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Ontario

ASSESSMENT REPORT ON
2016 AIRBORNE GEOPHYSICS SURVEY

LINCOLN AND COPPERFIELD
TOWNSHIPS
PORCUPINE DISTRICT, ONTARIO

Submitted to:
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Date: 21 June 2016

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INTRODUCTION

During the spring of 2016, Probe Mines Limited (Goldcorp Borden Ltd) contracted Sander Geophysics Ltd to complete an airborne magnetic survey on its claims located in Copperfield and Lincoln townships. The high resolution fixed wing horizontal magnetic gradient survey was completed from May 17 to 19, 2016. A total of 1660 line kilometres were flown.

The claims are located approximately 50km northeast of the Borden Gold deposit and 20 km north of the East Limb project.

All maps coordinates are UTM Nad 83, Zone 17. All costs are in Canadian dollars.

LOCATION AND ACCESS

The Copperfield/Lincoln claims are located in the 1:50,000 NTS topographic sheets 42B02, 42B03, 42B06 and 42B07; approximately 50 km northeast of the town of Chapleau and 35 km west of the town of Foleyet, Ontario (Figure 1).

Access to the property on the East side is via logging roads off Highway 101; while the West side is accessed from logging roads originating from Chapleau enroute to Racine Lake. The property comprises a number of claims acquired through staking. The current report details work applicable to 64 claims, the details of which are listed in Table 1. The amount of credits applied from the work completed as detailed in this report is $84,710 and is being used towards keeping the project claims in good standing. The claims are 100% owned by Probe Mines Limited (Goldcorp Borden Ltd).

Table 1 – Mineral Claim Information

	Mineral Claim	District	Recording Date	Claim Due Date	Township	Claim Units
1	4274431	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	16
2	4274432	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	10
3	4275651	LINCOLN	29-May-14	May-29-16	LINCOLN	13
4	4275652	LINCOLN	29-May-14	May-29-16	LINCOLN	16
5	4275653	LINCOLN	29-May-14	May-29-16	LINCOLN	16
6	4275654	LINCOLN	29-May-14	May-29-16	LINCOLN	16
7	4275655	LINCOLN	29-May-14	May-29-16	LINCOLN	6
8	4275656	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	16
9	4275657	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	9
10	4275658	LINCOLN	29-May-14	May-29-16	LINCOLN	16
11	4275659	LINCOLN	29-May-14	May-29-16	LINCOLN	6
12	4275660	LINCOLN	29-May-14	May-29-16	LINCOLN	16
13	4275661	LINCOLN	29-May-14	May-29-16	LINCOLN	16
14	4275662	LINCOLN	29-May-14	May-29-16	LINCOLN	16
15	4275663	LINCOLN	29-May-14	May-29-16	LINCOLN	16
16	4275664	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	16
17	4275665	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	4
18	4275666	LINCOLN	29-May-14	May-29-16	LINCOLN	9
19	4275667	LINCOLN	29-May-14	May-29-16	LINCOLN	16
20	4275668	LINCOLN	29-May-14	May-29-16	LINCOLN	16
21	4275669	LINCOLN	29-May-14	May-29-16	LINCOLN	16
22	4275670	LINCOLN	29-May-14	May-29-16	LINCOLN	16

	Mineral Claim	District	Recording Date	Claim Due Date	Township	Claim Units
23	4275671	LINCOLN	29-May-14	May-29-16	LINCOLN	16
24	4275672	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	8
25	4275673	COPPERFIELD	29-May-14	May-29-16	COPPERFIELD	10
26	4275674	LINCOLN	29-May-14	May-29-16	LINCOLN	6
27	4275675	LINCOLN	29-May-14	May-29-16	LINCOLN	16
28	4275676	LINCOLN	29-May-14	May-29-16	LINCOLN	16
29	4275677	LINCOLN	29-May-14	May-29-16	LINCOLN	16
30	4275678	LINCOLN	29-May-14	May-29-16	LINCOLN	16
31	4275679	LINCOLN	29-May-14	May-29-16	LINCOLN	16
32	4275680	LINCOLN	29-May-14	May-29-16	LINCOLN	16
33	4275681	LINCOLN	29-May-14	May-29-16	LINCOLN	16
34	4275682	LINCOLN	29-May-14	May-29-16	LINCOLN	16
35	4275683	LINCOLN	29-May-14	May-29-16	LINCOLN	16
36	4275684	LINCOLN	29-May-14	May-29-16	LINCOLN	16
37	4275685	LINCOLN	29-May-14	May-29-16	LINCOLN	15
38	4275686	LINCOLN	29-May-14	May-29-16	LINCOLN	16
39	4275687	LINCOLN	29-May-14	May-29-16	LINCOLN	16
40	4275688	LINCOLN	29-May-14	May-29-16	LINCOLN	16
41	4275085	LINCOLN	30-Jun-14	June-30-16	LINCOLN	5
42	4277191	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	16
43	4277192	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	16
44	4277193	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	16
45	4277194	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	8
46	4277195	LINCOLN	30-Jun-14	June-30-16	LINCOLN	12
47	4277196	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	12
48	4277197	LINCOLN	30-Jun-14	June-30-16	LINCOLN	8
49	4277198	LINCOLN	30-Jun-14	June-30-16	LINCOLN	8
50	4277199	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	16
51	4277200	COPPERFIELD	30-Jun-14	June-30-16	COPPERFIELD	14
52	4275086	COPPERFIELD	15-Jul-14	July-15-16	COPPERFIELD	16
53	4274438	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
54	4274439	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
55	4274440	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
56	4274441	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
57	4274442	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
58	4274443	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
59	4274444	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
60	4274445	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
61	4274446	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
62	4274447	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
63	4275087	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16
64	4275088	LINCOLN	31-Jul-14	July-31-16	LINCOLN	16

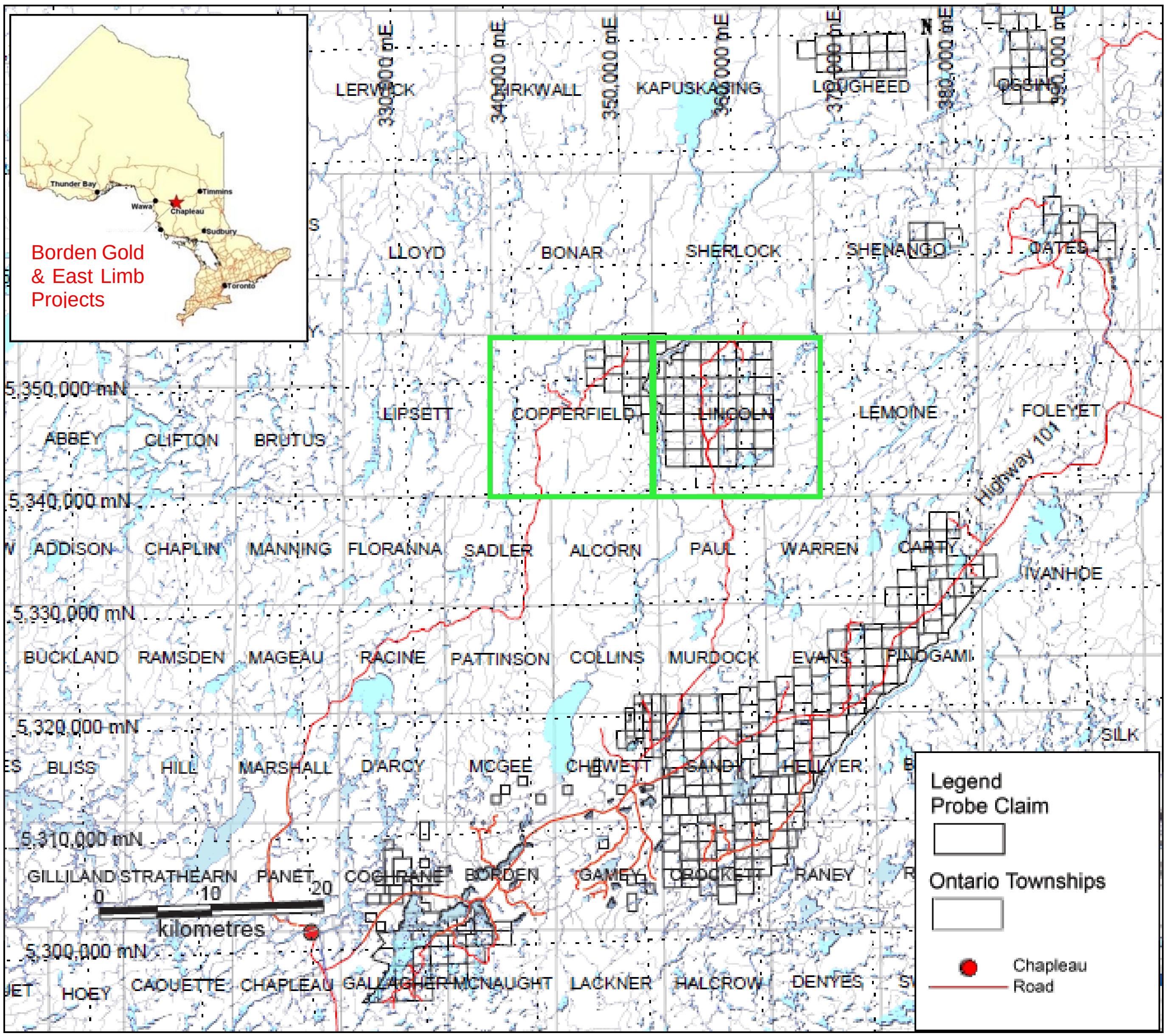

Figure 1- Location of the Copperfield & Lincoln Claims (townships outlined in green)

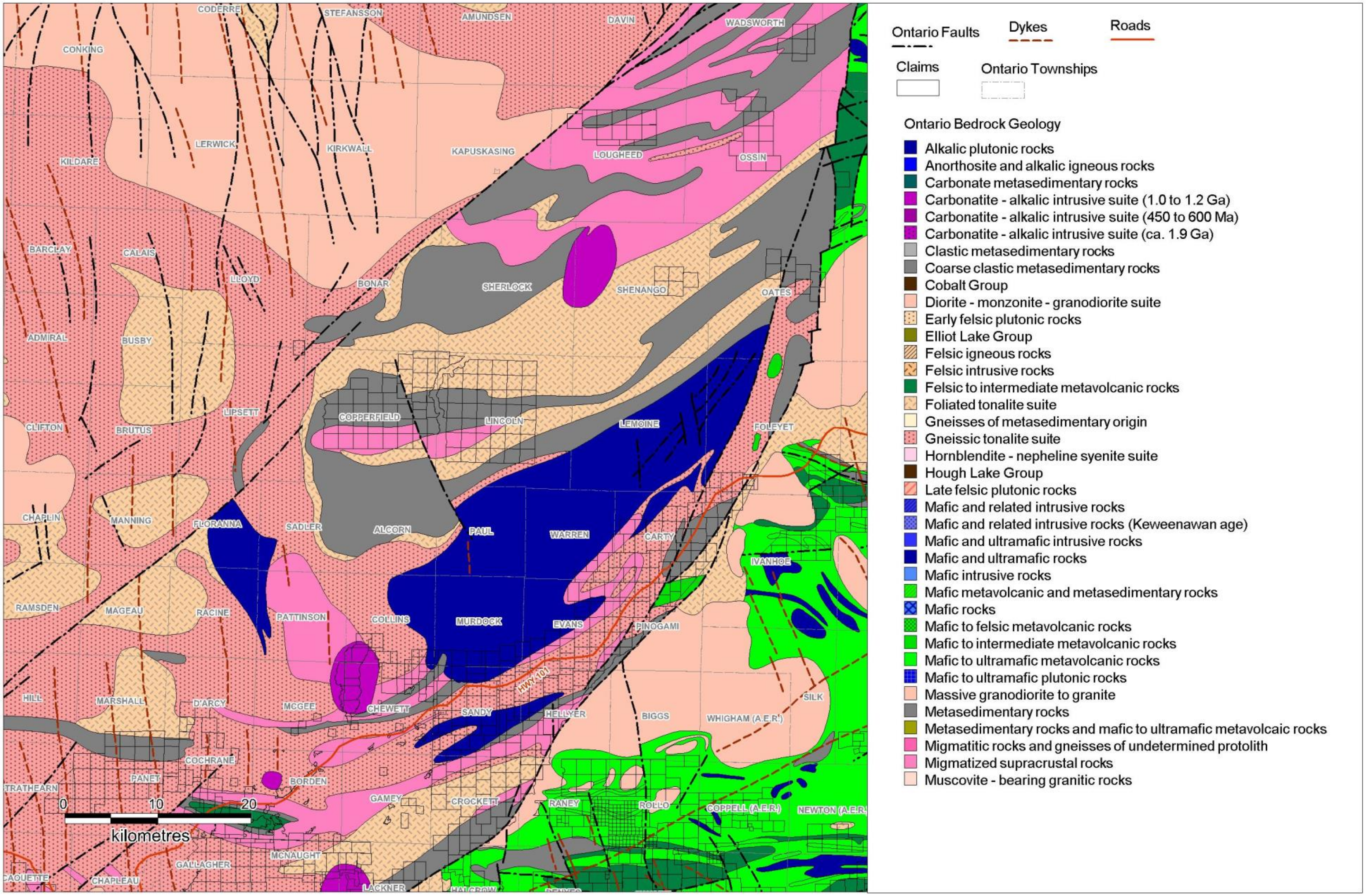

Figure 2 – General Geology of the Southern KSZ and Lincoln/Copperfield Claim Group

GEOLOGY

The Copperfield/Lincoln claims are located in the Superior Province of Northern Ontario. The Superior Province is divided into numerous Subprovinces, bounded by linear faults and characterized by differing lithologies, structural/tectonic conditions, ages and metamorphic conditions. The Subprovinces are divided into 4 categories: volcano-plutonic; metasedimentary; gneissic/plutonic; and high-grade gneissic (Thurston, 1991). The rocks range in age from 3.5Ga to less than 2.76 Ga and form an east-west trending pattern of alternating terranes.

Regionally, the Kapuskasing Structural Zone (KSZ), an elongate north to northeast trending structure, transects the Wawa Subprovince to the west, and the Abitibi Subprovince to the east (Figure 2). The KSZ is approximately 500km long, extending from James Bay at its northeast end to the east shore of Lake Superior at its southwest end. Typically, the KSZ is represented by high-grade metamorphic granulite and amphibolite facies paragneisses, tonalitic gneisses and anorthosite-suite gneisses occurring along a moderate northwest dipping crustal-scale thrust fault. This fault is believed to have resulted from an early Proterozoic event (Percival and McGrath 1986).

The Wawa and Abitibi Subprovinces, which abut the KSZ, are volcano-plutonic terranes comprising low-grade metamorphic metavolcanic-metasedimentary belts. They contain lithologically diverse metavolcanic rocks with various intrusive suites and to a lesser extent chemical and clastic metasedimentary rocks. The individual greenstone belts within the subprovinces have been intruded, deformed and truncated by felsic batholiths. The east trending Abitibi and Swayze greenstone belts of the Abitibi subprovince have historically been explored and mined for a variety of commodities; while the Wawa subprovince hosts the east-trending Wawa greenstone belt and the Mishibishu greenstone belt where much exploration and mining has occurred.

Several alkalic rocks such as carbonatite complexes along with lamprohyric dykes intruded along the KSZ, approximately 1022 to 1141 Ma ago. The carbonatite occurrences appear to display close spatial relationships with major northeast-striking shear zones. Proximal to the project area, on the northern side of the KSZ, three (3) such complexes are known to occur. These include the Borden Township carbonatite complex, the Nemegosenda Lake alkalic complex; and the Lackner Lake alkalic complex.

PREVIOUS WORK

Minimal previous work has been completed in the Copperfield/Lincoln township area. Available assessment reports are limited and are related to diamond exploration in the early 1990s by a group of prospectors. Work completed comprised heavy mineral concentrate sediment sampling and ground geophysics. One drillhole in August 1992 is reported north of the property in Sherlock township. The 60m hole intersected a magnetite rich intermediate intrusive.

During the summer of 2014, Probe Mines Limited conducted a regional exploration program across the southern extent of the Kapuskasing Structural Zone (KSZ) which included work on its claims located in Copperfield and Lincoln townships. The program comprised rock prospecting/sampling and till sampling. Following the acquisition of Probe Mines by Goldcorp on March 13, 2015 a more detailed till survey and soil sampling was carried as a follow up on the anomalous gold samples found in 2014. A Lidar survey was also carried on the claims to allow a better structural interpretation, to map outcrops areas and plan future till and soil surveys.

CURRENT WORK PROGRAM

High Resolution Fixed Wing Magnetic Survey

During the spring of 2016, Probe Mines Limited (Goldcorp Borden Ltd) contracted Sander Geophysics Ltd to complete an airborne magnetic survey on its claims located in Copperfield and Lincoln townships. The high resolution fixed wing horizontal magnetic gradient survey was completed from May 17 to 19, 2016. A total of 1660 line kilometres were flown. Traverse lines were oriented north-south and at 75m spacing, while control lines were oriented east-west at 1500m spacing. The survey was flown using SGL's Cessna Grand Caravan 208B, registration C-GSGW.

The location of the airborne survey is illustrated in Figure 3. A total of 1207.26 line km was flown on the actual claims. Table 2 summarizes the line kilometres per claim.

Table 2 – Line kilometres flown per Claim

Claim	Line Km
4277199	6.14
4275664	30.50
4275665	8.45
4275666	19.91
4275667	30.50
4275668	32.60
4275669	33.44
4275670	34.70
4275671	34.70
4274440	36.80
4274441	35.20
4275679	35.20
4275678	35.20
4275677	35.20
4275676	35.20
4275675	35.20
4275674	12.30
4275673	20.53
4275672	18.30
4274432	16.80

Claim	Line Km
4277200	27.79
4275680	35.20
4275681	35.20
4275682	35.20
4275683	35.20
4275684	35.20
4274442	35.20
4274443	35.20
4274444	35.20
4275658	35.20
4274445	36.30
4274446	34.10
4274447	35.20
4275687	35.20
4275686	35.20
4275087	35.20
4275088	35.20
4275688	35.20
4275685	34.20

RESULTS

The technical details about the acquisition process, quality control and processing can be found in the report submitted by Sander Geophysics that is attached in Appendix I of this report. The Appendix includes the large scale maps of the results.

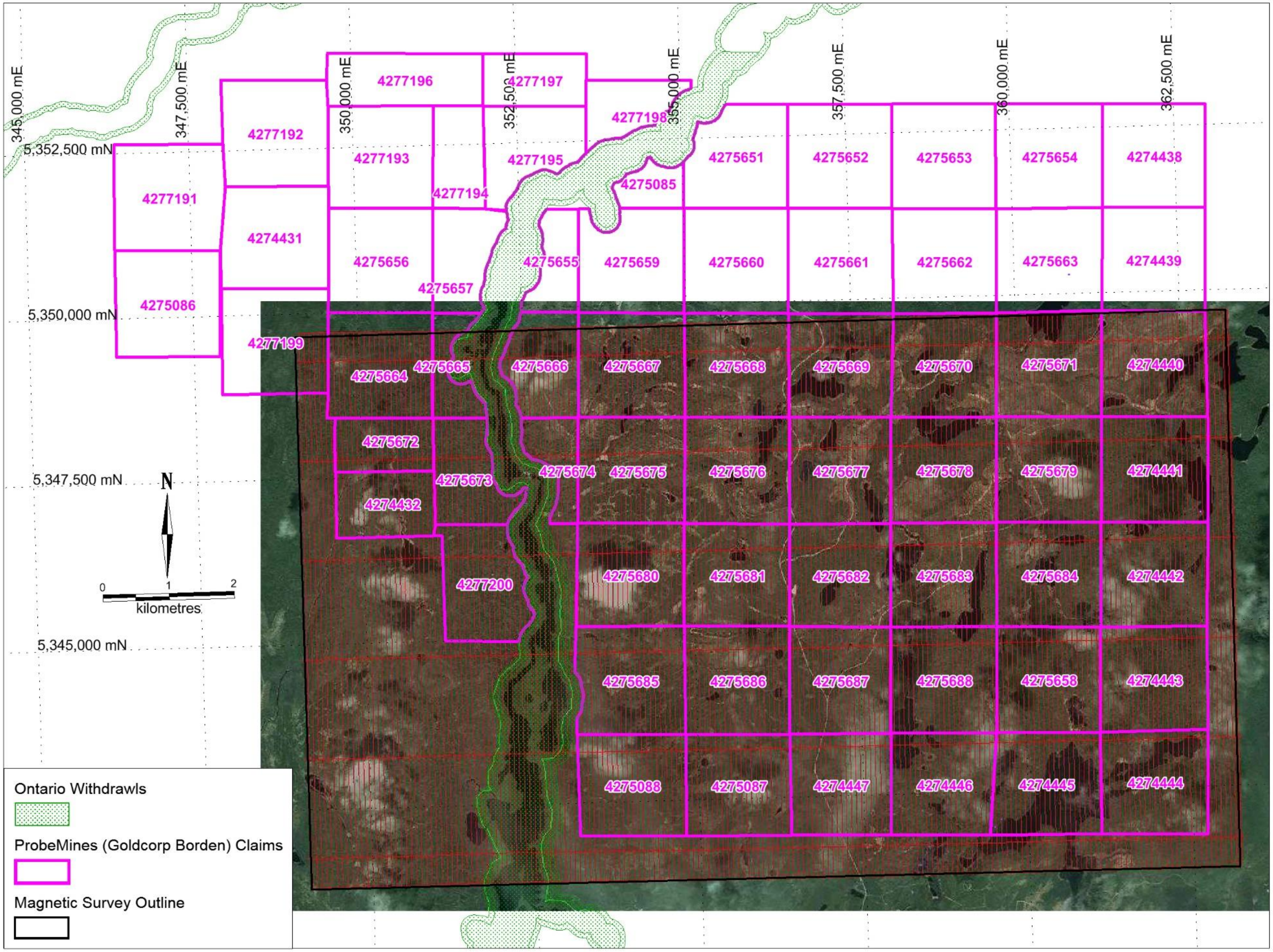

Figure 3 – Location of the Airborne Magnetic Survey with flight lines illustrated

RECOMMENDATIONS

The results of the 2016 airborne geophysical survey on the Lincoln/Copperfield claims indicate that there are areas that warrant follow up work.

