Report on
Magnetometer Surveys

at

Karl Zeemal, Graff Lake and Lake 282
Musselwhite Mine Site, NW Ontario

Winter 2010

ClearView Geophysics Inc.

Report On
Magnetometer Surveys
at
Karl Zeemal, Graff Lake and Lake 282
Musselwhite Mine Site, NW Ontario

On behalf of:

Goldcorp, Musselwhite Mine
P.O. Box 7500
Thunder Bay, Ontario
P7B 6S8

telephone: (807) 928-2200
facsimile: (807) 928-2067
E-mail: Jim.Edwards@goldcorp.com

Contact: Mr. Jim Edwards

By:

ClearView Geophysics Inc.
12 Twisted Oak Street
Brampton, Ontario
L6R 1T1

telephone: 905.458.1883
facsimile: 905.792.1884
cellular: 416.617.1884
E-mail: joe.mihelcic@geophysics.ca

Contact: Mr. Joe Mihelcic

ClearView Refs: *O0208*

TABLE of CONTENTS

LIST of TABLES

LIST of PLATES

1. Introduction

ClearView Geophysics Inc. carried out Total Field Magnetics for *Goldcorp, Musselwhite Mine* at a number of target areas. The work was carried out in February 2010. The purpose for the surveys was to refine and follow-up airborne magnetic for their ongoing exploration program.

2. Location & Access

The survey locations are located within several kilometers of each other and are predominantly east of the Musselwhite Mine site. Access was by snowmachine. The surveys were completed in walking-mode. Navigation and positioning was with GPS.

3. Personnel

Joe Mihelcic, M.B.A., P.Eng.; Geophysicist, ClearView:
Mr. Mihelcic navigated and blazed trail with a machete ahead of the magnetometer operator. He also assisted with the magnetics survey and was responsible for the surveys and data quality.

Claude Bisson, Operator, ClearView:
Mr. Bisson carried out the magnetics survey.

4. Survey Specifications & Equipment

Table 1: Daily Magnetics Survey Summary

Date (2010):	Area	Activity
Feb. 15	n/a	• Mobilization • Claude: Timmins to Thunder Bay • Joe: Brampton to Thunder Bay • Snowmobile Safety Training
Feb. 16	n/a	• Mobilization – Thunder Bay to Musselwhite Mine • Orientation Meetings
Feb. 17	n/a	• Standby for gear • Setup equipment
Feb. 18	Karl Zeemal	• Field Surveys – Day 1 • Batteries not fully charged or not holding charge, replaced
Feb. 19	Karl Zeemal	• Field Surveys – Day 2 • Repeat data for quality check
Feb. 20	Karl Zeemal	• Field Surveys – Day 3
Feb. 21	Graff Lake	• Field Surveys – Day 4
Feb. 22	Graff Lake	• Field Surveys – Day 5
Feb. 23	Graff Lake Lake 282	• Field Surveys – Day 6 • Terminated work at Lake 282 due to excess deadfall
Feb. 24	n/a	• Demobilization

		• Musselwhite to Kasabonika
Feb. 25-Mar. 1	*n/a*	• *Work for Kasabonika Lake First Nations*
March 2	n/a	• Demobilization • Claude: Thunder Bay to Ottawa • Joe: Thunder Bay to Brampton

Table 2: Magnetics Coverage Summary

Target	Coverage
Karl Zeemal	11.7 km
Graff Lake	2.5 km
Lake 282	1.4 km
Total:	15.6 km

Total Survey Coverage = 15.6 km
(Note: Total Coverage does not include repeats/tests, tie-lines or access coverage.)

Table 3: Magnetics Survey Specifications

Line separation	Nominally 100 metres
Reading interval – walking mode	2x per second
Base Station reading interval	1x per second

Table 4: Survey Equipment

Refer to Appendix A for Instrument Specifications.

