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REPORT

FILE

Geophysical Investigation Report

Rosen Site
Cortland, New York

Contributing Potentially Responsible Parties

July 1996

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

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1. Introduction

This report presents the results of a geophysical investigation conducted by Blasland, Bouck & Lee, Inc. (BBL) at the Rosen Site in Cortland, New York. The geophysical investigation was conducted in accordance with the United States Environmental Protection Agency (USEPA)-approved scope of work dated June 21, 1995, as modified by a letter from BBL to Mr. Mark Granger, USEPA, dated April 1, 1996. Per USEPA comments, the investigation included the originally proposed former cooling pond area and the following additional areas:

- Near the former scale house area;
- Near the center area of the site;
- In the vicinity of soil boring B-1 (southwest) area; and
- In the coal bin area (east and west).

These additional investigation areas were selected by the USEPA, based on a review of the site history and depositions of former Rosen employees. BBL representatives accompanied Mr. Mark Granger, USEPA, to the site on April 11 and 12, 1996. During this site visit, the investigation areas were modified as set forth in a letter from BBL to Mr. Mark Granger, USEPA, dated April 15, 1996. The geophysical investigation was conducted following the protocols and methodologies presented in the original scope of work and the April 1, 1996 letter.

In accordance with the scope of work, a pilot geophysical testing program was first completed to determine which geophysical methods were likely to be the most effective in delineating subsurface metallic materials. The pilot geophysical testing was performed from April 3, 1996 to April 5, 1996. Following data evaluation, three geophysical methods were selected for the full-scale geophysical investigation. The full-scale geophysical investigation was performed over a two-week period, from April 15, 1996 to April 26, 1996.

The overall objectives of the geophysical investigation were to:

- Characterize, to the extent possible, the nature of fill material present (soil materials, construction materials vs. metallic materials and/or containers).
- Delineate the presence of subsurface areas of metallic materials; and
- Evaluate if groups (i.e., more than 10) of potentially intact drums could be present in the delineated subsurface areas of metallic materials.

This report is organized into six sections as follows:

- Section 1.0, Introduction;
- Section 2.0, Field Methods and Approach, which describes the implementation of the geophysical investigation, including both the pilot study and the full-scale geophysical investigation;
- Section 3.0, Geophysical Investigation Results, which presents the results of the full-scale geophysical investigation, organized by site area;

- Section 4.0, Summary and Conclusions, which summarizes the investigation and proposes test pitting for consideration to further assess selected areas; and
- Section 5.0, References.

2. Field Methods and Approach

The integrated geophysical investigation program consisted of three geophysical techniques in the investigation areas shown on Figure 1. A pilot geophysical program was performed to evaluate the viability of each proposed geophysical technique in the investigation areas (Figure 1) and to determine the most appropriate geophysical methods for the full-scale geophysical investigation. The full-scale geophysical investigation utilized three integrated geophysical methods.

The pilot and full-scale geophysical programs are discussed in the subsequent sections.

2.1 Pilot Geophysical Program

The pilot geophysical program was performed over a three-day period, from April 3 to April 5, 1996, using several geophysical techniques in the proposed investigation areas. The geophysical techniques tested included magnetic (total field and vertical gradient), electromagnetic (frequency-domain using EM-31 and EM-34, and time-domain using EM-61), and GPR. The EM-61 technique was added to the pilot program to evaluate this relatively new technique to traditional magnetic techniques. The locations of the pilot program's test lines were modified to include additional investigation areas outside the former cooling pond area. Pilot test lines were completed, using the aforementioned geophysical techniques, in the following areas:

- Scale house;
- Center area;
- Former coal bin area (west side); and
- Former cooling pond area.

The instrument's responses for each technique and area were plotted and reviewed to evaluate the consistency of the geophysical data. Three geophysical methods were determined to have direct and consistent response in the pilot test areas: EM-31, EM-61, and GPR. These three methods were subsequently proposed and used for the full-scale geophysical investigation. The use of magnetics was found to be less effective than EM-61 in identifying potential subsurface metal due to the decreased spatial resolution caused by surface scrap metal and high gradients caused by site features (e.g., scrap piles). The use of EM-34 was determined to have a practical use only if confirmation of deeper metallic materials (greater the 16 feet) was necessary, such as in the former cooling pond area. The use of EM-34 was therefore held in reserve, to be used on an as needed basis. Data collected during the pilot testing are not included in this report, since the data from the full-scale geophysical investigation are more comprehensive, but are available upon request. Using the three geophysical techniques identified above (EM-31, EM-61, and GPR), the full-scale geophysical investigation was conducted as described below.

2.2 Full-Scale Geophysical Investigation

The full-scale geophysical investigation commenced on April 15, 1996 and was performed over a two-week period. The full-scale geophysical investigation was completed in the following five areas, as shown on Figure 1:

- Scale house area;
- Center area;
- Southwest area;
- Former coal bin area (east and west sides); and
- Former cooling pond area, including the B-1 area.

The field work included the following tasks:

- Establish grid location and clear vegetation and debris from the geophysical survey lines (when necessary);
- Perform electromagnetic surveys consisting of EM-31 and EM-61 in the five areas;
- Perform GPR survey in the five areas; and
- Determine the need for additional geophysical methods or coverage.

The locations of these five areas are shown on the Geophysical Investigation Areas Map (Figure 1). The geophysical investigation was performed with technical oversight by a USEPA representative during the full-scale field work.

Prior to beginning the full-scale geophysical survey of the above identified areas, a horizontal control grid was established for the various investigation areas, along with clearing (when necessary) the geophysical survey lines. The size of the horizontal grid spacing for the survey areas was selected to delineate subsurface areas of metallic materials. The USEPA-approved grids consisted of 10 - foot spacings in the areas outside the former cooling pond and a 25 - foot spacing in the former cooling pond area. The 10-foot grid provides detailed geophysical coverage to adequately delineate metallic materials that could potentially represent a small number (2 or 3) of subsurface drums located in the same area. The 25-foot grid provides detailed geophysical coverage to adequately delineate metallic materials that could potentially represent a small group (3 to 5) of subsurface drums in the same area.

Clearing the geophysical survey lines was necessary in the former cooling pond area, and a portion of the B-1 area that was covered with vegetation. Establishment of the horizontal control grid was completed using the Global Positioning System (GPS) and conventional surveying techniques. Wooden stakes were used to locate geophysical lines and data collection points in each of the investigation areas.

The EM-31 and EM-61 surveys were completed using a 10-foot grid spacing (10-foot spacing between lines with data collected at 10-foot intervals along each line) in the investigation areas, with the exception of the former cooling pond area, where a 25-foot grid spacing was used. The GPR survey was performed using the same grid spacing as the EM surveys, with data collected continuously along each survey line. Data collected during the EM-31 and EM-61 surveys were stored in digital data loggers (Omnidata 720) along with the appropriate site area survey information (i.e., line number and survey direction, etc.).

Procedures performed during the EM-31 survey included:

- Collection of both quadrature phase and inphase response at each data station;
- Collection of background quadrature phase and inphase response along an off-site line location west of the Rosen Site; and
- Calibration of the instrument's sensitivity, phasing, and null setting, prior to beginning the full-scale survey.

Vertical dipoles (horizontal coplanar coil orientation) were used during data collection and the instrument orientation was consistently kept in a north direction during the survey.

Procedures performed during the EM-61 survey included:

- Collection of channel T (top), channel B (bottom), and the channel differential (D) responses at each data station;
- Collection of background channel T, B, and D responses along an off-site line location on west of the Rosen site; and
- Confirmation of battery power level and gain settings.

During data collection, the instrument orientation was consistently maintained in the same (north) direction. Channel B and channel D responses were contoured and used for anomaly interpretation.

Procedures performed during the GPR survey included:

- Determination of vertical high and low pass filter settings of 25 and 200 megahertz (MHZ) for data collection with a 100 MHZ transducer;
- Selection of range settings from 180 to 400 nanoseconds (ns) based on the estimated depth of potential targets and a dielectric constant of 15 to 20 for saturated sands;
- Selection of data collection parameters of 16 bits/sample, 16 scans/second, and 512 samples/scan; and
- Selection of 5 points (typical) for range gains and adjustment of the gains as needed depending on the signal amplification requirements in each of the investigation areas.

GPR data were typically collected using a south to north profile orientation along each survey line, which was consistent with the EM-31 and EM-61 data collection. Additional GPR data were collected using east to west profiles at selected anomaly locations, as described in Section 3.0. Digital data storage was used to record the GPR data, using a Geophysical Survey Systems, Inc. (GSSI), SIR-2 with a separate hardcopy output to a thermal printer.

Geophysical equipment used during this investigation was operated in accordance with the manufacturer's operating procedures and specifications. Results of the full-scale geophysical investigation are provided in the subsequent sections of this report.

3. Geophysical Investigation Results

Data from the electromagnetic surveys (EM-31 and EM-61) were evaluated by preparing contour maps of the responses. The contoured EM-31 data include the quadrature phase response, representing the apparent ground conductivity in milliSiemens/meter (mS/M), and the inphase response, which represents the instrument's response to metallic materials in parts per thousand (ppt). The contoured EM-61 data include channel B and channel D responses in millivolts (mV). The channel B response represents near surface and deeper metallic materials. The channel D (differential) response removes the response from near surface metallic materials, allowing characterization of deeper metallic materials from shallow metallic materials or surface metal. Metallic materials will have the electromagentic responses as described below:

- Increased EM-31 quadrature and inphase responses, two to three times above site background levels; and
- Increased EM-61 Channel D response, two to three times above site background levels.

These elevated responses above background levels are referred to as anomalies.

The GPR data provide radar images of the subsurface by recording reflected energy between materials with different electrical properties. GPR data images were reviewed and evaluated to assess the types of subsurface materials present. In general, metallic materials will have high-amplitude (intensity) GPR responses. Specific types of metallic materials can be differentiated by the sizes and the shapes of the reflection images, also known as targets.

The following discussion of geophysical results for the five areas provides our interpretation of the data, including an evaluation of whether groups of potentially intact drums could be present in the delineated areas of subsurface metallic materials. This evaluation was based on the electromagnetic anomalies indicative of metallic materials in conjunction with GPR responses indicative of metallic materials with the following specifics:

- Circular or hyperbolic shaped targets;
- Two to three-foot diameter targets; and
- Group of targets (i.e., greater than 10) in the same area.

The aforementioned specific GPR targets could also represent other types of metallic targets which are the same sizes and shapes as potential drums, such as pipes or wheel rims.

To facilitate data presentation in this report, GPR survey data that did not contain targets that could potentially represent drums in the five areas of investigation are not included. These data are available in electronic format (Radan - Subsurface Interface Radar files) for review upon request.

Please note that the electromagnetic and GPR surveys for the B-1 area were completed in conjunction with the surveys of the former cooling pond area; however, for presentation of the results, the B-1 area is discussed separately from the former cooling pond area in this report.

3.1 Former Scale House Area

Electromagnetic survey results indicate three apparent anomalies areas potentially caused by subsurface metallic materials. The anomalies defined by the EM-31 and EM-61 are consistent and include the following locations shown on the scale house contour maps (Figures 2 to 5):

- Anomaly 1, located from about 20 feet north to 60 feet north, and 0 feet east to 40 feet east;
- Anomaly 2, located from about 40 north to 60 feet north, and 140 feet east to 160 feet east; and
- Anomaly 3, located from about 0 feet north to 30 feet north, and 160 feet east to 190 feet east.

The remaining EM-31 and EM-61 anomalies detected in the scale house area are attributed to surface features (e.g., former scale house concrete pad) or to surface scrap metal and/or metallic debris (e.g., iron turnings). Anomalies caused by these surface conditions are identified on the appropriate EM-31 and EM-61 contour maps.

The GPR survey data identified the presence of fill materials containing small targets (about 12 inches in diameter or less) at Anomalies 1 and 2. These fill materials are estimated to be about 4 to 6 feet deep, using an average two-way travel time (velocity) of 10 nanoseconds per foot (ns/ft) for saturated sands (GSSI, 1994). Anomaly 1 did not have observed GPR targets that could potentially represent subsurface drums. Anomaly 2, located just southeast of the former scale house building, did have two small areas (about 4 to 5 feet in length) each containing a GPR target that could potentially represent a subsurface drum, but not a group of drums. Due to a significant amount of scrap metal located next to Anomaly 2 in the northeast corner of the scale house area, these two targets could also be caused by scrap materials of about the same size as a drum (e.g., metal pipe) that may be located in this area.

Given the absence of targets at Anomaly 1 and the absence of targets detected at Anomaly 2 that could represent subsurface drums, there is no potential for Anomalies 1 and 2 to contain a group of intact drums.

Anomaly 3 did have GPR targets that could potentially represent subsurface drums. Potential targets were detected at the following locations:

- 15 to 20 feet north and 160 feet east;
- 5 to 25 feet north and 170 feet east;
- 30 to 40 feet north and 180 feet east; and
- 20 to 28 feet north and 190 feet east.

Seven additional east-west oriented GPR lines were completed in the Anomaly 3 area to provide additional information on the locations of potential targets. The lines were spaced at about 5-foot intervals from 0 to 40 feet north, and between 150 to 190 feet east. Potential targets were also identified along several of the east-west oriented GPR lines. Potential target locations identified by GPR are shown on the four EM-31 and EM-61 contour maps, Figures 2 to 5. These targets typically are circular and approximately 2 to 3 feet in length on the GPR files. These potential targets are also characterized by repetitive reflection patterns or "ringing" caused by metallic materials. The estimated depth range of these targets is approximately 4 to 6.5 feet below ground level (bgl). Given the apparent presence of multiple circular targets that could potentially represent drums, there is potential for Anomaly 3 to contain a group of subsurface intact drums.

Selected GPR data for Anomaly 3 survey lines, with potential target areas identified, are provided in Appendix A.

3.2 Center Area

The electromagnetic survey data indicate the presence of one anomaly potentially caused by subsurface metallic materials in the center area. This apparent anomaly (Anomaly 1) is located from approximately grid interval 50 to 80 feet north and 80 to 130 feet east, as shown on the series of contour maps prepared for the center area, Figures 6 to 9. The remaining EM-31 and EM-61 anomalies detected in the center area are attributed to either surface scrap metal or metallic debris, as identified on the appropriate EM-31 and EM-61 contour maps, Figures 6 to 9.

The GPR survey was performed along 15 north-south oriented grid lines in the center area, with four additional east-west GPR lines completed across Anomaly 1. The four additional east-west GPR lines were spaced at 10-foot intervals from 40 to 80 feet north, and between 110 and 150 feet east. The EM and GPR data indicate a significant amount of metallic debris is present in the Anomaly 1 area, with primarily small diameter (6 inches or less) metallic targets contributing to the source of the anomaly. Anomaly 1 did have one small area (about 5 feet in length) that contained a target that could potentially represent a subsurface drum. This single target could also be caused by a pipe or another metallic object having dimensions similar to a drum. The intensity and orientation of the EM anomaly suggests shallow scrap metal is responsible for this anomaly. Given the limited number of targets that could potentially represent subsurface drums, there is no potential for Anomaly 1 to contain a group of intact drums.

3.3 Southwest Area

The southwest area comprises the area immediately north of the B-1 area, as shown on the Geophysical Investigation Areas Map (Figure 1). The electromagnetic survey data indicate the apparent anomalies delineated in the southwest area are caused by either surface features (e.g., scrap piles and tanker trucks) or scrap metal debris just below the ground surface. There were no significant EM-31 or EM-61 anomalies identified as potentially caused by subsurface materials in the southwest area. Two apparent anomalies were determined to be attributed to near surface scrap metal based on the EM and GPR data. These two areas and the apparent anomalies caused by surface features are identified on the EM-31 and EM-61 contour maps (Figures 10 to 13).