The work expenditures for the program will be applied to the claims to keep them in good standing.

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APPENDIX 1

Technical Report on High Resolution Airborne Magnetic Survey by Sander Geophysics Ltd accompanied by 1:25,000 scale results maps:

a) Residual magnetic field
b) First vertical derivative of residual magnetic field
c) Digital terrain model

SGL

Technical Report

A High Resolution Fixed-Wing Horizontal Magnetic Gradient Survey

Chapleau, Ontario
2016

for

Goldcorp Borden Ltd.

PROFESSIONAL GEOSCIENTIST
MARTIN P. BATES
PRACTISING MEMBER
2330
ONTARIO

13 June 2016

Martin Bates, Ph.D., P.Geo

Keith Wells, B.Sc.

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Appendix

1. EXECUTIVE SUMMARY

Sander Geophysics Limited (SGL) conducted a fixed-wing, high resolution, horizontal gradient magnetic survey in Northern Ontario for Goldcorp Borden Ltd. Please refer to *Appendix I* for a Company Profile of SGL.

The survey was flown using SGL's Cessna Grand Caravan 208B, registration C-GSGW. Production flights commenced on May 17, 2016 and data acquisition was completed on May 19, 2013. A total of 3 (1001 to 1003) flights were flown during the survey to complete the planned 1660 line kilometres. The survey operations were conducted from Victor M. Power Airport (YTS), Timmins, Ontario.

The traverse lines are oriented north-south and spaced at 75 m, while the control lines are oriented east-west and spaced at 1,500 m. A drape surface was created taking into account the terrain and the performance of the aircraft at the modelled altitudes and estimated temperature. The survey was flown with a target clearance of 70 m above ground level. The target average ground speed was 120 knots.

2. INTRODUCTION

This report describes the survey that Sander Geophysics Limited (SGL) flew for Goldcorp Borden Ltd in the spring of 2016 over the Borden Gold Project near Chapleau in Northern Ontario.

Horizontal gradient magnetic data were gathered during this survey. The instruments used to collect the data are described in this report as well as the tests performed to ensure optimal data quality.

The Field Operations section contains all information relating to operations at the survey location including the airport used, reference station coordinates and any problems encountered during the survey. Re-flights are listed as well as field crew members.

The Digital Data Compilation section details all processing performed from data acquisition to final product creation.

One page colour maps of all the survey data types which are included in the appendices, give a meaningful overview of the extensive data gathered.

The following Project Brief gives a quick reference of the details of the survey.

Project Brief

Survey Title	A High Resolution Fixed-Wing Horizontal Magnetic Gradient Survey
Client:	Goldcorp Borden Ltd
Survey Location:	Northern Ontario
Survey Start Date:	May 17, 2016
Survey End Date:	May 19, 2013
Contact:	Jason Rickard (Jason.Rickard@goldcorp.com)
Field Office Location:	Timmins, Ontario
Airport Used:	Victor M. Power Airport (YTS)
Aircraft Type:	Cessna Grand Caravan 208B
Total line kilometres:	1660
Survey Flying Particulars	
Traverse Lines	
Line numbers:	1001 to 1188
Line direction:	north-south
Line spacing:	75 m
Control Lines	
Line numbers:	101 to 106
Line direction:	east-west
Line spacing:	1,500 m
Survey Altitude:	smoothed drape with target height of 70 m above ground.
Digital Terrain Source:	
Number of Flights (numbers):	3 (1001 to 1003)
Aircraft Target Ground Speed	120 knots
Data	
Base Station Location (WGS-84)	W081° 21' 50.5488”, N48° 29' 26.8340”, 235.88m
Delivery Datum:	NAD-83
Projection:	UTM 17N

3. SURVEY AREA

The survey area covers the Borden Gold project located approximately 55 km northeast of Chapleau, Ontario. The survey area is situated in the boreal shield ecozone and is characterized by thick boreal forests, numerous lakes and rivers, broadly rolling uplands and lowlands and many bedrock outcrops. There is no significant human presence or infrastructure in the block except for a few small camps on the shores of the many lakes in the region. The terrain is relatively flat for most of the survey area, varying from approximately 235 m above mean sea level (MSL) to approximately 369 m above MSL. The weather during the survey was predominately sunny and the temperatures were within seasonal expectations with lows of 0°C in the morning to highs of 19°C later in the day.

Survey Area Map

The survey was flown as a single block. *Figure 1* shows the geographical location of the survey area. The planned survey lines are illustrated in *Figure 2* and listed in *Appendix II*. The flown lines are listed in *Appendix III*.

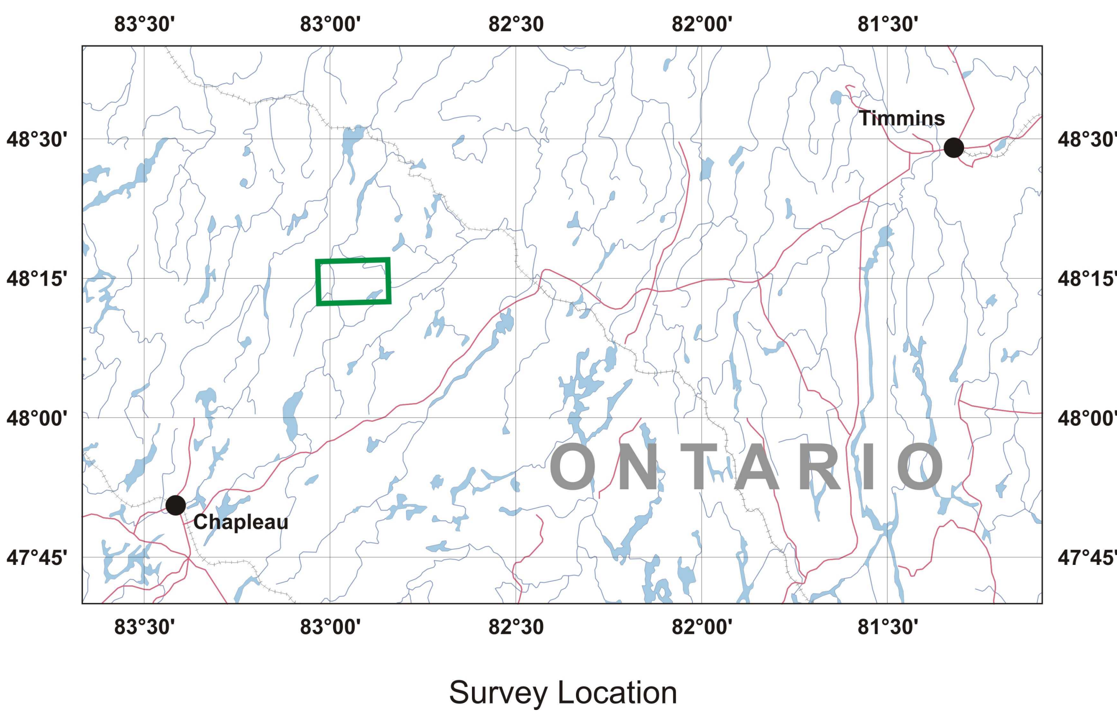


Figure 1: Survey Area

Figure 2: Survey Area Flight Lines

Survey Boundary

The block is bounded by the coordinates provided in *Table 1.*

Table 1: Survey Boundaries (datum WGS-84, projection UTM 17N)

Easting (m)	Northing (m)
349199.6105	5341301.0306
349199.6103	5349681.0319
363199.6124	5349681.0322
363199.6126	5341301.0310

4. SURVEY SPECIFICATIONS

Data Recording

In the aircraft:

- GPS positional data (time, latitude, longitude, altitude and raw range from each satellite being tracked) 10 readings per second (10 Hz);
- Terrain clearance as measured by the radar altimeter at 10 readings per second (10 Hz);
- Terrain clearance as measured by the laser rangefinder at 3.3 readings per second (3.3 Hz);
- Total magnetic field recorded at 160 readings per second (160 Hz), from three separately mounted magnetometers (port wing tip, starboard wing tip, tail stinger).

At the base magnetic/GPS reference station:

- Total magnetic field at 11 readings per second (11 Hz);
- GPS positional data (time, latitude, longitude, and raw range from each satellite being tracked) at 10 readings per second (10 Hz).

Technical Specifications

The following technical specifications were adhered to:

- Location (x, y, z) ≤ 1 m in X, Y, Z after differential correction.
- Data gaps ≤ 0.5 sec in any time, airborne or ground GPS xyz, or airborne magnetometer.
- Horizontal deviation from planned lines < 20 m for a distance of > 3.0 km and not > 40 m in any instance (subject to the pilot's discretion in the interest of safety).
- Vertical deviation from planned drape surface < 10 m for a distance of > 3.0 km and not > 30 m in any instance (subject to the pilot's discretion in the interest of safety).
- Airborne magnetometer Figure of Merit (FOM) < 1.5 nT with all equipment operating.
- Airborne magnetometer high frequency noise < 0.2 nT peak to trough for a period of three minutes or more while on line.
- Ground magnetometer high frequency noise < 0.1 nT peak to trough for a period of three minutes or more while on line.

Flight Line Specifications

The survey area flight line specifications are listed in the following table. The line direction is with respect to the UTM zone reference frame.

Table 2: Flight line specifications

	Line Direction	Line Spacing (m)
Traverse Lines	north-south	75
Control Lines	east-west	1,500

Survey Ground Speed

The survey target average ground speed was 120 knots.

Terrain Clearance

A pre-planned drape surface was prepared for the survey to guide the aircraft over the topography in a consistent manner, as close to the minimum clearance as possible. The drape surface was prepared with digital elevation model (DEM) data obtained from the Shuttle Radar Topography Mission (http://srtm.usgs.gov/) for the area in question. The DEM included an extension beyond the survey boundary to allow the aircraft to achieve the drape clearance before coming on line.

The drape surface created used a climb and descent rate of 150 ft/nm to 100 ft/nm at altitudes of 312 m to 454 m above sea level (ASL) respectively. Interpolation or extrapolation was used to calculate climb and descent rates for the smooth surface for all locations. The temperature component used for the calculation was based on published weather history. The gentle drape surface created was below the maximum climbing and descending capabilities of the survey aircraft and guided the aircraft as close to the target height of 70 m above the terrain as possible in all locations whilst retaining reasonable safety margins.

Picture 1: View from the survey aircraft

5. SURVEY EQUIPMENT

SGL provided the following instrumentation for this survey; see *Appendix IV* for further details:

Airborne Navigation and Data Acquisition System

Sander Geophysics Data Acquisition System (SGDAS)

The SGDAS is the latest version of airborne navigation and data acquisition computers developed by SGL. It is the data gathering core for all the different types of survey data. The computer incorporates an altimeter analog to digital converter and a NovAtel GPS multi-frequency receiver (see the GNSS and GPS Receivers section below for the details) which automatically provides the UTC time base for the recorded data. The system acquires the different data streams from the sensors and receives and processes GPS signals from the GPS antenna. Navigation information from the navigation side of the computer guides the pilots along the pre-planned flight path in all three dimensions. Profiles of the incoming data are displayed in real-time to the pilots for continuous monitoring. The data are recorded in database format on redundant solid-state data storage modules. The AIRGrav system incorporates an additional data acquisition system; Gravity DAS (GDAC). The GDAC controls the AIRGrav system records the data collected, and includes a separate user interface.

Aerial and Ground Magnetometers

Geometrics G-822A

Both the ground and airborne systems used a non-oriented (strap-down) optically-pumped cesium split-beam sensor. These magnetometers have a sensitivity of 0.005 nT and a range of 20,000 to 100,000 nT with a sensor noise of less than 0.0005 nT. The airborne sensor was mounted in a fibreglass stinger extending from the tail of the aircraft. The system included two additional sensors, housed in each wingtip pod. Total magnetic field measurements were recorded at 160 Hz in the aircraft, then later down sampled to 10 Hz in the processing. The ground systems recorded magnetic data at 11 Hz. Three sensors were mounted on the aircraft as shown in *Figure 3.* The three sensors are designated as Mag1 on the port wingtip, Mag2 on the starboard wingtip, and Mag3 in the tail mounted stinger.

Figure 3: Three Magnetometer Array

Magnetic Compensation System

Sander Geophysics AIRComp

SGL's own hardware and software system, AIRComp, was used to remove the effects of the aircraft and its manoeuvres from the recorded magnetic data. This system records the magnetic field measured by up to 4 cesium magnetometers, as well as the three axis output of a fluxgate magnetometer. These data are recorded for post-processing. Calibration of the magnetic effects of the aircraft is carried out as described in section 6, System Tests. Coefficients to be used for compensation are derived by processing the calibration flight data. The compensation coefficients are applied to data recorded during normal survey operations to produce compensated magnetic data.

Reference Station Acquisition System

Sander Geophysics SGRef

The SGRef reference (ground) station is a dual reference station. One half consists of a data acquisition computer with a cesium magnetometer interface and frequency counter to process the signal from the magnetometer sensor and from the GNSS receiver (see the GNSS and GPS Receivers section below for the details). The other half contains only a GNSS receiver. These two halves operate independently of each other. The time base (UTC) of both the ground and airborne systems is automatically provided by the GNSS receiver, ensuring proper merging of both data sets. All data are displayed on an LCD flat panel monitor. The magnetic data, sampled at 11 Hz and the GNSS data, sampled at 10 Hz, are recorded on solid state data storage modules. The entire reference data acquisition system was set for automatic, unattended recording. The noise level of the reference station magnetometer is less than 0.1 nT.

Picture 2: Reference station setup with GPS antenna in the background

REFERENCE STATION AND AIRBORNE ACQUISITION SYSTEM GPS RECEIVERS

NovAtel OEMV-3 receiver board

The NovAtel OEMV-3, multi-frequency GNSS (Global Navigation Satellite System) receiver is configurable up to 72 channels with the tracking of GPS (L1, L2, L5), GLONASS (L1, L2), SBAS, and L-band satellites and signals. It provides averaged position and raw range information of all satellites in view. GNSS positional data are recorded at 10 Hz.

Altimeters

SGLas-P - Riegl LD90-31K-HiP Laser Rangefinder

The Riegl laser altimeter uses a single optical laser beam to measure distance to the ground. It is effective over water and is eye safe. This profilometer has a range of 1,500 m, a resolution of 0.01 m with an accuracy of 5 cm and a 3.3 Hz data rate.

Bendix/King KRA-10A Radar Altimeter

The Bendix-King radar altimeter has a resolution of 0.5 m, an accuracy of 5%, a range of 6 to 760 m, and a 10 Hz data rate. This system is employed as a backup system and not actively employed for survey guidance or data processing.

TRT ERT 530A Digital Radar Altimeter

The TRT uses radio wave echoing to determine the height above ground. It will generally "see through" foliage. The TRT radar altimeter has a resolution of 0.5 m, an accuracy of 1%, a range of 1 to 2,440 m and a 10 Hz data rate.

Survey Aircraft

Cessna 208B Grand Caravan (C-GSGW)

The Cessna 208B Grand Caravan is an all metal, high wing single-engine aircraft powered by a Pratt & Whitney Canada PT6A-114A engine driving a constant speed, full feathering, reversible propeller. The aircraft has fixed gear, extendable flaps, manually adjustable trim tabs, full de-icing equipment, and sufficient avionics for instrument flying. The Grand Caravan is equipped with a rigid aluminum and composite material 3 m tail stinger designed to accommodate a magnetometer sensor. The belly of the aircraft has a 14 cm diameter glass opening allowing for the laser altimeter and video camera. The airframe has been extensively modified to reduce the magnetic signature of the aircraft by replacing ferromagnetic parts with those made from special non-magnetic stainless steel or aluminum. Several wiring changes have also been made to the electrical system to reduce the magnetic field variations around the aircraft. Other alterations have been made to the Grand Caravan allowing for gravity, spectrometer, LiDAR and methane sensing surveys. All survey modifications are certified to meet the requirements of the Canadian Aviation Regulations (CARs). A complete description of this survey aircraft is given in *Appendix V.*

Data Processing Hardware and Software

Compilation of the data was performed on high performance desktop computers optimized for data processing tasks. SGL's proprietary geophysical software was used for data processing.

6. SYSTEM TESTS

Magnetometer System Tests

Magnetometer Heading Test

The heading test of the three magnetic system sensors in the survey aircraft was carried out at the Morewood test site west of Ottawa. The test was performed by flying a "cloverleaf" pattern over a known point at survey altitude. The cloverleaf consists of a pass over the known point orientated in all four directions of the traverse and control lines.

The heading test was performed prior to the start of the survey on 12th May 2016. The heading test flight lines were pre-planned using the Geological Survey of Canada (GSC) heading test specifications, and reference ground magnetic data were obtained through the use of Natural Resources Canada's (NRCAN) Ottawa magnetic observatory.

The results of the heading test are presented in *Table 3, Table 4* and *Table 5. The test determined average northwest-southeast heading errors of 0.47 nT, 0.58 nT and 0.52 nT and average northeast-southwest heading error of 0.13 nT, 0.66 nT and -0.11 nT for Mag1, Mag2 and Mag3 respectively.* The results of the test were used as a quality control procedure to ensure proper functioning of the magnetic system and are not applied to the acquired data. The heading error is fully corrected during the normal airborne magnetic data processing.

Table 3: Mag1, Port Magnetometer heading test

Aircraft type :	Cessna 208B	Date:	12th May 16
Registration :	C-GSGW	Height flown:	1500 ft AGL
Organization :	Sander Geophysics	Magnetometer type :	Geometrics G-822A
Pilot :	Shane Willson	Compensator:	Post flight compensation
Co-Pilot :	Andre Lafontaine	Sampling rate :	10/s
		Data acquisition system :	Sander SGDAS-3

Dir	Line #	GMT	Total Field Aircraft	Ground Mag	Calculated	Error Value	Variation from Average
NW	2001.02	16:11:17	53,734.24	54,380.7	53,740.6	-6.63	0.46
SE	2001.01	15:59:50	53,734.04	54,381.1	53,741.0	-7.01	-0.19
NE	201.02	16:16:53	53,733.74	54,380.8	53,740.7	-6.92	-0.11
SW	201.01	16:05:38	53,733.78	54,380.7	53,740.6	-6.85	0.04
NW	2001.04	16:33:23	53,733.67	54,380.5	53,740.4	-6.72	0.10
SE	2001.03	16:22:20	53,733.65	54,380.7	53,740.7	-7.00	-0.19
NE	201.04	16:38:58	53,733.89	54,380.7	53,740.6	-6.67	0.15
SW	201.03	16:27:49	53,733.35	54,380.5	53,740.3	-7.00	-0.18
					Total	-54.52	
					Average	-6.81	

Average Northwest-Southeast Heading Error	0.47 nT
Average Northeast-Southwest Heading Error	0.13 nT

Table 4: Mag 2, Starboard Magnetometer heading test

Aircraft type :	Cessna 208B	Date:	12th May 16
Registration :	C-GSGW	Height flown:	1500 ft AGL
Organization :	Sander Geophysics	Magnetometer type :	Geometrics G-822A
Pilot :	Shane Willson	Compensator:	Post flight compensation
Co-Pilot :	Andre Lafontaine	Sampling rate :	10/s
		Data acquisition system :	Sander SGDAS-3

Dir	Line #	GMT	Total Field Aircraft	Ground Mag	Calculated	Error Value	Variation from Average
NW	2001.02	16:11:17	53,745.88	54,380.7	53,740.6	5.28	0.47
SE	2001.01	15:59:50	53,745.53	54,381.1	53,741.0	4.48	-0.33
NE	201.02	16:16:53	53,745.60	54,380.8	53,740.7	4.94	0.12
SW	201.01	16:05:38	53,745.16	54,380.7	53,740.64.	4.53	-0.29
NW	2001.04	16:33:23	53,745.29	54,380.5	53,740.4	4.90	0.09
SE	2001.03	16:22:20	53,745.19	54,380.7	53,740.7	4.54	-0.28
NE	201.04	16:38:58	53,745.94	54,380.7	53,740.6	5.38	0.57
SW	201.03	16:27:49	53,745.82	54,380.5	53,740.3	4.47	-0.34
					Total	38.53	
					Average	4.82	

Average Northwest-Southeast Heading Error	0.58 nT
Average Northeast-Southwest Heading Error	0.66 nT

Table 5: Mag3, Tail Magnetometer heading test

Aircraft type :	Cessna 208B	Date:	12th May 16
Registration :	C-GSGW	Height flown:	1500 ft AGL
Organization :	Sander Geophysics	Magnetometer type :	Geometrics G-822A
Pilot :	Shane Willson	Compensator:	Post flight compensation
Co-Pilot :	Andre Lafontaine	Sampling rate :	10/s
		Data acquisition system :	Sander SGDAS-3

Dir	Line #	GMT	Total Field Aircraft	Ground Mag	Calculated	Error Value	Variation from Average
NW	2001.02	16:11:17	53,737.98	54,380.7	53,740.6	-2.62	0.54
SE	2001.01	15:59:50	53,737.67	54,381.2	53,741.0	-3.38	-0.22
NE	201.02	16:16:53	53,737.30	54,380.8	53,740.7	-3.36	-0.20
SW	201.01	16:05:38	53,737.52	54,380.7	53,740.6	-3.11	0.05
NW	2001.04	16:33:23	53,737.34	54,380.5	53,740.4	-3.05	0.11
SE	2001.03	16:22:20	53,737.33	54,380.7	53,740.7	-3.32	-0.16
NE	201.04	16:38:58	53,737.35	54,380.7	53,740.6	-3.21	-0.05
SW	201.03	16:27:49	53,737.10	54,380.5	53,740.3	-3.25	-0.09
					Total	-25.29	
					Average	-3.16	

Average Northwest-Southeast Heading Error	0.52 nT
Average Northeast-Southwest Heading Error	-0.11 nT

Compensation Calibration

Compensation calibrations determine the magnetic influence of aircraft and its manoeuvres. During the compensation calibration flight, the aircraft performs sets of three pitches (+/-5°), rolls (+/-10°), and yaws (+/-5°), while flying in the four flight line directions at high altitude over a magnetically quiet area. The coefficients calculated from the calibration are applied to the acquired magnetometer data to measure the effectiveness of the compensation system in mitigating the magnetic interference.

