MACTEC

January 20, 2005

Mr. Scott Smale
Brownfields/State Response
Bureau of Corrective Actions
Nevada Division of Environmental Protection
333 W. Nye Lane, Room 138
Carson City, Nevada 89706

GEOPHYSICAL INVESTIGATION REPORT
OLD WHITE PINE COUNTY LANDFILL
BROWNFIELDS PROJECT
10-acre PARCEL AT SOUTHEAST CORNER OF MADISON AND MICHIGAN
ELY, NEVADA

MACTEC Project No. 4306040070

Dear Mr. Smale:

This report presents the findings of MACTEC Engineering and Consulting, Inc.'s (MACTEC) geophysical investigation and backhoe trenching program for the Nevada Division of Environmental Protection (NDEP) Bureau of Corrective Actions, Brownfields Program. The Subject Property is an old rural, unregulated municipal landfill 10 acres in size located near the town of Ely in White Pine County (WPC), Nevada. The old landfill is currently owned by WPC. The County has requested this site be accepted under the NDEP Brownfields Program for cleanup and future development (desired use being residential).

The purpose of the geophysical investigation was to assess the horizontal extent of buried refuse within the 10-acre parcel. Additionally, a backhoe was used to evaluate refuse thickness at selected locations so that a refuse volume could be estimated. The geophysical investigation comprised magnetic (MAG) and electromagnetic (EM) surveys to delineate areas of anomalous geophysical response indicative of buried refuse. Briefly, MAG was used to map the extent of ferrous metal debris in the landfill and EM was used to map changes in the electrical conductivity of subsurface materials. Landfill areas often exhibit higher conductivity than the surrounding native soil and rock because they contain metal debris, decaying refuse, and conductive leachate.

SUMMARY OF FINDINGS

The horizontal extent of buried refuse measures approximately 4.16 acres (Figure 1). In general, the extent of buried refuse corresponds to a distinct, oval-shaped topographic plateau centered within the 10-acre parcel. Refuse thickness varies from approximately 6 feet in the western portion of the site to greater than 11 feet (the maximum reach of the backhoe) in the eastern portion of the site. Maximum refuse thickness was estimated to be approximately 18 feet on the basis of the topographic relief exhibited by the steep, debris laden slope marking the eastern landfill boundary (Figure 2). Calculations using interpreted refuse area acreage, test pit data, and site topography place the buried refuse volume at roughly 66,400 cubic yards. This volume estimate does not include either the concrete or the metal debris on the ground surface.

GEOPHYSICAL METHODS AND INSTRUMENTATION

MAG data were collected with a Geometrics, Inc. Model G-858 gradient magnetometer. EM data were collected with a Geonics, Limited Model EM31-D terrain conductivity meter connected to a Polycorder Model 720 digital data logger. A Trimble Pro-XRS global positioning system (GPS) was used to geo-reference the geophysical data and to map significant site features (e.g., roads, slope breaks, surface metal debris) and produce a detailed basemap on which to present the investigation findings. Additionally, the GPS was used to obtain rough topographic data across the site.

Magnetics

The magnetic method measures the strength of the earth's natural magnetic field at the magnetometer sensor location. Ferrous (iron) metal objects produce localized distortions (anomalies) in the earth's magnetic field intensity. These distortions can be detected by a magnetic survey. Magnetometers are extremely sensitive and will respond to a wide range of metallic targets, from small shallowly-buried objects to larger more deeply buried objects. The burial depth and size of detected metal objects can be estimated from magnetic data. Thus, magnetometers make good tools for mapping landfills, which usually contains metallic debris. Magnetometer investigation depth depends on the target mass. For comparison, the G-858 magnetometer used for this investigation can detect a single 55-gallon drum at a depth of 8 to 10 feet; larger metal masses can be detected at greater depths. Although magnetometers are extremely sensitive, they can only detect (ferrous) metal refuse. For that reason, the magnetic surveys are often performed in conjunction with an electromagnetic (EM) survey for landfill investigations. EM can detect non-metallic refuse, as well as both ferrous and non-ferrous