Magnetometers:	Three (3) ver. 4/6/7 GEM Systems Overhauser
	Two (2) Scintrex Cesium NavMag SM-5
GPS Receivers:	Mag Base: Internal GPS for UTC time stamps
	Mag Walking Rovers: Internal GPS
GPS Differential:	Mag Walking Rovers: Real-Time WAAS
Rover Navigation:	Navigator with handheld GPS

5. SURVEY METHODOLOGY

The Walking-mode magnetometer surveys were carried out using Scintrex SM5 Cesium NavMag. The internal GPS from the magnetometers was used for positioning. Readings were acquired at 2x per second. The magnetometer sensor was located on a vertical staff over 0.5 metres above the operator's head. The GPS sensor antenna was located on a backpack carried by the operator.

GEM Systems Overhauser magnetometers were used for the base station corrections. The base station magnetics data were real-time UTC stamped. They were located less than 10 km from the survey grids. Two base stations were running at all times during the NavMag surveys. This was done so that a backup was available in case the main base station failed, and as a quality test.

6. DATA PROCESSING AND PRESENTATION

All data were downloaded and transferred to a central Dell laptop computer. *In-house* and *Geosoft* software were used to convert and present the readings. The Cesium and Overhauser magnetometer clocks were synchronized to UTC time using their internal GPS receivers.

Magnetic diurnal corrections were done with *Geosoft's Table-lookups.* This application linked the files according to GPS acquired UTC time. Base station readings were taken at 1-second intervals. Straight-line interpolation was applied to the base station readings to match the coinciding field magnetometer readings.

There are different database formats for the data:

<Sentmag.gdb>, <mag.gdb>, <base.gdb>.

The <Sentmag.gdb> database contains all of the presently acquired ground magnetics data. The line numbers indicated in the databases are coded as follows:

The 'Line' column is coded as follows: D<day> *decimal* <7>. The 7 indicates that the version 7 base station magnetometer data was used for diurnal corrections.

The <mag.gdb> file separates the survey lines (e.g., L1) from the tielines (e.g., T1).

The <base.gdb> database contains all of the base station data. The line number represents the day, and the decimal 6 or 7 relates to which GEM Systems magnetometer was used (i.e., version 6 or version 7).

The survey coverage and colour-shaded map is on the plate presented in Appendix B. Postings of the data are not presented on the plate because readings are too dense to display at the presented map scales. Note that the plotted profiles are relative to the survey line positions. Therefore, any deviation in the plotted line position would also skew the plotted profiles accordingly. A straight-line version of the profiles is available upon request.

All plots were output to the following printers:

- Samsung CLP-510 colour laser printer
- HP Designjet 800PS 42" colour printer

7. Problems & Logistical Issues

There were very few problems and issues related to the surveys. The main problem related to the dense bush in certain areas. The survey required a navigator to break and blaze trail ahead of the magnetometer operator. Production rates were therefore significantly lower compared to typical surveys on pre-cut survey lines. Access through dense bush and deadfall at the Lake 282 survey area prevented complete coverage. Work in dense bush and deadfall should be carried out after survey lines are chainsaw cleared to avoid injury to personnel and damage to equipment.

8. Discussion of Results

The survey data are presented on the plate in Appendix B. A brief discussion of the results follows:

Lake 282 and Graff Lake Survey Lines:

These survey lines were completed to more accurately locate peak magnetic anomalies identified by airborne magnetics surveys. The Lake 282 profiles show a pair of sharp peaks within 30 metres from each other. The stronger of the two is approximately 2000 nT above background. This is typical of magnetic sulphide mineralization (e.g., pyrrhotite). Peak responses at the Graff Lake survey lines are over 30,000 nT above background. This is typical for iron formation and magnetite mineralization.

Karl Zeemal:

Ground magnetics coverage over this grid was on regularly spaced survey lines. The dominant features consist of very strong magnetic high zones that extend across the survey area. Readings are typically off-scale at the peak locations, which can be over 30 metres wide (e.g., L21 southern anomaly).

