GROUND MAGNETIC SURVEY

over

the

SILVER PEAK PROSPECT

ESMERALDA COUNTY, NV

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for

SIERRA GEOTHERMAL POWER CORP.

SEPTEMBER 2009

SUBMITTED BY

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TABLE OF CONTENTS

INTRODUCTION

A ground magnetic survey was conducted over the Silver Peak Prospect in Esmeralda County, Nevada for Sierra Geothermal Power Corp. during the period of September 9 to September 17, 2009. A total of 332 line kilometers of magnetic data were acquired using Geometrics Model G-858 magnetometers. Real-time differentially-corrected GPS was used for positioning.

Measurements of the total magnetic intensity were taken in the continuous mode at two-second intervals along east-west lines spaced 200 meters apart. A base magnetometer was operated during all periods of data acquisition and recorded readings every two seconds. The field operations were based out of Tonopah, Nevada.

All raw and processed data are included on a CD that will be delivered separately.

DATA ACQUISITION

Survey Personnel

Brian Page, Chris Michalowski, and Sean Watters acquired the ground magnetic data and operated the GPS for navigation and positioning. Christopher Magee supervised survey operations, performed quality-control analysis and processed all of the magnetic data.

Roving Magnetometer

Geometrics G-858 Cesium Vapor magnetometers were used on this project. The magnetometer sensors were mounted on aluminum poles attached to backpacks with a sensor height of about 2.9 meters above ground level. The relatively high sensor height was necessary to maximize the distance between the sensor and the GPS antenna and minimize the heading errors caused by the presence of the GPS antenna. The heading error with this system is on the order of one nT. The magnetometer was set up to record the total intensity of the magnetic field every two seconds resulting in an average sample spacing of two to three meters or less.

Base Magnetometer

A Geometrics Model G-858 magnetometer was also used as a base magnetometer to record diurnal changes in the Earth's magnetic field. The base magnetometer was set up in an area where the gradient of the magnetic field is low as determined by a quick site survey that was performed. The base magnetometer sensor was secured to a 6-foot staff and the unit was set up to automatically record a total field measurement every 2 seconds.

The NAD27 UTM Zone 11 North coordinates (in meters) of the base magnetometer location are 445319.08m E and 4182836.78m N with a NAVD88 elevation of 1306.70m. An International Geomagnetic Reference Field (IGRF) 2005 value of 50171 nT was assigned to the base magnetometer location using a latitude of N37.79311°, a longitude of W117.62105° and an elevation of 1306.70 m on September 9, 2009. The IGRF model gives this location an IGRF value of 50171.06 nT, a magnetic inclination 62.39° and a magnetic declination of 13.76°. The base magnetometer was operated at all times that magnetic data were being acquired with the roving magnetometer.

GPS Positioning

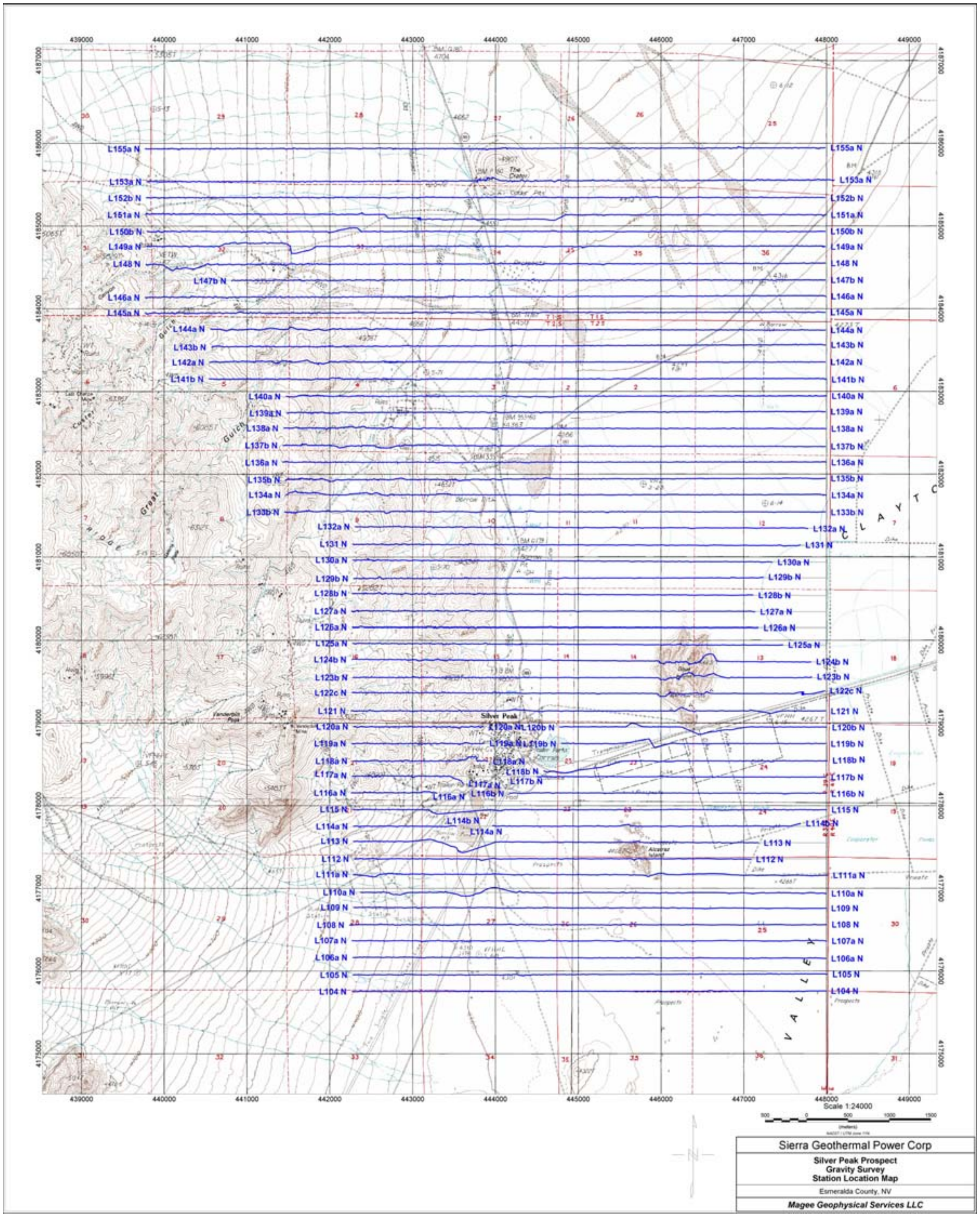
Trimble Model GeoExplorer XT and XH GPS receivers were used to provide navigation and positioning. The receivers were configured to receive differential corrections in real-time from WAAS (Wide Area Augmentation System) geo-stationery satellites. This system is operated by the United States Government Federal Aviation Administration. The resulting positions usually have an accuracy of about two meters. The GPS receiver was set up to output a NMEA string of positional data to be recorded on the magnetometer along with the magnetic readings. The NMEA string format that was used is the GGA format described below:

Field	Meaning
1	UTC of position fix
2	Latitude
3	Direction of Latitude (N or S)
4	Longitude
5	Direction of Longitude (E or W)
6	GPS Quality Indicator: 0: Fix not available or invalid 1: GPS fix 2: Differential GPS fix 4: RTK (fixed) 5: RTK (float)
7	Number of Satellites in fix
8	HDOP
9	Orthometric Height
10	Units of orthometric height
11	Geoid Separation
12	Units of geoid separation
13	Age of differential correction
14	Reference Station ID

The positions of the magnetic readings were recorded on the G-858 magnetometer in WGS-84 latitude and longitude.

Magnetic Profile Lines

A total of 332 line kilometers were surveyed along 51 east-west profiles. Lines varied in length from 5.7 km to 8.2 km. A line location map is shown on the following page. The survey required 23 man-days to setup and complete with two or three operators surveying at a time.



Silver Peak Ground Magnetic Survey
Line Location Map

DATA PROCESSING

Overview

After downloading the magnetic data from the magnetometers onto a notebook PC, diurnal corrections were applied (by assigning the appropriate value to the base magnetometer location) using the Geometrics software package, *MagMap2000*. Geosoft compatible XYZ files were then generated with WGS-84 geographic coordinates for each magnetic measurement. After importing the XYZ files into a Geosoft Oasis montaj database, NAD27 UTM coordinates were generated, profiles were prepared, and additional editing was performed as necessary. The editing mostly consists of deleting readings affected by cultural noise and deleting dropouts which are large-amplitude negative spikes that occur when the magnetometer sensor is tilted too far from a vertical orientation.

Mapping and Gridding

The Silver Peak Total Magnetic Field data were gridded, mapped, and contoured to insure high quality data were collected. Contoured color images of the diurnally-corrected Total Magnetic Intensity (TMI) are shown in Appendix A. Other images include The Geosoft versions of TMI with IGRF removed, TMI Reduced to Pole (RTP), and the First Vertical Derivative of TMI-RTP.

Difficulties were encountered using Geosoft to calculate the Reduction To Pole and the Vertical Derivative due to the very large amplitude anomaly in the northern part of the survey area. When using the 2DFFT in the Magmap module of Geosoft the large anomaly causes ringing and produces false north-south features in the northern part of the survey area.

To alleviate this problem data were forwarded to consulting geophysicist Jim Wright who designed some specialty filters and processing. The ringing was removed and an explanation of the processing techniques used along with the results are included in Appendix B.

DATA FILES

Raw Data Files

All of the raw data files for the project are included with the delivered data. Field and base magnetometer files are in binary format with the filename extension *.bin*. The *.bin* files are unedited. XYZ files are output from MAGMAP 2000 and contain the raw measurements, diurnal corrections, and WGS-84 latitude and longitude. Files are named with the date and operator.

Geosoft Database File and Final XYZ File

The Geosoft database file with the all of the processed and edited ground magnetic data included on the CD is named *Silver_Peak_Ground_Magnetic_Survey_Sep_2009.gdb*. The Geosoft database file was exported as an XYZ file and is named *Silver_Peak_Ground_Mag_Sep_21_2009.XYZ*.

Map and Grid Files

The file names for the Geosoft grid files used to create the maps in this report are as follows and are included with the delivered data. Each map has been exported as a registered Geotiff and has been converted to a PDF. Each grid file has been saved as a Geosoft database and exported as an XYZ file.

Total Magnetic Intensity (TMI)	*tmi_silver_peak.grd*
Calculated IGRF Values	*igrf_silver_peak.grd*
TMI with IGRF Removed	*igrf_removed_silver_peak.grd*
TMI with IGRF Removed Reduced to Pole (RTP)	*igrf_removed_silver_peak_rtp.grd*
First Vertical Derivative of TMI-RTP	*igrf_removed_silver_peak_rtp_VD_SM.grd*

The grid, database, TIFF, and XYZ files produced with Jim Wright's specialty processing are included in a separate folder and are named as follows:

