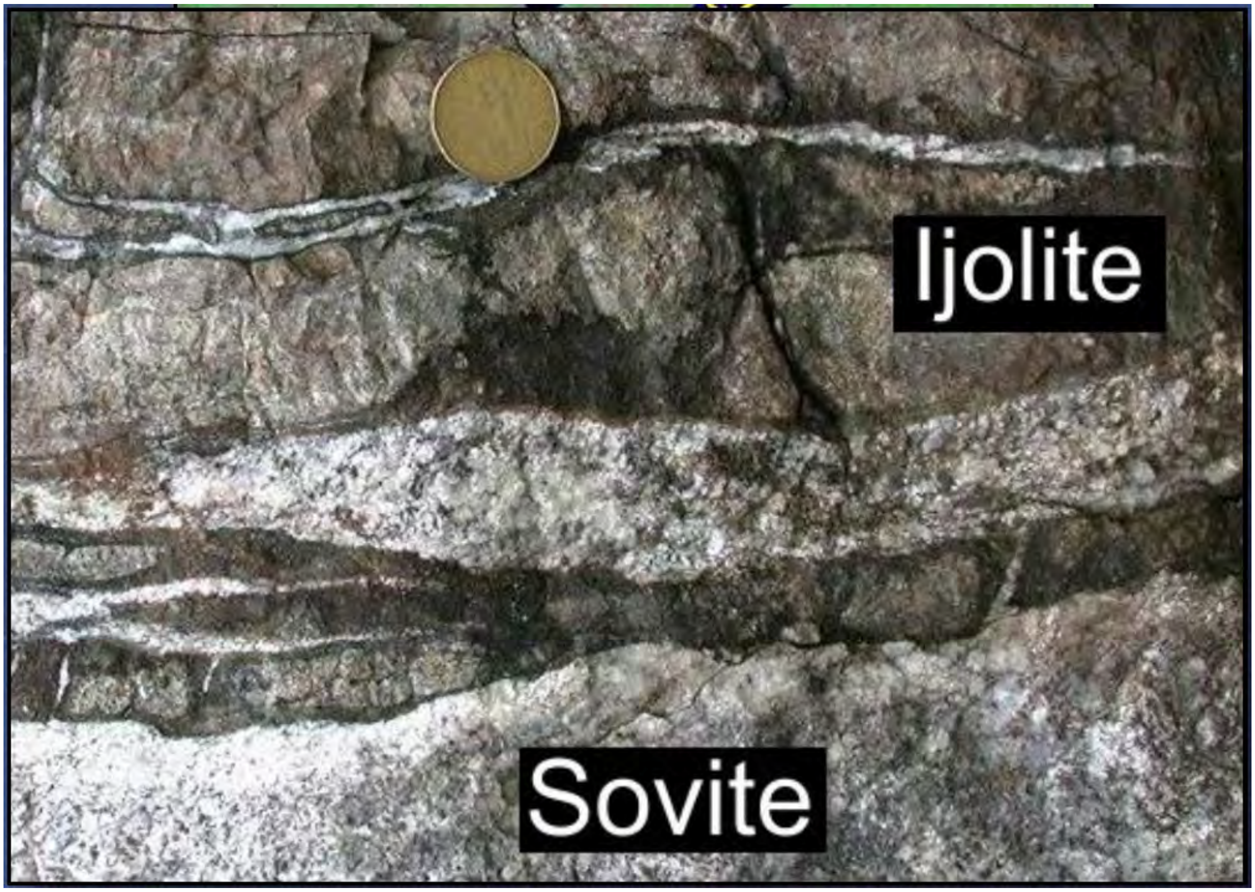



*Figure 7-2 Big Beaver House outcrop photo (TNR Gold Corp. corporate presentation, July 2012).*

### 7.3 Mineralization

The first mention of Niobium mineralization on the Big Beaver House Property was at Pyrochlore Point, along the south shore of Camp Lake in 1961. A carbonatite dyke was identified and was exposed in trenches and outcrops for a length of 130 ft (=39.6 m) and widths up to 30 ft (=9.1 m) (MNDM assessment report 53A12SE0002, 1961). The dyke strikes northwest-southeast and dips 35° to 60° to the northeast. The dyke's footwall or south contact is altered gneiss and the hanging wall or north contact is under Camp Lake.

The Niobium mineralization at Pyrochlore Point was reported from a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$ (MNDM assessment report

53A12SE0002, 1961). The composite was selected from highly radioactive pieces of carbonatite. The pyrochlore is light olive-green crystals to dark brown. Pyrochlore is fairly abundant along the apatite-amphibole seams which have weathered out to form depressions. Apatite-amphibole is more likely to occur in the border zone of a carbonatite complex.

Mapping in 1961 was followed up by a drill program in 1962. Hole 4 was designed to test the border phase of the carbonatite complex. Hole 4 intersected Nb in three intervals:

- **1.46 % $Nb_2O_5$** over 0.4 ft (0.12 m) (215.9-216.3 ft),
- **3.05 % $Nb_2O_5$** over 1.0 ft (= 0.30 m) (229.5-230.5 ft) and
- **5.30% $Nb_2O_5$** over 5.5 ft (=1.7 m) (234.5-240 ft) (Figure 6-2).

(MNDM assessment report 53A12SE0002, 1962). The intervals contained pyrochlore in pink apatite-rich seems with actinolite and no magnetite. Narrow apatite zones have up to 10% pyrochlore which range in colour from light yellow to amber to olive green to dark brown. Most of the pyrochlore crystals appear to be octahedrons. Thus, the pyrochlore mineralization is associated with a low magnetic zone and topographic low. The intervals had radioactivity twice the background and contained minor to trace pyrrhotite, chalcopyrite and brown mica. Chalcopyrite was in the core immediately adjacent to the pyrochlore-rich mineralization.

A drill program in 1966 intersected Niobium mineralization in Hole 8 which was designed to test the downdip extension of Hole 4 (MNDM assessment report 53A12SE0002, 1966). The hole intersected 2.92 % $Nb_2O_5$ over 5 ft (=1.5 m) with a true width of 2 ft (0.6 m). This interval consists of brown pyrochlore (up to 10%), apatite, calcite, pyrrhotite, chalcopyrite and platy black non-magnetic metallic mineral and a section of magnetite within the pyrochlore zone.

In addition to Niobium mineralization, the Property also has potential for Phosphorus mineralization. In July 1976, the 1966 historic drill core was assayed for phosphorus and apatite-rich sample BB-4 contained 8.80% $P_2O_5$ and sample BB-6 contained 7.28 % $P_2O_5$.

The property also has the potential for rare-earth element mineralization. Partial Rare-Earth Elements analyses conducted by the Ontario Geological Survey on historical drill holes on the property in the 1980's has reported up to 3,200 ppm La+Ce+Nd in apatite-magnetite-clinopyroxene-phlogopite silicocarbonatite, sample 1077 (Sage, 1982). This sample also had possible titanite ($CaTiSiO_5$). Ontario

Geological Survey sample 1085 has 2,840 ppm La+Ce+Nd in magnetite-titanite-amphibole-phlogopite sövite (Sage, 1982). Of significance is the documentation of loparite [(Ce, Na, Ca)$TiO_3$] in the Big Beaver House Carbonatite complex (Platt, 1994). Loparite may contain up to 34 wt.% total Rare-Earth Elements oxides (TREO) and is an important ore mineral for the Rare-Earth Elements in Russia (TNR Gold press release dated Oct. 14, 2009).

### 7.4 Geological Deposit Type

The Big Beaver House Property covers the Big Beaver House Carbonatite Complex which consists of pyroxenite, ijolite and silicocarbonatite cut by fractures filled with sövite (Sage, 1987). Carbonatites may contain economic quantities of niobium, tantalum, phosphorus and rare-earth elements. Carbonatites are typically vertical plugs/dykes that are zoned with fenites in the outer zone and carbonate-rich carbonatites in the inner core.

## 8.0 EXPLORATION

### 8.1 Airborne Geophysics Survey

Terraquest Ltd., Markham, Ontario conducted a Tri-boom horizontal magnetic gradient, radiometric and VLF-EM and resistivity helicopter survey over the Big Beaver House Property in 2020 on behalf of 2609572 Ontario Inc (Figure 8-1). The purpose of the survey was to collect geophysical data that can be used to prospect for minerals characterized by anomalous magnetic and radiometric responses. Big Beaver House Property contains abundant magnetite and rare-earth minerals (e.g., apatite and loparite) which typically have a high radioactive response. Also, the magnetic geophysical signature can be used to show the geology including rock types, faults, shear zones, folding, alteration zones and other structures.

The base of flight operations was Pickle Lake airport, but the refueling was done at Kingfisher First Nation community. The survey was completed over 3 flights all on Sept. 18, 2020. Flight #1 was positioning to Kingfisher Lake and refueling. Flight #2 was survey with return to Kingfisher Lake for refueling. Flight #3 completed the survey, background water line and return to Pickle Lake.

#### *8.1.1 Survey Parameters*

Terraquest's survey covered all of the Big Beaver House claims as listed in Appendix 2 in Misamikwash Lake and Asinne Lake Areas (Table 8-1 and Table 8-2). The Property was traversed by a helicopter along parallel flight lines over a rectangular block 4.8 km east-west and 5.0 km north-south (Figure 8-2 and Figure 8-3). There was 48 traverse lines (N-S, 000°/180°) at 100 m spacing for a total of 240.1 line km and 5 tie lines (E-W, 90°/270°) at 1000 m spacing for a total of 24.0 line km. The total line km is 264.1. The mean terrain clearance for the survey was 24.9 m.

The full report from Terraquest with the details of the survey including descriptions of the survey specifications, geophysical equipment, base station equipment, tests and calibrations and data processing is given in Appendix 4.

*Figure 8-1 Photo of Terraquest's tri-boom multi sensor helicopter with 3 magnetometers.*

*Table 8-1 UTM corner coordinates for Terraquest's airborne geophysics survey, Z 16, NAD 83.*

| Corner | Easting | Northing |
|---|---|---|
| 1 - SW | 301300 | 5862000 |
| 2 - NW | 301300 | 5867000 |

| | | |
|---|---|---|
| 3 - NE | 306100 | 5867000 |
| 4 - SE | 306100 | 5862000 |
| | | |

*Table 8-2 Number of line km flown per cell claim, Big Beaver House Property.*

| Cell Claim | Line km flown (m) | Line km flown (km) |
|---|---|---|
| 104843 | 1860 | 1.86 |
| 104891 | 1860 | 1.86 |
| 104922 | 930 | 0.93 |
| 105612 | 1860 | 1.86 |
| 105714 | 1860 | 1.86 |
| 105715 | 2281 | 2.28 |
| 105716 | 2076 | 2.08 |
| 105721 | 1321 | 1.32 |
| 105867 | 2282 | 2.28 |
| 106975 | 2281 | 2.28 |
| 126543 | 1860 | 1.86 |
| 126635 | 2281 | 2.28 |
| 126636 | 2281 | 2.28 |
| 126640 | 1860 | 1.86 |
| 126643 | 2281 | 2.28 |
| 128537 | 1395 | 1.40 |
| 128553 | 223 | 0.22 |
| 128554 | 186 | 0.19 |
| 129273 | 1860 | 1.86 |
| 129274 | 2281 | 2.28 |
| 129968 | 2281 | 2.28 |
| 138003 | 2281 | 2.28 |
| 138098 | 2281 | 2.28 |
| 138099 | 1517 | 1.52 |
| 140000 | 2281 | 2.28 |
| 140001 | 2281 | 2.28 |
| 140002 | 2281 | 2.28 |
| 140028 | 2515 | 2.52 |
| 140029 | 2277 | 2.28 |
| 147376 | 77 | 0.08 |
| 153911 | 1860 | 1.86 |
| 154552 | 2281 | 2.28 |

| Cell Claim | Line km flown (m) | Line km flown (km) |
|---|---|---|
| 155174 | 1730 | 1.73 |
| 155175 | 884 | 0.88 |
| 155177 | 1657 | 1.66 |
| 155179 | 2281 | 2.28 |
| 163210 | 2325 | 2.33 |
| 171059 | 2162 | 2.16 |
| 171167 | 2281 | 2.28 |
| 171171 | 1860 | 1.86 |
| 172487 | 2281 | 2.28 |
| 172488 | 1187 | 1.19 |
| 172680 | 1736 | 1.74 |
| 173309 | 1860 | 1.86 |
| 174640 | 1395 | 1.40 |
| 174715 | 199 | 0.20 |
| 175414 | 2281 | 2.28 |
| 176607 | 1926 | 1.93 |
| 176608 | 1860 | 1.86 |
| 190029 | 1860 | 1.86 |
| 190030 | 1860 | 1.86 |
| 190054 | 1860 | 1.86 |
| 190619 | 1583 | 1.58 |
| 190624 | 1860 | 1.86 |
| 190625 | 2281 | 2.28 |
| 190626 | 2281 | 2.28 |
| 190627 | 1395 | 1.40 |
| 190631 | 2281 | 2.28 |
| 190632 | 2281 | 2.28 |
| 190633 | 1388 | 1.39 |
| 192051 | 2502 | 2.50 |
| 192052 | 1860 | 1.86 |
| 192768 | 2330 | 2.33 |
| 221250 | 2281 | 2.28 |
| 221251 | 2325 | 2.33 |
| 221252 | 2281 | 2.28 |
| 221298 | 2281 | 2.28 |
| 221316 | 2281 | 2.28 |
| 223187 | 1806 | 1.81 |
| 223188 | 1860 | 1.86 |
| 227350 | 2746 | 2.75 |
| 227902 | 2281 | 2.28 |

| Cell Claim | Line km flown (m) | Line km flown (km) |
|---|---|---|
| 227909 | 1860 | 1.86 |
| 227910 | 2281 | 2.28 |
| 227911 | 1860 | 1.86 |
| 229273 | 286 | 0.29 |
| 229274 | 1870 | 1.87 |
| 229275 | 2325 | 2.33 |
| 231216 | 2325 | 2.33 |
| 239440 | 1659 | 1.66 |
| 239441 | 2281 | 2.28 |
| 240045 | 1615 | 1.62 |
| 240047 | 1860 | 1.86 |
| 240048 | 1860 | 1.86 |
| 241383 | 1060 | 1.06 |
| 241438 | 1860 | 1.86 |
| 248184 | 1860 | 1.86 |
| 248185 | 2325 | 2.33 |
| 248186 | 1860 | 1.86 |
| 248187 | 2281 | 2.28 |
| 248188 | 1124 | 1.12 |
| 248749 | 1860 | 1.86 |
| 248750 | 2746 | 2.75 |
| 250189 | 11 | 0.01 |
| 256778 | 2325 | 2.33 |
| 256782 | 1460 | 1.46 |
| 285847 | 2278 | 2.28 |
| 285947 | 1257 | 1.26 |
| 287858 | 1860 | 1.86 |
| 287882 | 352 | 0.35 |
| 287883 | 1860 | 1.86 |
| 287884 | 930 | 0.93 |
| 293944 | 2281 | 2.28 |
| 294554 | 1860 | 1.86 |
| 294555 | 1860 | 1.86 |
| 294556 | 1111 | 1.11 |
| 294559 | 1395 | 1.40 |
| 294560 | 2281 | 2.28 |
| 295975 | 2281 | 2.28 |
| 295976 | 1722 | 1.72 |
| 297915 | 2325 | 2.33 |
| 306050 | 2164 | 2.16 |

| Cell Claim | Line km flown (m) | Line km flown (km) |
|---|---|---|
| 306051 | 1594 | 1.59 |
| 306658 | 1860 | 1.86 |
| 306659 | 2746 | 2.75 |
| 306663 | 2746 | 2.75 |
| 306668 | 2325 | 2.33 |
| 310067 | 2277 | 2.28 |
| 315392 | 2281 | 2.28 |
| 322559 | 1524 | 1.52 |
| 322560 | 2746 | 2.75 |
| 323189 | 1395 | 1.40 |
| 323195 | 1860 | 1.86 |
| 323201 | 2281 | 2.28 |
| 323767 | 1860 | 1.86 |
| 325192 | 1762 | 1.76 |
| 325193 | 2266 | 2.27 |
| 334836 | 1856 | 1.86 |
| 334837 | 2741 | 2.74 |
| 336154 | 2741 | 2.74 |
| 336155 | 1392 | 1.39 |
| 336221 | 1679 | 1.68 |
| 336222 | 2277 | 2.28 |
| 336244 | 1174 | 1.17 |
| 336245 | 2271 | 2.27 |
| 336246 | 2320 | 2.32 |
| 336247 | 1856 | 1.86 |
| 345487 | 2277 | 2.28 |
| 345526 | 2320 | 2.32 |
| **Total** | **264,099.00** | **264.10** |

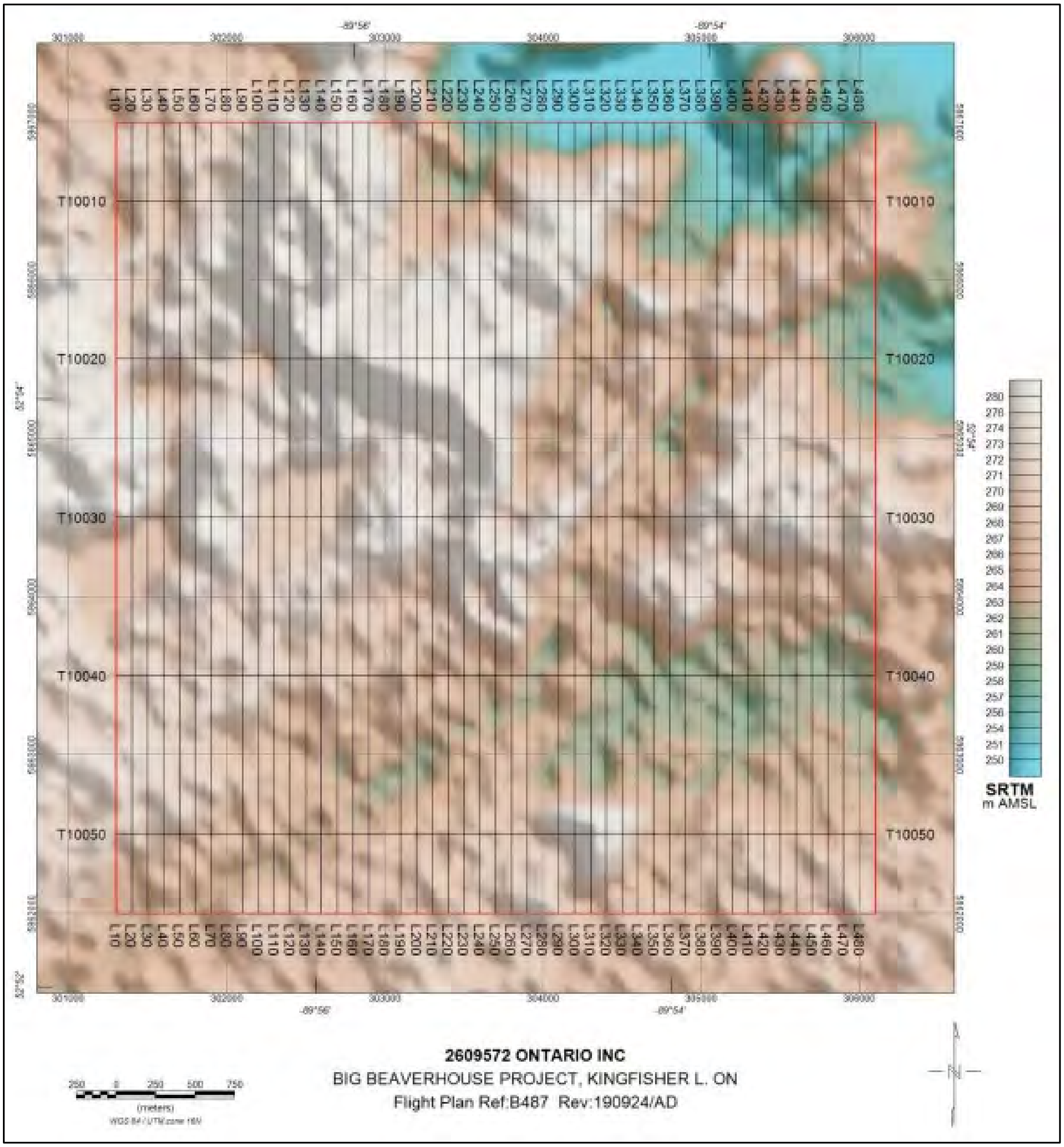



*Figure 8-2 Map of flight lines on satellite digital terrain model for Terraquest's geophysical survey, Big Beaver House Property, UTM Z 16, NAD 83.*

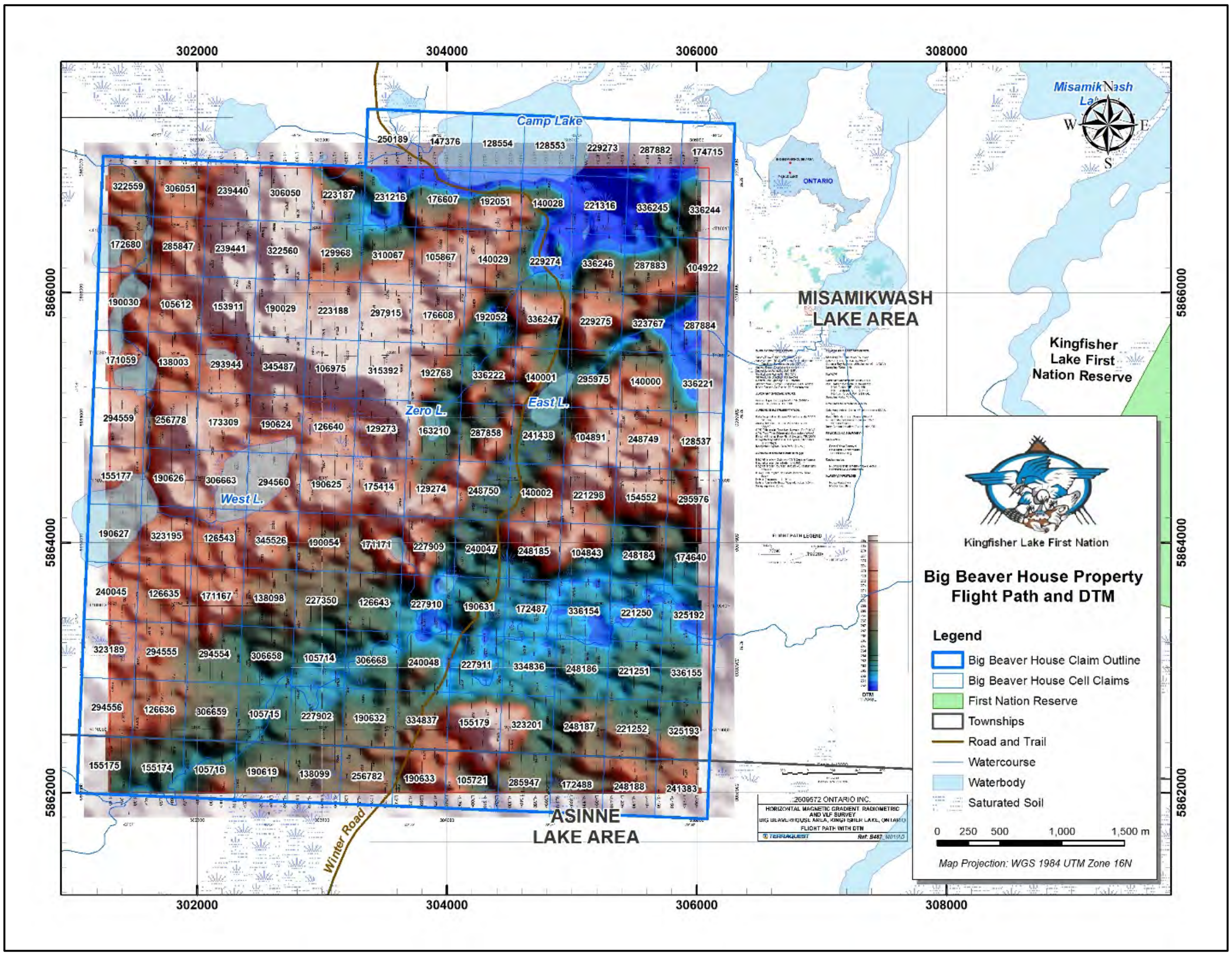



*Figure 8-3 Flight path and Digital Terrain Model overlapped with cell claims, Big Beaver House Property.*

### *8.1.1 Survey Results*

Terraquest produced a total of 20 maps from their survey results at a scale of 1:10,000 on the survey block as listed in Table 8-3 and given in Appendix 4.

*Table 8-3 List of Terraquest's maps produced from the survey.*

| Map Number | Map Title |
|---|---|
| 1 | Flight Path with DTM grid |
| 2 | Total Magnetic Intensity |

| Map Number | Map Title |
|---|---|
| 3 | Anomalous (IGRF corrected) Total Field with contours |
| 4 | Calculated Vertical Magnetic Derivative |
| 5 | Calculated Analytic Signal |
| 6 | Measured East-West Magnetic Gradient |
| 7 | Measured North-South Magnetic Gradient |
| 8 | Reconstructed Total Field (from Horizontal Gradient) |
| 9 | Total Count (Radiometrics) |
| 10 | Potassium |
| 11 | Uranium |
| 12 | Thorium |
| 13 | Ternary Radiometerics (Standard) |
| 14 | Ternary Radiometerics (Normalized) |
| 15 | VLF Amplitude (Total Field) - Station NAA (Culter, Maine) |
| 16 | VLF Amplitude (Total Field) - Station NML (LaMoure, ND) |
| 17 | VLF Amplitude (Total Field) - Station NLK (Jim Creek, WA) |
| 18 | Montage of 6 VLF Resistivity Depth Slices - Station NAA (Culter, Maine) |
| 19 | Montage of 6 VLF Resistivity Depth Slices - Station NML (LaMoure, ND) |
| 20 | Montage of 6 VLF Resistivity Depth Slices - Station NLK (Jim Creek, WA) |

The Digital Terrain Model (DTM) shows that the low ground is in the southern part of the Property in the swamps along the river that flows north to Pipestone River and south of Camp Lake (Figure 8-4). The DTM shows that the high ground is a ridge in the northwestern part of the Property.

The total magnetic intensity map indicates that the southeast part of the Carbonatite Complex has magnetic anomalies likely due to the presence of magnetite (Figure 8-5). The map also indicates four possible NW-SE trending faults through the Carbonatite Complex.

The total count radiometerics, Potassium, Thorium and Uranium maps are very similar with anomalies south of Camp Lake and along the ridge in the northwest part of the Carbonatite Complex (Figure 8-6). The radiometrics anomalies are likely due to the presence of apatite and rare-earth minerals which often contain trace amounts of Uranium and Thorium. The radiometric and magnetic anomalies don't overlap except for one area between West and Zero Lakes.

The VLF Resistivity Depth Slice at 20 m shows anomalies very similar to the Radiometrics anomalies (Figure 8-7).

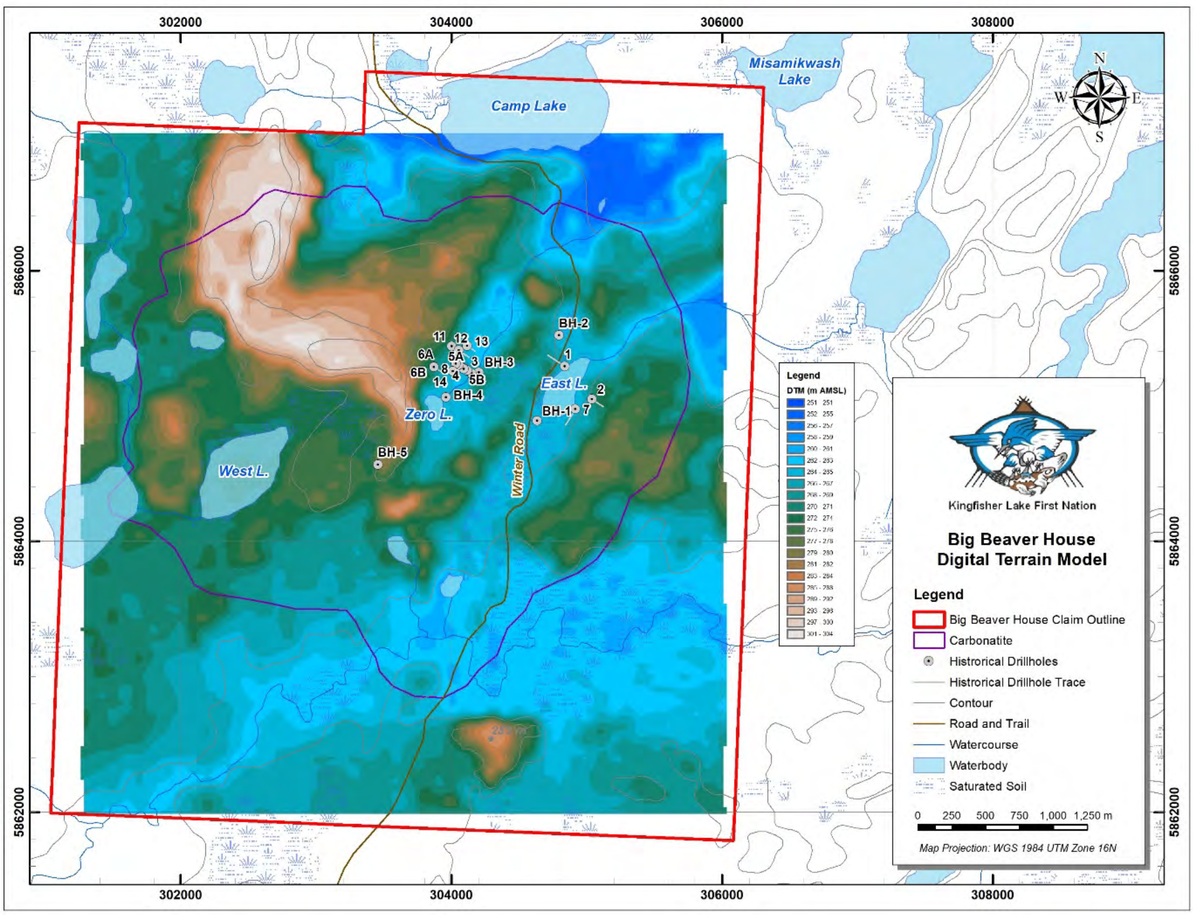



*Figure 8-4 Digital Terrain Model image for Big Beaver House Property.*

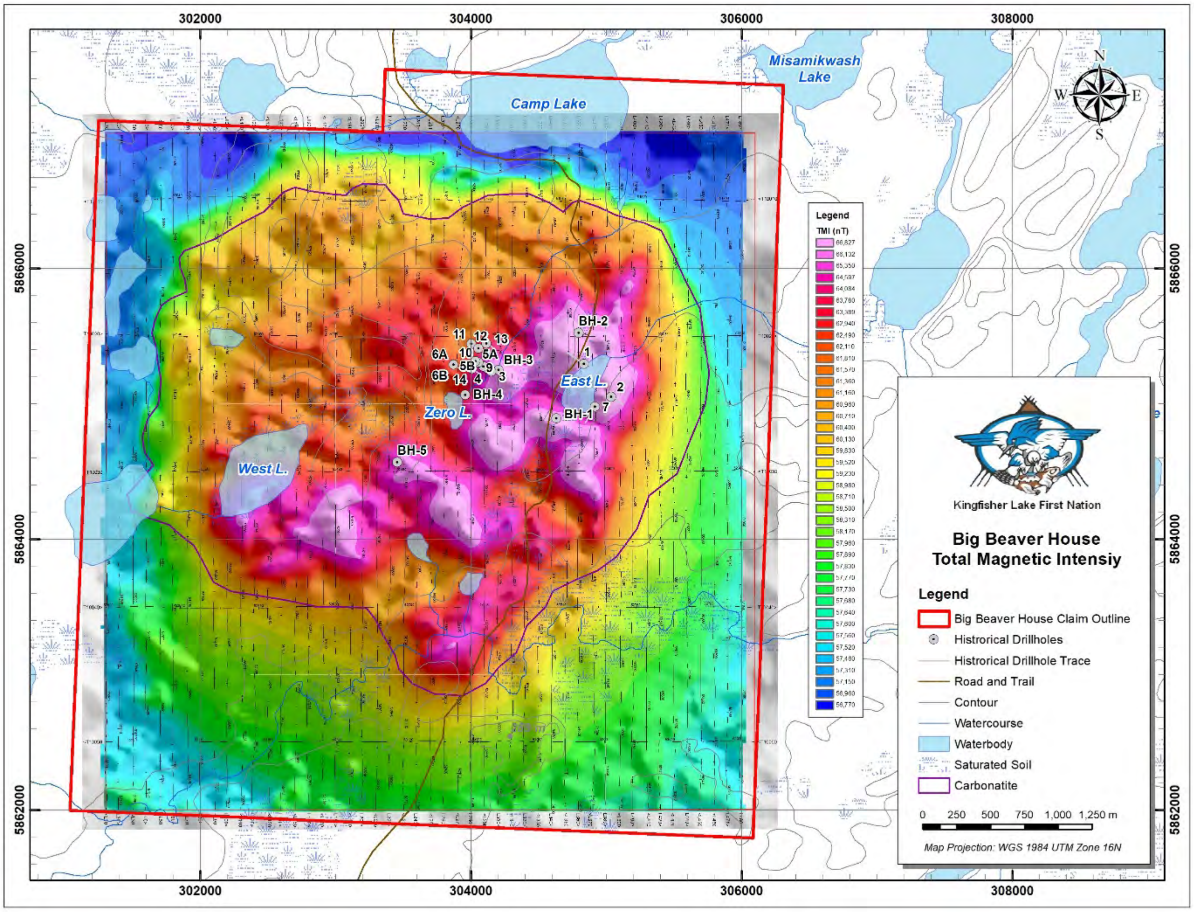



*Figure 8-5 Total magnetic intensity, colour shaded image - TMI (nT), Big Beaver House Property.*