A thick brown dashed line was drawn on the plate (Appendix B) along the peaks to detect deviations that could be significant for gold exploration (e.g., dilation zones, breaks, etc.). Three target areas were selected and indicated as **T1** through **T3.**

T1 represents the upper part of L6 and L7. The dashed lines that connect the peak anomalies appear to terminate at this area. In the south, the peak trend appears continuous. This could indicate the southern trend is the result of geologically newer rocks compared to rocks of the northern trends which appear broken and shifted.

T2 is also located along the northern peak trend in a location where the dashed line indicates a flexure or deviation. This could indicate a fault.

T3 represents a broad area on L17 and L18. The north and south peak trends appear to converge at **T3.** A broad magnetic high zone on L19 and L20 could be related to this convergence.

9. CONCLUSIONS AND RECOMMENDATIONS

The present survey was successful in locating and refining the locations of airborne detected anomalies. Additional fill-in lines at 50 m or 25 m are recommended at the Karl Zeemal grid to better determine and refine the interpreted peak anomaly trend directions. This 100-metre lines spacing from the present survey is too wide to accurately map complex geologic trends, especially in the vicinity of the recommended target areas. Survey lines should be cut prior to surveying in thick deadfall bush.

If there are any questions about the surveys, please do not hesitate to contact the undersigned.

LICENSED PROFESSIONAL ENGINEER
J. F. MIHELCIC
March 23/10
PROVINCE OF ONTARIO

Sincerely,

ClearView Geophysics Inc.

Joe Mihelcic, P.Eng., M.B.A.
Geophysicist/President

10. STATEMENT OF QUALIFICATIONS, JOE MIHELCIC

I, Joe Mihelcic, Hereby certify that:

1) I am a geophysicist with business office at 12 Twisted Oak Street, Brampton, Ontario L6R 1T1.
2) I am the owner of ClearView Geophysics Inc., a company performing geophysical services.
3) I am a graduate of Queen's University in Applied Science, Geological Engineering (B.Sc. 1988) and of Ivey Business School (M.B.A. 1995).
4) I am a member of the Professional Engineers of Ontario (PEO).
5) I have practiced my profession for over 20 years.

Signed ____________________

Joe Mihelcic, M.B.A., P.Eng.
Brampton, Ontario
March 23, 2010

APPENDIX A – Instrument Specifications

Sensor:

Self-oscillating split-beam Cesium Vapor (non-radioactive Cs_{133}) automatic hemisphere switching
Single sensor is standard
Optional second sensor (gradiometer)
Standard systems are field upgradable

Data capacity:

Up to 8 million readings in internal flash.

Operating Zones:

10-85 Degrees

Data output:

RS-232C, USB and optional portable FlashDisk

Resolution:

0.01 nT (?) for all sample rates

Sensitivity:

< 0.003 nT (?) vHz RMS

Sample rate:

User selectable 1,2,5,10 samples per second

Gradient tolerance:

1,000 nT (?) per inch (40,000 nT(?)/m)

Display:

Full VGA color display

User interface:

Environmental pointing device (mouse) and 5 dedicated keys

Heading Error:

< ± 1 nT (?)

Temperature drift:

0.01 nT (?) per degrees C

Real Time Clock:

Accurate synchronization to GPS PPS
Drift less than 0.2 sec / day

Standard Cables:

USB cable for "active sync" communication

Battery Charger:

Standard 120/240V AC

Audio Output:

Auto baseline tracking
Internal speaker or optional non-magnetic headsets

Standard software:

Scintrex Map Registration and Setup Utility
Mag Util quality control and display tool

Mechanical:

Console: 8.6"(W), 7.2"(D), 7.9"(H)
Weight: 2kg
Backpack: 0.25kg
Console batteries: 2x @ 0.75kg each
Sensor: 1.7kg
Staff and harness: 0.9kg