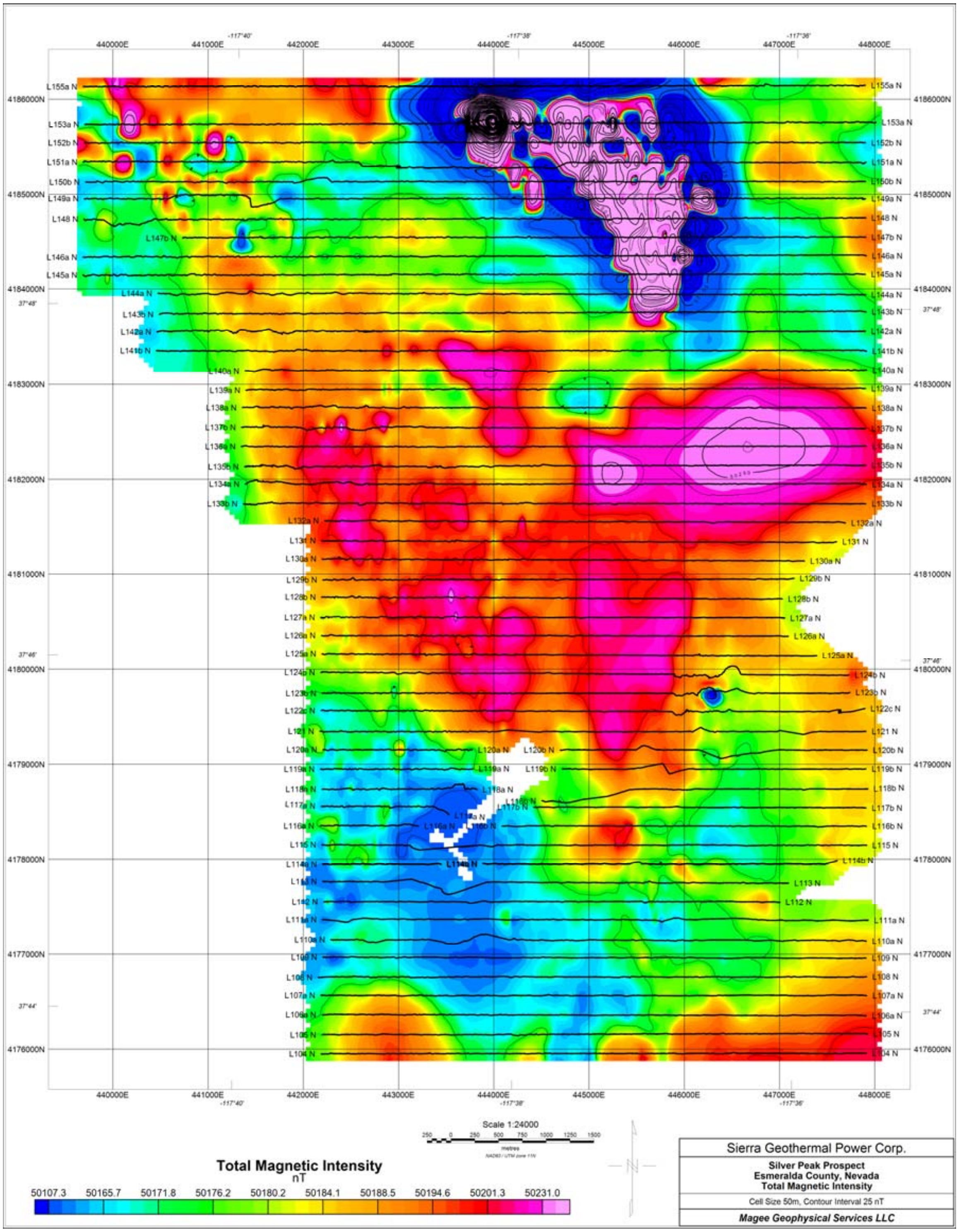
Total Magnetic Intensity (TMI)	*GMAG_50_M*
TMI - Reduced to Pole (RTP)	*GMAG_RTP_FIL_50_M*
First Vertical Derivative of TMI-RTP	*GMAG_RTP_VD_FIL_M*

It should be noted that all of Jim Wright's work was done in NAD83 UTM Zone 11 North meters.

