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RCRA FACILITY INVESTIGATION (RFI) WORK PLAN ADDENDUM NO. 4

**GM POWERTRAIN BEDFORD FACILITY
105 GM DRIVE
BEDFORD, INDIANA**

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1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has prepared the following Test Pit Investigation (TPI) Work Plan for the GM Powertrain Bedford Facility (Bedford Facility or Site) located in Bedford, Indiana. The purpose of proposed test-pitting activities outlined herein is to determine the source and extent of various anomalies which were identified in a multi-phase geophysical investigation recently completed by CRA.

Geophysical surveys were completed over selected Areas of Interest (AOIs) that had previously been described in the Current Conditions Report (CCR) for the Site (CRA, May 2001). The CCR identified some of the AOIs as former disposal areas associated with the historic operations of the aluminum foundry at the Site. These materials included foundry sand, waste aluminum dross, wastewater lagoon sludges and miscellaneous solid wastes. Geophysics was also utilized at some reported off-Site disposal areas. The results of the geophysical surveys are presented in the Geophysical Investigation (GI) Report (Appendix A). Survey coverage of AOIs (on-Site) and off-Site areas completed to date are presented in Figure 1.1 of Appendix A.

The GI Report confirms that conductivity and metal detection anomalies were delineated in some of the on-Site and off-Site investigative areas. In order to determine the sources of these anomalies, the following TPI Work Plan has been developed. The Work Plan includes visual evaluation of the types and depth of materials present, and collection of samples for analytical testing. If containers are encountered, the test pits will be handled following the procedures described in this Work Plan. A decision tree is included as Figure 1.2 for determining the appropriate course of action to be followed while conducting the work. The data gathered will be used to:

- 1) document existing conditions of the test pit areas investigated;
- 2) assess if removal of the materials is required; and
- 3) develop procedures for removal, transportation, and disposal, if needed.

2.0 BACKGROUND

Prior to conducting the geophysical investigation and preparation of this work plan, CRA reviewed historical documents, aerial photographs, and interviewed local property owners and Plant employees who were familiar with former operations at the Bedford Facility. As a result of this documentation review and interview process, the following areas were selected for investigation.

2.1 ON-SITE (AOI) INVESTIGATIVE AREAS

Geophysical surveys were completed at five on-Site AOIs in January 2002. As indicated by Figure 1.1 of Appendix A, these AOIs are situated east of GM Drive, and partially encompass the existing stormwater lagoon. The Geophysical Investigation delineated conductivity and metal detection anomalies associated with former disposal areas, and thus provided targets for subsequent confirmatory test pitting activities. On-Site AOI investigative areas include the former north disposal area (AOI 4), the former east sand disposal area [plateau and ravine] (AOI 5), the former sludge disposal and fire training area (AOI 6), the former north lagoon and Outfall 001 (AOI 7), and the former equipment storage area (AOI 15).

2.2 OFF-SITE INVESTIGATIVE AREAS

Additional geophysical testing was completed at four off-Site locations in August 2002 known as Areas 1 through 4. The first three areas are located adjacent to the Bedford Facility, just north of Breckenridge Road as shown on Figure 1.1 of Appendix A. The fourth location is situated approximately 2 miles to the northwest of Areas 1 through 3. Geophysical surveys were completed over suspected fill and/or disposal areas on these properties at the request of the respective property owners. The property owners believe that the fill/disposal materials located in these areas originated from the Bedford Facility. Thus, geophysical surveys were completed to delineate any potential anomalous responses associated with the fill/disposal areas, and determine proposed locations for subsequent test pitting activities.

3.0 DISCUSSION

Because of the limited knowledge regarding the types of materials that may be present at the anomalous areas, it is recommended that overburden materials will be excavated within the anomalous areas using a backhoe to evaluate the types and depths of the waste encountered. It may be determined that removal of the waste is not required.

Visual inspections, as well as sampling and testing of the waste, will be performed, if necessary, to profile the materials. Samples will be collected and analyzed in accordance with the procedures detailed in the previously submitted RFI Work Plan, Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP) for the Bedford Facility.

4.0 PROPOSED TEST PIT LOCATIONS

The anomalies delineated in on-Site AOIs and off-site areas have been compiled on Figures 4.1 to 4.5 of Appendix A. The most prominent of these geophysical features have also been identified (with an "A" designation), based on the intensity of the response (moderate to high amplitude) and size or extent of the anomaly. In order to determine the nature of the buried objects or materials associated with the geophysical responses observed, proposed test pit locations for anomalies warranting further investigation have also been provided, and are labeled as indicated ("TP" designation). The rationale for these proposed test pitting activities in on-Site AOIs and off-Site areas has been summarized in Tables 4.1 and 4.2 of Appendix A, respectively.

5.0 SCOPE OF WORK

CRA's scope of work to evaluate the geophysical anomalies includes the following:

- preparation of a task-specific Health and Safety Plan;
- clearance of underground utilities;
- excavation of test pits using a backhoe;
- collection of waste material/fill/soil samples and container contents for analytical testing; and
- preparation of a report that is based on the collected data.

5.1 HEALTH AND SAFETY PLAN PREPARATION, UTILITY CLEARANCE

A task-specific Health and Safety Plan (HASP) for work associated with the test pits is presented in Appendix B. During all fieldwork, procedures outlined in the HASP will be followed. The HASP is intended to identify and mitigate the potential hazard exposure encountered by onsite personnel. The plan includes provisions for Site access control, worker training and medical monitoring requirements, worker personal protection, on-Site and off-Site air monitoring, personnel decontamination, and contingency planning. Air quality will be monitored during performance of intrusive activities to ensure that the community will not be adversely impacted during Site activities. All personnel conducting activities at the Site will be properly trained in their specific assigned work functions. They will be familiar with the operation of equipment required for assigned tasks and will be capable of mitigating physical hazards associated with the operation of the equipment. The Indiana underground utility clearance service, Holy Moly, as well as the City of Bedford, North Lawrence Water, and other non-notified utility companies will be notified at least 48 hours in advance of any excavation activities.

5.2 TEST PIT INVESTIGATION

The test pits will be excavated at the locations summarized in Section 4.0 of this Work Plan. Prior to starting the excavations, the location of each test pit will be staked in the

field by a professional land surveyor. Each test pit will be centered on the surveyed location and will in general be, 3 feet wide, 12 feet deep, and 15 feet long. Individual test pits may be smaller, should bedrock be encountered during the excavation work. The pits will be excavated using a backhoe with an approximate three-foot bucket attachment. The teeth of the backhoe bucket will be removed or covered to reduce the potential for damaging any containers, should they be encountered while excavating. If required, a grappler attachment will also be mobilized on-Site for use in the removal of containers. Excavation activities shall be completed in a controlled manner to minimize damage to any potentially intact containers.

Each test pit will be monitored using a photo-ionization detector (PID) LEL/ O₂ meter to identify organic vapors, and/or explosive gases. Materials removed from the excavation will be visually inspected for the types and quantities of materials, percentage of soil versus waste, and other waste characteristics. Air monitoring will be conducted during each test pit investigation according to procedures outlined in the HASP. The excavated material will be temporarily staged alongside each test pit on polyethylene sheeting. The following information will be recorded:

- 1) unique test pit identification number;
- 2) test pit location tied to Site coordinate system;
- 3) test pit stratigraphy log and description of orientation, dimension, and material encountered (see Table 5.1); and
- 4) photographs of the completed test pit and stockpiled material.

If possible, soil/waste material will be backfilled into open excavations before the contractor leaves the Site for the day. If the waste material cannot be backfilled at the end of the workday, the contractor will ensure the material is covered securely with a polyethylene liner or cover. Any excavation left open overnight will be secured with temporary fencing, at a minimum.

Should intact containers be encountered the following procedures will be implemented:

- 1) remove container or other suspect anomaly and stage on a steel grated pan or a bermed polyethylene sheeting;

- 2) conduct preliminary field screening of the container to identify organic vapors, and/or explosive gases, prior to physically handling the container by the field workers;
- 3) inspect for the presence of labels or other information that may assist in identification of the contents. Record pertinent information on field log (see Table 5.2);
- 4) segregate intact containers into the following two categories: (1) containers with solids, debris, or liquids, and (2) RCRA empty containers (see Sections 5.3.1 and 5.3.2);
- 5) for each container in category (1) identified, complete a test pit container field data sheet. Information recorded should include, at a minimum, unique identification number, visual assessment (size, type, condition), volume of material, nature of material, air monitoring screening data, and other pertinent information;
- 6) place containers with solids, debris, or liquids in a suitable overpack;
- 7) place empty containers or container parts into lined roll-off box;
- 8) remove liquids (if present) from excavated areas and place in a designated container;
- 9) collect representative samples of soils/materials in test pit excavation, as necessary;
- 10) transport containers to a secure staging area on GMPT property for appropriate characterization and disposal; and
- 11) backfill excavated material into test pits.

5.2.1 TEST PIT SAMPLING PROCEDURE

Samples will be collected using a stainless steel spoon, trowel, or shovel and transferred into appropriate pre-cleaned laboratory containers. To prevent potential contaminant migration to or from a sample, containers will be filled to the top taking care to prevent soil from remaining in the lid threads. After sample containers are filled, they will be labeled, sealed, chilled, and processed under proper chain of custody protocol for shipment to the laboratory for analytical testing. Personnel involved in the sampling event will wear clean, disposable nitrile gloves, and properly decontaminate sampling

equipment between each sample. All field sampling will be recorded on the appropriate forms and in the field logbook as sampling is completed.

Based on testing done to date, hazardous materials exceeding LDRs are not anticipated. However, test pits located on GM owned property in which industrial waste containers, elevated PID levels, or other evidence of contaminated materials are encountered will be covered and secured with temporary fencing, following excavation of the materials. Excavated materials will be temporarily staged adjacent to each test pit on poly sheeting and also covered and secured. At a minimum, one sample will be collected from the excavated stockpiled soil adjacent to each test pit. If the test pit excavation is over four feet in depth, a long reach tool will be utilized, if feasible and depending on field conditions, to collect one sample from the test pit sidewalls, and one from the bottom. Due to safety concerns, unshored excavations greater than four feet in depth will not be entered by field personnel. Should the excavation be under four feet in depth, the pit will be entered and sampled. No backfilling of soils will occur until results of analytical data representative of this material are received. Materials will be identified as hazardous if they meet the requirements for ignitability, corrosivity, reactivity, toxicity, or the special categories of hazardous waste. Materials identified to be unsuitable for backfilling (e.g. hazardous waste or exceed LDRs), will be transported to an appropriate disposal facility and clean backfill brought in to fill the test pit excavation. Test pits located off-Site (at areas with property or access agreements in place) will be secured with upgraded fencing or will be backfilled with clean fill depending on location and concerns with traffic.

Should buried containers be found while excavating test pits, additional work will be conducted to determine the lateral and vertical extent of the containers. This work may include additional excavation work, and a geophysical survey of the area immediately surrounding any buried containers.

5.3 CONTAINER SEGREGATION AND HANDLING

All handling, moving, and transporting of containers will utilize mechanical equipment wherever possible. A team of personnel specifically trained in the handling of container waste will be designated to perform this task. Containers will be moved by grapppler, backhoe bucket, or other means, that will prevent damage to containers and release of their contents.

Movement or handling by personnel (outside of the excavation area) may be required in the event that mechanical means cannot be properly or safely employed due to container breakage or leakage. If necessary, non-metallic slings will be used, but only after removal from the excavation by other means. All equipment used in the handling of material associated with the test pits will be equipped with Class ABC fire extinguishers. Safety apparel and equipment as specified in the HASP will be worn or used at all times.

5.3.1 CONTAINERS WITH SOLIDS, DEBRIS, OR LIQUIDS

Any container with solids, debris, or liquids will be placed temporarily on a steel grated pan or a bermed polyethylene liner near the excavation areas. Once the field screening has been performed for organic vapors and explosive gases a detailed inspection of the container and its contents will be performed and recorded. Each container will be assigned a unique container identification number and will have subsequent information associated with it documented on the container database. Contents inside the container will be sampled, overpacked in an 85-gallon or 110-gallon overpack, and transported to a secure staging area on GMPT property pending characterization and ultimate disposal of the waste.

5.3.2 RCRA EMPTY CONTAINERS

Any container that has less than 1 inch of material, any flattened containers, or large pieces of former containers will be recorded as a RCRA empty container, which is consistent with Federal Regulations (RCRA), 40 CFR 261.7. All empty containers and container fragments will be placed temporarily in a lined roll-off box. Once sufficient quantities have accumulated, the empty roll-off will be transported and stored at the secure GMPT staging area for off-Site disposal. Empty containers will not be assigned a unique identification number but will be counted and recorded by the date and test pit designation from which they were removed. Container fragments, lids, and other small pieces of metal that may formerly have been containers will not be counted.

5.4 CONTAINER SAMPLING

Container sampling procedures will consist of the use of non-sparking tools (brass container ratchet, etc.) to open up the container for access to contents. Once the container is opened, the contents will be sampled by the use of a stainless steel spoon or ladle to obtain a representative sample that will be labeled, logged and placed in laboratory supplied sample containers. The sample containers will be immediately capped and placed in an ice-chilled cooler for transport to the analytical laboratory. Samples will be recorded on chain-of-custody forms to document sample identification and handling.

5.5 ANALYTICAL TESTING

All samples will be analyzed for one or more of the following constituents:

1. Overburden Material Analysis
 - Target compound list (TCL) volatile organic compounds (VOC);
 - TCL semi-volatile organic compounds (SVOC);
 - Polychlorinated biphenyls (PCB);
 - Target analyte list (TAL) metals (less the earth metals); and
 - Total cyanide.
2. Container Waste Characterization Analysis

RCRA Hazardous Waste Characteristics will be determined including:

 - toxicity determination by Toxic Characteristic Leaching Procedure (TCLP), U.S. EPA SW-846 method 1311 with analysis for:
 - TCLP VOC by U.S. EPA SW-846 method 8260B,
 - TCLP SVOC by U.S. EPA SW-846 method 8270C,
 - TCLP Pesticides by U.S. EPA SW-846 method 8081A,
 - TCLP Herbicides by U.S. EPA SW-846 method 8151A, and
 - TCLP Metals by U.S. EPA SW-846 method 6010B/7470A;
 - reactivity by U.S. EPA SW-846 Section 7.3;
 - corrosivity by U.S. EPA SW-846 Section 7.2;

- ignitability by U.S. EPA SW-846 Section 7.1; and
- PCBs by U.S. EPA SW-846 method 8082.

5.6 REPORT PREPARATION

The results of the test pit investigation will be presented in a report that will describe the field observations and findings, summarize the analytical results, and provide conclusions and recommendations for removal of the materials encountered in the test pits. The report will consist of a description of the field investigations performed, including field methods and procedures utilized, analyses performed, and photographs of the materials encountered.

6.0 SCHEDULE

CRA anticipates the field investigation activities will begin within 14 days of U.S. EPA's concurrence with this Work Plan, assuming there are no delays due to access. The field activities are estimated to require four to six weeks to perform. Laboratory analyses are estimated to require six to eight weeks to complete, with data validation requiring an additional six to eight weeks. Report preparation will begin upon receipt of the validated data, and will require approximately four weeks to complete.