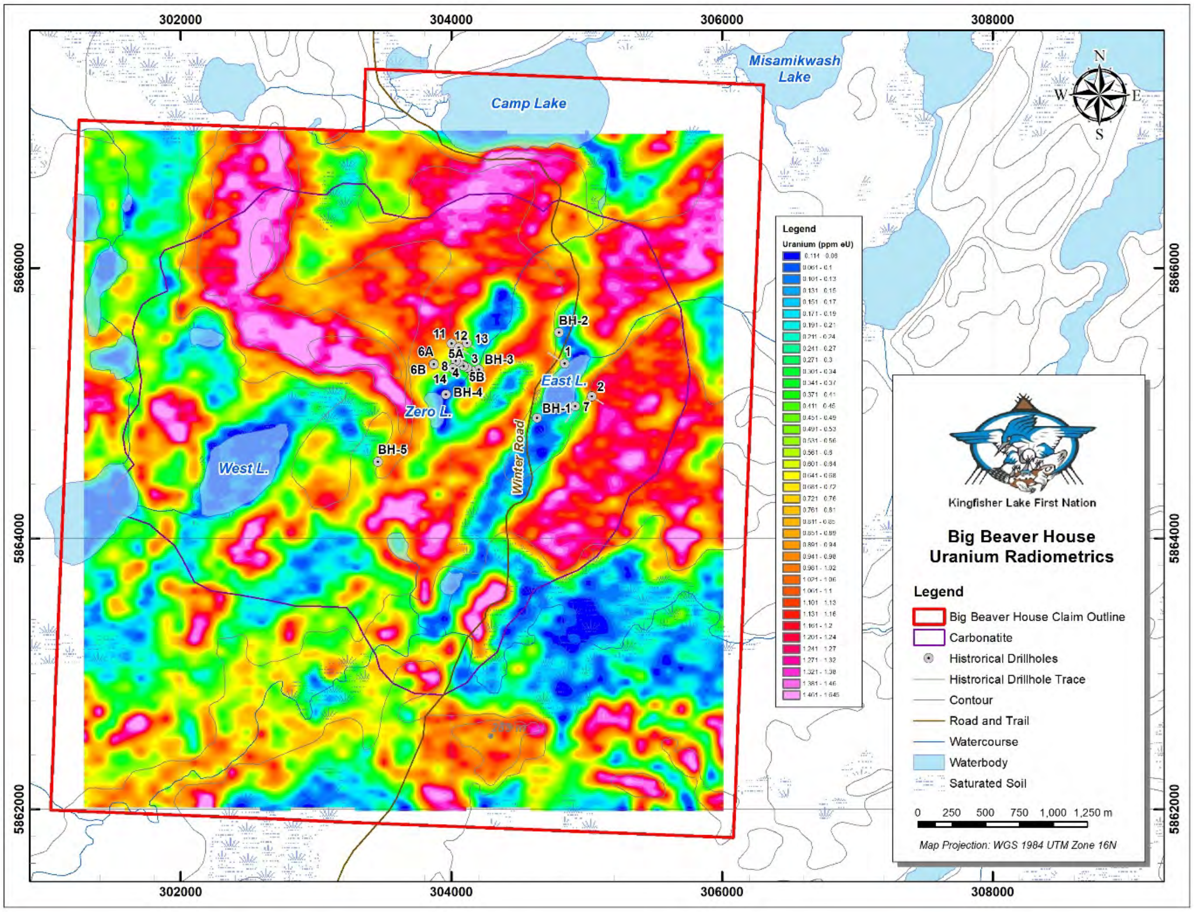



*Figure 8-6 Uranium Radiometrics (ppm eU), Big Beaver House Property.*

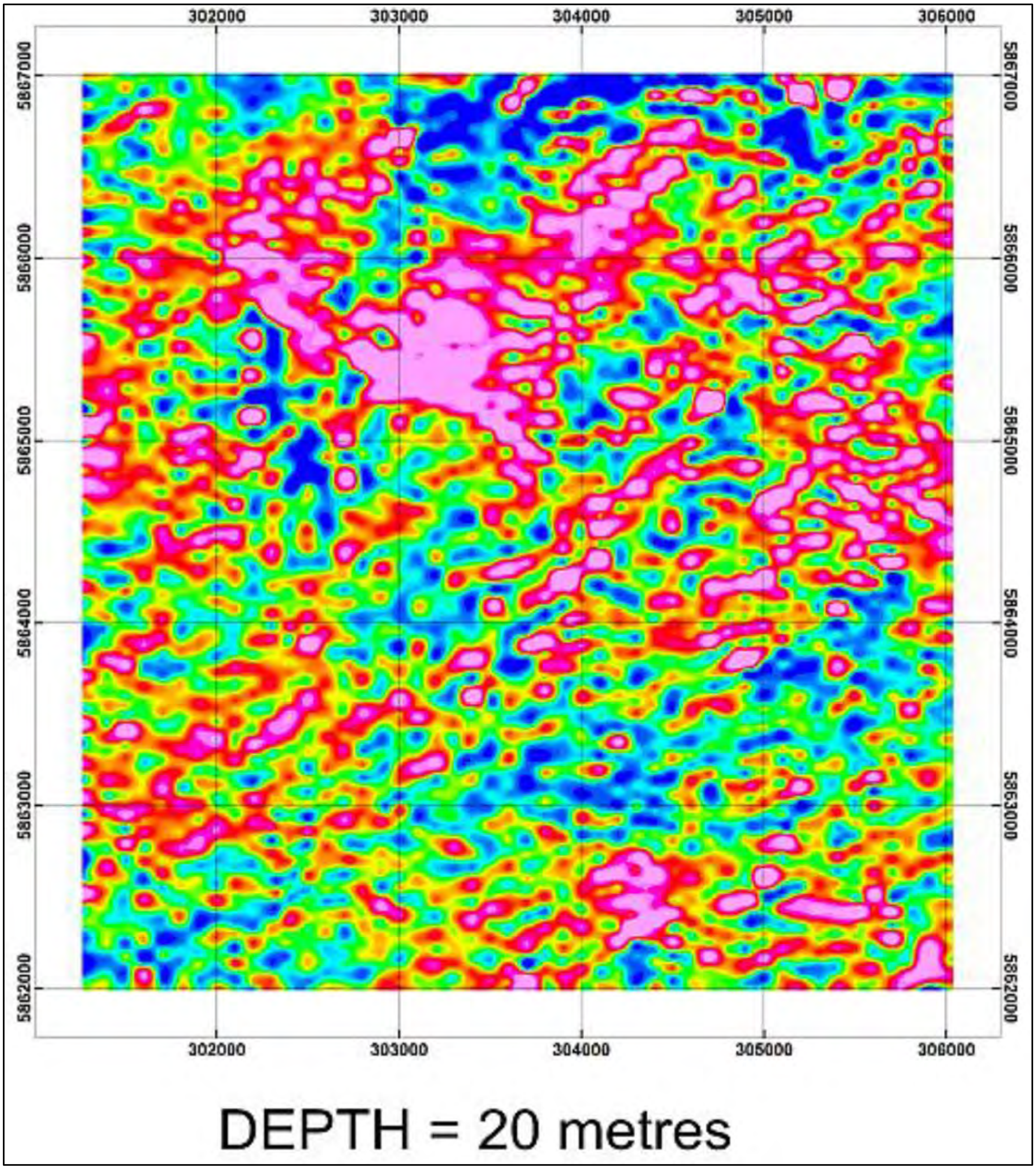



*Figure 8-7 VLF Resistivity Depth Slice at 20 m for Station NML (LaMoure, ND), Big Beaver House.*

# 9.0 DATA VERIFICATION

### 9.1 Quality Control for Airborne Geophysics Survey

Reflight tolerances, tests and calibrations and data quality control for Terraquest survey are given in Appendix 4.

# 10.0 INTERPRETATION AND CONCLUSIONS

Big Beaver House Property is located 12.5 km southwest of Kingfisher Lake FN community, 156 km north of Pickle Lake and 500 km north of Thunder Bay, northwestern Ontario. The center of the Property is located at 304092 m E, 5865465 m N, Zone 16, NAD 83.

Big Beaver House Property consists of 139 single cell mining claims in Misamikwash Lake and Asinne Lake Areas and NTS Sheet: 53A13NW. The claims are held 100% by 2609572 Ontario Inc. and are in good standing. The Property is approximately 5 km x 5 km.

Big Beaver House Carbonatite Complex is emplaced into granitic rocks within the Sachigo Subprovince, Superior Province. An isotopic age of 1109 ± 61 Ma was determined by K-Ar isotopic methods for the complex (Sage, 1987). Aeromagnetic data (ODM-GSC 1960, Map 939G) indicate that it may have been emplaced into an inferred northwest-trending fracture. From the aeromagnetic pattern, the complex is estimated to have a surface area of 16 $km^2$ (Sage, 1987).

Reconnaissance mapping along Misamikwash Lake, 3 km northeast of the complex, indicated that gneissic migmatitic host rocks are composed of massive to foliated biotite and biotite-hornblende trondhjemite to quartz monzonite (Sage 1987). The foliation within these rocks has a northwest strike and vertical to southerly dip.

The Big Beaver House Carbonatite Complex consists predominantly of pyroxenite, ijolite and silicocarbonatite cut by fractures filled with sövite (Sage, 1987). Pyroxenite is the dominant mafic lithology in the Carbonatite Complex.

The host rock for the Carbonatite Complex is **fenitized granitic gneiss** which is exposed only at Pyrochlore Point on Camp Lake (Sage, 1987). The rock consists of 5-10% quartz, 50-70% albite and trace amounts of secondary riebeckite, calcite, phlogopite and apatite and accessory magnetite and pyrite.

**Pyroxenite** is clinopyroxene and phlogopite-rich and some samples contain significant apatite and magnetite. Carbonate may compose up to 20% of the pyroxenite. With the addition of nepheline, the pyroxenite is gradational into ijolite and Sage (1987) noted that they can't be distinguished in outcrop.

**Ijolite** is a nepheline-clinopyroxene rock with minor phase of the pyroxenite.

**Silicocarbonatite** is similar to the sövite but contains less than 50% carbonate. While in some instances it clearly cuts the more mafic phases, in other cases, it may have formed by reaction between the intruding sövite and the more mafic rocks. In these cases, the rock appears gradational into the more mafic phases.

**Sövite** contains abundant calcite and accessory magnetite, apatite, phlogopite-biotite, perovskite, amphibole, and traces of sulphide. White sövite intrudes the mafic pyroxenites and ijolite.

The first mention of Niobium mineralization on the Big Beaver House Property was at Pyrochlore Point, along the south shore of Camp Lake in 1961. A carbonatite dyke was identified and was exposed in trenches and outcrops for a length of 130 ft (=39.6 m) and widths up to 30 ft (=9.1 m) (MNDM assessment report 53A12SE0002, 1961). The dyke strikes northwest-southeast and dips 35° to 60° to the northeast. The dyke's footwall or south contact is altered gneiss and the hanging wall or north contact is under Camp Lake.

The Niobium mineralization at Pyrochlore Point was reported from a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$ (MNDM assessment report 53A12SE0002, 1961). The composite was selected from highly radioactive pieces of carbonatite. The pyrochlore is light olive-green crystals to dark brown. Pyrochlore is fairly abundant along the apatite-amphibole seams which have weathered out to form depressions. Apatite-amphibole is more likely to occur in the border zone of a carbonatite complex.

Mapping in 1961 was followed up by a drill program in 1962. Hole 4 intersected Nb in three intervals: 1.46 % $Nb_2O_5$ over 0.4 ft (0.12 m), 3.05 % $Nb_2O_5$ over 1.0 ft (= 0.30 m) and 5.30% $Nb_2O_5$ over 5.5 ft (=1.7 m) (MNDM assessment report 53A12SE0002, 1962). The intervals contained pyrochlore in pink apatite-rich zones with actinolite and no magnetite. Narrow apatite zones have up to 10% pyrochlore which range in colour from light yellow to amber to olive green to dark brown. Most of the pyrochlore crystals appear to be octahedrons. Thus, the pyrochlore mineralization is associated with a low magnetic zone and topographic low. The intervals were slightly radioactive and contained minor to trace pyrrhotite, chalcopyrite and brown mica. Chalcopyrite was in the core immediately adjacent to the pyrochlore-rich mineralization.

A drill program in 1966 intersected Niobium mineralization in Hole 8 which was designed to test the downdip extension of Hole 4 (MNDM assessment report 53A12SE0002, 1966). The hole intersected 2.92 % $Nb_2O_5$ over 5 ft (=1.5 m) with a true width of 2 ft (0.6 m). This interval consists of brown pyrochlore (up to 10%), apatite, calcite, pyrrhotite, chalcopyrite and platy black non-magnetic metallic mineral and a section of magnetite within the pyrochlore zone.

In addition to Niobium mineralization, the Property also has potential for Phosphorus mineralization. In July 1976, the 1966 historic drill core was assayed for phosphorus and apatite-rich sample BB-4 contained 8.80% $P_2O_5$ and sample BB-6 contained 7.28 % $P_2O_5$.

The property also has the potential for rare-earth element mineralization. Partial Rare-Earth Elements analyses conducted by the Ontario Geological Survey on historical drill holes on the property in the 1980's has reported up to 3,200 ppm La+Ce+Nd in silicocarbonatite (Sage, 1982). Of significance is the documentation of loparite [(Ce, Na, Ca)TiO3] in the Big Beaver House Carbonatite complex (Platt, 1994). Loparite may contain up to 34 wt.% total Rare-Earth Elements oxides (TREO) and is an important ore mineral for the Rare-Earth Elements in Russia (TNR Gold press release dated Oct. 14, 2009).

Terraquest Ltd., Markham, Ontario conducted a Tri-boom horizontal magnetic gradient, radiometric and VLF-EM and resistivity helicopter survey over the Big Beaver House Property in 2020 on behalf of 2609572 Ontario Inc (Figure 8-1). The purpose of the survey was to collect geophysical data that can be used to prospect for minerals characterized by anomalous magnetic and radiometric responses. Big Beaver House Property contains abundant magnetite and rare-earth minerals (e.g., apatite and loparite) typically have a high radioactive response. Also, the geophysical signature can be used to show the geology including rock types, faults, shear zones, folding, alteration zones and other structures. The base of flight operations was Pickle Lake airport, but the refueling was done at Kingfisher First Nation community. The survey was completed over 3 flights all on Sept. 18, 2020.

Terraquest's survey covered all of the Big Beaver House claims as listed in Appendix 2 in Misamikwash Lake and Asinne Lake Areas. The Property was traversed by a helicopter along parallel flight lines over a rectangular block 4.8 km east-west and 5.0 km north-south. There was 48 traverse lines (N-S, 000°/180°) at 100 m spacing for a total of 240.1 line km and 5 tie lines (E-W, 90°/270°) at 1000 m spacing for a total of 24.0 line km. The total line km is 264.1. The mean terrain clearance for the survey was 24.9 m. Terraquest produced a total of 20 maps from their survey results at a scale of 1:10,000 on the survey block.

The historic data from outcrop sampling and drill core sampling indicates that the Niobium mineralization (i.e., pyrochlore) occurs associated with pink apatite and green amphibole seams. The pyrochlore intervals don't contain magnetite but may be in close proximity to magnetite. As apatite, often contains rare-earth elements and radioactive elements such as uranium and thorium, radiometrics is the best indicator of the presence of apatite and pyrochlore. The total count radiometerics, Potassium, Thorium and Uranium maps are very similar with anomalies south of Camp Lake and along the ridge in the northwest part of the Carbonatite Complex. The VLF Resistivity Depth Slice at 20 m shows anomalies very similar to the radiometrics anomalies. Thus, future exploration should focus on areas with radiometric anomalies.

Historically, drilling focused on the magnetic anomalies, but these anomalies indicate the presence of abundant magnetite which does not correspond to the presence of pyrochlore. These covered a small area in the center of the Carbonatite Complex rather than targeting the area south of Camp Lake where pyrochlore and niobium mineralization has been identified in outcrop.

The Qualified Person is recommending that future drilling focuses on the areas with radiometric anomalies where Niobium, Phosphorus and Rare-Earth Element mineralization may all occur. Five drill targets have been identified and are shown in Figure 11-1.

- Target 1 is a radiometric high south of Camp Lake where a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$. The composite was selected from highly radioactive pieces of carbonatite. Target 1 is the outer part of the Carbonatite Complex.
- Targets 2 and 3 are similar radiometric anomalies along the outer part of the Carbonatite Complex.
- Targets 4 and 5 are radiometric anomalies closer to the center of the Carbonatite Complex to test if Niobium mineralization also occurs there. Historic Hole 4 is close to Target 4. Hole 4 intersected Nb in three intervals: 1.46 % $Nb_2O_5$ over 0.4 ft (0.12 m), 3.05 % $Nb_2O_5$ over 1.0 ft (=

0.30 m) and 5.30% $Nb_2O_5$ over 5.5 ft (=1.7 m). The intervals contained pyrochlore in pink apatite-rich zones with actinolite and no magnetite.

- Target 6 is a weaker radiometric anomaly also on outer part of the Carbonatite Complex.

It is recommended that the drill program be conducted in the winter for easy access along the winter road and frozen swamps. It is recommended that 5 drill holes 300 m each be drilled on each of the 6 target areas to evaluate to determine which one has the most potential for Niobium, Phosphorus and Rare-Earth Element mineralization. The recommended budget is $1,866,800.

To the best of the Qualified Person's knowledge, there are no significant risks and uncertainties that could reasonably be expected to affect the reliability or confidence in the exploration information or projected economic outcomes. There are no historic or current mineral resource or mineral reserve estimates on the Property.

The purpose of the report was to file the Terraquest 2020 survey for assessment credit. The objectives of the report were to interpret the maps produced by Terraquest and make recommendations for future exploration. These objectives were met.

## 11.0 Recommendations

Historically, Big Beaver House Carbonatite Complex has only been tested for Niobium mineralization, but Phosphorus mineralization (apatite) and Rare-Earth Element mineralization is also possible in carbonatite complexes. Previous drilling on the Property focussed on the magnetic highs, but there does not seem to be a correlation between pyrochlore and magnetite. The pyrochlore correlates with apatite and amphibole. Only a small area of the Carbonatite Complex has been drill tested, so there is a lot of area with potential to drill.

The Qualified Person recommends that future drilling focuses on the areas with radiometric anomalies where Niobium, Phosphorus and Rare-Earth Element mineralization may all occur. Five drill targets have been identified and are shown in Figure 11-1.

- Target 1 is a radiometric high south of Camp Lake where a carbonatite composite sample with abundant apatite (trench 28D) which had an assay of 1.82 % $Nb_2O_5$. The composite was selected from highly radioactive pieces of carbonatite. Target 1 is the outer part of the Carbonatite Complex.

- Targets 2 and 3 are similar radiometric anomalies along the outer part of the Carbonatite Complex.
- Targets 4 and 5 are radiometric anomalies closer to the center of the Carbonatite Complex to test if Niobium mineralization also occurs there. Historic Hole 4 is close to Target 4. Hole 4 intersected Nb in three intervals: 1.46 % $Nb_2O_5$ over 0.4 ft (0.12 m), 3.05 % $Nb_2O_5$ over 1.0 ft (= 0.30 m) and 5.30% $Nb_2O_5$ over 5.5 ft (=1.7 m). The intervals contained pyrochlore in pink apatite-rich seems with actinolite and no magnetite. The hole was designed to test the border zone of the carbonatite complex.
- Target 6 is a weaker radiometric anomaly also on outer part of the Carbonatite Complex.

Geological mapping on the Property is not recommended as the only outcrop on the Property is along the south shore of Camp Lake. Trenching on the Property is not recommended due to thick overburden on the Property and the abundance of swamps. The 1961 drill program noted that the overburden depth varied from 40-75 ft (=12.2-22.9 m) and averaged 58 ft (17.7 m).

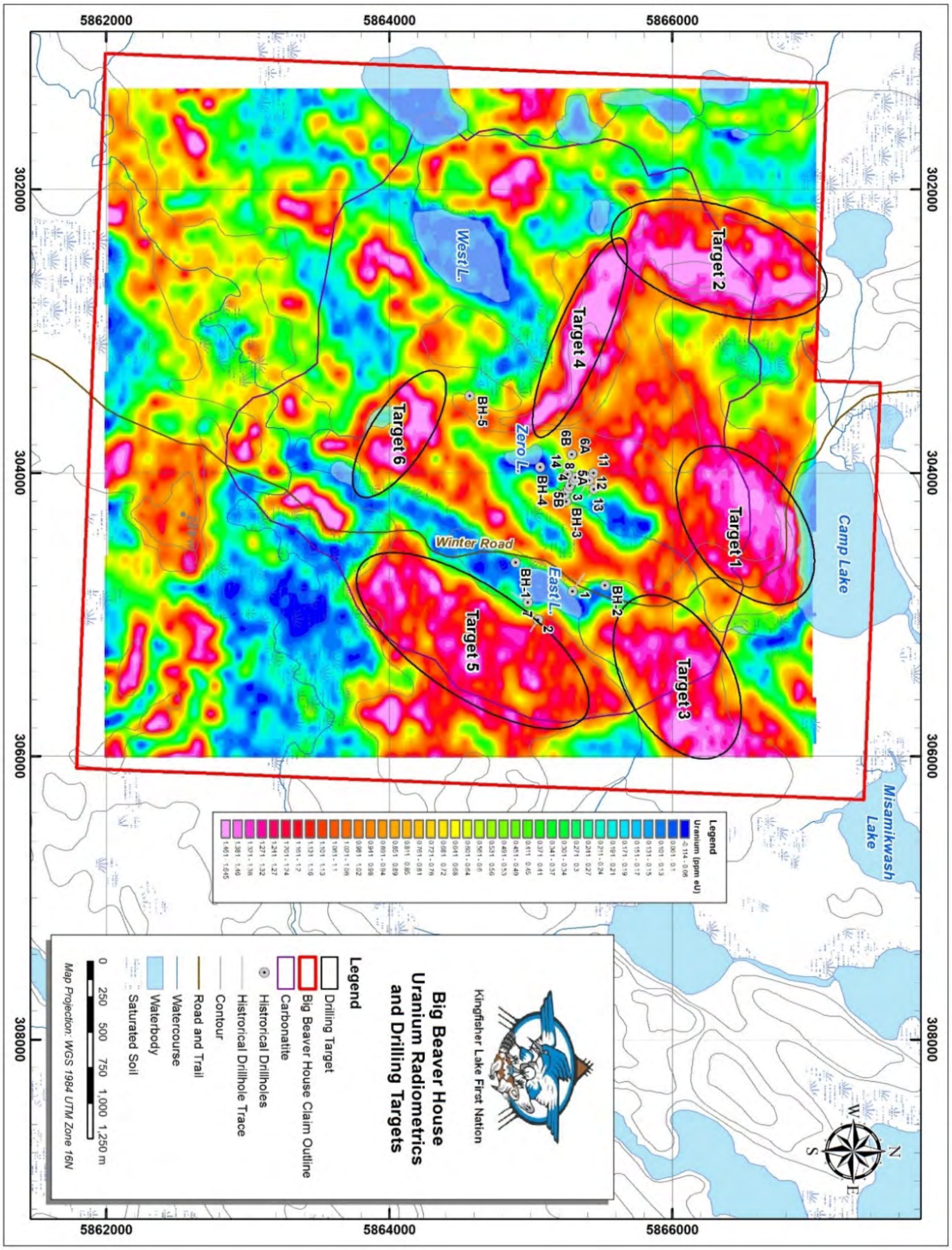



*Figure 11-1 Big Beaver House proposed drill targets on Uranium Radiometeric background.*

### 11.1 Proposed Budget

It is recommended that the drill program be conducted in the winter for easy access along the winter road and the swamps would be frozen. It is recommended that 5 drill holes 300 m each be drilled on each target to evaluate to determine which one has the most potential for Niobium, Phosphorus and Rare-Earth Element mineralization.

- 5 holes x 300 m = 1,500 m per target
- 1,500 m x 6 targets = 9000 m total meterage.
- Total of 5 holes * 6 targets = 30 drill holes.

Table 11-1 contains the recommended exploration budget for the Big Beaver House Property.

*Table 11-1 Budget for recommended drill program at Big Beaver House.*

| Item | unit | No of units | rate | total |
|---|---|---|---|---|
| drilling | m | 9000 | $ 150.00 | $ 1,350,000.00 |
| mode/demobe drill | mobe | 2 | $ 5,000.00 | $ 10,000.00 |
| senior geologist - core logger | day | 90 | $ 800.00 | $ 72,000.00 |
| core cutter | day | 90 | $ 500.00 | $ 45,000.00 |
| assays | sample | 3600 | $ 70.00 | $ 252,000.00 |
| | | | | |
| truck rental | month | 3 | $ 4,000.00 | $ 12,000.00 |
| meals | day | 180 | $ 50.00 | $ 9,000.00 |
| accommodations | day | 180 | $ 120.00 | $ 21,600.00 |
| | | | | |
| project management | day | 90 | $ 800.00 | $ 72,000.00 |
| QA/QC of assays | day | 15 | $ 800.00 | $ 12,000.00 |
| write assessment report | day | 14 | $ 800.00 | $ 11,200.00 |
| | | | **total** | **$ 1,866,800.00** |

## 12.0 REFERENCES

Ferguson, Stewart A., 1971. Columbium (Niobium) Deposits of Ontario; Ontario Dept. of Mines and Northern Affairs, Mineral Resources Circular 14, 58p. Accompanied by Prelim. Map P.452 (revised).

Geological Survey of Canada, 1960. Big Beaver House, Kenora District, Ontario, Geophysical Series Map 939G, Aeromagnetic, scale 1:63,360.

Le Maitre, R.W., 2002. Igneous Rocks: A Classification and Glossary of Terms. Cambridge University Press, Cambridge, U.K., 236 p.

Sage, R.P., 1987. Geology of Carbonatite - Alkalic Rock Complexes in Ontario: Big Beaver House Carbonatite Complex, District of Kenora; Ontario Geological Survey, Study 51, 71p.

TNR Gold Corp, 2012, Rare Earth Element Projects, Seabrook and Big Beaver House, corporate presentation dated July 2012.

## 13.0 STATEMENT OF AUTHORSHIP

This Report, titled "Airborne Geophysics Assessment Report, Big Beaver House Property, Kingfisher Lake First Nation, Northwestern Ontario, Canada, NTS: 53A13NW, Townships: Misamikwash Lake and Asinne Lake Areas", and dated Dec. 3, 2021 was prepared and signed by the following author and Qualified Person:

Julie Selway

PROFESSIONAL GEOSCIENTIST
JULIE B. SELWAY
PRACTISING MEMBER
0738
ONTARIO

Julie Selway
Principal Geologist, Ph.D., P.Geo.
Dec. 3, 2021
Sudbury, Ontario

# Appendix 1 – Certificate of Qualified Person

**Julie Selway**
40 Mission Hill
Sudbury, Ontario, Canada, P3E 6M1
Telephone: 705-690-7996
Email: jselway@eastlink.ca

**CERTIFICATE OF QUALIFIED PERSON**

I, Julie Selway, do hereby certify that:

1. I am employed as a Principal Geologist for geological consulting firm J-J Minerals, Sudbury, Ontario.
2. I am the Qualified Person for this Report entitled "Airborne Geophysics Assessment Report Big Beaver House Property, Kingfisher Lake First Nation, Northwestern Ontario, Canada, NTS: 53A13NW, Townships: Misamikwash Lake and Asinne Lake Areas" dated Dec. 3, 2021, and prepared for 2609572 Ontario Inc.
3. I hold the following academic qualifications: B.Sc. (Hons) Geology (1991) Saint Mary's University; M.Sc. Geology (1993) Lakehead University; Ph.D. Mineralogy (1999) University of Manitoba.
4. I am a member of the Association of Professional Geoscientists of Ontario (Member #0738). I am a member in good standing of the Mineralogical Association of Canada, Geological Association of Canada and Mineralogical Society of America.
5. I am the co-author of one NI 43-101 Independent Technical Reports on a carbonatite property in British Columbia and one assessment report on a carbonatite property in Ontario.
6. I have not visited the Big Beaver House Property.
7. As of the date of this certificate, to the best of my knowledge, information and belief, the report contains all scientific and technical information that is required to be disclosed to make this report not misleading.

Dated this 3rd Day December 2021.

Julie Selway

PROFESSIONAL GEOSCIENTISTS
JULIE B. SELWAY
PRACTISING MEMBER
0738
ONTARIO

Julie Selway, Ph.D., P.Geo.
Principal Geologist, J-J Minerals

# Appendix 2 – 2609572 Ontario Inc.'s cell claims for Big Beaver House Property

*Table 13-1 Big Beaver House claim table.*

| Legacy Claim Id | Township / Area | Tenure ID | Tenure Type | Anniversary Date | Work Required |
|---|---|---|---|---|---|
| 4288514 | Misamikwash Lake Area | 104843 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 104891 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 104922 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 105612 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 105714 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 105715 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Asinne Lake Area, Misamikwash Lake Area | 105716 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Asinne Lake Area, Misamikwash Lake Area | 105721 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 105867 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 106975 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 126543 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 126635 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 126636 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 126640 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 126643 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 128537 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 128553 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 128554 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 129273 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 129274 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 129968 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 138003 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 138098 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Asinne Lake Area, Misamikwash Lake Area | 138099 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 140000 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 140001 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 140002 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 140028 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 140029 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 147376 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 153911 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 154552 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Asinne Lake Area, Misamikwash Lake Area | 155174 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |

| Legacy Claim Id | Township / Area | Tenure ID | Tenure Type | Anniversary Date | Work Required |
|---|---|---|---|---|---|
| 4288515 | Asinne Lake Area, Misamikwash Lake Area | 155175 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 155177 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 155179 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 163210 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 171059 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 171167 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 171171 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 172487 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Asinne Lake Area, Misamikwash Lake Area | 172488 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 172680 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 173309 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 174640 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 174715 | Single Cell Mining Claim | 2021-08-20 | $ 200.00 |
| 4288513 | Misamikwash Lake Area | 175414 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 176607 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 176608 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 190029 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 190030 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 190054 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Asinne Lake Area, Misamikwash Lake Area | 190619 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 190624 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 190625 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 190626 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 190627 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 190631 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 190632 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Asinne Lake Area, Misamikwash Lake Area | 190633 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 192051 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 192052 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 192768 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 221250 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 221251 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 221252 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 221298 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 221316 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 223187 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |

| Legacy Claim Id | Township / Area | Tenure ID | Tenure Type | Anniversary Date | Work Required |
|---|---|---|---|---|---|
| 4288510 | Misamikwash Lake Area | 223188 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 227350 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 227902 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 227909 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 227910 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 227911 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 229273 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 229274 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 229275 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 231216 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 239440 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 239441 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 240045 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 240047 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Misamikwash Lake Area | 240048 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Asinne Lake Area, Misamikwash Lake Area | 241383 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 241438 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 248184 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 248185 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 248186 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Misamikwash Lake Area | 248187 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288517 | Asinne Lake Area, Misamikwash Lake Area | 248188 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288514 | Misamikwash Lake Area | 248749 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 248750 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288510 | Misamikwash Lake Area | 250189 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288512 | Misamikwash Lake Area | 256778 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Asinne Lake Area, Misamikwash Lake Area | 256782 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 285847 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288516 | Asinne Lake Area, Misamikwash Lake Area | 285947 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288513 | Misamikwash Lake Area | 287858 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 287882 | Single Cell Mining Claim | 2021-08-20 | $ 200.00 |
| 4288511 | Misamikwash Lake Area | 287883 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288511 | Misamikwash Lake Area | 287884 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288509 | Misamikwash Lake Area | 293944 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 294554 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |
| 4288515 | Misamikwash Lake Area | 294555 | Single Cell Mining Claim | 2021-08-20 | $ 400.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4288515 | Misamikwash Lake Area | 294556 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288512 | Misamikwash Lake Area | 294559 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288512 | Misamikwash Lake Area | 294560 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 295975 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288514 | Misamikwash Lake Area | 295976 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288510 | Misamikwash Lake Area | 297915 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288509 | Misamikwash Lake Area | 306050 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288509 | Misamikwash Lake Area | 306051 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288515 | Misamikwash Lake Area | 306658 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288515 | Misamikwash Lake Area | 306659 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288512 | Misamikwash Lake Area | 306663 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288516 | Misamikwash Lake Area | 306668 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288510 | Misamikwash Lake Area | 310067 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288510 | Misamikwash Lake Area | 315392 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288509 | Misamikwash Lake Area | 322559 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288509 | Misamikwash Lake Area | 322560 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288515 | Misamikwash Lake Area | 323189 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288512 | Misamikwash Lake Area | 323195 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288516 | Misamikwash Lake Area | 323201 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 323767 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288517 | Misamikwash Lake Area | 325192 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288517 | Misamikwash Lake Area | 325193 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288516 | Misamikwash Lake Area | 334836 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288516 | Misamikwash Lake Area | 334837 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288517 | Misamikwash Lake Area | 336154 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288517 | Misamikwash Lake Area | 336155 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 336221 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288510 | Misamikwash Lake Area | 336222 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 336244 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 336245 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 336246 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288511 | Misamikwash Lake Area | 336247 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288509 | Misamikwash Lake Area | 345487 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| 4288512 | Misamikwash Lake Area | 345526 | Single Cell Mining Claim | 2021-08-20 | $ | 400.00 |
| | | | | **Total** | **$** | **55,200.00** |

# Appendix 3 – Assessment files used in this report

*Table 13-2 Assessment files used in this report*

| Assessment Report Number | Year of Report | Year of Work | Company | Type of Work |
|---|---|---|---|---|
| 53A12SE0002 | 1961 | 1961 | Many Lakes Exploration Company Ltd. | trenching, ground mag survey |
| 53A12SE0002 | 1962 | 1962 | Many Lakes Exploration Company Ltd. | drilling, 9 holes, 977.5 m, holes 1 to 7 |
| 53A13NW0002 | 1962 | 1962 | Many Lakes Exploration Company Ltd. | cross sections and logs for holes 1, 2 and 7 |
| 53A13NW0003 | 1962 | 1962 | Many Lakes Exploration Company Ltd. | cross sections and logs for holes 3, 4, 5A, 5B, 6A and 6B |
| 53A12SE0002 | 1966 | 1966 | Teck Corporation | drilling, 7 holes, 915.0 m, holes T-8 to 14 |
| 53A13NW0001 | 1977 | 1976-1977 | International Minerals & Chemical Corp | mineralogical studies, examine old core, drilling, 5 holes, 192.0 m, BH-1 to 5 |

# Appendix 4 – Terraquest Report

# Operations Report for

# **2609572 ONTARIO INC.**

# Tri-Boom Horizontal Magnetic Gradient, Radiometric and VLF-EM + Resistivity Helicopter Survey

# Big Beaverhouse Project

# Kingfisher Lake Area, ON

December 17, 2020

**Report #: B487**

Requested by:
**Colin Bowdidge, Ph.D., P.Geo.**
2609572 ONTARIO INC.

Prepared by:
Charles Barrie, Managing Partner
***Terraquest Ltd.***

# *Table of Contents*

# 1 Introduction

## 1.1 Executive Summary

This report describes the specifications and parameters of a helicopter geophysical survey carried out on behalf of:

**2609572 ONTARIO INC.**
P.O. Box 57
Kingfisher Lake, ON, Canada
P0V 1Z0

Attention: James Mamakwa, Director
Tel: 807-532-2067
Email: jamesm@kingfisherlake.ca

The survey was performed by:

**TERRAQUEST LTD.,**
301-2900 John Street, Markham
ON, Canada
L3R 5G3

Charles Barrie, P.Geo, M.Sc.
Phone: 905-477-2800 ext. 31 Email: cb@terraquest.ca

The purpose of a survey of this type is to collect geophysical data that can be used to prospect directly for economic minerals that are characterized by anomalous magnetic and radiometric responses. Secondly, the geophysical patterns can be used indirectly for exploration by mapping the geology in detail, including rock types, faults, shear zones, folding, alteration zones and other structures.