Power:

External Power: 21 – 28 V two connectors
Internal console batteries
2 x 12V Gel cells,
Optional battery pack/belt

Environmental:

Operating temperature:
-30°C to +50°C
Storage temperature:
-40°C to +70°C

Options:

Battery Belt/pack
Data and Power Cables
USB FlashDisk portable storage upgrade
Additional Cs sensor
Back pack
Internal GPS
External GPS
External keyboard

NOTE: Preliminary specifications are subject to change without notice

GSM-19 v7.0

Overhauser Magnetometer / Gradiometer / VLF

Introduction

The GSM-19 v7.0 Overhauser instrument is the total field magnetometer / gradiometer of choice in today's earth science environment - representing a unique blend of physics, data quality, operational efficiency, system design and options that clearly differentiate it from other quantum magnetometers.

With data quality exceeding standard proton precession and comparable to costlier optically pumped cesium units, the GSM-19 is a standard (or emerging standard) in many fields, including:

* **Mineral exploration (ground and airborne base station)**
* **Environmental and engineering**
* **Pipeline mapping**
* **Unexploded Ordenance Detencion**
* **Archeology**
* **Magnetic observatory measurements**
* **Volcanology and earthquake prediction**

Taking Advantage of a "Quirk" of Physics

Overhauser effect magnetometers are essentially proton precession devices except that they produce an order-of magnitude greater sensitivity. These "supercharged" quantum magnetometers also deliver high absolute accuracy, rapid cycling (up to 5 readings / second), and exceptionally low power consumption.

The Overhauser effect occurs when a special liquid (with unpaired electrons) is combined with hydrogen atoms and then exposed to secondary polarization from a radio frequency (RF) magnetic field.

The unpaired electrons transfer their stronger polarization to hydrogen atoms, thereby generating a strong precession signal-- that is ideal for very high-sensitivity total field measurement.

In comparison with proton precession methods, RF signal generation also keeps power consumption to an absolute minimum and reduces noise (i.e. generating RF frequencies are well out of the bandwidth of the precession signal).

In addition, polarization and signal measurement can occur simultaneously - which enables faster, sequential measurements. This, in turn, facilitates advanced statistical averaging over the sampling period and/or increased cycling rates (i.e. sampling speeds).

The unique Overhauser unit blends physics, data quality, operational efficiency, system design and options into an instrumentation package that ... exceeds proton precession and matches costlier optically pumped cesium capabilities.

And the latest v7.0 technology upgrades provide even more value, including:

- **Data export in standard XYZ** (i.e. line-oriented) format for easy use in standard commercial software programs
- **Programmable export format** for full control over output
- **GPS elevation values** provide input for geophysical modeling
- **<1.5m standard GPS** for high-resolution surveying
- **Enhanced GPS positioning** resolution
- **Multi-sensor capability** for advanced surveys to resolve target geometry
- **Picket marketing / annotation** for capturing related surveying information on the go.

And all of these technologies come complete with the most attractive prices and warranty in the business!

Description	Range	Services	Output	Nav Option
Standalone	5m	GPS	Time, Lat / Long, UTM	Y
Corrected geometrically by GPS without radio modem	1m	WAAS / EGNOS, OmniSTAR	Time, Lat / Long, UTM	Y
Corrected geometrically by GPS without radio modem	[illegible]	WAAS / EGNOS, OmniSTAR	Time, Lat / Long, UTM	Y
Corrected geometrically by GPS with radio modem	0.1m	[illegible], RTK	Time, Lat / Long, UTM	Y

Key System Components

Key components that differentiate the GSM-19 from other systems on the market include the sensor and data acquisition console. Specifications for components are provided on the right side of this page.

Sensor Technology

Overhauser sensors represent a proprietary innovation that combines advances in electronics design and quantum magnetometer chemistry.