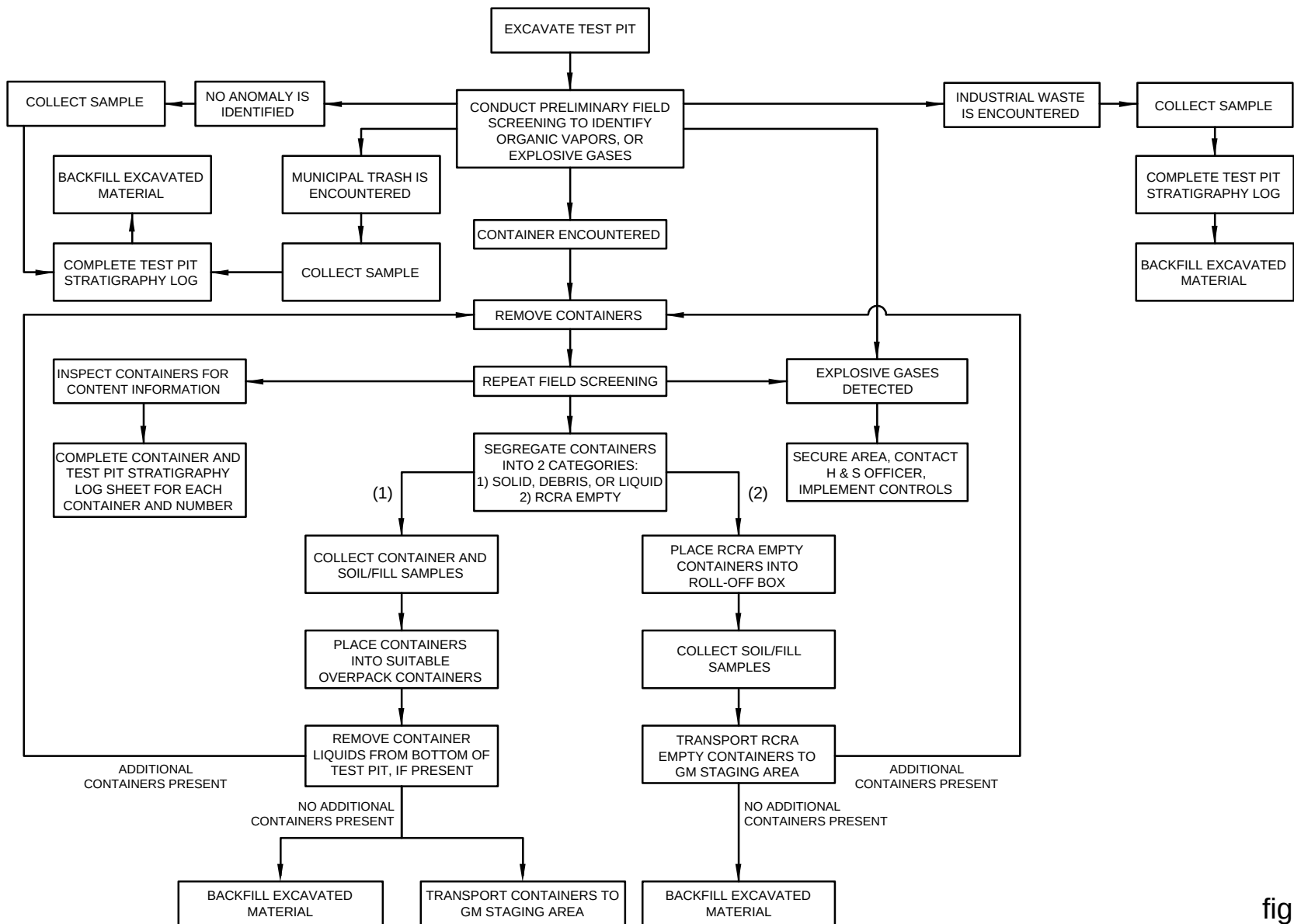


figure 1.2

DECISION TREE FOR TEST PIT EXCAVATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



[illegible]

TEST PIT CONTAINER FIELD DATA SHEET
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA

APPENDIX A

GEOPHYSICAL INVESTIGATION REPORT

GEOPHYSICAL INVESTIGATION REPORT

**GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

FEBRUARY 3, 2003

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1.0 INTRODUCTION

This Geophysical Investigation Report has been prepared on behalf of General Motors (GM) by Conestoga-Rovers & Associates (CRA), to present the results of geophysical surveys completed at the GM Powertrain Bedford Facility (Bedford Facility or Site) in Bedford, Indiana.

In March 2001, a Current Conditions Report (CCR) for the Site was completed by CRA, in which Areas of Interest (AOIs) or areas of potential environmental concern were identified. Some of the AOIs were former disposal areas of potentially hazardous materials associated with the historic operations of the aluminum foundry at the Site. These materials included foundry sand, waste aluminum dross, wastewater lagoon sludges, miscellaneous solid wastes, and possibly drummed wastes.

In order to delineate these former disposal areas, a Geophysical Investigation of on-Site AOIs was completed in January 2002. An additional phase of Geophysical Investigation was also completed at some suspected off-Site disposal areas in August 2002, at the request of the property owners. Survey coverage of AOIs (on-Site) and off-Site areas completed to date are presented on Figure 1.1.

1.1 GEOPHYSICAL REFERENCE GRID

Prior to the start of data collection, geophysical survey grids were established over on-Site AOIs and off-Site areas. A Ground Positioning System (GPS) was utilized to establish a number of control points on 100-foot centers over each survey area. Geophysical grids were completed by using the control points to establish detailed survey lines spaced 20 feet apart. Station spacings on these lines were measured off at 20-foot intervals using pin flags. Finally, the survey grids within each area were designated with a Cartesian coordinate system, to facilitate the use of the various data loggers.

2.0 GEOPHYSICAL SURVEY METHODS

The Geophysical Investigation consisted of EM31 metal detection (in-phase) and terrain conductivity surveys, an EM38 conductivity survey, and an EM61 survey.

The EM31 and EM38 are ground conductivity meters that generally consist of a rigid boom containing transmitter and receiver coils separated by a fixed distance. The coil separation for the EM31 is 14 feet, and 3 feet for the EM38. The depth of penetration attainable for these instruments is a function of the transmitter/receiver coil separation and the orientation of the dipoles emitting the primary field signal, either horizontal or vertical. With vertically oriented dipoles, the approximate depths of penetration for the EM31 and EM38 are 15 to 20 feet and 4 to 5 feet, respectively.

The EM31 and EM38 can be operated in both metal detection and terrain conductivity modes. The EM31 was utilized in metal detection mode, to identify the location of buried metal objects. EM31 and EM38 terrain conductivity surveys were conducted to determine limits of any disposal areas, based on a potential contrast in terrain conductivity between the conductive buried materials (i.e., foundry sand, waste aluminum dross, etc.) and the background response of native soil.

The EM61 is a buried metal detector which uses two 1.5 by 3-foot rectangular coils in a stacked configuration to transmit 150 EM pulses per second into the ground at each measuring point. During the off-time between transmitted pulses, receiver coils measure the decay of the transient electrical currents induced by the pulses. Electrical currents in moderately conductive earth materials (including moist clays, mineralized soils, etc.) dissipate rapidly, leaving only the more prolonged currents due to buried metal objects. The EM61 detects and measures the prolonged transient currents, yielding a result in millivolts (mV) proportional to the metallic content of the buried object, and inversely proportional to its depth of burial. The effective depth of penetration of the EM61 is approximately 10 feet. EM61 surveys were conducted to locate buried metallic debris, metal objects (possibly including drums), or metallic materials in the near subsurface.

The EM38 survey was completed along each survey line by manually triggering a reading at 2-foot station intervals. Terrain conductivity readings were measured at each station, and were stored in an Omni data logger. The data were downloaded at the end of each day.

The EM31 survey was completed at 4-foot station intervals along each survey line. Metal detection (in-phase) and terrain conductivity readings were measured

simultaneously, and were stored in an Omni data logger. The data were downloaded at the end of each day.

The EM61 survey was completed along each survey line by manually triggering a reading at 2-foot station intervals. Channel 1 through Channel 4 of the current decay curve were measured simultaneously, and were stored in an Omni data logger. The data were downloaded at the end of each day. The coil platform was mounted on wheels, and the "wagon" assembly was towed or pushed along the survey line by the operator.

All surveys were conducted on 20-foot spaced lines. Since data for each instrument were downloaded at the end of each day the data could be constantly monitored, and the locations of anomalous responses could generally be noted. This allowed the opportunity for intermediate 10-foot spaced lines to be subsequently surveyed, over these anomalous areas.

Grid coverage for all geophysical methods was relatively complete, with the exception of heavily wooded areas and the inaccessible portions of AOI 4 within the existing stormwater lagoon perimeter fence. During the course of the various surveys, the locations of all surficial metal objects or debris which were encountered on survey lines were noted. This includes several metal structures which were located within the boundaries of the former fire training area.

3.0 EVALUATION OF GEOPHYSICAL SURVEY RESULTS

The evaluation of EM31 metal detection and terrain conductivity, EM38 terrain conductivity, and EM61 surveys for on-Site (AOI) and off-Site areas is presented as follows.

3.1 ON-SITE (AOI) INVESTIGATIVE AREAS

Geophysical surveys were completed at five on-Site AOIs in January 2002. As indicated by Figure 1.1, these AOIs are situated east of GM Drive, and partially encompass the existing stormwater lagoon. The Geophysical Investigation was expected to delineate conductivity and metal detection anomalies associated with former disposal areas, and thus provide targets for subsequent confirmatory test pitting activities.

3.1.1 AOI 4

AOI 4 is located in the northeast portion of the survey coverage, between the stormwater lagoon to the south and east, and the wooded ravine to the north. Historic air photos also indicated that a small quarry formerly existed in the northeast corner of AOI 4. The EM38 results (Figure 3.1) indicate that shallow subsurface is generally characterized by weak to moderate conductivity, with sporadic elevated zones also evident. However, the EM31 data (Figure 3.2) suggests that the deeper subsurface is less conductive and generally close to background values, with the exception of the slightly elevated response in the north central area of AOI 4 and in the vicinity of the former quarry.

The EM61 response (Figure 3.3) reveals that moderate to strong metal detection responses were observed along a linear trend in the western portion of AOI 4. Slightly elevated results were generally observed over the remainder of the former north disposal area. The EM31 metal detection results presented on Figure 3.4 also indicate that relatively few anomalies were detected at depth within the boundaries of AOI 4.

3.1.2 AOI 5

The survey coverage for AOI 5 (see Figure 1.1) represents the plateau and ravine area east of the salaried parking lot perimeter fence. Conductivity results for the EM38 survey (Figure 3.5) and EM31 survey (Figure 3.6) indicate that coincident high intensity anomalies were delineated in the southwest portion of Area 5. These anomalies are

located on the plateau and are open to the west, which suggests that the high conductivity responses continue beneath the adjacent parking lot. One strong EM61 metal detection anomaly was detected on the boundary between AOI 5 and AOI 6 (see Figure 3.7). The EM31 survey also detected buried metal at this location (Figure 3.8). A moderate feature was also delineated on the plateau, within the boundaries of the elevated conductivity responses. A shallow resistivity anomaly (based on EM38 response, Figure 3.9) was also detected in the eastern corner of AOI 5, adjacent to a disposal pit in AOI 6 (identified in air photos).

3.1.3 AOI 6

AOI 6 is comprised of the ravine east of AOI 5 and the former fire training area, and extends westward to the perimeter fence along GM Drive. Review of the EM38 conductivity survey results presented on Figure 3.5 reveals that the area surrounding the former fire training structures (identified as gray squares and rectangles) is characterized by elevated responses. Areas of high conductivity were also observed in two areas to the west, immediately south of the parking lot and AOI 5.

The EM31 conductivity plot (see Figure 3.6) reveals that the fire training area is generally characterized by weak to moderate response at depth, and that higher conductivities were only encountered over a small zone within the training structures. Thus, the conductivity anomaly delineated with the EM38 appears to be a near surface feature, and not appear to extend downward over a large area. Additional strong EM31 conductivity anomalies were detected in the northwest and southwest corners of the survey coverage. The EM31 conductivity response was also useful in determining the approximate location of the water line alignment between the storm water lagoon and water tower.

Numerous metal detection anomalies were delineated during the EM61 metal detection survey, as indicated on Figure 3.7. Several of these anomalies were attributed to sources observed on surface, including the metal fire training structures, iron bollards, fire hydrants, metal grates, and utility pole support wires. However, other anomalies were also delineated including the high amplitude picture between AOI 5 and AOI 6, and a moderate amplitude feature immediately to the south of this location. Elevated EM61 metal detection results were also observed in the southeast portion of the surveyed area, and near the western boundary of AOI 6. The metal detection results for the EM31 survey (Figure 3.8) indicate that a few buried objects were detected on the sideslopes and in the ravine, generally in close proximity or on the boundary with AOI 5. To the

south, the majority of the EM31 metal detection response can be attributed to the fire training structures, with the exception of a few relatively small, discrete responses.

The resistivity response based on the EM38 data indicates the presence of shallow anomalies in the north end of AOI 6, at a location coincident with a disposal pit observed on a historic air photo.

3.1.4 AOI 7

Geophysical surveys were also completed over the Former North Lagoon designated as AOI 7, to confirm the absence of disposal areas and buried metal objects following the completion of remedial activities in this area in the 1980s. The EM38 and EM31 results presented on Figure 3.1 and 3.2, respectively, reveal weakly anomalous responses which appear to curve along the northern and eastern boundaries of the former lagoon. These results may delineate a remnant clay berm associated with the former lagoons. Similarly, the strong conductivity response bisecting the former lagoon along a north-south axis may also represent clay fill beneath the subsurface.

The EM61 metal detection results (Figure 3.3) indicate that the former lagoon is generally characterized by background response. With the exception of a strong anomaly associated with a concrete manhole and a weak response coincident with the conductivity anomalies, background values were generally recorded with the EM31 metal detection survey.

3.1.5 AOI 15

AOI 15 is located in the northeast corner of the survey coverage, and has been identified as a former equipment storage area. Presently, it is used by a GM subcontractor to park semi-tractor trailers. With minor exceptions, the EM38 and EM31 conductivity surveys (Figures 3.1 and 3.2) yielded background results. A few discrete EM61 and EM31 metal detection anomalies were also delineated, as indicated on Figures 3.3 and 3.4.

3.2 OFF-SITE INVESTIGATIVE AREAS

Additional geophysical testing was completed at four off-Site locations in August 2002. Review of Figure 1.1 confirms that Areas 1, 2, and 3 are located adjacent to the Bedford Facility, just north of Breckenridge Road. The fourth location is situated some distance

away relative to the other areas, approximately 2 miles northwest. Geophysical surveys were completed over suspected fill and/or disposal areas on these properties at the request of the respective Owners. The Owners believe that the fill/disposal materials located in these areas originated from the Bedford Facility. Thus, EM31 and EM61 surveys were completed to delineate any potential anomalous responses associated with the fill/disposal areas, and if necessary, to determine proposed locations for subsequent test pitting activities.

3.2.1 AREA 1

Area 1 is an open field covering approximately 5 acres, which is located immediately to the northwest of the Bedford Facility. The EM61 metal detection results for Area 1 indicate that an area of predominately weak to moderate responses was delineated in the southwest portion of the surveyed area (Figure 3.10). Several discrete strong or higher intensity features were also detected in this vicinity. Approximately 300 feet to the north, a weak metal detection response was observed. The high intensity responses detected along the northeast boundary of the survey grid were attributed to two culverts which were found in this area.

Review of the EM31 metal detection results (Figure 3.11) indicates that the responses for this survey were similar to those observed for the EM61. A weak to moderate EM31 anomaly covered the southwest portion of the survey grid, with stronger responses also observed within its boundaries. A weak EM31 response was also observed further to the north, coincident with the EM61 response in this area. In the southeast portion of the survey grid, a relatively small, weak amplitude anomaly was also detected.

The EM31 conductivity results presented on Figure 3.12 indicate that the majority of the field was characterized by background values. Conductivity response increased in the southeast portion of the survey grid, where two anomalies were detected. Additional conductivity anomalies were detected in the southwest corner of the grid, and along the western survey boundary (at line 400 N).

3.2.2 AREA 2

Area 2 is situated due north of the Bedford Facility, and consists of an elongated plateau running north-south to northwest-southwest. Relatively steep sideslopes fall off of the plateau to the west, north, and east. The metal detection results for the EM61 and EM31 surveys presented on Figures 3.13 and 3.14, respectively, indicate that similar responses

were observed. Strong EM61 anomalies were delineated in the northern portion of the survey coverage in Area 2, both on top of the plateau and down the northeastern sideslope. Coincident EM31 metal detection response was also observed over this area, especially down the sideslope. Minor discrete anomalies for both surveys were delineated further south. A strong EM31 conductivity anomaly was also detected within the boundaries of Area 2 (see Figure 3.15). However, the elevated conductivity response was delineated south of the metal detection anomalies, and was generally confined to the top of the plateau. A suspected utility line was also detected, along the southern boundary of the survey coverage.

3.2.3 AREA 3

The survey grid for Area 2 was extended eastward to also cover Area 3. Figure 3.13 indicates that EM61 metal detection responses were delineated in the northwest corner of Area 3, (and were observed to extend further northward into adjacent property). Additional strong EM61 results were observed at the base of the northeast sideslope, and further to the southeast. The EM31 anomalies (Figure 3.14) appear similar to the EM61 results. Coincident strong EM31 metal detection features were delineated in the northwest corner of Area 3, and along the sideslope. Two smaller anomalies were also detected near the north central and northeast areas of the survey grid.