Electromagnetics

The EM method measures electrical conductivity by means of an applied electromagnetic field. The applied field causes (induces) electric currents to flow in subsurface materials. The strength of the induced current, which is measured by the EM instrument's receiver, is directly proportional to the electrical conductivity of the subsurface material. Buried refuse conducts electricity differently than the surrounding soil, and is thus indicated by anomalous conductivity readings. Metal objects, in particular, are readily detected by the EM method because they are highly conductive compared to soil and rock and therefore produce high-amplitude EM anomalies. Domestic waste in landfill trenches is also readily detected with the EM method because decaying refuse and the associated leachate are usually more conductive than the surrounding soil. Buried construction debris (e.g., concrete, wood, brick) with little or no metal can be difficult to detect with an EM device because the electrical properties of such are similar to those of soil and rock. Such debris usually produces a low-amplitude EM anomaly that is apparent only if the debris is present in quantities sufficient to displace a large volume of native soil. In general, small, isolated pockets of non-metallic refuse are difficult targets for a geophysical survey. The EM31-D instrument used for this investigation consists of transmitter and receiver coils mounted on each end of a 10-foot long PVC boom; the EM31-D can measure electrical conductivity to a depth of approximately 15 feet bgs.

SITE DESCRIPTION AND FIELD PROCEDURES

The investigation area is characterized by a distinct topographic plateau that appears to indicate the refuse area. Metal and concrete debris litter the ground surface in abundance, particularly along the steep eastern and southern slopes of the plateau. The investigation was performed on December 28 through 30, 2004 by a MACTEC geophysicist. At the time of the survey the weather was cold and cloudy with snow flurries. The geophysicist first inspected the parcel to determine the investigation area boundaries and

then staked a 100- x 100-foot grid within a 700- by 800-foot (12.8 acres) area bounded by Madison Street on the north, and Minnesota and Michigan streets to the east and west, respectively (Figure 1). A metal building was taken to mark the southern site boundary as no other distinct boundary was evident to the south. The investigation area boundaries were determined on the basis of landforms indicative of subsurface disposal and the distribution of refuse on the ground surface. The grid stakes provided visual reference points that helped the geophysicist maintain the proper transect spacing and alignment while collecting the geophysical data.

Next, the geophysicist used the Trimble GPS to map site features, particularly roads, slope breaks, and areas with a large amount metal and concrete on the surface. Finally, the geophysical data were obtained. MAG and EM data were collected in separate surveys by hand-carrying each instrument along parallel survey lines spaced approximately 12.5 feet apart. While performing the geophysical surveys, the geophysicist also carried the backpack-mounted Trimble GPS to obtain positioning information for the geophysical data. Counting both MAG and EM surveys, over 46,000 line-feet (8.7 miles) of data were obtained.

The geophysical data were processed and interpreted in the field and the resulting contour maps were used to position backhoe test pits. To evaluate the refuse thickness estimated by the geophysics results, thirteen test pits were excavated at locations selected by the MACTEC geophysicist. The excavation was completed using a backhoe owned and operated by WPC. The removed material was placed back into the pits after inspection and the pit locations were marked with tall staking lath and surveyed with the GPS. Additionally, the geophysicist used a hand-level to estimate north-south and east-west topographic profiles across the site. The profiles were used in combination with the test pit data to generate two, approximate refuse thickness cross sections (Figure 2).

DATA PROCESSING

The MAG, EM, and GPS data were downloaded in the field to a laptop computer and subjected to a QC inspection each evening. The geophysicist used Geosoft OASIS montaj software to produce data profiles and color-filled contour maps of the MAG and EM data. In addition to computer contouring, the magnetic data were subjected to "analytic signal processing," a procedure that reduces magnetic anomalies so their mapped extent more closely match the extent of the "source body" (i.e., the buried metal mass that produced the anomaly). This procedure is helpful because the extreme sensitivity of the magnetic method causes magnetic anomalies to extend well beyond the physical limits of the source body, making appear much larger than its true size. Analytic signal displays depict the horizontal extent of buried metal objects more accurately than total magnetic field or magnetic gradient contour maps. The GPS data were processed with Trimble Pathfinder Office software to produce site basemaps upon which to present the geophysical data and select test pit locations.

Refuse thickness contours interpreted by the MACTEC geophysicist were digitized and input into OASIS montaj to perform the volume estimate calculation.

RESULTS

The interpreted extent of buried refuse at the Old White Pine County Landfill is presented on Figure 1. Cross-sections showing interpreted refuse thickness are presented on Figure 2. OASIS montaj color contour maps of the MAG and EM data are presented on Figures 3 through 5. Additionally, a three-dimensional perspective view of the site topography draped with the magnetic analytic signal grid is presented on Figure 6.