The total compensated signal noise resulting from the twelve manoeuvres, referred to as the Figure of Merit (FOM), is calculated from the maximum peak-to-peak value resulting from each manoeuvre. A new compensation calibration must be performed after any aircraft or system modifications that may affect the aircraft's magnetic field interference.

A compensation calibration flight was performed on the 12th of May 2016 over a magnetically quiet area west of Ottawa. *Table 6* shows the compensation calibration test performed and the results. See *Figure 4, Figure 5* and *Figure 6* for an illustration of the compensated and uncompensated data acquired during the compensation calibration.

Table 6: Magnetic compensation calibration test and results

Magnetometer Sensor	Valid for Flights	FOM (nT)	Date Flown
Port (mag1)	1001-1003	1.01	12th May, 2016
Starboard (mag2)	1001-1003	1.11	12th May, 2016
Tail (mag3)	1001-1003	0.97	12th May, 2016

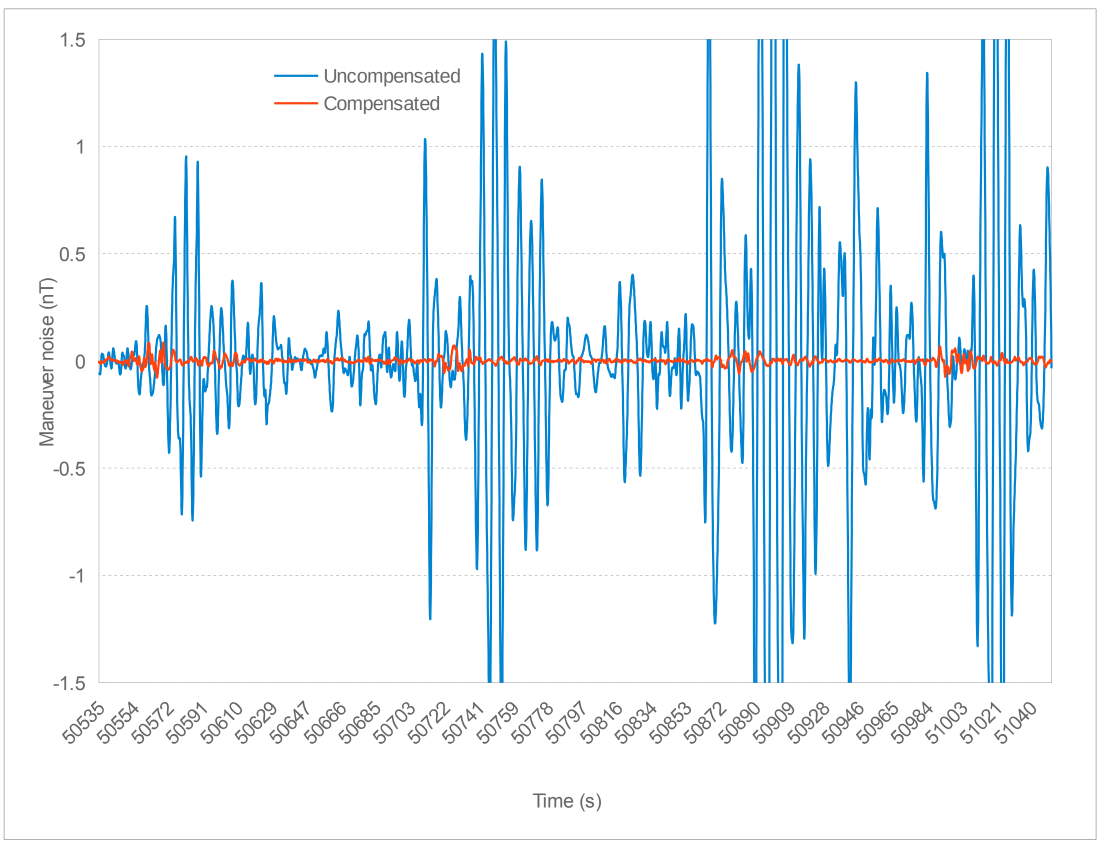


Figure 4: Mag1 Port Compensation calibration test

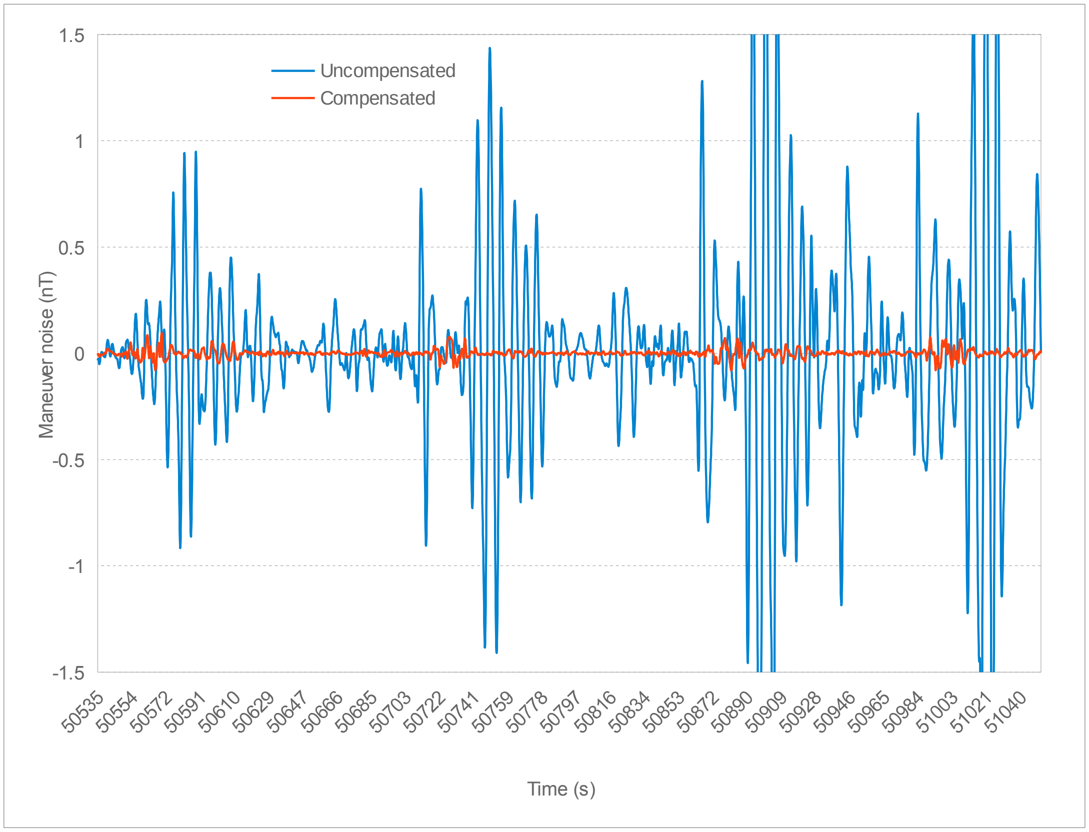


Figure 5: Mag2 Starboard Compensation calibration test

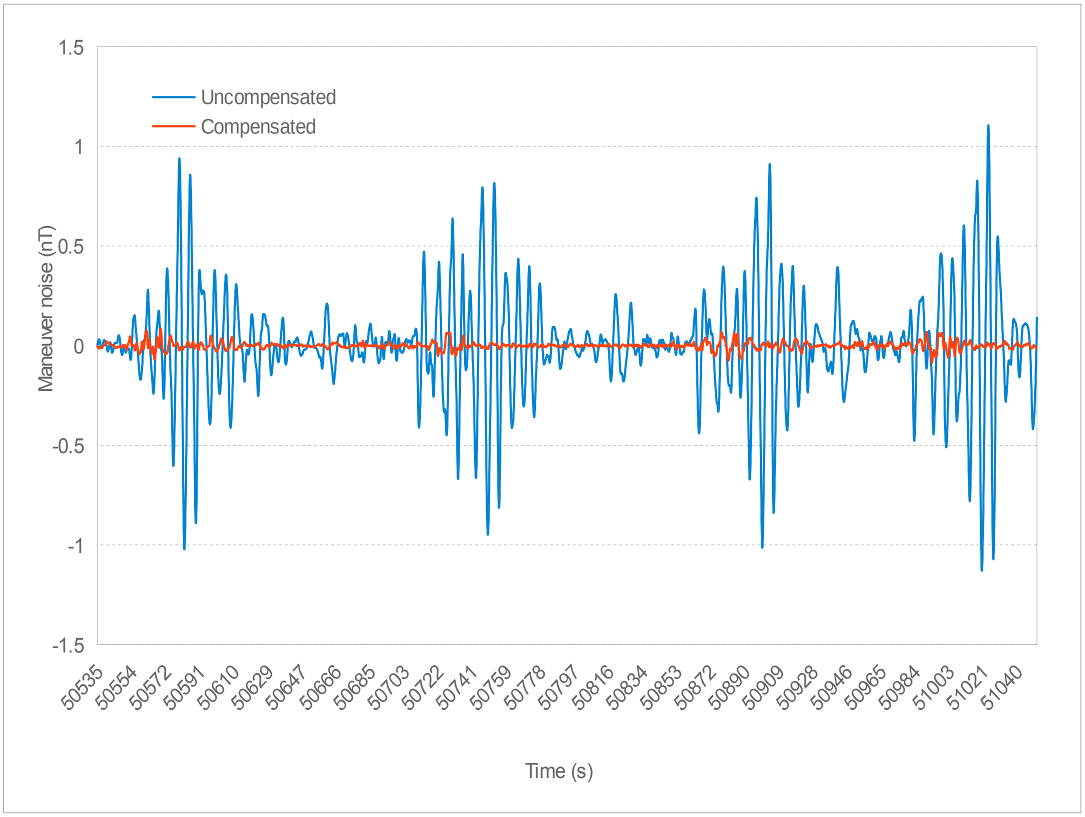


Figure 6: Mag 3 Tail Compensation calibration test

Instrumentation Lag

The lag in the magnetic data is a function of two components, a static lag due to signal processing and a speed-dependent dynamic lag due to the physical offset of the magnetometer and the GPS antenna. Both elements of the lag are well-known. The static lag is known to be 0.244 s from the filters applied during signal processing. The dynamic lag is equal to the offset of the GPS sensor from the magnetometers as measured along the long axis of the aircraft, divided by the flying speed. For the wingtip sensors the offset is 1.13 m, whilst for the tail sensor the offset is 12 m. Given that the average speed was 70 m/s during the test, the total lag for the wingtip sensors would be 0.26 s and 0.41 s for the tail sensor.

The lag test was flown on 12th May, 2016 before deployment to the survey location. The tests were flown close to Ottawa over a railway bridge that crosses the Ottawa River near the township of Pontiac. The results are shown in *Figure 8, Figure 8 and Figure 9.* The lag correction is applied in the first step of magnetic data compilation.

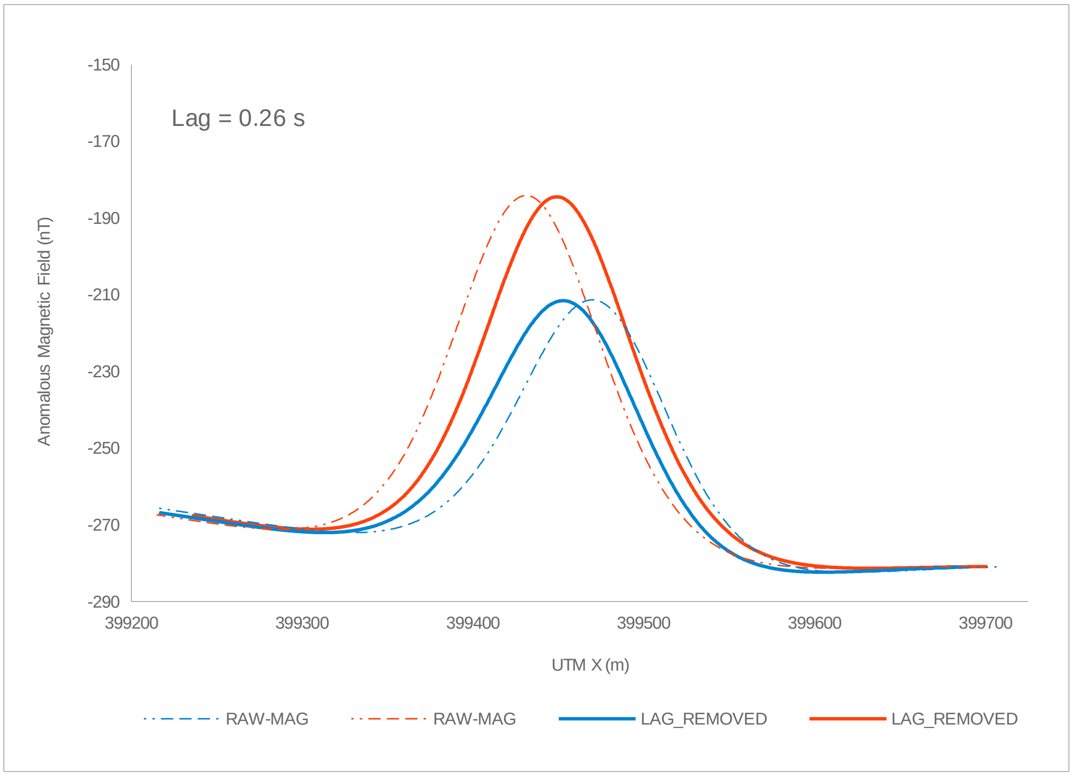


Figure 8: Mag1 Port Magnetic Sensor Instrumentation lag test

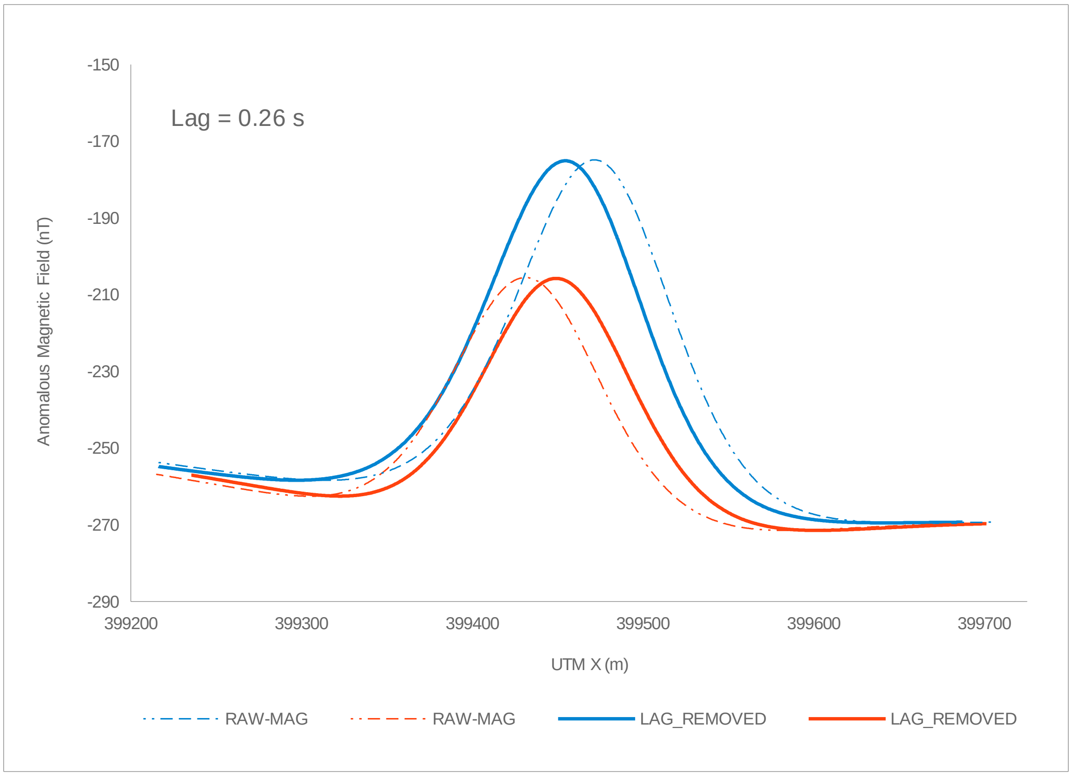


Figure 9: Mag2 Starboard Magnetic Sensor Instrumentation lag test

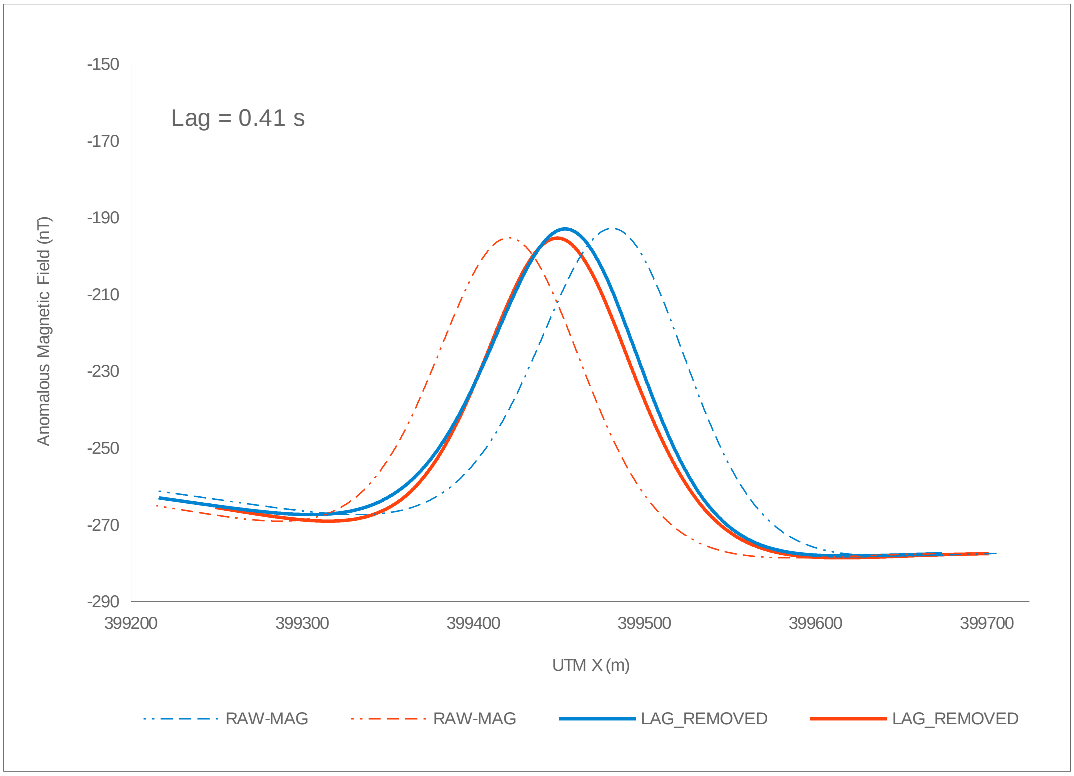


Figure 10: Mag3 Tail Magnetic Sensor Instrumentation lag test

Altimeter System, Position And Digital Terrain Model Tests

Radar And Laser Altimeter Calibration

A test flight to calibrate the radar and laser altimeters was flown prior to mobilizatiion on 12th May , 2016 over the runway at Gatineau Airport. Five passes at 60m intervals were conducted over the runway with heights ranging from 0 to 300 m above ground. The altimeter values were compared to the post-flight differentially corrected GPS altitude above ground for calibration. An ideal altimeter would yield a slope of 1 and an intercept of 0. The TRT radar altimeter slope was 0.9991 and the intercept 1.0004 m. The laser altimeter slope was 1.0015 and the intercept was -0.0294 m. The Bendix/King radar altimeter slope was 1.0848 and the intercept was 0.4301 m. These results are well within the expected accuracy of the altimeters. Please refer to *Figure 11* which illustrates the results of the altimeter test.

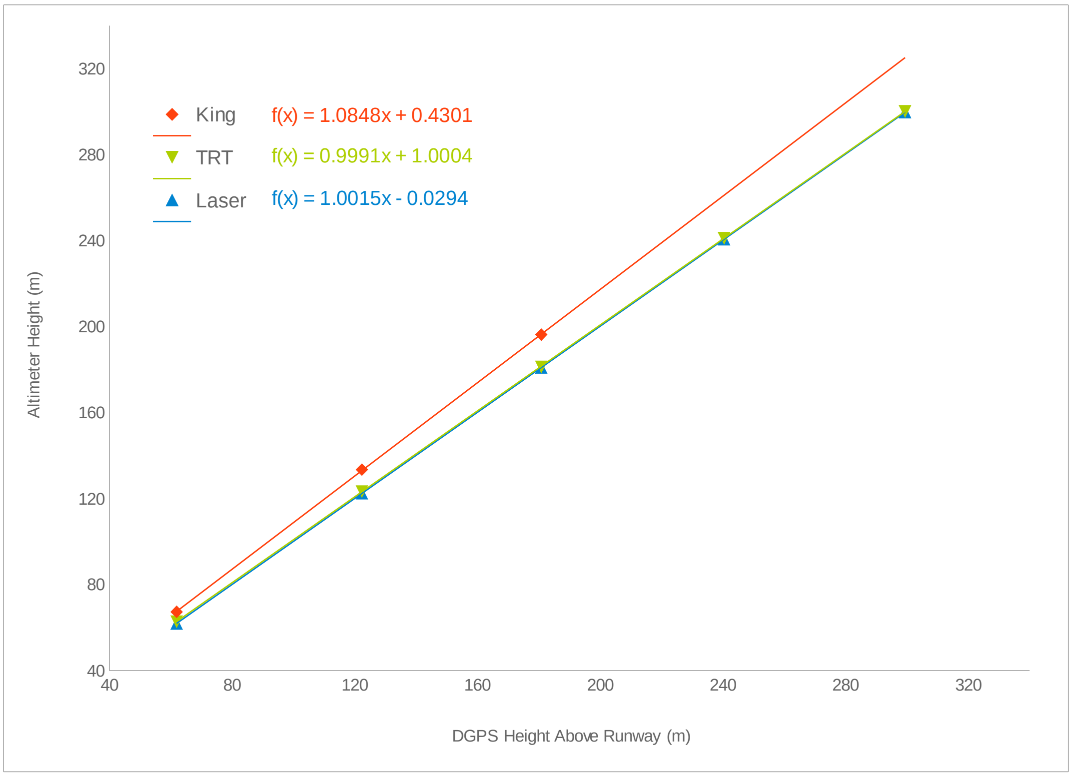


Figure 11: Altimeter test

7. FIELD OPERATIONS

Operations were conducted from Victor M. Power Airport in Timmins, Ontario. The survey required 3 production flights, from 17th to 19th May, 2016.