The GPR survey was performed along north-south oriented grid lines spaced at 10-foot intervals. Four additional east-west oriented GPR profiles were completed in the southwest area to confirm the nature of reflections observed on the north-south profiles. The GPR data indicate that the subsurface materials present in the southwest area are typically construction debris and fill materials mixed with scrap metal. The GPR data did not contain targets that could represent subsurface drums. Given the absence of anomalies/targets in the southwest area that could potentially represent drums, there is no potential for this area to contain a group of intact drums.

3.4 Former Coal Bin Area

The geophysical survey of the former coal bin area was subdivided into two sections; an east and west section due to physical features (scrap piles) in the center of this area. Results of the geophysical survey performed on the east side of the former coal bin are provided first, followed by the results of the geophysical surveys performed on the west side of the former coal bin.

3.4.1 Former Coal Bin - East

The electromagnetic survey data indicate no significant apparent anomalies potentially caused by subsurface metallic materials. Several small EM-31 and EM-61 anomalies are located in the central portion of this area as follows:

- From locations 50, 60, and 70 east, and from 40 to 60 feet north; and
- From locations 100, 110, and 120 east, and from 30 to 50 feet north.

These two slight anomalies do not correlate well with the two areas identified during the GPR survey which contained potential targets.

The location of the EM-31 and EM-61 anomalies identified above are shown on the appropriate contour maps (Figures 14 to 17). The remaining EM-31 and EM-61 anomalies detected in the former coal bin - east are due to surface scrap and metallic debris. Anomalies caused by these features are identified on the appropriate EM-31 and EM-61 contour maps.

The majority of GPR targets were located in two areas designated Anomalies 1 and 2, as shown on the four EM contour maps (Figures 14 to 17). The GPR data identified fill materials containing smaller diameter targets (typically 12 inches or less). The fill materials also contained frequent flat metallic reflectors consistent with subsurface scrap metal. Given the low correlation between the EM and GPR data, and the absence of targets that could potentially represent subsurface drums, there is no potential for Anomalies 1 and 2 to contain a group of intact drums.

3.4.2 Former Coal Bin - West

The electromagnetic survey data of the former coal bin - west indicate two apparent anomalies potentially caused by subsurface metallic materials. These two areas defined by the EM-31and EM-61 are consistent and include the following locations:

- Anomaly 1 located from about 0 to 70 north, and extending from 0 to 140 feet east; and
- Anomaly 2 located from about 60 to 80 north, and extending from 0 to 90 feet east.

The remaining EM-31 and EM-61 anomalies detected in the former coal bin - west are attributed to surface scrap metal as identified on the appropriate EM-31 and EM-61 contour maps (Figures 18 to 21).

The GPR survey data identified fill materials with multiple circular targets located in Anomaly 1. These GPR targets could potentially represent subsurface drums based on the size, magnitude, and shape of GPR reflections. In Anomaly 1, the depth of fill materials and potential targets typically range from about 5 to 6.5 feet below ground level (bgl) in the western half of this area and increases in depth to the northeast. Potential target locations identified during the GPR survey are shown on the EM-31 and EM-61 contour maps, Figures 18 to 21. Due to the apparent presence of multiple circular targets that could potentially represent intact drums and the correlation between the GPR targets and EM anomalies in this area, there is a potential for Anomaly 1 to contain a group of intact drums.

In Anomaly 2, the GPR survey identified fill materials with several (5 to 10) circular targets and metallic debris. The depth of the fill materials and potential targets typically ranged from about 4 to 6 feet bgl. Due to the absence of multiple circular targets that could potentially represent subsurface drums, there is no potential for Anomaly 2 to contain a group of intact drums. Furthermore, due to the significant amount of scrap metal located in the vicinity of the former coal bin west area, many of the above described targets associated with both Anomalies 1 and 2 could be caused by scrap materials having about the same dimensions as a drum such as a metal pipe or wheel rim.

Selected GPR data for Anomalies 1 and 2 containing potential targets are provided in Appendix A.

3.5 B-1 Area

The electromagnetic and GPR surveys of the B-1 area were completed in conjunction with the geophysical survey of the former cooling pond area. For presentation of the results in this report, the B-1 area is discussed separately from the former cooling pond area. The electromagnetic data collected during the field work are presented on the EM-31 and EM-61 contour maps for the former cooling pond (Figures 22 to 25). The EM-31 and EM-61 contour maps indicate the following two anomalies are potentially caused by subsurface metallic materials:

- Anomaly 1, located from about 60 to 90 feet north, and 140 to 275 feet east; and
- Anomaly 2, located from about 60 to 80 feet north, and 5 to 100 feet east.

The magnitudes of the EM-31 and EM-61 responses for Anomaly 2 in the B-1 area are significantly less than Anomaly 1, indicating that less metallic material is associated with Anomaly 2.

GPR targets from Anomaly 1 indicate metallic debris is present in this area, with the majority of the targets displaying flat, linear features, consistent with crushed metal debris or scrap metal. Also within this area, intermittent (4 or 5) circular targets were observed that could potentially represent subsurface drums. Due to the significant amount of scrap metal located in the vicinity of the B-1 area, many of these targets appear to be caused by scrap materials similar to those observed at the surface. The circular targets could also be caused by pipes or other metallic objects. The distribution of potential targets, identified by GPR in Anomaly 1, are shown on the EM-31 and EM-61 contour maps, Figures 22 to 25.

The GPR results from Anomaly 2 indicate metallic targets are present in this area, although to a lesser degree than Anomaly 1. Again, the majority of the objects have flat, linear features, which are consistent with crushed metal debris. A few (2 to 3) circular targets were also observed in the Anomaly 2 area that could potentially represent subsurface drums. The distribution of potential targets identified by GPR in Anomaly 2 are shown on Figures 22 to 25.

The depth of targets detected in Anomalies 1 and 2 typically ranged from about 4 to 9 feet bgl, with a majority of the GPR targets occurring between about 6 and 7 feet bgl.

Previous test pit excavations completed for the RI and Supplemental RI included two locations in the immediate vicinity of Anomalies 1 and 2, as shown on Figures 22 to 25. The supplemental RI test pits TP-1 and TP-10 were completed in the B-1 area. Materials encountered at these locations included:

- TP-1: fill materials consisting of fine to coarse sand and silt with gravel and cobbles mixed with bricks, plastic, ash and dried black tar; and

- TP-10: fill materials consisting of fine to coarse sand with silt, gravel, cobbles, concrete and slag.

No drums or drum fragments were encountered in these test pit excavations. Detailed test pit logs and descriptions of the excavated materials were provided in the RI Report (BBL,1992/ 1994).

Due to the limited number (5 or less) of circular targets that could potentially represent subsurface drums, and the absence of any drums in previous test pit excavations completed in this area, there is no potential for Anomalies 1 and 2 to contain a group of intact drums.

3.6 Former Cooling Pond Area

Geophysical data were collected in this area using a 25-foot grid spacing due to the size of this area and surface conditions (i.e., wooded and overgrown) of the former cooling pond. Due to surface conditions, the geophysical lines required clearing with a bulldozer prior to the survey. The electromagnetic survey data indicate the presence of three apparent anomalies, potentially caused by subsurface metallic materials. These locations are designated Anomalies 1, 2, and 3 as shown on the EM-31 and EM-61 contour maps (Figures 22 to 25). The remaining EM-31 and EM-61 anomalies detected in the former cooling pond area are attributed to either surface scrap metal or debris piles, and have been identified on the appropriate contour maps.

Within each of the three apparent EM anomalies, the GPR data identified fill materials with only a few widely scattered (i.e., less than 5) metallic circular targets. Due to the significant amount of scrap metal and construction debris present in the former cooling pond area, these targets are most likely caused by these materials. The distribution of these potential GPR targets at each anomaly location is shown on the EM contour maps (Figures 22 to 25). Depth to the GPR targets generally ranged from approximately 7 to 14 feet bgl, with occasional deeper targets at about 16 feet bgl.

RI test pit T-08 was excavated in the former cooling pond area, in the immediate vicinity of Anomaly 1 as shown on Figures 22 to 25. Fill materials were encountered to the termination depth of the test pit at 13 feet bgl. Fill materials consisted of bricks, wood, wire, coal and scrap metal; which agree with the types of materials interpreted on the GPR records for this area. No drums or drum fragments were encountered in this test pit excavation.

In general, the GPR survey data identified the presence of fill materials throughout the former cooling pond area ranging in depth from about 9 feet in the western portion of the former cooling pond area to about 23 feet in the central and southeast portions of the former cooling pond area. The fill materials appear to contain a large amount of construction debris, concrete, brick, and wooden materials. In the vicinity of the concrete retaining wall along the northeast side of the former cooling pond area, reworked fill soils are evident south of the concrete wall. These fill soils appear to have been graded and show little signs of disturbance by additional filling in this area. In the southeast corner of the former cooling pond area, more small metallic targets were encountered indicating a general increase in metallic debris, possibly mixed with municipal solid waste in this area.

The presence of mixed solid waste in the southeast corner of the former cooling pond is further corroborated by the high EM-31 quadrature phase response in this area (see Figure 24). The EM-31 quadrature phase response is representative of apparent ground conductivity. This high quadrature response is commonly due an increase in iron and chloride ions due to the presence of municipal solid waste. Apparent iron precipitation was also visually observed along the southeast corner of the former cooling pond area.

Given the absence of multiple GPR targets detected at Anomalies 1, 2, and 3 in the former cooling pond that could potentially represent subsurface drums, there is no potential for the former cooling pond to contain a group of intact drums.

4. Summary and Conclusions

The locations of the apparent anomalies delineated for each area during the geophysical investigation are summarized in Table 1, along with an evaluation of whether groups of intact drums could be present in these anomalies. Locations of all the anomalies that correspond to those summarized in Table 1 are shown on Figure 26. The focus of the geophysical investigation was on areas that the USEPA believed had the greatest potential (based on depositions from Rosen's former employees and a site visit) to contain groups of intact subsurface drums. As expected, the geophysical investigation has identified the presence of fill in these areas, and in some cases indicated the potential presence of subsurface metallic debris and scrap metal.

Present site conditions and surface and subsurface conditions identified during this geophysical investigation demonstrate that the investigation areas and the site, in general, contain significant amounts of metallic debris, fills, and scrap metal. These materials were observed to range in depth from about 5 to 8 feet in areas outside the former cooling pond, and to range in depth from about 9 to 23 feet in the former cooling pond area.

The geophysical investigation has identified two areas where groups of intact drums could be present. The two anomalies with corresponding electromagnetic and GPR responses indicative of metallic materials that also contained multiple GPR targets potentially characteristic of intact drums include:

- Scale house area, Anomaly 3; and
- Former coal bin area - west, Anomaly 1.

Test pit excavations should be considered at these two anomaly locations.

5. References

Blasland, Bouck & Lee, Inc., Integrated Geophysical Program - Former Cooling Pond Area, Rosen Site, Cortland, New York, Scope of Work, June 21, 1995.

Blasland, Bouck & Lee, Inc., Letter from Nancy E. Gensky to Mark E. Granger of the United States Environmental Protection Agency (USEPA) , Region 2 (April 1, 1996).

Blasland, Bouck & Lee, Inc., Health and Safety Plan. Remedial Investigation/Feasibility Study, Rosen Site, Cortland, New York. October 1989, Final Revision December 1990.

Blasland, Bouck & Lee, Inc., Remedial Investigation Report, Rosen Site, Cortland, New York, October 1992, Revised May 1994.

Geonics Limited, Operating Manual for the EM-31-D Non-Contacting Terrain Conductivity Meter, Mississauga, Ontario, 1984.

Geonics Limited, EM-61 High Sensitivity Metal Detector Operating Manual, Mississauga, Ontario, September 1994.

Geophysical Survey Systems, Inc., SIR System - 2 Operational Manual, Manual #MN72-140, June 8, 1994.

Geophysical Survey Systems, Inc., Radan for Windows Operating System Manual, Version 3.1, November 15, 1995.

Table

TABLE 1

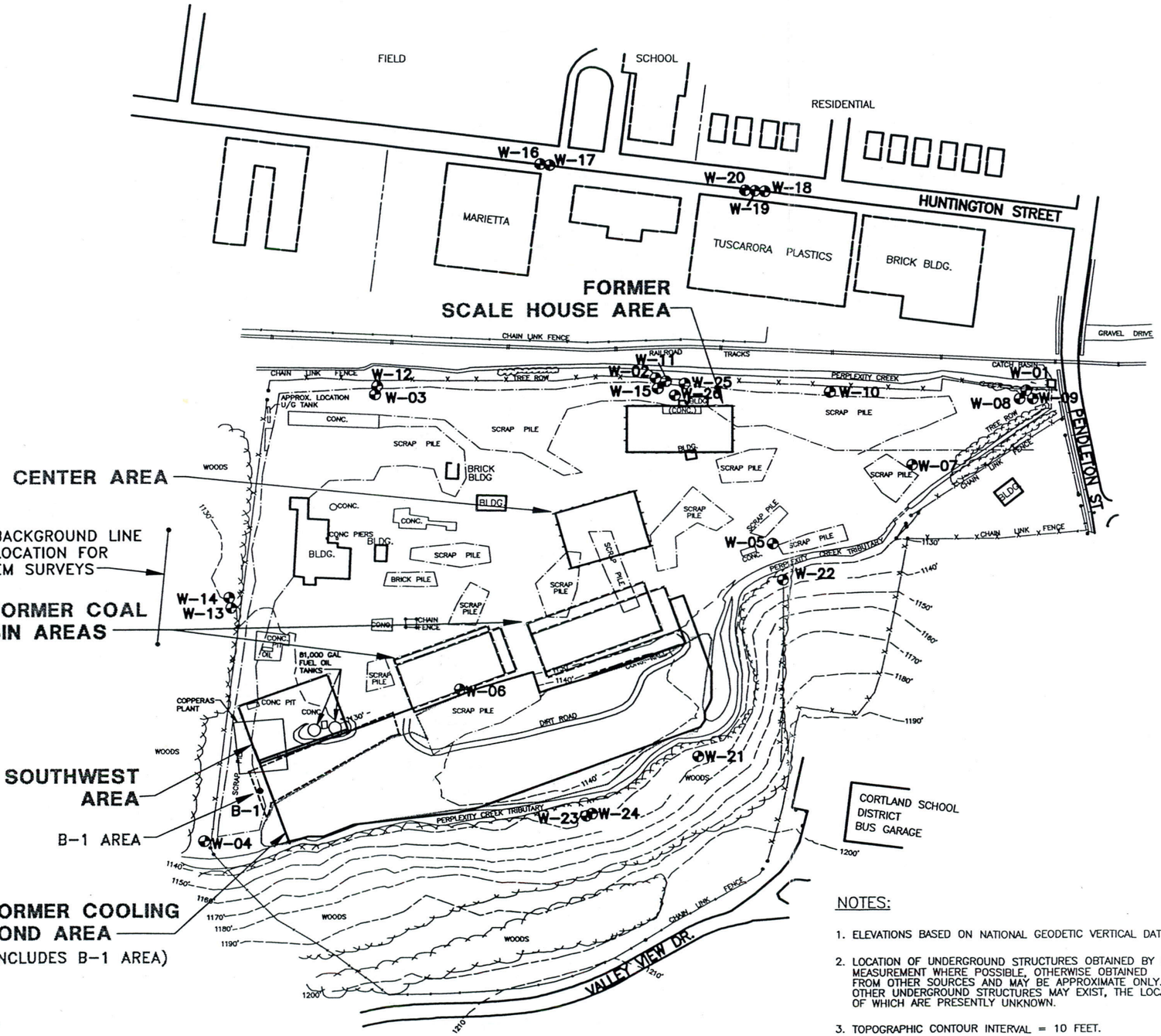
GEOPHYSICAL SURVEY
ROSEN SITE
CORTLAND, NEW YORK

SUMMARY OF ANOMALIES

Investigation Area	Anomaly Number & Description	Potential for Groups of Subsurface Intact Buried Drums
Scale House	1. EM anomaly with small GPR targets (metallic debris).	No
	2. EM anomaly with few circular GPR targets.	No
	3. EM anomaly with multiple circular GPR targets.	Yes
Center Area	1. EM anomaly with small GPR targets (metallic debris).	No
Coal Bin (East)	1. Slight EM anomalies with primarily small GPR targets (metallic debris). EM and GPR data do not correlate well.	No
	2. Slight EM anomalies with primarily small GPR targets (metallic debris). EM and GPR data do not correlate well.	No
Coal Bin (West)	1. EM anomaly with multiple circular GPR targets.	Yes
	2. EM anomaly with several circular GPR targets.	No
B-1 Area	1. EM anomaly with several flat (few circular) GPR targets.	No
	2. EM anomaly with several flat (few circular) targets.	No
Southwest Area	Anomalies attributed to surface features or scrap metal.	No
Cooling Pond Area	1. Slight EM anomaly with few circular targets.	No
	2. Slight EM anomaly with few circular targets.	No
	3. Moderate EM anomaly with few circular targets.	No

Figures

Appendix A
GPR Data Files



LEGEND

- MONITORING WELL
- SOIL BORING

SCALE
200' 0 200'

NOTES:

1. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
2. LOCATION OF UNDERGROUND STRUCTURES OBTAINED BY FIELD MEASUREMENT WHERE POSSIBLE, OTHERWISE OBTAINED FROM OTHER SOURCES AND MAY BE APPROXIMATE ONLY. OTHER UNDERGROUND STRUCTURES MAY EXIST, THE LOCATIONS OF WHICH ARE PRESENTLY UNKNOWN.
3. TOPOGRAPHIC CONTOUR INTERVAL = 10 FEET.