In general, buried refuse occurs within a 4.16 acre oval shaped area that largely conforms to the toe of the topographic plateau centered in the 12.8-acre survey area. In addition to buried refuse, there is a large amount debris on the ground surface, including concrete rubble in the western portion of the site and metal debris (car bodies, appliances, cans, drums) along the eastern and southern slopes of the topographic plateau. Because much of this surface debris extends beyond the buried refuse area, MACTEC took special care to place several test pits in the surface debris areas to insure that no additional buried refuse was present. These test pits were particularly important for defining the lateral limits of buried refuse because geophysical noise from large metal objects on the ground surface severely limited the amount of subsurface information that could be obtained from the MAG and EM data.

The vertical extent of fill (refuse) was readily apparent in the test pits. The fill material itself was characterized by dark soil containing glass, metal, and ash. The presence of ash and deformed bottles indicates that the refuse was burned (the extent and method of the burning cycle is not known). Native soil beneath the refuse appeared yellow-brown and was much lighter in color than the overlying fill. Additionally, the backhoe operator reported feeling a "hardpan" when he dug through the refuse into native material. Refuse thickness from the test pits ranged from 6 feet in the west to greater than 11 feet (the maximum reach of the backhoe) in the east. The maximum refuse thickness in the eastern portion of the fill area was estimated to be approximately 18 feet on the basis of the topographic relief exhibited by the steep, debris laden slope of the eastern landfill boundary. MACTEC used refuse acreage, test pit data, and site topography to interpret a refuse thickness contour map and cross sections (Figure 2). OASIS montaj was used to create a grid of the thickness contour map to facilitate the volume estimate calculation. Fill volume is estimated to be roughly 66,400 cubic yards (CY).

The 66,400 CY of buried refuse volume estimate does not include the concrete and metal debris on the ground surface in both the landfill proper and the surrounds. MACTEC did map those metal and concrete areas, finding them to be an estimated 0.44 and 0.63 acres in size, respectively. In their loose, uncompacted state on the ground surface, an estimated volume of the surface debris, using and average thickness of 2.5 feet would be 1,790 and 2,570 CY for the metal and concrete, respectively.

CONCLUSIONS

An estimated 66,400 CY of buried refuse fill material, characterized by dark soil containing glass, metal, and ash comprises approximately 4.16 acres of the 10-acre subject site. Surface debris comprised primarily of metal and concrete debris covers approximately one-acre of the subject site.

As discussed in the scoping meeting on November 8, 2004, land-mining (technique where wastes are excavated and screened and recyclables removed) of the wastes was discussed as a potential alternative to offsite disposal of the waste. Because the buried refuse is characterized predominantly by ash with little metal debris, current technologies would not make land-mining of the refuse economically feasible. However, based on the amount and surface distribution of the amount of metal and concrete debris, land-mining is a likely alternative to onsite re-use or disposal of this surface material.

Based on MACTEC's current understanding of White Pine County's planned use for the Site and current available funding through the Brownfields Program, offsite disposal is not a likely scenario for the disposition of the refuse. An option may be encapsulation of the buried refuse within a clay liner and offsite recycling of the surface metal and concrete debris.

One option for waste management would include encapsulation of the buried refuse within a clay liner, and offsite recycling of the surface metal and concrete debris. During the up coming scheduled meeting, we would discuss various waste management and disposal options that would allow the County to

optimize future site re-use, and fulfill the NDEP's requirements for "remediation" of the landfill. Based on this meeting, MACTEC would develop costs for implementing the selected remedial plan.

MACTEC appreciates the opportunity to provide environmental consulting services for NDEP, Bureau of Corrective Actions. If you should have any questions, please call either of the undersigned at (510) 628-3227 or (775) 888-9992, respectively.