To obtain this data, the area was systematically traversed by helicopter carrying geophysical equipment along parallel flight lines. The lines are oriented to intersect the geology and structure so as to provide optimum resolution of the geophysical data.

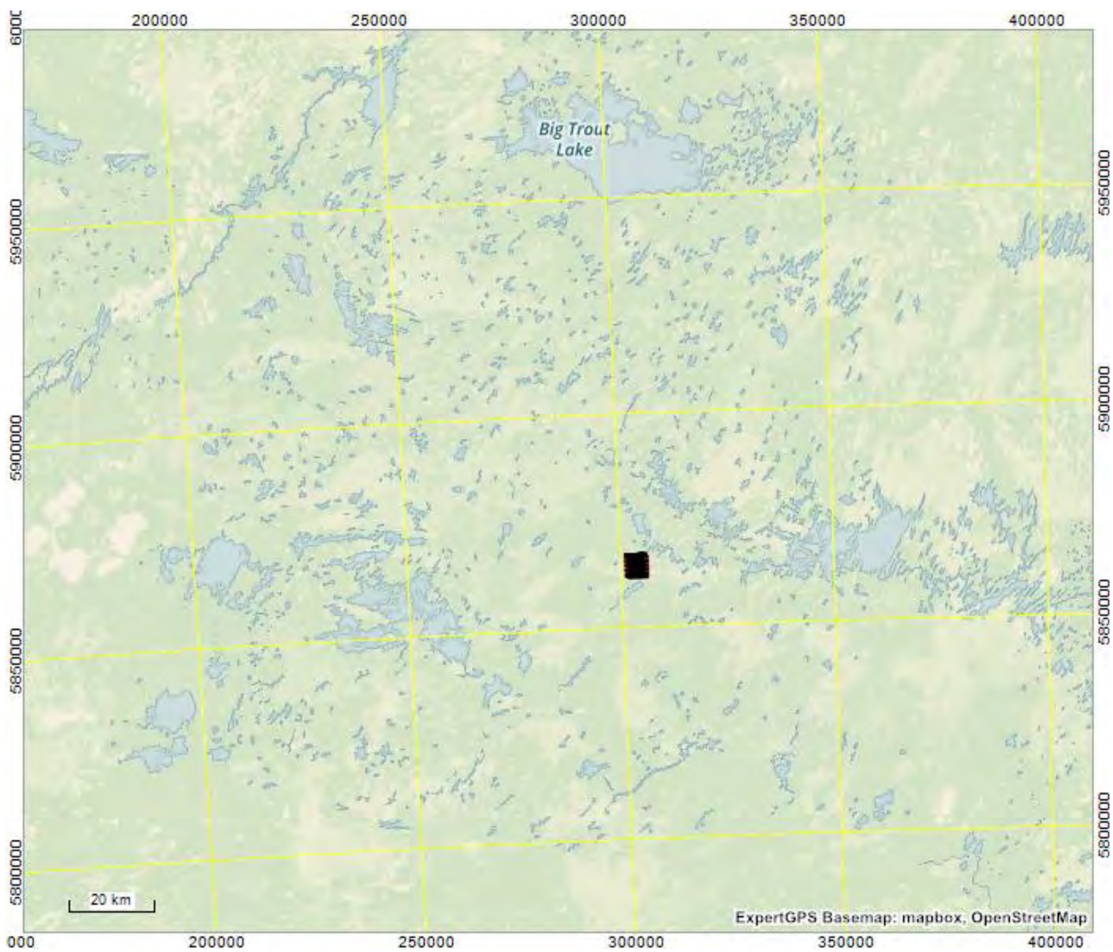
## 1.2 Location

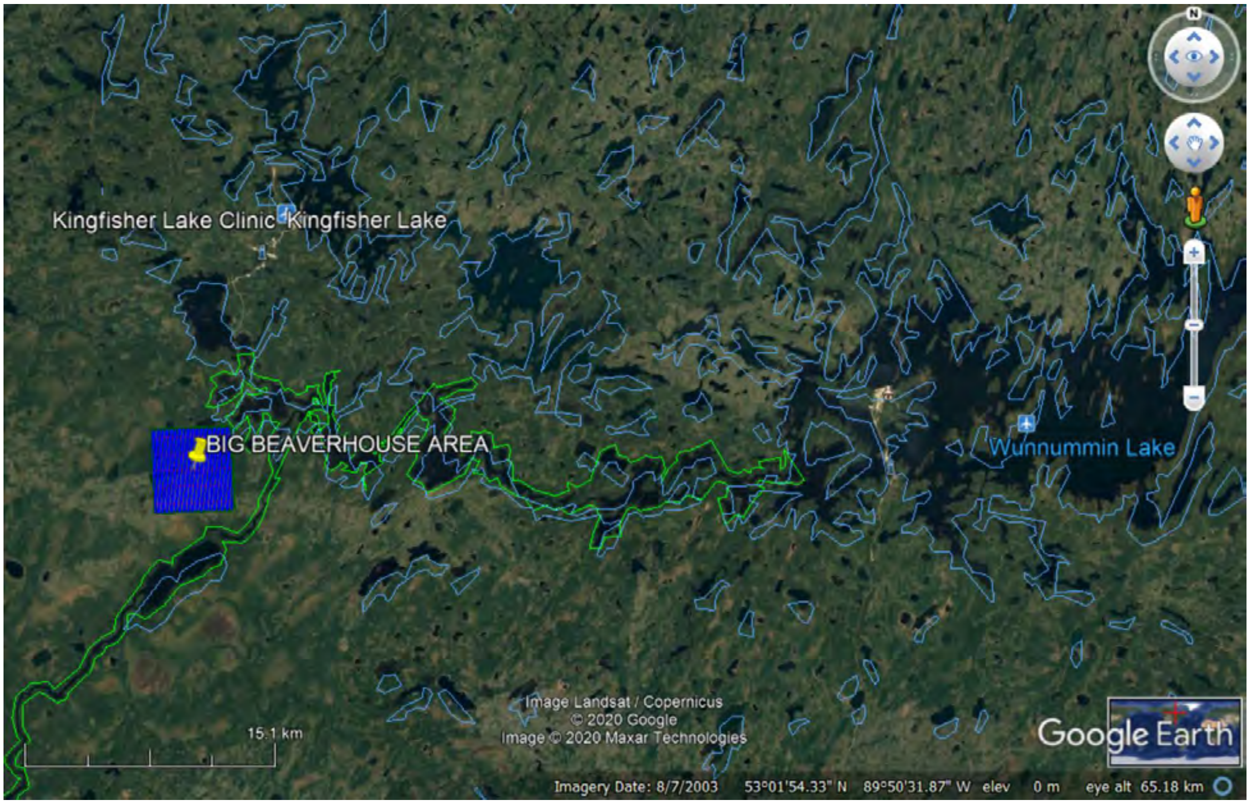
The Big Beaverhouse survey area is located in the Thunder Bay North Mining District of Ontario approximately 520 kilometres north of Thunder Bay, 163 kilometres north of Pickle Lake (base of operations), 14 kilometres southwest of the settlement of Kingfisher Lake and 3 kilometres south of the settlement of Big Beaverhouse.

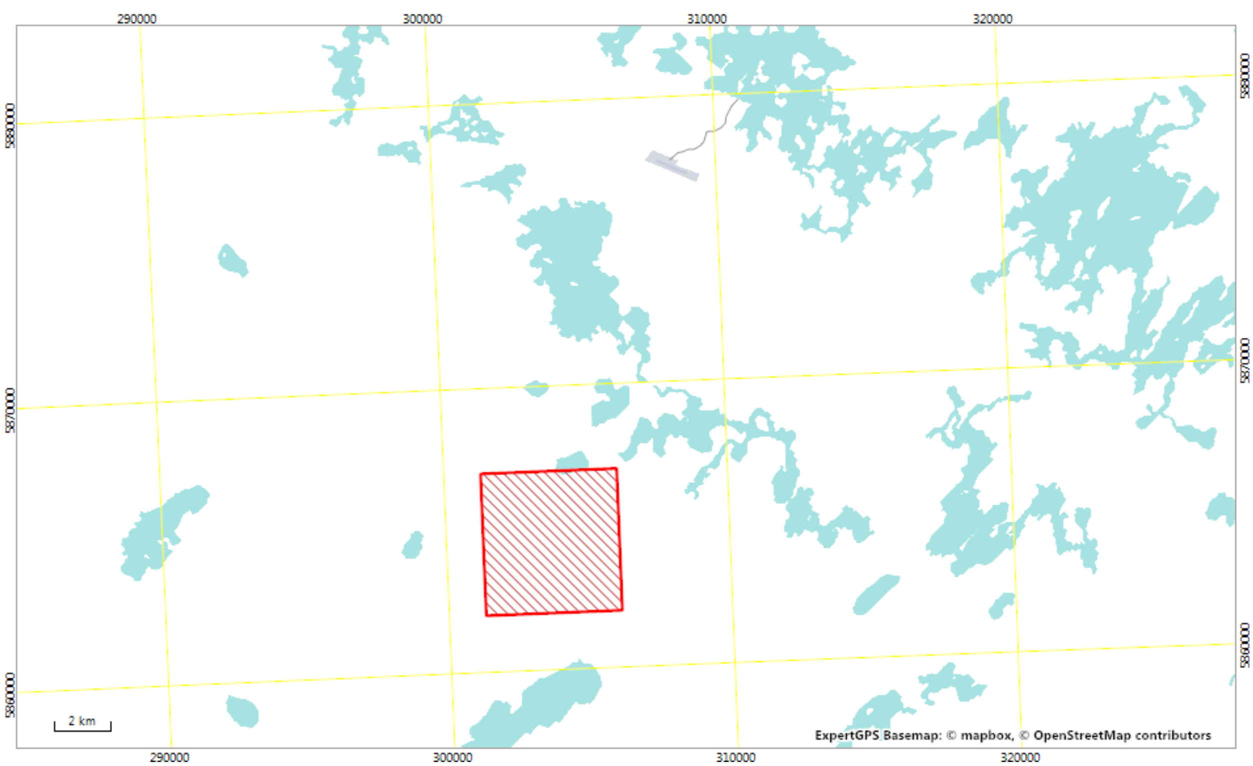
The survey block is rectangular measuring 4.8 kilometres east-west and 5.0 kilometres north-south. The centre of the block is approximately 52 degrees 53 minutes 30 second north and 89 degrees 55 minutes 20 seconds west.

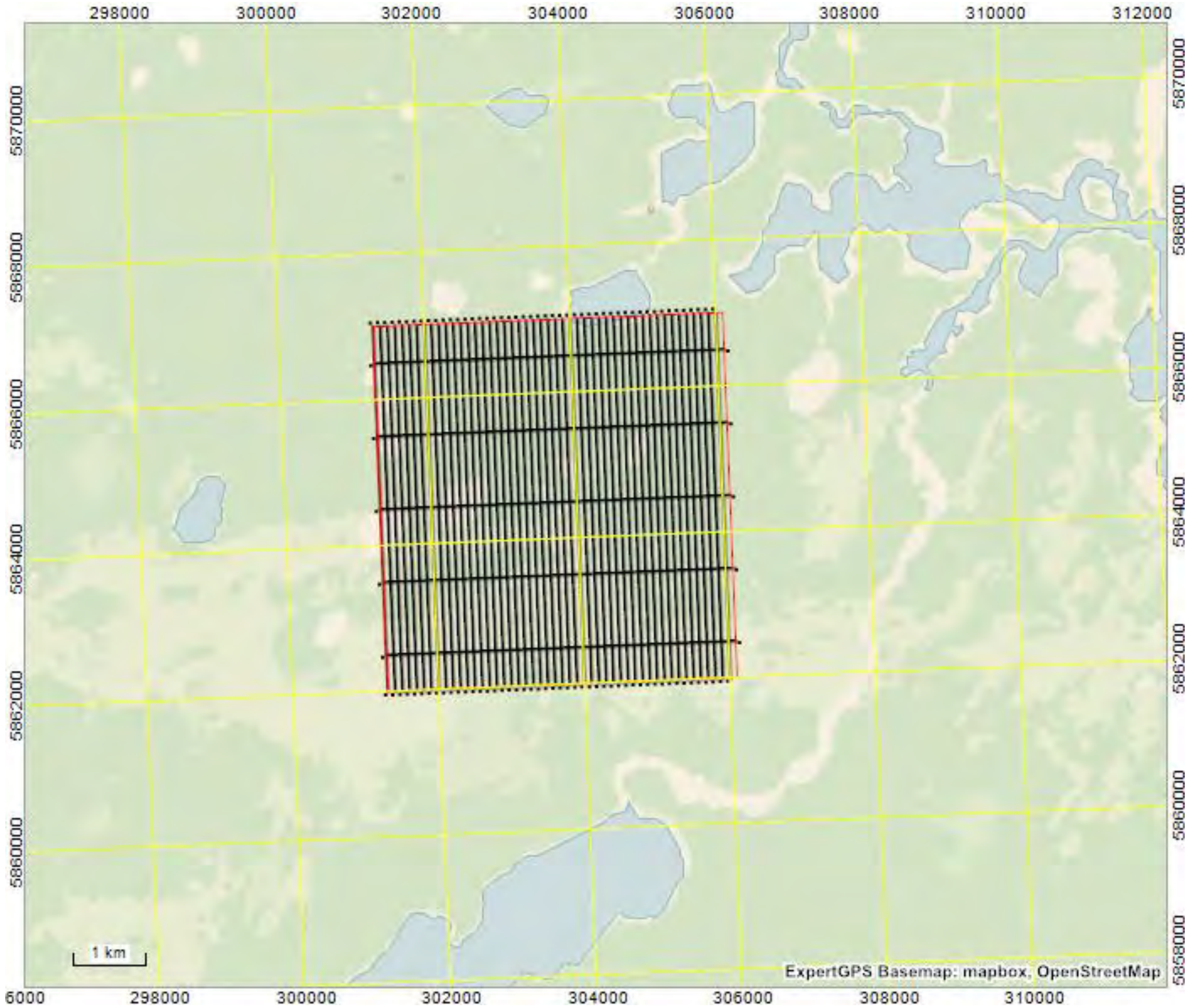
## *General Location*


## *Regional Location*




Kingfisher Lake Clinic
Kingfisher Lake
BIG BEAVERHOUSE AREA
Wunnummin Lake
15.1 km
Image Landsat / Copernicus
© 2020 Google
Image © 2020 Maxar Technologies
Google Earth
Imagery Date: 8/7/2003 53°01'54.33" N 89°50'31.87" W elev 0 m eye alt 65.18 km


290000
300000
310000
320000
5880000
5870000
5860000
2 km
ExpertGPS Basemap: © mapbox, © OpenStreetMap contributors


298000
300000
302000
304000
306000
308000
310000
312000
5870000
5868000
5866000
5864000
5862000
5860000
5858000
1 km
ExpertGPS Basemap: mapbox, OpenStreetMap
6000

# 2 SURVEY SPECIFICATIONS

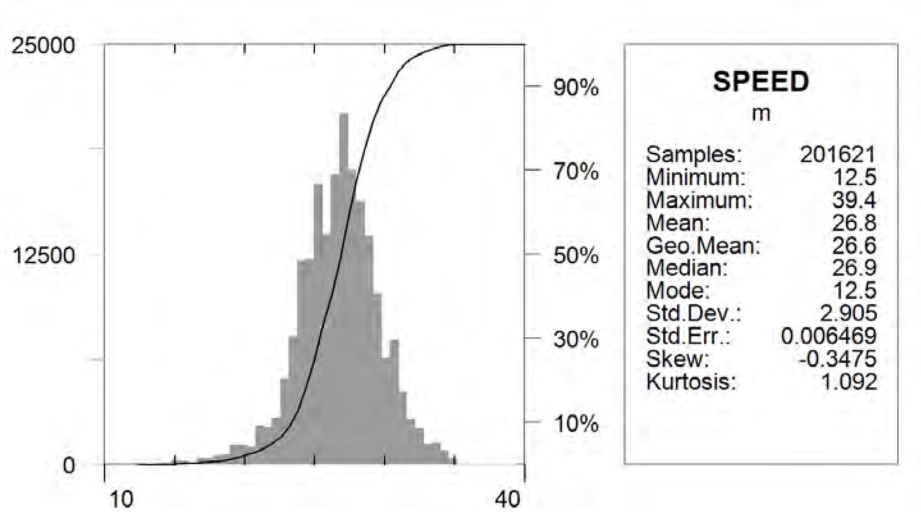
## 2.1 SURVEY PARAMETERS

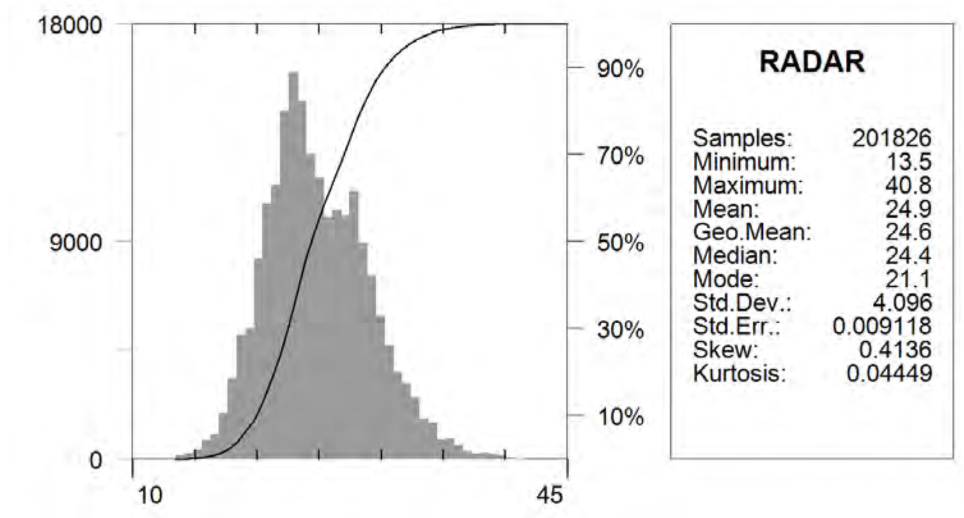
| | |
|---|---|
| **Project Name** | **Big Beaverhouse Project** |
| **Acquisition** | **Horizontal Gradient Magnetics, VLF-EM, Radiometrics** |
| **Aircraft** | **ASTAR 350B2 registration C-FFKK** |
| **Base of Operations** | **Pickle Lake** |
| **Main Ferry** | **163 km to Pickle Lake** |
| **Refuel Ferry** | **14 km to Kingfisher Settlement** |

## 2.2 SURVEY KILOMETRAGE

| **PARAMETERS** | **SPECIFICATIONS** |
|---|---|
| **Big Beaverhouse Block** | |
| Traverse Line #, Spacing and line km | 48 lines @ 100 metres = **240.1 Lkm** |
| Traverse Line Direction | 000/180 degrees |
| Control Line #, Spacing and line km | 5 tie lines @ 1000 m = **24.0 Lkm** |
| Control Line Direction | 090/270 degrees |
| Total Line Kilometers | **264.1 Lkm** |

## 2.3 SPEED AND TERRAIN CLEARANCE






Summary Mean Terrain Clearance, Speed and Data Interval

| **Parameter** | **Big Beaverhouse Block** |
|---|---|
| Helicopter Mean Speed | 26.8 m/sec 96.5 km/hr |
| Data Sample Interval (mag, GPS at 20Hz) | 1.34 metres |
| Data Sample Interval (radiometric at 1 Hz) | 26.8 metres |
| Mean Terrain Clearance | 24.9 metres |

## 2.4 NAVIGATION SPECIFICATIONS

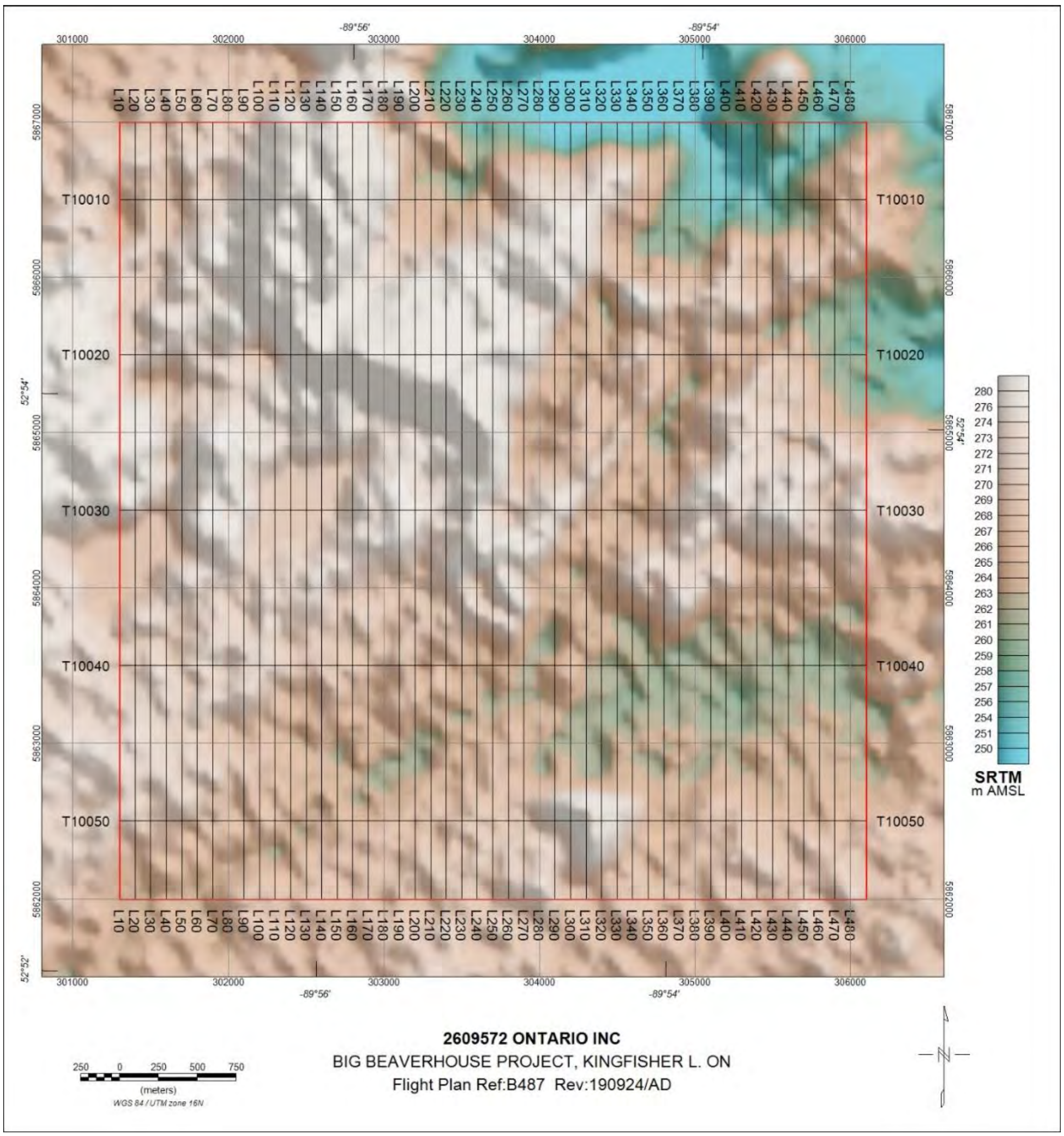
The satellite navigation system was used to ferry to the survey site and to survey along each line. The survey coordinates were supplied by the client and were used to establish the survey boundaries and the flight lines. Generally, standard GPS provides accuracy for the most part better than 10 metres. Real-time GPS correction using the Hemisphere differential receiver and corrected by Atlas broadcast services for North America improves the navigational accuracy to about 3 metres or less in the horizontal plane and 4-5 metres in the vertical direction.

```
0  KING
1  U 273
2      301300     5862000       AREA CORNER 1
2      301300     5867000       AREA CORNER 2
2      306100     5867000       AREA CORNER 3
2      306100     5862000       AREA CORNER 4
2      301300     5862000       AREA CORNER 5
3      301300     5862000  COR1 WAYPOINT 1
4          48                   NUMBER OF LINES
5       100.0                   SPACING, m
8          75                   MAX CROSS TRACK, m
9    0  0  0                    DELTA X/Y/Z
10          1                   LOG FPR EVERY 1 SECS
11 0.9996000000       0.0       0.0 K0, X/Y SHIFT
14          0                   LINES EXTENDED BEYOND AREA
16         10                   FIRST LINE NUMBER
17   301300.0   5862000.0   0.0 MASTER POINT, HEADING
18   301300.0   5861500.0  90.0 TIE LINE MASTER POINT, HEADING
19     1000.0         0         TIE LINE SPACING, LINE EXTENSION, m
20 WGS-84      6378137.0   298.257223563 22       ELLIPSOID
21         0                    NO EQUATORIAL CROSSING, N HEMISPHERE
30         20    9600  N  1  8  RS-232 PORT 2 INCOMING FORMAT
```

```
31        20    9600  N  1  8  RS-232 PORT OUTGOING FORMAT
38         0                   METRIC SYSTEM
41      0.00                   SYSTEM LAG, Secs.
80       0.00                  PLANNED ALTITUDE, m
83         0                   GPS ALTITUDE FOR VERTICAL BAR
84      0.00        0.00       ALTITUDE COEFFICIENT, OFFSET
85        100                  MAX VERTICAL BAR SCALE
102  UTM                       UTM X/Y SCALE
```

## 2.5 FLIGHT PLAN NAVIGATION MAP

The following map shows the initial pre-survey plan of 100 metre interval lines for the survey block, plotted on the satellite digital terrain model and used for navigation as well as the general terrain. The actual flown flight path map is shown in the map section 7 of this report.



## 2.6 TOLERANCES - REFLIGHT

### 2.6.1 Traverse Line Interval

Re-flights would take place if the flight line separation of the final differentially corrected flight path is greater than 1.25 of the intended line separation over a distance greater than 1 kilometre along the line.

### 2.6.2 Terrain Clearance:

The contract specifications were designed for a fixed wing aircraft with a 70-80 metres mean terrain clearance. The helicopter survey averaged 24.9 metres above the ground.

### 2.6.3 Diurnal Variation:

Diurnal activity in the survey was limited to +/-3.0 nT peak to peak deviation from a 1-minute chord.

### 2.6.4 GPS Data:

GPS data included at least 4 satellites for navigation and flight path recovery. There were no significant gaps in any of the digital data.

### 2.6.5 Radio Transmission:

The aircraft pilot makes no radio transmission that interferes with magnetic response unless mandated by safety concerns.

### 2.6.6 Sample Density:

A reflight is required if the sample density along one or more of the survey lines exceeds 10 metres over a cumulative total of 1000 metres for the magnetic survey.

# 3 AIRBORNE GEOPHYSICAL EQUIPMENT

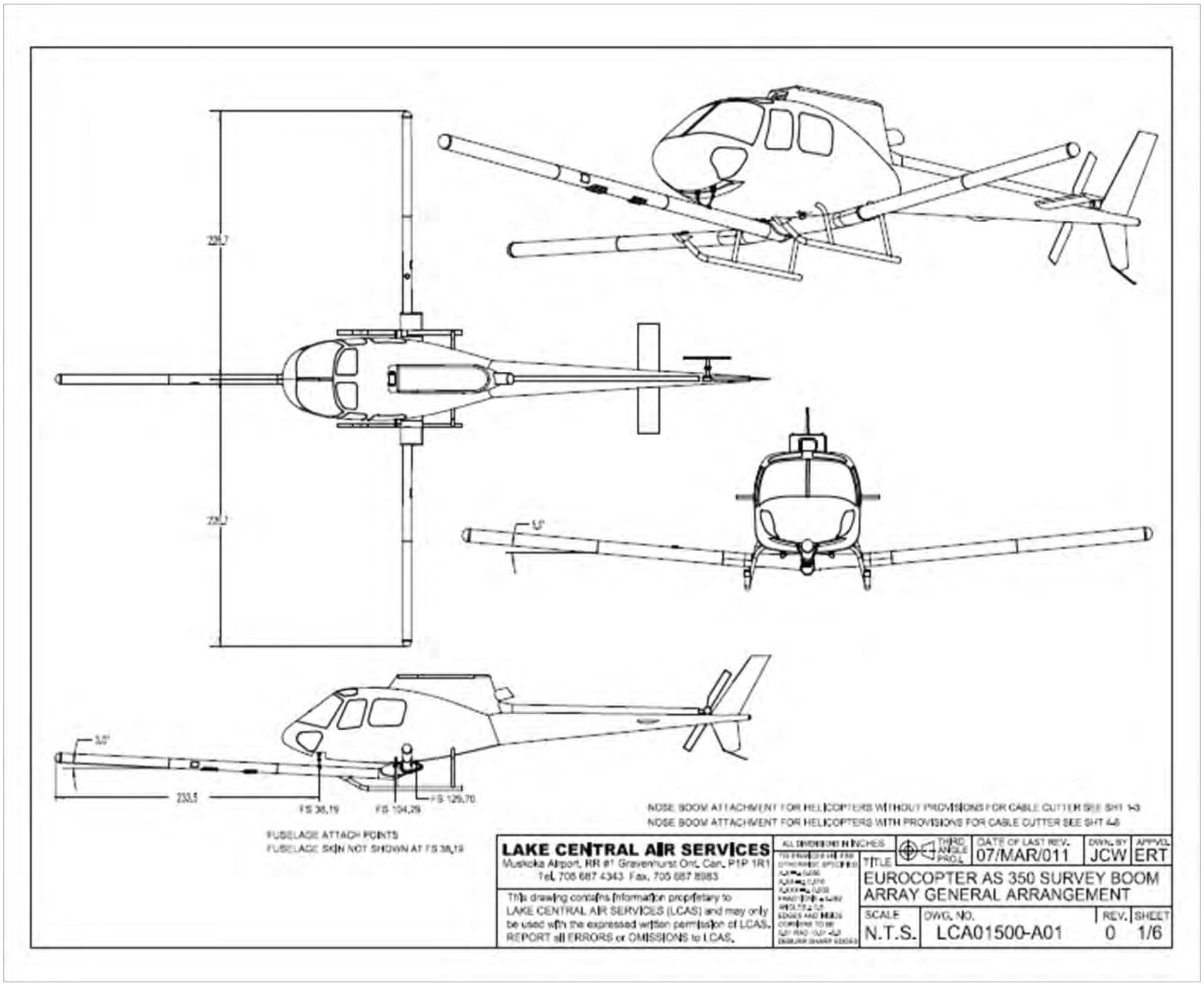
The primary airborne geophysical equipment includes three high sensitivity cesium vapour magnetometers, a digital Matrix VLF-EM and a gamma ray spectrometer. Ancillary support equipment includes a tri-axial fluxgate magnetometer, data acquisition system, radar altimeter, barometric altimeter, GPS receiver with a real-time correction service, and a navigation system. The navigation system comprises a left/right indicator for the pilot and a screen and displays the survey area, planned flight lines, and the real time flight path. All data were collected and stored by the data acquisition system. The following provides detailed equipment specifications:

## 3.1 EQUIPMENT SUMMARY

| | |
|---|---|
| **Helicopter** | Eurocopter ASTAR 350 B2 registration C-FFKK |
| **Equipment:** | |
| Magnetometer | Scintrex : CS-3 Cesium Vapour (3) |
| Magnetic Counter | Kroum VS : KMAG4 |
| Analog processer | Kroum VS : KANA8 |
| 3-axis Magnetometer | Billingsley: TFM100-LN |
| Gamma Ray Spectrometer | Radiation Solutions: RSX-4 1024 $in^3$ (16.8 litres) Downward; s/n 5423 |
| VLF-EM | Magenta: Matrix digital VLF-EM system |
| GPS Receiver | Hemisphere: R130 DGPS with Atlas or WAAS |
| Radar Altimeter | Free Flight Systems TRA3500 |
| Barometric Altimeter | Honeywell: transducer |
| Data Acquisition | Archer: handheld computer using<br>Kroum VS: SDAS software |
| Navigation | AgNav: Guia/LiNav P151 |
| **Magnetic Specifications:** | |
| Nose Boom total length | 7.69 metres (form point of intersection) |
| Nose Boom length from skids | 5.96 metres |
| Lateral Booms, each side | 5.76 metres (from point of intersection) |
| Lateral Separation | 11.52 metres |
| Output Sample Rate | 20 Hz |
| $4^{th}$ difference noise envelope | 0.10 nT |
| FOM index | <3.0 nT |
| Sensor Sensitivity | 0.005 nT |

## 3.2 SURVEY AIRCRAFT

The survey aircraft for this project was a Eurocopter ASTAR 350 B2, registration C-FFKK sub-contracted services from Heli Explore based in La Sarre, Quebec. The helicopter has been specifically modified with a 7.69 metre long and 21.6 cm (8.5”) diameter nose stinger that extends approximately 6 metres forward of the skids, and lateral booms with a total separation of 11.52 metres. The booms and stinger are hard fixed to the belly of the helicopter.