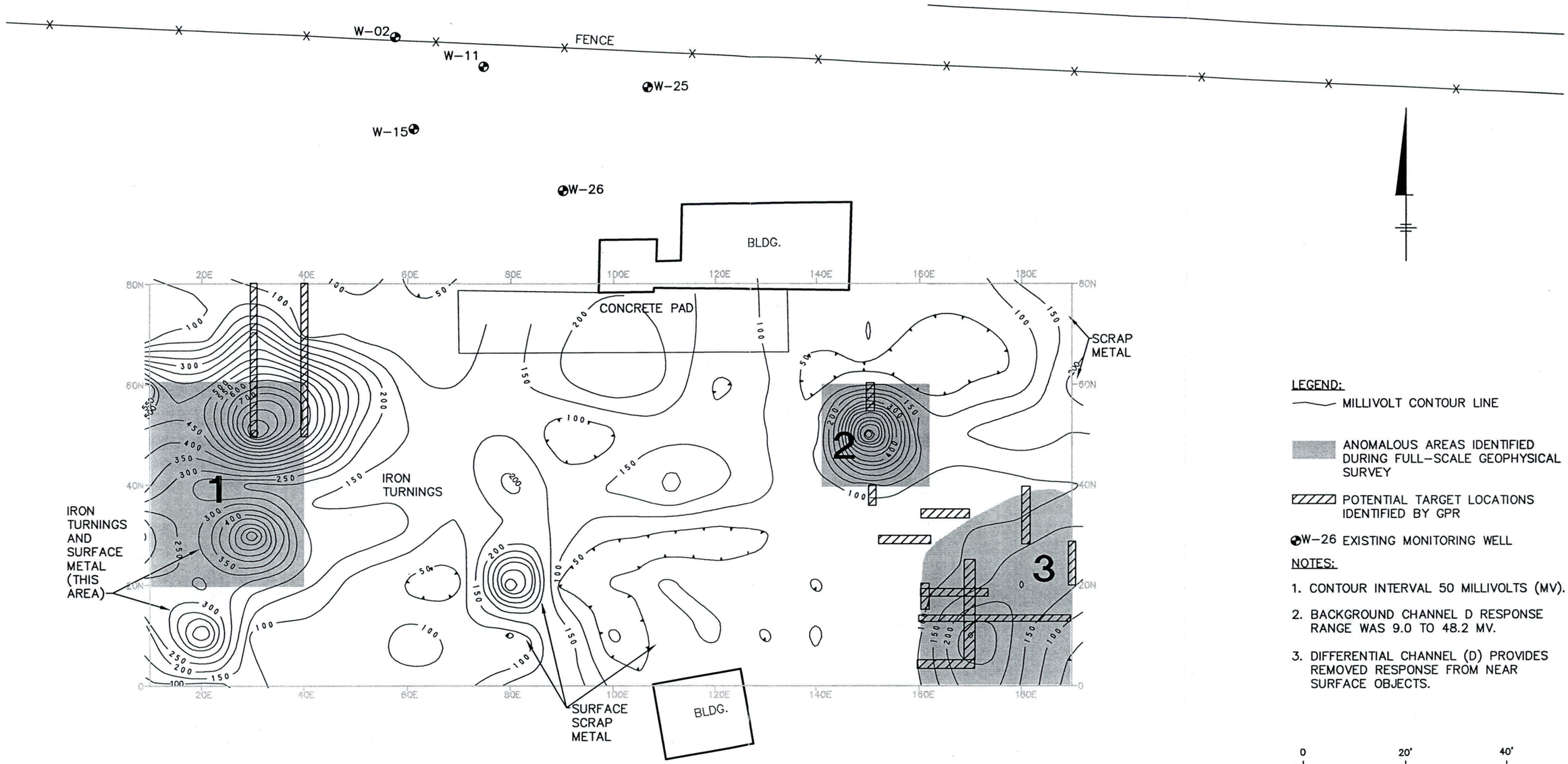
ROSEN SITE
CORTLAND, NEW YORK
GEOPHYSICAL INVESTIGATION

GEOPHYSICAL INVESTIGATION AREAS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1

L ON: GIA; L OFF: SUM, ANOMALY, NUM
P: STD-PCP/BL
5/9/96 SYR-54-PGL
49406004/4940JGP9.DWG



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- W-26 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 50 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

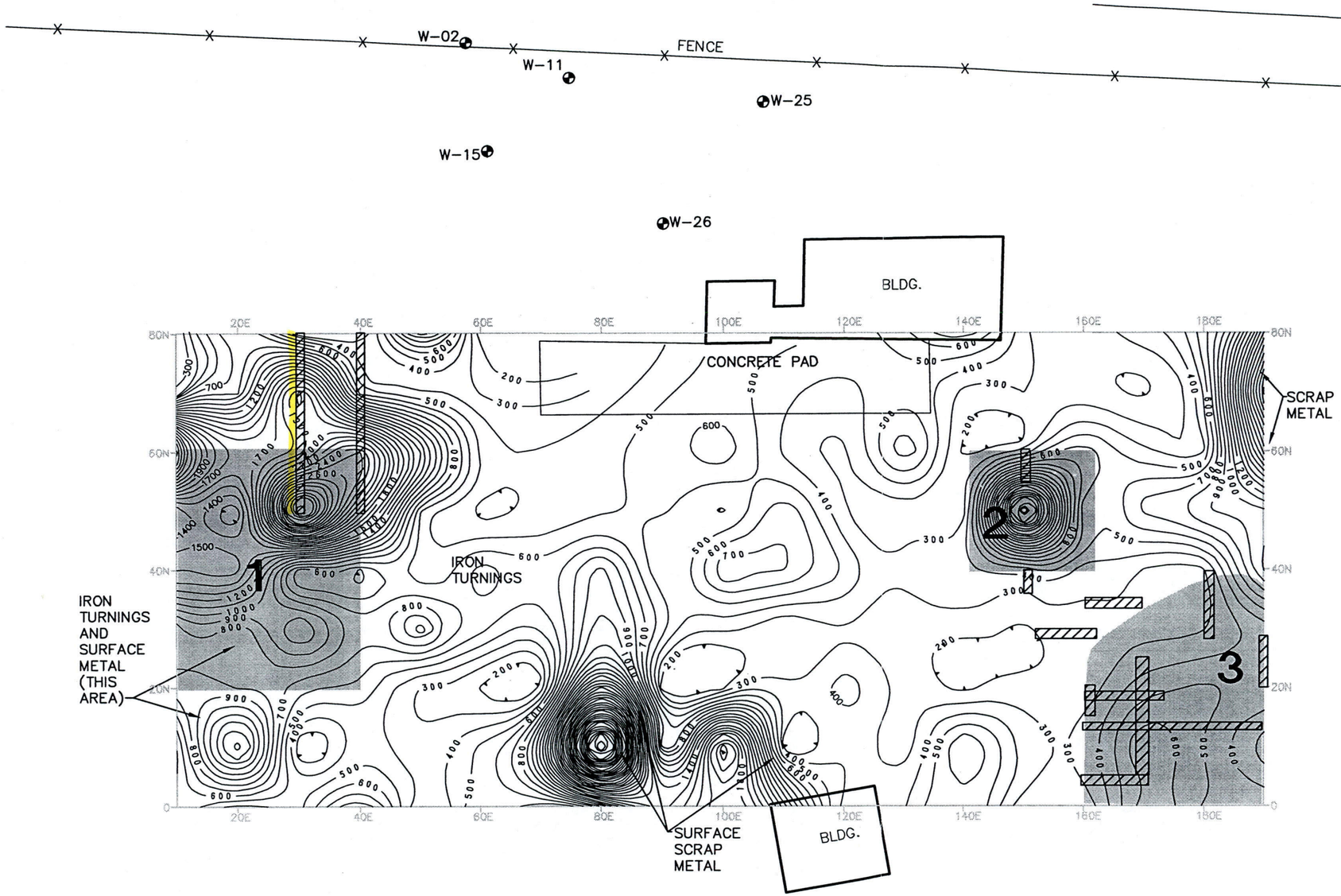
GEOPHYSICAL INVESTIGATION

SCALE HOUSE AREA - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2

L:31*,61* OFF; 61SCD,61SCD-D* ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP3.DWG



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- W-26 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 100 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL B RESPONSE RANGE WAS -7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

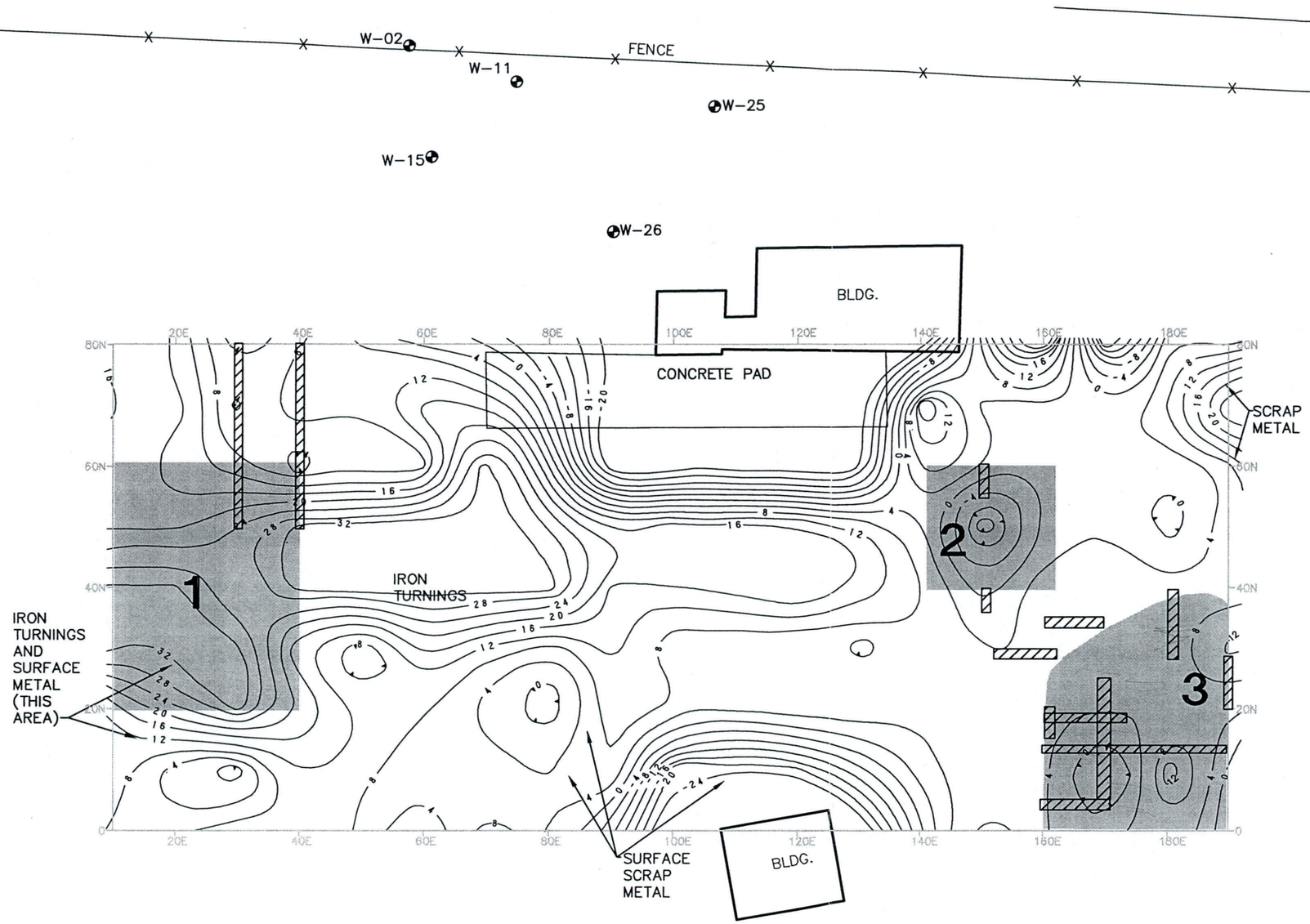
GEOPHYSICAL INVESTIGATION

SCALE HOUSE AREA - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3

L:31*,61* OFF; 61SHB, 61SHB-D* ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP3.DWG



LEGEND:

- INPHASE RESPONSE CONTOUR LINE (ppt)
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- W-26 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.
3. AVERAGE BACKGROUND INPHASE RESPONSE WAS -1.1 ppt.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