Sincerely,

MACTEC Engineering and Consulting, Inc

Roark W. Smith
Senior Geophysicist, G.P. 987

William J. Reich, CF
Principal Environmental Scientist

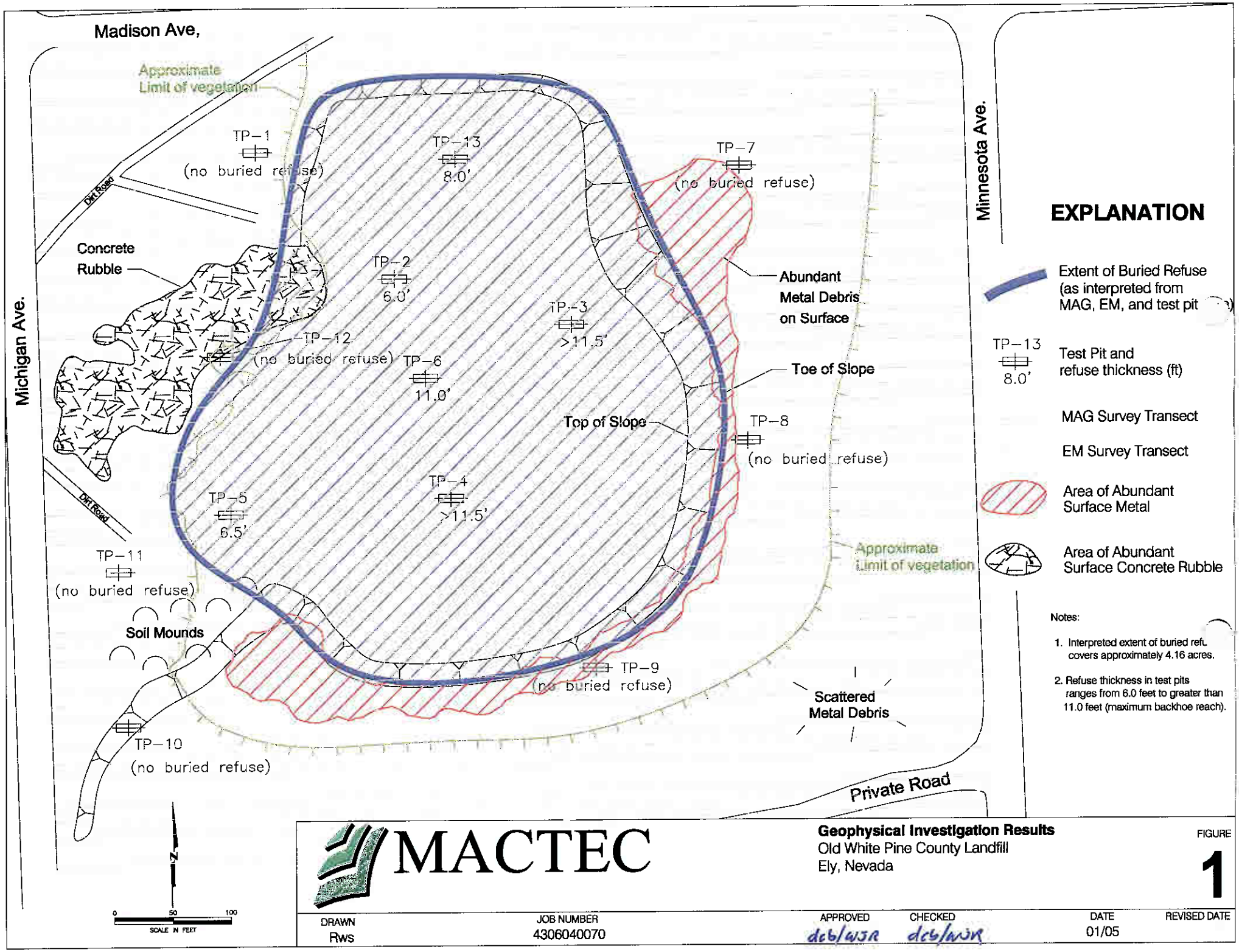
In accordance with Nevada Administrative Code 459.97285,

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state, and local statutes, regulations, and ordinances.

Daniel C. Burns, PG, CEM
Environmental Manager Certification Number1692
Expiration Date: 10/07/05

cc: Addressee by mail and by email to ssmale@ndep.nv.gov
Ms. Karen Rajala, White Pine County Economic Diversification Council,
957 Campton Street, Ely, Nevada 89301
by email to wpcedc@mwpower.net
Mactec Project File

Attachments:
Figure 1 Interpreted Extent of Buried Refuse
Figure 2 Interpreted Refuse Thickness Cross Sections and Contour Map
Figure 3 Magnetic Data Contour Map
Figure 4 Results of Magnetic Survey – Analytic Signal Grid
Figure 5 EM Terrain Conductivity Contour Map
Figure 6 Site Topography with Magnetic Survey Results



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Geophysical Investigation Results
Old White Pine County Landfill
Ely, Nevada