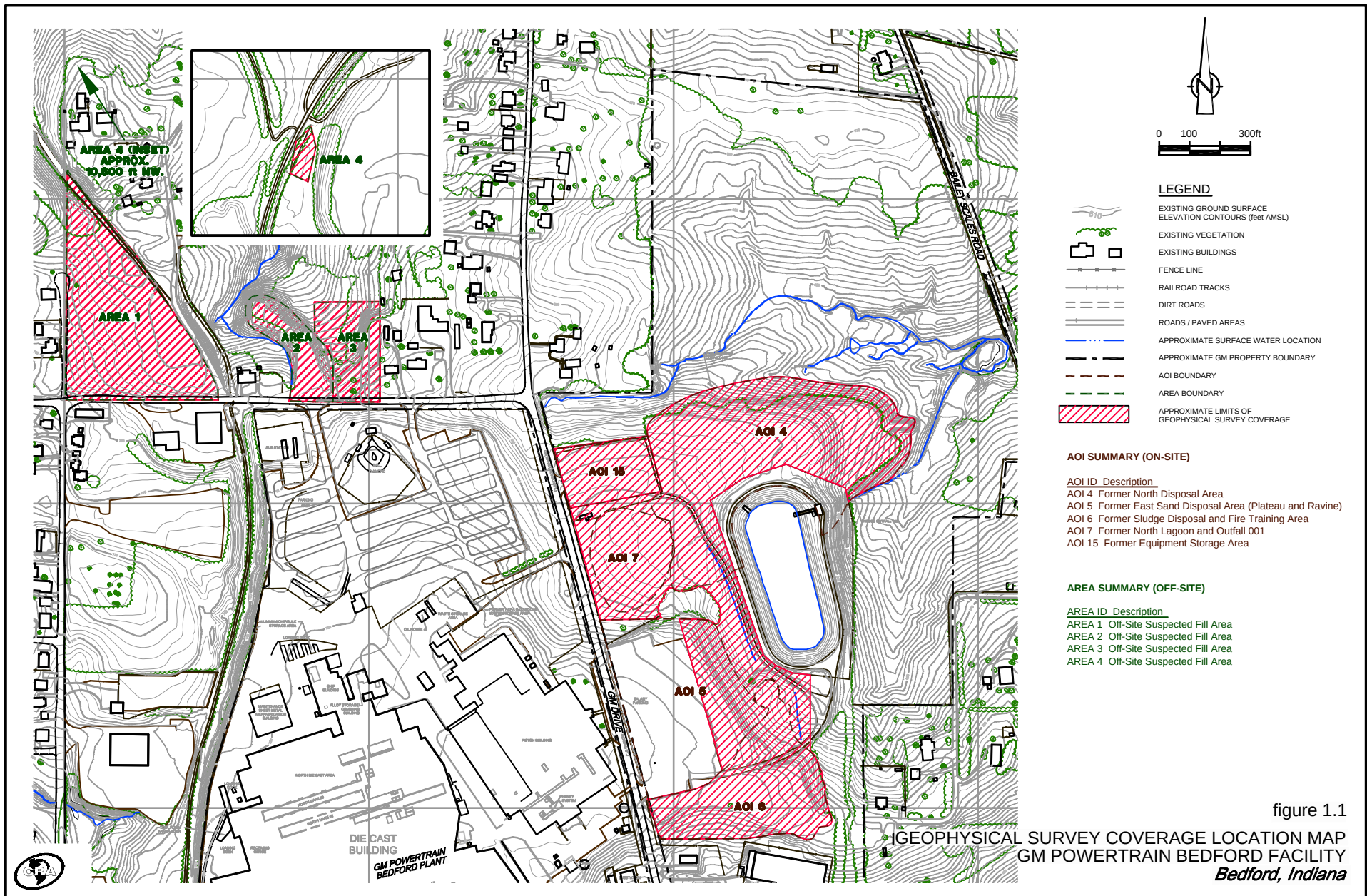
The EM31 conductivity results (Figure 3.15) indicate that with the exception of a small feature situated on the downslope (and a suspected utility line as indicated), no conductivity anomalies were detected within Area 3.

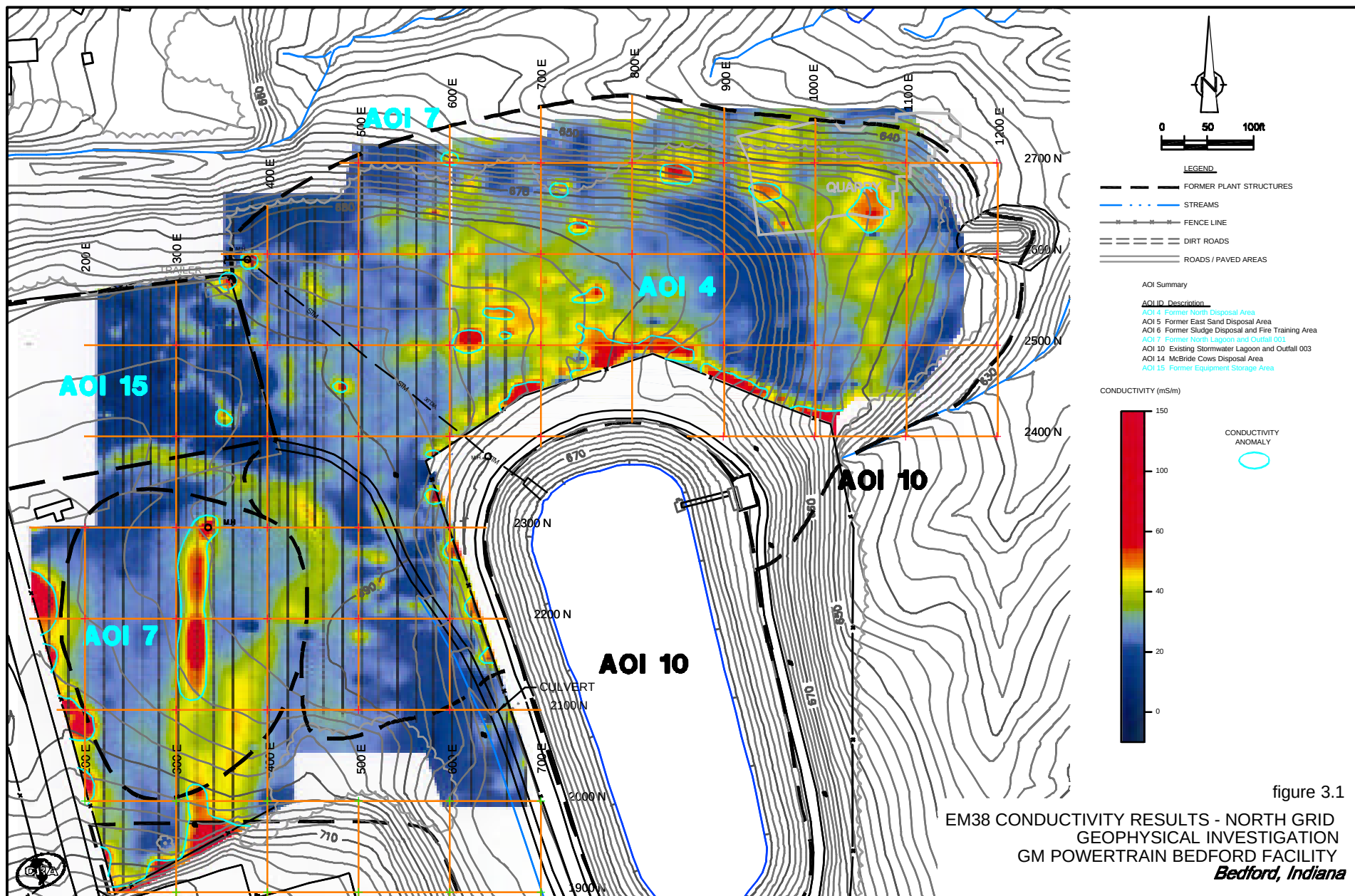
3.2.4 AREA 4

Area 4 is situated approximately 2 miles northwest of the Bedford Facility, and represents survey coverage within a larger parcel of land situated at this location. Results of the geophysical surveys completed at Area 4 are presented on Figures 3.16 to 3.18, inclusive. Without exception, these surveys delineated a linear anomalous response at the eastern boundary of the coverage. According to the owners, the linear anomalies may be coincident with a disposal trench situated on the property.

4.0 PROPOSED TEST PIT LOCATIONS

The anomalies delineated in on-Site AOIs and off-site areas as presented on Figures 3.1 to 3.18 have been compiled on Figures 4.1 to 4.5. The most prominent of these geophysical features have also been identified (with an "A" designation), based on the intensity of the response (moderate to high amplitude) and size or extent of the anomaly. In order to determine the nature of the buried objects or materials associated with the geophysical responses observed, proposed test pit locations for anomalies warranting further investigation have also been provided, and are labeled as indicated ("TP" designation). The rationale for these proposed test pitting activities in on-Site AOIs and off-Site areas has been summarized in Tables 4.1 and 4.2, respectively.





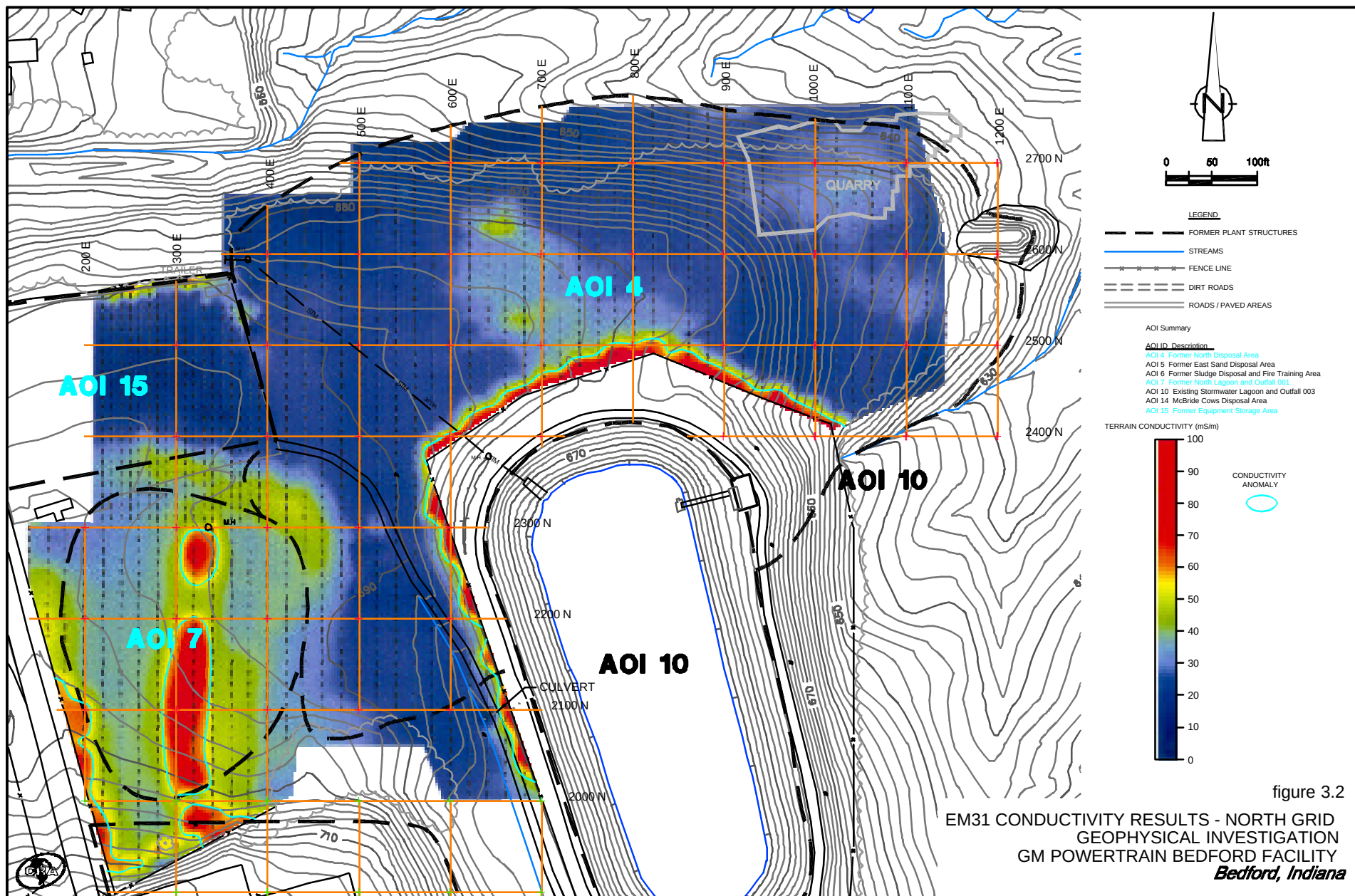
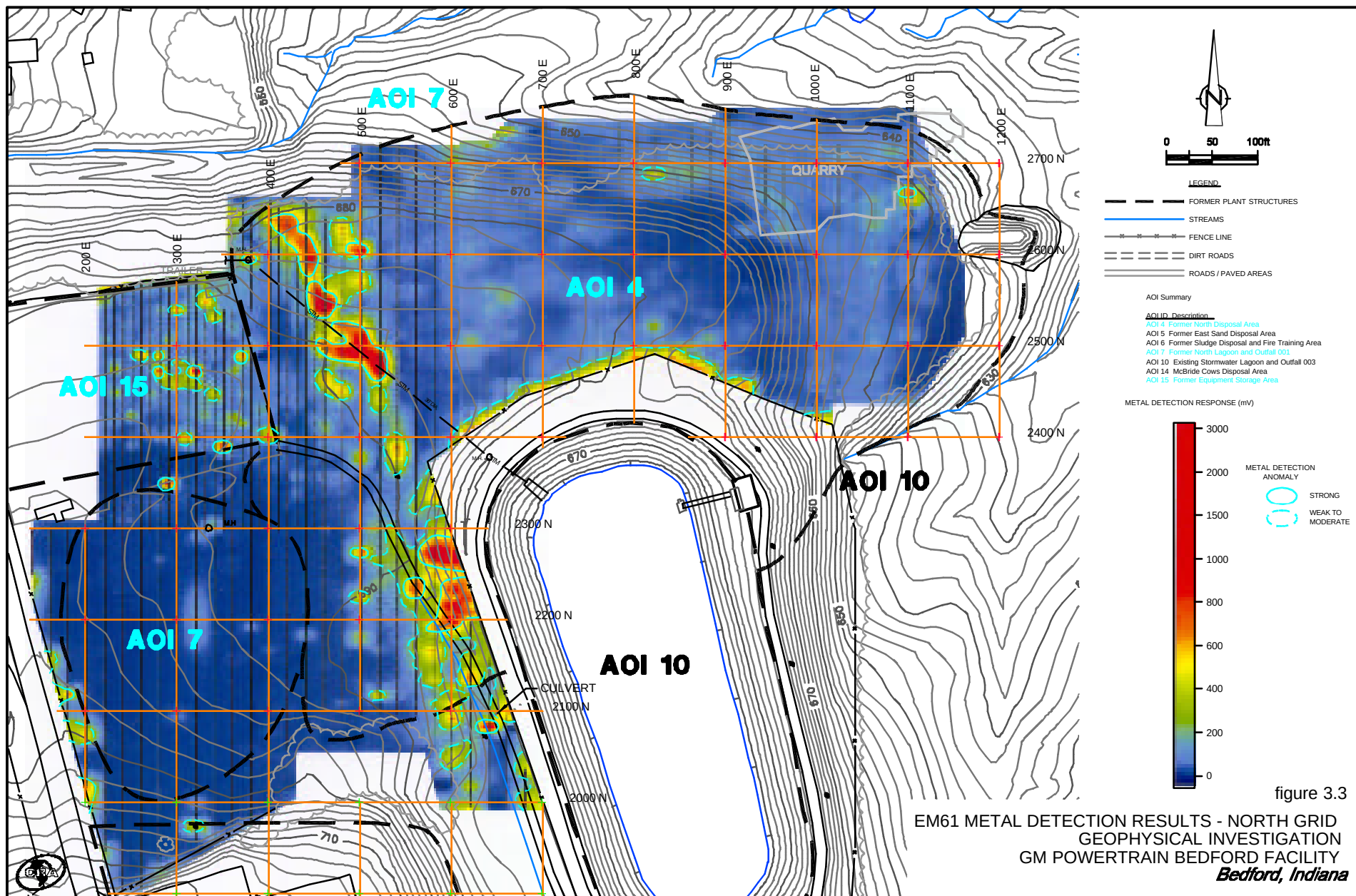
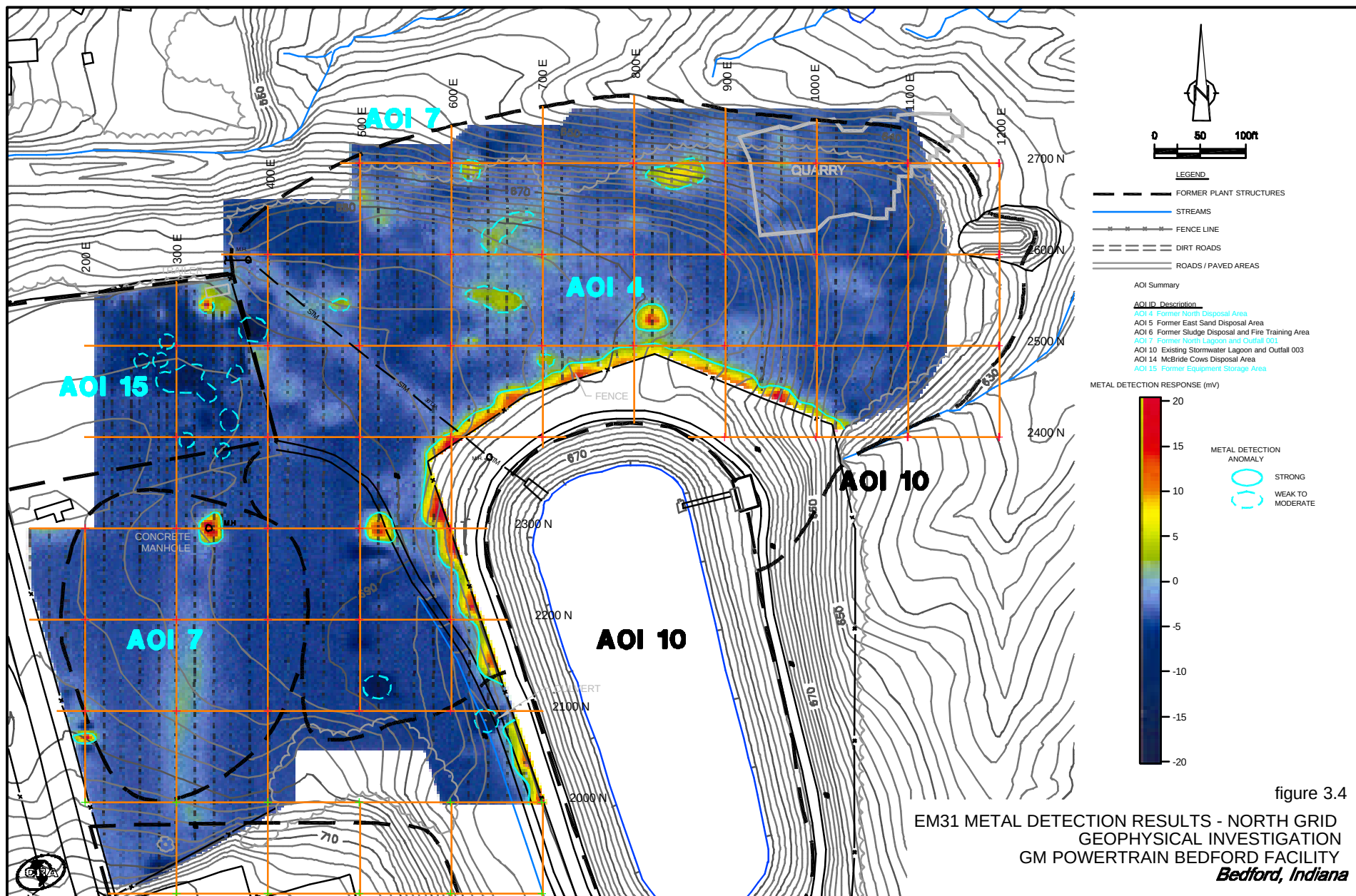
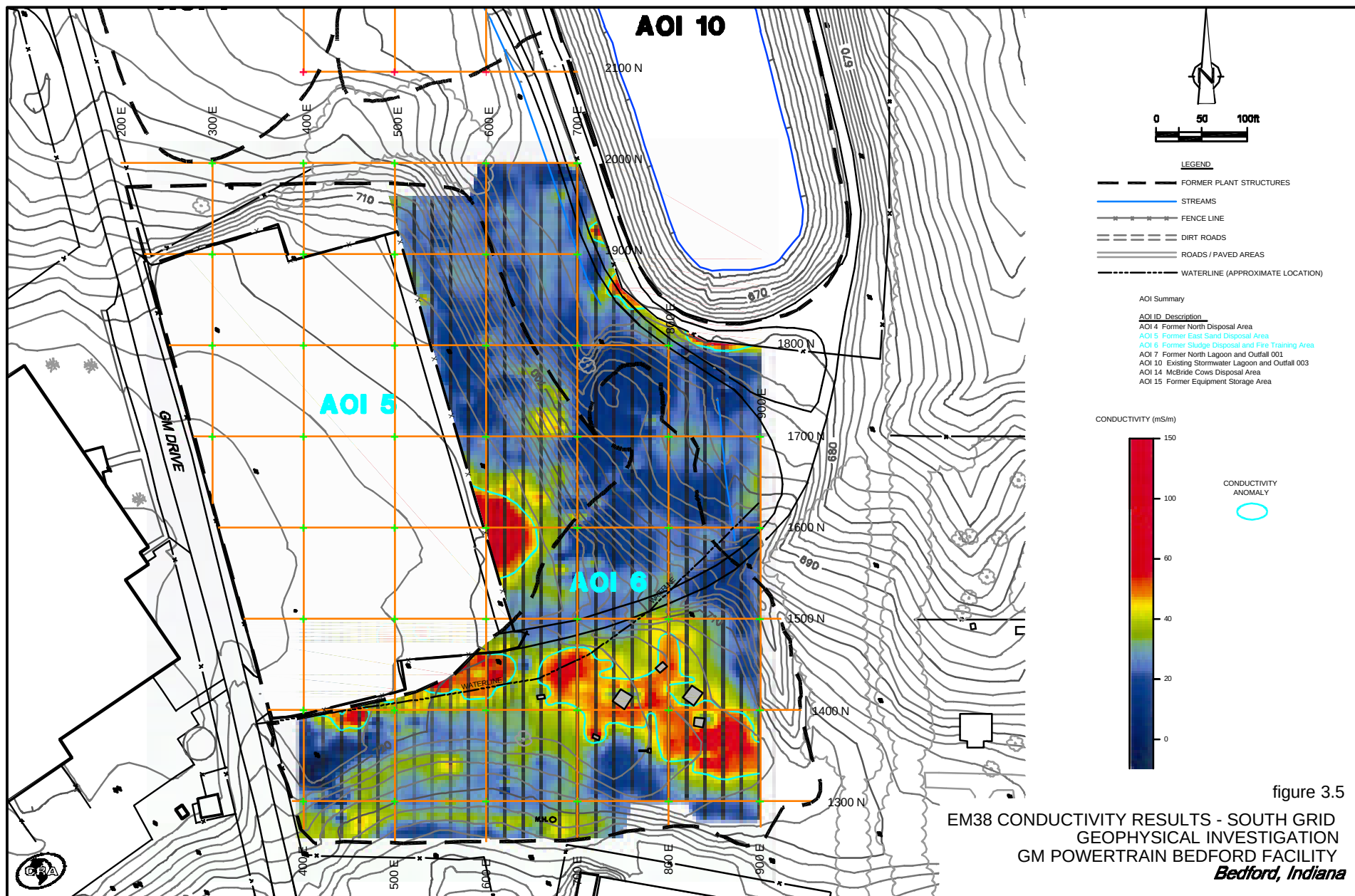