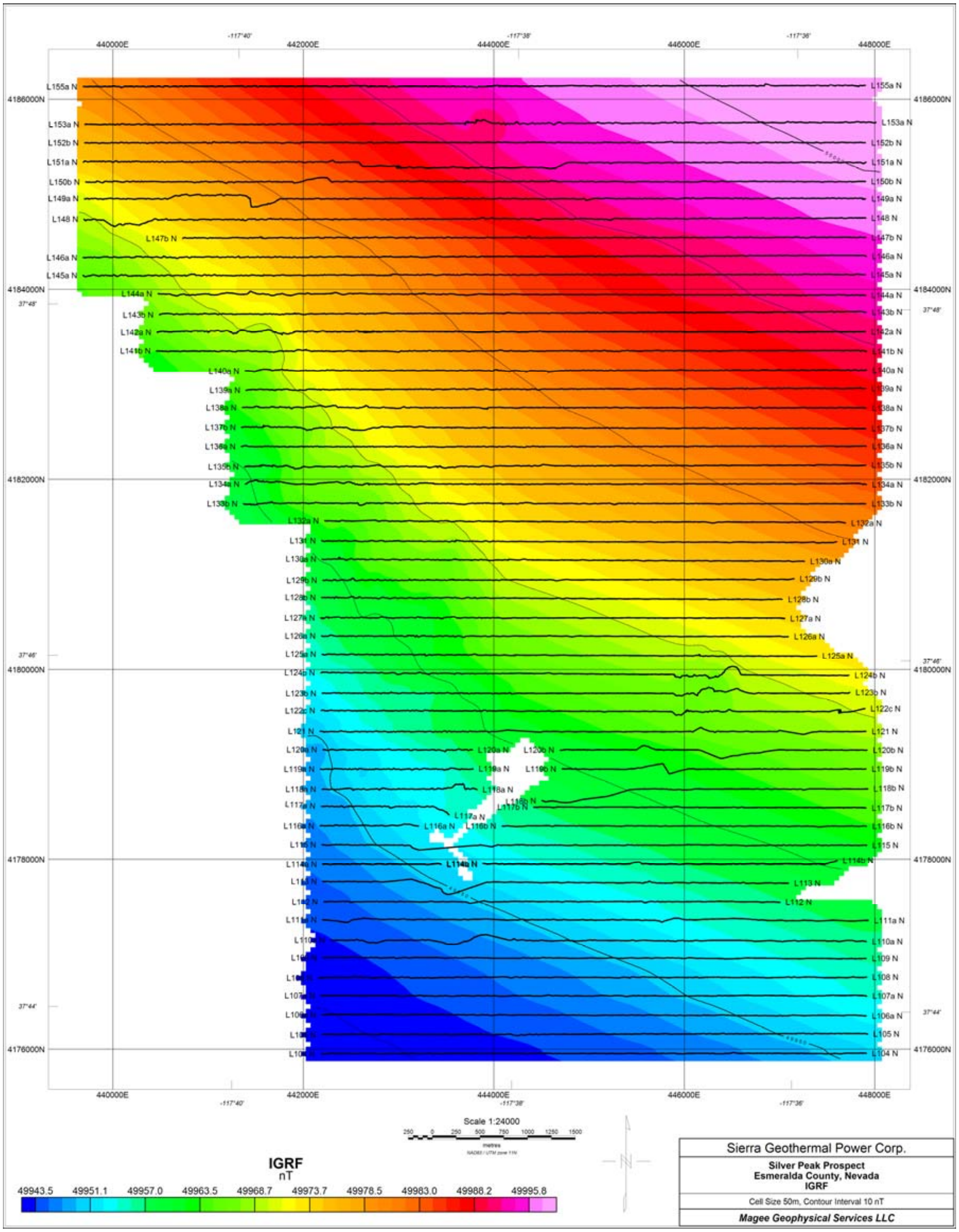
Submitted by:

Christopher Magee
Consulting Geophysicist

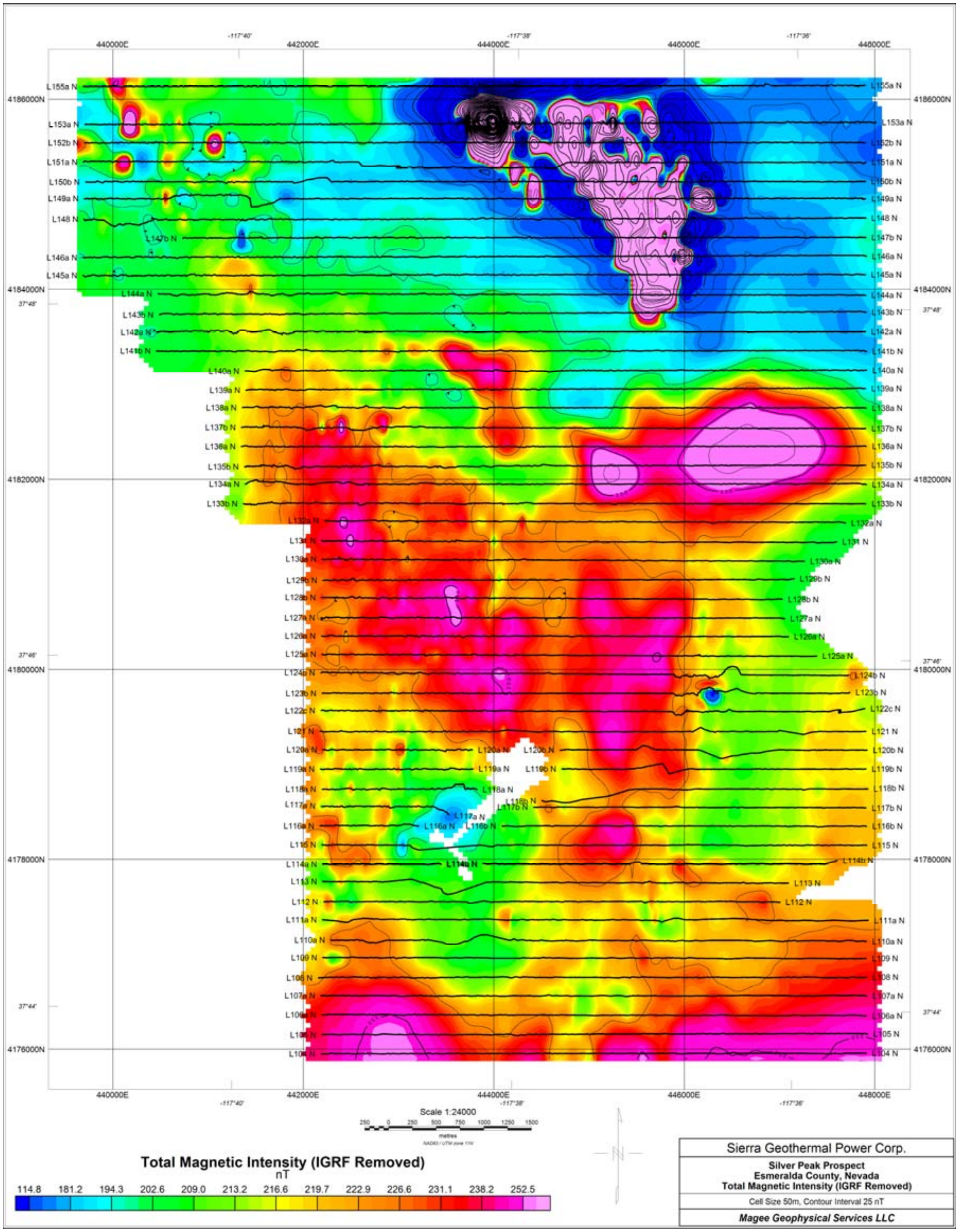
APPENDIX A MAPS



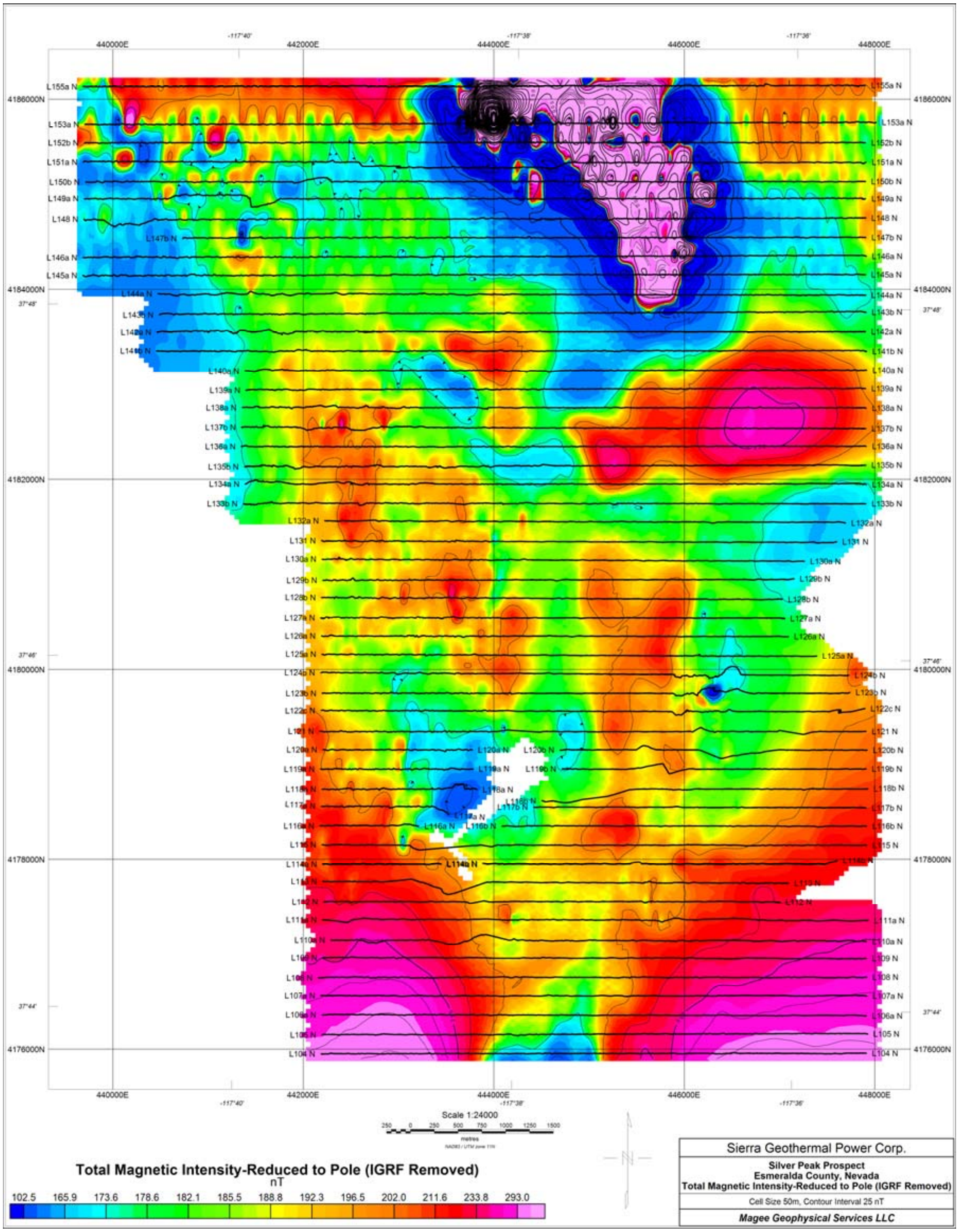
Silver Peak Ground Magnetic Survey
Total Magnetic Intensity