FIGURE
1

DRAWN	JOB NUMBER	APPROVED	CHECKED	DATE	REVISED DATE
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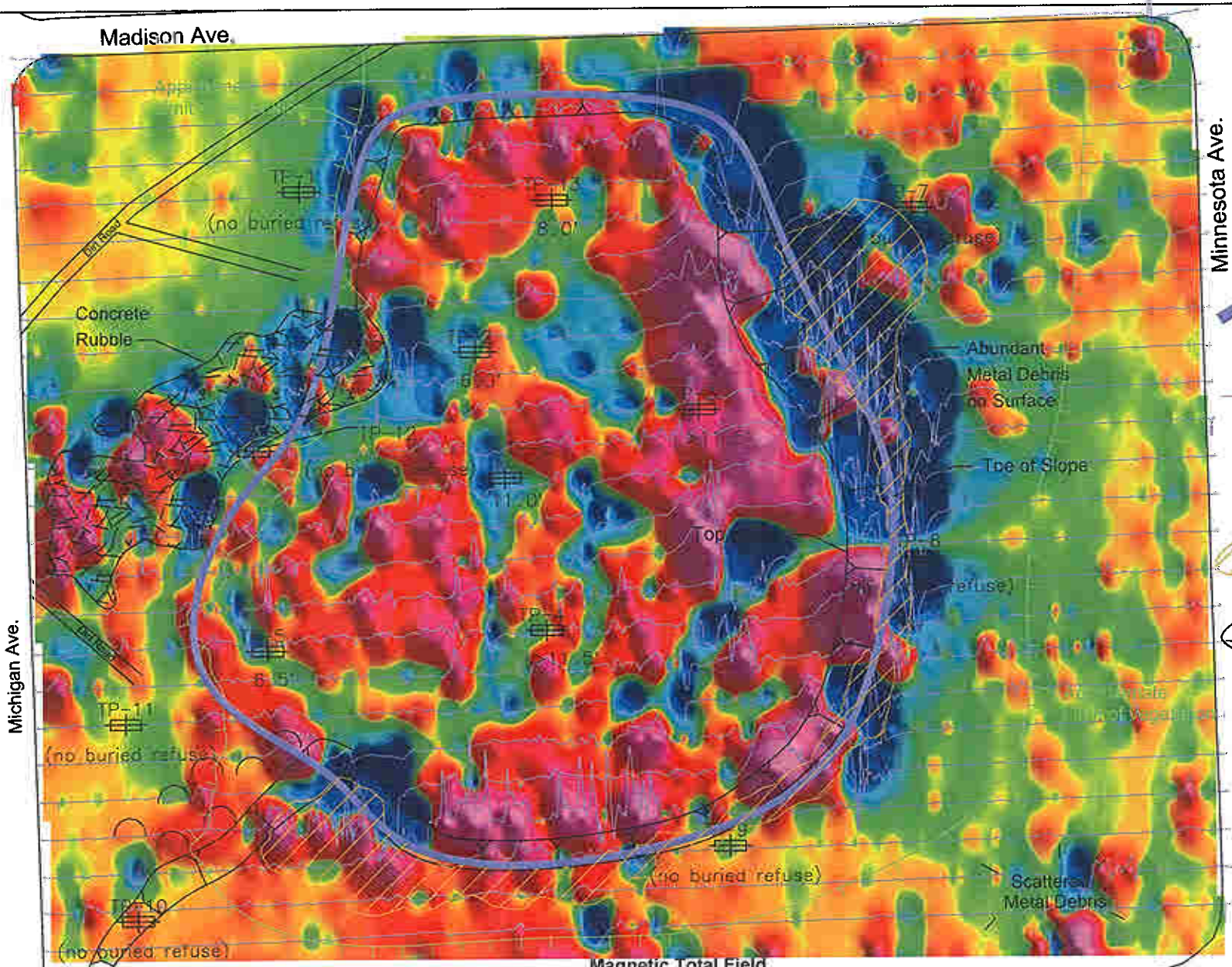

EXPLANATION

- Extent of Buried Refuse (as interpreted from MAG, EM, and test pit data)
- MAG Data Profile
- TP-13, 8.0' — Test Pit and refuse thickness (ft)
- Area of Abundant Surface Metal
- Area of Abundant Surface Concrete Rubble

Notes:

1. Interpreted extent of buried refuse covers approximately 4.16 acres.
2. Refuse thickness in test pits ranges from 6.5 feet to greater than 11.5 feet (maximum backhoe reach).