figure 3.2
EM31 CONDUCTIVITY RESULTS - NORTH GRID
GEOPHYSICAL INVESTIGATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana







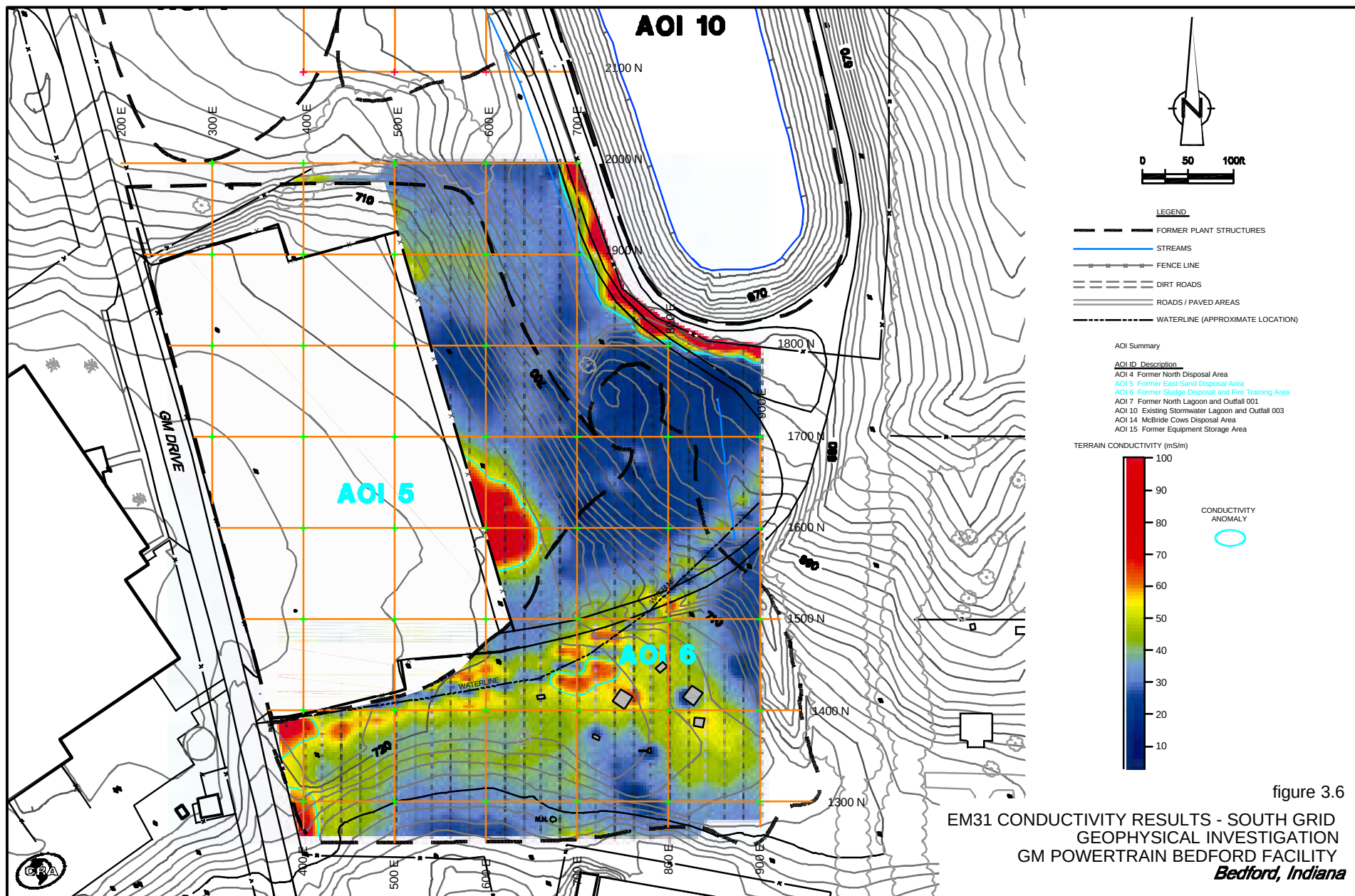
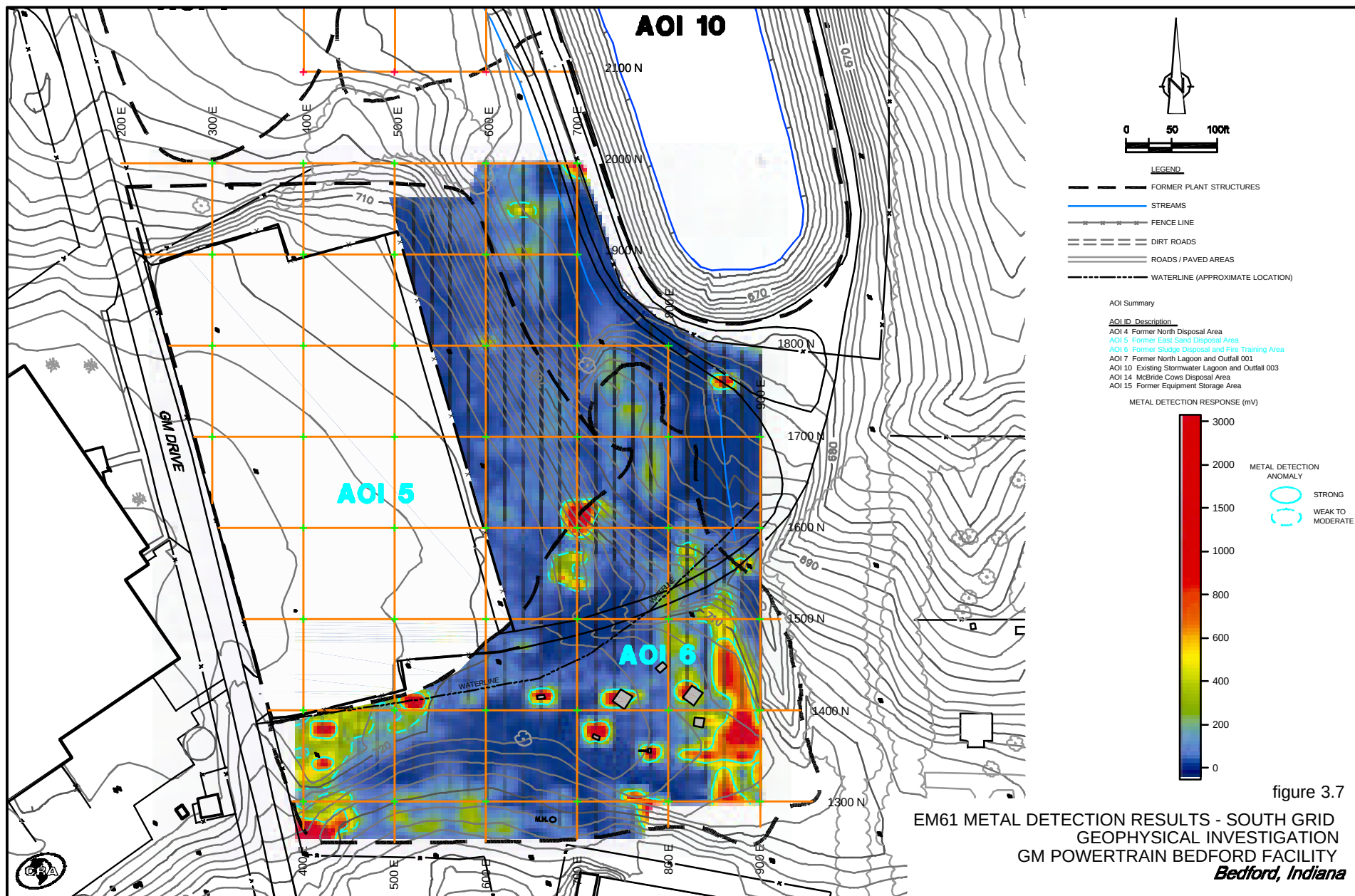


figure 3.6
EM31 CONDUCTIVITY RESULTS - SOUTH GRID
GEOPHYSICAL INVESTIGATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



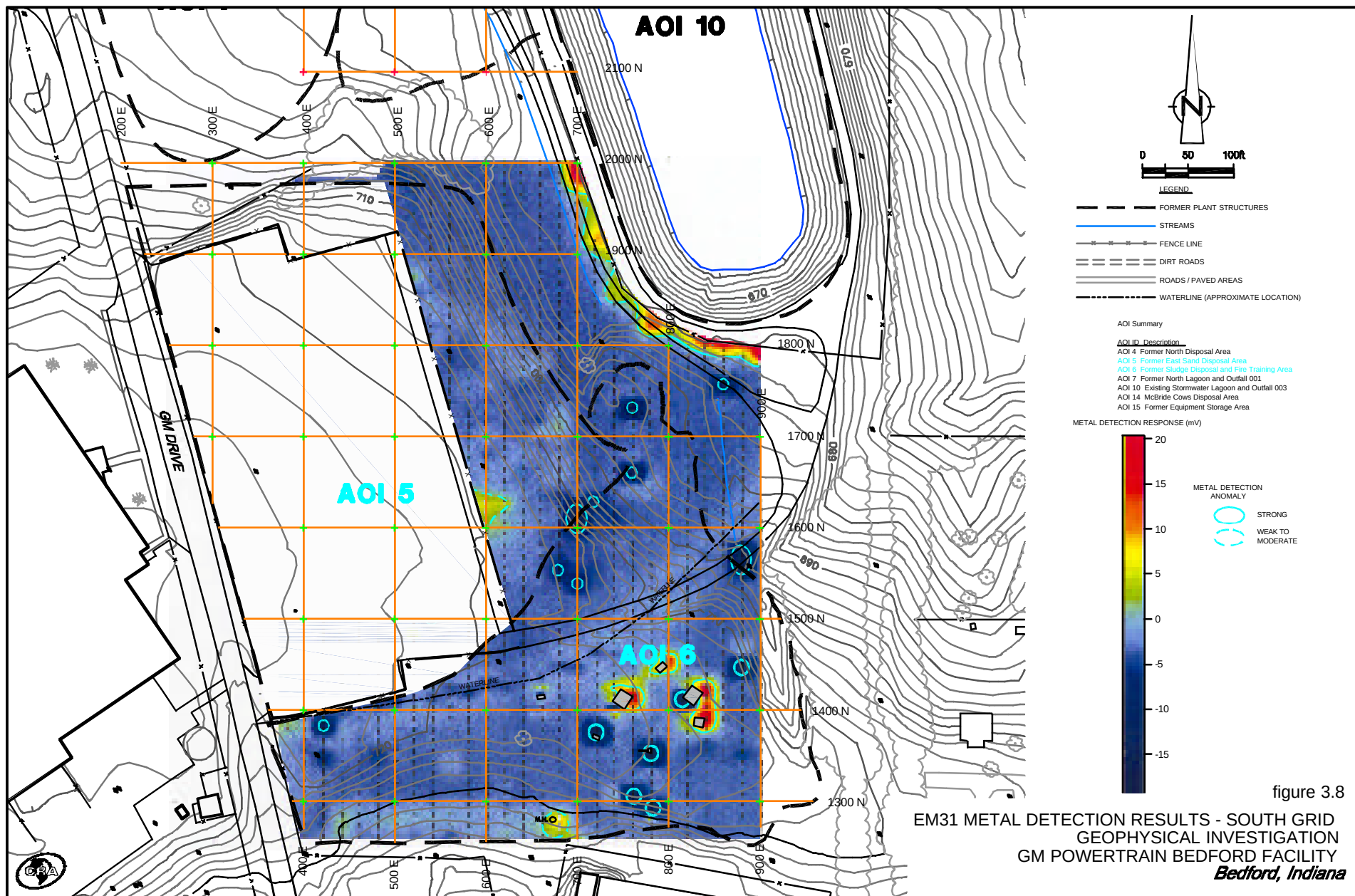


figure 3.8
EM31 METAL DETECTION RESULTS - SOUTH GRID
GEOPHYSICAL INVESTIGATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana

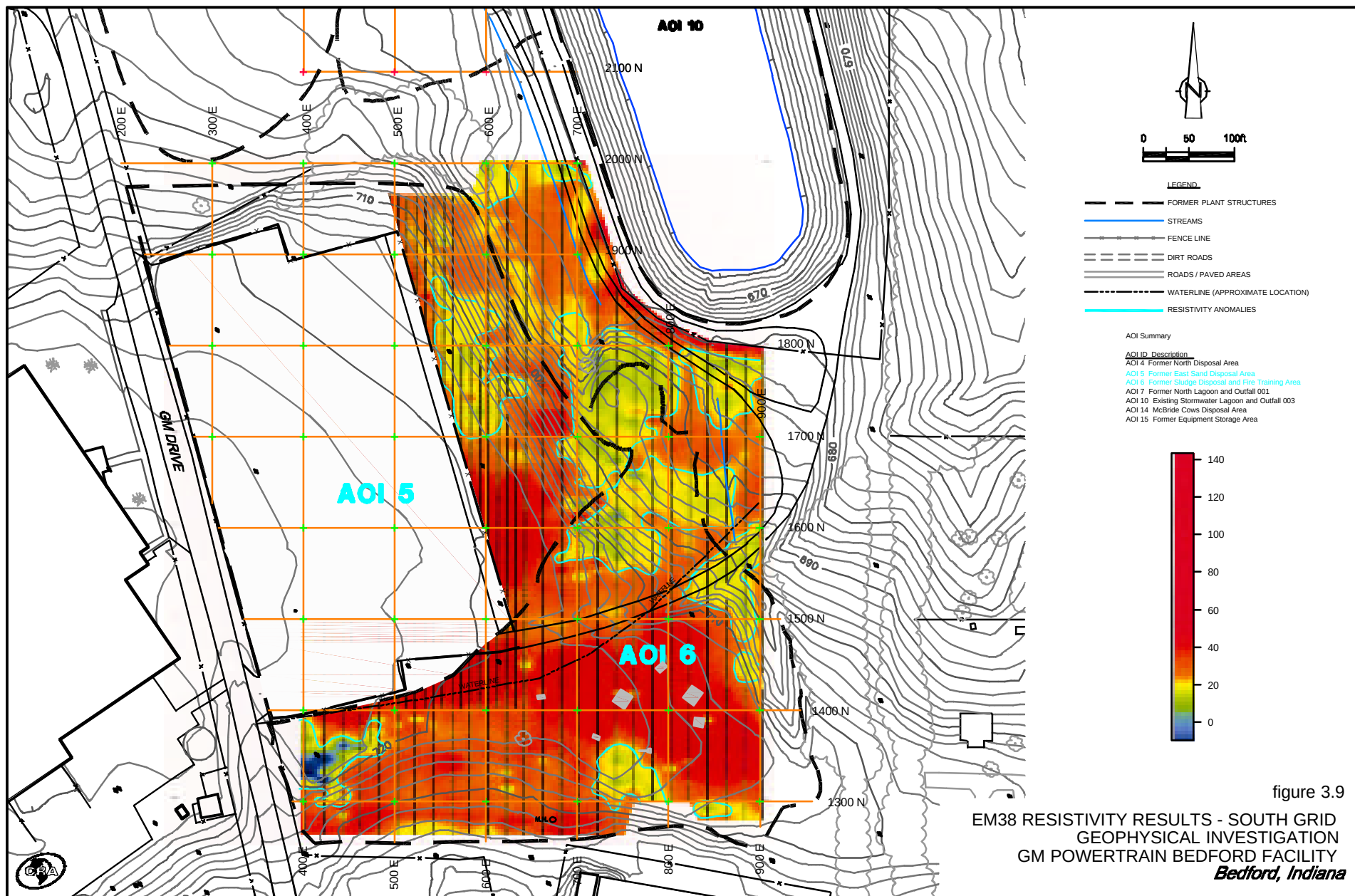
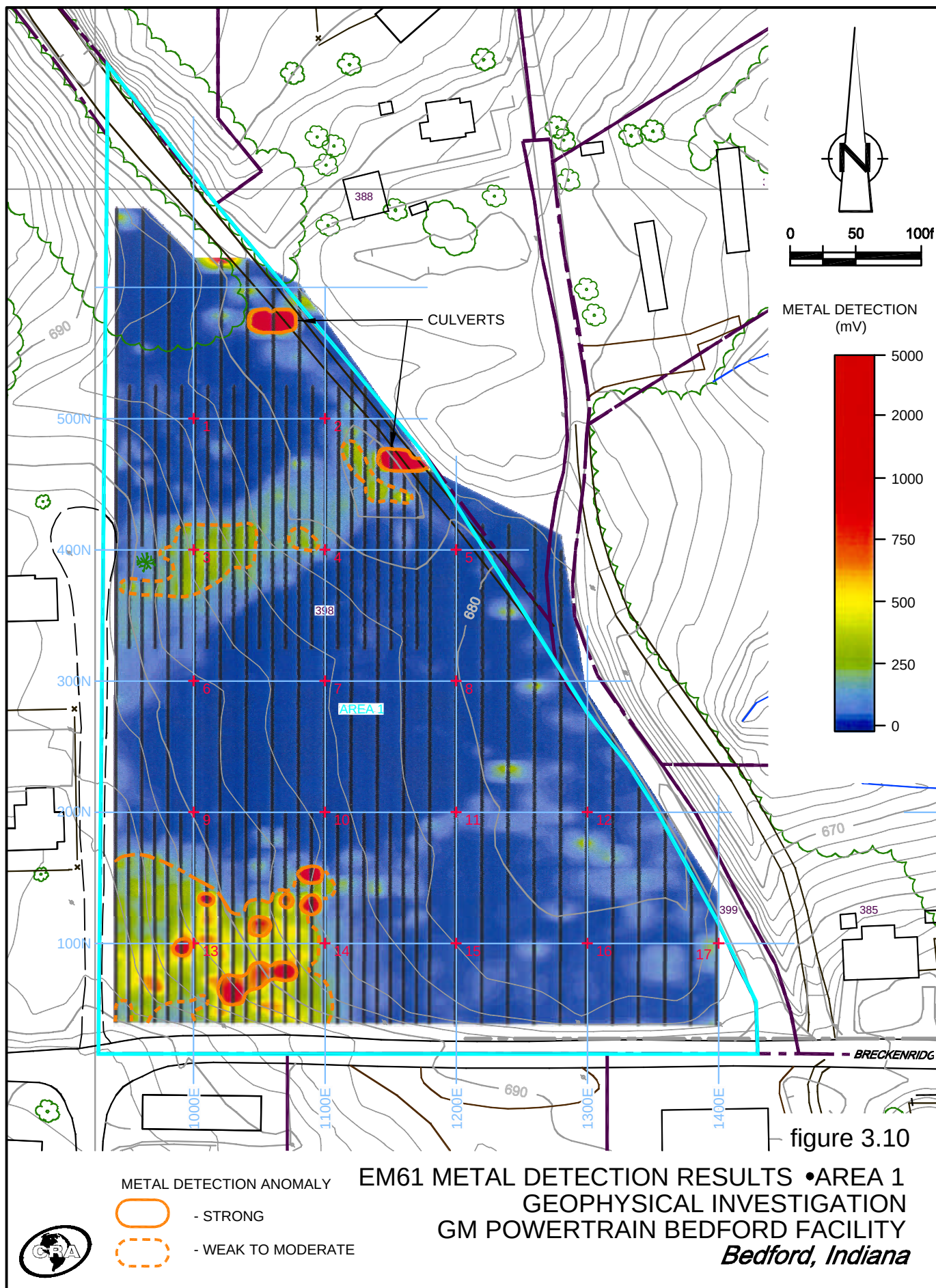


figure 3.9
EM38 RESISTIVITY RESULTS - SOUTH GRID
GEOPHYSICAL INVESTIGATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