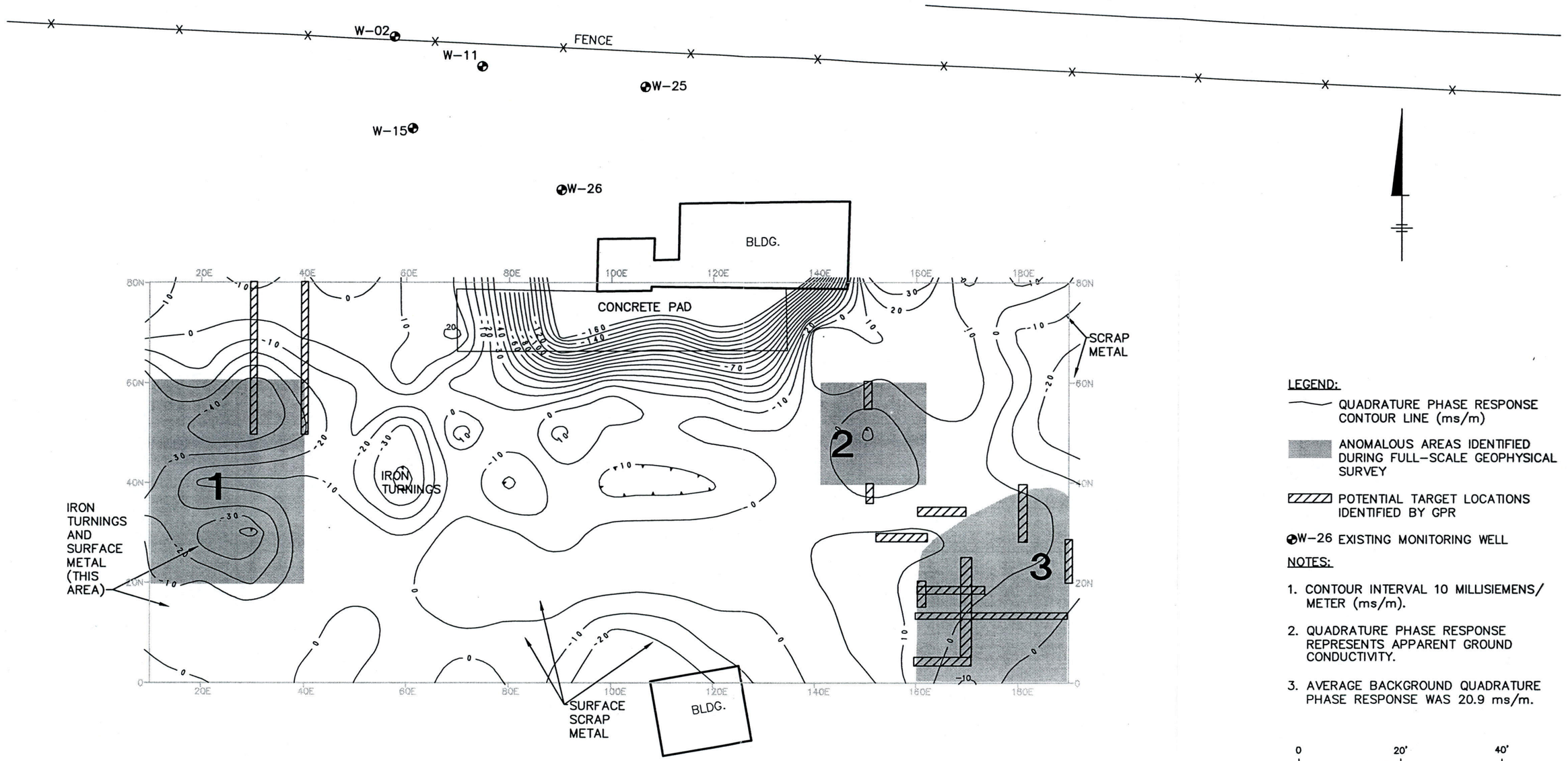
GEOPHYSICAL INVESTIGATION

SCALE HOUSE AREA - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 4

L:31*,61* OFF; 31SCZ2,31SCZ2-D ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP3.DWG



LEGEND:

- QUADRATURE PHASE RESPONSE CONTOUR LINE (ms/m)
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- W-26 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 10 MILLISIEMENS/METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. AVERAGE BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

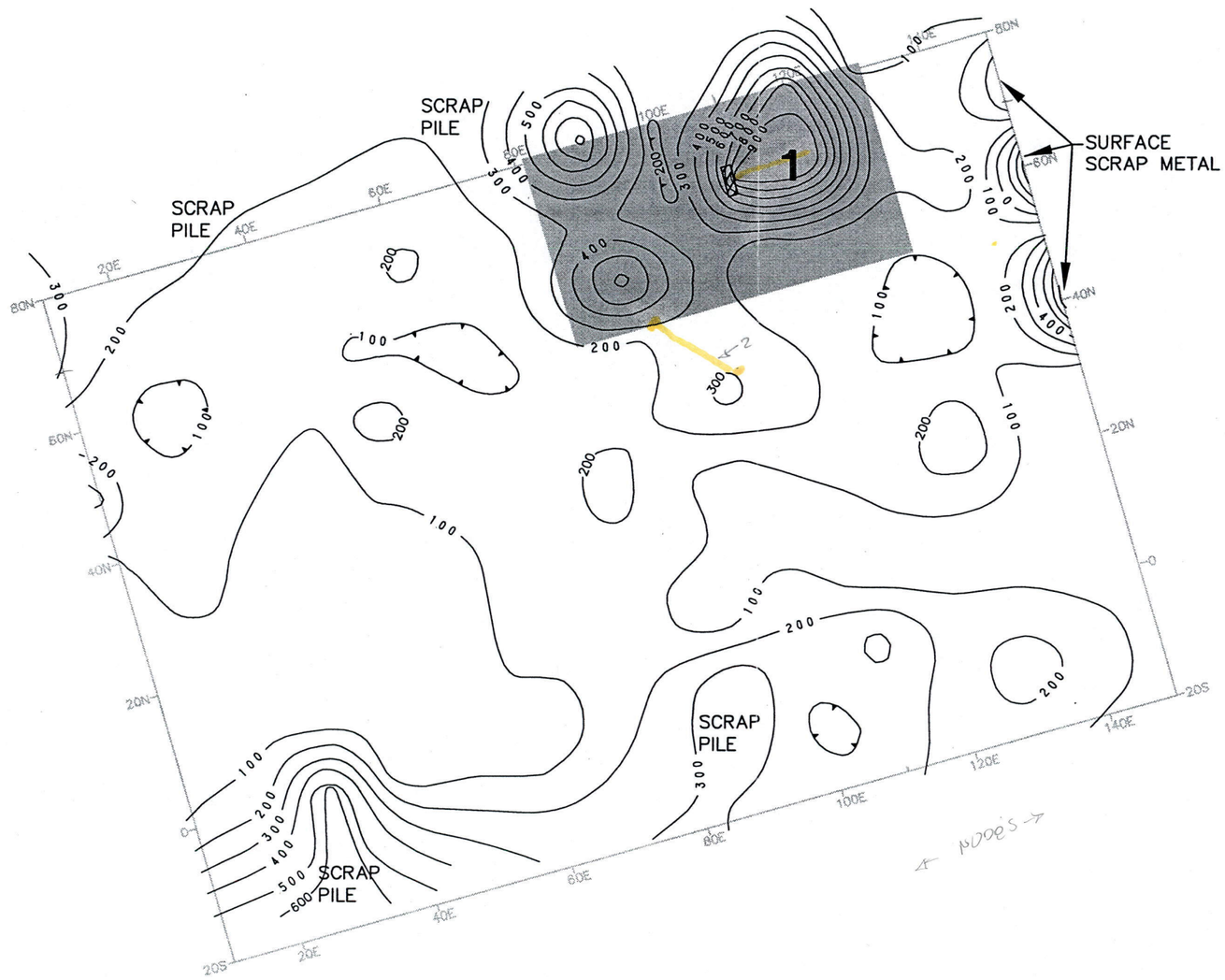
GEOPHYSICAL INVESTIGATION

SCALE HOUSE AREA - EM31 SURVEY QUADRATURE PHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 5

L:31*.61* OFF; 31SHZ1 ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP3.DWG



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

1. CONTOUR INTERVAL 100 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

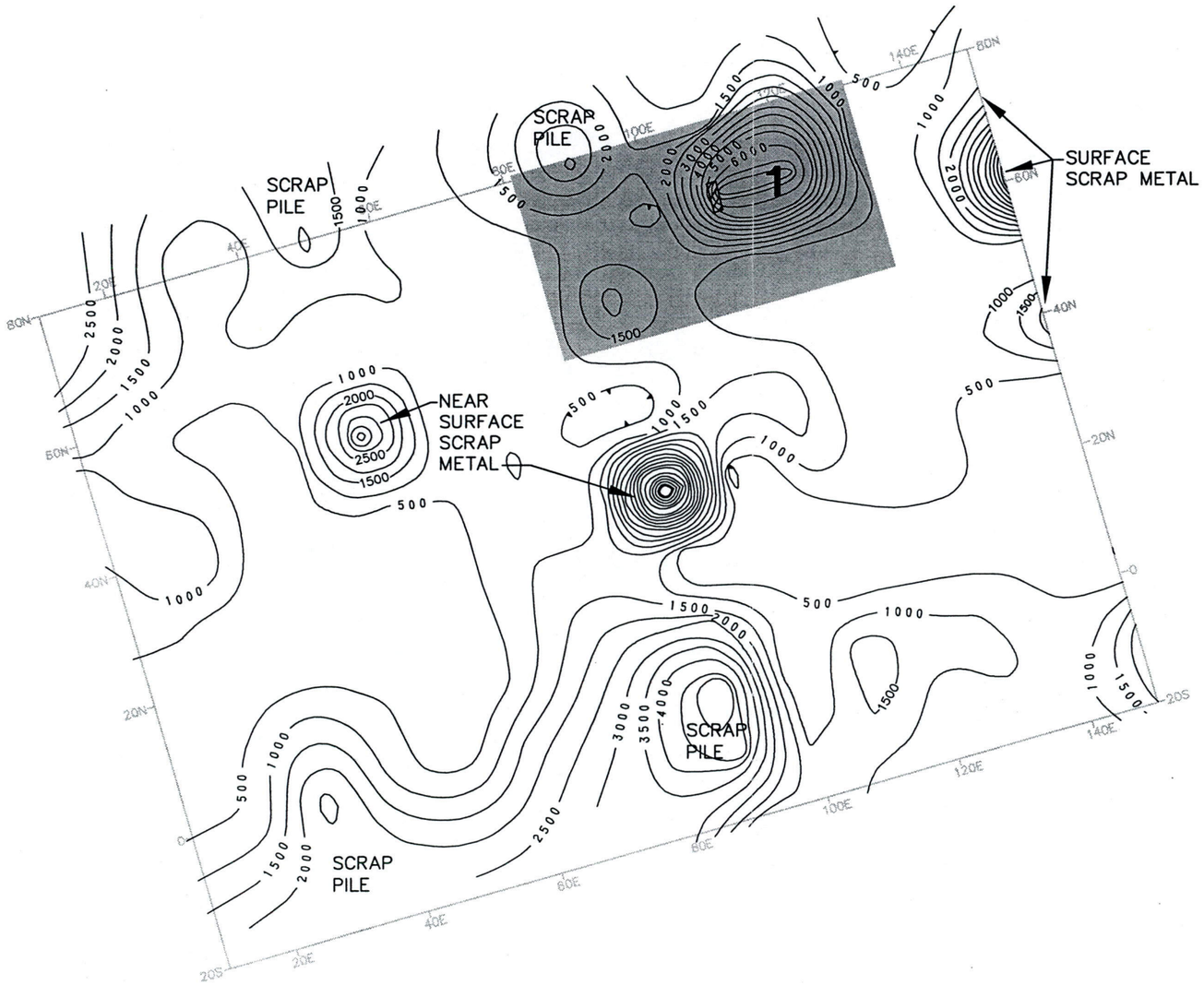
GEOPHYSICAL INVESTIGATION

CENTER AREA - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 6

L:31*,61* OFF; 61CTRD, 61CTRD-D*ON
P: STD-PCP/BL
5/14/96 SYR-54-PGL
49406003/49403GP4.DWG



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 500 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL B RESPONSE RANGE WAS -7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

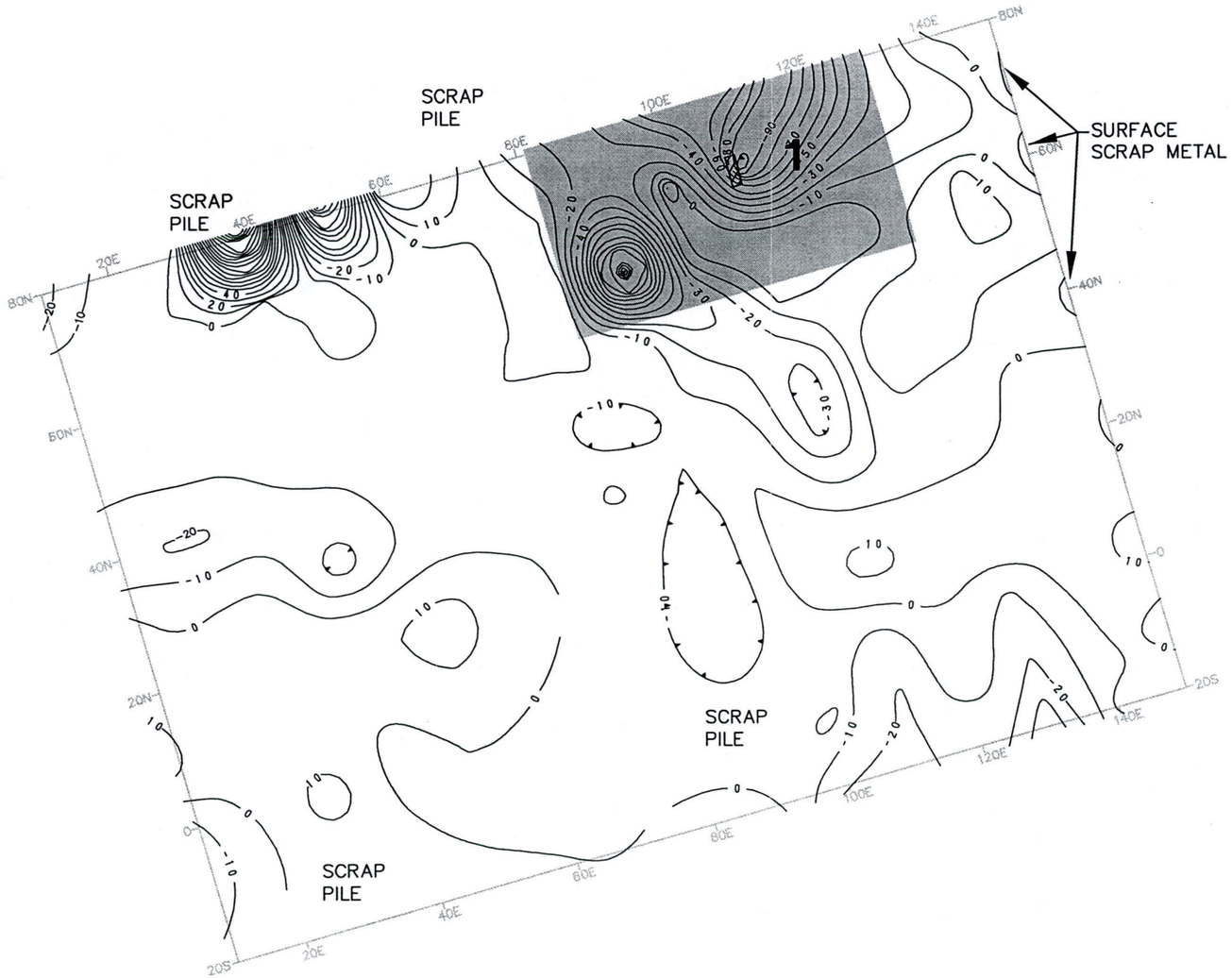
GEOPHYSICAL INVESTIGATION

CENTER AREA - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 7

L:31*,61* OFF; 61CTRB, 61CTRB-D*ON
P: STD-PCP/BL
5/14/96 SYR-54-PCL
49406003/49403GP4.DWG



LEGEND:

- QUADRATURE PHASE RESPONSE CONTOUR LINE (ms/m)
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 10 MILLISIEMENS PER METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. AVERAGE BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