0 50 100
SCALE IN FEET

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Magnetic Data Contour Map
Old White Pine County Landfill
Ely, Nevada

FIGURE 3

DRAWN	JOB NUMBER	APPROVED	CHECKED	DATE	REVISED DATE
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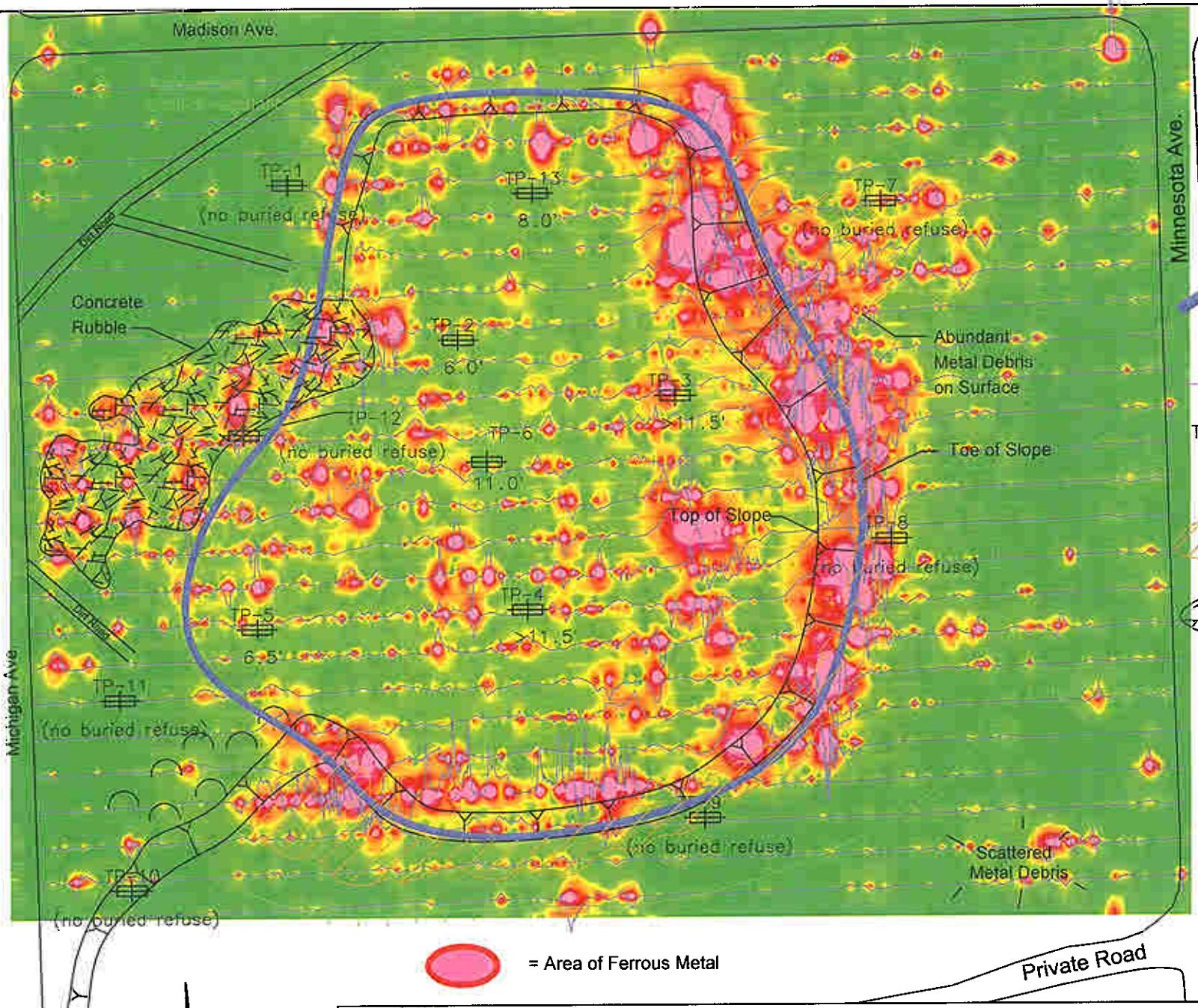

EXPLANATION

- Extent of Buried Refuse (as interpreted from MAG, EM, and test pit data)
- MAG Data Profile
- TP-13 / 8.0' — Test Pit and refuse thickness (ft)
- Area of Abundant Surface Metal
- Area of Abundant Surface Concrete Rubble

Notes:

1. Interpreted extent of buried refuse covers approximately 4.16 acres.
2. Refuse thickness in test pits ranges from 6.5 feet to greater t. 11.5 feet (maximum backhoe reach).