Mobilization to Timmins began with the arrival of the field crew chief and equipment on 15th May. The Caravan, C-GSGW, arrived the following day on 16th May. The field office was set up in room 221 at the Cedar Meadow Resort. The Victor M. Power Airport features two main hard surfaced runways of 6,000 ft and 4,907 ft, and a wide range of aviation facilities. Mobilization was completed on 16th May, with the combined magnetometer and GPS reference station installed in a grassy field at the Cedar Meadow Resort.

Picture 3: Preparing the aircraft for a survey flight

Good weather in May enabled the data acquisition to be completed over 3 consecutive days of flying. The entire project including mobilization, data acquisition and de-mobilization was completed in 6 days.

Reference Stations

The reference station was set-up in a grassy field behind the Cedar Meadow Resort in Timmins, Ontario on 16th May. *Table 7* shows the coordinates of the reference stations.

Table 7: Locations of reference stations (datum WGS-84)

Station #	Location	Latitude	Longitude	Elevation
REF1	Timmins	48:29:26.8340 N	81:21:50.5488 W	235.88 m

The position of the REF1 reference station GPS antenna was not itself differentially corrected and was only used to differentially correct the airborne GPS data during the field QC process. The final airborne position data was corrected using the Precise Point Positioning (PPP) method described in the "Positional Processing" section.

Re-flights

All Re-flight lines were flown as part of the final production flight, 1003. The survey flying was completed on 19th May, 2016. Demobilization started immediately and was completed on 20th May, 2016 with the departure of the aircraft from the base of operations. *Table 8* shows a list of re-flights and the reasons they were required.

Table 8: Re-flight list

Original Flight		Re-Flights		
Line	Flight	Line	Flight	Reason
1151.00	1001	1151.01	1003	Above Drape at line intercept
1152.00	1001	1153.01	1003	Above Drape at line intercept
1158.00	1001	1158.01	1003	Above Drape at line intercept
1161.00	1001	1161.01	1003	Above Drape at line intercept
1166.00	1001	1166.01	1003	Above Drape middle of line
1173.00	1001	1173.01	1003	Above Drape at line intercept

A listing of theoretical flight lines and their coordinates is given in *Appendix II*. Coordinates and times of the actual lines flown are listed in *Appendix III*. The Weekly Reports are in *Appendix VI*.

Field Personnel

Table 9 shows a list of SGL technical personnel who participated in the field operations.

Table 9: Survey field crew

Position	Name	Dates in Field
Project Manager	Al Pritchard	N/A
Crew Chief / Data Processor	Keith Wells	15th May – 20th May, 2016
Pilot	Shane Wilson	16th May – 20th May, 2016
Pilot	André Lafontaine	16th May – 20th May, 201

8. DIGITAL DATA COMPILATION

Preliminary processing for on-site quality control was performed in the field as each flight was completed. This included verifying the data on the computer screen, profiling all of the data channels, and creating preliminary data grids.

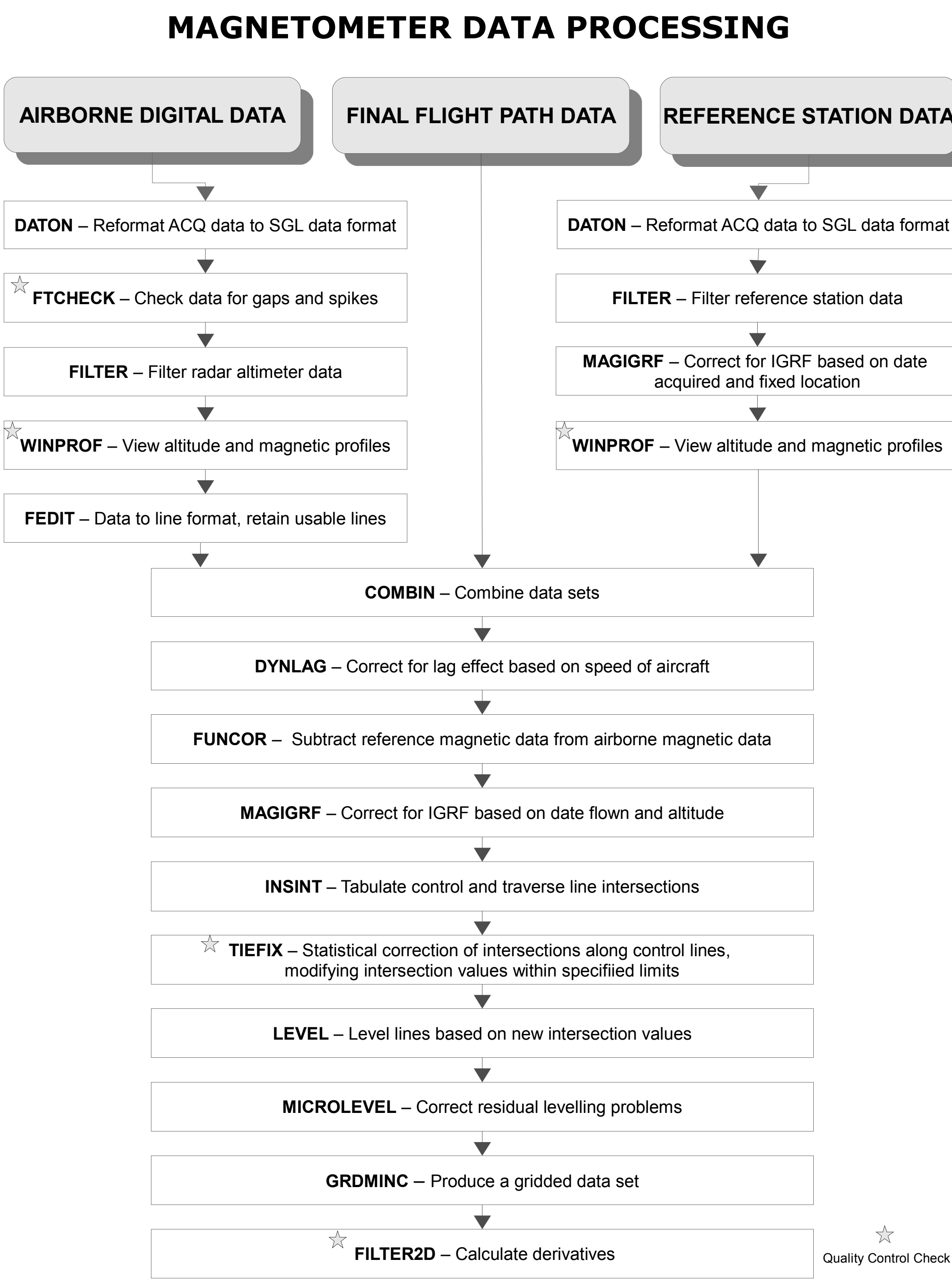


Figure 12: Magnetometer data processing flowchart

Magnetometer Data

A magnetic data flowchart is presented in *Figure 12.* The airborne magnetometer data were recorded at 160 Hz, and down sampled to 10 Hz for processing. All magnetic data were plotted and checked for any spikes or noise. A 0.25 s static lag correction due to signal processing, plus a dynamic lag correction for a total lag averaging 0.26 s for the wingtip sensors and 0.41 s for the tail sensor but varying depending on the instantaneous velocity of the aircraft was applied to each data point. The aircraft speed dependent dynamic lag was calculated using SGL's Dynlag software.

Ground magnetometer data were inspected for cultural interference and edited where necessary. All reference station magnetometer data were filtered using a 121 point low pass filter (*Appendix VII*) to remove any high frequency signal, but retain the low frequency diurnal variations.

A correction for the International Geomagnetic Reference Field (IGRF) year 2015 model, was extrapolated for all ground magnetometer data using the fixed ground station location (see Section 7 – FIELD OPERATIONS) and the recorded date for each flight. The mean residual value of the reference station calculated to be 191.724 nT was subtracted to remove any bias from the local anomalous field. Diurnal variations in the airborne magnetometer data were removed by subtracting the corrected reference station data.

The airborne magnetometer data were corrected for the IGRF using the location, altitude, and date of each point. IGRF values were calculated using the year 2015 IGRF model. The altitude data used for the IGRF corrections are DGPS heights above the GRS-80 ellipsoid.

Levelling

Levelling is only applied to the tail sensor Mag3 data. Mag1 and Mag2 are only used in the gradient processing described below.

Intersections between control and traverse lines were determined by a program which extracts the magnetic, altitude, and x and y values of the traverse and control lines at each intersection point. Each control line was adjusted by a constant value to minimize the intersection differences, calculated as follows:

$\Sigma\, |i - a|$ summed over all traverse lines
where, i = (individual intersection difference)
a = (average intersection difference for that traverse line)

Adjusted control lines were further corrected locally to minimize any residual differences. Traverse line levelling was carried out by a program that interpolates and extrapolates levelling values for each point based on the two closest levelling values. After traverse lines have been levelled, the control lines are matched to them. This ensures that all intersections tie perfectly and permits the use of all data in the final products.

CLEVEL provides a curved correction using a function similar to spline interpolation. A third degree polynomial is used to interpolate between two intersections and the two values and two derivatives are chosen to determine the polynomial. CLEVEL is an improved method as it allows intersection points to be preserved with no mismatch and interpolation is smooth with the first derivative continuously approaching the same value from both sides of the intersection points.

The levelling procedure was verified through inspection of magnetic anomaly and vertical derivative grids, plotting profiles of corrections along lines, and examining levelling statistics to check for steep correction gradients.

Micro-Levelling

Micro-levelling was applied to remove any residual diurnal effects from the data. This was achieved by using directional filters to identify and remove artifacts that are long wavelengths parallel to survey lines and short wavelengths perpendicular to survey lines. A limit of +/-0.4 nT was set for all micro-levelling corrections.

Gridding

The grid of the total magnetic intensity was made using a minimum curvature algorithm to create a two-dimensional grid equally sampled in the x and y directions. The algorithm produces a smooth grid by iteratively solving a set of difference equations minimizing the total second horizontal derivative while attempting to honour the input data (Briggs, I.C, 1974, Geophysics, v 39, no. 1).

The final grids of the magnetic data were created with 15 m grid cell size appropriate for survey lines spaced at 75 m.

Measured Magnetic Gradients

The measured lateral and longitudinal gradients provide an improved rendition of the shorter wavelengths in magnetic field than the total magnetic field measured by the tail sensor Mag3 alone. This is because the direction and amplitude of the field's total horizontal gradient can be determined using the two measured gradients, providing information regarding the behaviour of the magnetic field in between traverse lines.

Initially, the magnetic gradients are derived with respect to the aircraft frame. The across-aircraft gradient data is derived from the difference in total magnetic intensity recorded at the wingtip sensors Mag1 and Mag2 divided by the separation across the wings of 19.02 m. The along-aircraft gradient is derived from all sensors, being the difference in total magnetic intensity between the mean value of the wingtip sensors Mag1 and Mag2 and the tail sensor Mag3 divided by the longitudinal separation along the aircraft body of 10.88 m.

Due to the different sensors employed on the aircraft, there is an inherent directional bias in the horizontal gradients. By comparing data flown in opposite directions along the test line, the biases were estimated to be -0.590 nT/m for the lateral gradient, and -0.295 nT/m for the longitudinal gradient. The across and along the aircraft gradients and the azimuth of the aircraft, available from the aircraft avionics, are combined to calculate the horizontal and longitudinal gradients with respect to the survey lines so that positive gradients are eastward and northward respectively.

Lateral and longitudinal gradients were then "levelled" to gradients derived from the tail sensor Mag3 anomalous magnetic field data. This was done by subtracting the average difference between gradients derived from the tail sensor alone and the measured gradients. The difference was filtered using a 59 point average to allow for some variation of the correction along the line without compromising the short wavelength gradient data provided by the measured gradients. This process reconciles minor line-by-line and along line differences not accounted for by the simple bias correction.

The two horizontal gradients, lateral gradient and longitudinal gradient, are used to create a first vertical derivative using the Hilbert transform relationship (Nabighian, M.N., 1984, Toward a three-dimensional automatic interpretation of potential field data via generalized Hilbert transforms: Fundamental relations; Geophysics, v.49, p.780-786). Once the Hilbert transform had been applied to the lateral and longitudinal gradients, the outputs are summed to create a first vertical derivative grid. The first vertical derivation is then integrated to create a gradient-enhanced magnetic anomaly.

However the integrated gradient enhanced magnetic anomaly does not contain the long wavelength signal that is well sampled and retained in the non-gradient enhanced single sensor magnetic anomaly data. To account for this the long wavelength magnetic anomaly must be recovered. This was achieved by applying 2 km low pass 2nd order Butterworth filter to the difference between the enhanced and non-enhanced data to isolate the missing long wavelengths. The long wavelength data was then added to the integrated data to create the gradient enhanced magnetic anomaly grid.

All grids generated during this procedure are created using a minimum curvature algorithm and a cell size of 15 m.

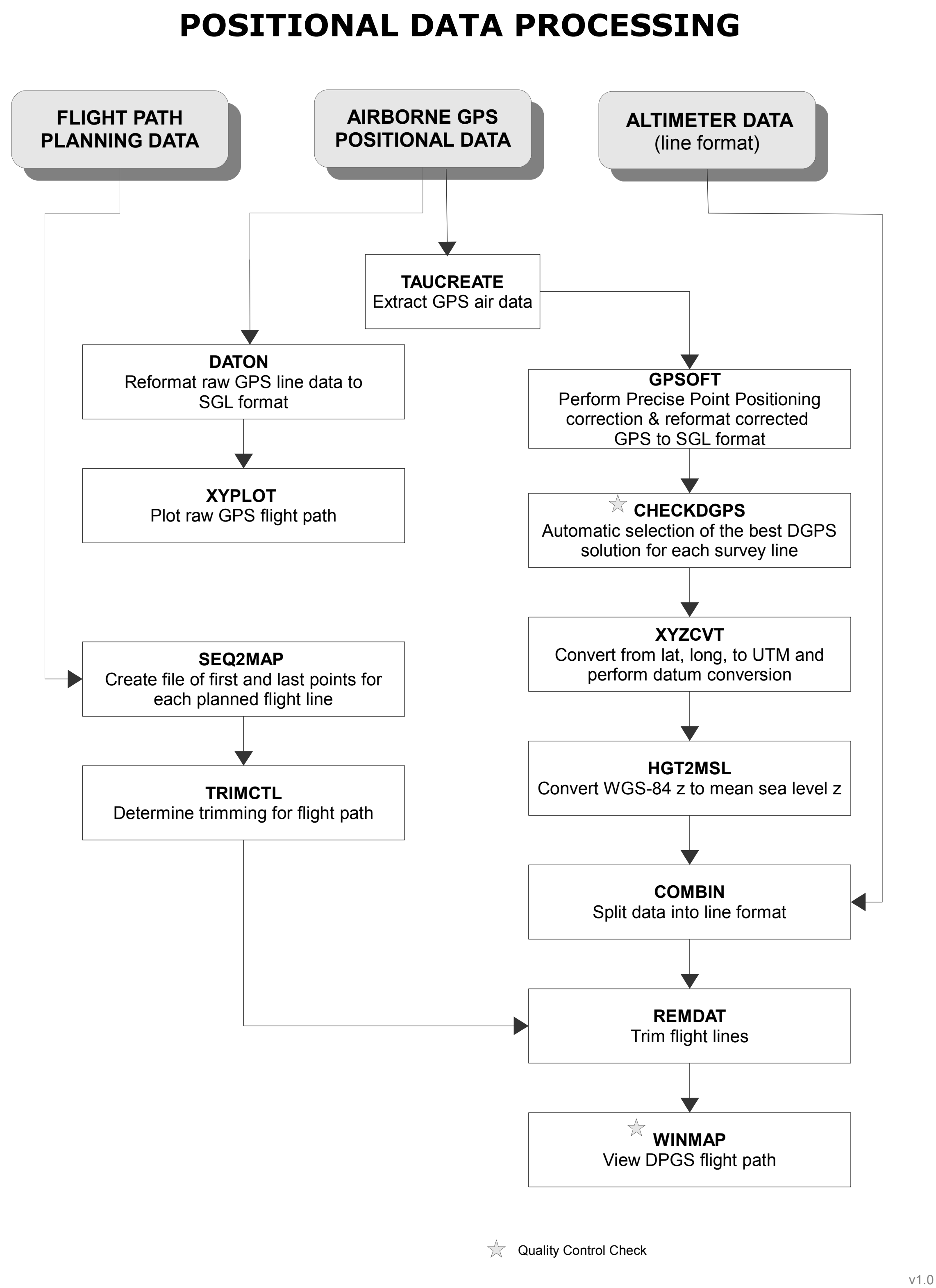


Figure 13: Positional data processing flowchart

Positional Data

A positional data flowchart is presented in *Figure 13.* A number of programs were executed for the compilation of navigation data in order to reformat and recalculate positions in differential mode. SGL's GPS data processing package, GPSoft, was used to calculate DGPS positions from raw 10 Hz range data obtained from the moving (airborne) and stationary (ground) receivers using combinations of L1 and L2 phase signal.

Accurate locations of the GPS antenna were determined through Precise Point Positioning (PPP) corrections using the algorithm developed by the Natural Resources Canada (NRCAN) (http://webapp.geod.nrcan.gc.ca/geod/tools-outils/ppp.php) adapted to run under SGL's suite of software. This technique provides a final receiver location with an accuracy of better than 5 cm.

Positional data (x, y, z) were recorded and all data processing was performed in the WGS-84 datum, UTM projection zone UTM17N. See *Table 10* for the ellipsoid parameters.

Table 10: Ellipsoid parameters for WGS-84

Ellipsoid	WGS-84
Semi-major axis	6378137.0
1/flattening	298.257223563

Elevation data were recorded relative to the GRS-80 ellipsoid and transformed to mean sea level (MSL) using the Earth Gravitational Model 2008 (EGM2008).

Radar, Barometric, and Laser Altimeter Data

The terrain clearance measured by the radar altimeter and the barometric altitude were recorded at 10 Hz. The barometric altimeter was recorded but was not used in processing because of the availability of more accurate GPS altitudes.

The laser altimeter recorded terrain clearance at 3.3 Hz. Even though the laser altimeter can record returns from more than 700 m above the ground with a high degree of certainty, some laser data dropouts occurred while flying over the lakes and wet parts of the survey area. The laser data shows the effects of the dense tree cover; variable penetration of the canopy results in a high frequency variation of recorded altitude.

The TRT radar data penetrates the canopy less as it records the first return within the footprint of its signal. The radar altimeter data were filtered to remove high-frequency noise using a 67-point low pass filter (*Appendix VII*). The final data were plotted and inspected for quality.

A digital elevation model (DEM) was derived by subtracting the laser altimeter data from the GPS altitude with respect to mean sea level. Short sections of poor laser data due to locally weak reflectivity or the effects of clouds were replaced using TRT radar data. The DEM is provided as a grid with a 15 m cell size. Adjustments of up to 5 m were applied using microlevelling to account for some variability in laser and radar altimeter data over different ground conditions.

9. FINAL PRODUCTS

Magnetic Line Data Format

A listing of the data channels delivered in ASCII format (Mag_Channels.xyz) with a sampling rate of 10 Hz can be found in *Table 11*.

Table 11: Magnetic line data channels and format

Title	Units	Field Length	Null	Description
X-coord	m	16	*	GPS X, WGS84 datum, UTM17N
Y-coord	m	16	*	GPS Y, WGS84 datum, UTM17N
Z-coord	m	16	*	GPS Z w.r.t. WGS84 datum
time	s	10	*	Fiducial time
latitude	degrees	16	*	Latitude, WGS84 datum
longitude	degrees	16	*	Longitude, WGS84 datum
Z-MSL	m	16	*	GPS Z w.r.t. Mean Sea Level
radar	m	10	*	Radar altimeter
laser	m	10	*	Laser altimeter
dem	m	10	*	Digital elevation model
flight	-	9	-	Flight number
line	-	9	-	Line number
date	YYYYMMDD	10	*	Date
mag_port	nT	13	*	Compensated, edited and lag corrected magnetic field from port wingtip sensor
mag_star	nT	13	*	Compensated, edited and lag corrected magnetic field from starboard wingtip sensor
mag_tail	nT	13	*	Compensated, edited and lag corrected magnetic field from tail sensor
diurnal	nT	13	*	Diurnal correction from magnetic base station
mag_diurn_tail	nT	13	*	Diurnally-corrected magnetic field from tail sensor
igrf	nT	13	*	IGRF field
mag_igrf_tail	nT	13	*	IGRF-corrected magnetic field
mag_lev_tail	nT	13	*	Levelled magnetic anomaly from tail sensor
mag_mic_tail	nT	13	*	Microlevelled magnetic anomaly from tail sensor
mag_grad_lat_raw	nT/m	13	*	Raw lateral horizontal magnetic gradient (from wingtip sensors)
mag_grad_lon_raw	nT/m	13	*	Raw longitudinal horizontal magnetic gradient (from wingtip & tail sensors)
pitch	degrees	13	*	Aircraft pitch
roll	degrees	13	*	Aircraft roll
azimuth	degrees	13	*	Aircraft azimuth
mag_grad_lat_final	nT/m	13	*	Levelled lateral horizontal magnetic gradient
mag_grad_lon_final	nT/m	13	*	Levelled longitudinal horizontal magnetic gradient
mag_enhanced	nT	13	*	Gradient enhanced magnetic anomaly

Digital Grids

The following are provided as digital grids in Geosoft Binary (.grd), Grid Exchange Format (GXF) and ASCII XYZ format:

Formats:	Geosoft Binary (.grd), Grid Exchange (GXF) & XYZ (XYZ)
Grid Cell Size:	15 m
Datum:	NAD-83
Projection:	UTM 17N

Table 12: Delivered digital grids

Grid File Name	Units	Description
DEM	m	Digital elevation model
MAG	nT	Magnetic anomaly from tail sensor
1VD	nT/m	First vertical derivative of magnetic anomaly from tail sensor
MAGLAT	nT/m	Lateral (across line) horizontal magnetic gradient
MAGLON	nT/m	Longitudinal (along line) horizontal magnetic gradient
MAG-EN	nT	Magnetic anomaly enhanced by gradients
1VD-EN	nT/m	First vertical derivative of magnetic anomaly enhanced by gradients

Appendix I

Company Profile

ABOUT US

Sander Geophysics Limited (SGL) provides worldwide airborne geophysical surveys for petroleum and mineral exploration, and geological and environmental mapping. Services offered include high resolution airborne gravity, magnetic, electromagnetic, and radiometric surveys, using fixed-wing aircraft and helicopters.