## 3.3 SURVEY EQUIPMENT AND SPECIFICATIONS:

### 3.3.1 High Sensitivity Magnetometer

Three high-resolution cesium vapour magnetometers, manufactured by Scintrex are mounted in a nose stinger that extends approximately 6 metres forward from the skids and two lateral booms with a total separation of 11.52 metres. A Fluxgate tri-axial magnetometer, model TFM100-LN by Billingsley Magnetics Ltd., is mounted in front of the mid-section of the boom to monitor aircraft manoeuvre and magnetic interference. The magnetic data is post-flight compensated for aircraft manoeuvre noise.

| | |
|---|---|
| **Magnetometer Sensor Type** | Split-Beam Cesium Vapour (3) |
| **Model** | CS-3 |
| **Manufacturer** | Scintrex Ltd. |
| **Resolution** | 0.001 nT counting at 0.1 per second |
| **Sensitivity** | +/- 0.005 nT |
| **Dynamic Range** | 15,000 to 100,000 nT |
| **Fourth Difference** | 0.02 nT |
| **Recorded Sample Rate** | 0.05 seconds |
| **Noise Envelope** | 0.10nT |

### 3.3.2 Tri-Axial Fluxgate Magnetic Sensor

| | |
|---|---|
| **Tri-Axial Fluxgate** | (for compensation, mounted in nose stinger) |
| **Model** | TFM100-LN |
| **Manufacturer** | Billingsley Magnetics |
| **Description** | Low noise miniature triaxial fluxgate magnetometer |
| **Axial Alignment** | > Orthogonality > +/- 0.5 degree |
| **Accuracy** | < +/- 0.75% of full scale (0.5% typical) |
| **Field Measurement** | +/- 100,000 nanotesla |
| **Linearity** | < +/- 0.0035% of full scale |
| **Sensitivity** | 100 microvolt/nanotesla |
| **Noise** | < 14 picotesla RMS/–Hz @ 1 Hz |
| **Recorded Sample Rate** | 0.05 seconds |

### 3.3.3 Radiometric System

| | |
|---|---|
| **Radiometric Type** | Gamma Ray Spectrometer |
| **Model** | Software RS-500 |
| **Detector Pack** | RX-4 |
| **Manufacturer** | Radiation Solutions Inc. |
| **Downwards Volume** | 4 X 256 cubic inches down |
| **Hardware** | FPGA/DSP technology |
| **Software** | RS-500 Advanced Digital, Self-Calibrating each crystal |
| **Dynamic Range** | 250,000 cps per crystal |
| **Resolution** | 1,000,000 channel resolution |
| **Sample Rate** | 1 second |

### 3.3.4 Radar Altimeter

| | |
|---|---|
| **Altimeter** | Radar |
| **Model** | TRA3500 |
| **Manufacturer** | Free Flight Systems |
| **Type** | Twin horn |
| **Range** | 0 – 2500 ft |
| **Accuracy** | + 5ft for 0-100 ft; 5% 100-500ft |
| **Calibrate Accuracy** | 1% |
| **Output** | Digital for pilot, converted to analog for data acquisition |
| **Recorded Sample Rate** | 0.05 seconds |

#### 3.3.5 Barometric Altimeter

| | |
|---|---|
| **Altimeter** | Barometric pressure transducer |
| **Model** | PPT0020AWN2VA-C s/n 41189 |
| **Manufacturer** | Honeywell |
| **Sensitivity** | 1 foot |
| **Source** | coupled to aircraft barometric system |
| **Recorded Sample Rate** | 0.05 seconds |

#### 3.3.6 Data Acquisition System

| | |
|---|---|
| **Data Acquisition System** | Handheld computer |
| **Software** | SDAS |
| **Manufacturer** | Kroum VS |
| **Operating System** | iPAQ Pocket PC |
| **Microprocessor** | Archer handheld computer |
| **Ports** | RS232 COM ports data input |
| **Recorded Sample Rate** | 0.05 seconds |

#### 3.3.7 Analog Processor

| | |
|---|---|
| **Analog Processor** | KANA8 standalone module |
| **Manufacturer** | Kroum VS |
| **Channels / Input** | 8 independent analog channels |
| **Processing** | Separate 24-bit delta sigma ADC and signal conditioning circuitry for each channel |
| **Time Synchronization** | GPS UTC each sample, and PPS signal |
| **Overlay** | Video text overlay |

#### 3.3.8 Magnetometer Processor

| | |
|---|---|
| **Magnetometer Counter** | 4 inputs, stand-alone module |
| **Model** | KMAG4 |
| **Manufacturer** | KROUM VS |
| **Input Range** | 10,000 – 100,000 nT |
| **Relative Resolution** | 3.85 ppb |
| **Sampling Rates** | Selectable 1 to 1,000 per second: 0.05 seconds |
| **Reference Frequency** | 260 MHz |
| **Bandwidth** | Selectable 0.7, 1.0 or 2.0 Hz |
| **Modes** | SyncIn, SyncOut, RS232 Ports, PPS |

#### 3.3.9 Navigation System

| | |
|---|---|
| **Navigation System** | Stand-alone module |
| **Model** | Guia P151 |
| **Manufacturer** | AgNav Inc. |
| **Software** | LiNav software |
| **Microprocessor** | CPU Board Pentium: 166Mhz, 16MB |
| **Ports** | USB Memory stick, 4 RS232 I/O ports |
| **Graphic Display** | Full colour sunlight readable LED array 28x30 lines |
| **Pilot Display** | position, left/right/vertical, navigational info |

| | |
|---|---|
| **Recording Media** | standard hard drive, USB memory stick |
| **Sampling** | Navigation 0.2 seconds (magnetometers at 0.05 seconds) |

### 3.3.10 GPS Differential Receiver

| | |
|---|---|
| **GPS Receiver** | Differential GPS |
| **Model** | R130 |
| **Manufacturer** | Hemisphere |
| **Antenna** | Dome AT1665 |
| **Channels** | 12 L1L2 |
| **Position Update** | 0.5 second for navigation |
| **Correction Service** | Real time correction subscription – Atlas |
| **Sample Rate** | 0.05 seconds |
| **Accuracy** | ~ 3 meters |

### 3.3.11 Proprietary Matrix VLF-EM System

The Matrix frequency specific, digital VLF-EM System was recently developed for Terraquest Ltd. and was deployed on this survey. It employs 3 orthogonal, air-core coils mounted near the front of the nose boom, and coupled with a receiver-console, tuned to receive independently up to four frequencies. On this survey the frequencies were Cutler Maine NAA frequency 24 kHz, La Moure North Dakota NML frequency 25.2 kHz and Seattle WA NLK frequency 24.8 kHz.

| | |
|---|---|
| **VLF - EM** | Stand-alone module |
| **Model** | Matrix |
| **Manufacturer** | Magenta Ltd. |
| **Primary Source** | Magnetic field component radiated from government VLF radio transmitters |
| **Parameters Measured** | Total Field Conductivity Amplitude, Vertical and Planar Ellipicities, Azimuth to transmitter, Tipper coefficients and Field Tilt Angles |
| **Frequency Range** | Up to four independent frequencies |
| **Gain** | Constant gain setting |
| **Filtering** | No filtering |
| **Recorded Sample Rate** | 0.05 seconds |
| **Recording** | Internally with USB access, externally to DAS for redundancy |

# 4 Base Station Equipment

## 4.1 BASE STATION MAGNETOMETER & GPS

High sensitivity magnetic base station data was provided by a split beam cesium vapour magnetometer logging onto a computer and with time synchronization from a GPS base station receiver. The magnetometer was similar to the type used in the aircraft, a cesium magnetometer manufactured by Scintrex. The magnetometer processor/counter was a KMAG manufactured by Kroum VS Instruments and the data logger was a PDA by Archer. The counter was powered by a 10VAC 50/60hz to 30VDC 3.0 amp power supply with an internal 12VDC fan. The logging software SDAS-1 was written by Kroum VS Instrument Ltd. specifically for handheld pc hardware. It supports real time graphics with selectable windows (uses two user selectable scales, coarse and fine). Time recorded was taken from the base GPS receiver. Magnetic data was logged at 1Hz. Data collection was by RS232 recording ASCII string and stored on flash card.

| | |
|---|---|
| **Magnetometer Type** | Cesium Vapour (high sensitivity) |
| **Model** | CS-3 |
| **Manufacturer** | Scintrex Ltd. |
| **Sensitivity** | 0.005 nT |
| **Resolution** | 0.001 nT |
| **Dynamic Range** | 15,000 – 120,000 nT |
| **GPS model** | Universal 12 channel |
| **GPS manufacturer** | Deluo |
| **Sample rate** | 1 second |

# 5 TESTS AND CALIBRATIONS

## 5.1 MAGNETIC FIGURE OF MERIT

Compensation calibration tests were performed to determine the magnetic influence of aircraft maneuvers and the effectiveness of the aircraft compensation method. The aircraft flew a square pattern in the four survey directions at a high altitude over a magnetically quiet area and perform pitches (± 5°), rolls (± 10°) and yaws (± 5°). The sum of the maximum peak-to-peak residual noise amplitudes in the total compensated signal resulting from the twelve maneuvers is referred to as the FOM index. The FOM calibration was performed near Pickle Lake on Sept 01, 2020 resulting in an index of 4.26, 0.87 and 3.64 nT for respectively the left, nose and right magnetometers (see Appendix 9.3).

## 5.2 RADAR ALTIMETER CALIBRATION

The radar altimeter was calibrated on August 29, 2020 at Pickle Lake. Raw radar altimeter data (in mV) was collected from a vertical ascent over a fixed ground reference location and correlated with corrected GPS altimetry to calculate calibration factors. See appendix 9.4.

## 5.3 MAGNETIC LAG CALIBRATION

Evaluation of the magnetic lag factor was accomplished by comparing survey data flown over distinct anomalies in opposing directions. The measured lag was 0 seconds for the nose magnetometer (GPS antenna is located at the front of nose stinger) and 0.3 seconds for the left and right boom magnetometers.

## 5.4 RADIOMETRIC COSMIC COEFFICIENTS

Cosmic calibrations were not performed on this survey; no cosmic adjustments have been performed.

## 5.5 RADIOMETRIC HIGH-ALTITUDE MEASUREMENTS

No high-level background measurements were recorded on this survey; over water data were used in final data processing to adjust raw data for day-to-day background variations.

## 5.6 RADIOMETRIC COMPTON COEFFICIENTS

The detector pack (s/n 5423) was calibrated using standard Background, Potassium, Uranium and Thorium test pads. The calibration was performed on July 30, 2020 by the manufacturer, Radiation Solutions Inc. in Mississauga, Ontario, Canada. Compton coefficients were derived from the resulting measurements and a summary report is presented in Appendix 9.5.

## 5.7 RADIOMETRIC ALTITUDE ATTENUATION

Altitude attenuation coefficients are measured on Oct 01, 2020 and the results are presented in Appendix 9.6.

## 5.8 RADIOMETRIC SENSITIVITY FACTORS

In this procedure, the helicopter measures the radiometric responses over a fixed reference point at a series of different ground clearances. At each individual ground clearance, a background measurement is also acquired over a nearby body of water (the calibration site is specifically selected based on this requirement). Ground measurements using a calibrated ground spectrometer are performed simultaneously with airborne operations. The airborne spectrometer sensitivity factors are then determined by correlating the corrected airborne data with the calibrated ground measurements and then adjusted to the mean terrain clearance of this survey. This was performed on Oct 01, 2020 at Red Lake and the results are presented in Appendix 9.7.

# 6 LOGISTICS

## 6.1 PERSONNEL

The contractor and subcontractor supplied the following properly qualified and experienced personnel to carry out the survey and to reduce, compile and report on the data:

| | | |
|---|---|---|
| Field: | Pilot | Ian Simmons |
| | Aircraft Mechanic | Yannick |
| | Operator/Field Manager | Nathanael Walton |
| | QC processor (office) | Allen Duffy |
| Office: | Final Data Processor | Allen Duffy |
| | Manager | Charles Barrie |

## 6.2 FIELD REPORTING

The operator, pilot, mechanic and helicopter were already in Pickle Lake (CYPL - main base of operations) prior to this survey and drummed fuel had been delivered in advance to Kingfisher Lake (CNM5) for local refueling between flights. The calibrations were performed prior, during and after the actual survey (see section 5).

The survey was delayed by high winds on Sept 16$^{th}$ and 17$^{th}$. The survey production was completed over 3 flights all on September 18, 2020. Flight #1 was positioning to Kingfisher Lake and refueling. Flight #2 was survey with return to Kingfisher Lake for refueling. Flight #3 completed the survey, background water line and return to Pickle Lake. Sporadic spiking occurred on the left magnetometer on north bound lines only; these spikes were narrow and easily removed without damage to the database. There were no maintenance days. The client approved the data promptly and the crew were released the following day.

The Terraquest survey operator provided flight survey reports and the geophysicist provided preliminary data and images for Quality Control and client examination. All members of the field crew worked together to achieve a flexible and efficient operation that could meet the client's objectives.

The details of the operations are shown in the Operational Summary below and in Appendix 9.2.

## *FINAL OPERATIONAL SUMMARY*

TERRAQUEST

**PROJECT REF B487 /KINGFISHER FIRST NATIONS /BIG BEAVERHOUSE: SUMMER, 2020**

| CURRENT STATUS: | 18-Sep-20 | C-FFKK | | | | | |
|---|---|---|---|---|---|---|---|
| TOTAL DAYS | INSTALL/ SET-UP | HIATUS | OPS DAYS | LKM/DAY | COMPL (%) | TOTAL FLT TIME | TOTAL PRD TIME |
| 1 | | | 1 | 264.1 | 100.00% | 6:24:00 | 2:50:02 |

**OVERALL PRODUCTION SUMMARY:**

| | PLAN | | FLOWN | | | |
|---|---|---|---|---|---|---|
| | NLIN | LKMS | NLIN | LKMS | REMAIN | COMPL (%) |
| TOTAL | 53 | 264.1 | 53 | 264.1 | | 100.00% |
| | | | | | | |
| LINE | 48 | 240.1 | 48 | 240.1 | | 100.00% |
| TIE | 5 | 24.0 | 5 | 24.0 | | 100.00% |
| BORDER | | | | | | |
| | | | | | | |

| SURVEY STATS | DAY | PROJECT |
|---|---|---|
| FLIGHT HOURS | 6:24:00 | 6:24:00 |
| SURVEY HOURS | 2:50:02 | 2:50:02 |
| LKMS ACCEPT | 264.10 | 264.10 |
| LKMS REJECT | 10.00 | 10.00 |
| LKMS % TOTAL | 100.00% | 100.00% |

**SUMMARY BY BLOCK:**

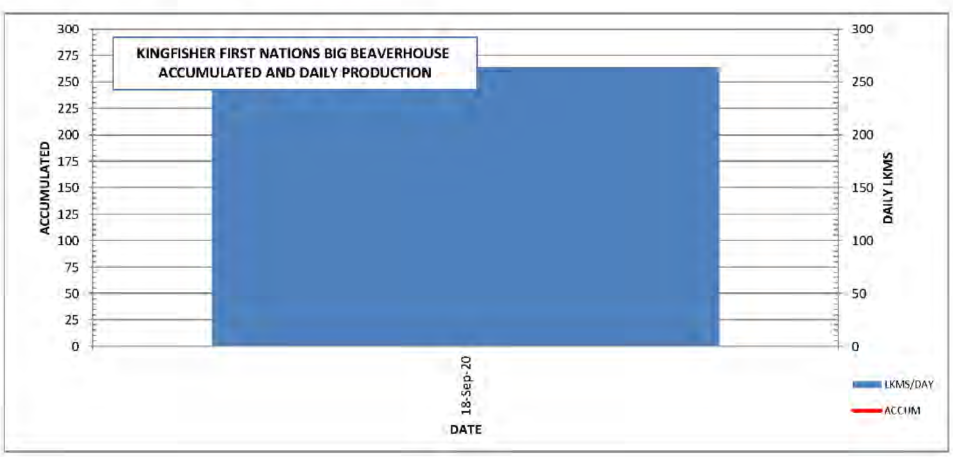
| NAME | CODE | PLAN | | FLOWN | | COMPL (%) |
|---|---|---|---|---|---|---|
| | | NLIN | LKMS | NLIN | LKMS | |
| BIG BEAVERHOUSE | BVR | 53 | 264.10 | 53 | 264.10 | 100.00% |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**COMMENTS**

Flown from Pickle L: FKK001 (FERRY); FKK002; FKK003( survey + ferry); sporadic heli interfence on TF3 (right boom) sensor on northbound lines only

**C-FFKK**

| DAY CLASS SUMMARY | |
|---|---|
| CALIBRATION | |
| EQUIPMENT | |
| INSTALL | |
| MAINT (SCHED) | |
| MAINT (UNSCHED) | |
| MOB/DEMOB | |
| SETUP | |
| SURVEY | 1.0 |
| TESTING | |
| STANDBY/WX | |
| STANDBY/DIURNAL | |
| STANDBY/TQ | |
| STANDBY/CLIENT | |
| STANDBY/RESTRICT | |
| TRAINING | |
| *TOTAL* | 1.0 |

## 6.3 BASE OF OPERATIONS

The field crew were quartered in the town of Pickle Lake (CYPL). An operational day base/re-fuel site was established at Kingfisher Lake (CNM5), with the helicopter being refueled from the barreled fuel, supplied by Morgan Fuels.

The base station was set up at Pickle Lake airport, well away from cultural interference, at 51°26.9035'N and 90° 13.0558'W.

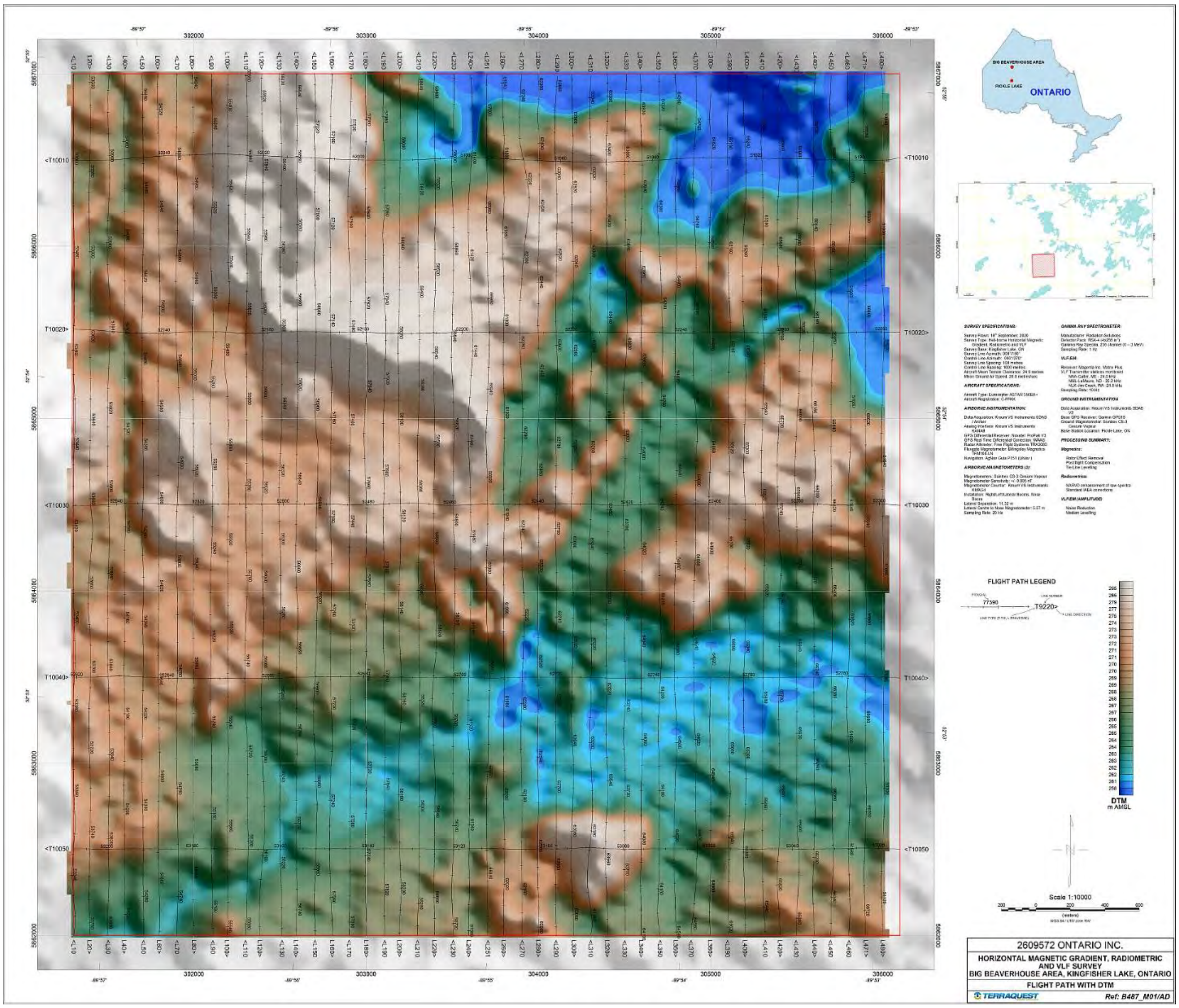
The magnetometer sensor was set up in the open with clear view of satellites and the power and electronics were in a weather-proof box.

# 7 Data Processing

## 7.1 DATA QUALITY CONTROL

The field data were sent to a geophysicist by ftps site to be examined after each production day to inspect the data for quality control and tolerances. All data were approved and checked for continuity and integrity. Partially processed magnetic data were gridded to produce preliminary plots; these were forwarded to the client. The final map below shows the survey flight path.

***B487-M01: Final Flight Path Superimposed on Digital Terrain Model (DTM)*** calculated by subtracting the radar altimeter values from the real-time corrected GPS positions (Compare with satellite topographic map around the edge of the survey area and the navigation map in section 2.5). The DTM data did not require micro-levelling.



## 7.2 FINAL MAGNETIC DATA PROCESSING

### 7.2.1 Lag Correction of Total Magnetic Field

The evaluation of the magnetic lag factor was accomplished by acquiring survey data flown in opposite directions over a series of distinct magnetic anomalies. The measured factors were 0 seconds for the nose magnetometer (the GPS antenna was located near the nose of the stinger) and 0.3 seconds for the lateral boom magnetometers.

### 7.2.2 Diurnal Data

Magnetic data from the Diurnal Base Station were scrutinized for spurious readings (data spikes) and any obvious cultural interference. Any such features were manually removed and the data re-interpolated (Akima spline) to maintain a continuous record. Given the distance to the survey area, the data were not used to adjust survey data. The base station data was used solely to verify the general diurnal activity at the time of the survey.

### 7.2.3 Rotor Effect Removal

In the helicopter stinger assembly, the nose magnetometer sensor head is mounted just ahead of the disk swept out by the main rotor, and it therefore "senses" the tips of the blades as they pass over the stinger assembly (the helicopter transmission and, to a lesser extent, tail rotor also contribute). The Eurocopter ASTSAR 350 B2 has a relatively pronounced effect because of its three carbon fibre blade main rotor. A high frequency suppression filter was applied to the magnetic data to suppress the aliased rotor noise.

### 7.2.4 Total Magnetic Field (TMI) Tie-Traverse Line Intersection Leveling

Tie-Traverse line intersection leveling was applied to the Traverse line data (using the "pre-levelled" Tie Line data). Using the Geosoft Oasis implementation of this procedure, an initial table of tie-traverse line intersection differences is compiled (together with supporting ancillary parameters such as local gradient, etc.) and intersection data loaded into the processing databases. In a series of iterative leveling passes, outlier intersection values are either disabled or modified to refine and finalize the overall result.

### 7.2.5 Total Magnetic Field (TMI) Micro-Leveling

Leveling imperfections did not remain in the intersection leveled data, therefore there was no need to microlevel the magnetic data.

### 7.2.6 Anomalous (IGRF Corrected) Total Magnetic Intensity

The *Anomalous Field* correction was made using 2020 field coefficients calculated to September 18$^{th}$, 2020 at an effective altitude of 295 m AMSL.

### 7.2.7 Calculated Vertical Derivative

The first *Vertical Derivative* was calculated using a 2D FFT operator on the Total Field data grid. Unwanted, high frequency "ringing" in the resulting 1VD grid was minimized by concurrent application of an 8th order Butterworth low pass filter with a cut-off keyed to the line spacing without damaging the geologic signal.

### 7.2.8 Magnetic Analytic Signal (ANSIG)

The angle of the earth's magnetic field at this survey latitude is flattened substantially, affecting the apparent location of magnetic sources in the Total Magnetic Intensity map. The resulting interpretational complexity may be simplified by calculation and display of the magnetic *Analytic Signal*. Analytic signal, which is derived from the three orthogonal magnetic gradients, has the advantage of producing body centric anomalies - regardless of magnetic inclination - with source edges mapped out by the function's maxima. Additionally, approximate source depth may be estimated by measuring individual anomaly widths at half amplitude.

### 7.2.9 Horizontal Gradients

Terraquest solves the spatial mathematical relationship of the three total field measurements (left, nose and right) by using the accurate location of the three magnetic sensors in space to directly calculate the East-West and North-South gradients, referenced to geographic north, at each point along the survey line.

Both *Horizontal Gradients* were then median leveled to remove bias; followed by mild micro-leveling to remove any remaining imperfections. Following this, the transverse and longitudinal gradients were gridded using a bi-directional Akima algorithm and a cell size of 25 metres. The measured transverse and longitudinal gradients provide an improved rendition of the shorter wavelengths in magnetic field than the residual magnetic field measured by the nose sensor alone. This is because the direction and amplitude of the field's total horizontal gradient can be determined using the 2 measured gradients, providing information regarding the behavior of the magnetic field in-between traverse lines. Thus, it is useful to incorporate the gradient data in the preparation of the residual magnetic field grid.

### 7.2.10 Reconstructed Total Field (RTF)

Data grids of the measured horizontal gradients were used to generate the *Reconstructed Total Magnetic Field* using the 2D FFT process described by J. B. Nelson (Nelson, 1994)*. This product (RTF) has the advantage of being un-affected by magnetic diurnal activity and excellent representation of the near surface responses especially in the transverse component. Longer (deeper) magnetic spatial wavelengths are not represented due to measurement resolution limitations in the magnetometers. The resulting data units (expressed as pseudo nanoTesla) are not true nT; approximate conversion to true nT may be accomplished by application of scaling factor if required. Using the calculated Reconstructed Total Field data grid, an "RTF" Geosoft database channel is created by performing a grid look-up ("grid sample") for each data point in the production database.

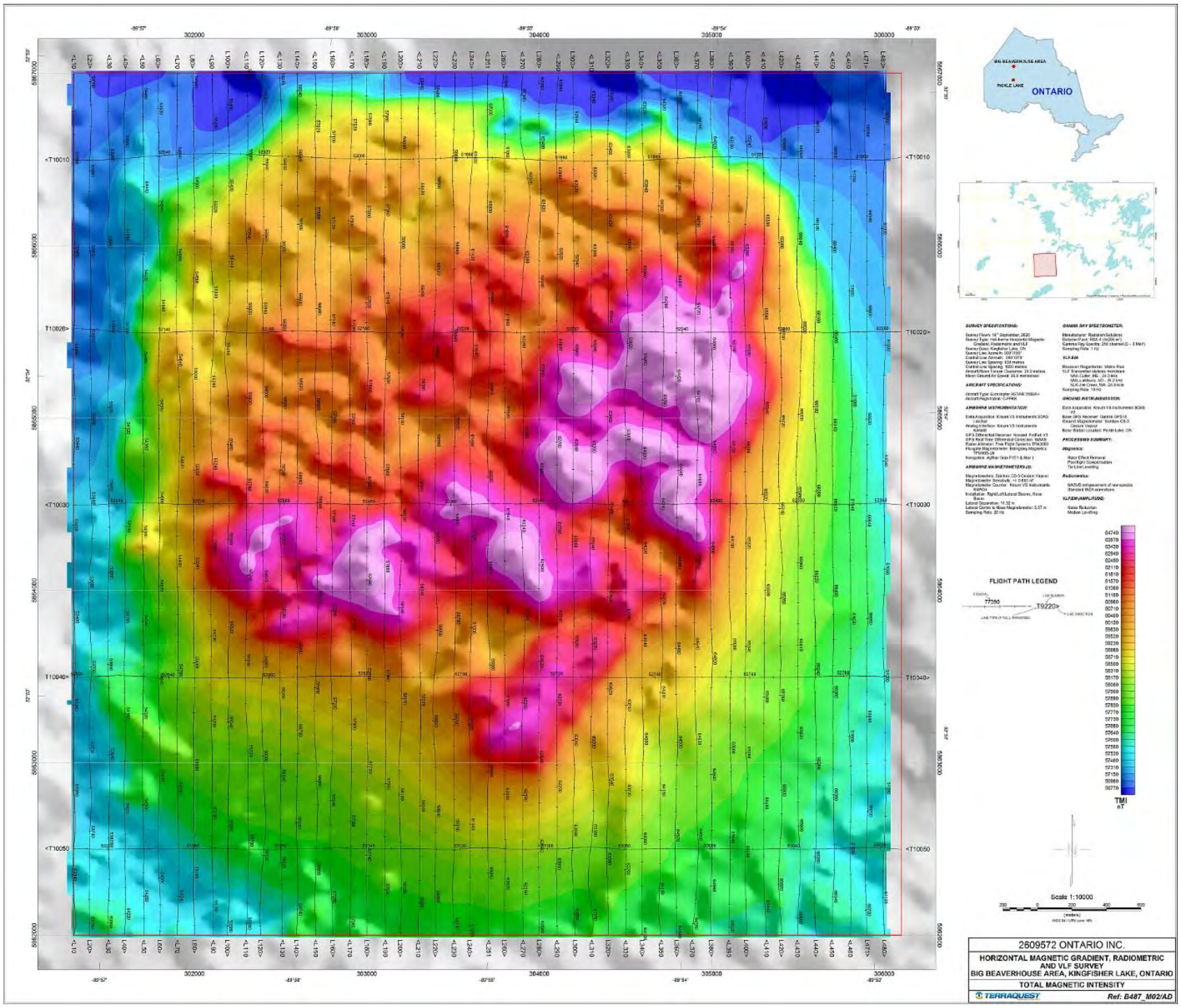
** Reference: Nelson, J.B., 1994, Leveling total-field aeromagnetic data with measured horizontal gradients: Geophysics, 59, 1166-1170*

### 7.2.11 Data Grids

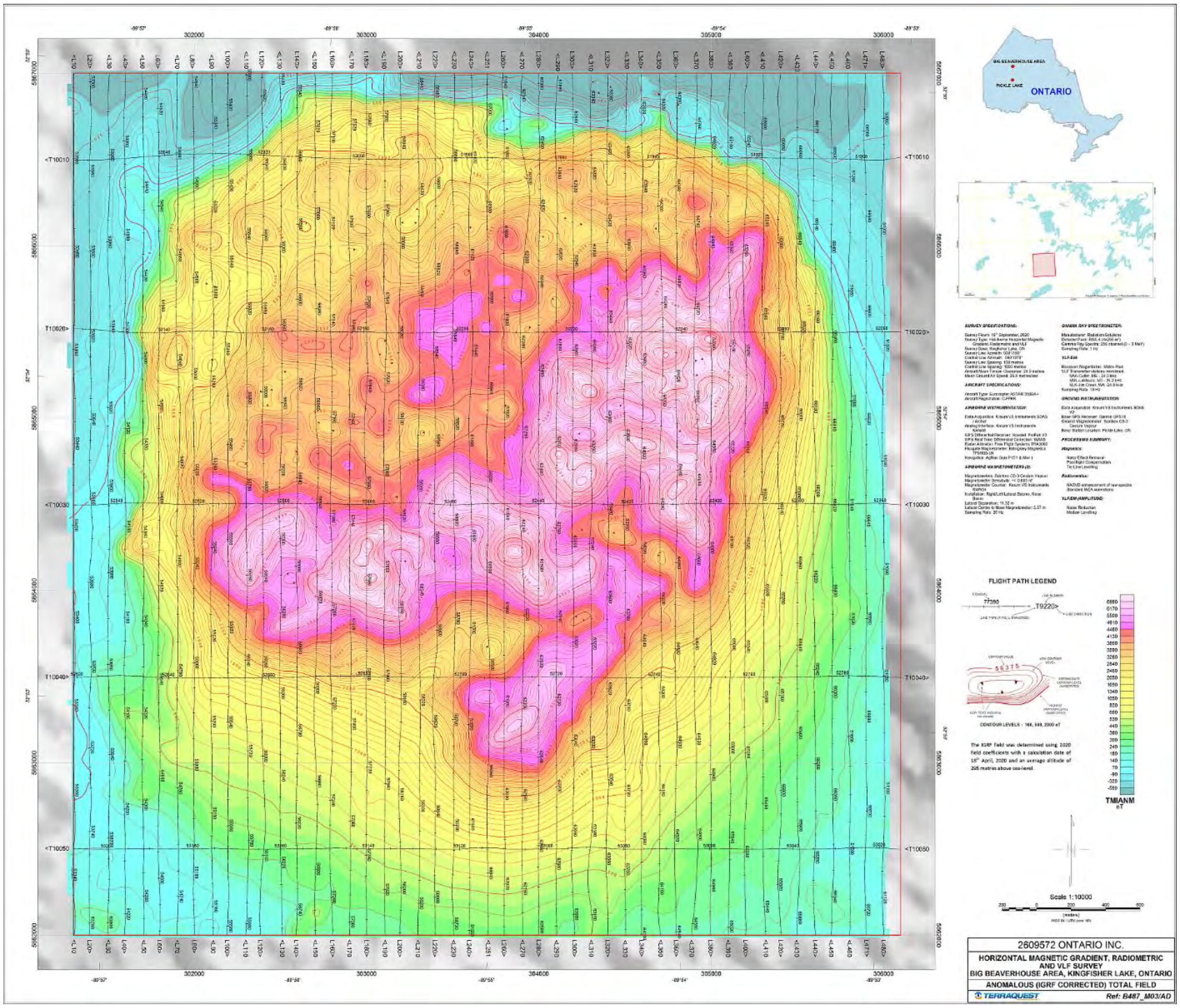
All the magnetic data were interpolated using Bi-Directional (Akima) gridding at a cell size of 25 metres.