Electronically, the detection assembly includes dual pick-up coils connected in series opposition to suppress far-source electrical interference, such as atmospheric noise. Chemically, the sensor head houses a proprietary hydrogen-rich liquid solvent with free electrons (free radicals) added to increase the signal intensity under RF polarization.

From a physical perspective, the sensor is a small size, light-weight assembly that houses the Overhauser detection system and fluid. A rugged plastic housing protects the internal components during operation and transport.

All sensor components are designed from carefully screened non-magnetic materials to assist in maximization of signal-to-noise. Heading errors are also minimized by ensuring that there are no magnetic inclusions or other defects that could result in variable readings for different orientations of the sensor.

Optional omni-directional sensors are available for operating in regions where the magnetic field is near-horizontal (i.e. equatorial regions). These sensors maximize signal strength regardless of field direction.

Data Acquisition Console Technology

Console technology comprises an external keypad / display interface with internal firmware for frequency counting, system control and data storage / retrieval. For operator convenience, the display provides both monochrome text as well as real-time profile data with an easy to use interactive menu for performing all survey functions.

The firmware provides the convenience of upgrades over the Internet via its software. The benefit is that instrumentation can be enhanced with the latest technology without returning the system to us -- resulting in both timely implementation of updates and reduced shipping / servicing costs.

Performance

Sensitivity:	< 0.015 nT / vHz@1Hz
Resolution:	0.01 nT
Absolute Accuracy:	+/- 0.1 nT
Dynamic Range:	10,000 to 120,000 nT
Gradient Tolerance:	> 10,000 nT/m
Sampling Rate:	60, 3, 2, 1, 0.5, 0.2 sec
Operating Temp:	-40C to +55C

Operating Modes

Manual:
Coordinates, time, date and reading stored automatically at minimum 3 second interval.

Base Station:
Time, date and reading stored at 3 to 60 second intervals.

Remote Control:
Optional remote control using RS-232 interface.

Input / Output:
RS-232 or analog (optional) output using 6-pin weatherproof connector

Storage - 16Mbytes (# of Readings)

Mobile:	838,860
Base Station:	2,796,202
Gradiometer:	699,050
Walking Magnetometer:	1,677,721