SGL head office in Ottawa, Canada

Dr. George W. Sander (1924-2008) founded SGL in 1956 to provide ground geophysical surveys. The first airborne surveys were performed as early as 1958, and by 1967 airborne geophysical surveys were the company's main focus. Operations have expanded steadily since SGL was founded 60 years ago. The company is led by co-Presidents Luise Sander and Stephan Sander.

WORLDWIDE OPERATIONS

SGL's head office and aircraft maintenance hangar are located at the International Airport in Ottawa, Canada. Sander Geophysics has operated on every continent including Antarctica, over diverse conditions ranging from the tropics to deserts, mountains and offshore.

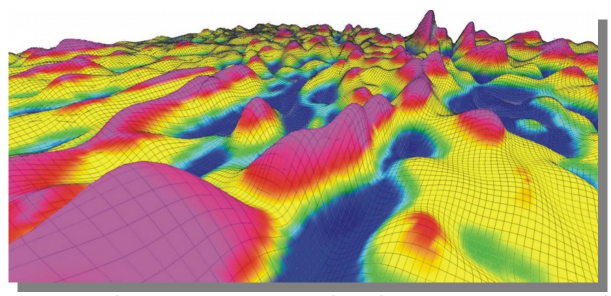
Facilities at the head office include a state of the art data processing department with an integrated digital cartographic department and a fully equipped electronics workshop for research, development and production of geophysical instruments. A Transport Canada Approved Maintenance Organization (AMO) for fixed-wing aircraft and helicopters allows most aircraft maintenance and modifications to be performed in-house.

SERVICES

AIRBORNE SURVEYS

- **Gravity (AIRGrav)**
- **Magnetic Total Field**
- **Magnetic Gradient**
- **Electromagnetic**
- **Gamma-ray Spectrometer**
- **Scanning LiDAR**

SGL offers gravity surveys with **AIRGrav** (Airborne Inertially Referenced Gravimeter), which was designed specifically for the unique characteristics of the airborne environment and is the highest resolution airborne gravimeter available. **AIRGrav** can be flown in an efficient survey aircraft during normal daytime conditions and is routinely flown in combination with magnetometer systems in SGL's airplanes and helicopters.



***AIRGrav** data: 3d image of the first vertical derivative of terrain corrected Bouguer gravity*

DATA PROCESSING

Immediate data processing is part of SGL's standard quality control procedure, and provides clients with rapid results for evaluation while a survey is in progress. Sander Geophysics offers a full range of data enhancement programs and integrated interpretation services by experienced geoscientists. Available products in digital and/or hard copy include:

- **Contour, colour or shaded relief maps of any parameter or combination of parameters**
- **NASVD processed gamma-ray spectrometer data**
- **Filtered line or grid products such as vertical or horizontal gradients, frequency slices,**

high/low-pass or band-pass filtered, amplitude of the analytic signal, reduction to the pole, upward or downward continuation

- **Computed depth to basement**
- **Calculated digital terrain models**
- **Two- or three-dimensional modelling**
- **Cultural editing**
- **Complete geophysical interpretative reports**

ENVIRONMENTAL MONITORING

The company also provides environmental monitoring services using gamma-ray spectrometers and specialized processing to detect and quantify natural and anthropogenic radiation.

HEALTH & SAFETY

Sander Geophysics is a founding and active executive member of the International Airborne Geophysics Safety Association (IAGSA), which promotes the safe operation of helicopters and fixed-wing aircraft on airborne geophysical surveys.

SGL has developed and implemented a Safety Management System (SMS) and comprehensive Health, Safety and Environment (HSE) policies that govern all aspects of company operations. Safety initiatives include:

- **Project-specific Aviation Risk Analysis (ARA) and Personnel Risk Analysis (PRA) for all surveys**
- **Real-time satellite tracking of SGL aircraft**
- **HSE and first aid training for all field personnel**
- **Low-level flight and aircraft simulator training for pilots**
- **Advanced safety training appropriate to the survey location, such as water-egress, wilderness survival, etc.**

SGL's excellent safety record reflects the quality and experience of its survey crews. This, combined with management's ongoing commitment to safety, helps to ensure that Sander Geophysics is a safe and reliable choice for airborne geophysical surveys.

PERSONNEL

Sander Geophysics has over 160 experienced permanent employees, including geophysicists, software and hardware engineers, aircraft maintenance engineers and pilots.

AIRCRAFT

SGL owns and operates seventeen aircraft, including eight Cessna Grand Caravans and a Twin Otter all equipped for geophysical surveys.

The Grand Caravans have been modified to allow the installation of a tri-axial magnetic gradiometer system. The company's fleet also includes three all composite Diamond DA42 Twin Stars, modified for gravity and horizontal magnetic gradient surveys, and two AS350 B3 helicopters equipped for gravity, magnetic and radiometric surveys. Extensive modifications have been made to all of the survey aircraft to accommodate geophysical instruments and to reduce the aircraft's magnetic field. Typical Figures of Merit (FOM) for Sander Geophysics' fixed-wing aircraft are less than 1 nT. The company's aircraft are flown and maintained by licensed and experienced permanent employees of Sander Geophysics.

SGL aircraft

RESEARCH & DEVELOPMENT

Nearly one-third of the company's resources are devoted to developing new and more efficient instrumentation for airborne geophysical surveying, and to further refine its full suite of software for geophysical data processing.

SGL

Appendix II

PLANNED SURVEY LINES, WGS-84

SEGMENT NO	START LAT	START LONG	END LAT	END LONG	LENGTH NM	LENGTH KM
C0101.0	N48:12.66	W083:01.86	N48:12.86	W082:50.41	7.65	14.18
C0102.0	N48:13.47	W083:01.89	N48:13.66	W082:50.44	7.65	14.18
C0103.0	N48:14.28	W083:01.92	N48:14.47	W082:50.47	7.65	14.18
C0104.0	N48:15.09	W083:01.95	N48:15.28	W082:50.50	7.65	14.18
C0105.0	N48:15.90	W083:01.98	N48:16.09	W082:50.53	7.65	14.18
C0106.0	N48:16.71	W083:02.02	N48:16.90	W082:50.56	7.65	14.18
T1001.0	N48:12.42	W083:01.79	N48:16.94	W083:01.96	4.53	8.38
T1002.0	N48:12.42	W083:01.72	N48:16.94	W083:01.90	4.53	8.38
T1003.0	N48:12.42	W083:01.66	N48:16.94	W083:01.84	4.53	8.38
T1004.0	N48:12.42	W083:01.60	N48:16.95	W083:01.78	4.53	8.38
T1005.0	N48:12.42	W083:01.54	N48:16.95	W083:01.72	4.53	8.38
T1006.0	N48:12.43	W083:01.48	N48:16.95	W083:01.66	4.53	8.38
T1007.0	N48:12.43	W083:01.42	N48:16.95	W083:01.60	4.53	8.38
T1008.0	N48:12.43	W083:01.36	N48:16.95	W083:01.54	4.53	8.38
T1009.0	N48:12.43	W083:01.30	N48:16.95	W083:01.48	4.53	8.38
T1010.0	N48:12.43	W083:01.24	N48:16.95	W083:01.42	4.53	8.38
T1011.0	N48:12.43	W083:01.18	N48:16.95	W083:01.36	4.53	8.38
T1012.0	N48:12.43	W083:01.12	N48:16.95	W083:01.30	4.53	8.38
T1013.0	N48:12.43	W083:01.06	N48:16.95	W083:01.24	4.53	8.38
T1014.0	N48:12.43	W083:01.00	N48:16.96	W083:01.18	4.53	8.38
T1015.0	N48:12.44	W083:00.94	N48:16.96	W083:01.12	4.53	8.38
T1016.0	N48:12.44	W083:00.88	N48:16.96	W083:01.06	4.53	8.38
T1017.0	N48:12.44	W083:00.82	N48:16.96	W083:00.99	4.53	8.38
T1018.0	N48:12.44	W083:00.76	N48:16.96	W083:00.93	4.53	8.38
T1019.0	N48:12.44	W083:00.70	N48:16.96	W083:00.87	4.53	8.38
T1020.0	N48:12.44	W083:00.64	N48:16.96	W083:00.81	4.53	8.38
T1021.0	N48:12.44	W083:00.57	N48:16.96	W083:00.75	4.53	8.38
T1022.0	N48:12.44	W083:00.51	N48:16.96	W083:00.69	4.53	8.38
T1023.0	N48:12.44	W083:00.45	N48:16.97	W083:00.63	4.53	8.38
T1024.0	N48:12.44	W083:00.39	N48:16.97	W083:00.57	4.53	8.38
T1025.0	N48:12.45	W083:00.33	N48:16.97	W083:00.51	4.53	8.38
T1026.0	N48:12.45	W083:00.27	N48:16.97	W083:00.45	4.53	8.38
T1027.0	N48:12.45	W083:00.21	N48:16.97	W083:00.39	4.53	8.38
T1028.0	N48:12.45	W083:00.15	N48:16.97	W083:00.33	4.53	8.38
T1029.0	N48:12.45	W083:00.09	N48:16.97	W083:00.27	4.53	8.38
T1030.0	N48:12.45	W083:00.03	N48:16.97	W083:00.21	4.53	8.38
T1031.0	N48:12.45	W082:59.97	N48:16.97	W083:00.15	4.53	8.38
T1032.0	N48:12.45	W082:59.91	N48:16.97	W083:00.09	4.53	8.38
T1033.0	N48:12.45	W082:59.85	N48:16.98	W083:00.02	4.53	8.38
T1034.0	N48:12.46	W082:59.79	N48:16.98	W082:59.96	4.53	8.38
T1035.0	N48:12.46	W082:59.73	N48:16.98	W082:59.90	4.53	8.38
T1036.0	N48:12.46	W082:59.67	N48:16.98	W082:59.84	4.53	8.38
T1037.0	N48:12.46	W082:59.61	N48:16.98	W082:59.78	4.53	8.38
T1038.0	N48:12.46	W082:59.55	N48:16.98	W082:59.72	4.53	8.38
T1039.0	N48:12.46	W082:59.49	N48:16.98	W082:59.66	4.53	8.38
T1040.0	N48:12.46	W082:59.42	N48:16.98	W082:59.60	4.53	8.38
T1041.0	N48:12.46	W082:59.36	N48:16.98	W082:59.54	4.53	8.38
T1042.0	N48:12.46	W082:59.30	N48:16.99	W082:59.48	4.53	8.38
T1043.0	N48:12.46	W082:59.24	N48:16.99	W082:59.42	4.53	8.38
T1044.0	N48:12.47	W082:59.18	N48:16.99	W082:59.36	4.53	8.38
T1045.0	N48:12.47	W082:59.12	N48:16.99	W082:59.30	4.53	8.38
T1046.0	N48:12.47	W082:59.06	N48:16.99	W082:59.24	4.53	8.38
T1047.0	N48:12.47	W082:59.00	N48:16.99	W082:59.18	4.53	8.38
T1048.0	N48:12.47	W082:58.94	N48:16.99	W082:59.12	4.53	8.38
T1049.0	N48:12.47	W082:58.88	N48:16.99	W082:59.05	4.53	8.38
T1050.0	N48:12.47	W082:58.82	N48:16.99	W082:58.99	4.53	8.38
T1051.0	N48:12.47	W082:58.76	N48:16.99	W082:58.93	4.53	8.38
T1052.0	N48:12.47	W082:58.70	N48:17.00	W082:58.87	4.53	8.38
T1053.0	N48:12.48	W082:58.64	N48:17.00	W082:58.81	4.53	8.38

PLANNED SURVEY LINES, WGS-84

SEGMENT	START		END		LENGTH	
NO	LAT	LONG	LAT	LONG	NM	KM
T1054.0	N48:12.48	W082:58.58	N48:17.00	W082:58.75	4.53	8.38
T1055.0	N48:12.48	W082:58.52	N48:17.00	W082:58.69	4.53	8.38
T1056.0	N48:12.48	W082:58.46	N48:17.00	W082:58.63	4.53	8.38
T1057.0	N48:12.48	W082:58.40	N48:17.00	W082:58.57	4.53	8.38
T1058.0	N48:12.48	W082:58.33	N48:17.00	W082:58.51	4.53	8.38
T1059.0	N48:12.48	W082:58.27	N48:17.00	W082:58.45	4.53	8.38
T1060.0	N48:12.48	W082:58.21	N48:17.00	W082:58.39	4.53	8.38
T1061.0	N48:12.48	W082:58.15	N48:17.01	W082:58.33	4.53	8.38
T1062.0	N48:12.48	W082:58.09	N48:17.01	W082:58.27	4.53	8.38
T1063.0	N48:12.49	W082:58.03	N48:17.01	W082:58.21	4.53	8.38
T1064.0	N48:12.49	W082:57.97	N48:17.01	W082:58.15	4.53	8.38
T1065.0	N48:12.49	W082:57.91	N48:17.01	W082:58.08	4.53	8.38
T1066.0	N48:12.49	W082:57.85	N48:17.01	W082:58.02	4.53	8.38
T1067.0	N48:12.49	W082:57.79	N48:17.01	W082:57.96	4.53	8.38
T1068.0	N48:12.49	W082:57.73	N48:17.01	W082:57.90	4.53	8.38
T1069.0	N48:12.49	W082:57.67	N48:17.01	W082:57.84	4.53	8.38
T1070.0	N48:12.49	W082:57.61	N48:17.01	W082:57.78	4.53	8.38
T1071.0	N48:12.49	W082:57.55	N48:17.02	W082:57.72	4.53	8.38
T1072.0	N48:12.49	W082:57.49	N48:17.02	W082:57.66	4.53	8.38
T1073.0	N48:12.50	W082:57.43	N48:17.02	W082:57.60	4.53	8.38
T1074.0	N48:12.50	W082:57.37	N48:17.02	W082:57.54	4.53	8.38
T1075.0	N48:12.50	W082:57.31	N48:17.02	W082:57.48	4.53	8.38
T1076.0	N48:12.50	W082:57.25	N48:17.02	W082:57.42	4.53	8.38
T1077.0	N48:12.50	W082:57.18	N48:17.02	W082:57.36	4.53	8.38
T1078.0	N48:12.50	W082:57.12	N48:17.02	W082:57.30	4.53	8.38
T1079.0	N48:12.50	W082:57.06	N48:17.02	W082:57.24	4.53	8.38
T1080.0	N48:12.50	W082:57.00	N48:17.03	W082:57.18	4.53	8.38
T1081.0	N48:12.50	W082:56.94	N48:17.03	W082:57.11	4.53	8.38
T1082.0	N48:12.51	W082:56.88	N48:17.03	W082:57.05	4.53	8.38
T1083.0	N48:12.51	W082:56.82	N48:17.03	W082:56.99	4.53	8.38
T1084.0	N48:12.51	W082:56.76	N48:17.03	W082:56.93	4.53	8.38
T1085.0	N48:12.51	W082:56.70	N48:17.03	W082:56.87	4.53	8.38
T1086.0	N48:12.51	W082:56.64	N48:17.03	W082:56.81	4.53	8.38
T1087.0	N48:12.51	W082:56.58	N48:17.03	W082:56.75	4.53	8.38
T1088.0	N48:12.51	W082:56.52	N48:17.03	W082:56.69	4.53	8.38
T1089.0	N48:12.51	W082:56.46	N48:17.03	W082:56.63	4.53	8.38
T1090.0	N48:12.51	W082:56.40	N48:17.04	W082:56.57	4.53	8.38
T1091.0	N48:12.51	W082:56.34	N48:17.04	W082:56.51	4.53	8.38
T1092.0	N48:12.52	W082:56.28	N48:17.04	W082:56.45	4.53	8.38
T1093.0	N48:12.52	W082:56.22	N48:17.04	W082:56.39	4.53	8.38
T1094.0	N48:12.52	W082:56.16	N48:17.04	W082:56.33	4.53	8.38
T1095.0	N48:12.52	W082:56.10	N48:17.04	W082:56.27	4.53	8.38
T1096.0	N48:12.52	W082:56.03	N48:17.04	W082:56.21	4.53	8.38
T1097.0	N48:12.52	W082:55.97	N48:17.04	W082:56.14	4.53	8.38
T1098.0	N48:12.52	W082:55.91	N48:17.04	W082:56.08	4.53	8.38
T1099.0	N48:12.52	W082:55.85	N48:17.04	W082:56.02	4.53	8.38
T1100.0	N48:12.52	W082:55.79	N48:17.05	W082:55.96	4.53	8.38
T1101.0	N48:12.52	W082:55.73	N48:17.05	W082:55.90	4.53	8.38
T1102.0	N48:12.53	W082:55.67	N48:17.05	W082:55.84	4.53	8.38
T1103.0	N48:12.53	W082:55.61	N48:17.05	W082:55.78	4.53	8.38
T1104.0	N48:12.53	W082:55.55	N48:17.05	W082:55.72	4.53	8.38
T1105.0	N48:12.53	W082:55.49	N48:17.05	W082:55.66	4.53	8.38
T1106.0	N48:12.53	W082:55.43	N48:17.05	W082:55.60	4.53	8.38
T1107.0	N48:12.53	W082:55.37	N48:17.05	W082:55.54	4.53	8.38
T1108.0	N48:12.53	W082:55.31	N48:17.05	W082:55.48	4.53	8.38
T1109.0	N48:12.53	W082:55.25	N48:17.05	W082:55.42	4.53	8.38
T1110.0	N48:12.53	W082:55.19	N48:17.06	W082:55.36	4.53	8.38
T1111.0	N48:12.53	W082:55.13	N48:17.06	W082:55.30	4.53	8.38
T1112.0	N48:12.54	W082:55.07	N48:17.06	W082:55.24	4.53	8.38

PLANNED SURVEY LINES, WGS-84

SEGMENT NO	START LAT	START LONG	END LAT	END LONG	LENGTH NM	LENGTH KM
T1113.0	N48:12.54	W082:55.01	N48:17.06	W082:55.17	4.53	8.38
T1114.0	N48:12.54	W082:54.95	N48:17.06	W082:55.11	4.53	8.38
T1115.0	N48:12.54	W082:54.88	N48:17.06	W082:55.05	4.53	8.38
T1116.0	N48:12.54	W082:54.82	N48:17.06	W082:54.99	4.53	8.38
T1117.0	N48:12.54	W082:54.76	N48:17.06	W082:54.93	4.53	8.38
T1118.0	N48:12.54	W082:54.70	N48:17.06	W082:54.87	4.53	8.38
T1119.0	N48:12.54	W082:54.64	N48:17.06	W082:54.81	4.53	8.38
T1120.0	N48:12.54	W082:54.58	N48:17.07	W082:54.75	4.53	8.38
T1121.0	N48:12.54	W082:54.52	N48:17.07	W082:54.69	4.53	8.38
T1122.0	N48:12.55	W082:54.46	N48:17.07	W082:54.63	4.53	8.38
T1123.0	N48:12.55	W082:54.40	N48:17.07	W082:54.57	4.53	8.38
T1124.0	N48:12.55	W082:54.34	N48:17.07	W082:54.51	4.53	8.38
T1125.0	N48:12.55	W082:54.28	N48:17.07	W082:54.45	4.53	8.38
T1126.0	N48:12.55	W082:54.22	N48:17.07	W082:54.39	4.53	8.38
T1127.0	N48:12.55	W082:54.16	N48:17.07	W082:54.33	4.53	8.38
T1128.0	N48:12.55	W082:54.10	N48:17.07	W082:54.27	4.53	8.38
T1129.0	N48:12.55	W082:54.04	N48:17.07	W082:54.20	4.53	8.38
T1130.0	N48:12.55	W082:53.98	N48:17.08	W082:54.14	4.53	8.38
T1131.0	N48:12.55	W082:53.92	N48:17.08	W082:54.08	4.53	8.38
T1132.0	N48:12.56	W082:53.86	N48:17.08	W082:54.02	4.53	8.38
T1133.0	N48:12.56	W082:53.79	N48:17.08	W082:53.96	4.53	8.38
T1134.0	N48:12.56	W082:53.73	N48:17.08	W082:53.90	4.53	8.38
T1135.0	N48:12.56	W082:53.67	N48:17.08	W082:53.84	4.53	8.38
T1136.0	N48:12.56	W082:53.61	N48:17.08	W082:53.78	4.53	8.38
T1137.0	N48:12.56	W082:53.55	N48:17.08	W082:53.72	4.53	8.38
T1138.0	N48:12.56	W082:53.49	N48:17.08	W082:53.66	4.53	8.38
T1139.0	N48:12.56	W082:53.43	N48:17.08	W082:53.60	4.53	8.38
T1140.0	N48:12.56	W082:53.37	N48:17.09	W082:53.54	4.53	8.38
T1141.0	N48:12.56	W082:53.31	N48:17.09	W082:53.48	4.53	8.38
T1142.0	N48:12.57	W082:53.25	N48:17.09	W082:53.42	4.53	8.38
T1143.0	N48:12.57	W082:53.19	N48:17.09	W082:53.36	4.53	8.38
T1144.0	N48:12.57	W082:53.13	N48:17.09	W082:53.30	4.53	8.38
T1145.0	N48:12.57	W082:53.07	N48:17.09	W082:53.23	4.53	8.38
T1146.0	N48:12.57	W082:53.01	N48:17.09	W082:53.17	4.53	8.38
T1147.0	N48:12.57	W082:52.95	N48:17.09	W082:53.11	4.53	8.38
T1148.0	N48:12.57	W082:52.89	N48:17.09	W082:53.05	4.53	8.38
T1149.0	N48:12.57	W082:52.83	N48:17.09	W082:52.99	4.53	8.38
T1150.0	N48:12.57	W082:52.77	N48:17.10	W082:52.93	4.53	8.38
T1151.0	N48:12.57	W082:52.71	N48:17.10	W082:52.87	4.53	8.38
T1152.0	N48:12.58	W082:52.64	N48:17.10	W082:52.81	4.53	8.38
T1153.0	N48:12.58	W082:52.58	N48:17.10	W082:52.75	4.53	8.38
T1154.0	N48:12.58	W082:52.52	N48:17.10	W082:52.69	4.53	8.38
T1155.0	N48:12.58	W082:52.46	N48:17.10	W082:52.63	4.53	8.38
T1156.0	N48:12.58	W082:52.40	N48:17.10	W082:52.57	4.53	8.38
T1157.0	N48:12.58	W082:52.34	N48:17.10	W082:52.51	4.53	8.38
T1158.0	N48:12.58	W082:52.28	N48:17.10	W082:52.45	4.53	8.38
T1159.0	N48:12.58	W082:52.22	N48:17.10	W082:52.39	4.53	8.38
T1160.0	N48:12.58	W082:52.16	N48:17.11	W082:52.33	4.53	8.38
T1161.0	N48:12.58	W082:52.10	N48:17.11	W082:52.26	4.53	8.38
T1162.0	N48:12.59	W082:52.04	N48:17.11	W082:52.20	4.53	8.38
T1163.0	N48:12.59	W082:51.98	N48:17.11	W082:52.14	4.53	8.38
T1164.0	N48:12.59	W082:51.92	N48:17.11	W082:52.08	4.53	8.38
T1165.0	N48:12.59	W082:51.86	N48:17.11	W082:52.02	4.53	8.38
T1166.0	N48:12.59	W082:51.80	N48:17.11	W082:51.96	4.53	8.38
T1167.0	N48:12.59	W082:51.74	N48:17.11	W082:51.90	4.53	8.38
T1168.0	N48:12.59	W082:51.68	N48:17.11	W082:51.84	4.53	8.38
T1169.0	N48:12.59	W082:51.62	N48:17.11	W082:51.78	4.53	8.38
T1170.0	N48:12.59	W082:51.55	N48:17.12	W082:51.72	4.53	8.38
T1171.0	N48:12.59	W082:51.49	N48:17.12	W082:51.66	4.53	8.38