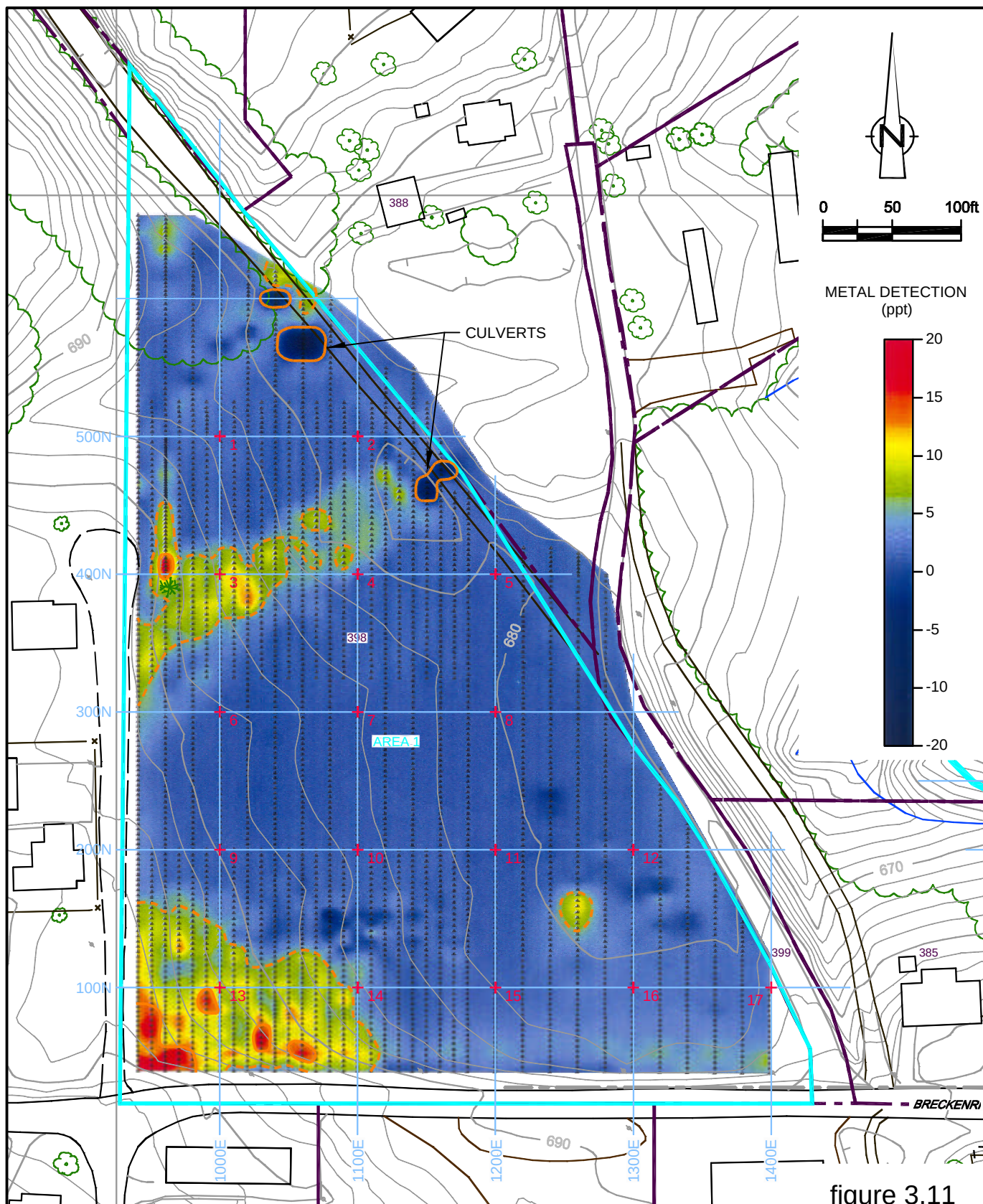


figure 3.11

METAL DETECTION ANOMALY



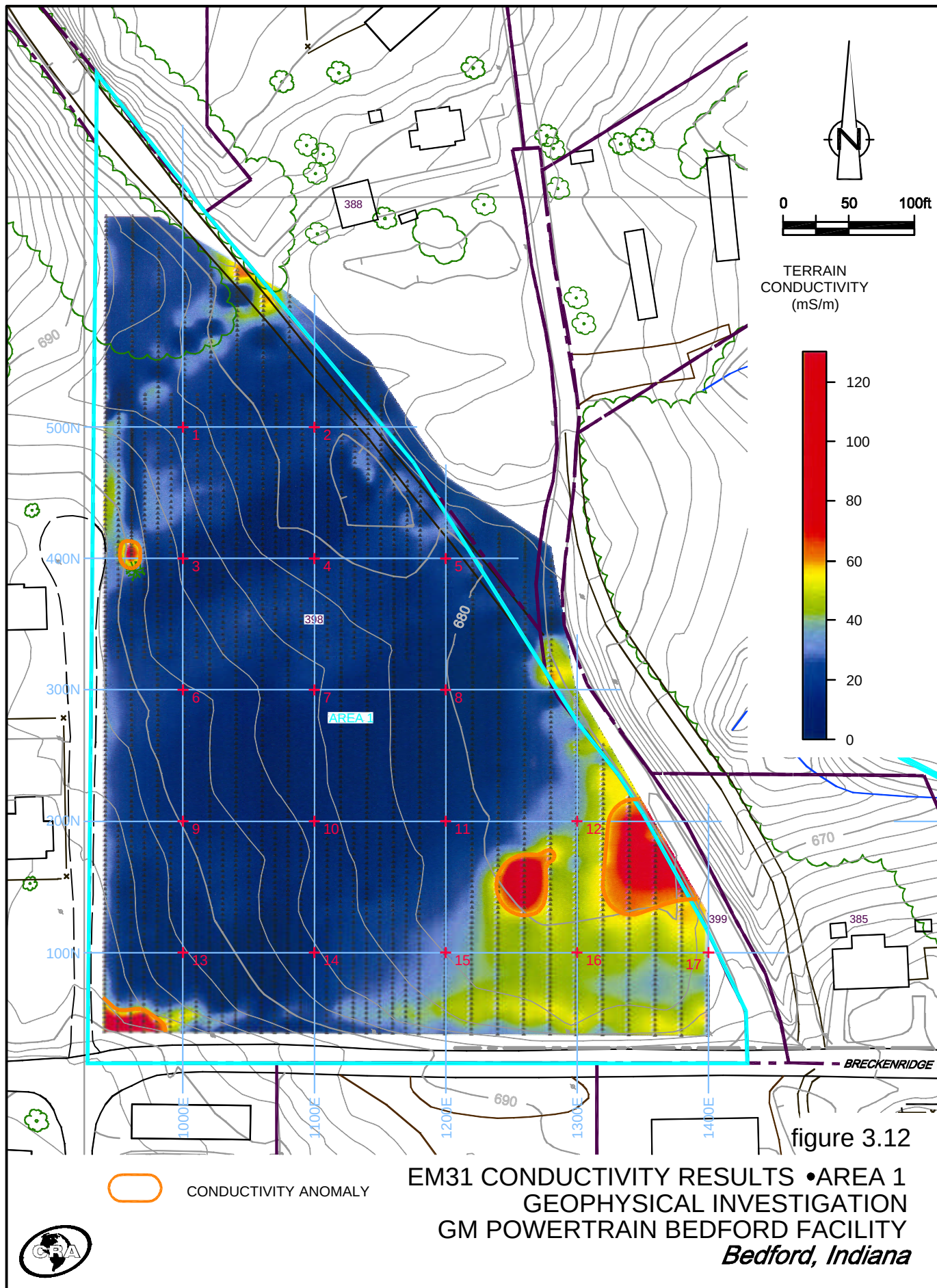
- STRONG

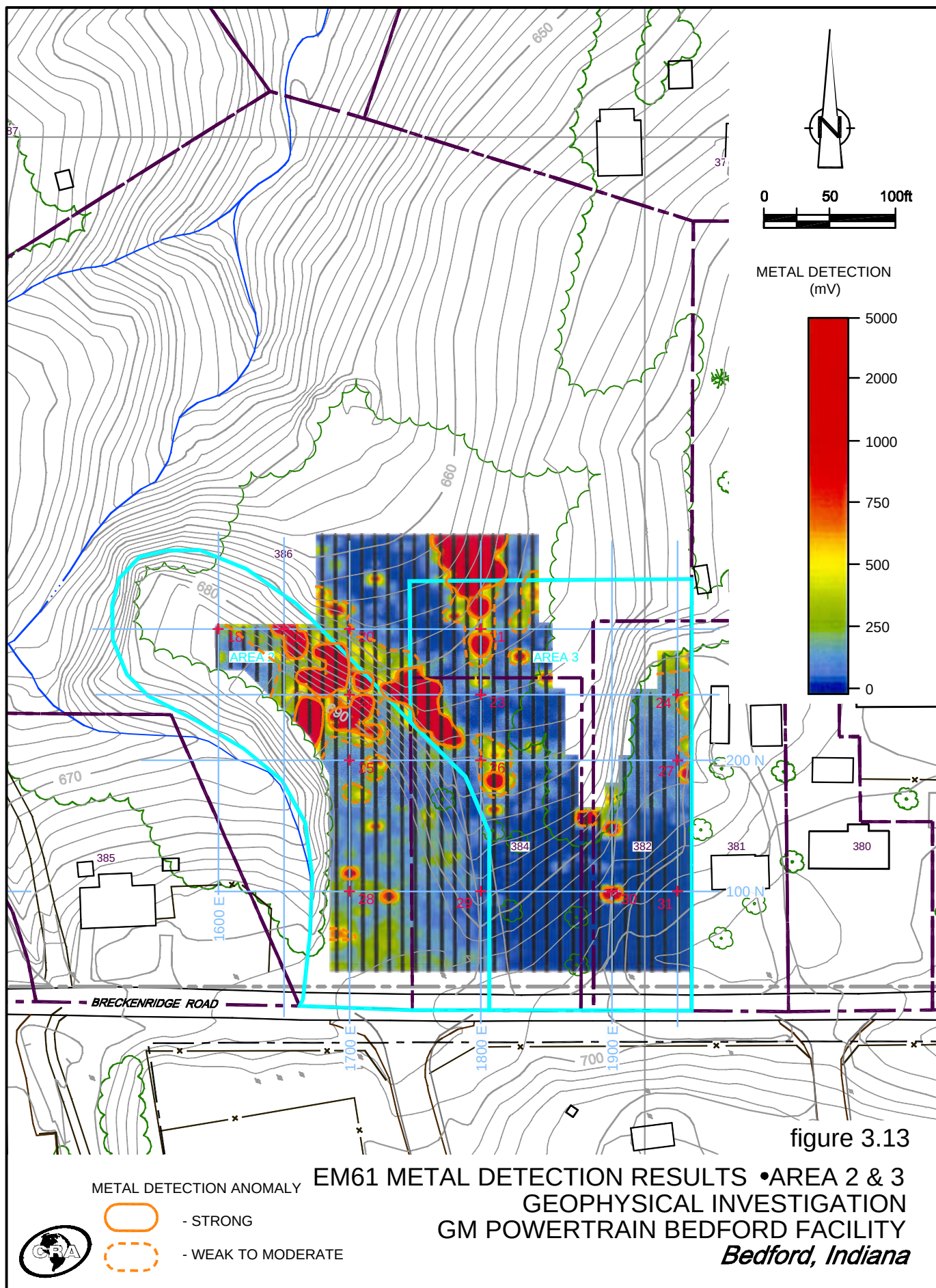


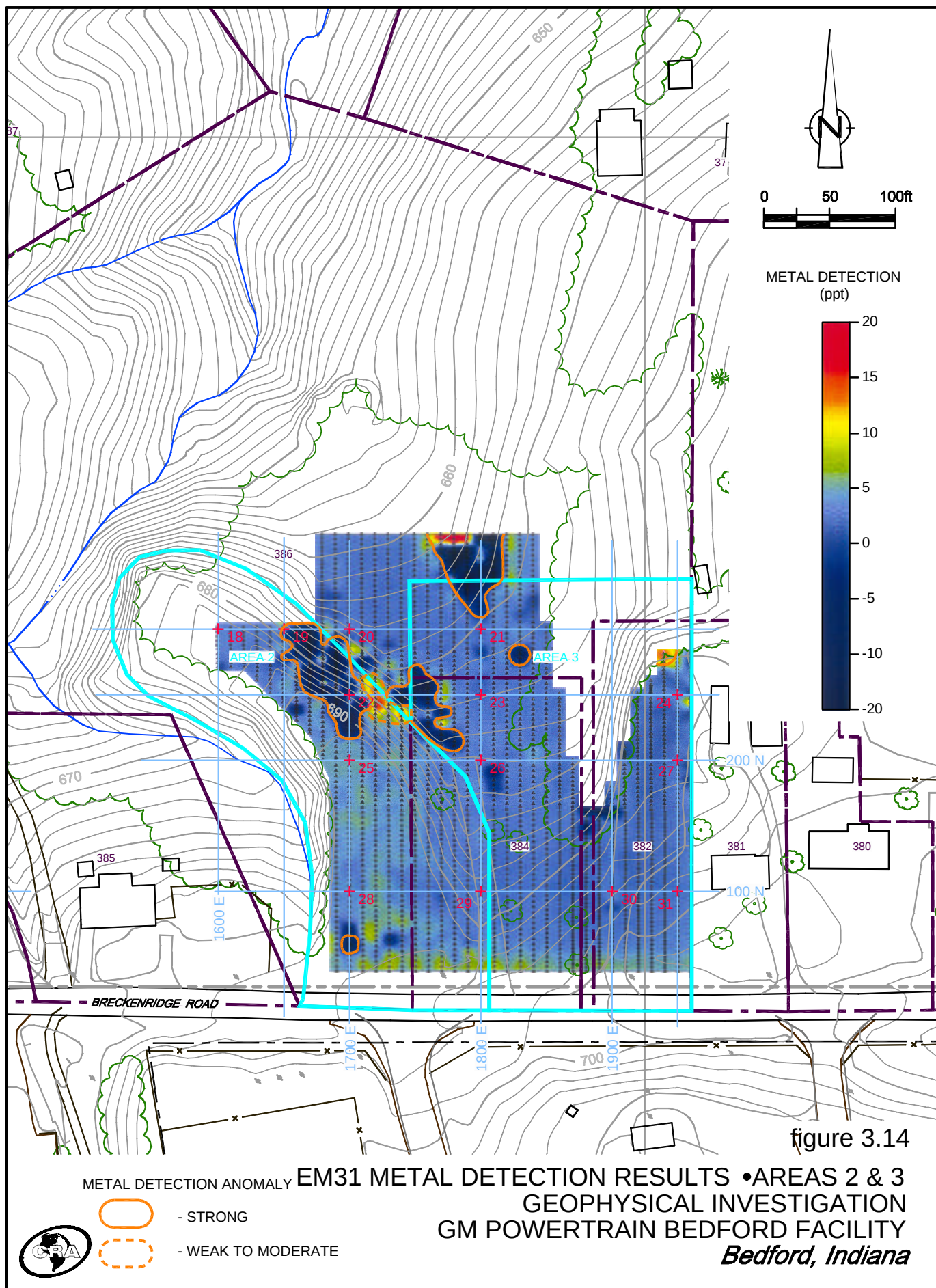
- WEAK TO MODERATE



EM31 METAL DETECTION RESULTS • AREA 1
GEOPHYSICAL INVESTIGATION
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana







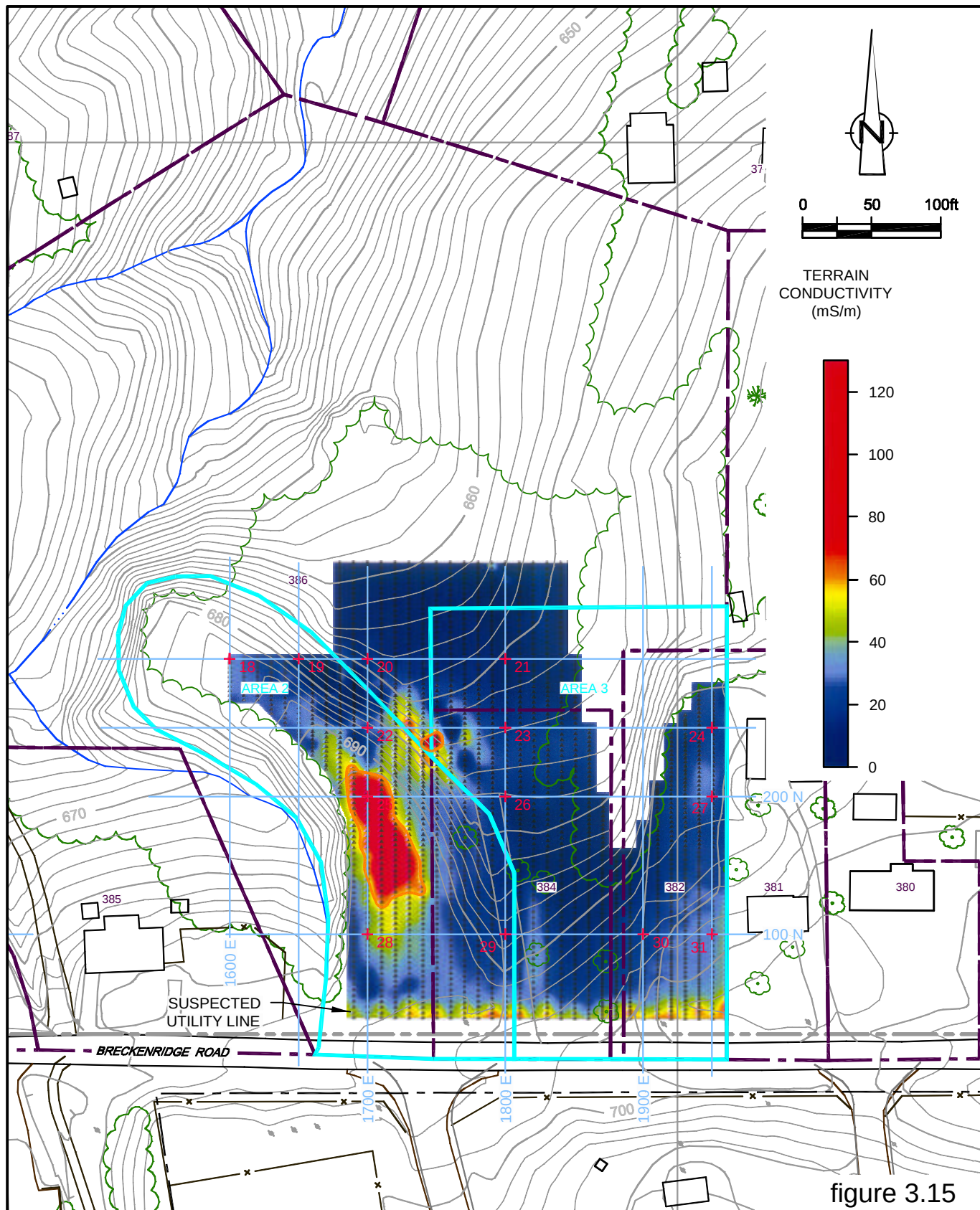
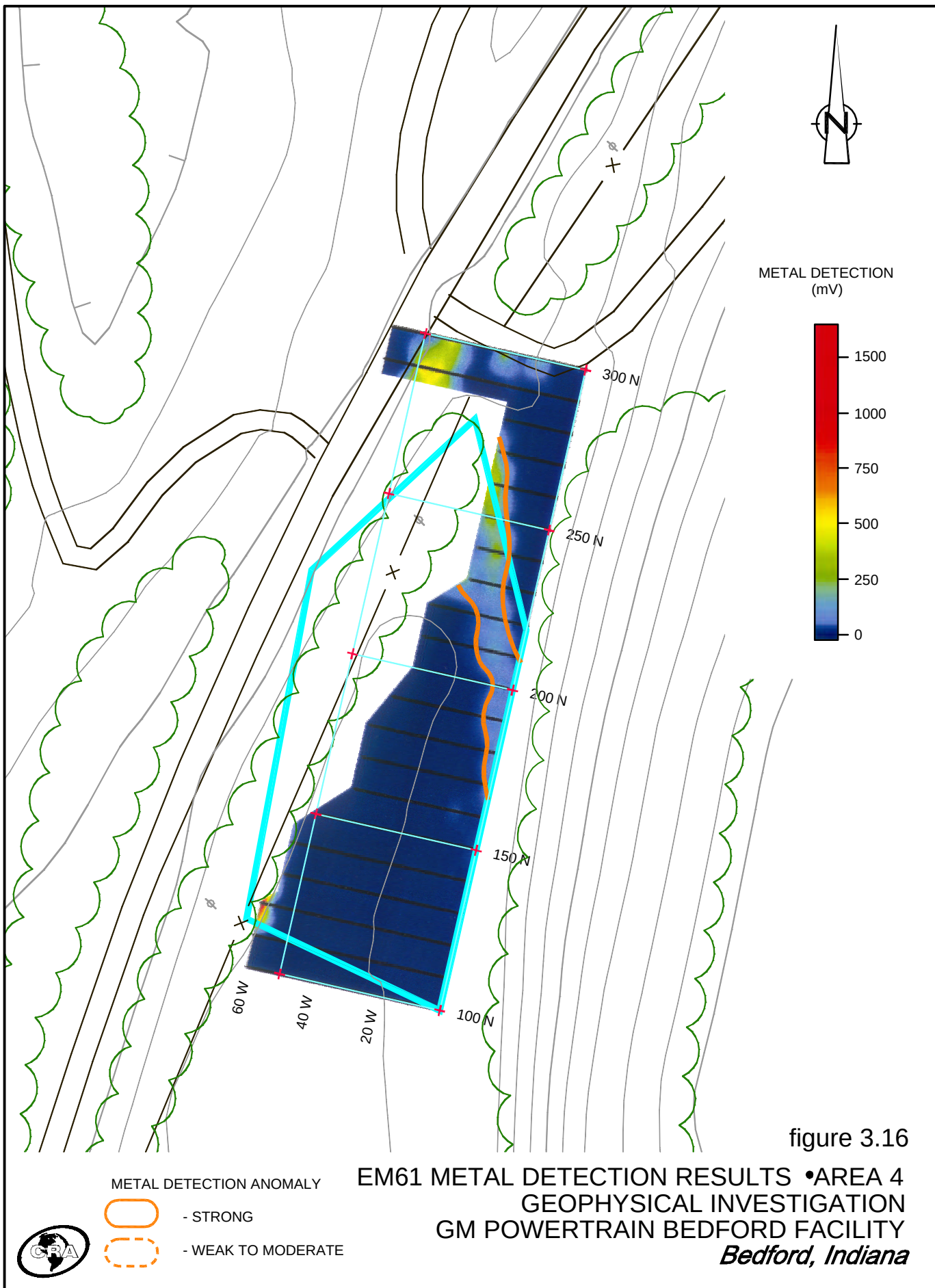