### 7.2.12 Final Processed Magnetic Maps (Low Resolution for this Report)

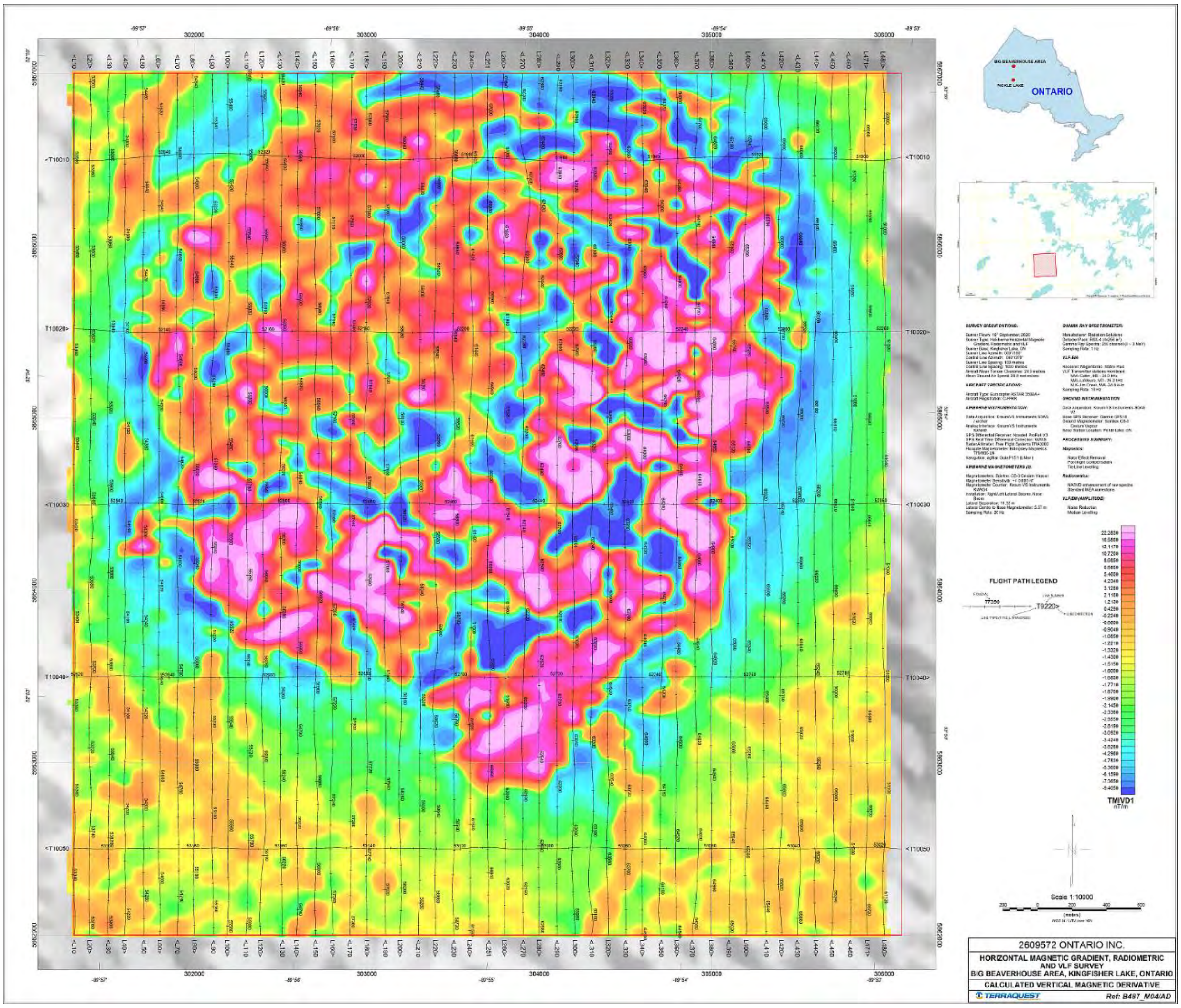
## *B487-M02: Total Magnetic Intensity, Colour Shaded Image – TMI (nT)*



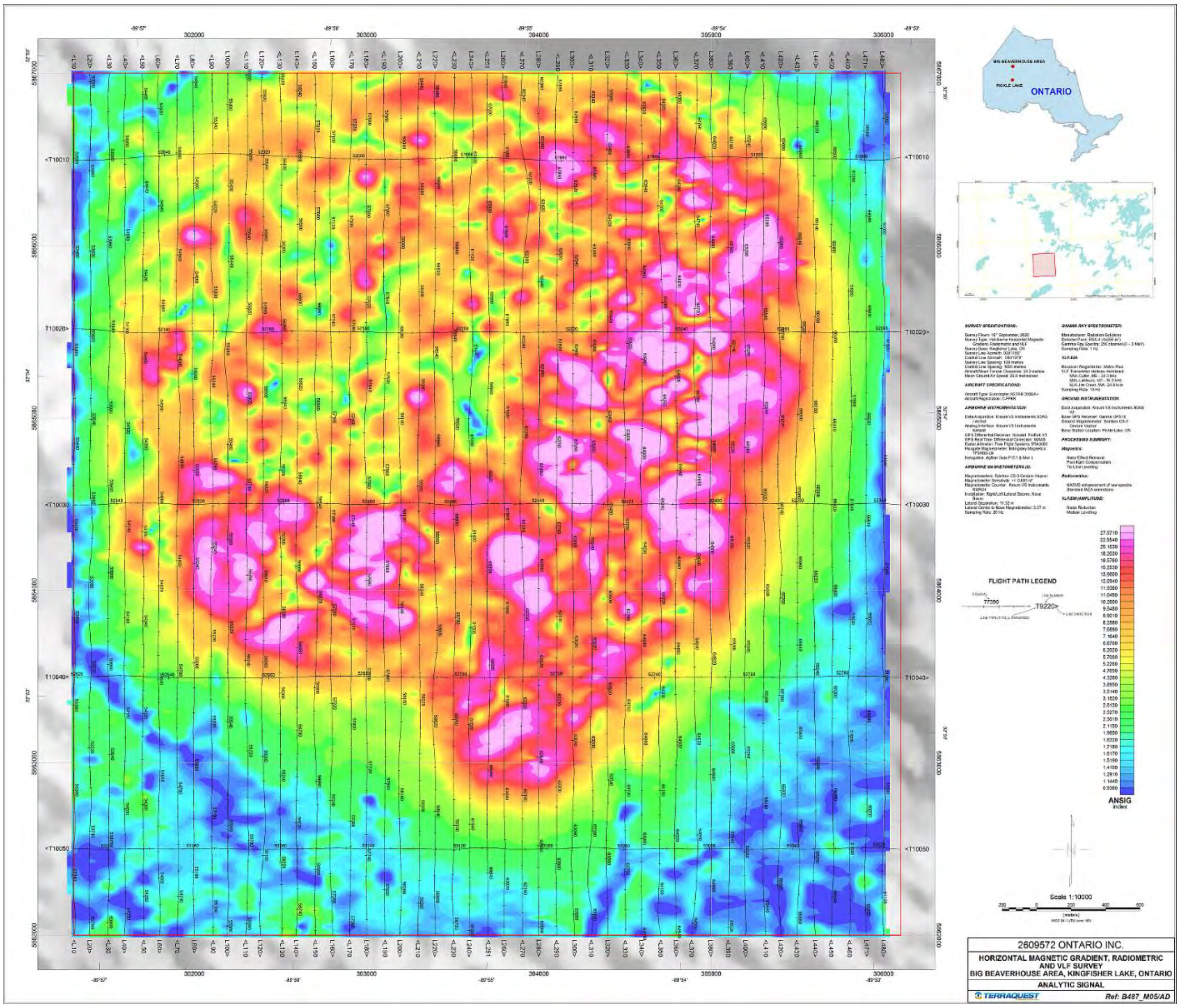
## *B487-M03: Anomalous IGRF Corrected Magnetic Field (nT)*



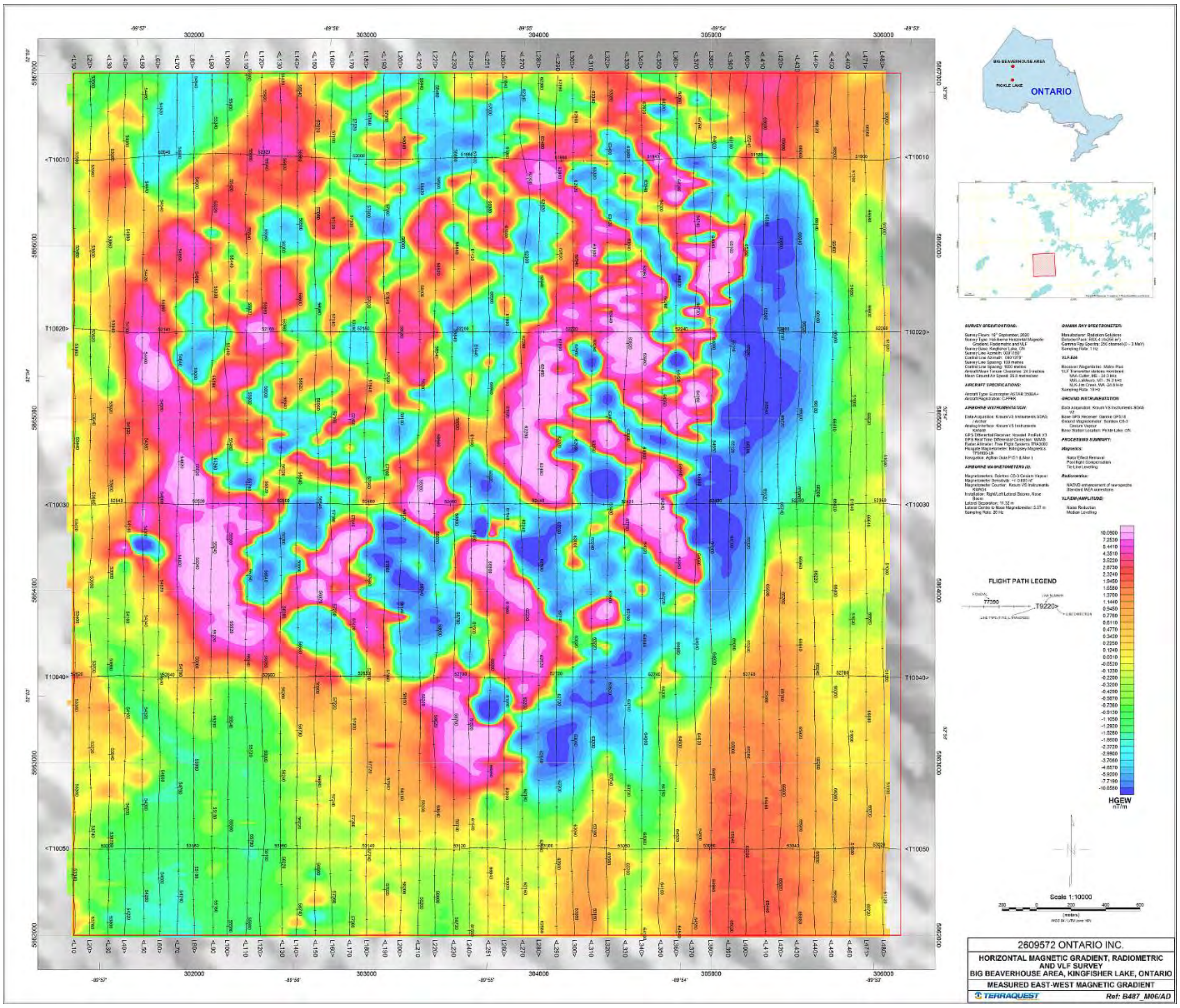
## *B487-M04: Calculated Vertical Magnetic Derivative of TMI (nT/m)*



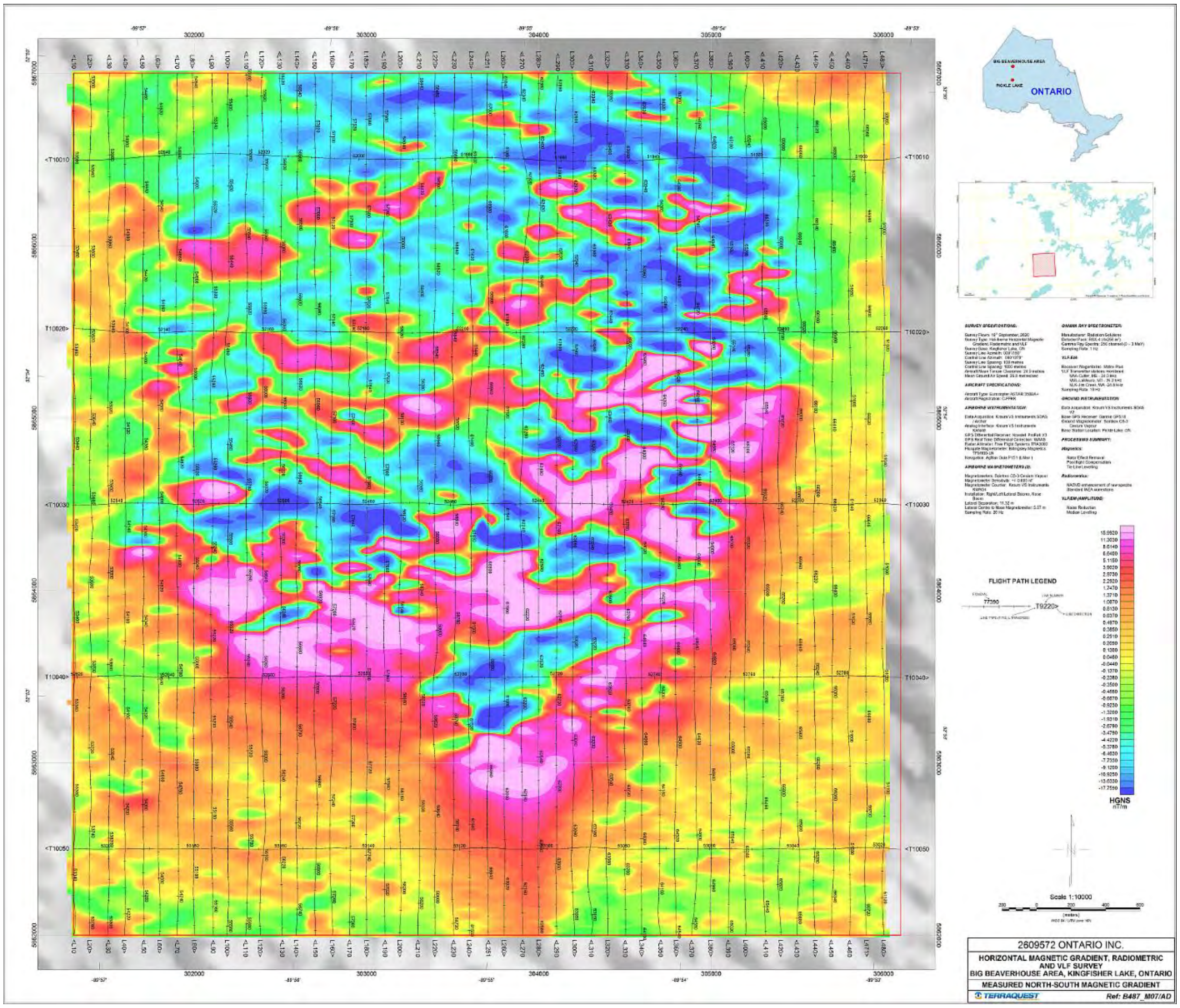
## *B487-M05: Calculated Analytic Signal of TMI (ANSIG-index)*



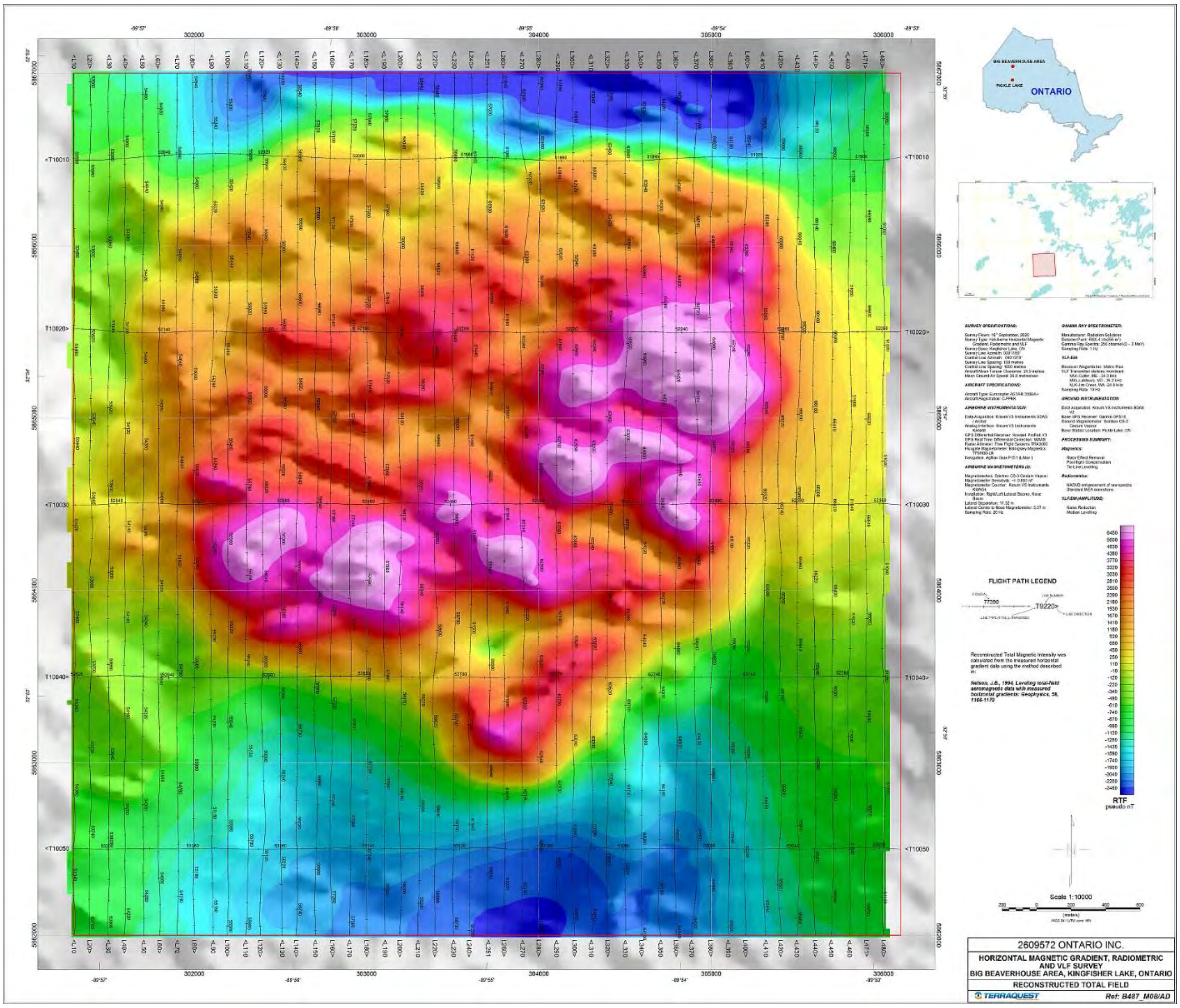
## *B487-M06: Measured East-West Horizontal Magnetic Gradient (nT/m)*



## *B487-M07: Measured North-South Horizontal Magnetic Gradient (nT/m)*



## *B487-M08: Reconstructed Total Field (pseudo nT)*



# 7.3 FINAL RADIOMETRIC PRODUCTS

## 7.3.1 Radiometric Data Processing

The radiometric data were processed according to guidelines established in the definitive IAEA Technical Report “Airborne Gamma Ray Spectrometer Surveying” (IAEA Technical Reports Series No. 323, 1991). The following specifics were performed:

- Recorded as a 256-channel spectrum, the four raw integral (or “terrestrial”) windows (Total Count, Potassium, Uranium and Thorium) were initially generated by summing the recorded counts between their appropriate channel limits – as specified below:

  *256 Channel ROI definitions (based on 0-255 channel indices):*

  | | |
  |---|---|
  | Total Count: | 30 - 233 |
  | Potassium: | 115 - 131 |
  | Uranium: | 139 - 156 |
  | Thorium: | 201 - 233 |
  | Cosmic (>3 MeV): | 255 |

- Since the Radiation Solutions RS500 Spectrometer does not suffer from conventional measurement “dead time”, no discrete correction for this effect need be applied.

- An effective way of ameliorating the effects of decreased signal-to-noise ratio is to reduce the natural Poisson noise component by application of modern principal component analysis techniques - NASVD (or "Noise Adjustment by Singular Value Decomposition" *) being a particularly effective technique. In this process, the measured 256 channel gamma ray spectra are analyzed en masse, producing a set of 256 distinct "principal components" which can be recombined to produce very accurate representations of the original spectral measurements. Given consistent recording of the gamma-ray spectra, the actual "signal" part is concentrated in the first few principal components with the remaining higher order components largely concerned with noise. By reconstructing the original spectra using only these initial components, statistical measurement noise is largely suppressed. ROIs (Total Count, Potassium, Uranium and Thorium) are then extracted from the noise reduced spectra. The practical advantage of this is to allow successful isolation of geological signals (given a fixed detector volume) at greater terrain clearances than are normally feasible.

  * *Hovgaard,J.;Grasty,R.L. : Reducing Statistical Noise in Airborne Gamma Ray Data Through Spectral Component Analysis – presented at Exploration97, Toronto, Canada 1997(Paper 98 - Radiometric Methods and Remote Sensing)*

- The *Radiometric Lag* factor 0.5 seconds (half the sample interval) was applied to the data.

- The raw count rates were corrected for static and ambient background sources (Aircraft, Cosmic and Radon) by using local overwater measurements, where geologic responses are completely suppressed by the water cover.

- The background corrected measurements were corrected for *Compton Scattering* by application of “Stripping Coefficients” experimentally determined in a specific calibration exercise using standard large-scale radio-element sources (see Appendix 9.5).

- Count rates were further adjusted by correction to constant terrain clearance (*Altitude Attenuation Correction*). This correction step includes the application of exponential attenuation coefficients, specific to each of the four integral windows, determined during a specific calibration procedure (see Appendix 9.6).

The applied constant terrain clearance was 40 m, using the temperature/pressure corrected Radar altimeter as input.

- Corrected radiometric data are delivered both as count rates (counts-per-second) and as calibrated ground units by application of sensitivity factors determined during the calibration procedures performed at Red Lake. Sensitivity factors are specific to the constant terrain clearance set for the block (24.9m) - see Appendix 9.7. Applicable ground units for each of the four integral windows are as follows:

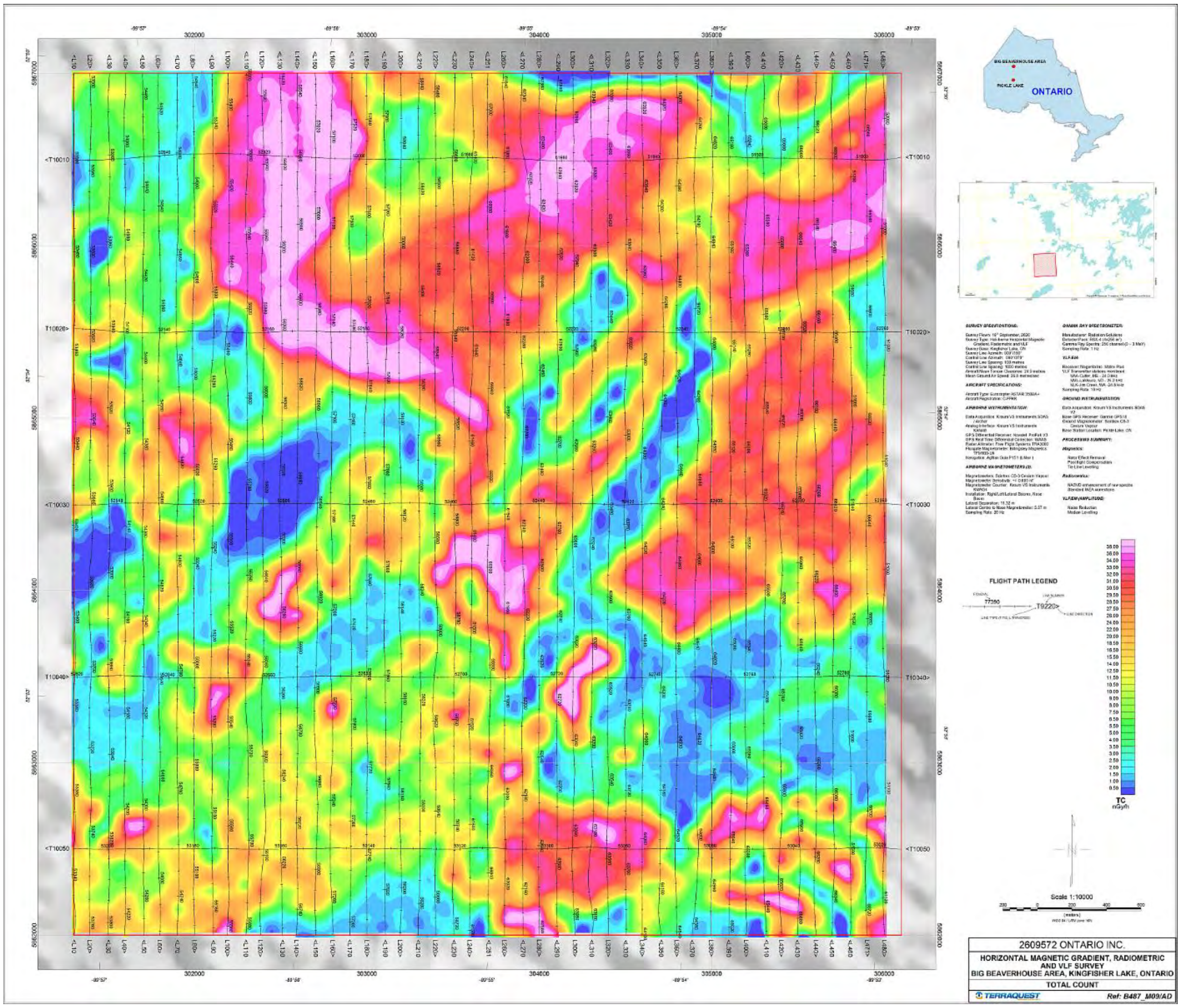
| | |
|---|---|
| Total Count: | Exposure Rate, nano Gray/hour (nGy/h) |
| Potassium: | Percent (%K) |
| Uranium: | Parts per Million equivalent Uranium (ppm eU) |
| Thorium: | Parts per Million equivalent Thorium (ppm eTh) |

- Potassium, Uranium and Thorium were also presented as a standard Ternary map and as a Normalised Ternary map. The Normalised Ternary map is designed to enhance colour discrimination of the various geologic units by pre-normalising each ROI component prior to imaging (the Geologic Survey of Canada “STERGEN” process was used to accomplish this)

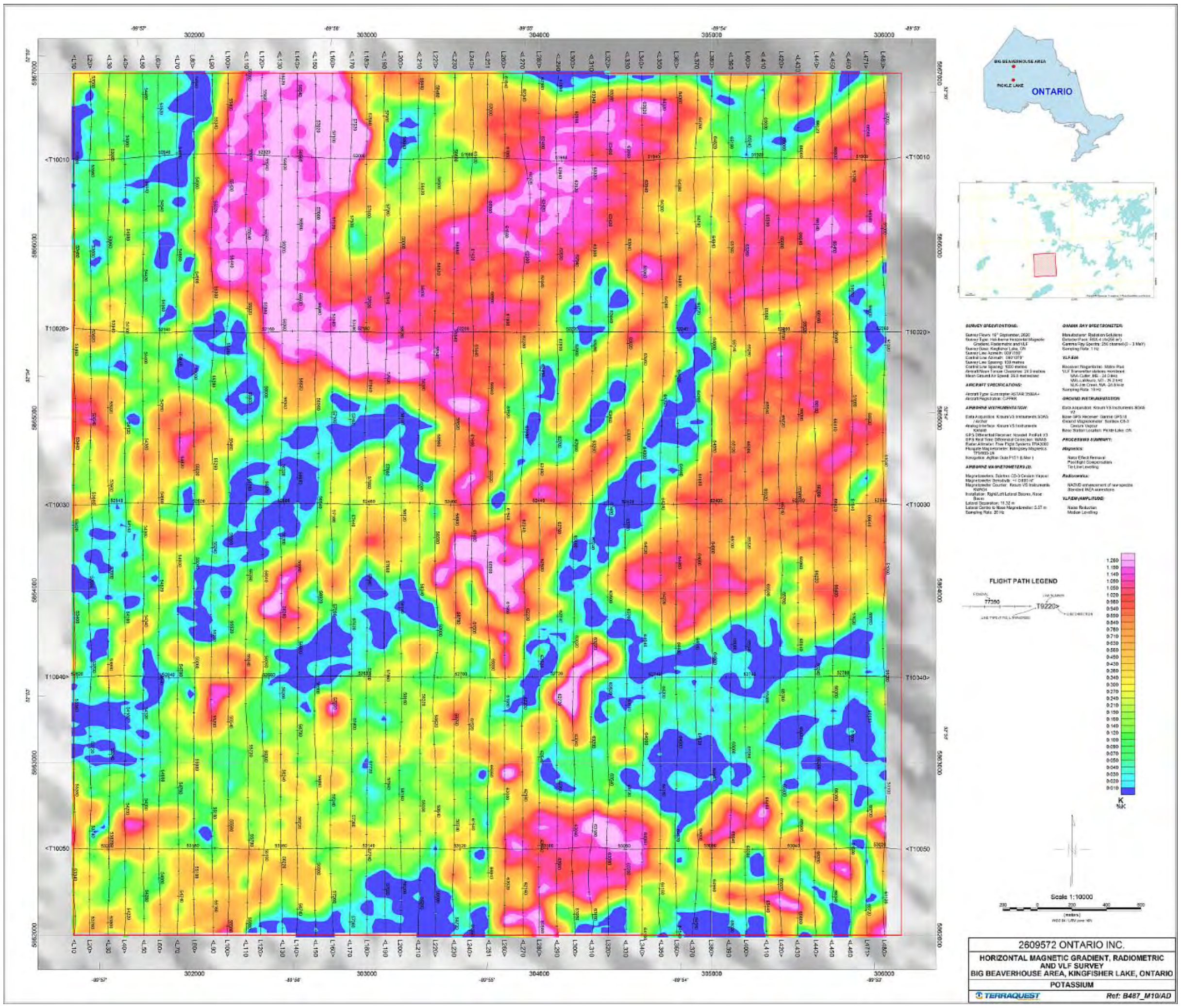
The final processed radiometric data did not require any microlevelling. The radiometric data were gridded using minimum curvature procedures with a cell size of 25 metres.