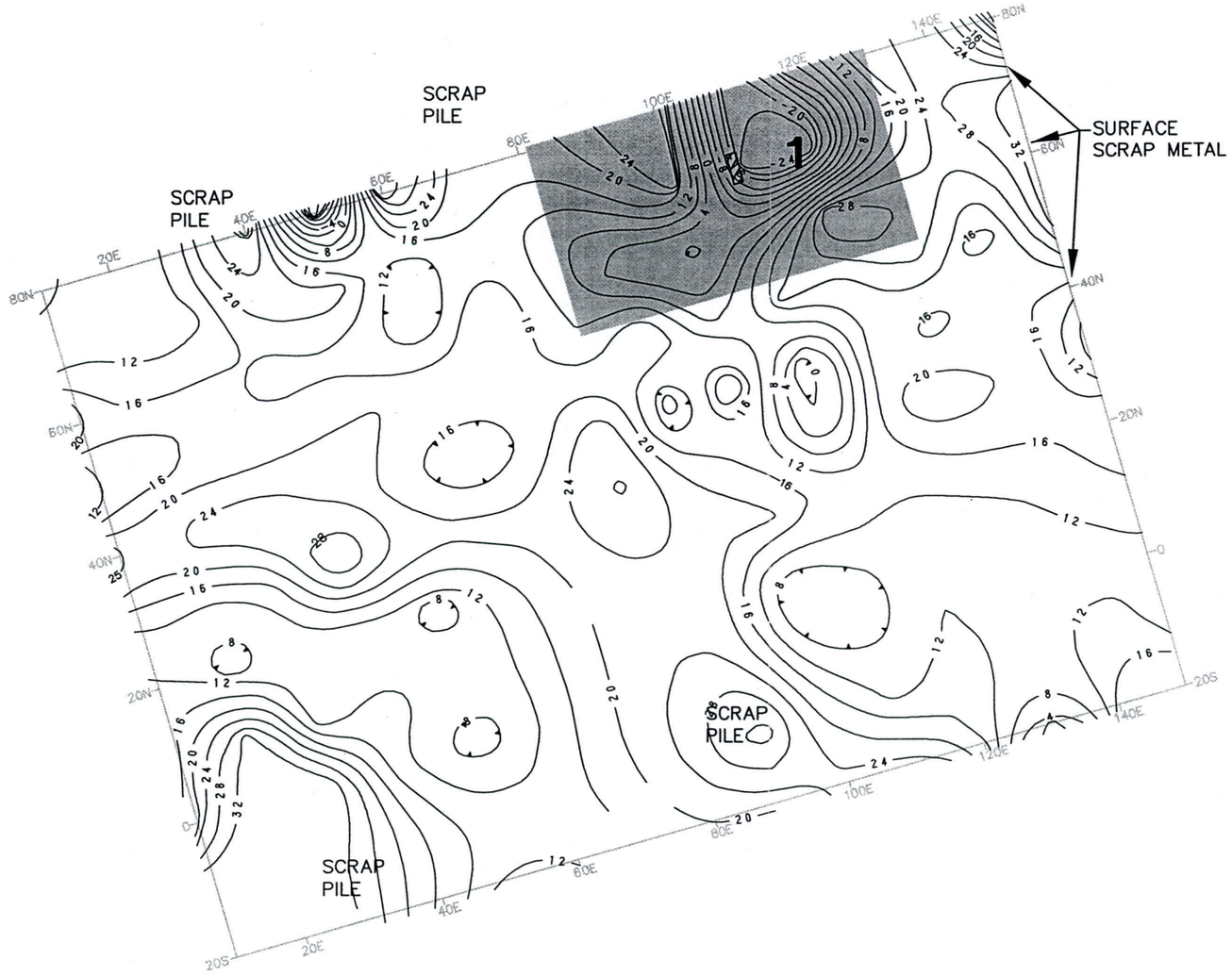
GEOPHYSICAL INVESTIGATION

CENTER AREA - EM31 SURVEY QUADRATURE PHASE REPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 8

L:31*,61* OFF; 31CTRQZ1, 31CTRQZ1-D*ON
P: STD-PCP/BL
5/14/96 SYR-54-PGL
49406003/49403GP4.DWG



LEGEND:

- INPHASE RESPONSE CONTOUR LINE (ppt)
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.
3. AVERAGE BACKGROUND INPHASE RESPONSE WAS -1.1 ppt.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

CENTER AREA - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 9

L:31*,61* OFF; 31CTRI, 31CTRI-D*ON
P: STD-PCP/BL
5/14/96 SYR-54-PGL
49406003/49403GP4.DWG

L:31+61+ OFF; 61NTD, 61NTD-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP7.DWG

LEGEND:

MILLIVOLT CONTOUR LINE

NOTES:

1. CONTOUR INTERVAL 40 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

SOUTHWEST AREA - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 10

LEGEND:

MILLIVOLT CONTOUR LINE

NOTES:

1. CONTOUR INTERVAL 300 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL B RESPONSE WAS −7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

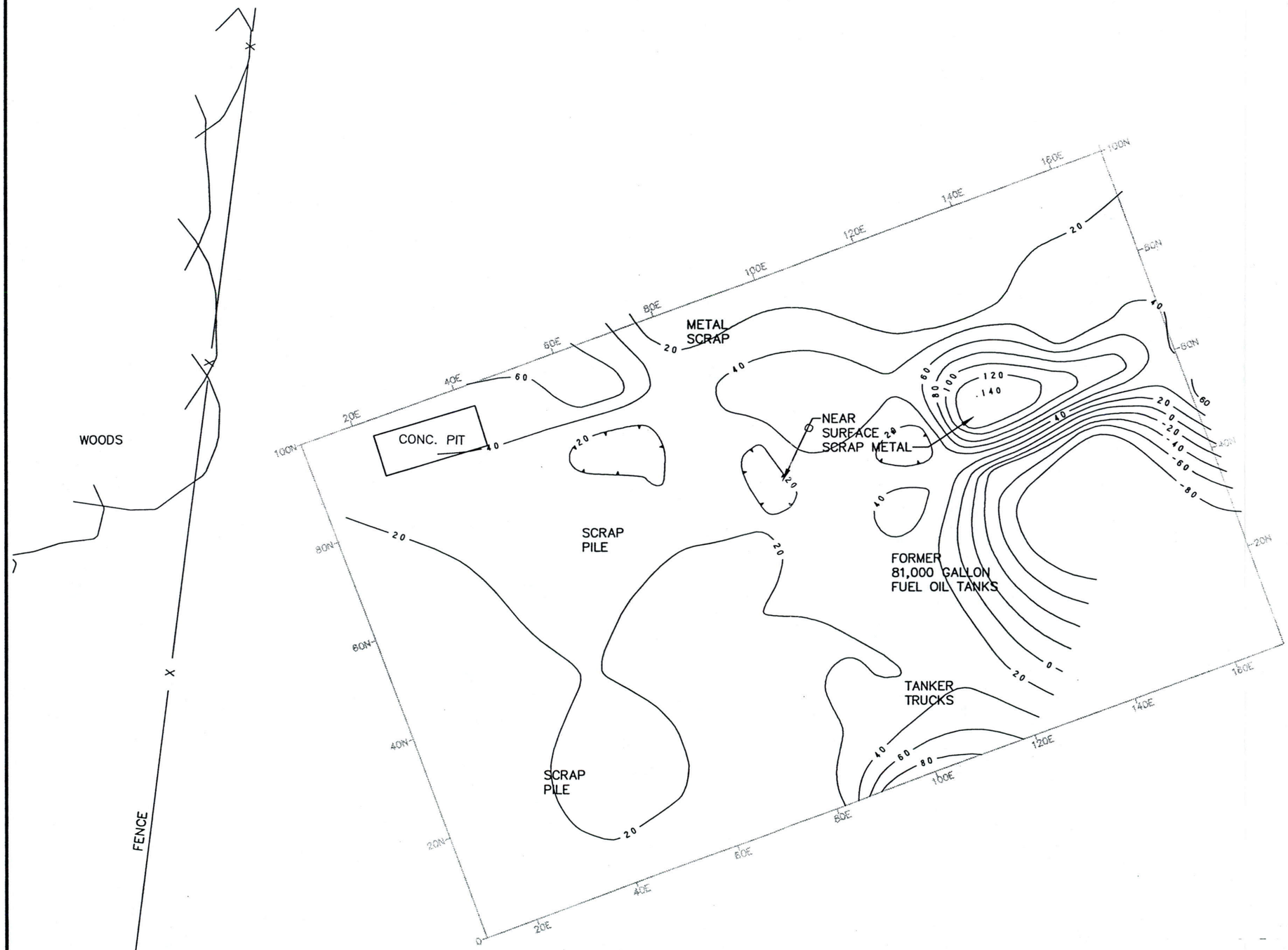
GEOPHYSICAL INVESTIGATION

SOUTHWEST AREA - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 11

L:31+,61+ OFF: 61NTB, 61NTB-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49408003/49403GP7.DWG



LEGEND:

QUADRATURE PHASE CONTOUR LINE

NOTES:

1. CONTOUR INTERVAL 20 MILLISIEMENS/ METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. AVERAGE BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

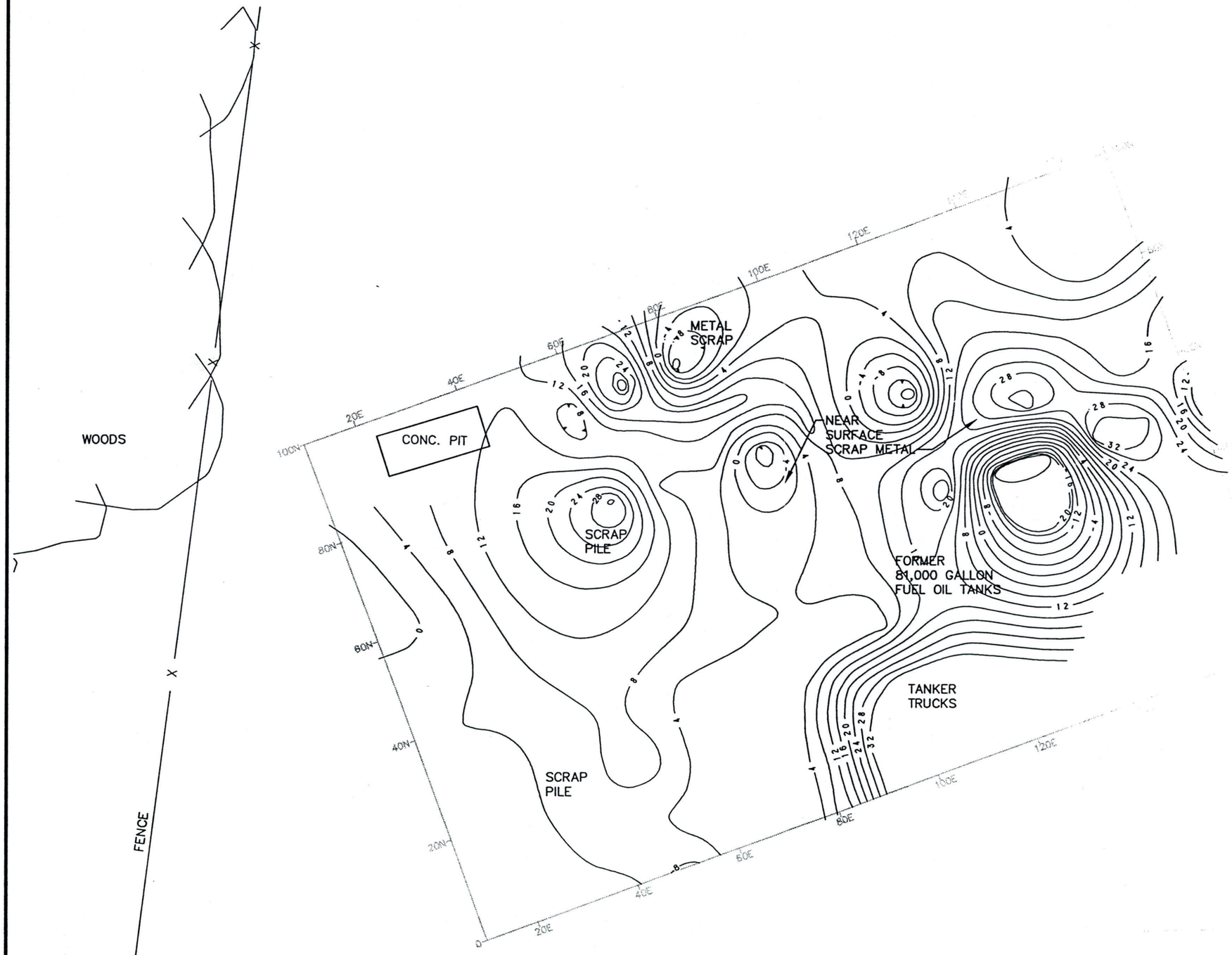
GEOPHYSICAL INVESTIGATION

SOUTHWEST AREA - EM31 SURVEY QUADRATURE PHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 12

L:31+.81+ OFF; 31NTQZ1, 31NTQZ1-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PCL
49408003/49403GP7.DWG



LEGEND:

INPHASE RESPONSE CONTOUR LINE

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.
3. AVERAGE BACKGROUND INPHASE RESPONSE WAS −1.1 ppt.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

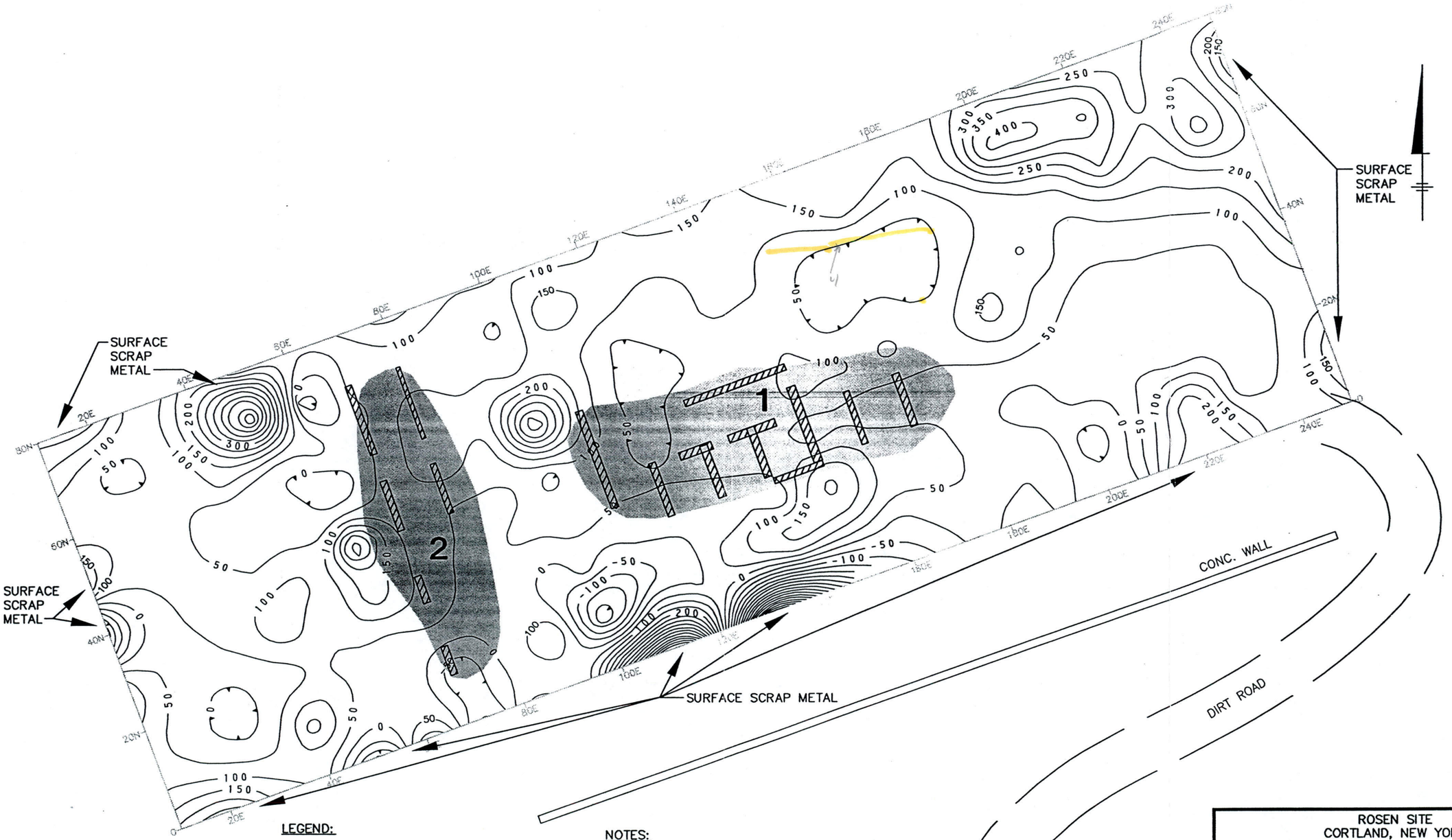
GEOPHYSICAL INVESTIGATION

SOUTHWEST AREA - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 13

L:31*,61* OFF; 31NTIZ2, 31NTIZ2-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP7.DWG