0 50 100
SCALE IN FEET

MACTEC

Magnetic Survey Results - Analytic Signal Grid
Old White Pine County Landfill
Ely, Nevada

FIGURE 4

DRAWN	JOB NUMBER	APPROVED	CHECKED	DATE	REVISED DATE
Rws	4306040070			01/05	

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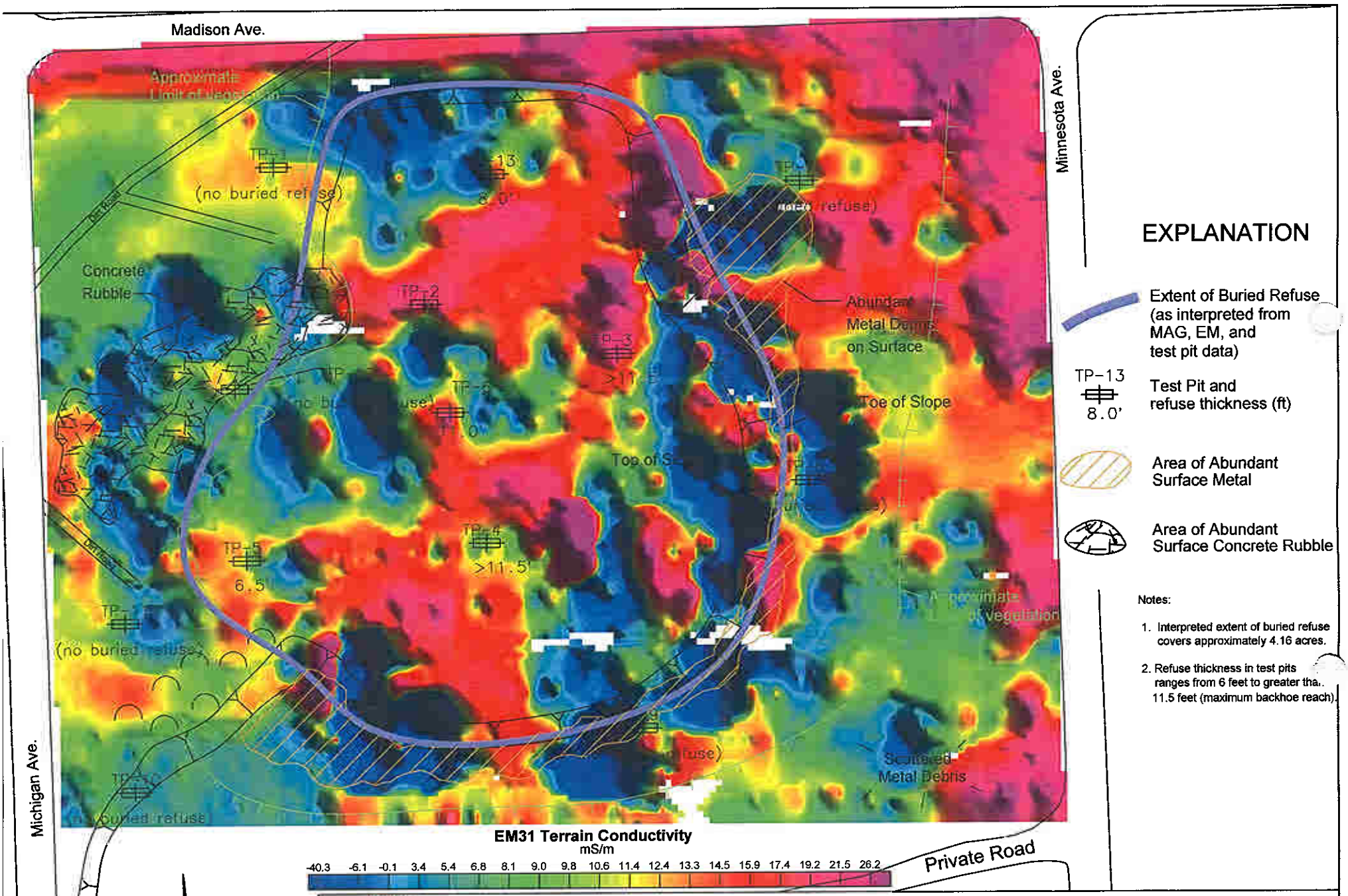

EXPLANATION

- Extent of Buried Refuse (as interpreted from MAG, EM, and test pit data)
- TP-13 / 8.0' — Test Pit and refuse thickness (ft)
- Area of Abundant Surface Metal
- Area of Abundant Surface Concrete Rubble

Notes:

1. Interpreted extent of buried refuse covers approximately 4.16 acres.
2. Refuse thickness in test pits ranges from 6 feet to greater tha.. 11.5 feet (maximum backhoe reach).