PLANNED SURVEY LINES, WGS-84

SEGMENT NO	START LAT	START LONG	END LAT	END LONG	LENGTH NM	LENGTH KM
T1172.0	N48:12.60	W082:51.43	N48:17.12	W082:51.60	4.53	8.38
T1173.0	N48:12.60	W082:51.37	N48:17.12	W082:51.54	4.53	8.38
T1174.0	N48:12.60	W082:51.31	N48:17.12	W082:51.48	4.53	8.38
T1175.0	N48:12.60	W082:51.25	N48:17.12	W082:51.42	4.53	8.38
T1176.0	N48:12.60	W082:51.19	N48:17.12	W082:51.36	4.53	8.38
T1177.0	N48:12.60	W082:51.13	N48:17.12	W082:51.29	4.53	8.38
T1178.0	N48:12.60	W082:51.07	N48:17.12	W082:51.23	4.53	8.38
T1179.0	N48:12.60	W082:51.01	N48:17.12	W082:51.17	4.53	8.38
T1180.0	N48:12.60	W082:50.95	N48:17.13	W082:51.11	4.53	8.38
T1181.0	N48:12.60	W082:50.89	N48:17.13	W082:51.05	4.53	8.38
T1182.0	N48:12.60	W082:50.83	N48:17.13	W082:50.99	4.53	8.38
T1183.0	N48:12.61	W082:50.77	N48:17.13	W082:50.93	4.53	8.38
T1184.0	N48:12.61	W082:50.71	N48:17.13	W082:50.87	4.53	8.38
T1185.0	N48:12.61	W082:50.65	N48:17.13	W082:50.81	4.53	8.38
T1186.0	N48:12.61	W082:50.59	N48:17.13	W082:50.75	4.53	8.38
T1187.0	N48:12.61	W082:50.53	N48:17.13	W082:50.69	4.53	8.38
T1188.0	N48:12.61	W082:50.47	N48:17.13	W082:50.63	4.53	8.38

Total control line length = 45.92 nautical miles
= 85.05 kilometers.

Total traverse line length = 850.87 nautical miles
= 1575.82 kilometers.

Total length of all lines = 896.80 nautical miles
= 1660.87 kilometers.

SGL

Appendix III

FLOWN LINES
WGS-84, UTM Zone 17N

MLINE	TIME	TIME	MIN X	MAX X	MIN Y	MAX Y	FLIGHT	DAY	YEAR
101.00	49723.90	49931.20	349030.63	363394.37	5341745.40	5341752.96	1002	139	2016
102.00	49258.50	49469.70	349029.17	363393.67	5343248.47	5343257.68	1002	139	2016
103.00	48820.30	49033.40	349028.70	363394.10	5344745.33	5344756.99	1002	139	2016
104.00	48423.60	48637.60	349030.05	363395.62	5346247.33	5346257.42	1002	139	2016
105.00	48058.90	48264.00	349031.52	363396.19	5347745.79	5347754.13	1002	139	2016
106.00	47641.10	47850.50	349025.53	363393.25	5349247.49	5349255.89	1002	139	2016
1001.00	55667.30	55790.40	349196.21	349206.85	5341200.55	5349780.11	1003	140	2016
1002.00	55385.10	55511.70	349269.14	349276.93	5341200.31	5349780.22	1003	140	2016
1003.00	55106.30	55229.60	349347.66	349356.83	5341205.59	5349780.60	1003	140	2016
1004.00	54842.00	54968.70	349416.53	349427.76	5341204.39	5349777.80	1003	140	2016
1005.00	54572.30	54699.20	349497.88	349507.04	5341200.71	5349777.22	1003	140	2016
1006.00	54233.30	54363.60	349569.33	349578.97	5341205.05	5349780.92	1003	140	2016
1007.00	53902.90	54029.40	349647.57	349654.80	5341206.80	5349781.78	1003	140	2016
1008.00	53374.10	53500.80	349722.86	349732.97	5341200.02	5349775.97	1003	140	2016
1009.00	52862.90	52989.00	349791.71	349804.06	5341202.40	5349779.23	1003	140	2016
1010.00	52299.30	52426.40	349872.25	349880.57	5341204.32	5349780.35	1003	140	2016
1011.00	51751.90	51879.40	349946.29	349957.84	5341205.36	5349780.26	1003	140	2016
1012.00	51217.20	51344.10	350021.63	350028.03	5341205.01	5349775.21	1003	140	2016
1013.00	50693.10	50819.90	350097.23	350104.21	5341201.80	5349775.82	1003	140	2016
1014.00	50169.50	50296.30	350172.32	350179.04	5341205.46	5349776.16	1003	140	2016
1015.00	49647.90	49773.90	350248.86	350255.03	5341202.45	5349775.49	1003	140	2016
1016.00	49122.00	49248.80	350319.90	350327.69	5341204.46	5349778.61	1003	140	2016
1017.00	48572.20	48698.70	350395.21	350403.72	5341200.14	5349779.42	1003	140	2016
1018.00	48032.00	48159.00	350471.19	350479.71	5341205.35	5349780.14	1003	140	2016
1019.00	69642.20	69767.60	350545.20	350558.12	5341201.23	5349781.81	1002	139	2016
1020.00	69154.70	69278.00	350617.71	350635.71	5341201.09	5349778.62	1002	139	2016
1021.00	68645.30	68770.60	350695.69	350703.88	5341205.25	5349777.71	1002	139	2016
1022.00	68120.50	68244.90	350769.28	350776.81	5341204.14	5349778.38	1002	139	2016
1023.00	67591.60	67716.50	350846.71	350854.54	5341200.50	5349779.47	1002	139	2016
1024.00	67080.60	67204.10	350904.49	350932.11	5341200.85	5349776.81	1002	139	2016
1025.00	66580.50	66705.50	350993.94	351004.09	5341201.55	5349778.14	1002	139	2016
1026.00	66065.00	66189.30	351069.34	351083.50	5341205.29	5349776.41	1002	139	2016
1027.00	65567.50	65691.00	351143.46	351155.66	5341207.07	5349780.59	1002	139	2016
1028.00	65038.70	65161.70	351218.99	351232.63	5341206.24	5349777.05	1002	139	2016
1029.00	64531.00	64653.80	351294.51	351305.44	5341204.19	5349779.04	1002	139	2016
1030.00	64022.50	64143.20	351370.58	351379.20	5341201.74	5349776.98	1002	139	2016
1031.00	63510.40	63633.40	351444.01	351461.69	5341200.52	5349781.32	1002	139	2016
1032.00	63007.70	63129.70	351520.37	351533.36	5341205.32	5349778.99	1002	139	2016
1033.00	62510.20	62634.80	351593.28	351605.01	5341202.76	5349775.50	1002	139	2016
1034.00	61223.00	61347.00	351670.52	351683.59	5341204.46	5349781.15	1002	139	2016
1035.00	60705.50	60827.10	351744.57	351755.15	5341204.24	5349775.81	1002	139	2016
1036.00	60184.60	60308.00	351820.80	351830.30	5341201.80	5349775.89	1002	139	2016
1037.00	59686.80	59809.10	351891.28	351907.16	5341206.69	5349777.88	1002	139	2016
1038.00	59183.90	59304.10	351967.30	351981.85	5341204.75	5349777.48	1002	139	2016
1039.00	58707.10	58829.90	352044.05	352059.87	5341201.78	5349777.53	1002	139	2016
1040.00	58209.40	58332.30	352122.03	352129.78	5341205.88	5349776.31	1002	139	2016
1041.00	57684.40	57804.70	352194.16	352201.54	5341205.14	5349780.78	1002	139	2016
1042.00	57166.70	57289.50	352269.91	352278.33	5341205.53	5349775.53	1002	139	2016
1043.00	56631.30	56753.30	352346.41	352352.52	5341206.67	5349777.05	1002	139	2016
1044.00	56142.30	56263.70	352418.56	352428.08	5341200.10	5349777.16	1002	139	2016
1045.00	55633.80	55756.60	352495.57	352504.38	5341203.49	5349777.04	1002	139	2016
1046.00	55133.80	55255.10	352570.40	352583.31	5341204.80	5349776.56	1002	139	2016
1047.00	54613.90	54736.40	352645.53	352651.35	5341206.60	5349778.05	1002	139	2016
1048.00	54076.90	54199.70	352717.36	352727.20	5341201.39	5349780.22	1002	139	2016
1049.00	53527.70	53649.70	352795.92	352801.77	5341202.86	5349781.64	1002	139	2016
1050.00	52990.60	53114.10	352867.55	352879.43	5341201.51	5349775.66	1002	139	2016
1051.00	53637.60	53764.90	352946.41	352953.34	5341205.20	5349781.21	1003	140	2016
1052.00	53114.50	53241.90	353021.52	353029.15	5341203.60	5349779.16	1003	140	2016
1053.00	52566.40	52694.80	353093.22	353102.46	5341204.06	5349775.54	1003	140	2016
1054.00	52024.10	52152.50	353171.96	353179.35	5341205.25	5349776.62	1003	140	2016
1055.00	51488.00	51617.00	353244.84	353253.11	5341203.83	5349781.33	1003	140	2016
1056.00	50950.30	51079.20	353322.31	353328.89	5341202.37	5349776.87	1003	140	2016
1057.00	50430.60	50559.10	353394.86	353402.22	5341204.21	5349778.92	1003	140	2016
1058.00	49913.00	50040.80	353471.60	353478.76	5341202.64	5349778.03	1003	140	2016
1059.00	49388.00	49516.00	353548.75	353554.52	5341202.20	5349781.36	1003	140	2016

FLOWN LINES
WGS-84, UTM Zone 17N

MLINE	TIME	TIME	MIN X	MAX X	MIN Y	MAX Y	FLIGHT	DAY	YEAR
1060.00	48848.90	48977.00	353620.88	353626.63	5341202.69	5349775.71	1003	140	2016
1061.00	48297.50	48425.60	353694.90	353703.70	5341202.62	5349775.49	1003	140	2016
1062.00	47471.60	47597.80	353771.14	353777.81	5341201.27	5349775.33	1003	140	2016
1063.00	69887.00	70011.80	353844.35	353853.31	5341201.54	5349776.61	1002	139	2016
1064.00	69399.40	69523.70	353920.06	353929.60	5341204.95	5349778.71	1002	139	2016
1065.00	68900.20	69025.90	353996.88	354003.58	5341201.54	5349777.90	1002	139	2016
1066.00	68386.20	68511.80	354070.03	354079.25	5341206.70	5349779.44	1002	139	2016
1067.00	67856.40	67982.70	354146.73	354153.17	5341205.57	5349779.73	1002	139	2016
1068.00	67335.00	67461.00	354216.75	354228.01	5341203.57	5349781.72	1002	139	2016
1069.00	66840.10	66967.60	354290.34	354308.62	5341206.03	5349780.41	1002	139	2016
1070.00	66322.70	66449.70	354368.48	354379.80	5341200.31	5349780.42	1002	139	2016
1071.00	65816.80	65942.60	354441.97	354453.90	5341204.59	5349778.42	1002	139	2016
1072.00	65298.80	65424.30	354520.79	354526.91	5341203.16	5349779.26	1002	139	2016
1073.00	64786.30	64911.80	354590.93	354604.82	5341206.17	5349778.65	1002	139	2016
1074.00	64281.60	64407.90	354670.92	354678.85	5341202.73	5349778.13	1002	139	2016
1075.00	63760.70	63888.60	354744.16	354754.51	5341202.77	5349780.88	1002	139	2016
1076.00	63262.60	63388.40	354817.62	354833.71	5341204.89	5349775.29	1002	139	2016
1077.00	62765.40	62891.30	354889.91	354905.70	5341201.52	5349778.57	1002	139	2016
1078.00	61484.00	61608.10	354972.11	354979.91	5341204.81	5349775.58	1002	139	2016
1079.00	60964.40	61090.10	355042.63	355052.17	5341201.81	5349780.88	1002	139	2016
1080.00	60451.50	60576.50	355120.85	355130.98	5341202.39	5349776.23	1002	139	2016
1081.00	59933.60	60060.70	355191.25	355203.19	5341206.91	5349777.99	1002	139	2016
1082.00	59433.70	59557.10	355268.88	355280.33	5341202.74	5349775.79	1002	139	2016
1083.00	58944.10	59066.90	355342.49	355356.11	5341203.84	5349781.93	1002	139	2016
1084.00	58471.50	58594.80	355420.40	355430.12	5341200.59	5349780.77	1002	139	2016
1085.00	57942.20	58064.80	355498.22	355505.27	5341202.59	5349776.52	1002	139	2016
1086.00	57428.30	57551.30	355571.89	355578.37	5341207.11	5349778.11	1002	139	2016
1087.00	56901.50	57025.40	355646.14	355653.64	5341204.37	5349775.08	1002	139	2016
1088.00	56384.10	56506.90	355719.43	355729.30	5341205.53	5349775.70	1002	139	2016
1089.00	55878.00	56003.40	355794.98	355802.56	5341200.60	5349779.08	1002	139	2016
1090.00	55390.70	55515.90	355868.86	355881.63	5341200.58	5349778.87	1002	139	2016
1091.00	54876.60	55001.60	355943.78	355954.20	5341200.83	5349777.30	1002	139	2016
1092.00	54348.20	54471.90	356021.68	356029.50	5341206.37	5349778.65	1002	139	2016
1093.00	53796.40	53920.30	356095.75	356104.01	5341202.90	5349776.76	1002	139	2016
1094.00	53254.70	53377.70	356172.54	356178.44	5341206.76	5349775.17	1002	139	2016
1095.00	52732.00	52858.30	356246.76	356255.56	5341203.97	5349778.40	1002	139	2016
1096.00	52247.40	52372.20	356322.05	356332.51	5341203.64	5349778.92	1002	139	2016
1097.00	51764.40	51886.90	356396.20	356407.07	5341201.17	5349781.20	1002	139	2016
1098.00	51250.30	51373.40	356472.25	356480.21	5341205.60	5349776.12	1002	139	2016
1099.00	50729.30	50851.10	356549.22	356557.02	5341200.35	5349775.95	1002	139	2016
1100.00	72986.80	73115.00	356621.75	356634.43	5341200.77	5349776.65	1001	138	2016
1101.00	72513.20	72639.30	356699.11	356705.54	5341206.41	5349779.22	1001	138	2016
1102.00	72009.40	72137.50	356772.35	356780.85	5341200.26	5349775.58	1001	138	2016
1103.00	71498.00	71624.30	356846.96	356856.62	5341205.37	5349780.63	1001	138	2016
1104.00	70990.80	71117.80	356923.18	356932.30	5341201.25	5349776.19	1001	138	2016
1105.00	70513.40	70643.60	356990.73	357006.89	5341205.45	5349781.34	1001	138	2016
1106.00	70018.90	70147.90	357070.85	357087.57	5341200.53	5349777.71	1001	138	2016
1107.00	69539.50	69668.20	357148.22	357156.39	5341200.18	5349776.10	1001	138	2016
1108.00	69048.80	69181.20	357219.30	357234.22	5341201.52	5349781.73	1001	138	2016
1109.00	68532.50	68662.40	357297.05	357308.02	5341201.56	5349777.89	1001	138	2016
1110.00	68011.00	68143.20	357372.35	357383.03	5341202.98	5349781.14	1001	138	2016
1111.00	67502.40	67631.10	357447.52	357454.37	5341201.20	5349779.49	1001	138	2016
1112.00	66651.00	66779.80	357519.38	357536.14	5341205.03	5349777.02	1001	138	2016
1113.00	66151.70	66282.10	357595.76	357608.36	5341203.40	5349780.88	1001	138	2016
1114.00	65654.40	65781.70	357670.92	357683.68	5341203.46	5349781.36	1001	138	2016
1115.00	65171.40	65300.00	357743.80	357757.91	5341202.42	5349777.59	1001	138	2016
1116.00	64650.10	64779.00	357822.70	357830.03	5341202.57	5349775.98	1001	138	2016
1117.00	64128.50	64255.20	357898.04	357905.46	5341203.56	5349781.98	1001	138	2016
1118.00	63599.10	63726.50	357967.90	357980.09	5341202.46	5349776.63	1001	138	2016
1119.00	63131.80	63254.70	358045.29	358053.97	5341205.80	5349779.17	1001	138	2016
1120.00	62659.20	62786.50	358121.22	358134.03	5341204.38	5349780.02	1001	138	2016
1121.00	62167.90	62298.90	358197.65	358209.93	5341205.60	5349780.64	1001	138	2016
1122.00	61663.00	61794.10	358272.47	358282.13	5341200.39	5349776.26	1001	138	2016
1123.00	61140.10	61271.20	358347.14	358354.80	5341203.42	5349777.88	1001	138	2016
1124.00	60005.70	60139.10	358422.52	358430.34	5341201.26	5349781.46	1001	138	2016

FLOWN LINES
WGS-84, UTM Zone 17N

MLINE	TIME	TIME	MIN X	MAX X	MIN Y	MAX Y	FLIGHT	DAY	YEAR
1125.00	59511.70	59646.20	358495.04	358505.18	5341203.89	5349779.57	1001	138	2016
1126.00	59027.30	59159.00	358571.69	358580.79	5341200.68	5349778.45	1001	138	2016
1127.00	58547.50	58679.00	358645.77	358656.64	5341202.39	5349781.28	1001	138	2016
1128.00	58042.40	58170.80	358725.81	358733.87	5341202.42	5349776.43	1001	138	2016
1129.00	57532.40	57663.20	358800.12	358806.26	5341202.42	5349779.60	1001	138	2016
1130.00	57015.80	57146.80	358872.97	358880.55	5341203.41	5349778.21	1001	138	2016
1131.00	56501.50	56631.60	358950.17	358959.15	5341202.85	5349776.88	1001	138	2016
1132.00	56014.20	56145.30	359021.03	359028.02	5341204.84	5349776.76	1001	138	2016
1133.00	55530.30	55663.30	359096.52	359106.64	5341205.51	5349778.41	1001	138	2016
1134.00	55044.20	55178.20	359170.73	359181.87	5341203.49	5349776.10	1001	138	2016
1135.00	54535.00	54672.50	359248.41	359258.19	5341204.35	5349779.72	1001	138	2016
1136.00	53990.90	54129.60	359324.09	359329.81	5341202.65	5349781.18	1001	138	2016
1137.00	53457.60	53594.60	359399.35	359406.09	5341200.52	5349780.01	1001	138	2016
1138.00	52935.80	53070.40	359471.24	359480.35	5341200.15	5349776.11	1001	138	2016
1139.00	52437.00	52570.40	359544.29	359555.24	5341200.51	5349778.89	1001	138	2016
1140.00	51938.70	52079.50	359619.39	359627.65	5341205.49	5349778.83	1001	138	2016
1141.00	51437.70	51575.10	359696.81	359705.57	5341200.85	5349778.95	1001	138	2016
1142.00	52484.70	52607.80	359767.47	359777.41	5341201.53	5349776.44	1002	139	2016
1143.00	52009.80	52135.00	359842.65	359852.91	5341202.08	5349780.44	1002	139	2016
1144.00	51511.50	51635.50	359917.46	359928.45	5341203.16	5349780.36	1002	139	2016
1145.00	50984.40	51110.20	359995.30	360000.98	5341204.44	5349777.10	1002	139	2016
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1149.00	71751.10	71866.80	360290.25	360299.95	5341203.51	5349776.30	1001	138	2016
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1151.01	56009.40	56137.50	360444.60	360455.13	5341205.61	5349776.82	1003	140	2016
1152.00	70263.80	70379.60	360515.50	360529.68	5341201.23	5349778.65	1001	138	2016
1153.01	56274.30	56398.00	360596.41	360602.86	5341206.67	5349781.32	1003	140	2016
1154.00	69311.10	69427.70	360666.70	360680.29	5341205.79	5349775.22	1001	138	2016
1155.00	68789.70	68907.90	360740.81	360750.62	5341201.97	5349776.57	1001	138	2016
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1163.00	64391.90	64509.30	361343.89	361352.42	5341207.21	5349781.56	1001	138	2016
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1166.01	57282.00	57410.50	361572.11	361579.98	5341204.09	5349776.26	1003	140	2016
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1179.00	55787.70	55904.70	362542.73	362552.34	5341201.31	5349776.55	1001	138	2016
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1181.00	54808.00	54927.70	362694.95	362704.50	5341202.41	5349776.88	1001	138	2016
1182.00	54263.90	54383.40	362769.39	362775.54	5341205.24	5349777.14	1001	138	2016
1183.00	53729.90	53849.60	362845.19	362851.79	5341204.63	5349780.26	1001	138	2016
1184.00	53199.80	53320.70	362902.36	362927.91	5341200.73	5349776.27	1001	138	2016
1185.00	52702.40	52822.20	362993.53	363002.62	5341200.34	5349778.44	1001	138	2016
1186.00	52199.90	52323.70	363068.91	363077.79	5341207.00	5349780.11	1001	138	2016
1187.00	51705.20	51828.00	363143.46	363150.71	5341200.30	5349780.63	1001	138	2016
1188.00	51219.30	51340.50	363219.61	363229.79	5341203.80	5349779.35	1001	138	2016