Dimensions

Console:	223 x 69 x 240 mm
Sensor:	175 x 75mm diameter cylinder

Weights

Console:	2.1 kg
Sensor and Staff Assembly:	1.0 kg

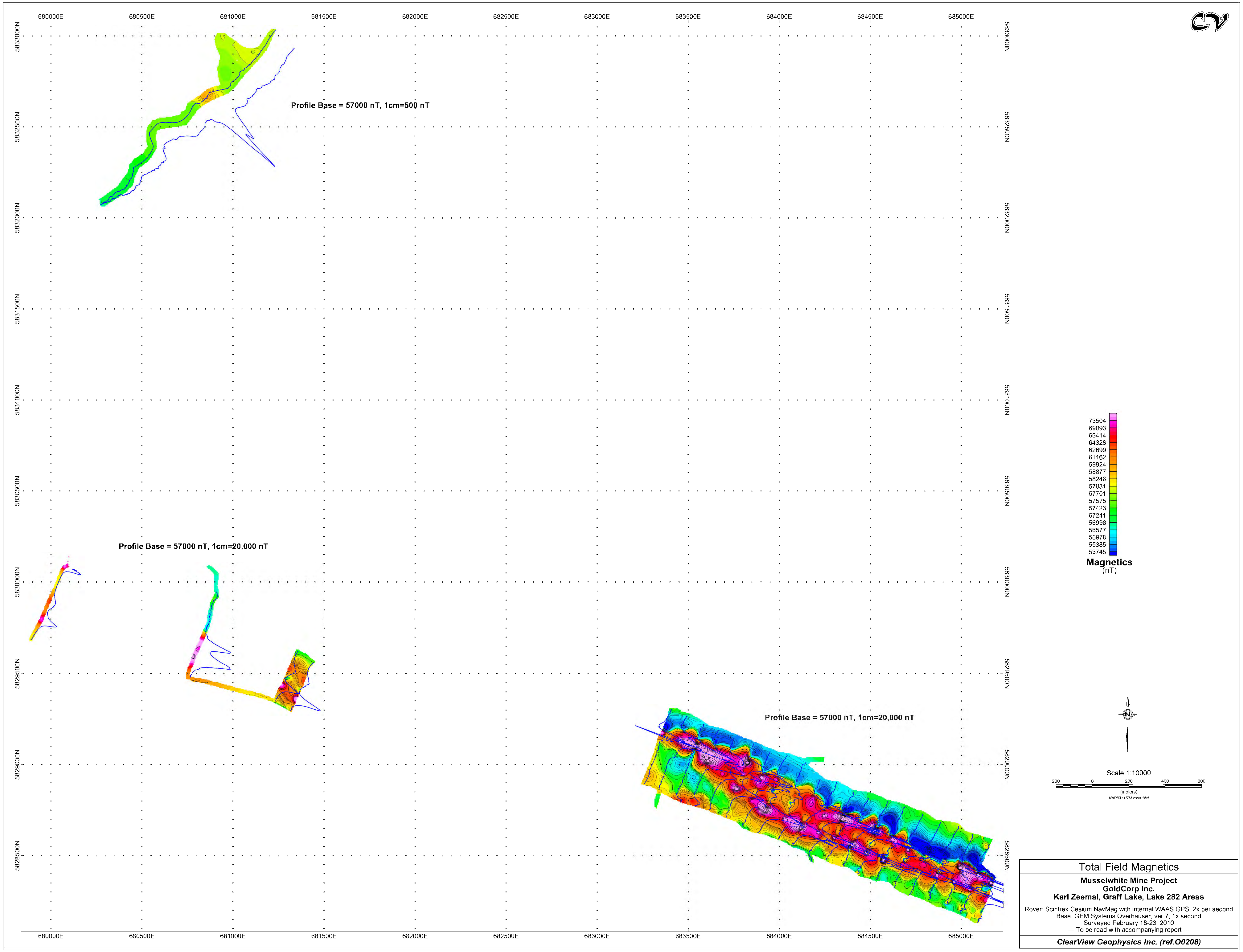
Standard Components

GSM-19 console, GEMLinkW software, batteries, harness, charger, sensor with cable, RS-232 cable, staff, instruction manual and shipping case.

Optional VLF

Frequency Range:	Up to 3 stations between 15 to 30.0 kHz
Parameters:	Vertical in-phase and out-ofphase components as % of total field. 2 relative components of the horizontal field.
Resolution:	0.1% of toal field

APPENDIX B – Plan Maps


Profile Base = 57000 nT, 1cm=500 nT
Profile Base = 57000 nT, 1cm=20,000 nT
Profile Base = 57000 nT, 1cm=20,000 nT
680000E
680500E
681000E
681500E
682000E
682500E
683000E
683500E
684000E
684500E
685000E
5833000N
5832500N
5832000N
5831500N
5831000N
5830500N
5830000N
5829500N
5829000N
5828500N
73504
69093
66414
64328
62699
61162
59924
58877
58246
57831
57701
57575
57423
57241
56998
56577
55978
55385
53745
Magnetics
(nT)
N
Scale 1:10000
200 0 200 400 600
(meters)
NAD83 / UTM zone 15N
Total Field Magnetics
Musselwhite Mine Project
GoldCorp Inc.
Karl Zeemal, Graff Lake, Lake 282 Areas
Rover: Scintrex Cesium NavMag with internal WAAS GPS, 2x per second
Base: GEM Systems Overhauser, ver.7, 1x second
Surveyed February 18-23, 2010
--- To be read with accompanying report ---
ClearView Geophysics Inc. (ref.O0208)