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EM31 Terrain Conductivity Contour Map
Old White Pine County Landfill
Ely, Nevada

FIGURE 5

DRAWN	JOB NUMBER	APPROVED	CHECKED	DATE	REVISED DATE
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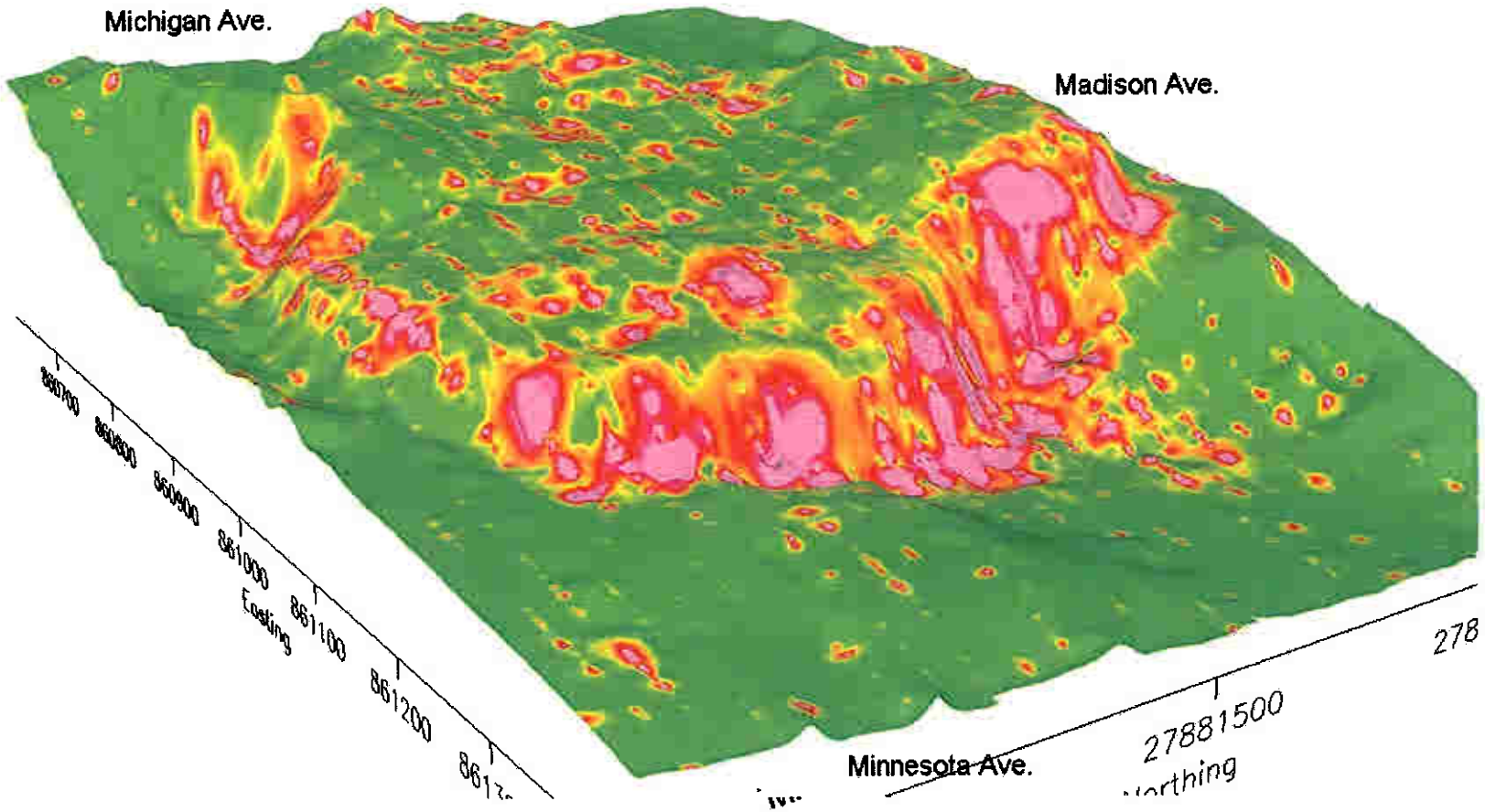

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3-Dimensional Perspective View of Site Topography
Draped with Magnetic Analytic Signal Data Grid
Old White Pine County Landfill
Ely, Nevada

FIGURE 6

DRAWN	JOB NUMBER	APPROVED	CHECKED	DATE	REVISED DATE
RWS	4306040070	wjr/dd6	wjr/dd6	01/05	

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