Appendix IV

Equipment List

Part	Serial No.	Description
Aircraft C-GSGW	208B-0646	Cessna 208B Grand Caravan, engine Pratt & Whitney Canada
Baro Sensor	1099727	model THE AP122,BJ,2C
Data acquisition computer	CDAC-11	CPCI Data Acquisition computer
Fluxgate Magnetometer	875	model TFM100G2-1E, Three Axis Magnetic Field Sensor
GPS Antenna	12828	S67-1575-39
GPS Antenna	SGA0735	model 511
GPS Antenna	512C-5972	model 512C, L1/L2
L1/L2 GPS Omnistar Antenna	122868	Novatel GPS-534-C Omnistar Antenna L1/L2
Laser Profilometer	9995928	LD90-31K-HiP, 11-28VDC laser rangefinder
Magnetometer Sensor	75409-C1924	model G-822A,
Magnetometer Sensor	75536-C2491	model G-822A,
Magnetometer Sensor	75424-C1963	model G-822A
RA Antenna - KING	13954	
RA Antenna - TRT	22984	S67-2002
RA Transceiver -KING	16665	model KRA 10A
RA Transceiver -TRT	9800	model ERT-530A, range 8,000 ft
GPS Antenna	NAE08470045	Model 702-GG, L1/L2 Kinematic GPS Antenna
GPS Antenna	NZT07220015	Model 702L, w OMNISTAR, L1/L2 Kinematic GPS Antenna
GPS Receiver	DVA10370031	OEM4-G2-L1L2
INMARSAT Transceiver	DCC004ADA09F	Transceiver D+, P/N SM200200- BHG, Model 200D
Magnetometer Sensor	75281-C826	model G-822A, Sensor S/N G826,
Magnetometer Sensor	75421-C1961	model G-822A, cable 14' 8"
SGRef Station	SGREF-09	Dual CPCI ground station - 28Vdc input

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Appendix V

GEOPHYSICAL SURVEY AIRCRAFT

Cessna 208B Grand Caravan

Registration	C-GSGW	C-GSGY	C-GSGZ	C-GSGL	C-GSGV	C-GSGU	C-GSGJ	C-GSGA
Serial #	208B0646	208B0600	208B0493	208B0783	208B0524	208B0747	208B1187	208B1228

The Cessna 208B Grand Caravan is an all metal, high wing, single-engine aircraft powered by a Pratt & Whitney Canada PT6A-114A engine. This engine drives a constant speed, fully feathering, reversible propeller. The aircraft has fixed gear, extendable flaps and manually adjustable trim tabs on the primary controls for the roll and pitch axis and full rudder trim for the yaw axes. The aircraft is equipped with full de-icing equipment and sufficient avionics for instrument flying including a flight control system and weather radar. Supplementary fuel can be added for transoceanic flight. The Caravan is certified for IFR flights in known icing conditions.

GEOPHYSICAL SURVEYING

SGL aircraft have a rigid aluminum and composite material 3 m tail stinger designed to accommodate the magnetometer sensor. The stinger can be easily removed and the aircraft returned to its original configuration. There is a camera hole in the belly of the aircraft and provisions for other survey and navigation systems.

The Cessna Grand Caravan uses the extremely reliable Pratt & Whitney Canada PT6 turbine engine. These engines have recorded tens of millions of hours of flight time and with virtually no in-flight engine stoppages due to mechanical failure. Over 2,000 Caravans are in use around the world. Because the Caravan has one engine, fixed landing gear, and no single engine control speed limitations, it is considered an easy and very safe aircraft to fly. The PT6 turbine engine provides ample power for climbing over terrain, working at altitudes up to 7,000 m and can withstand frequent rapid power changes. The low stall speeds and abundant available power, mean that the Caravan is a safe and effective aircraft for surveys which require low airspeeds, drape flying over rough topography, or flights at high altitudes.

CESSNA 208B GRAND CARAVAN SPECIFICATIONS

Crew Capacity:
- 2 pilots, 1 operator (optional)

Fuselage:
- semi-monocoque

Wings:
- strut braced, high wing
- outboard ailerons with spoiler and trim tab

Tail:
- conventional stabilizers
- elevator and rudder with trim tabs

Power Plant:
- Pratt & Whitney Canada PT6A-114A, 675 shp, free-turbine gas engine, overhaul 4,600 hours
- three-blade, fully-feathering, constant-speed, reversible propeller, overhaul 4,000 hours or 10 years

Systems:
- dual flight controls with IFR instruments and avionics
- 2 axis autopilot
- weather radar
- full airframe and propeller de-icing

Dimensions:

Wing span	52 ft 1in	16.11 m
Exterior length	41 ft 7 in	12.68 m
Exterior height	15 ft 5.5 in	4.72 m
Interior usable length	15 ft 10 in	4.83 m
Interior usable width	5 ft 4 in	1.63 m
Interior height	4 ft 6 in	1.37 m
Usable fuel capacity (with survey tank)	519 US gal	2,011 l

Weights:

Empty	4,237 lb	1,926 kg
Maximum take-off	9,062 lb	4,110 kg

Performance (2000 ft ASL, standard day, maximum take-off weight, 1900 rpm, 1375 ft-lb tq):

Range, maximum range power (plus reserve)	1,450 nm	2,685 km
Cruise speed at maximum range power	155 kt	287 km/h
Fuel flow at maximum range power	50 US gal/h	189 l/h
Stall airspeed, landing configuration	61 kt	113 km/h
Service ceiling	25,000 ft	7,620 m
Minimum required runway length	2,500 ft	765 m
Rate of climb	975 ft/min	297 m/min
Maximum sustained climb gradient	650 ft/nm	107 m/km

Type of Aviation Fuel: Jet A, A-1, B, JP-1, 4, 5, 8

Maximum Endurance: 8 hours plus 1 hour reserve at maximum range power

GEOPHYSICAL CAPABILITIES

AIRGrav, SGL airborne gravimeter

Magnetic total field

Tri-axial magnetic gradient

Gamma-ray spectrometer, up to 63 litres (3,840 in^3) of detector crystals

SGMethane, methane gas sensing

Additional Features:
- Tail stinger, 3 m long, 21 cm in diameter, capable of housing a 5.5 kg sensor
- HF radio
- Video camera mount with 14 cm diameter glass covered opening in the belly of the aircraft
- Two instrument racks, standard 48 cm (19 in) width
- Radar altimeter, 0-3,000 m
- Electrical power capacity, 28 VDC at 200 amp
- Static inverters, 115 VAC - 400 Hz, 110 VAC - 60 Hz
- GPS receiver and antenna plus data link for real-time corrections
- Cabin fuel tank certified for a normal production flying

v2.2

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Appendix VI

SANDER GEOPHYSICS AIRBORNE GEOPHYSICAL SURVEY

260 Hunt Club Road, Ottawa, ON K1V 1C1 Canada Tel: +1 613-521-9626 Fax: +1 613-521-0215 www.sgl.com

SURVEY DETAILS

Survey Name	Goldco16.ON	**Client Name**	Goldcorp Inc
Survey Location	Timmins, ON	**Contact Name**	
Project Code	838	**Contact Phone**	
Total km	1660.5	**Client Address**	
Line Spacing	75 m		
Survey Type	Mag Gradient	**Email**	

SURVEY PRODUCTION SUMMARY

Production This Week (km)	0.0	**Total km Flown to Date**	0.0
Total Remaining (km)	1660.0	**km Reflown This Week**	0.0
Percent Complete (%)	0.0	**Flight Time This Week (h)**	0.0
Prod km/Day This Week	0.0	**Prod km/Flt Hour This Week**	

WEEKLY PRODUCTION

Week 1			**Flight No.**	**Flight Time**	**No. of Lines Flown**	**No. Reflight Lines Flown**	**Production (km)**	**Reflown (km)**
TOTALS				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
9-May	**Mon**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
10-May	**Tue**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
11-May	**Wed**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
12-May	**Thu**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
13-May	**Fri**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
14-May	**Sat**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**				
15-May	**Sun**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather								
Geomag				**Remarks**	Keith Arrives in Timmins from Ottawa. Mag ref site is scouted and field office set up in room 221.			

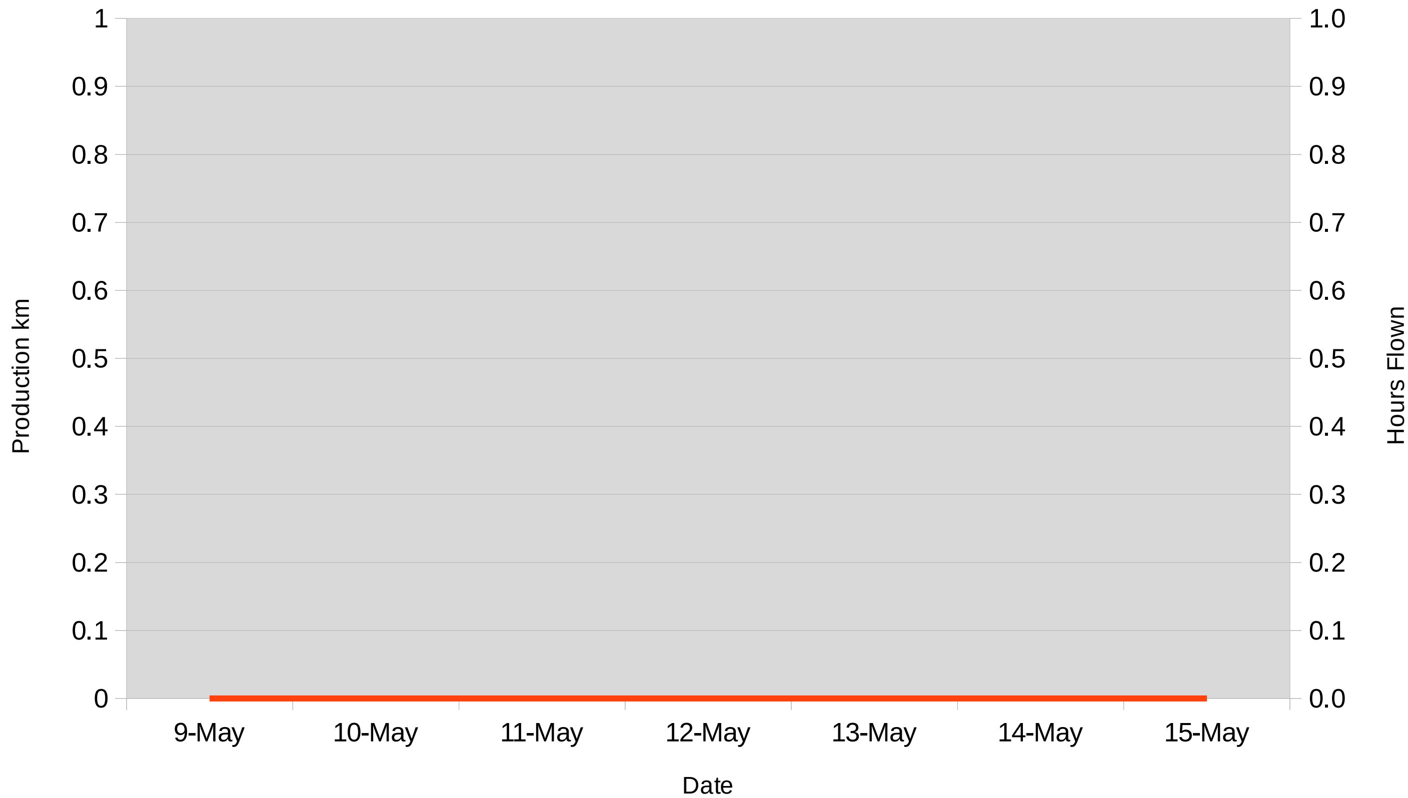
Comments

Signed Keith Wells

PERSONNEL ON SITE THIS WEEK

Name	Position	Arrival This Week	Departure This Week	On Site?	No. of Days On Site This Week	No. of Days on Site To Date
Keith Wells	Data Analyst	15-May-16		ON SITE	1	1
Shane Wilson	Pilot				0	0
Andre Lafontaie	Pilot				0	0

WEEKLY PRODUCTION KILOMETRES AND HOURS FLOWN



SANDER GEOPHYSICS AIRBORNE GEOPHYSICAL SURVEY

260 Hunt Club Road, Ottawa, ON K1V 1C1 Canada Tel: +1 613-521-9626 Fax: +1 613-521-0215 www.sgl.com

SURVEY DETAILS

Survey Name	Goldco16.ON	**Client Name**	Goldcorp Inc
Survey Location	Timmins, ON	**Contact Name**	
Project Code	838	**Contact Phone**	
Total km	1660.5	**Client Address**	
Line Spacing	75 m		
Survey Type	Mag Gradient	**Email**	

SURVEY PRODUCTION SUMMARY

Production This Week (km)	1660.5	**Total km Flown to Date**	1660.5
Total Remaining (km)	-0.5	**km Reflown This Week**	50.4
Percent Complete (%)	100.0	**Flight Time This Week (h)**	18.2
Prod km/Day This Week	237.2	**Prod km/Flt Hour This Week**	91.2

WEEKLY PRODUCTION

Week 2			**Flight No.**	**Flight Time**	**No. of Lines Flown**	**No. Reflight Lines Flown**	**Production (km)**	**Reflown (km)**
TOTALS				**18.2**	**200.0**	**6.0**	**1660.5**	**50.4**
16-May	**Mon**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather				**Remarks**	SGW ferries from Ottawa to Timmins. SGRef is set up.			
Geomag								
17-May	**Tue**	C-GSGW		7.1	84.0	0.0	704.0	0.0
Weather	Clear, warm			**Remarks**	Production Flight			
Geomag	Quiet							
18-May	**Wed**	C-GSGW		7.2	80.0	0.0	705.2	0.0
Weather	Clear, warm			**Remarks**	Production Flight.			
Geomag	Quiet							
19-May	**Thu**	C-GSGW		3.9	36.0	6.0	251.3	50.4
Weather	Clear, warm			**Remarks**	Production Flight. All lines complete.			
Geomag	Quiet							
20-May	**Fri**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather				**Remarks**	SGW ferries from Timmins to Ottawa. Demobilization complete.			
Geomag								
21-May	**Sat**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather				**Remarks**				
Geomag								
22-May	**Sun**	C-GSGW		0.0	0.0	0.0	0.0	0.0
Weather				**Remarks**				
Geomag								

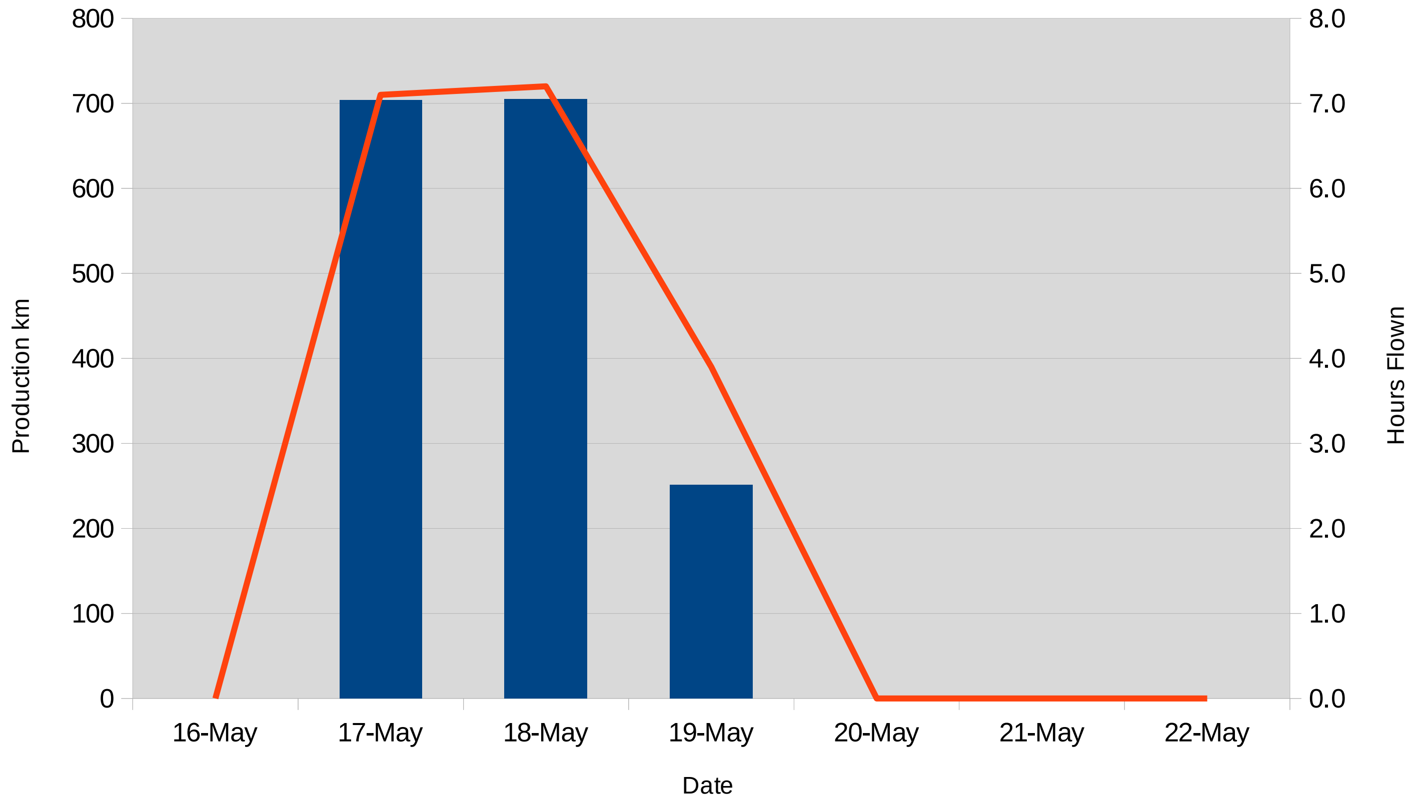
Comments

Signed Keith Wells

PERSONNEL ON SITE THIS WEEK

Name	Position	Arrival This Week	Departure This Week	On Site?	No. of Days On Site This Week	No. of Days on Site To Date
Keith Wells	Data Analyst		20-May-16	ON SITE	5	6
Shane Wilson	Pilot	16-May-16	20-May-16	ON SITE	5	5
Andre Lafontaie	Pilot	16-May-16	20-May-16	ON SITE	5	5

WEEKLY PRODUCTION KILOMETRES AND HOURS FLOWN



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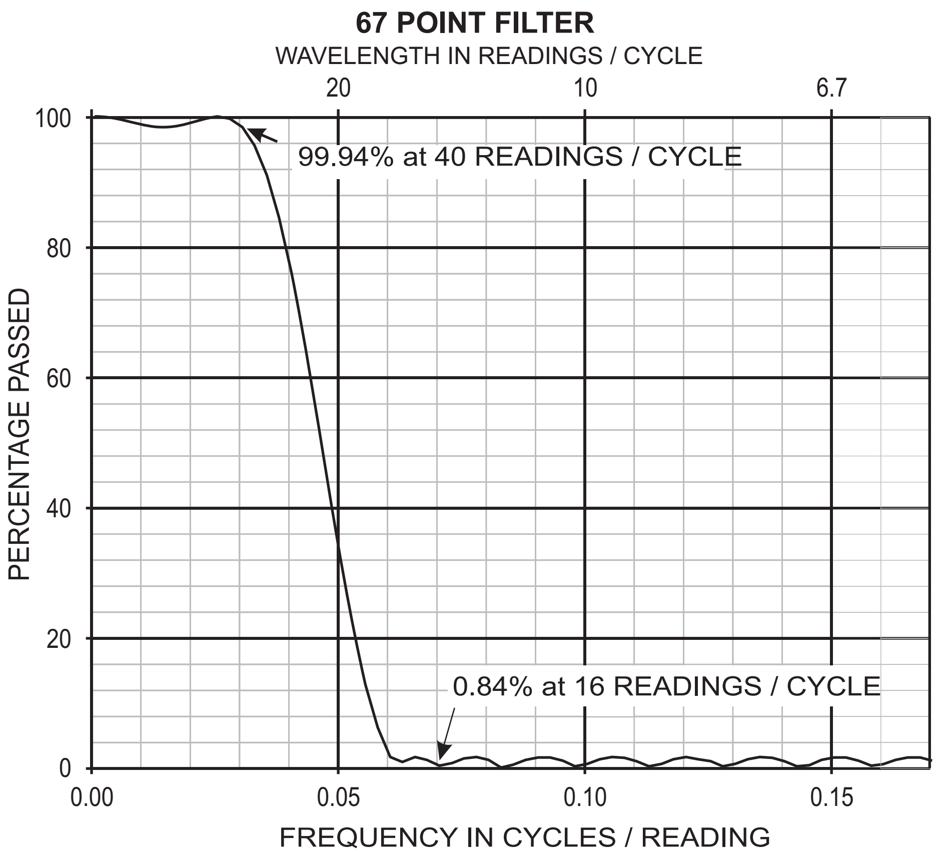
Appendix VII