### 7.3.2 Final Radiometric Maps (Low Resolution for Report)

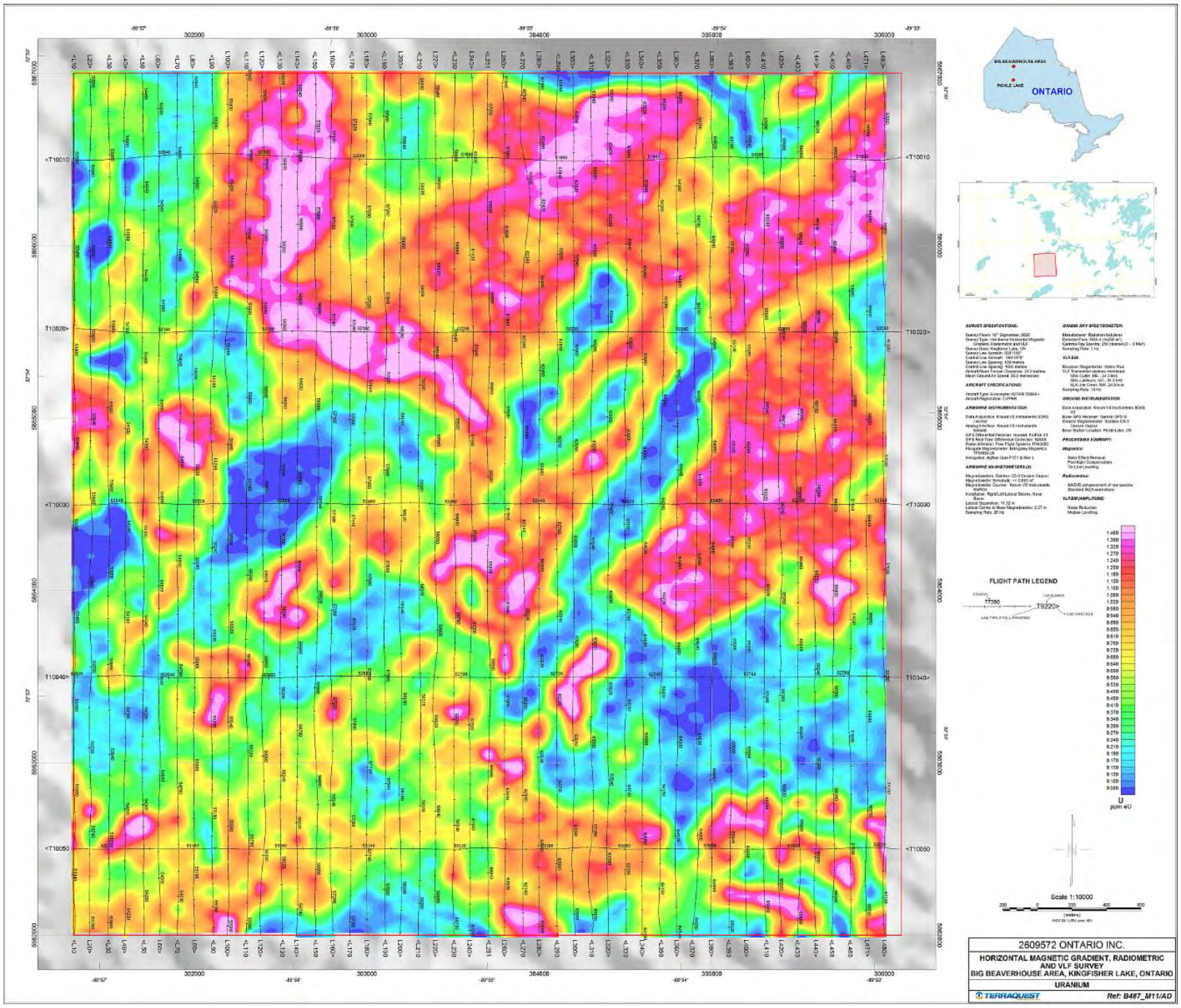
## *B489-M07: Total Count (nGy/h)*



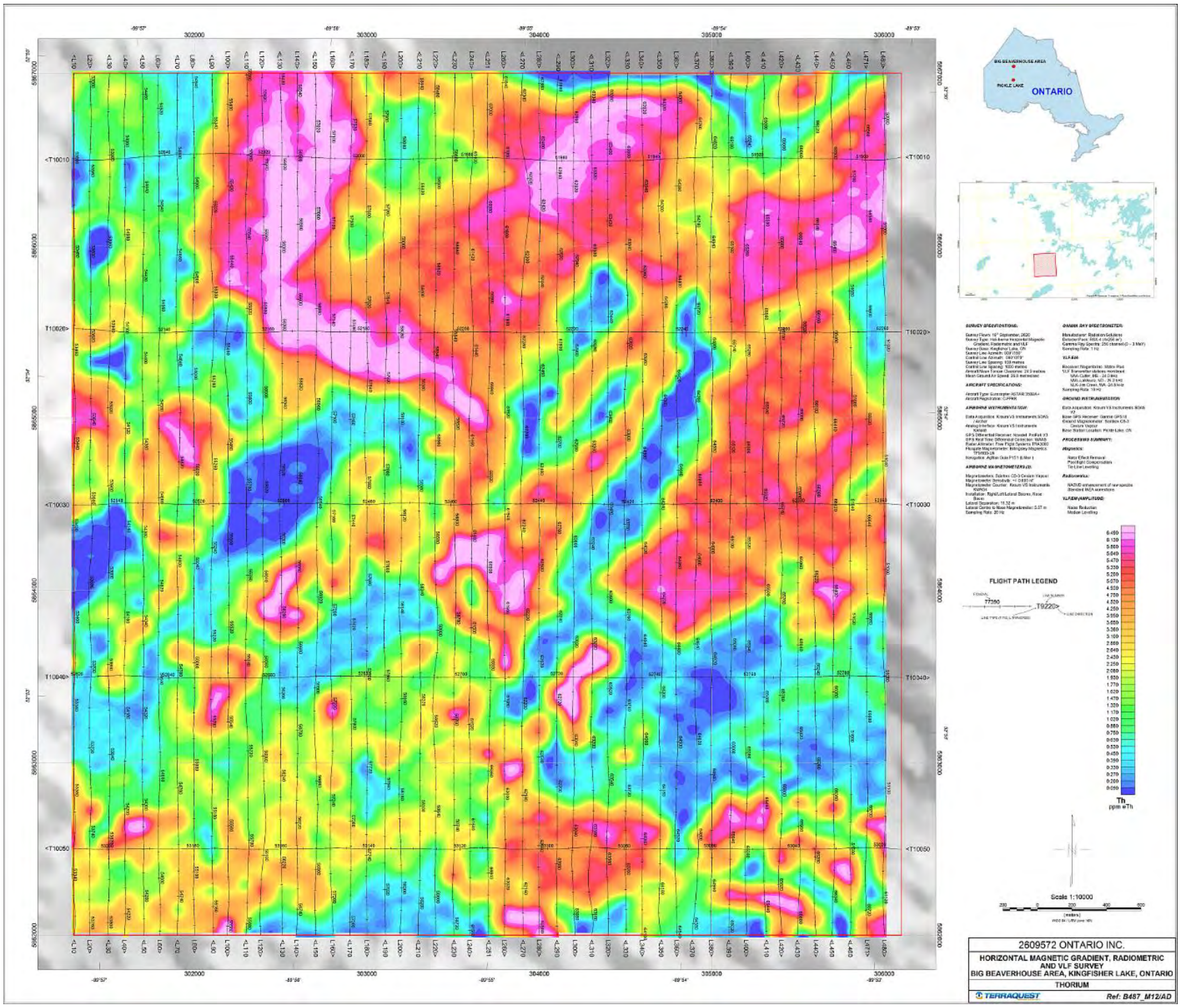
## *B487-M10: Potassium (%K)*



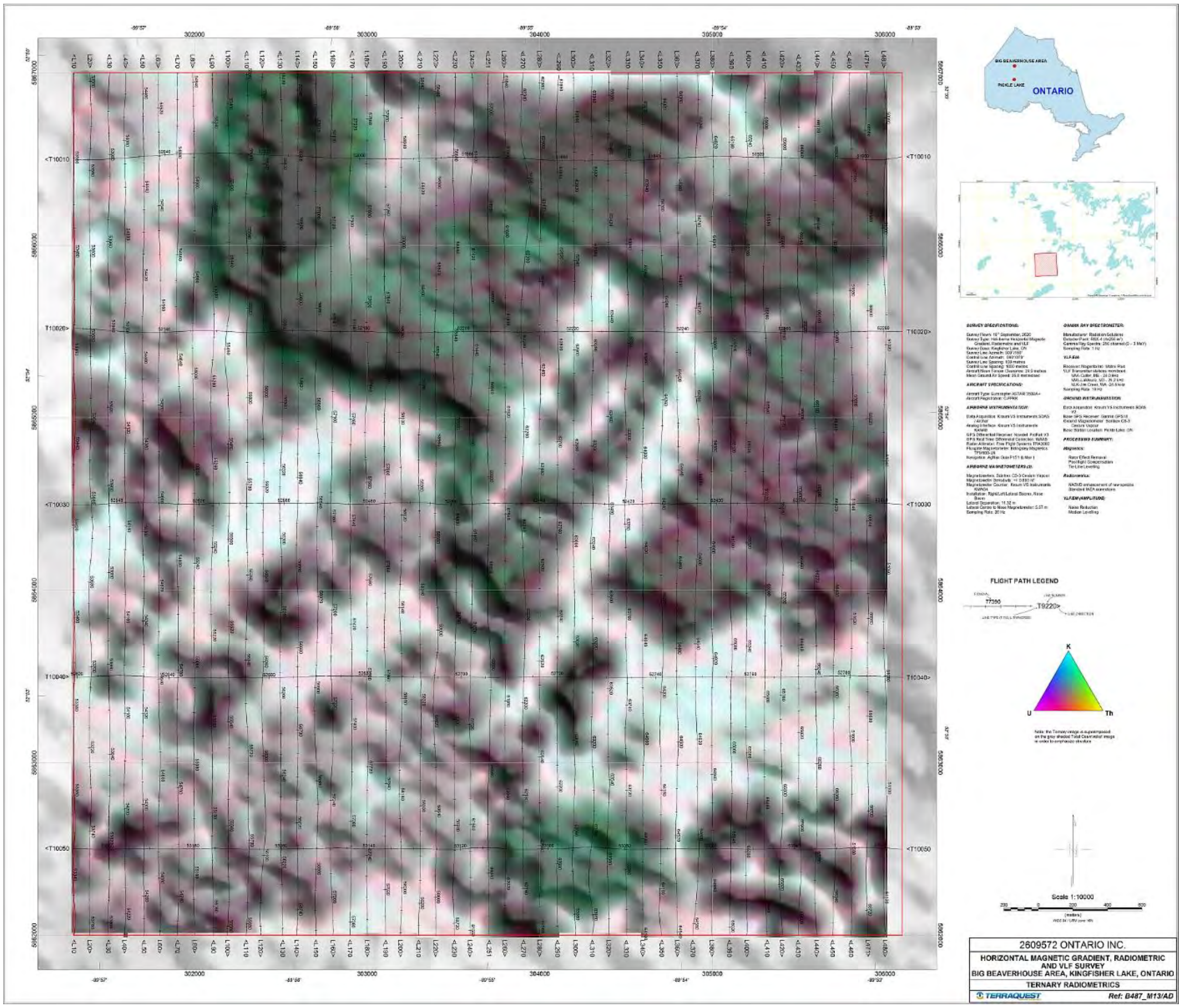
## B487-M11: Uranium (ppm eU)



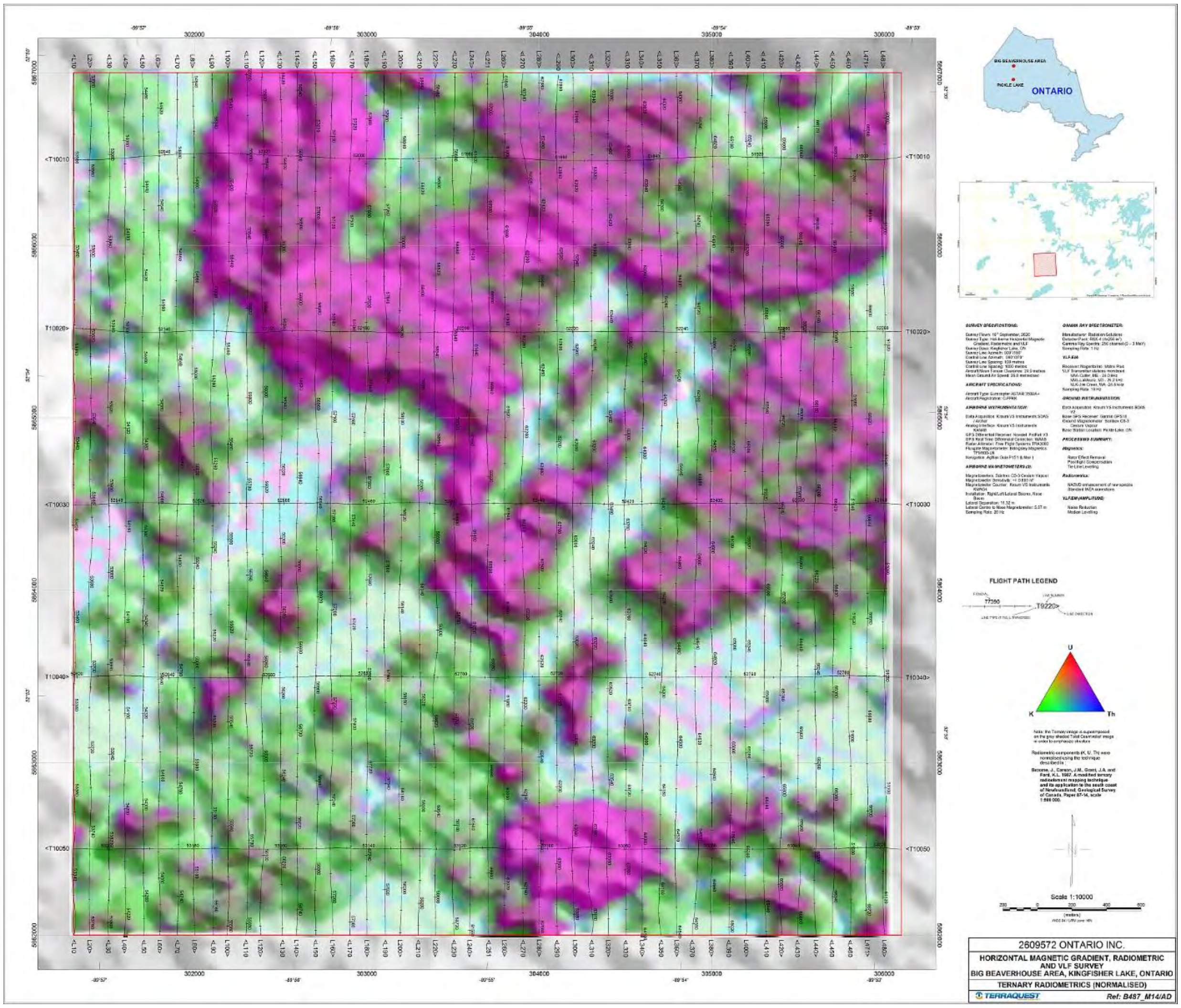
## *B487-M12: Thorium (ppm Th)*



***B487-M13: Ternary Radiometrics (Standard)*** (C:Potassium; M:Thorium; Y:Uranium)



***B487-M14: Ternary Radiometrics (STERGEN Normalized)*** (C:Potassium; M:Thorium; Y:Uranium)



# 7.4 MATRIX VLF-EM TOTAL FIELD

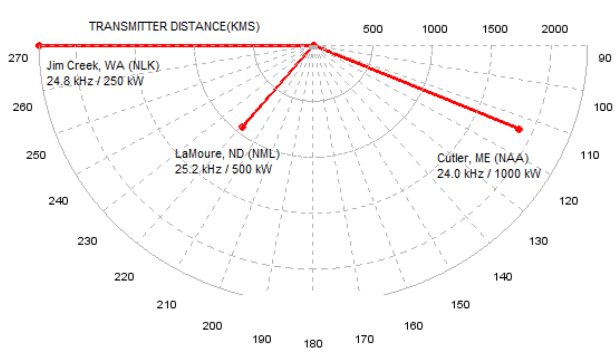
## 7.4.1 Matrix VLF-EM Monitoring

VLF-EM data were captured using a Magenta Inc. Matrix Digital VLF receiver. This instrument is capable of simultaneously monitoring up to four VLF frequencies, recording amplitude of secondary field, transmitter station azimuth (relative to aircraft orientation), vertical and planar ellipticities, Tipper coefficient and field tilt angle. For this project, the following VLF transmitters were monitored:

- Station NAA: Cutler, Maine – 24.0 kHz
- Station NML: La Moure, North Dakota – 25.2 kHz
- Station NLK: Jim Creek, Washington – 24.8 kHz

Transmitter power, distances and azimuths relative to the survey block are illustrated below and on the plotted maps. Transmitter stations are nominally shut down for scheduled maintenance as follows: NAA Cutler, Maine on Mondays, NML LaMoure, North Dakota on parts of Tuesdays, and NLK Seattle, Washington progressively throughout Wednesday such that there is generally always some signal. The survey was flown in a manner that ensured that all survey lines did not have any VLF Transmitter-off days.

**VLF STATION AZIMUTH**




## 7.4.2 Matrix VLF-EM Processing Total Field

The *Total Field Amplitude* was processed and presented separately for each of the frequencies. Processing of the raw amplitude data consisted of the following:

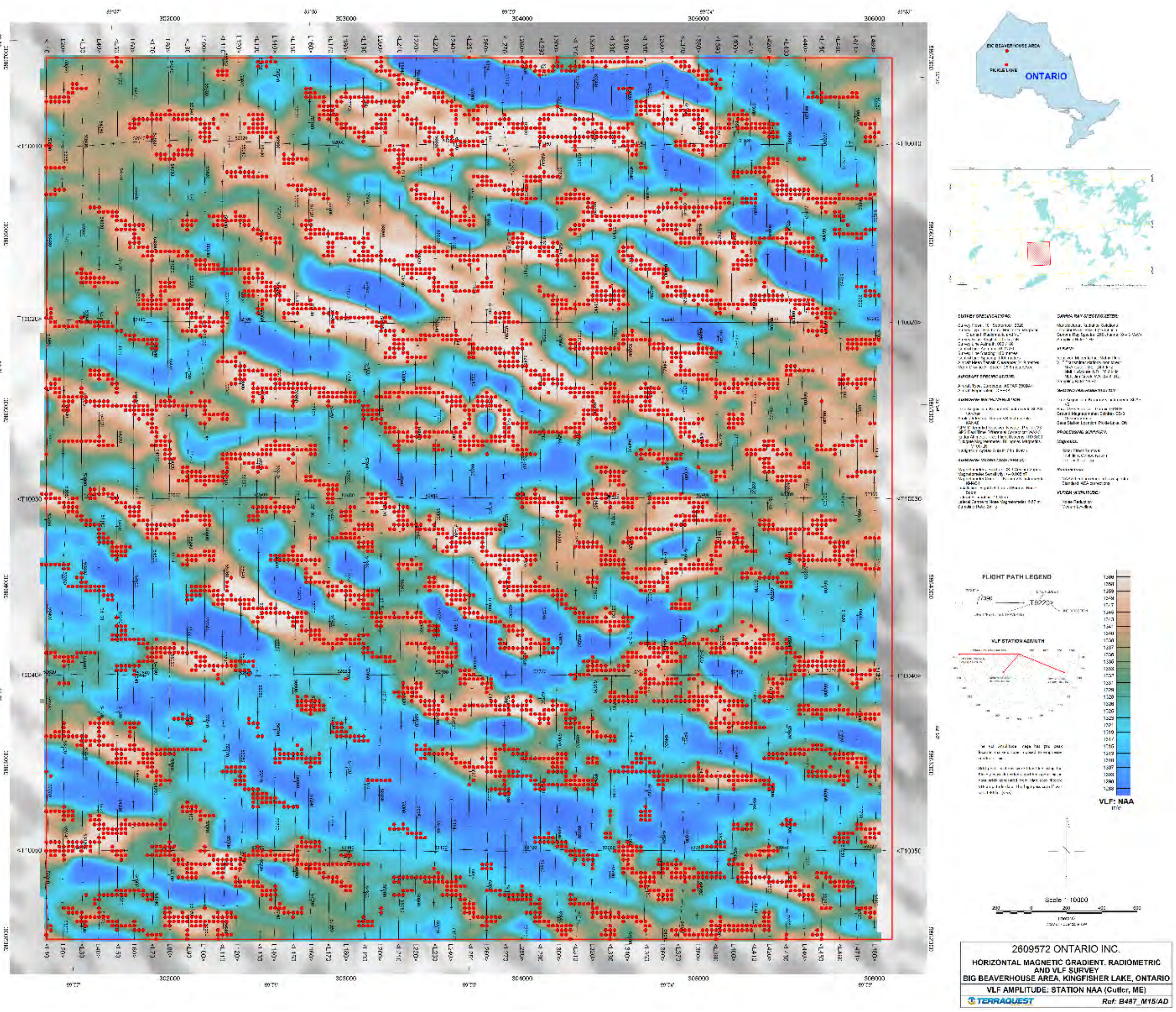
- Mask out any embedded “off-line” data
- Noise reduction filtering using non-linear Naudy filtering (5 pt filter width), gridded with 25 metres grids
- Initial leveling (mean subtraction)
- Fine leveling (micro-leveling)
- Application of bias offsets such that finalized data ranged positive

The finalised amplitude data for each channel were presented as a series of colour images of total field strength (amplitude). Conductor axes and other VLF anomalous features (topographic effects, conductive lake sediments, etc.) are mapped by “hot” colours (light brown -> white) as peak centric lineaments.

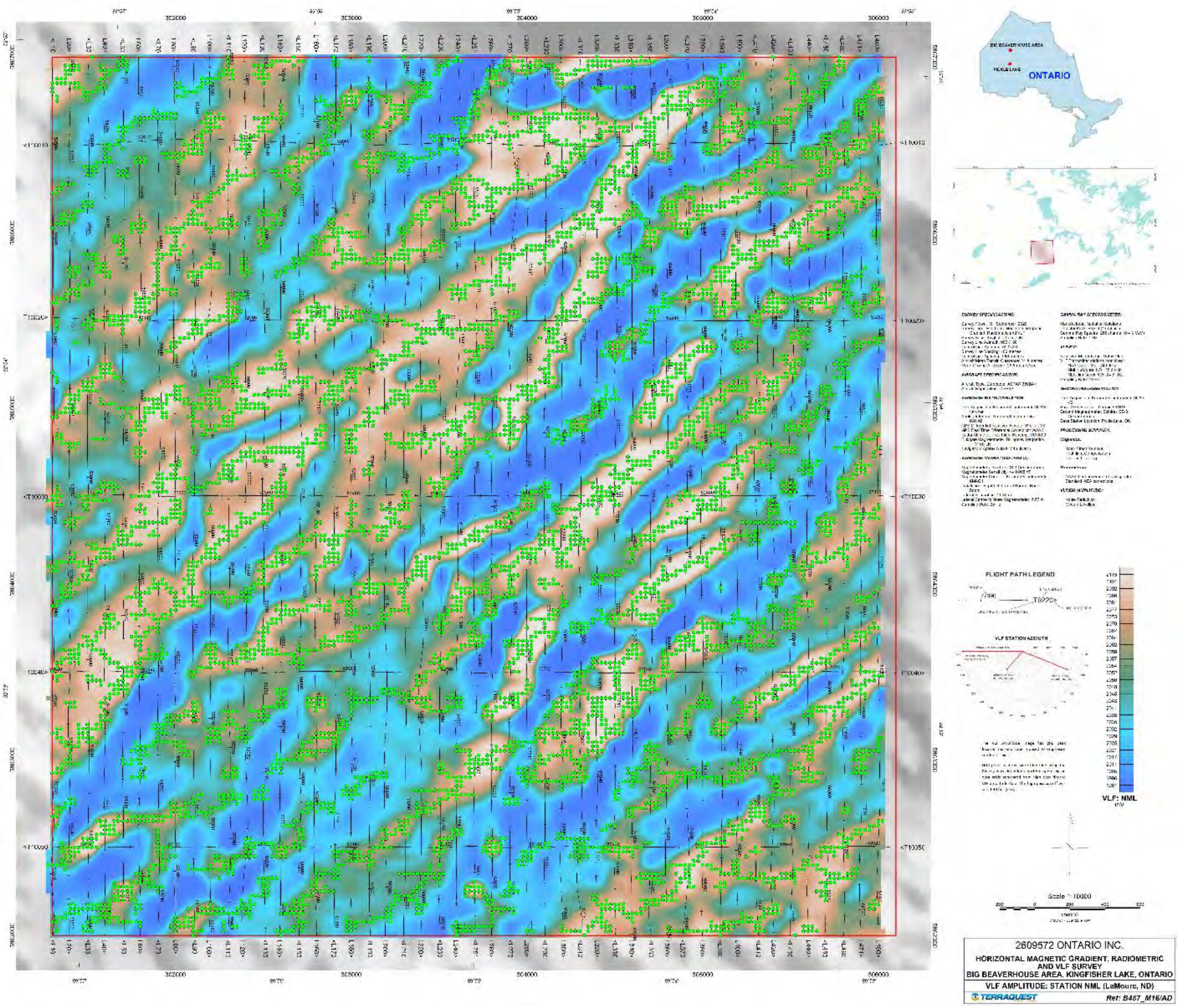
In addition, final corrected Amplitude data were high-pass filtered (30 fid cut-off) and used to create data grids which were analysed with a peak-detection algorithm (*Blakely algorithm*). The resulting **peak locations** were marked and superimposed on the amplitude images as dots to emphasize conductor axes.

### 7.4.3 MATRIX VLF-EM TOTAL FIELD STRENGTH MAPS

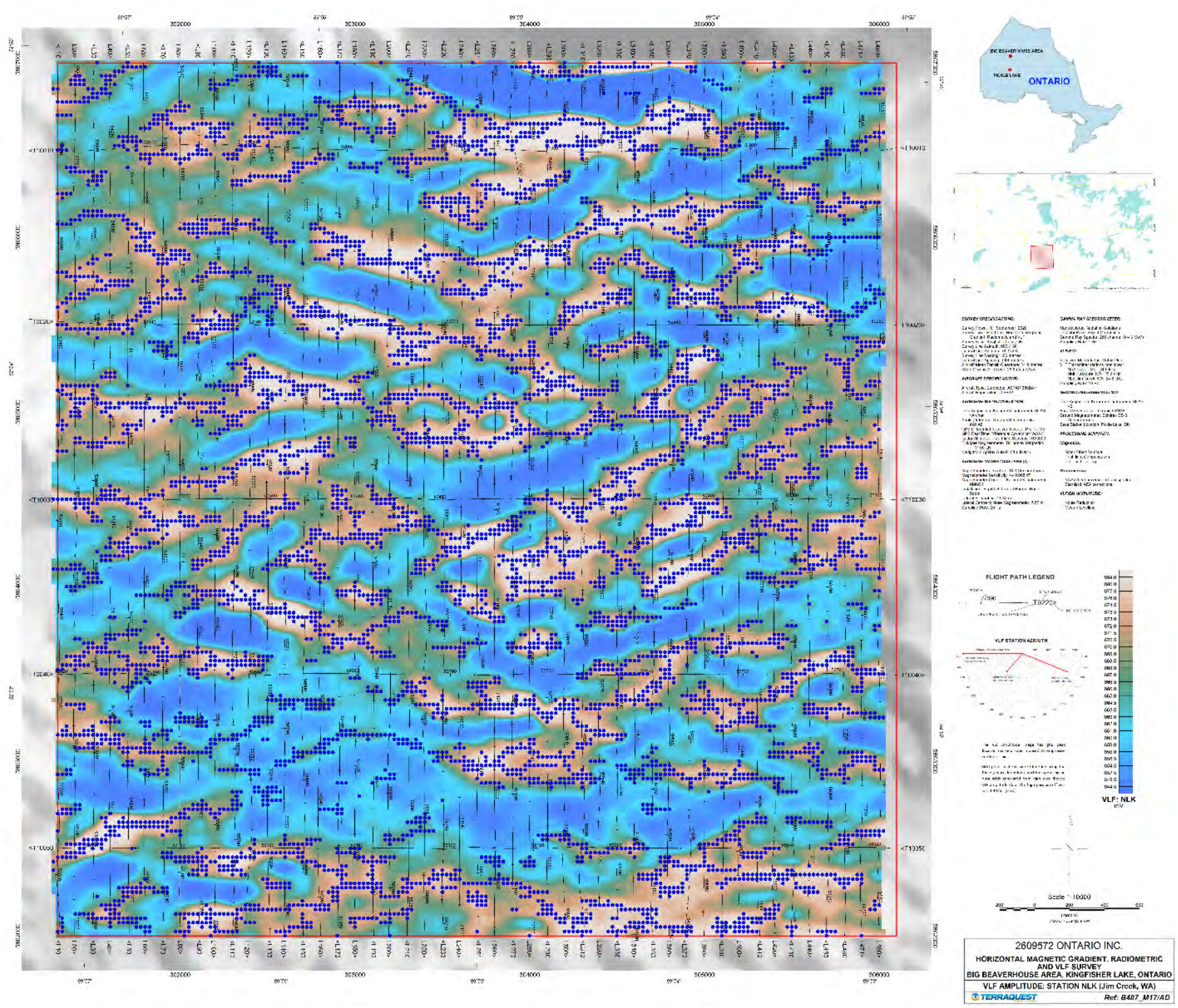
## *B487-M15: Amplitude &Profile Peaks of Secondary Total Field Strength: NAA, Cutler, ME*



***B487-M16: Amplitude &Profile Peaks of Secondary Total Field Strength: NML, LaMoure, ND***



## *B487-M17: Amplitude &Profile Peaks of Secondary Total Field Strength: NLK, Seattle, WA*



# 7.5 MATRIX VLF-EM INVERSE MODELLING

## 7.5.1 Introduction

Based on the quality of the Matrix data on this survey and correlation with airborne magnetic and ground data, the client requested to have the data inverted to calculate the resistivity. The final processed Total Field Strength and all recorded parameters were sent to EMTOMO to perform recently developed inversion procedures designed specifically for airborne VLF-EM data. Products from this processing include a resistivity channel in the database from which resistivity depth slices can be calculated at 5, 10, 20, 40, 60 and 100 metre depths for Cutler, La Moure and Jim Creek stations. These were final leveled and gridded with 10 metre grid cell size by Terraquest Ltd. and provided as grids for each depth slice. The depth slices have been stacked as three-dimensional montages shown in section 7.5.3 and presented as final plots for each station. Also, Geosoft VOXELS of resistivity for each VLF transmitter were created and included in the final archive (refer to README file Appendix 9.8); these are best visualized on a computer using 3D rotatable software to select desired parameters and views. A summary of inversion theory follows.

## 7.5.2 Inversion Processing

The VLF signal used in prospection is generated by communication antennas working in the frequency range of 10 kHz to 30 kHz. Those antennas behave like electric dipoles and its associated electromagnetic field (primary field) travels radially outward via two propagation mechanisms: along the earth's surface (wave guided) and by reflection at various charged layers in the ionosphere at altitudes of 60-400 km. The variable primary field induces electrical currents, mainly in conductive structures orientated parallel to the direction the electric field source (VLF transmitter). The induced currents generate an electromagnetic field (secondary field) that can be detected at surface or at some height by the receiver. Having a vertical component of the magnetic field, the following relationship exists between horizontal and vertical components:

$$H_z = T_{zy} H_y$$

where $T_{zy}$ is the magnetic transference function or Tipper. In VLF-EM, the data are the In-phase and Quadrature, or the real and imaginary parts of the tipper ($H_z^s / H_y$), where $H_z^s$ and $H_y$ are the vertical component of the secondary field and the horizontal component of the total magnetic field.

The nonlinear, smoothness-constrained inversion algorithm (Sasaki, 1989, 2001; DeGroot and Constable, 1990) was adopted for VLF inversion (Monteiro Santos et al., 2006). The inversion is performed by an iterative process that allows the final model to be obtained, with its response fitting the data set in a least square sense. At each iteration, the optimization equations that must be solved to get the corrections of the parameters are represented as follows:

$$(\mathbf{J}^T \mathbf{J} + \lambda \mathbf{C}^T \mathbf{C}) \delta\vec{p} = \mathbf{J}^T \vec{b}$$

where $\delta\vec{p}$ is the vector containing the corrections applicable to the parameters (logarithm of block conductivity, $\sigma_j$) of an initial model, $\vec{b} = \overrightarrow{T^o} - T_i^c \; is \; t$ is the vector of the differences between the observed and calculated tipper components, **J** is the Jacobian matrix whose elements are given by $(\sigma_j)(\partial T_i^c / \partial \sigma_j)$, the superscript T denotes the transpose operation, and λ is a Lagrange multiplier (Damping factor) that controls the amplitude of the parameter corrections and whose best value is determined empirically. The elements of the matrix **C** are the coefficients of the values of the roughness in each parameter, which is defined in terms of the four neighbours' parameters.

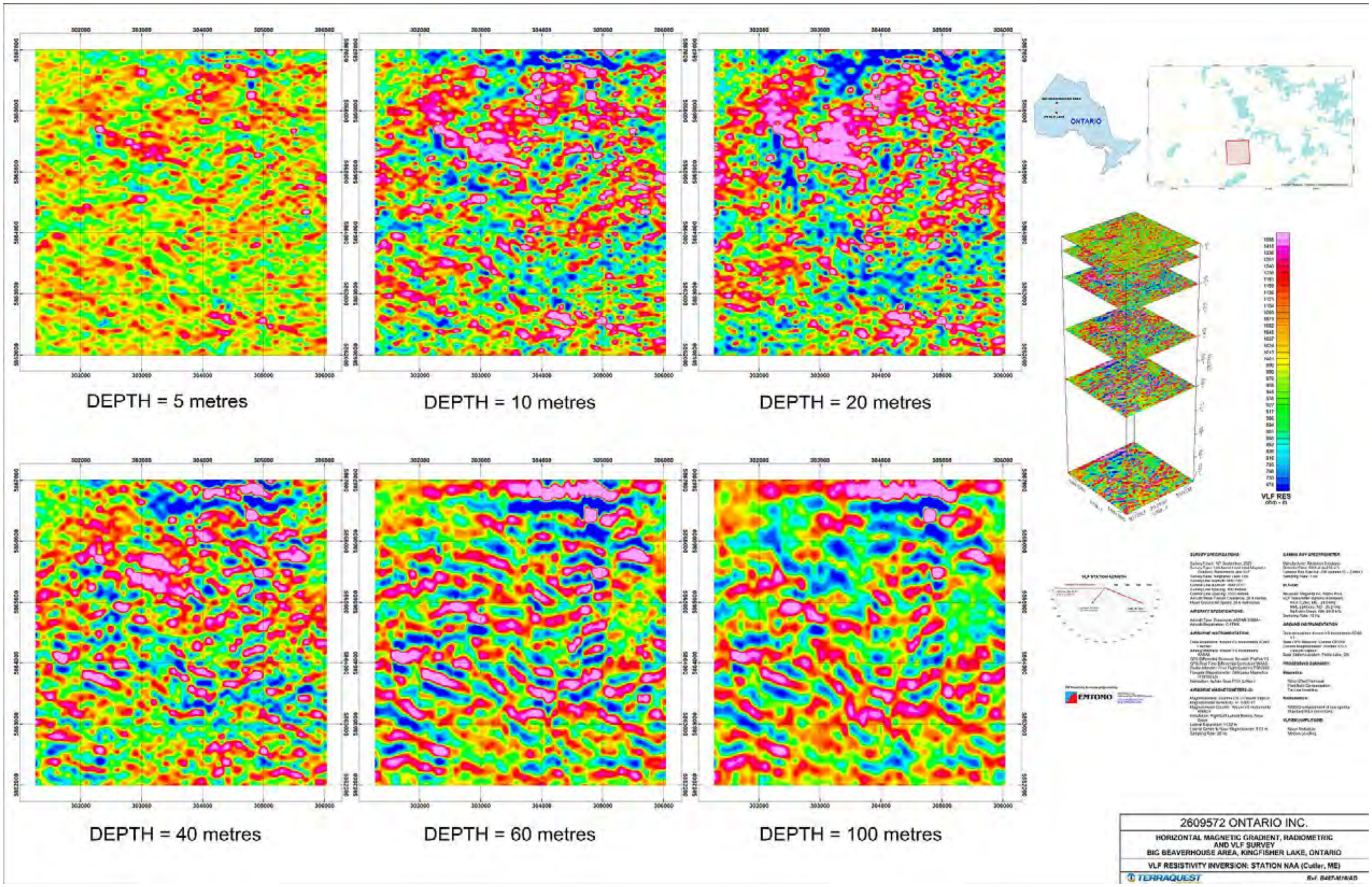
*DeGroot-Hedlin C. and Constable S.C., 1990. Occam's inversion to generate smooth, two-dimensional models from magnetotelluric data. Geophysics, 55, 1613-1624.*

*Monteiro Santos, F.A., António Mateus, Jorge Figueiras, Mário A. Gonçalves, 2006. Mapping groundwater contamination around a landfill facility using the VLF-EM method – a case study. Journal of Applied Geophysics.*

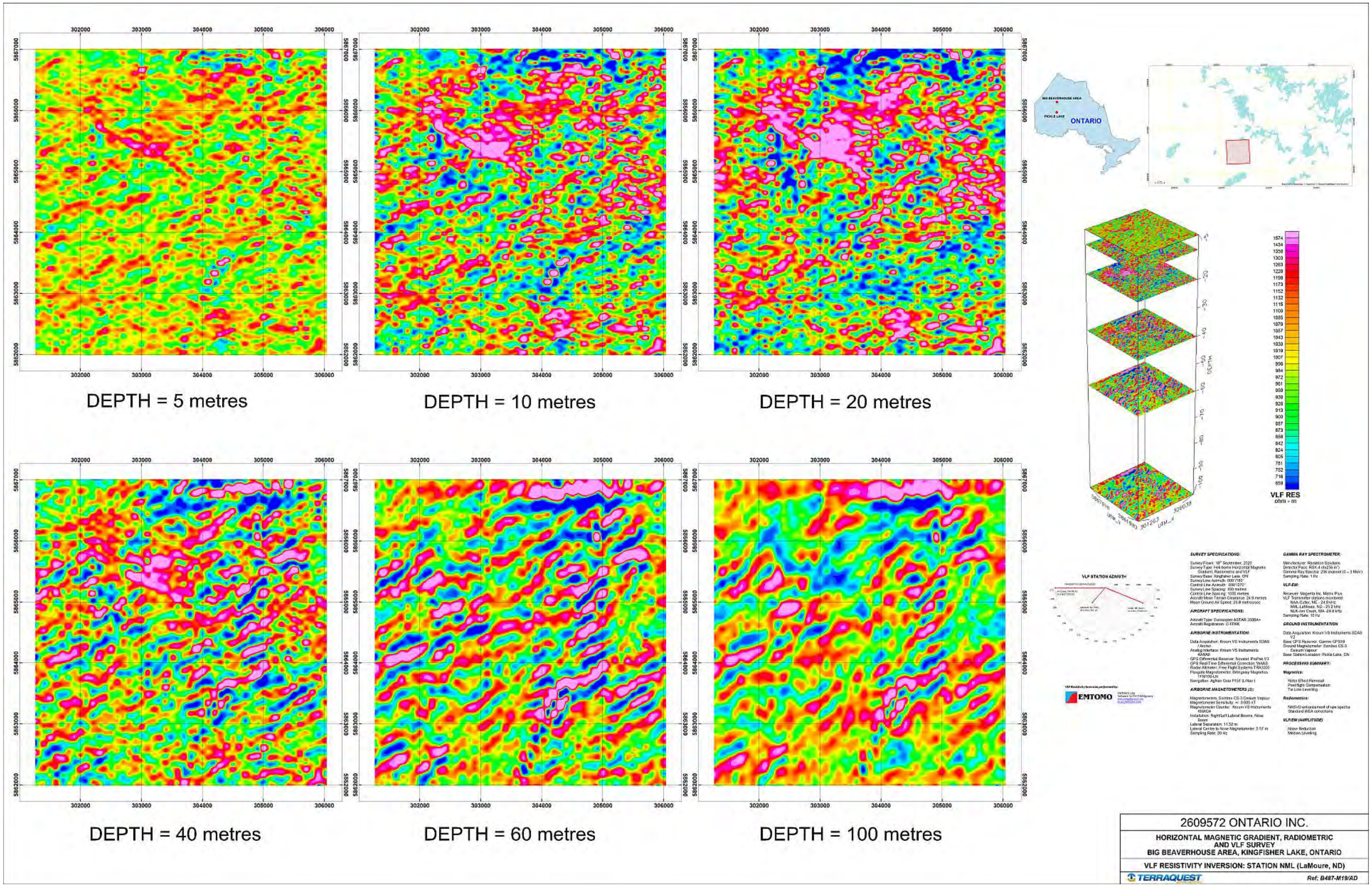
*Sasaki Y., 1989. Two-dimensional joint inversion of magnetotelluric and dipole-dipole resistivity data. Geophysics, 54, 254-262.*