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 50 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

L:31*,61* OFF; 61CBED, 61CBED-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP8.DWG

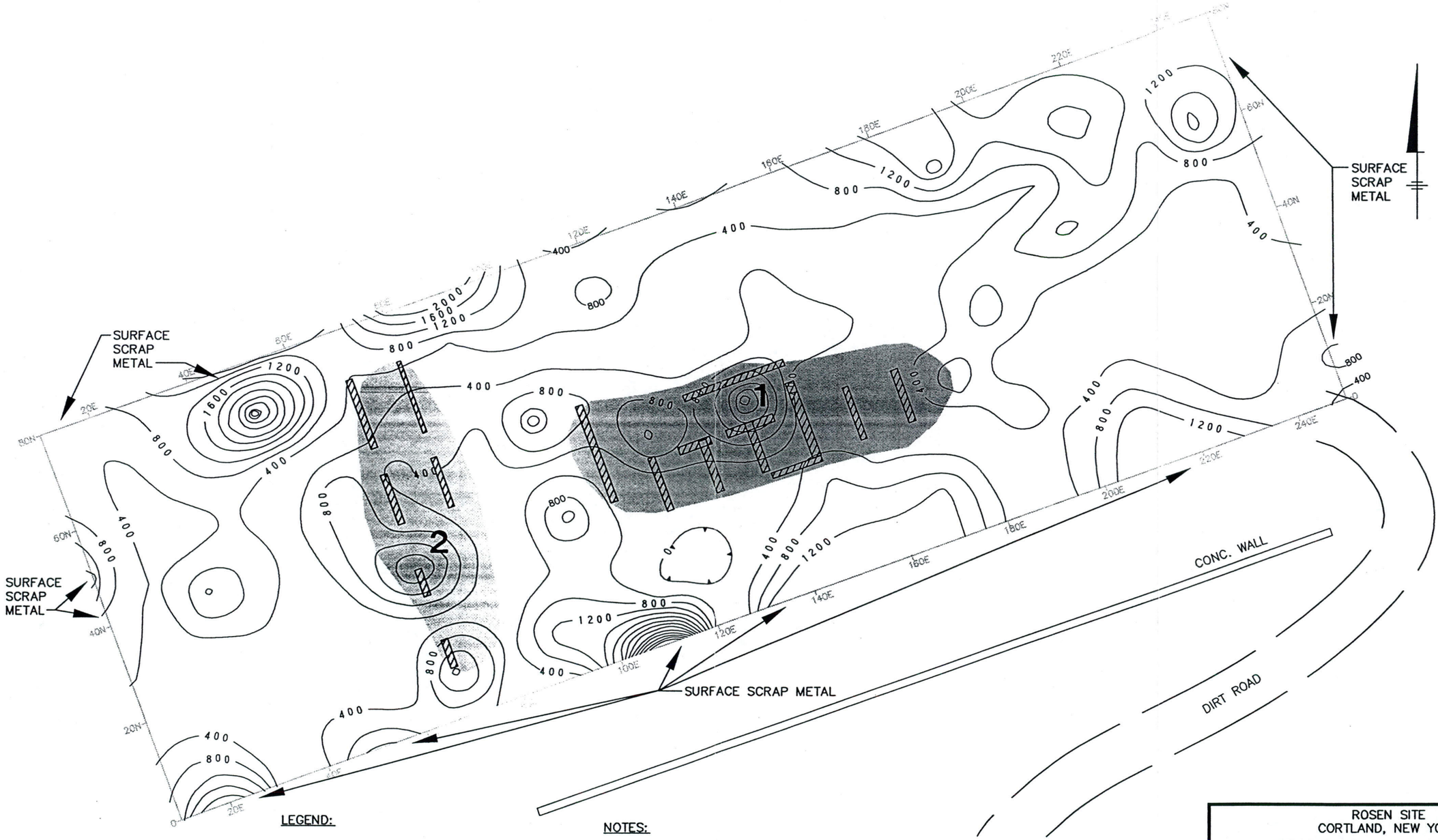
ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

COAL BIN EAST - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 14



LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 400 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL B RESPONSE WAS -7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

L:31+61+ OFF; 61CBEZ2, 61CBEZ2-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PCL
49406003/49403GP6.DWG

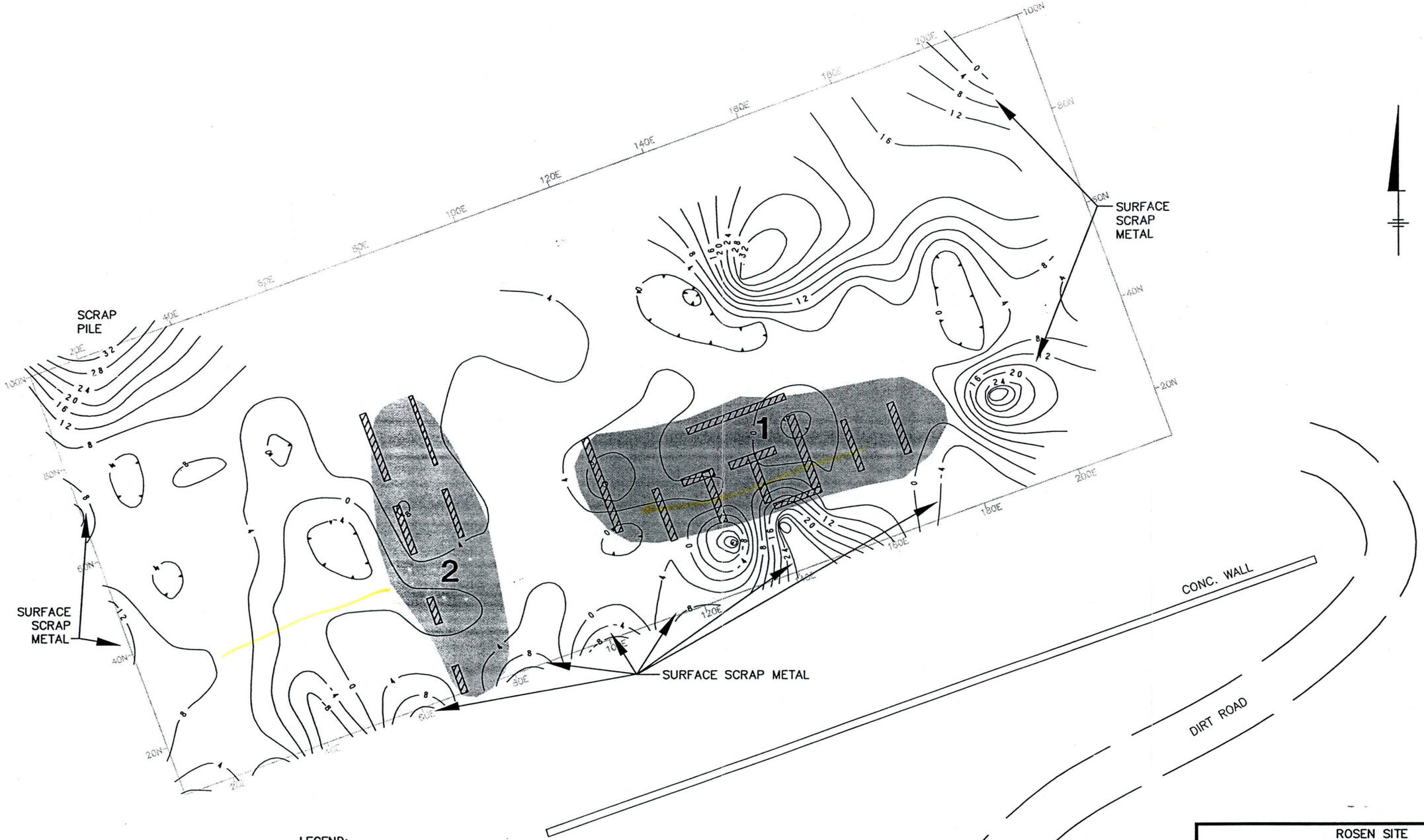
ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

COAL BIN EAST - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 15



LEGEND:

- INPHASE RESPONSE CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.
3. AVERAGE BACKGROUND INPHASE RESPONSE WAS -1.1 ppt.

0 20' 40'
SCALE: 1"=20'

L:31+81+ OFF: 31CBEZ2, 31CBEZ2-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PCL
49406003/49403GP8.DWG

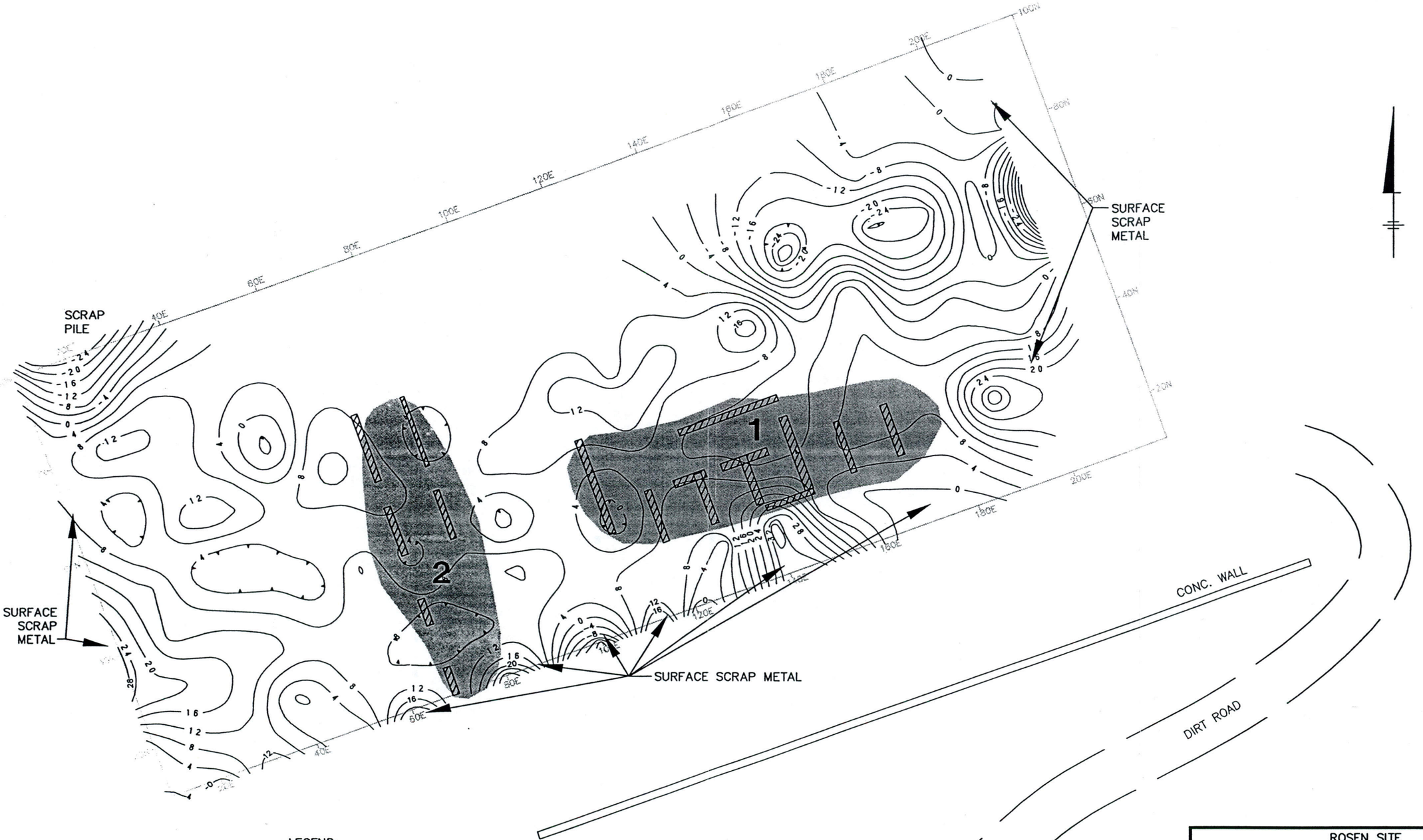
ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

COAL BIN EAST - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 16



LEGEND:

- QUADRATURE PHASE CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

NOTES:

1. CONTOUR INTERVAL 4 MILLISIEMENS/METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. AVERAGE BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m (AVERAGE).

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

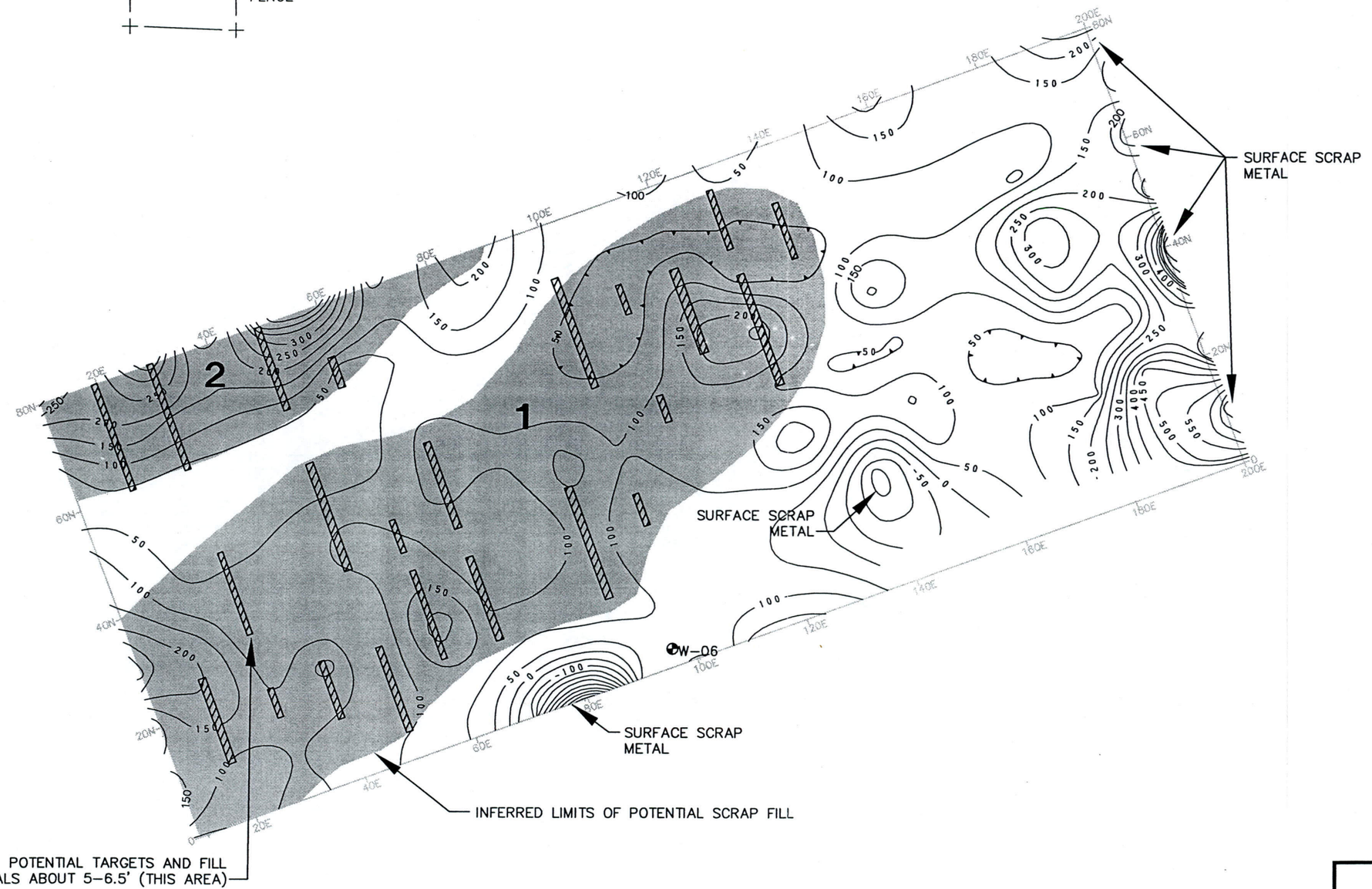
COAL BIN EAST - EM31 SURVEY QUADRATURE PHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 17