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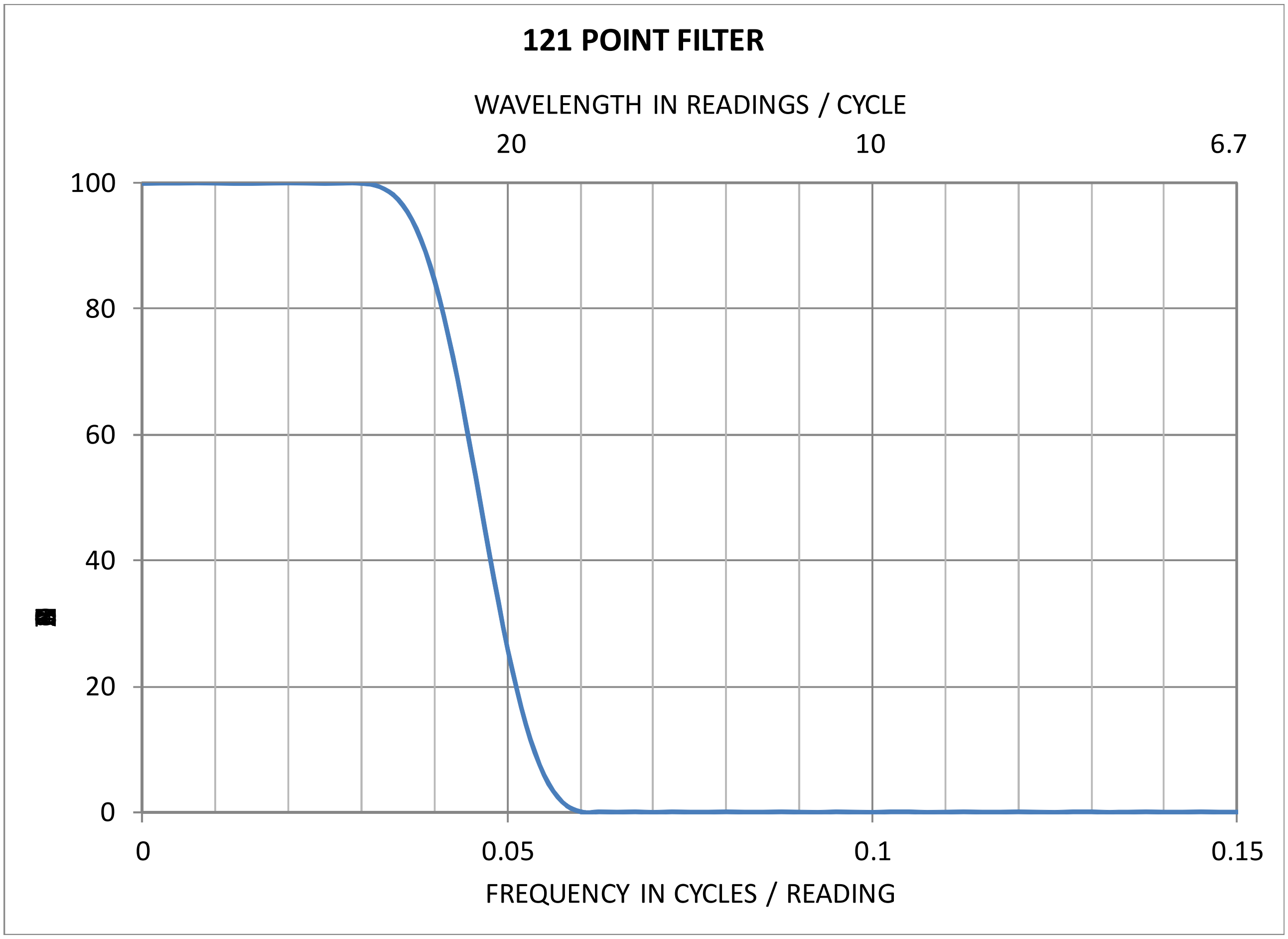
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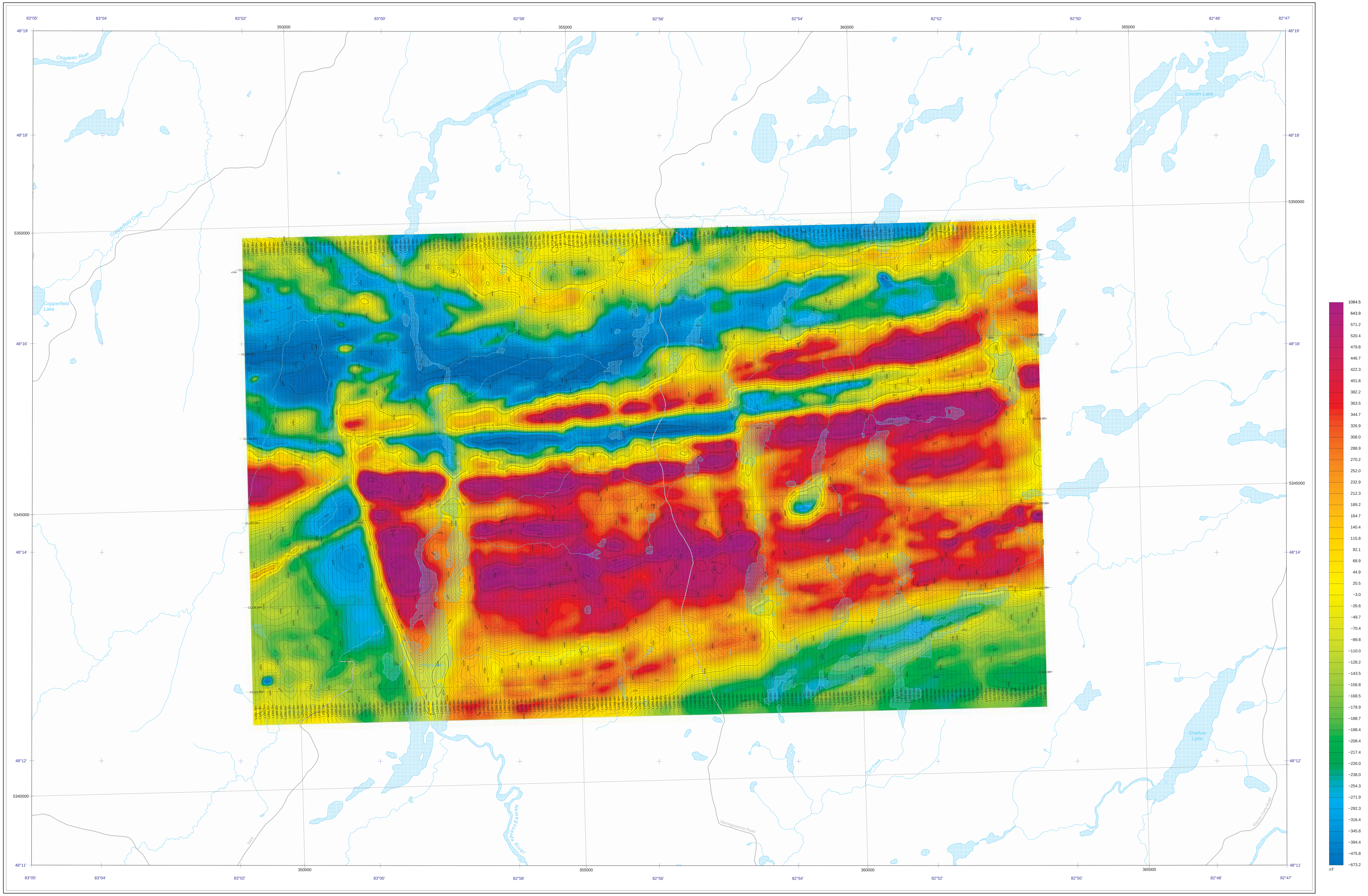
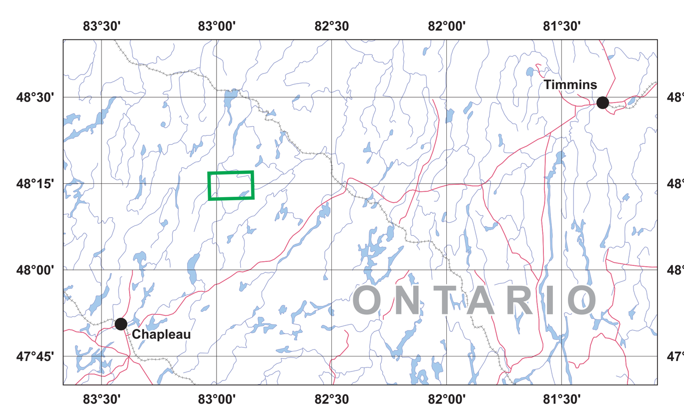




Survey Location

Legend

Hydrography . . . .

Roads . . . .

Base map derived from 1 : 50 000 scale NRCan data, and satellite data.

Flown and compiled by:

SANDER GEOPHYSICS
260 Hunt Club Road
Ottawa, Ontario, Canada K1V 1C1
Tel: +1 613-521-9626
surveys@sgl.com
sgl.com

GOLDCORP
BORDEN GOLD

High Resolution Fixed-wing Horizontal Magnetic Gradient Survey Chapleau, Ontario 2016

RESIDUAL MAGNETIC FIELD (nT)

(GRADIENT ENHANCED)

Scale 1 : 25 000

km 0.5 0 1 2 km

N
W E
S

Contour Intervals (nT)

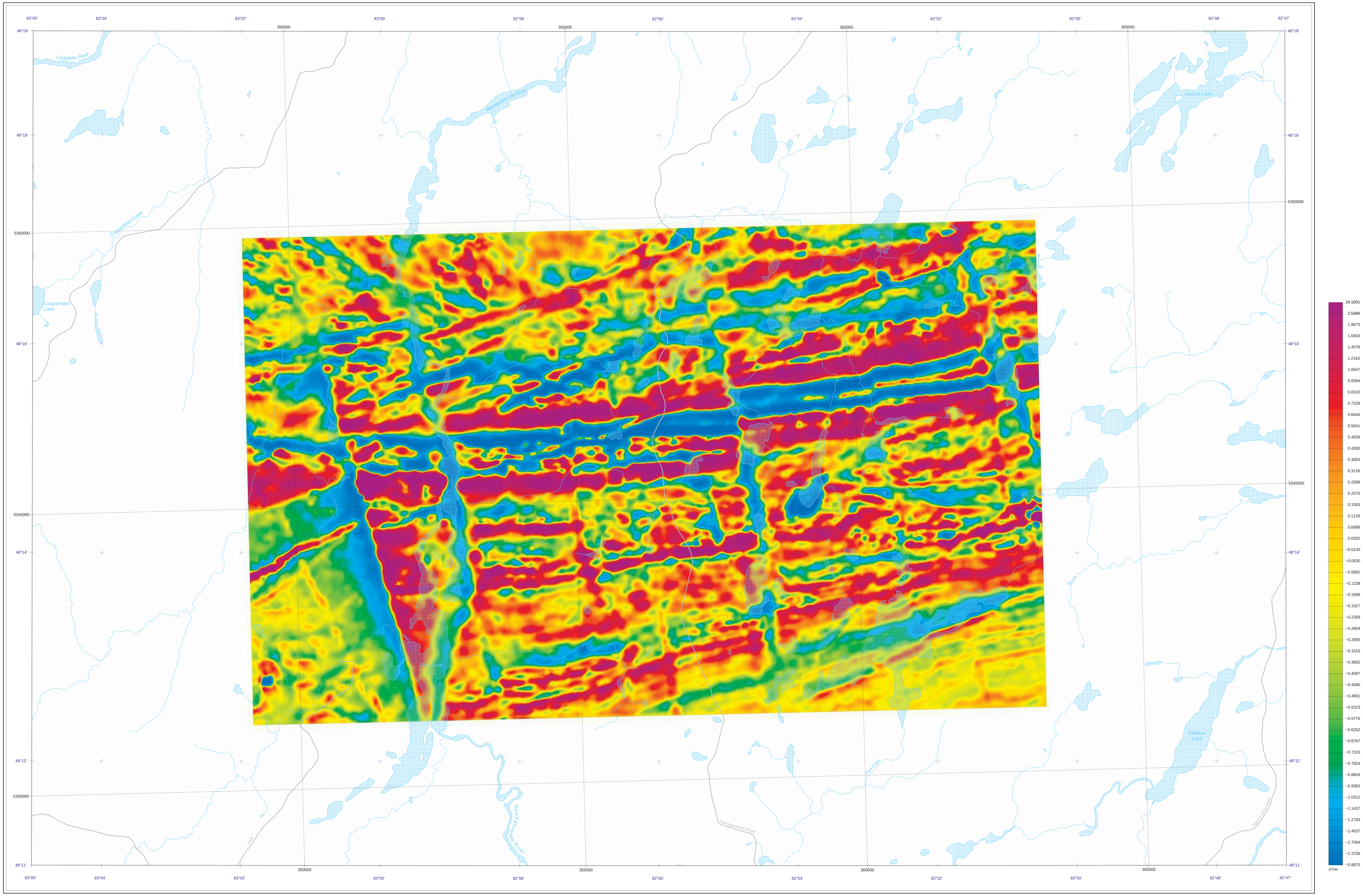
20 . . . .
100 . . . .
500 . . . .

Flight Lines

L1410.00>
41250
Fiducial
Line direction
Re-flight number
Segment number
Line number

Survey and Processing Specifications

Traverse Line Spacing	75 m
Traverse Line Direction	along bearing: 0° - 180°
Control Line Spacing	1500 m
Control Line Direction	along bearing: 90° - 270°
Aircraft Altitude	70 m above drape (WGS84)
Flying Speed	120 knots
Magnetometer Sensor	Geometrics G-822A, cesium split beam
Magnetometer Sensitivity	0.01 nT
Magnetometer Sample Rate	10 Hz
GPS Receiver	NovAtel OEMV-3
Aircraft	Cessna Grand Caravan 208B, C-GSGW
Magnetic Inclination at 48°14'51.68"N, 82°55'59.23"W	73.515°
Magnetic Declination at 48°14'51.68"N, 82°55'59.23"W	-9.206°
Total Magnetic Field	56109.0 nT
GPS Ground Station (WGS-84)	48°29'26.8340"N, 81°21'50.5488"W, 235.88 m
Magnetic Ground Station (WGS-84)	48°29'26.8340"N, 81°21'50.5488"W, 235.88 m
Date Flown	May 17 - 19, 2016
Grid Cell Size	15 m
IGRF Model	2015
Datum	WGS84
Projection	UTM 17N



GOLDCORP
BORDEN GOLD

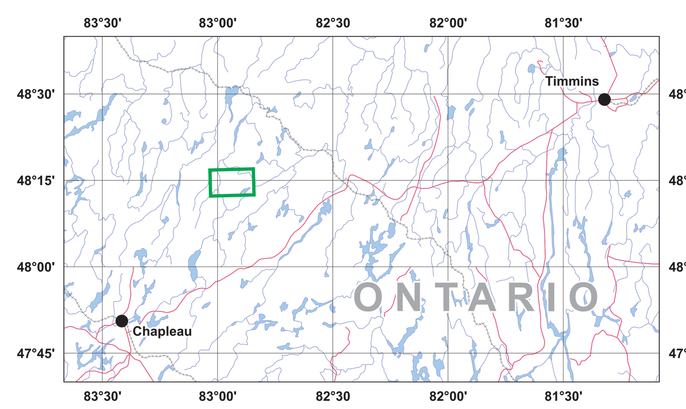
High Resolution Fixed-wing Horizontal Magnetic Gradient Survey
Chapleau, Ontario 2016

FIRST VERTICAL DERIVATIVE OF THE RESIDUAL MAGNETIC FIELD (nT/m)

(GRADIENT ENHANCED)

Scale 1 : 25 000

km 0.5 0 1 2 km



Survey Location

Legend

Hydrography . . . .

Roads . . . .

Base map derived from 1 : 50 000 scale NRCan data, and satellite data.

Flown and compiled by:

SANDER GEOPHYSICS
260 Hunt Club Road
Ottawa, Ontario, Canada K1V 1C1
Tel: +1 613-521-9626
surveys@sgl.com
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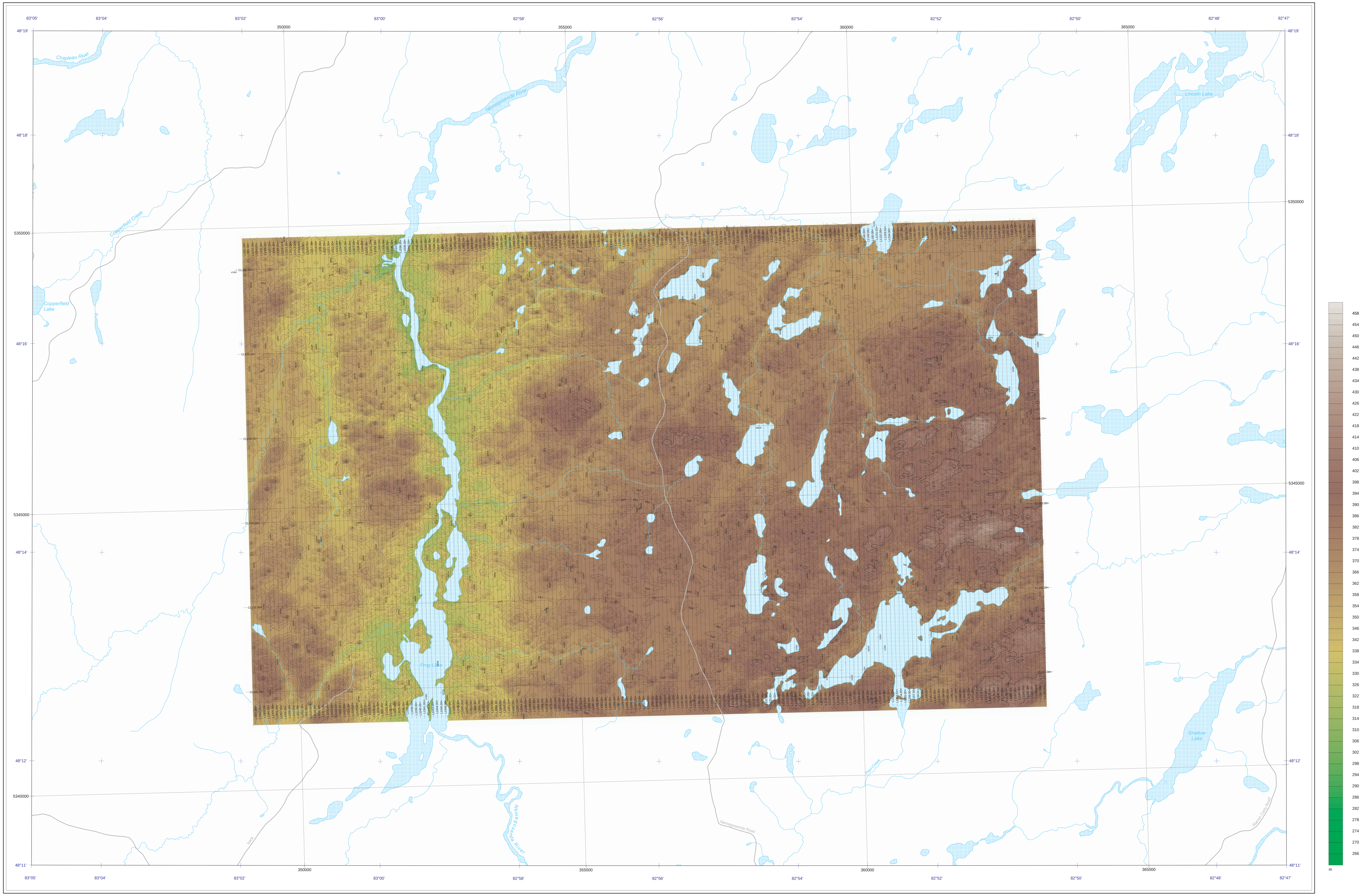
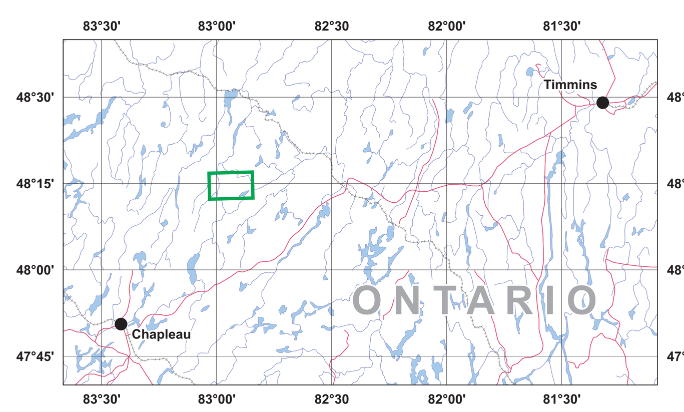
N
W E
S

Survey and Processing Specifications

Traverse Line Spacing	75 m
Traverse Line Direction	along bearing: 0° - 180°
Control Line Spacing	1500 m
Control Line Direction	along bearing: 90° - 270°
Aircraft Altitude	70 m above drape (WGS84)
Flying Speed	120 knots
Magnetometer Sensor	Geometrics G-822A, cesium split beam
Magnetometer Sensitivity	0.01 nT
Magnetometer Sample Rate	10 Hz
GPS Receiver	NovAtel OEMV-3
Aircraft	Cessna Grand Caravan 208B, C-GSGW
Magnetic Inclination at 48°14'51.68"N, 82°55'59.23"W	73.515°
Magnetic Declination at 48°14'51.68"N, 82°55'59.23"W	-9.206°
Total Magnetic Field	56109.0 nT
GPS Ground Station (WGS-84)	48°29'26.8340"N, 81°21'50.5488"W, 235.88 m
Magnetic Ground Station (WGS-84)	48°29'26.8340"N, 81°21'50.5488"W, 235.88 m
Date Flown	May 17 - 19, 2016
Grid Cell Size	15 m
IGRF Model	2015
Datum	WGS84
Projection	UTM 17N





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Chapleau, Ontario 2016

DIGITAL ELEVATION MODEL (m)

(above mean sea level)

Scale 1 : 25 000

km 0.5 0 1 2 km

N
W E
S

Contour Intervals (m)

5 . . . .
20 . . . .
100 . . . .

Flight Lines

L1410.00>
41250
Fiducial
Line direction
Re-flight number
Segment number
Line number

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