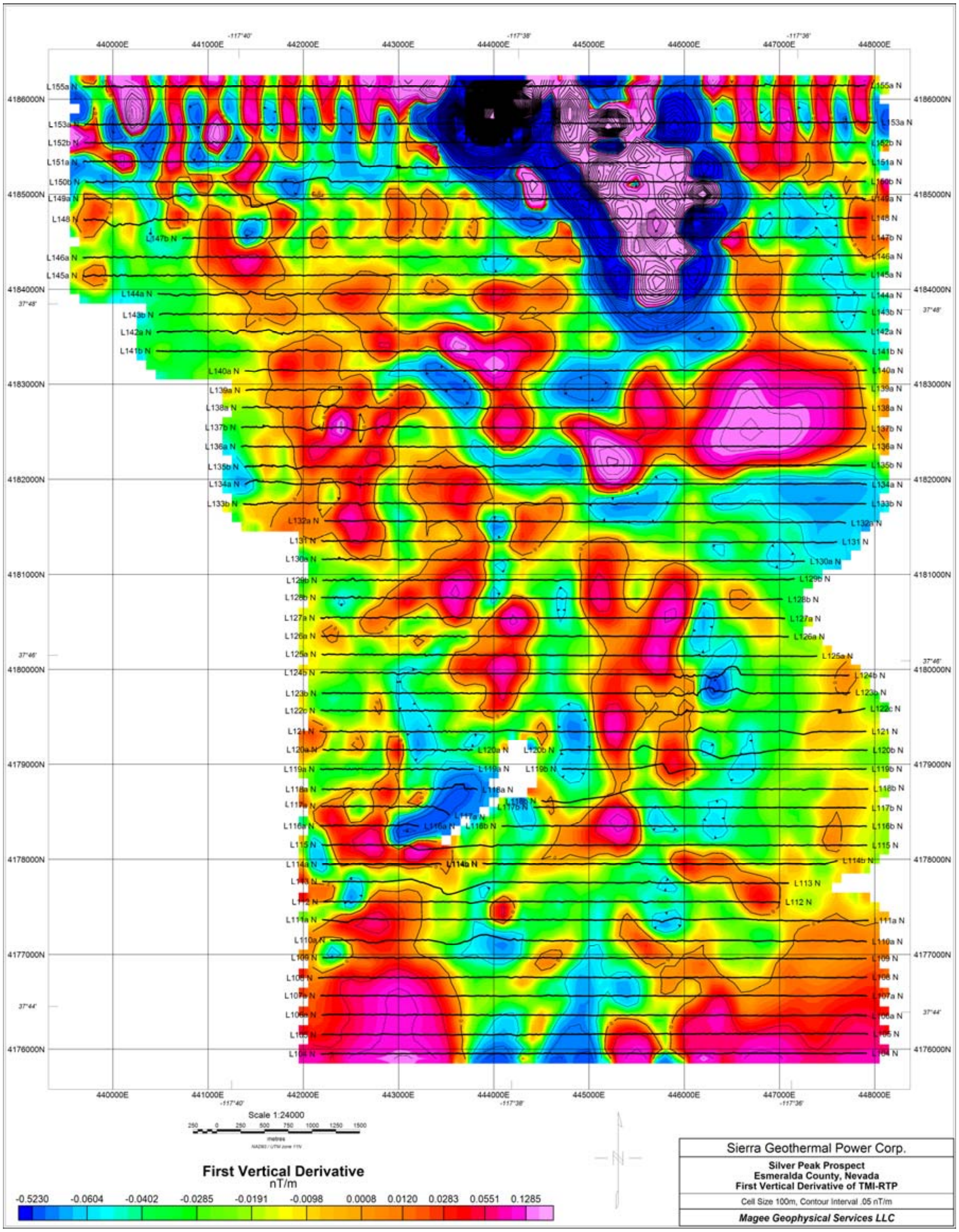
Silver Peak Ground Magnetic Survey
IGRF



Silver Peak Ground Magnetic Survey
Total Magnetic Intensity (IGRF Removed)



Silver Peak Ground Magnetic Survey
Total Magnetic Intensity – Reduced to Pole (IGRF Removed)



Silver Peak Ground Magnetic Survey
First Vertical Derivative of Total Magnetic Intensity – Reduced to Pole (IGRF Removed)

APPENDIX B RESULTS OF SPECIALTY PROCESSING

Specialty processing was applied to ground magnetic data to generate the standard secondary products of the reduced-to-pole (RTP) and first vertical derivative (VD). Figure 1 shows the total field (TMI) data for the survey in the standard units of nano-teslas.