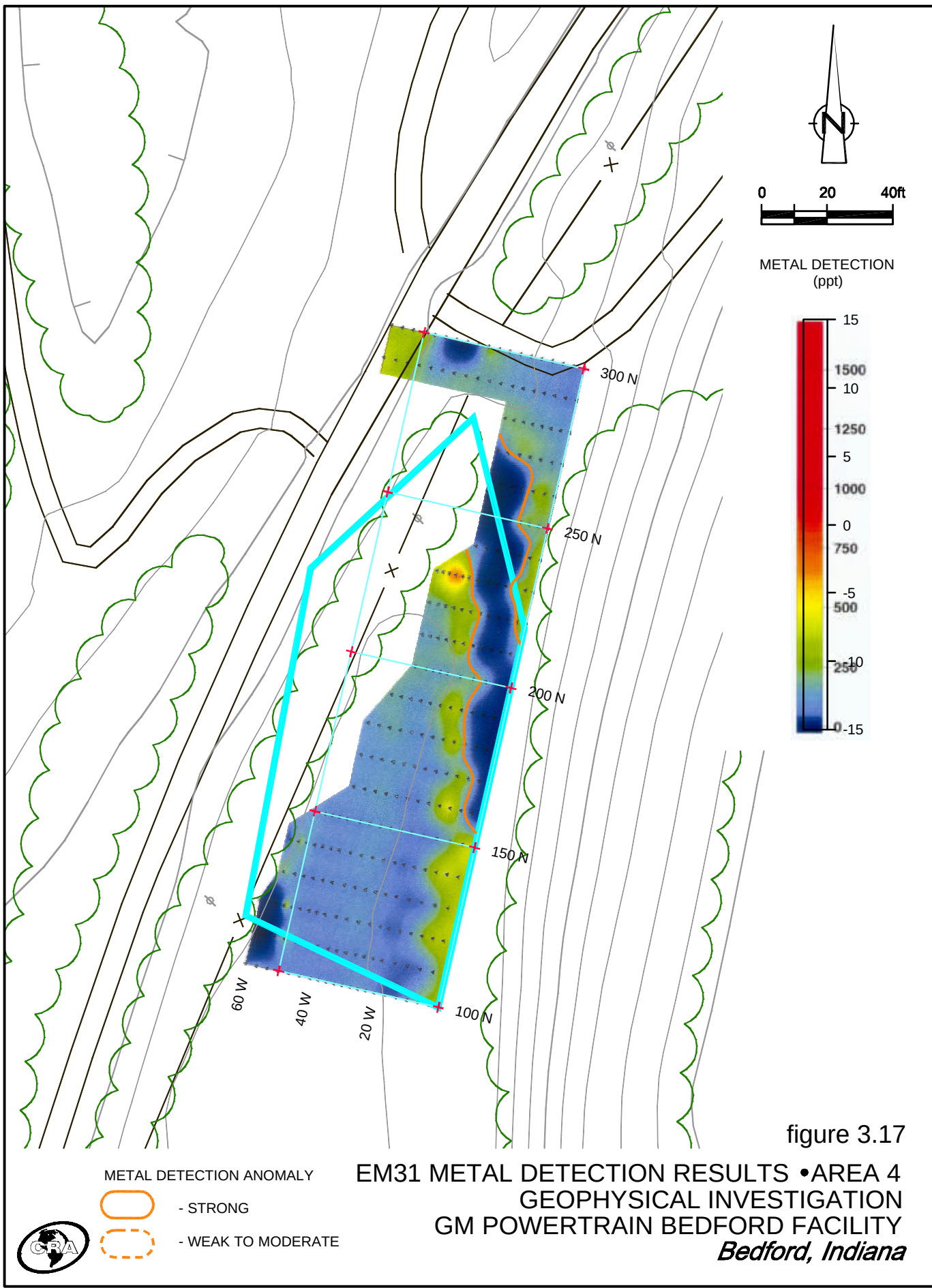
figure 3.15

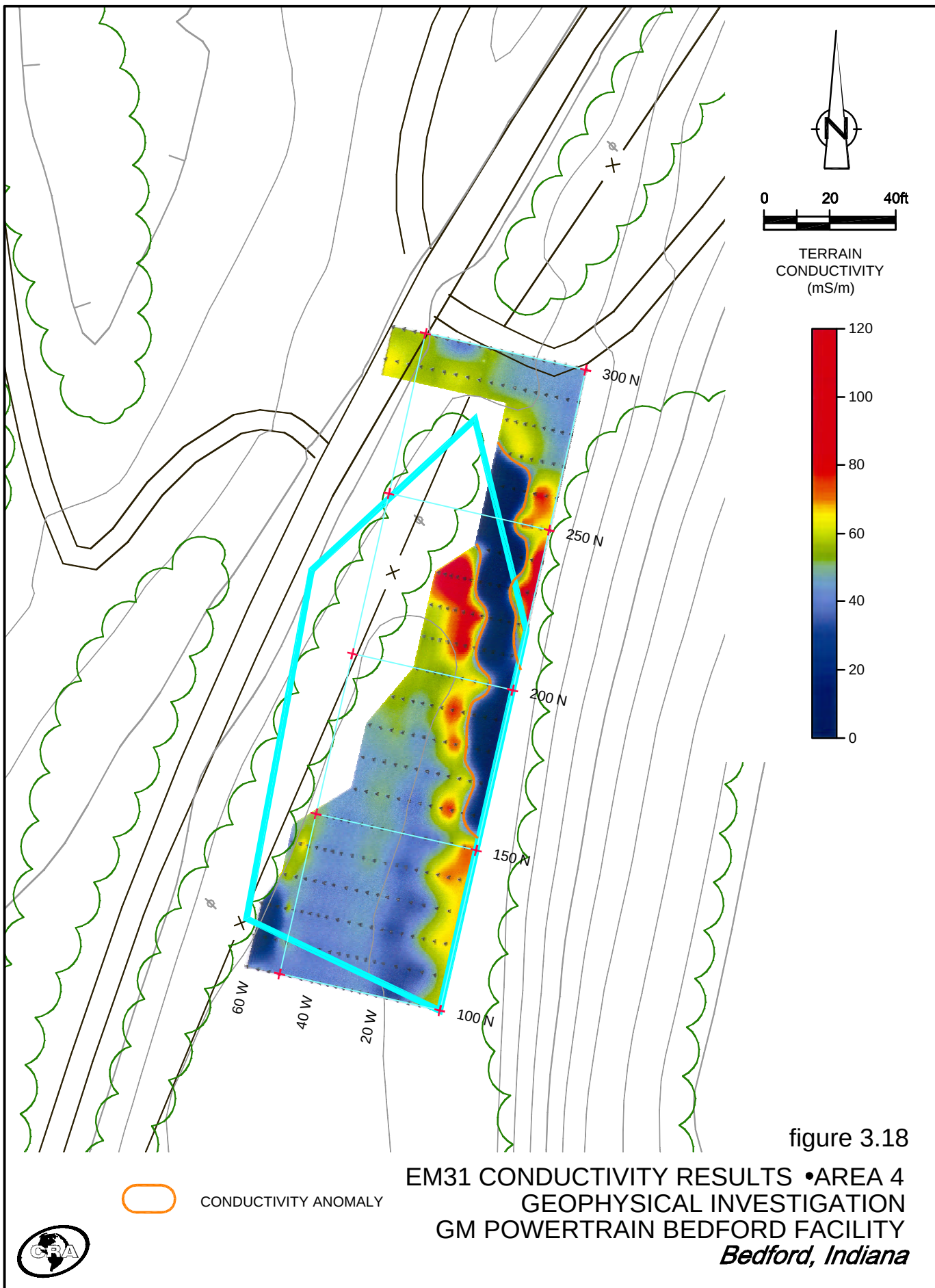
EM31 CONDUCTIVITY RESULTS • AREA 2 & 3
 GEOPHYSICAL INVESTIGATION
 GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



CONDUCTIVITY ANOMALY







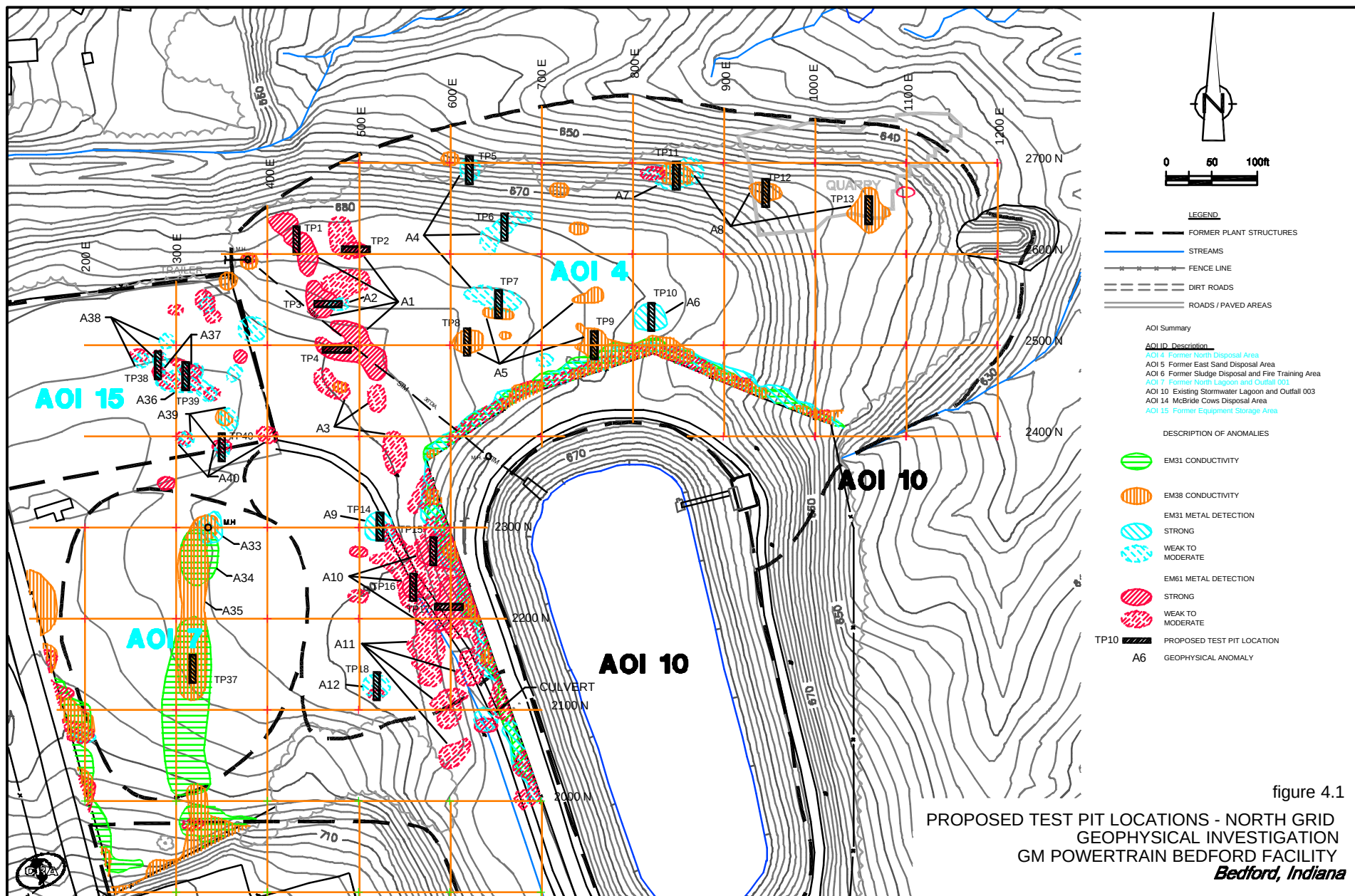


figure 4.1

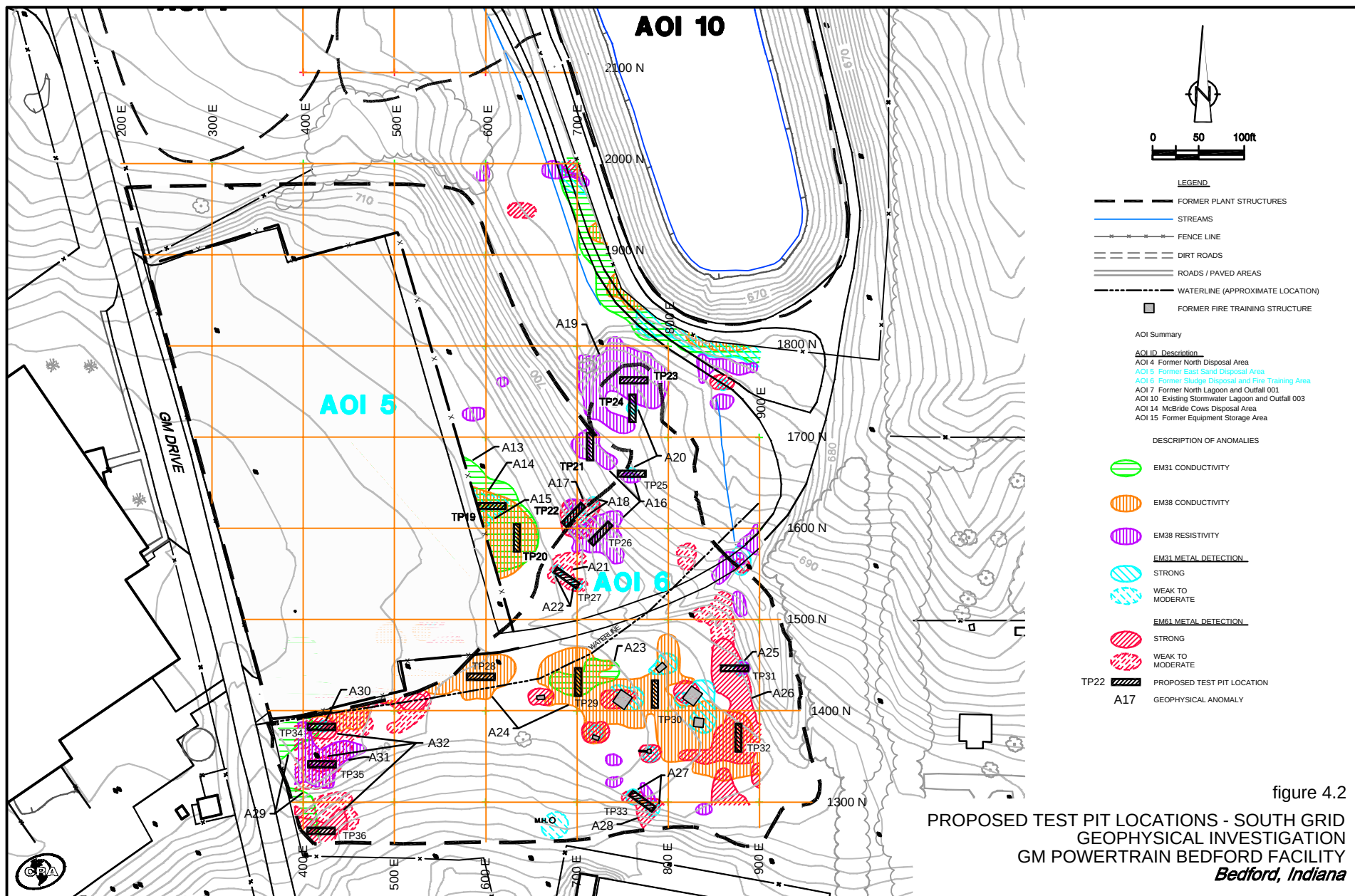
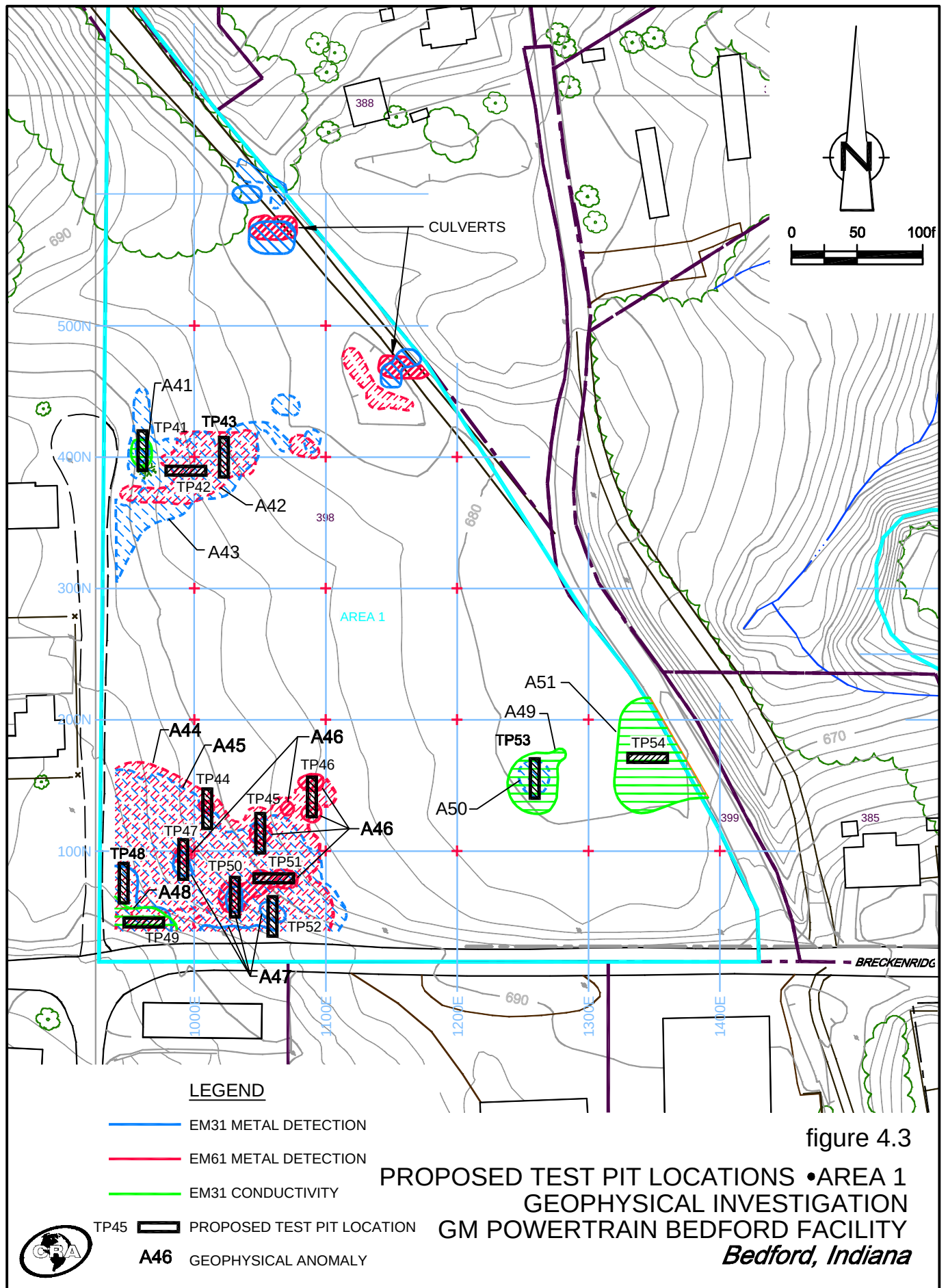


figure 4.2
 PROPOSED TEST PIT LOCATIONS - SOUTH GRID
 GEOPHYSICAL INVESTIGATION
 GM POWERTRAIN BEDFORD FACILITY
 Bedford, Indiana