L:31+,61+ OFF; 31CBEZ1, 31CBEZ1-D+ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49408003/49403GP8.DWG

CHAIN FENCE



LEGEND:

MILLIVOLT CONTOUR LINE

ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY

POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

W-06 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 50 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

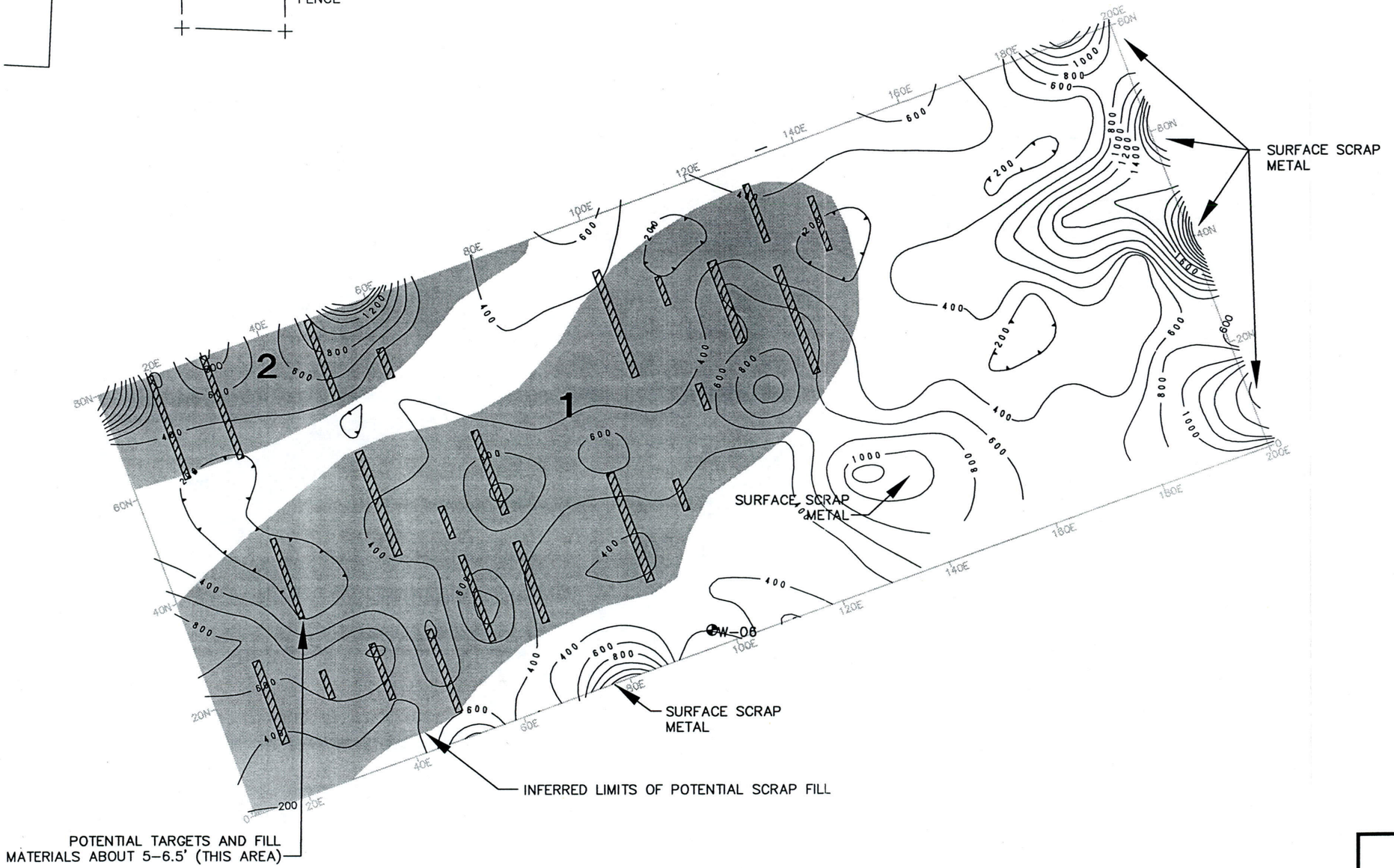
COAL BIN WEST - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 18

L:31*,61* OFF; 61CBWD, 61CBWD-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP5.DWG

CHAIN FENCE



LEGEND:

MILLIVOLT CONTOUR LINE

ANOMALOUS AREAS IDENTIFIED DURING FULL–SCALE GEOPHYSICAL SURVEY

POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

MW–06 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 200 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL B RESPONSE WAS –7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

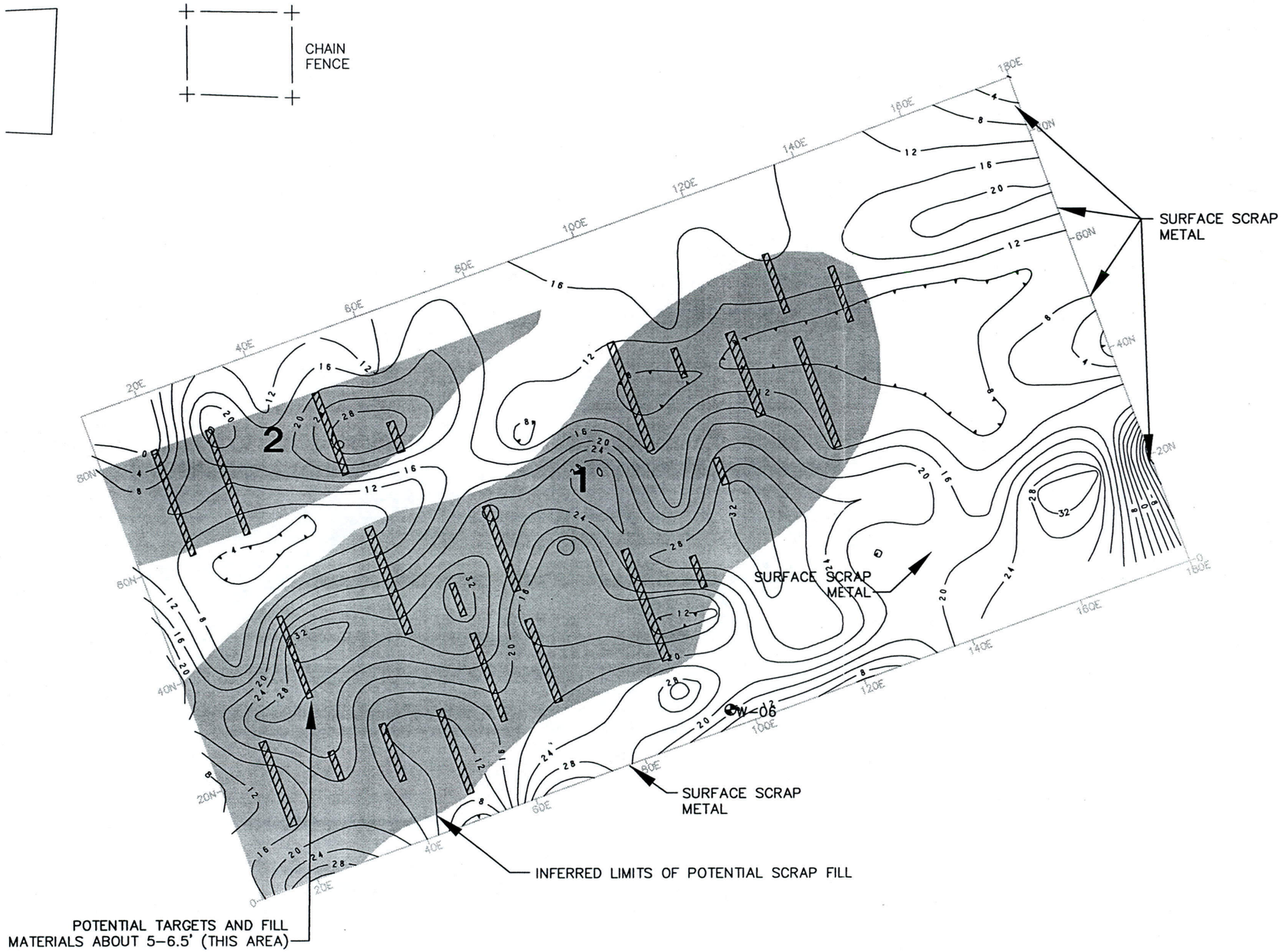
GEOPHYSICAL INVESTIGATION

COAL BIN WEST - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 19

L:31*,61* OFF; 61CBWB, 61CBWB-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP5.DWG



LEGEND:

INPHASE RESPONSE CONTOUR LINE

ANOMALOUS AREAS IDENTIFIED DURING FULL–SCALE GEOPHYSICAL SURVEY

POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

MW–06 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.
3. AVERAGE BACKGROUND INPHASE RESPONSE WAS –1.1 ppt.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

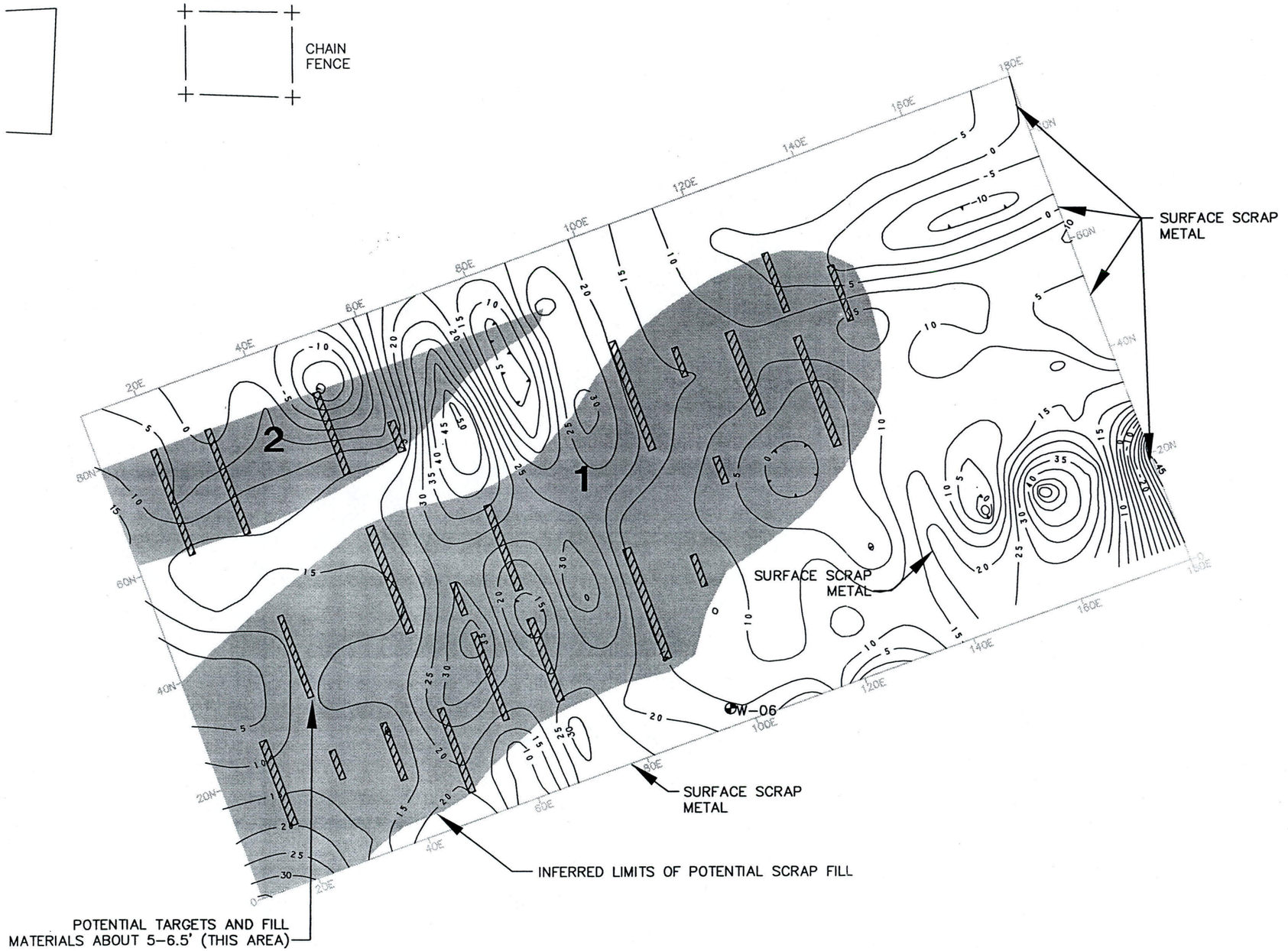
GEOPHYSICAL INVESTIGATION

COAL BIN WEST - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 20

L:31*,61* OFF; 31CBWI, 31CBWI-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP5.DWG



LEGEND:

QUADRATURE PHASE RESPONSE CONTOUR LINE

ANOMALOUS AREAS IDENTIFIED DURING FULL–SCALE GEOPHYSICAL SURVEY

POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

MW–06 EXISTING MONITORING WELL

NOTES:

1. CONTOUR INTERVAL 5 MILLISIEMENS/ METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. AVERAGE BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m.

0 20' 40'

SCALE: 1"=20'

ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

COAL BIN WEST - EM31 SURVEY QUADRATURE PHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 21

L:31*,61* OFF; 31CBWQ, 31CBWQ-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
49406003/49403GP5.DWG

CONC.

CHAIN FENCE

SOIL BORING B-1
LOCATED 12 FEET
WEST OF THIS POINT

B-1 AREA

INFERRED LIMITS OF POTENTIAL
SCRAP FILL

TANKER TRUCKS

50E 100E 150E 200E 250E 300E 350E 400E 450E 500E 550E 600E 650E 700E 750E

100N 50N 50S 100S

100 200 300 400 600

1 2

TP-1 TP-10

SCRAP
PILE

MW-06

NEAR SURFACE
SCRAP METAL

SURFACE METAL

T-08

DIRT ROAD (APPROXIMATE)

CONC. WALL

SURFACE METAL

NEAR SURFACE
SCRAP METAL

SURFACE SCRAP PILES

MW-23 MW-24 MW-21

LEGEND:

- MILLIVOLT CONTOUR LINE
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- EXISTING MONITORING WELL
- RI TEST PIT
- SUPPLEMENTAL RI TEST PIT

NOTES:

1. CONTOUR INTERVAL 100 MILLIVOLTS (MV).
2. BACKGROUND CHANNEL D RESPONSE RANGE WAS 9.0 TO 48.2 MV.
3. DIFFERENTIAL CHANNEL (D) PROVIDES REMOVED RESPONSE FROM NEAR SURFACE OBJECTS.