### 7.5.3 Matrix VLF-EM Resistivity Maps

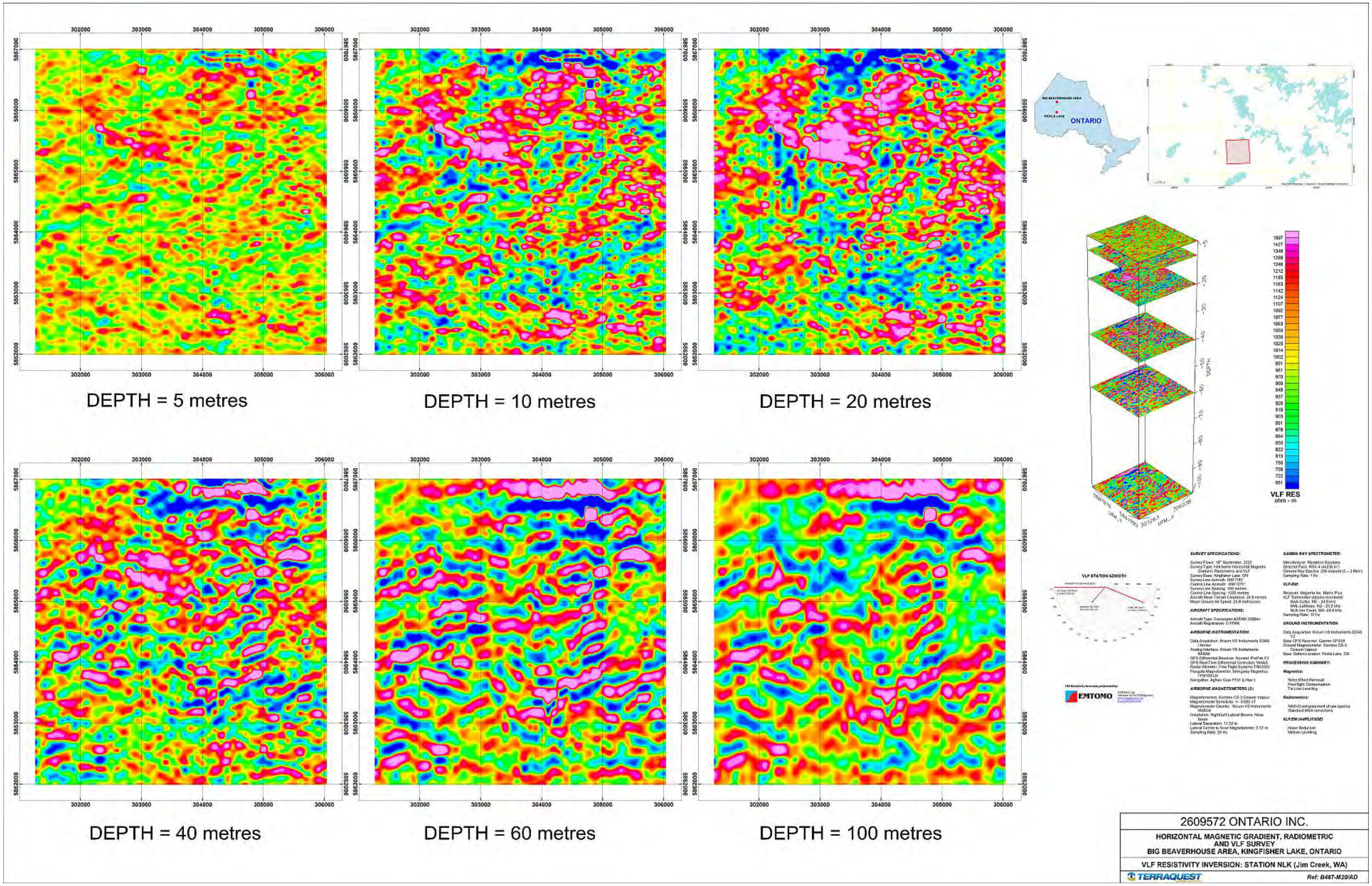
*Montage of 6 VLF Resistivity Depth Slices - Station NAA (Cutler, ME)*



*Montage of 6 VLF Resistivity Depth Slices - Station NML (LaMoure, ND)*



## *Montage of 6 VLF Resistivity Depth Slices - Station NLK (Jim Creek, WA)*



## 7.6 LIST OF FINAL PRODUCTS

Digital and colour glossy hard copies of the following 20 maps plots were produced at a scale of 1:10,000 for the survey block, plus Low Resolution emailable images for this report:

B487_2609572ON_M01_FPwDTM.png : Flight Path with DTM grid
B487_2609572ON_M02_TMI.png : Total Magnetic Intensity
B487_2609572ON_M03_TMIANM.png : Anomalous (IGRF corrected) Total Field with contours
B487_2609572ON_M04_TMIVD1.png : Calculated Vertical Magnetic Derivative
B487_2609572ON_M05_ANSIG.png : Calculated Analytic Signal
B487_2609572ON_M06_HGEW.png : Measured East-West Magnetic Gradient
B487_2609572ON_M07_HGNS.png : Measured North-South Magnetic Gradient
B487_2609572ON_M08_RTF.png : Reconstructed Total Field (from Horizontal Gradients)
B487_2609572ON_M09_TC.png : Total Count
B487_2609572ON_M10_K.png : Potassium
B487_2609572ON_M11_U.png : Uranium
B487_2609572ON_M12_Th.png : Thorium
B487_2609572ON_M13_TNY.png : Ternary Radiometrics (Standard)
B487_2609572ON_M14_TNYNRM.png : Ternary Radiometrics (Normalised)
B487_2609572ON_M15_VLFNAA.png : VLF Amplitude (Total Field) - Station NAA (Cutler, Maine)
B487_2609572ON_M16_VLFNML.png : VLF Amplitude (Total Field) - Station NML (LaMoure, ND)
B487_2609572ON_M17_VLFNLK.png : VLF Amplitude (Total Field) - Station NLK (Jim Creek,WA)
B487_2609572ON_M18_VLFNAA.png : Montage of 6 VLF Resistivity Depth Slices - Station NAA (Cutler, ME)
B487_2609572ON_M19_VLFNML.png : Montage of 6 VLF Resistivity Depth Slices - Station NML (LaMoure,ND)
B487_2609572ON_M20_VLFNLK.png : Montage of 6VLF Resistivity Depth Slices - Station NLK (Jim Creek,WA)

The following digital products were produced on a DVD:

- Database for Magnetics and VLF-EM Total Field in GEOSOFT GDB format (compatible with 4.1 or higher)
- Database for Radiometric data and products in GEOSOFT
- 20 Digital grids in GEOSOFT GRD format and Digital Images (PNG) (LoRes and HiRes)
- 2D Database for VLF-EM Resistivity Modelling
- 18 3D Resistivity Databases, Grids and digital Maps (PNG)
- 3 montage images of 6 depth slices (PNG) (LoRes and HiRes) (Cutler, LaMoure, Jim Creek)
- 3 Voxels in Geosoft format (Cutler, LaMoure, Jim Creek)
- Operations Report in PDF format (Archives in back pocket)

# 8 SUMMARY

A helicopter borne high sensitivity, horizontal magnetic gradient, radiometric and Matrix VLF-EM (including resistivity modelling) survey was performed over the Big Beaverhouse Project near Kingfisher Lake located 163 kilometres north of Pickle Lake, ON. The survey parameters are: 100 metre line intervals with north-south headings, 1,000 metre control line intervals with east-west headings, and 24.9 metres mean terrain clearance. With a mean ground speed of 26.8 m/sec the mean GPS positioning, magnetic and VLF-EM data sample points at 20 Hz are at approximately 1.34 metres along the flight lines and the radiometric data points at 1 Hz at 26.8 metres along the flight lines. The base of operations was at Pickle Lake with near-by refueling depot at Kingfisher Lake Settlement. A high sensitivity magnetic and GPS base station at Pickle Lake recorded the diurnal magnetic activity and GPS time for adherence to survey tolerances.

The data were subjected to careful final processing and gridding at 25 metres grid cell size to produce of the following 20 colour maps plotted at 1:10,000 scale on glossy film at high resolution plus low-resolution images for the report and ease of emailing. In addition, 18 map high resolution digital images of resistivity (6 depth slices x 3 Transmitters) were created and archived as digital products and reduced to 3 montage plots showing 6 depth slices for each transmitter, including lo-resolution images for this report:

**a) Flight Path** and **Digital Terrain Model**

**b) Magnetics**:
Total Magnetic Intensity - Colour Image and Shaded
Anomalous (IGRF Corrected) Total Magnetic Intensity - Colour Image and Contoured
Calculated Vertical Derivative of TMI - Colour Image
Calculated Analytic Signal
Measured East-West Horizontal Magnetic Gradient
Measured North-South Horizontal Magnetic Gradient
Reconstructed Total Magnetic Field

**c) Radiometrics:**
Total Count - Colour Image
Potassium - Colour Image
Uranium - Colour Image
Thorium - Colour Image
Ternary Standard - Colour Image
Ternary Stergen Normalised - Colour Image

**c) Matrix VLF-EM:**
Total Field Strength and Profile Peaks for Cutler NAA
Total Field Strength and Profile Peaks for LaMoure NML
Total Field Strength and Profile Peaks for Jim Creek NLK

**d) Matrix VLF-EM Resistivity:**
Montage of 6 Resistivity depth slices for Cutler NAA
Montage of 6 Resistivity depth slices for LaMoure NML
Montage of 6 Resistivity depth slices for Jim Creek NLK
(2D and 3D databases, Grids and Voxels for Cutler, LaMoure and Jim Creek)

All databases, readme files, grids, voxels, map images and final operations report have been archived on DVD contained in the back pocket of a hard copy of this report.

Respectfully Submitted,

Charles Barrie, M.Sc., P.Geo.
Vice President
Terraquest Ltd.

PROFESSIONAL GEOSCIENTISTS
CHARLES Q. BARRIE
PRACTISING MEMBER
1674
ONTARIO

# 9 APPENDICES

## 9.1 APPENDIX I - CERTIFICATE OF QUALIFICATION

I, Charles Barrie, certify that I:

1) am registered as a Fellow with the Geological Association of Canada, as P. Geo. with the Association of Professional Geoscientists of Ontario and work professionally as a geologist,
2) hold an Honours degree in Geology from McMaster University, Canada, obtained in 1977,
3) hold an M.Sc. in Geology from Dalhousie University, Canada, obtained in 1980,
4) am a member of the Prospectors and Developers Association of Canada,
5) am a member of the Canadian Institute of Mining, Metallurgy and Petroleum,
6) have worked as a geologist for over forty years,
7) am employed by and am an owner of Terraquest Ltd., specializing in high sensitivity airborne geophysical surveys, and
8) have prepared this operations and specifications report pertaining to airborne data collected by Terraquest Ltd.

Markham, Canada

Signed

Charles Barrie, M.Sc., P.Geo.
Vice President
Terraquest Ltd.

PROFESSIONAL GEOSCIENTIST
CHARLES Q. BARRIE
PRACTISING MEMBER
1874
ONTARIO

# 9.2 APPENDIX II – OPERATIONS SUMMARIES

## *OPERATIONAL SUMMARY*

TERRAQUEST

**PROJECT REF B487 /KINGFISHER FIRST NATIONS /BIG BEAVERHOUSE: SUMMER, 2020**

| CURRENT STATUS: | 18-Sep-20 | C-FFKK | | | | | |
|---|---|---|---|---|---|---|---|
| TOTAL DAYS | INSTALL/ SET-UP | HIATUS | OPS DAYS | LKM/DAY | COMPL (%) | TOTAL FLT TIME | TOTAL PRD TIME |
| 1 | | | 1 | 264.1 | 100.00% | 6:24:00 | 2:50:02 |

**OVERALL PRODUCTION SUMMARY:**

| | PLAN | | FLOWN | | | |
|---|---|---|---|---|---|---|
| | NLIN | LKMS | NLIN | LKMS | REMAIN | COMPL (%) |
| TOTAL | 53 | 264.1 | 53 | 264.1 | | 100.00% |
| LINE | 48 | 240.1 | 48 | 240.1 | | 100.00% |
| TIE | 5 | 24.0 | 5 | 24.0 | | 100.00% |
| BORDER | | | | | | |

| SURVEY STATS | DAY | PROJECT |
|---|---|---|
| FLIGHT HOURS | 6:24:00 | 6:24:00 |
| SURVEY HOURS | 2:50:02 | 2:50:02 |
| LKMS ACCEPT | 264.10 | 264.10 |
| LKMS REJECT | 10.00 | 10.00 |
| LKMS % TOTAL | 100.00% | 100.00% |

**SUMMARY BY BLOCK:**

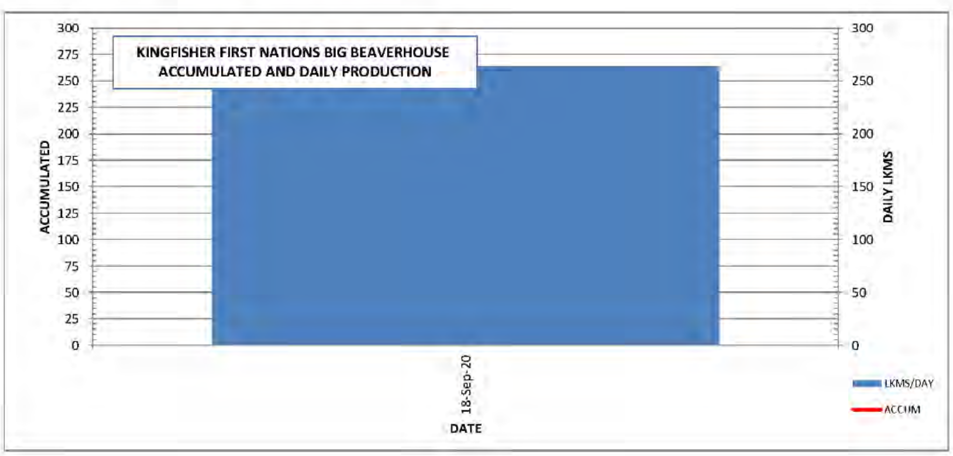
| NAME | CODE | PLAN | | FLOWN | | COMPL (%) |
|---|---|---|---|---|---|---|
| | | NLIN | LKMS | NLIN | LKMS | |
| BIG BEAVERHOUSE | BVR | 53 | 264.10 | 53 | 264.10 | 100.00% |

**COMMENTS**

Flown from Pickle L: FKK001 (FERRY); FKK002; FKK003( survey + ferry); sporadic heli interfence on TF3 (right boom) sensor on northbound lines only

C-FFKK

| DAY CLASS SUMMARY | |
|---|---|
| CALIBRATION | |
| EQUIPMENT | |
| INSTALL | |
| MAINT (SCHED) | |
| MAINT (UNSCHED) | |
| MOB/DEMOB | |
| SETUP | |
| SURVEY | 1.0 |
| TESTING | |
| STANDBY/WX | |
| STANDBY/DIURNAL | |
| STANDBY/TQ | |
| STANDBY/CLIENT | |
| STANDBY/RESTRICT | |
| TRAINING | |
| TOTAL | 1.0 |

## *FLIGHT LIST*

FLT

| AC | FLIGHT | DATE | TYPE | TIME UP | TIME DOWN | FLIGHT TIME | FROM | TO | CREW | PROD TIME | LKMS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C-FFKK | 1 | 18-Sep-20 | FERRY | 12:27:00 | 13:39:00 | 1:12:00 | CYPL | CNM5 | Simmons, Walton | | |
| C-FFKK | 2 | 18-Sep-20 | SURVEY | 14:03:00 | 16:27:00 | 2:24:00 | CNM5 | CNM5 | Simmons, Walton | 1:35:11 | 149.05 |
| C-FFKK | 3 | 18-Sep-20 | SURVEY | 16:57:00 | 19:45:00 | 2:48:00 | CNM5 | CYPL | Simmons, Walton | 1:14:52 | 115.05 |

## ***LINE LIST*** *– Helicopter ASTAR 350B2 Registration C-FFKK*

| AC | BLK | LTYP | DATE | FLIGHT | FLINE | UTC_START | UTC_END | ACCEPT | IGNORE | REJECT | STATUS | PROD TIME | COMMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 10 | 14:48:45 | 14:51:58 | 5.0 | | | FULL | 0:03:13 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 20 | 14:52:38 | 14:56:03 | 5.0 | | | FULL | 0:03:25 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 30 | 14:56:37 | 14:59:59 | 5.0 | | | FULL | 0:03:22 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 40 | 15:00:46 | 15:03:44 | 5.0 | | | FULL | 0:02:58 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 50 | 15:04:31 | 15:07:44 | 5.0 | | | FULL | 0:03:13 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 60 | 15:08:32 | 15:11:31 | 5.0 | | | FULL | 0:02:59 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 70 | 15:12:12 | 15:14:55 | 5.0 | | | FULL | 0:02:43 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 80 | 15:15:38 | 15:18:32 | 5.0 | | | FULL | 0:02:54 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 90 | 15:19:13 | 15:22:31 | 5.0 | | | FULL | 0:03:18 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 100 | 15:23:13 | 15:26:22 | 5.0 | | | FULL | 0:03:09 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 110 | 15:27:57 | 15:31:20 | 5.0 | | | FULL | 0:03:23 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 120 | 15:31:54 | 15:35:17 | 5.0 | | | FULL | 0:03:23 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 130 | 15:36:43 | 15:40:21 | 5.0 | | | FULL | 0:03:38 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 140 | 15:42:15 | 15:45:47 | 5.0 | | | FULL | 0:03:32 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 150 | 15:47:24 | 15:50:33 | 5.0 | | | FULL | 0:03:09 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 160 | 15:51:25 | 15:54:28 | 5.0 | | | FULL | 0:03:03 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 170 | 15:55:58 | 15:58:51 | 5.0 | | | FULL | 0:02:53 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 180 | 15:59:30 | 16:02:39 | 5.0 | | | FULL | 0:03:09 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 190 | 16:03:31 | 16:06:30 | 5.0 | | | FULL | 0:02:58 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 200 | 16:07:05 | 16:10:11 | 5.0 | | | FULL | 0:03:06 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 210 | 16:11:13 | 16:14:02 | 5.0 | | | FULL | 0:02:49 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 220 | 16:14:36 | 16:17:49 | 5.0 | | | FULL | 0:03:13 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 230 | 16:18:38 | 16:21:36 | 5.0 | | | FULL | 0:02:58 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 240 | 17:03:04 | 17:06:01 | 5.0 | | | FULL | 0:02:57 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 250 | 17:07:03 | 17:10:04 | | | 5.0 | REJECT | 0:03:02 | Bad entry |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 251 | 18:33:44 | 18:36:47 | 5.0 | | | REFLIGHT | 0:03:03 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 260 | 17:10:37 | 17:13:52 | 5.0 | | | FULL | 0:03:15 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 270 | 17:15:51 | 17:19:05 | 5.0 | | | FULL | 0:03:14 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 280 | 17:19:37 | 17:23:02 | 5.0 | | | FULL | 0:03:25 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 290 | 17:24:23 | 17:27:42 | 5.0 | | | FULL | 0:03:19 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 300 | 17:28:09 | 17:31:25 | 5.0 | | | FULL | 0:03:16 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 310 | 17:32:35 | 17:35:45 | 5.0 | | | FULL | 0:03:10 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 320 | 17:36:11 | 17:39:39 | 5.0 | | | FULL | 0:03:27 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 330 | 17:41:23 | 17:44:39 | 5.0 | | | FULL | 0:03:15 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 340 | 17:45:11 | 17:48:20 | 5.0 | | | FULL | 0:03:09 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 350 | 17:49:10 | 17:52:07 | 5.0 | | | FULL | 0:02:56 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 360 | 17:52:34 | 17:55:41 | 5.0 | | | FULL | 0:03:07 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 370 | 17:56:17 | 17:59:31 | 5.0 | | | FULL | 0:03:14 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 380 | 18:00:05 | 18:02:50 | 5.0 | | | FULL | 0:02:45 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 390 | 18:03:38 | 18:06:33 | 5.0 | | | FULL | 0:02:55 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 400 | 18:07:07 | 18:09:57 | 5.0 | | | FULL | 0:02:50 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 410 | 18:10:34 | 18:13:30 | 5.0 | | | FULL | 0:02:56 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 420 | 18:14:04 | 18:17:11 | 5.0 | | | FULL | 0:03:06 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 430 | 18:17:56 | 18:21:16 | 5.0 | | | FULL | 0:03:20 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 440 | 18:21:48 | 18:24:57 | 5.0 | | | FULL | 0:03:10 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 450 | 18:25:33 | 18:28:36 | 5.0 | | | FULL | 0:03:03 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 460 | 14:19:22 | 14:21:59 | 5.0 | | | FULL | 0:02:36 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 470 | 14:16:05 | 14:18:48 | | | 5.0 | REJECT | 0:02:43 | Bad entry (terrain clearance?) |
| C-FFKK | BVR | LINE | 18-Sep-20 | 3 | 471 | 18:29:07 | 18:32:05 | 5.0 | | | REFLIGHT | 0:02:58 | |
| C-FFKK | BVR | LINE | 18-Sep-20 | 2 | 480 | 14:09:31 | 14:12:07 | 5.0 | | | FULL | 0:02:36 | |
| C-FFKK | BVR | TIE | 18-Sep-20 | 2 | 10010 | 14:24:52 | 14:27:38 | 4.8 | | | FULL | 0:02:45 | |
| C-FFKK | BVR | TIE | 18-Sep-20 | 2 | 10020 | 14:28:43 | 14:31:24 | 4.8 | | | FULL | 0:02:41 | |
| C-FFKK | BVR | TIE | 18-Sep-20 | 2 | 10030 | 14:32:35 | 14:35:50 | 4.8 | | | FULL | 0:03:15 | |
| C-FFKK | BVR | TIE | 18-Sep-20 | 2 | 10040 | 14:36:59 | 14:39:53 | 4.8 | | | FULL | 0:02:54 | |
| C-FFKK | BVR | TIE | 18-Sep-20 | 2 | 10050 | 14:43:35 | 14:46:48 | 4.8 | | | FULL | 0:03:13 | |

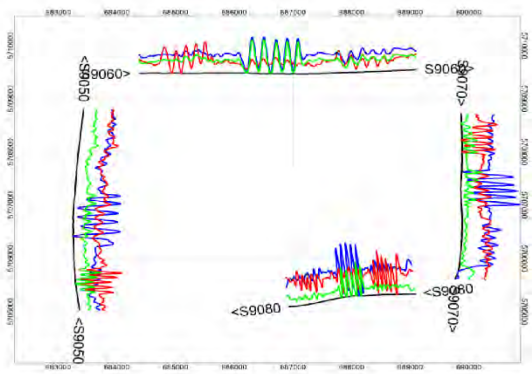
# 9.3 APPENDIX III – FIGURE OF MERIT

**2609572 Ontario Inc. / SUMMER-FALL 2020**

**Magnetic Figure of Merit Analysis**

| **Job Ref:** | B487 | **Date:** | 1-Sep-20 | **Aircraft:** | C-FFKK |
|---|---|---|---|---|---|
| **Location :** | Pickle Lake, ON | | | | |

**Flight Path + Manoevers**




| LINE | DIR | SD: RAW | | | SD: COMPENSATED | | | IMPROVEMENT RATIOS* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | TF1RAW | TF2RAW | TF3RAW | TF1CMP | TF2CMP | TF3CMP | TF1-IR | TF2-IR | TF3-IR |
| S9050 | NORTH | 4.8418 | 1.1374 | 5.5489 | 0.1251 | 0.0288 | 0.1108 | **38.7** | **39.5** | **50.1** |
| S9060 | EAST | 3.9118 | 1.2937 | 4.8298 | 0.0784 | 0.0282 | 0.0698 | **49.9** | **45.9** | **69.2** |
| S9070 | SOUTH | 5.9228 | 1.0992 | 6.7261 | 0.1021 | 0.0285 | 0.1159 | **58.0** | **38.6** | **58.0** |
| S9080 | WEST | 6.5789 | 0.9980 | 7.3813 | 0.0873 | 0.0185 | 0.0876 | **75.4** | **53.9** | **84.3** |

* Note: Improvement ratio defined as SDRAW/SDCMP; an improvement ratio of 1.0 indicates neutral compensation (i.e. no effective removal of manoeuvre effect)

**FOM Index : Sensor 1**

*Calculation note: Residual noise was isolated using a 101 pt Hanning high pass convolution filter with a subsequent low-pass filter (1.0 fid cutoff) applied to reduce non-related HF noise. Individual min-max values determined from the maximum consecutive peak-to-trough residual noise amplitude within each manoevre group*

| LINE | DIR | TRAV FLG | PITCH | | ROLL | | YAW | | | P | R | Y | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MAX | MIN | MAX | MIN | MAX | MIN | | | | | |
| 9010 | N | R | 0.2104 | -0.1157 | 0.1413 | -0.2258 | 0.2557 | -0.3724 | | 0.3260 | 0.3672 | 0.6282 | 1.3214 |
| 9020 | E | | 0.1438 | -0.0964 | 0.0683 | -0.2322 | 0.2421 | -0.1171 | | 0.2402 | 0.3005 | 0.3592 | 0.8999 |
| 9030 | S | R | 0.1344 | -0.2199 | 0.1633 | -0.1996 | 0.1564 | -0.0724 | | 0.3542 | 0.3629 | 0.2288 | 0.9460 |
| 9040 | W | | 0.1892 | -0.2392 | 0.1203 | -0.2049 | 0.1720 | -0.1715 | | 0.4283 | 0.3251 | 0.3435 | 1.0969 |
| | | | | | | | | | Σ | 1.3488 | 1.3558 | 1.5596 | 4.2642 |
| | | | | | | | | | **Full FOM Index :** | **4.2642** | | | |
| | | | | | | | | | **Eq. Traverse FOM Index ( Σ Trav x 2) :** | **4.5347** | | | |

**FOM Index : Sensor 2**

| LINE | DIR | TRAV FLG | PITCH | | ROLL | | YAW | | | P | R | Y | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MAX | MIN | MAX | MIN | MAX | MIN | | | | | |
| 9010 | N | R | 0.0436 | -0.0468 | 0.0469 | -0.0139 | 0.0380 | -0.0635 | | 0.0904 | 0.0608 | 0.1014 | 0.2526 |
| 9020 | E | | 0.0347 | -0.0294 | -0.0069 | -0.0545 | 0.0564 | -0.0201 | | 0.0641 | 0.0477 | 0.0765 | 0.1883 |
| 9030 | S | R | 0.0148 | -0.0760 | 0.0444 | -0.0421 | 0.0301 | -0.0348 | | 0.0908 | 0.0865 | 0.0649 | 0.2422 |
| 9040 | W | | 0.0266 | -0.0337 | 0.0363 | -0.0372 | 0.0337 | -0.0236 | | 0.0603 | 0.0735 | 0.0573 | 0.1912 |
| | | | | | | | | | Σ | 0.3056 | 0.2685 | 0.3002 | 0.8743 |
| | | | | | | | | | **Full FOM Index :** | **0.8743** | | | |
| | | | | | | | | | **Eq. Traverse FOM Index ( Σ Trav x 2) :** | **0.9897** | | | |

**FOM Index : Sensor3**

| LINE | DIR | TRAV FLG | PITCH | | ROLL | | YAW | | | P | R | Y | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MAX | MIN | MAX | MIN | MAX | MIN | | | | | |
| 9010 | N | R | 0.1112 | -0.0450 | 0.1268 | -0.2113 | 0.2050 | -0.2222 | | 0.1562 | 0.3380 | 0.4272 | 0.9214 |
| 9020 | E | | 0.0531 | -0.0991 | 0.0971 | -0.0953 | 0.1624 | -0.1652 | | 0.1522 | 0.1923 | 0.3276 | 0.6722 |
| 9030 | S | R | 0.1041 | -0.2551 | 0.1771 | -0.2086 | 0.2507 | -0.1423 | | 0.3592 | 0.3858 | 0.3931 | 1.1381 |
| 9040 | W | | 0.1294 | -0.0873 | 0.2504 | -0.1508 | 0.1400 | -0.1461 | | 0.2167 | 0.4011 | 0.2861 | 0.9039 |
| | | | | | | | | | Σ | 0.8843 | 1.3173 | 1.4340 | 3.6356 |
| | | | | | | | | | **Full FOM Index :** | **3.6356** | | | |
| | | | | | | | | | **Eq. Traverse FOM Index ( Σ Trav x 2) :** | **4.1190** | | | |

# 9.4 APPENDIX IV – RADAR ALTIMETER CALIBRATION

The radar altimeter was calibrated by performing an ascent over a fixed ground reference point and correlating the resulting corrected GPS altitude clearances (in metres) with the raw radar altimeter data (in mV):

Terraquest LTD Radar Altimeter Calibration 07/12/2020

**C-FFKK: RADAR CALIBRATION DATA SUMMARY**
***Calibration performed: Pickle Lake Airport, Ontario (29 August 2020, FKK001)***

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | INTERCEPT | -4.0377 |
| | | | | | SLOPE | 13.2434 |

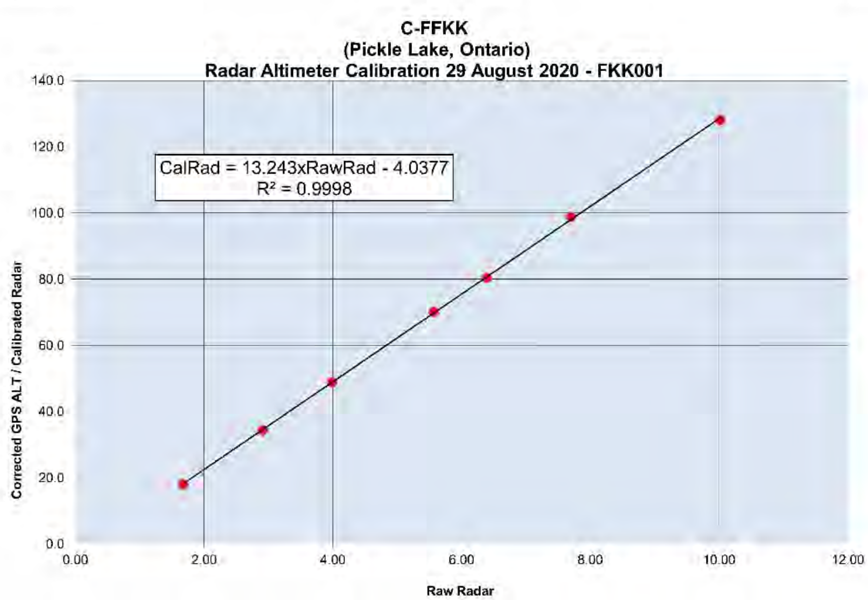
| LINE | RAW RADAR | GPS ALT | CORRECTED GPS ALT | LASER | CALIBRATED RADAR | ERROR * |
|---|---|---|---|---|---|---|
| *Ground Ref* | | 375.0 | 0.0 | | | |
| S10050 | 1.6760 | 393.0 | 18.0 | | 18.2 | 0.2 |
| S10100 | 2.9100 | 409.3 | 34.3 | | 34.5 | 0.2 |
| S10150 | 3.9883 | 423.8 | 48.8 | | 48.8 | 0.0 |
| S10200 | 5.5710 | 445.1 | 70.1 | | 69.7 | -0.4 |
| S10250 | 6.3957 | 455.4 | 80.4 | | 80.7 | 0.3 |
| S10300 | 7.7004 | 473.8 | 98.8 | | 97.9 | -0.9 |
| S10400 | 10.0239 | 503.1 | 128.1 | | 128.7 | 0.6 |
| S10500 | 16.8656 | 542.5 | 167.5 | | 219.3 | 51.8 |

** Error estimated as (Calibrated Radar) - (Corrected GPS Alt)*

***Imperial Units***

| LINE | GPS_ALT (ft) | CAL_RAD (ft) |
|---|---|---|
| S10050 | 59.1 | 59.6 |
| S10100 | 112.5 | 113.2 |
| S10150 | 160.1 | 160.0 |
| S10200 | 230.0 | 228.8 |
| S10250 | 263.8 | 264.6 |
| S10300 | 324.1 | 321.3 |
| S10400 | 420.3 | 422.3 |
| S10500 | 549.5 | 719.6 |

Terraquest LTD Radar Altimeter Calibration 07/12/2020



# 9.5 APPENDIX V – COMPTON COEFFICIENTS

**RADIATION SOLUTIONS INC**

## CALIBRATION SHEET

**Instrument:** **RSX-4**

**Customer:** Terraquest
**Contact:** Charles Barrie
**Console :**
**Detector 1:** 5423
**Detector 2:**

Date: July 30, 2020
Tech.: Jim C
Job Order: CR# 11803
Customer PO PO#

**Channels:** 1024 **ADC Offset:** N/A

| | A1 | A2 | A3 | A4 | A5 |
|---|---|---|---|---|---|
| **High Voltages** | 638 | 607 | 653 | 660 | n/a |

| Stripping Constant | "this system" | "normal" |
|---|---|---|
| Alpha | **0.274** | 0.250 |
| Beta | **0.411** | 0.400 |
| Gamma | **0.772** | 0.810 |
| a | **0.052** | 0.060 |
| b | **0.002** | 0.000 |
| g | **0.001** | 0.003 |

| ROI# | Channel | IAEA Specification [keV] | Label |
|---|---|---|---|
| 1 | 137-937 | 410-2810 | Total Count |
| 2 | 457-523 | 1370-1570 | Potassium K |
| 3 | 553-620 | 1660-1860 | Uranium U |
| 4 | 803-937 | 2410-2810 | Thorium Th |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | 553-620 | 1660-1860 | Uranium Upper U |

| Det# | Peak Cs | Cs FWHM | | Peak Th | Th FWHM |
|---|---|---|---|---|---|
| A1 | 220.84 | 7.30 | | 871.94 | 4.19 |
| A2 | 219.24 | 7.75 | | 872.34 | 4.28 |
| A3 | 220.74 | 7.42 | | 871.98 | 4.17 |
| A4 | 220.38 | 6.98 | | 872.16 | 3.77 |
| **Sum Dn** | **220.33** | **7.36** | | **872.17** | **4.11** |
| | | | | | |
| | | | | | |
| **Sum Up** | **n/a** | **n/a** | | **n/a** | **n/a** |