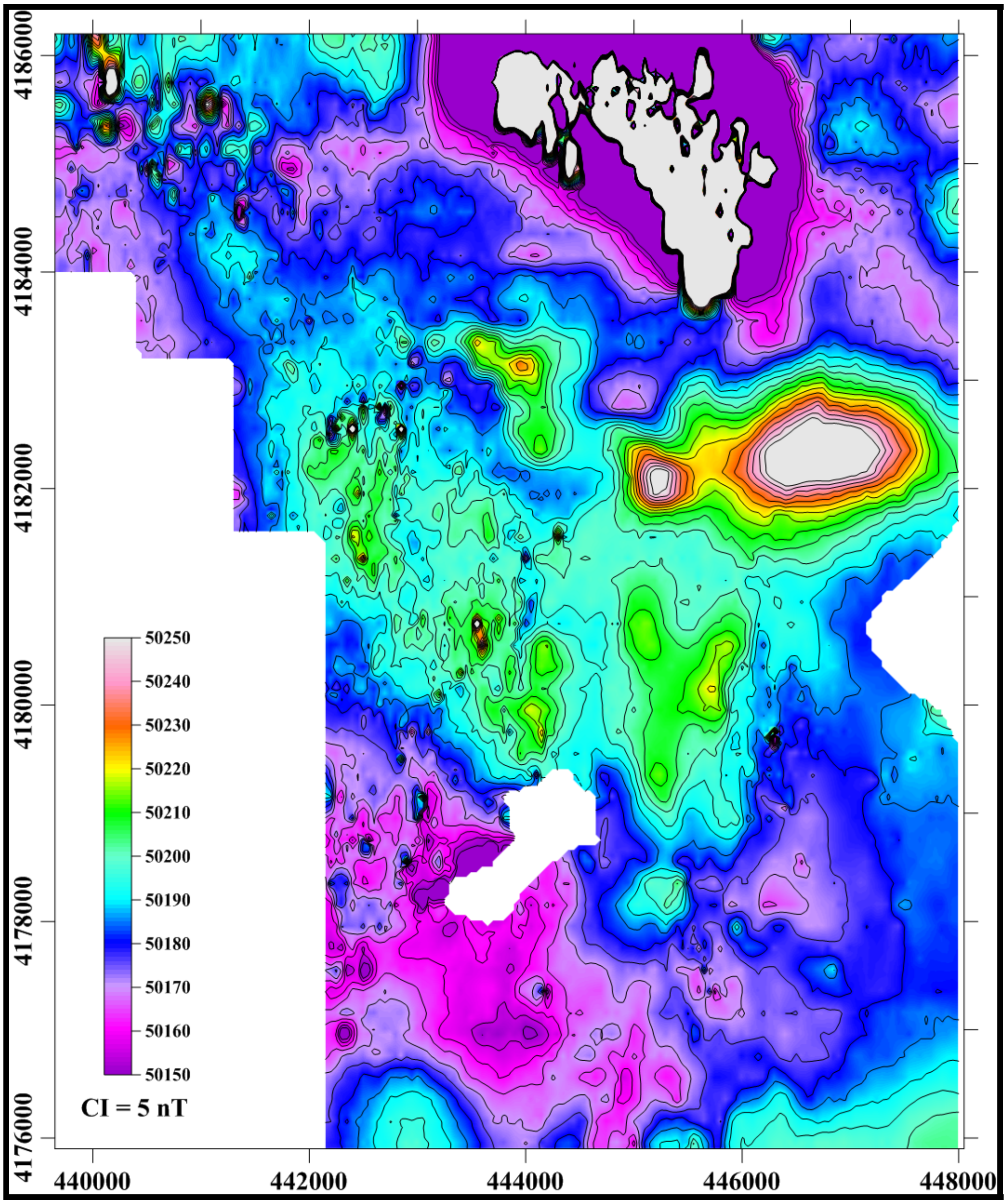


FIGURE 1: TMI Data

Localized extreme magnetic field values are observed in the north central portion of the survey with a data range approaching 8000 nT. The remainder of the survey exhibits quite modest magnetic variations spanning 100 nT (see color scale). Such a situation leads to processing difficulties when applying Fourier transform techniques to generate the RTP and VD products. Specifically, the Gibbs Phenomena or ringing generated by the high amplitude portion of the data sets swamps the low amplitude portions. The situation is further exacerbated by the requirement to generate the VD, which is a high pass filter further compounding the problem.

The ringing has a wavelength of twice the grid interval or sample spacing. In this case, the lines are spaced 200m and oriented east-west. An appropriate grid interval is 50m resulting in ringing with a wavelength of 100m. By reducing the grid interval the ringing can be shifted to a sufficient high frequency so as to allow low pass filtering to separate the geologic responses from the ringing. Direct gridding of the data at a very small interval results in “stitching” along the survey lines or generating of unwanted high frequency noise. A better approach is to grid the data at the appropriate grid spacing (i.e. 50m) then apply a spline interpolator to re-sample the grid down to the require smaller interval. In this case the grid was re-sampled to 10m. Finally, when performing the Fourier operations, the grid should be padded with additional grid cells. This helps mitigate the ringing. Two hundred (200) grid cells were added to the edges of the grid prior to the Fourier processing. Once the desired grid products are generated, a recursive nine point Gaussian filter is applied to remove the ringing and the grid de-sampled back to the 50m interval. It should be noted the VD is computed from the RTP rather than the TMI.

Figures 2 and 3 present the final products for the RTP and VD respectively. No ringing is evident either product. This is impressive given the very lows values in the VD product. The contour interval is a mere 0.1 nT/m and the color scale only spans from -0.5 to 0.5 nT/m.