0 50' 100'
SCALE: 1"=50'

L:31*,61* OFF; 61CPDZ2, 61CPDZ2-D*ON
P: STD-PCP/BL
5/15/96 SYR-54-PGL
494060003/49403GPBL.DWG

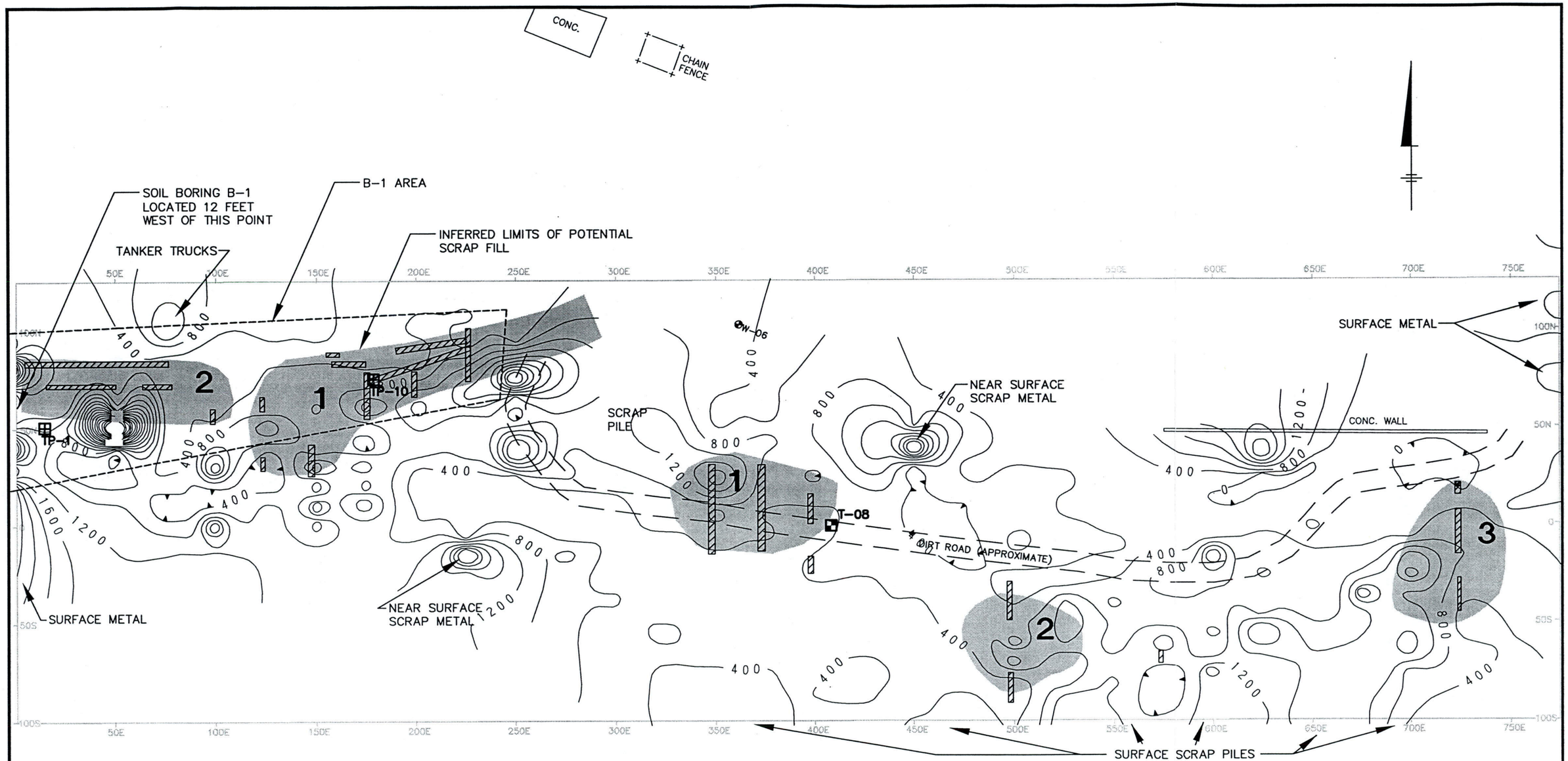
ROSEN SITE
CORTLAND, NEW YORK

GEOPHYSICAL INVESTIGATION

FORMER COOLING POND AREA - EM61 SURVEY CHANNEL D RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 22



LEGEND:

- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- MILLIVOLT CONTOUR LINE
- POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- EXISTING MONITORING WELL
- RI TEST PIT
- SUPPLEMENTAL RI TEST PIT

NOTES:

1. CONTOUR INTERVAL 400 MILIVOLTS (mv).
2. BACKGROUND CHANNEL B RESPONSE WAS -7.5 TO 69.0 MV.
3. CHANNEL B RESPONSE INCLUDES BOTH NEAR SURFACE AND DEEPER OBJECTS.

0 50' 100'

SCALE: 1"=50'

L:31*,61* OFF; 61CPBZ1, 61CPBZ1-D*ON
P: STD-PCP/BL
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49406D03/49403GP8.DWG

ROSEN SITE
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GEOPHYSICAL INVESTIGATION

FORMER COOLING POND AREA - EM61 SURVEY CHANNEL B RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 23

CONC.

CHAIN FENCE

SOIL BORING B-1 LOCATED 12 FEET WEST OF THIS POINT

B-1 AREA

INFERRED LIMITS OF POTENTIAL SCRAP FILL

TANKER TRUCKS

SURFACE METAL

NEAR SURFACE SCRAP METAL

SCRAP PILE

NEAR SURFACE SCRAP METAL

SURFACE METAL

CONC. WALL

DIRT ROAD (APPROXIMATE)

SURFACE SCRAP PILES

W-06

W-21

W-23

W-24

TP-10

T-08

1

2

3

50S 50E 100E 150E 200E 250E 300E 350E 400E 450E 500E 550E 600E 650E 700E 750E 100S

LEGEND:

ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY

INPHASE RESPONSE CONTOUR LINE

POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR

EXISTING MONITORING WELL

RI TEST PIT

SUPPLEMENTAL RI TEST PIT

NOTES:

1. CONTOUR INTERVAL 4 PARTS PER THOUSAND (ppt).
2. AVERAGE BACKGROUND INPHASE RESPONSE WAS -1.1 ppt.
3. INPHASE RESPONSE REPRESENTS INCREASED METAL SUSCEPTIBILITY.

0 50' 100'

SCALE: 1"=50'

L:31*,61* OFF; 31CPIZ2, 31CPIZ2-D*ON
P: STD-PCP/BL
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49408003/49403GP8.DWG

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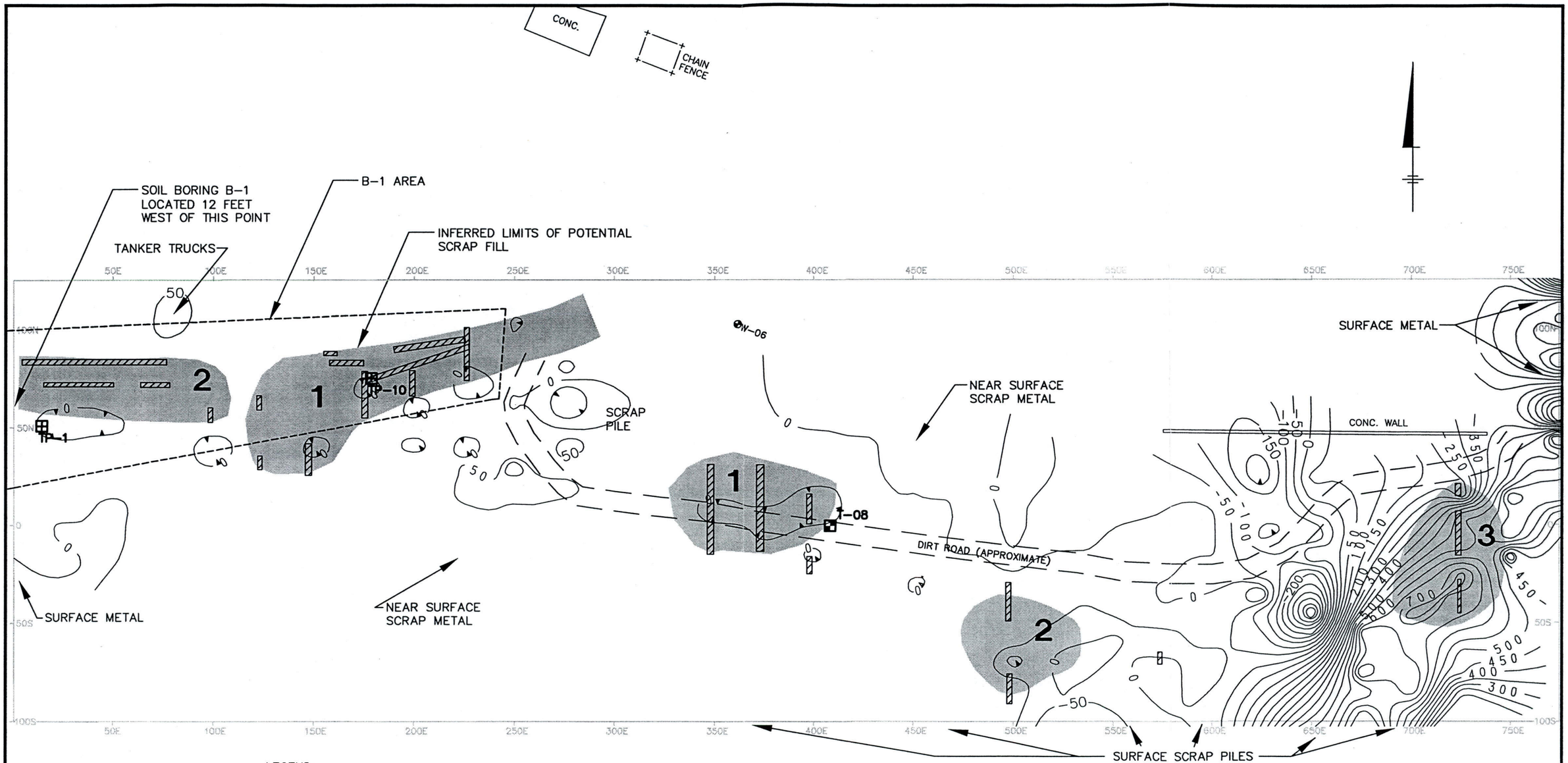
GEOPHYSICAL INVESTIGATION

FORMER COOLING POND AREA - EM31 SURVEY INPHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 24



LEGEND:

- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY
- QUADRATURE PHASE CONTOUR LINE POTENTIAL TARGET LOCATIONS IDENTIFIED BY GPR
- EXISTING MONITORING WELL
- RI TEST PIT
- SUPPLEMENTAL RI TEST PIT

NOTES:

1. CONTOUR INTERVAL 50 MILLISIEMENS/METER (ms/m).
2. QUADRATURE PHASE RESPONSE REPRESENTS APPARENT GROUND CONDUCTIVITY.
3. BACKGROUND QUADRATURE PHASE RESPONSE WAS 20.9 ms/m (AVERAGE).

0 50' 100'

SCALE: 1"=50'

L:31*,61* OFF; 31CPQZ1, 31CPQZ1-D*ON
P: STD-PCP/BL
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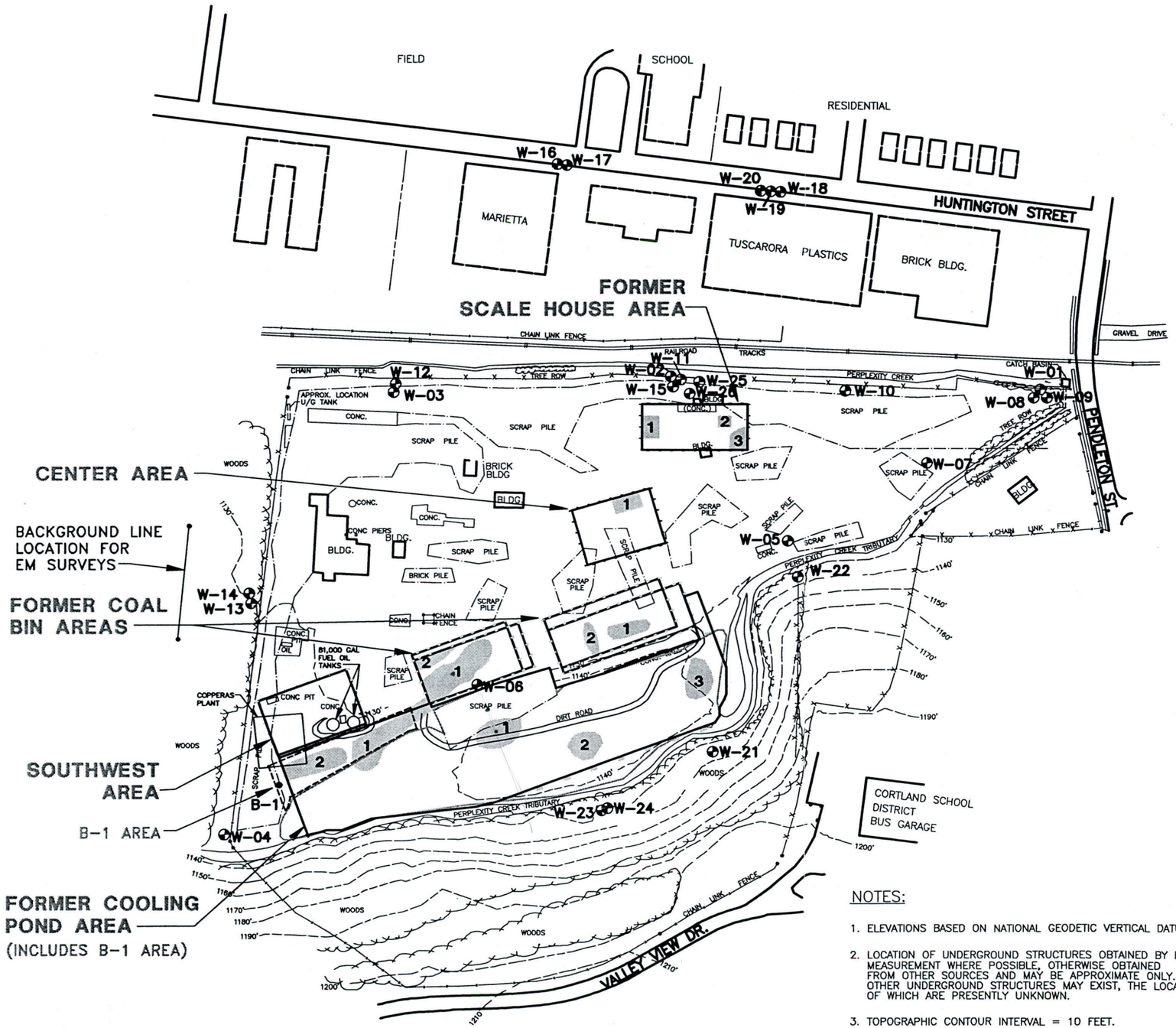
GEOPHYSICAL INVESTIGATION

FORMER COOLING POND AREA - EM31 SURVEY QUADRATURE PHASE RESPONSE CONTOUR MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 25



LEGEND

- MONITORING WELL
- SOIL BORING
- ANOMALOUS AREAS IDENTIFIED DURING FULL-SCALE GEOPHYSICAL SURVEY

SCALE

200' 0 200'

NOTES:

1. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
2. LOCATION OF UNDERGROUND STRUCTURES OBTAINED BY FIELD MEASUREMENT WHERE POSSIBLE, OTHERWISE OBTAINED FROM OTHER SOURCES AND MAY BE APPROXIMATE ONLY. OTHER UNDERGROUND STRUCTURES MAY EXIST, THE LOCATIONS OF WHICH ARE PRESENTLY UNKNOWN.
3. TOPOGRAPHIC CONTOUR INTERVAL = 10 FEET.
4. THE NUMBER ASSOCIATED WITH THE ANOMALOUS AREAS IS SIMPLY A NUMERICAL DESIGNATION FOR EACH AREA, AND DOES NOT IMPLY A RANKING OF THE ANOMALIES.

ROSEN SITE
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GEOPHYSICAL INVESTIGATION

SUMMARY OF ANOMALY LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 26

L:GIA OFF SUM ON
P: STD-PCP/BL
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