D-1067.00.00 Page 1 of 1 22 April 2015

# 9.6 APPENDIX VI - ALTITUDE ATTENTUATION

TERRAQUEST LTD Radiometric Procedures and Calibrations 03/12/2020

**TERRAQUEST C-FFKK / RSX-4**
**RADIOMETRIC ALTITUDE ATTENUATION CALIBRATION**
***RSX4-5423 - 01 OCT 2020 (FKK005) - Heli Local Cal: Pickle Lake, ON***

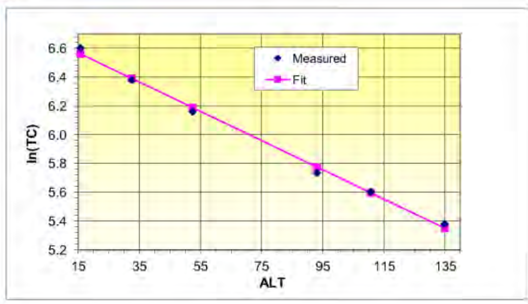
| LINE | Average Clearance, STP Corrected (metres) | TC (cor. CPS) | K (cor. CPS) | U (cor. CPS) | TH (cor. CPS) |
|---|---|---|---|---|---|
| S65:4 | 15.7 | 736.3 | 100.7 | 6.6 | 13.4 |
| S130:4 | 32.5 | 590.1 | 73.8 | 4.9 | 11.4 |
| S200:4 | 52.4 | 473.1 | 55.2 | 4.0 | 8.1 |
| S330:4 | 93.1 | 309.5 | 34.3 | 2.3 | 5.1 |
| S400:4 | 110.8 | 271.4 | 29.7 | 2.9 | 4.6 |
| S500:4 | 134.9 | 216.7 | 21.8 | 1.8 | 3.6 |

**ALTITUDE ATTENUATION COEFFICIENTS**
***Calculated by LSQ fit to : $ln(N) = ALT*\mu + ln(N_o)$ relation***

| | | | | | | |
|---|---|---|---|---|---|---|
| TC | $\mu_{TC}$ = | -0.010162 | $ln(N_0)_{TC}$ = | 6.7206 | $R^2$ Corr Coeff | 0.9956 |
| K | $\mu_K$ = | -0.012391 | $ln(N_0)_K$ = | 4.7295 | $R^2$ Corr Coeff | 0.9913 |
| U | $\mu_U$ = | -0.009934 | $ln(N_0)_U$ = | 1.9522 | $R^2$ Corr Coeff | 0.9190 |
| Th | $\mu_{Th}$ = | -0.011200 | $ln(N_0)_{Th}$ = | 2.7464 | $R^2$ Corr Coeff | 0.9887 |

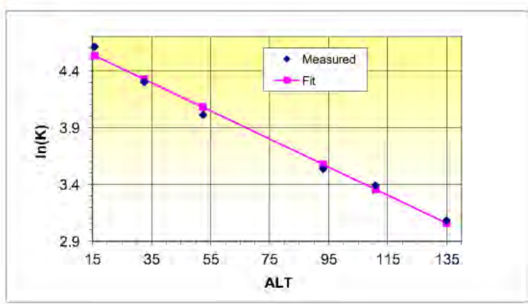
**ALTITUDE DEPENDENCE: TOTAL COUNT**

| ALT | ln(N) | FIT |
|---|---|---|
| 15.7 | 6.6016 | 6.5610 |
| 32.5 | 6.3803 | 6.3903 |
| 52.4 | 6.1593 | 6.1881 |
| 93.1 | 5.7350 | 5.7745 |
| 110.8 | 5.6036 | 5.5946 |
| 134.9 | 5.3785 | 5.3497 |




**ALTITUDE DEPENDENCE: POTASSIUM**

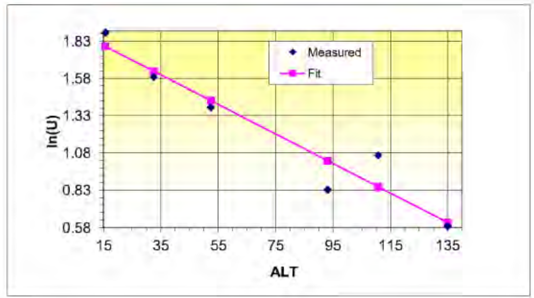
| ALT | ln(N) | FIT |
|---|---|---|
| 15.7 | 4.6121 | 4.5350 |
| 32.5 | 4.3014 | 4.3268 |
| 52.4 | 4.0110 | 4.0802 |
| 93.1 | 3.5351 | 3.5760 |
| 110.8 | 3.3911 | 3.3566 |
| 134.9 | 3.0819 | 3.0580 |




Altitude Attenuation Coefficients Page 1/2

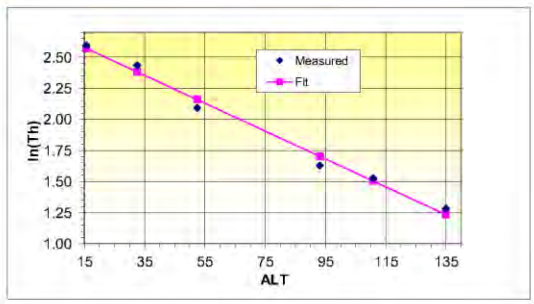
**ALTITUDE DEPENDENCE: URANIUM**

| ALT | ln(N) | FIT |
|---|---|---|
| 15.7 | 1.8871 | 1.7962 |
| 32.5 | 1.5892 | 1.6293 |
| 52.4 | 1.3863 | 1.4316 |
| 93.1 | 0.8329 | 1.0273 |
| 110.8 | 1.0647 | 0.8515 |
| 134.9 | 0.5878 | 0.6121 |
| | | |
| | | |




**ALTITUDE DEPENDENCE: THORIUM**

| ALT | ln(N) | FIT |
|---|---|---|
| 15.7 | 2.5953 | 2.5705 |
| 32.5 | 2.4336 | 2.3824 |
| 52.4 | 2.0919 | 2.1595 |
| 93.1 | 1.6292 | 1.7037 |
| 110.8 | 1.5261 | 1.5054 |
| 134.9 | 1.2809 | 1.2355 |
| | | |
| | | |



# 9.7 APPENDIX VII – SENSITIVITY FACTORS

| Measured Ground Values: | |
|---|---|
| Exp (TC) : nGy/hr | 26.46 |
| %K | 1.04 |
| ppm U | 0.79 |
| ppm Th | 3.34 |

**C-FFFK (RSX4-5423) : Local Ground Calibration 01-OCT-2020**

*Performed: Woman L (nr. Red Lake, ON); Ground survey with RS230 (survey by N.Walton)*

**** Radar Altimeter values adjusted to STP

TC,K,U,Th have been stripped with height adjusted values

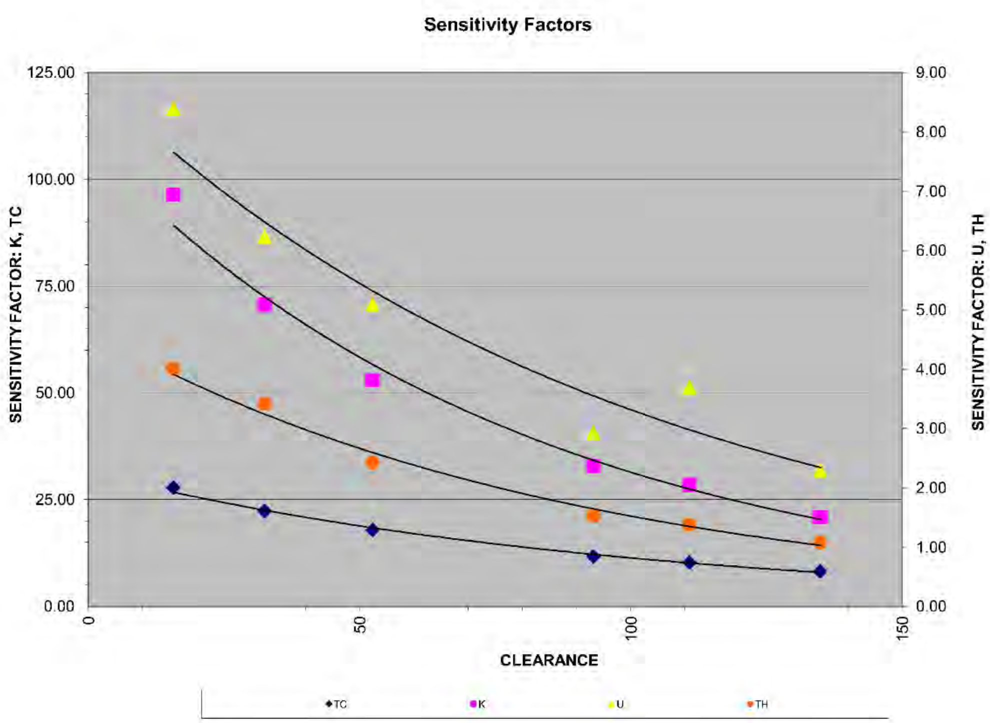
Total Count calculated as: TC (nGyh) = 13.078*K_pct + 5.675*U_ppm + 2.494*Th_ppm;

| Line | Clearance (metres) | TC (cps) | K (cps) | U (cps) | Th (cps) | STC (cps/unit) | SK (cps/unit) | SU (cps/unit) | STH (cps/unit) |
|---|---|---|---|---|---|---|---|---|---|
| S65 | 15.7 | 736.3 | 100.7 | 6.6 | 13.4 | 27.83 | 96.43 | 8.39 | 4.01 |
| S130 | 32.5 | 590.1 | 73.8 | 4.9 | 11.4 | 22.30 | 70.67 | 6.23 | 3.41 |
| S200 | 52.4 | 473.1 | 55.2 | 4.0 | 8.1 | 17.88 | 52.86 | 5.08 | 2.42 |
| S330 | 93.1 | 309.5 | 34.3 | 2.3 | 5.1 | 11.70 | 32.84 | 2.92 | 1.53 |
| S400 | 110.8 | 271.4 | 29.7 | 2.9 | 4.6 | 10.26 | 28.44 | 3.69 | 1.38 |
| S500 | 134.9 | 216.7 | 21.8 | 1.8 | 3.6 | 8.19 | 20.87 | 2.29 | 1.08 |

| Exponential Fit Parameters: | | "m" | "b" |
|---|---|---|---|
| | TC | 0.9899 | 31.3454 |
| | K | 0.9877 | 108.4352 |
| | U | 0.9901 | 8.9512 |
| | TH | 0.9889 | 4.6644 |

**Calculated Sensitivities**

| CLEARANCE: | 25 |
|---|---|
| TC | 24.31 |
| K | 79.55 |
| U | 6.98 |
| TH | 3.53 |



# 9.8 APPENDIX VIII – DATA ARCHIVES ("ReadMe" files)

```
TERRAQUEST Final Data Archive Documentation
===========================================

TERRAQUEST reference : B487

Client: 2609572 Ontario Inc.
Project: Big Beaverhouse Area, Kingfisher Lake, Ontario
Type: Aeromagnetic Gradient, Radiometric, VLF Survey (Helicopter)
Operations: Fall, 2020
Survey Base: Pickle Lake, ON
Aircraft: AS 350B2, C-CFFK
Archive Version: 201207
Prepared By: Allen Duffy
```

**AEROMAGNETIC GRADIENT, RADIOMETRIC & VLF-EM TOTAL FIELD**

```
1. Data Organisation:

\---B487ARC_KINGFISHER_201207
    +---DATA
    |       B487ARC_KINGFISHER_MAG_201207.gdb
    |       B487ARC_KINGFISHER_SPEC_201207.gdb
    |
    +---GRIDS
    |       DTM.grd
    |       DTM.grd.gi
    |       HGEW.grd
    |       HGEW.grd.gi
    |       HGNS.grd
    |       HGNS.grd.gi
    |       NAA_LAG.grd
    |       NAA_LAG.grd.gi
    |       NAA_LAG_HP.grd
    |       NAA_LAG_HP.grd.gi
    |       NLK_LAG.grd
    |       NLK_LAG.grd.gi
    |       NLK_LAG_HP.grd
    |       NLK_LAG_HP.grd.gi
    |       NML_LAG.grd
    |       NML_LAG.grd.gi
    |       NML_LAG_HP.grd
    |       NML_LAG_HP.grd.gi
    |       RTF.grd
    |       RTF.grd.gi
    |       SK.grd
    |       SK.grd.gi
    |       STC.grd
    |       STC.grd.gi
    |       STH.grd
    |       STH.grd.gi
    |       SU.grd
    |       SU.grd.gi
    |       TF2ANM.grd
    |       TF2ANM.grd.gi
    |       TF2ANSIG.grd
    |       TF2ANSIG.grd.gi
    |       TF2LVL.grd
    |       TF2LVL.grd.gi
    |       TF2VD1.grd
    |       TF2VD1.grd.gi
    |       TNYNRM.grd
    |       TNYNRM.grd.gi
    |
```

```
+---MAPS
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|   |   B487_2609572ON_M04_TMIVD1.png
|   |   B487_2609572ON_M05_ANSIG.png
|   |   B487_2609572ON_M06_HGEW.png
|   |   B487_2609572ON_M07_HGNS.png
|   |   B487_2609572ON_M08_RTF.png
|   |   B487_2609572ON_M09_TC.png
|   |   B487_2609572ON_M10_K.png
|   |   B487_2609572ON_M11_U.png
|   |   B487_2609572ON_M12_Th.png
|   |   B487_2609572ON_M13_TNY.png
|   |   B487_2609572ON_M14_TNYNRM.png
|   |   B487_2609572ON_M15_VLFNAA.png
|   |   B487_2609572ON_M16_VLFNML.png
|   |   B487_2609572ON_M17_VLFNLK.png
|   |
|   \---LORES
|           B487_2609572ON_M01_FPwDTM.png
|           B487_2609572ON_M02_TMI.png
|           B487_2609572ON_M03_TMIANM.png
|           B487_2609572ON_M04_TMIVD1.png
|           B487_2609572ON_M05_ANSIG.png
|           B487_2609572ON_M06_HGEW.png
|           B487_2609572ON_M07_HGNS.png
|           B487_2609572ON_M08_RTF.png
|           B487_2609572ON_M09_TC.png
|           B487_2609572ON_M10_K.png
|           B487_2609572ON_M11_U.png
|           B487_2609572ON_M12_Th.png
|           B487_2609572ON_M13_TNY.png
|           B487_2609572ON_M14_TNYNRM.png
|           B487_2609572ON_M15_VLFNAA.png
|           B487_2609572ON_M16_VLFNML.png
|           B487_2609572ON_M17_VLFNLK.png
|
+---README
|       B487ARC_KINGFISHER.ReadMe
|
\---REPORT
```

2. Database Contents:

MAGNETICS DATABASE - provided in Geosoft Database [.gdb] format (B487ARC_KINGFISHER_MAG_201207.gdb)

Database Contents (Data sampled at 20Hz) :

```
X_UTM_WIN   : UTM Easting - WGS84, UTM Zone 16N (metres)
Y_UTM_WIN   : UTM Easting - WGS84, UTM Zone 16N (metres)
Flight      : Flight Number
DATE        : Flight Date (DD/MM/YYYY format - ASCII)
AZIMUTH     : Flight line direction (ranged 0-360 degrees)
FID         : Fiducial (UTC seconds)
TIME        : UTC TIME (hh:mm:ss.ss format)
RADLAG      : Radar Altimeter, lag corrected (metres AGL)
ALT         : WGS84 Altitude (metres AMSL)
DTM         : Calculated Digital Terrain model (m AMSL)
LAT         : Latitude (degrees)
LON         : Longitude (degrees)
DIURNAL     : Raw Diurnal (nT)
DIUEDIT     : Edited Diurnal (culture, spikes removed, nT)
VMX         : Fluxgate X component (nT)
VMY         : Fluxgate Y component (nT)
VMZ         : Fluxgate Z component (nT)
TF1RAW      : Raw measured TMI (nT) - Left Boom
TF2RAW      : Raw measured TMI (nT) - Centre Boom
TF3RAW      : Raw measured TMI (nT) - Right Boom
```

```
TF1CMP      : Compensated TMI (nT) - Left Boom
TF2CMP      : Compensated TMI (nT) - Centre Boom
TF3CMP      : Compensated TMI (nT) - Right Boom
HGEWFNL     : Measured East-West Magnetic gradient (nT/m), lag corrected
HGNSFNL     : Measured North-South Magnetic gradient (nT/m), lag corrected
TF2LVL      : Tie-line levelled TF2 (Centre Boom TMI)
IGRF_TF     : IGRF Total Field (calculation date: 18 SEP 2020 at an effective
              altitude = 295m, 2020 IGRF coefficients)
TF2ANM      : Anomalous (IGRF corrected) TMI
Ampl_1      : Raw VLF Amplitude (Station NAA, Cutler, Maine)
Azmt_1      : Raw VLF Azimuth (Station NAA, Cutler, Maine)
El_P_1      : Raw VLF Planar Ellipticity (Station NAA, Cutler, Maine)
El_V_1      : Raw VLF Vertical Ellipticity (Station NAA, Cutler, Maine)
Tilt_1      : Raw VLF Tilt Angle (Station NAA, Cutler, Maine)
Ampl_2      : Raw VLF Amplitude (Station NML, LaMoure, North Dakota)
Azmt_2      : Raw VLF Azimuth (Station NML, LaMoure, North Dakota)
El_P_2      : Raw VLF Planar Ellipticity (Station NML, LaMoure, North Dakota)
El_V_2      : Raw VLF Vertical Ellipticity (Station NML, LaMoure, North Dakota)
Tilt_2      : Raw VLF Tilt Angle (Station NML, LaMoure, North Dakota)
Ampl_3      : Raw VLF Amplitude (Station NLK, Jim Creek, Washington)
Azmt_3      : Raw VLF Azimuth (Station NLK, Jim Creek, Washington)
El_P_3      : Raw VLF Planar Ellipticity (Station NLK, Jim Creek, Washington)
El_V_3      : Raw VLF Vertical Ellipticity (Station NLK, Jim Creek, Washington)
Tilt_3      : Raw VLF Tilt Angle (Station NLK, Jim Creek, Washington)
TpXi        : Tzx Tipper - Quadrature
TpXr        : Tzx Tipper - InPhase
TpYi        : Tzy Tipper - Quadrature
TpYr        : Tzy Tipper - InPhase
NAA_LAG     : Processed VLF Amplitude (Total Field) - Station NAA (Cutler, Maine)
NAA_LAG_HP  : Processed VLF Amplitude (HP filtered) - Station NAA (Cutler, Maine)
NML_LAG     : Processed VLF Amplitude (Total Field) - Station NML (LaMoure, North Dakota)
NML_LAG_HP  : Processed VLF Amplitude (HP filtered) - Station NML (LaMoure, North Dakota)
NLK_LAG     : Processed VLF Amplitude (Total Field) - Station NLK (Jim Creek, Washington)
NLK_LAG_HP  : Processed VLF Amplitude (HP filtered) - Station NLK (Jim Creek, Washington)
IP1_FNL     : Final In-Phase (from Tilt Angle)) - Station NAA (Cutler, Maine)
QD1_FNL     : Final Quadrature (from Vertical Ellipticity)) - Station NAA (Cutler, Maine)
IP2_FNL     : Final In-Phase (from Tilt Angle)) - Station NML (Lamoure, North Dakota)
QD2_FNL     : Final Quadrature (from Vertical Ellipticity)) - Station NML (Lamoure, North Dakota)
IP3_FNL     : Final In-Phase (from Tilt Angle)) - Station NLK (Jim Creek, Washington)
QD3_FNL     : Final Quadrature (from Vertical Ellipticity)) - Station NLK (Jim Creek, Washington)

RADIOMETRIC DATABASE - provided in Geosoft Database [.gdb] format (B487ARC_KINGFISHER_SPEC_201207.gdb)

Database Contents (Data sampled at 1Hz) :

X_UTM_WIN       : UTM Easting - WGS84, UTM Zone 16N (metres)
Y_UTM_WIN       : UTM Northing - WGS84, UTM Zone 16N (metres)
FLIGHT          : Flight Number
DATE            : Flight Date (DD/MM/YYYY format - ASCII)
AZIMUTH         : Aircraft Heading ( 0 - 360 deg)
FID             : Fiducial (UTC seconds)
TIME            : UTC TIME (hh:mm:ss.ss format)
RADAR           : Radar Altimeter (metres AGL)
ALT             : WGS84 Altitude (metres AMSL)
LAT             : Latitude (decimal degrees)
LON             : Longitude (decimal degrees)
PRESS           : Atmospheric Pressure (mB)
TEMP            : Air Temperature (deg C)
RADSTP          : Terrain Clearance corrected to STP (m AGL)
RAWCOS          : Raw Cosmic (cps)
RAWK            : Raw Potassium (cps)
RAWTC           : Raw Total Count (cps)
RAWTH           : Raw Thorium (cps)
RAWU            : Raw Uranium (cps)
SPC_DOWN        : Raw Downward Gamma Ray Spectrum (256 chn)
NAS_SPC_DOWN    : NASVD enhanced Downward Gamma Ray Spectrum (256 chn)
NAS_K           : NASVD enhanced Potassium (cps)
NAS_TC          : NASVD enhanced Total Count (cps)
NAS_TH          : NASVD enhanced Thorium (cps)
```

```
NAS_U          : NASVD enhanced Uranium (cps)
CK             : Final Corrected Potassium (cps)
CTC            : Final Corrected Total Count (cps)
CTH            : Final Corrected Thorium (cps)
CU             : Final Corrected Uranium (cps)
SK             : Final Corrected Potassium (%K)
STC            : Final Corrected Total Count (nGy/h)
STH            : Final Corrected Thorium (ppm eTh)
SU             : Final Corrected Uranium (ppm eU)
```

3. GRIDS

Grids prepared using Bi-Directional (Akima) spline with a 25m grid cell size

```
NAA_LAG.grd     :  VLF Amplitude (Total Field) - Station NAA (Cutler, Maine)
NAA_LAG_HP.grd  :  VLF Amplitude (HP filtered) - Station NAA (Cutler, Maine)
NML_LAG.grd     :  VLF Amplitude (Total Field) - Station NML (LaMoure, North Dakota)
NML_LAG_HP.grd  :  VLF Amplitude (HP filtered) - Station NML (LaMoure, North Dakota)
NLK_LAG.grd     :  VLF Amplitude (Total Field) - Station NLK (Jim Creek, Washington)
NLK_LAG_HP.grd  :  VLF Amplitude (HP filtered) - Station NLK (Jim Creek, Washington)
DTM.grd         :  Digital Terrain Model (m AMSL)
HGEW.grd        :  Measured East-West Horizontal Magnetic Gradient (nT/m)
HGNS.grd        :  Measured North-South Horizontal Magnetic Gradient (nT/m)
RTF.grd         :  Reconstructed Total Magnetic Field (calculated from Horizontal Gradients,pseudo nT)
TF2ANM.grd      :  Anomalous (IGRF corrected) TMI (nT)
TF2ANSIG.grd    :  Calculated Analytic Signal
TF2LVL.grd      :  Final, Levelled Total Magnetic Field (nT)
TF2VD1.grd      :  Calculated First Vertical Magnetic Derivative (nT/m)
```

Grids prepared using Minimum Curvature interpolation with a 25m grid cell size

```
SK.grd          :  Potassium (%K)
STC.grd         :  Total Count (nGy/h)
STH.grd         :  Thorium (ppm eTh)
SU.grd          :  Uranium (ppm eU)
TNYNRM.grd      :  Normalised (GSC "STERGEN") Ternary image (Geosoft Colour grid)
```

4. MAPS

PNG images of the printed map series in full resolution (300 DPI) and low resolution (email-able, files in sub folder 'LORES'). Data are presented on a series of 17 1:10000 scale maps:

```
B487_2609572ON_M01_FPwDTM.png    : Flight Path with DTM grid
B487_2609572ON_M02_TMI.png       : Total Magnetic Intensity
B487_2609572ON_M03_TMIANM.png    : Anomalous (IGRF corrected) Total Field with contours
B487_2609572ON_M04_TMIVD1.png    : Calculated Vertical Magnetic Derivative
B487_2609572ON_M05_ANSIG.png     : Calculated Analytic Signal
B487_2609572ON_M06_HGEW.png      : Measured East-West Magnetic Gradient
B487_2609572ON_M07_HGNS.png      : Measured North-South Magnetic Gradient
B487_2609572ON_M08_RTF.png       : Reconstructed Total Field (from Horizontal Gradients)
B487_2609572ON_M09_TC.png        : Total Count
B487_2609572ON_M10_K.png         : Potassium
B487_2609572ON_M11_U.png         : Uranium
B487_2609572ON_M12_Th.png        : Thorium
B487_2609572ON_M13_TNY.png       : Ternary Radiometrics (Standard)
B487_2609572ON_M14_TNYNRM.png    : Ternary Radiometrics (Normalised)
B487_2609572ON_M15_VLFNAA.png    : VLF Amplitude (Total Field) - Station NAA (Cutler, Maine)
B487_2609572ON_M16_VLFNML.png    : VLF Amplitude (Total Field) - Station NML (LaMoure, North Dakota)
B487_2609572ON_M17_VLFNLK.png    : VLF Amplitude (Total Field) - Station NLK (Jim Creek, Washington)
```

5. README

Archive documentation: this file ("B487ARC_KINGFISHER.ReadMe")

6. REPORT

Operational Report

**TERRAQUEST Final Resistivity Data Archive Documentation :**

**VLF-EM RESISTIVITY MODELLING**

===========================================

TERRAQUEST reference : B487

Client: 2609572 Ontario Inc.
Project: Big Beaverhouse Area, Kingfisher Lake, Ontario
Type: Aeromagnetic Gradient, Radiometric, VLF Survey (Helicopter)
Operations: Fall, 2020
Survey Base: Pickle Lake, ON
Aircraft: AS 350B2, C-CFFKK
Archive Version: 201207
Prepared By: Allen Duffy

1. Data Organisation:

```
\---B487ARC_KINGFISHER_VLFRESIST_201226
    +---NAA
    |   +---GRIDS
    |   |       NAA_RES_005.grd
    |   |       NAA_RES_005.grd.gi
    |   |       NAA_RES_010.grd
    |   |       NAA_RES_010.grd.gi
    |   |       NAA_RES_020.grd
    |   |       NAA_RES_020.grd.gi
    |   |       NAA_RES_040.grd
    |   |       NAA_RES_040.grd.gi
    |   |       NAA_RES_060.grd
    |   |       NAA_RES_060.grd.gi
    |   |       NAA_RES_100.grd
    |   |       NAA_RES_100.grd.gi
    |   |
    |   +---GRID_GDB
    |   |       NAA_RES_GRIDS.gdb
    |   |
    |   +---MAP
    |   |   |   B487_2609572ON_M18_RESIST_NAA.png
    |   |   |
    |   |   \---LORES
    |   |           B487_2609572ON_M18_RESIST_NAA.png
    |   |
    |   +---PROFILE_GDB
    |   |       NAA_RES_PROFILE.gdb
    |   |
    |   \---VOXEL
    |           NAA_RES_GRIDS_RESFNL.geosoft_voxel
    |
    +---NLK
    |   +---GRIDS
    |   |       NLK_RES_005.grd
    |   |       NLK_RES_005.grd.gi
    |   |       NLK_RES_010.grd
    |   |       NLK_RES_010.grd.gi
    |   |       NLK_RES_020.grd
    |   |       NLK_RES_020.grd.gi
    |   |       NLK_RES_040.grd
    |   |       NLK_RES_040.grd.gi
    |   |       NLK_RES_060.grd
    |   |       NLK_RES_060.grd.gi
    |   |       NLK_RES_100.grd
    |   |       NLK_RES_100.grd.gi
    |   |
    |   +---GRID_GDB
    |   |       NLK_RES_GRIDS.gdb
    |   |
```

```
|   +---MAP
|   |   |   B487_2609572ON_M20_RESIST_NLK.png
|   |   |
|   |   \---LORES
|   |           B487_2609572ON_M20_RESIST_NLK.png
|   |
|   +---PROFILE_GDB
|   |       NLK_RES_PROFILE.gdb
|   |
|   \---VOXEL
|           NLK_RES_GRIDS_RESFNL.geosoft_voxel
|
+---NML
|   +---GRIDS
|   |       NML_RES_005.grd
|   |       NML_RES_005.grd.gi
|   |       NML_RES_010.grd
|   |       NML_RES_010.grd.gi
|   |       NML_RES_020.grd
|   |       NML_RES_020.grd.gi
|   |       NML_RES_040.grd
|   |       NML_RES_040.grd.gi
|   |       NML_RES_060.grd
|   |       NML_RES_060.grd.gi
|   |       NML_RES_100.grd
|   |       NML_RES_100.grd.gi
|   |
|   +---GRID_GDB
|            NML_RES_GRIDS.gdb
|   +---MAP
|   |   |   B487_2609572ON_M19_RESIST_NML.png
|   |   |
|   |   \---LORES
|   |           B487_2609572ON_M19_RESIST_NML.png
|   |
|   +---PROFILE_GDB
|   |       NML_RES_PROFILE.gdb
|   |
|   \---VOXEL
|           NML_RES_GRIDS_RESFNL.geosoft_voxel
|
\---README
        B487ARC_KINGFISHER_VLF_RESIST.ReadMe
```

2A. Database Contents: PROFILE_GDB

"xxx_RES_PROFILE.gdb"

In each main VLF Transmitter folder (NAA, NLK and NML), survey line-based data archives are stored in sub-folder "PROFILE_GDB". The profile-based databases are named "xxx_RES_PROFILE", where "xxx" is NAA, NLK or NML, and contain the following data fields:

Data sampled at 10Hz ...

```
X_UTM_WIN       : UTM Easting - WGS84, UTM Zone 16N (metres)
Y_UTM_WIN       : UTM Easting - WGS84, UTM Zone 16N (metres)
DATE            : Flight Date (DD/MM/YYYY format - ASCII)
Flight          : Flight Number
AZIMUTH         : AZIMUTH (flight line direction, ranged 0-360 deg)
LTYP            : Line Type (L: Traverse; T: Tie)
RADAR           : Radar Altimeter (lag corrected, metres AGL)
ALT             : WGS84 Altitude (metres AMSL)
DTM             : Digital Terrain Model (metres AMSL)
LAT             : Latitude (degrees)
LON             : Longitude (degrees)
xxx_RES_005     : Resistivity (model inversion) - depth=5 metres (ohm-m)
xxx_RES_010     : Resistivity (model inversion) - depth=10 metres (ohm-m)
xxx_RES_020     : Resistivity (model inversion) - depth=20 metres (ohm-m)
xxx_RES_040     : Resistivity (model inversion) - depth=40 metres (ohm-m)
xxx_RES_060     : Resistivity (model inversion) - depth=60 metres (ohm-m)
```

```
xxx_RES_100     : Resistivity (model inversion) - depth=100 metres (ohm-m)
xxx_RES_005_FNL : Resistivity (model inversion) - depth=5 metres (ohm-m) (micro-levelled, if required)
xxx_RES_010_FNL : Resistivity (model inversion) - depth=10 metres (ohm-m) (micro-levelled, if required)
xxx_RES_020_FNL : Resistivity (model inversion) - depth=20 metres (ohm-m) (micro-levelled, if required)
xxx_RES_040_FNL : Resistivity (model inversion) - depth=40 metres (ohm-m) (micro-levelled, if required)
xxx_RES_060_FNL : Resistivity (model inversion) - depth=60 metres (ohm-m) (micro-levelled, if required)
xxx_RES_100_FNL : Resistivity (model inversion) - depth=100 metres (ohm-m) (micro-levelled, if required)
```

2B. Database Contents: GRID_GDB

"xxx_RES_GRIDS.gdb"

VLF inversion data are also stored in "GRID" format as a series of numerical lattices corresponding to each individual inversion depth (5, 10, 20, 40, 60 and 100 metres depths). This database format is useful for creating 3D data grids. In each main VLF Transmitter folder (NAA, NLK and NML), "grid" based data archives are stored in sub-folder "GRID_GDB". The grid-based databases are named "xxx_RES_GRIDS", where "xxx" is NAA, NLK or NML. Data are organised into 6 "lines", corresponding to each individual depth plane :

```
DDEPTH005    : Inversion plane at DEPTH=5m XYZ points
DDEPTH010    : Inversion plane at DEPTH=10m XYZ points
DDEPTH020    : Inversion plane at DEPTH=20m XYZ points
DDEPTH040    : Inversion plane at DEPTH=40m XYZ points
DDEPTH060    : Inversion plane at DEPTH=60m XYZ points
DDEPTH100    : Inversion plane at DEPTH=100m XYZ points
```

Each line contains the following data fields for each grid vertice:

```
X      : UTM Easting - WGS84, UTM Zone 16N (metres)
Y      : UTM Easting - WGS84, UTM Zone 16N (metres)
RES    : Resistivity (model inversion)
RESFNL : Resistivity (model inversion) (micro-levelled, if required)
DEPTH  : Depth (ranged 0 - -100 metres)
```

3. GRIDS

Grids were prepared using Minimum Curvature interpolation with a 10m grid cell size.

In each main VLF Transmitter folder (NAA, NLK and NML), data grids are stored in sub-folder "GRIDS". Data grids correspond to the 6 inversion depth slices (5, 10, 25, 40, 60 and 100m) and are named as follows (where "xxx" is NAA, NLK or NML):

```
xxx_RES_005[_FNL].grd     : final resistivity depth slice (5 metres) (optional "_FNL" if micro-levelling applied)
xxx_RES_010[_FNL].grd     : final resistivity depth slice (10 metres) (optional "_FNL" if micro-levelling applied)
xxx_RES_025[_FNL].grd     : final resistivity depth slice (25 metres) (optional "_FNL" if micro-levelling applied)
xxx_RES_040[_FNL].grd     : final resistivity depth slice (40 metres) (optional "_FNL" if micro-levelling applied)
xxx_RES_060[_FNL].grd     : final resistivity depth slice (60 metres) (optional "_FNL" if micro-levelling applied)
xxx_RES_100[_FNL].grd     : final resistivity depth slice (100 metres) (optional "_FNL" if micro-levelling applied)
```

3D grids :

3D grids (Geosoft "voxel" format) were also created and are stored in each main VLF Transmitter folder (NAA, NLK and NML) in the "VOXEL" sub-folder

4. MAP

PNG images of the printed map series in full resolution (300 DPI) and low resolution (email-able, files in sub folder 'LORES') in each VLF sub-folder. Data are presented on a series of 3 montage maps displaying resistivity data at depth. "nn" and"xxx" are [12,NAA], [13,NML] and [14,NLK] :

B487_2609572ON_Mnn_RESIST_xxx.png

5. README

Archive documentation : B487ARC_KINGFISHER_VLF_RESIST.ReadMe (this file)