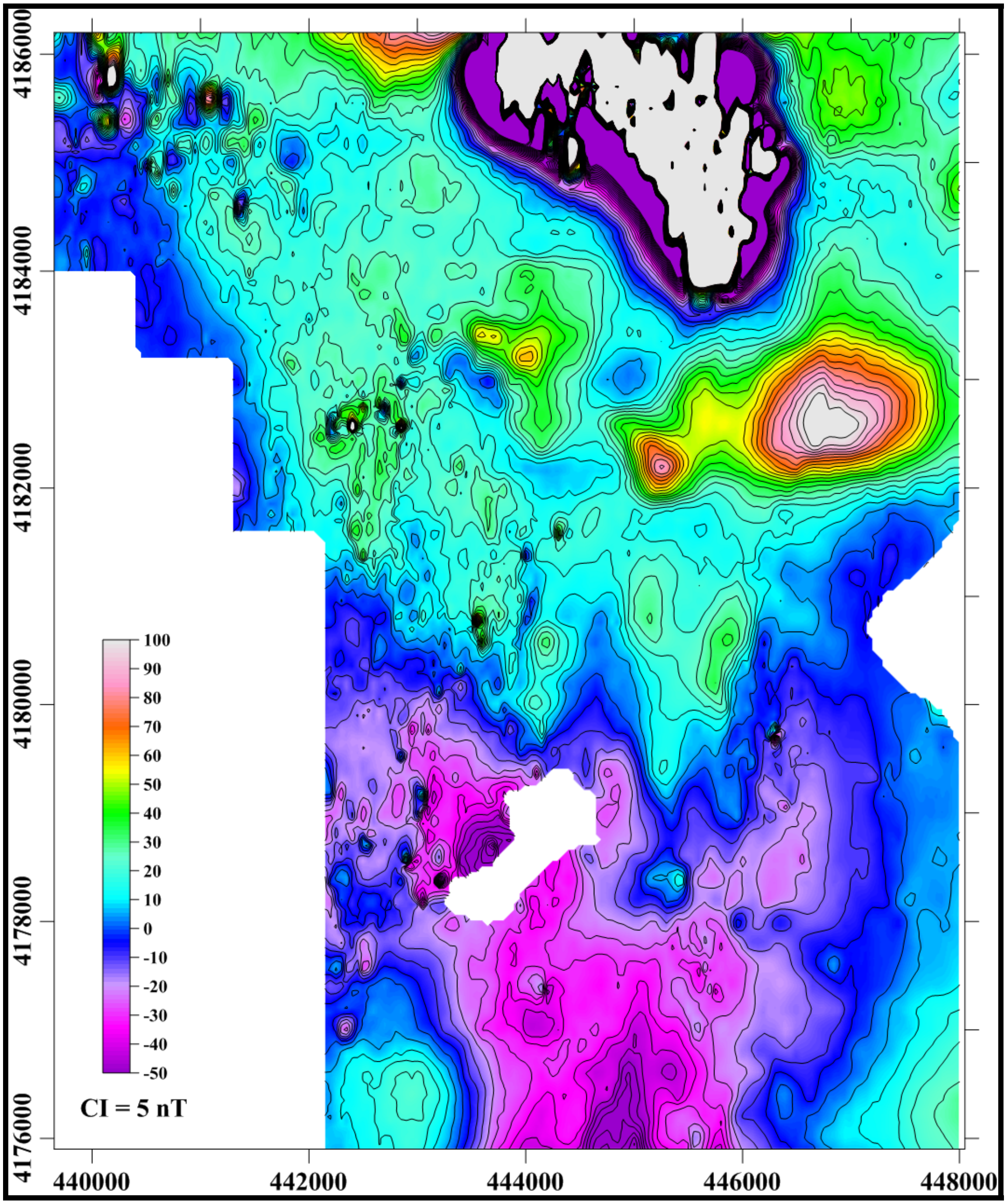

4186000
4184000
4182000
4180000
4178000
4176000
440000
442000
444000
446000
448000
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
CI = 5 nT

FIGURE 2: RTP

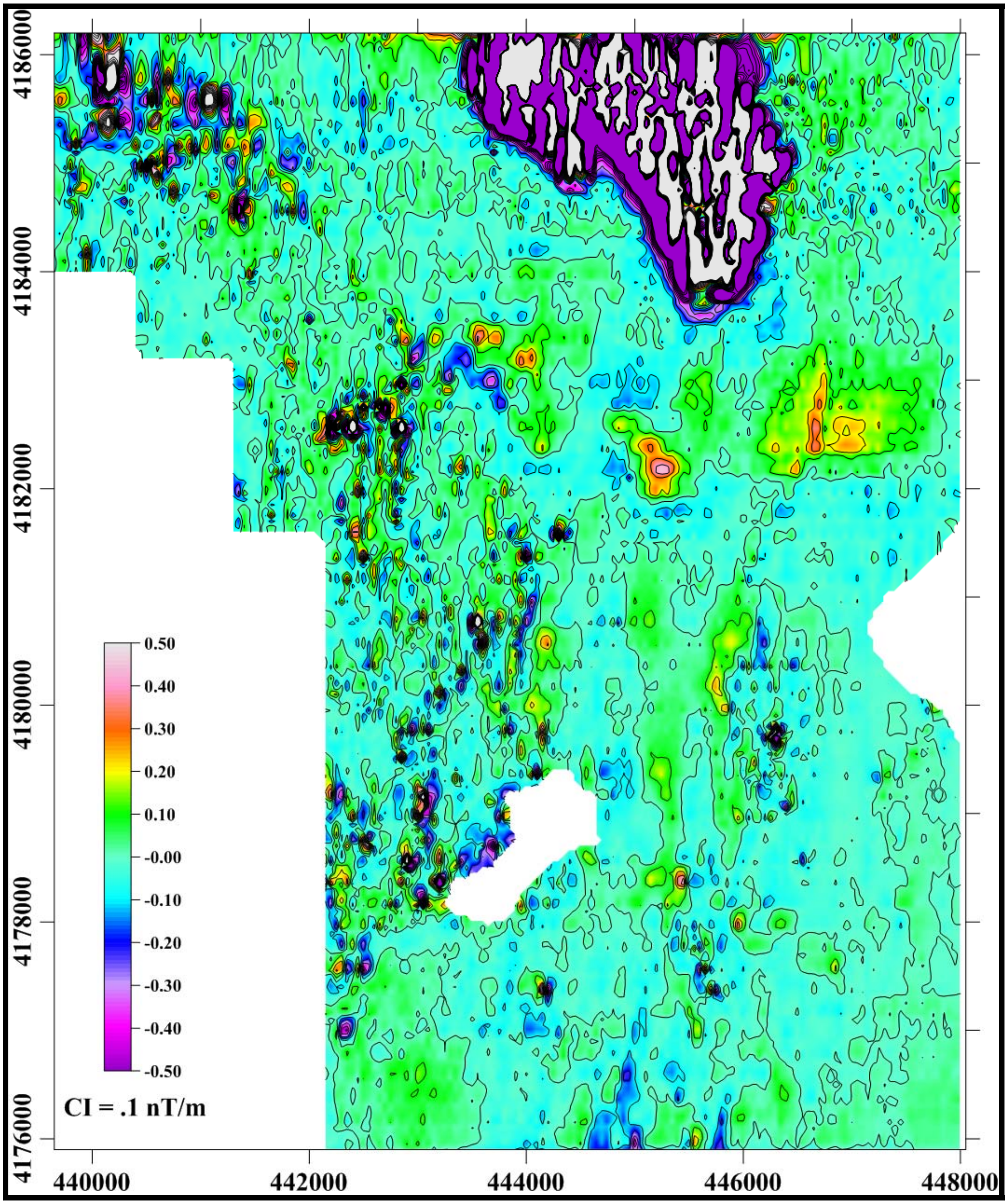

4186000
4184000
4182000
4180000
4178000
4176000
440000
442000
444000
446000
448000
0.50
0.40
0.30
0.20
0.10
-0.00
-0.10
-0.20
-0.30
-0.40
-0.50
CI = .1 nT/m

FIGURE 3: VD