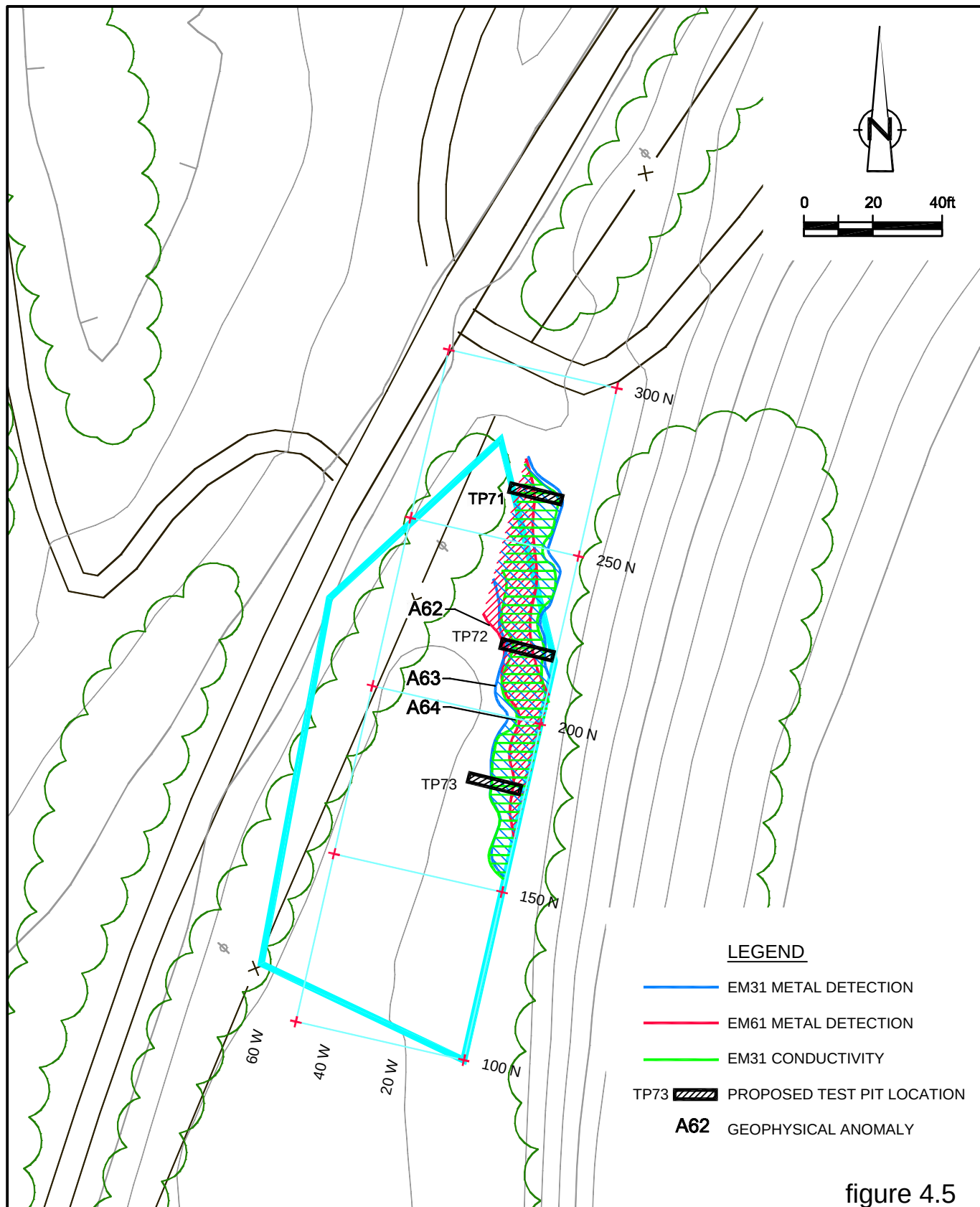


figure 4.5
 PROPOSED TEST PIT LOCATIONS • AREA 4
 GEOPHYSICAL INVESTIGATION
 GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



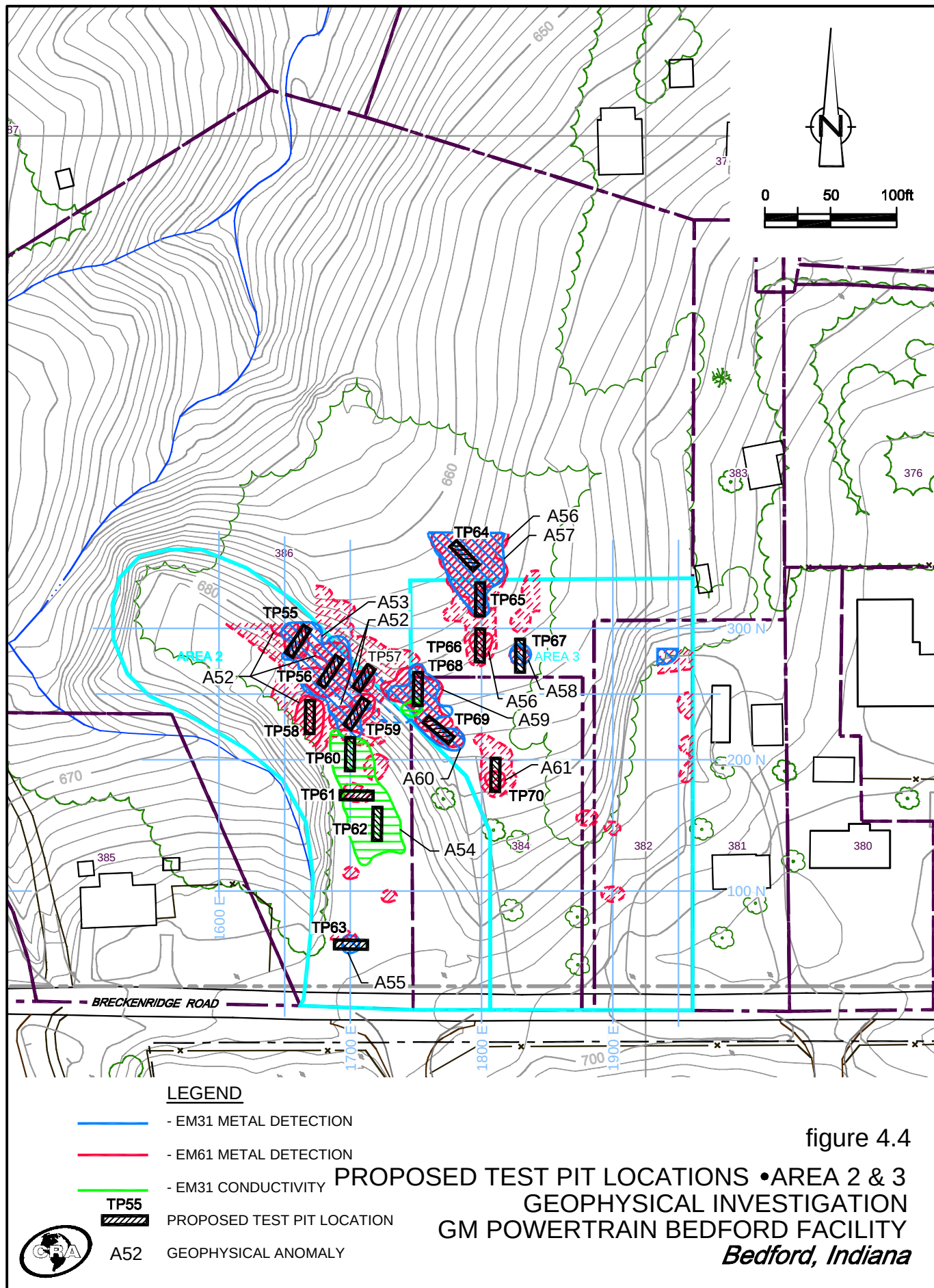


figure 4.4

TABLE 4.1
RATIONALE FOR ON-SITE (AOI) TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/Purpose</i>	<i>Suspected Target</i>
<u>AOI 4</u>				
TP1	430 E, 2600 to 2630 N	Strong - EM61 (metal detection)	To verify Anomaly A1 (northwest)	Metallic debris/ Foundry Sand
TP2	480 to 510 E, 3605 N	Strong - EM61 (metal detection)	To verify Anomaly A1 (northeast)	Metallic debris/ Foundry Sand
TP3	450 to 480 E, 2545 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A1 (central) and A2	Buried metal object/ Foundry Sand
TP4	460 to 490 E, 2495 N	Strong - EM61 (metal detection)	To verify Anomaly A1 (south)	Metallic debris/ Foundry Sand
TP5	620 E, 2680 to 2710 N	Moderate - EM31 (metal detection)	To verify Anomaly A4 (north)	Buried metal object/ metallic debris
TP6	660 E, 2615 to 2645 N	Moderate - EM31 (metal detection)	To verify Anomaly A4 (central)	Buried metal object/ metallic debris
TP7	655 E, 2530 to 2560 N	Moderate - EM31 (metal detection), high - EM38 (conductivity)	To verify Anomalies A4 (south) and A5 (north)	Buried metal object/ metallic debris
TP8	620 E, 2490 to 2520 N	High - EM38 (conductivity)	To verify Anomaly A5 (west)	Conductive fill (shallow)
TP9	760 E, 2485 to 2515 N	High - EM38 (conductivity)	To verify Anomaly A5 (east)	Conductive fill (shallow)
TP10	820 E, 2515 to 2545 N	Strong - EM31 (metal detection)	To verify Anomalies A5 and A7	Buried metal object/ metallic debris
TP11	850 E, 2670 to 2700 N	Moderate - EM31 (metal detection), high - EM38 (conductivity)	To verify Anomalies A7 and A8 (west)	Buried metal object/ Foundry Sand
TP12	945 E, 2650 to 2680 N	High - EM38 (conductivity)	To verify Anomaly A8 (center)	Conductive fill (shallow)
TP13	1060 E, 2635 to 2665 N	High - EM38 (conductivity)	To verify Anomaly A8 (east)	Conductive fill (shallow)
TP14	525 E, 2385 to 2415 N	Strong - EM31 (metal detection)	To verify Anomaly A9	Buried metal object/ metallic debris
TP15	580 E, 2260 to 2290 N	Strong - EM61 (metal detection)	To verify Anomaly A10 (north)	Buried metal object/ metallic debris

TABLE 4.1

**RATIONALE FOR ON-SITE (AOI) TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/Purpose</i>	<i>Suspected Target</i>
TP16	560 E, 2220 to 2250 N	Strong - EM61 (metal detection)	To verify Anomaly A10 (west)	Buried metal object/ metallic debris
TP17	585 to 615 E, 2212 N	Strong - EM61 (metal detection)	To verify Anomaly A10 (south)	Buried metal object/ metallic debris
TP18	520 E, 2110 to 2140 N	Moderate - EM31 (metal detection), moderate - EM61 (metal detection)	To verify Anomalies A11 and A12	Buried metal object/ metallic debris
<u>AOI 5</u>				
TP19	590 to 620 E, 1625 N	High - EM31 (conductivity), high - EM38 (conductivity), moderate - EM31 (metal detection)	To verify Anomalies A13, A14 and A15	Conductive fill/ Foundry Sand
TP20	635 E, 1575 to 1605 N	High - EM31 (conductivity), high - EM38 (conductivity)	To verify Anomalies A13 and A14	Conductive fill/ Foundry Sand
TP21	715 E, 1675 to 1705 N	High - EM38 (resistivity)	To verify Anomaly A16 (north)	Resistive fill/ Oily Sludge Residue
TP22	690 E, 1605 N, to 710 E, 1625 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A17 and A18	Buried metal object/ metallic debris
<u>AOI 6</u>				
TP23	750 to 780 E, 1760 N	High - EM38 (resistivity)	To verify Anomaly A19	Resistive fill/ Oily Sludge Residue
TP24	760 E, 1715 to 1745 N	Strong - EM31 (metal detection)	To verify Anomaly A20	Buried metal object/ metallic debris
TP25	745 to 775 E, 1660 N	Strong - EM31 (metal detection), high - EM38 (resistivity)	To verify Anomalies A16 (east) and A20	Buried metal object/ Resistive fill
TP26	715 E, 1585 N, to 735 E, 1605 N	High - EM38 (resistivity)	To verify Anomaly A16 (south)	Resistive fill/ Oily Sludge Residue
TP27	600 E, 1555 N, to 700 E, 1535 N	Strong - EM31 (metal detection), moderate - EM61 (metal detection)	To verify Anomalies A21 and A22	Buried metal object/ metallic debris
TP28	580 to 610 E, 1440 N	High - EM38 (conductivity)	To verify Anomaly A24 (west)	Conductive fill (shallow)
TP29	700 E, 1415 to 1445 N	High - EM31 (conductivity), high - EM38 (conductivity)	To verify Anomalies A23 and A24 (east)	Conductive fill/ Foundry Sand

TABLE 4.1

**RATIONALE FOR ON-SITE (AOI) TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/ Purpose</i>	<i>Suspected Target</i>
TP30	785 E, 1405 to 1435 N	High - EM38 (conductivity)	To verify Anomaly A24 (east)	Conductive fill (shallow)
TP31	860 to 890 E, 1445 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A25 and A26	Buried metal object/ Foundry sand
TP32	875 E, 1355 to 1385 N	Strong - EM31 (metal detection), high - EM38 (conductivity)	To verify Anomalies A24 (east) and A26	Metallic debris/fill Foundry Sand
TP33	760 E, 1310 N, to 780 E, 1290 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A27 and A28	Buried metal object/ Foundry sand
TP34	405 to 435 E, 1385 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A30 and A32 (north)	Buried metal object/ Foundry sand
TP35	405 to 435 E, 1340 N	Strong - EM61 (metal detection)	To verify Anomalies A31 and A32 (central)	Metallic debris/ Foundry sand
TP36	405 to 435 E, 1270 N	Strong - EM61 (metal detection)	To verify Anomaly A32 (south)	Metallic debris/ Foundry sand
<u>AOI 7</u>				
TP37	320 E, 2130 to 2160 N	High - EM31 (conductivity), high - EM38 (conductivity)	To verify Anomalies A34 (south) and A35	Conductive fill/ Foundry Sand
<u>AOI 15</u>				
TP38	280 E, 2460 to 2490 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A37 and A38	Buried metal object/ metallic debris
TP39	315 E, 2450 to 2480 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A36 and A37	Buried metal object/ metallic debris
TP40	350 E, 2375 to 2405 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A39 and A40	Buried metal object/ metallic debris

TABLE 4.2

**RATIONALE FOR OFF-SITE TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/Purpose</i>	<i>Suspected Target</i>
<u>AREA 1</u>				
TP41	1060 E, 390 to 420 N	Strong - EM31 (metal detection), high - EM31 (conductivity)	To verify Anomalies A41 and A43	Buried Metal Object
TP42	1080 to 1110 E, 390 N	Moderate - EM31 (metal detection), weak - EM61 (metal detection)	To verify Anomalies A42 and A43	Foundry Sand
TP43	1125 E, 385 to 415 N	Moderate - EM31 (metal detection), weak - EM61 (metal detection)	To verify Anomalies A42 and A43	Foundry Sand
TP44	1110 E, 115 to 145 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A45 and A46	Buried Metal Object/ Foundry Sand
TP45	1150 E, 100 to 130 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A45 and A46	Buried Metal Object/ Foundry Sand
TP46	1190 E, 125 to 155 N	Moderate to strong - EM61 (metal detection)	To verify Anomalies A44 and A46	Buried Metal Object/ Foundry Sand
TP47	1090 E, 80 to 110 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A46 and A47	Buried Metal Object/ Foundry Sand
TP48	1045 E, 60 to 90 N	Strong - EM31 (metal detection)	To verify Anomalies A44 and A47	Buried Metal Object/ Foundry Sand
TP49	1045 to 1075 E, 45 N	Strong - EM31 (metal detection), high - EM31 (conductivity)	To verify Anomalies A47 and A48	Buried Metal Object/ Foundry Sand
TP50	1130 E, 50 to 80 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A46 and A47	Buried Metal Object/ Foundry Sand
TP51	1145 to 1175 E, 80 N	Moderate - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A45 and A46	Buried Metal Object/ Foundry Sand
TP52	1160 E, 35 to 65 N	Strong - EM31 (metal detection), moderate - EM61 (metal detection)	To verify Anomalies A44 and A47	Buried Metal Object/ Foundry Sand

TABLE 4.2

**RATIONALE FOR OFF-SITE TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/Purpose</i>	<i>Suspected Target</i>
TP53	1260 E, 140 to 170 N	High - EM31 (conductivity)	To verify Anomalies A49 and A50	Conductive Fill/ Foundry Sand
TP54	1330 to 1360 E, 170 N	High - EM31 (conductivity)	To verify Anomaly A51	Conductive Fill
<u>AREA 2</u>				
TP55	1500 to 1525 E, 116 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A52 and A53	Buried Metal Object/ Metallic Debris
TP56	1542 E, 105 to 130 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A52 and A53	Buried Metal Object/ Metallic Debris
TP57	1595 E, 110 to 135 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A52 and A53	Buried Metal Object/ Metallic Debris
TP58	1595 to 1620 E, 66 N	Strong - EM61 (metal detection)	To verify Anomaly A52	Buried Metal Object/ Metallic Debris
TP59	1643 E, 95 to 120 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A52 and A53	Buried Metal Object/ Metallic Debris
TP60	1817 E, 145 to 180 N	High - EM31 (conductivity)	To verify Anomaly A54 (north)	Conductive Fill/ Foundry Sand
TP61	1851 E, 165 to 190 N	High - EM31 (conductivity), weak - EM61 (metal detection)	To verify Anomaly A54 (center)	Conductive Fill/ Foundry Sand
TP62	1878 E, 160 to 180 N	High - EM31 (conductivity)	To verify Anomaly A54 (south)	Conductive Fill/ Foundry Sand
TP63	2032 E, 205 to 235 N	Strong - EM31 (metal detection), weak - EM61 (metal detection)	To verify Anomaly A55	Buried Metal Object/ Metallic Debris

TABLE 4.2

**RATIONALE FOR OFF-SITE TEST PIT LOCATIONS
GM POWERTRAIN BEDFORD FACILITY
BEDFORD, INDIANA**

<i>Test Pit Designation</i>	<i>Test Pit Location</i>	<i>Amplitude of Response - Type of Survey</i>	<i>Rationale/ Purpose</i>	<i>Suspected Target</i>
<u>AREA 3</u>				
TP64	1725 E, 365 N to 1745 E, 345 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A56 (north) and A57	Buried metal object/ metallic debris
TP65	1800 E, 310 to 335 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A56 (north) and A57	Buried metal object/ metallic debris
TP66	1800 E, 275 to 300 N	Strong - EM61 (metal detection)	To verify Anomaly A56 (south)	Metallic debris/refuse
TP67	1830 E, 265 to 290 N	Strong - EM31 (metal detection), moderate - EM61 (metal detection)	To verify Anomaly A58	Buried metal object/ metallic debris
TP68	1750 E, 240 to 270 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A59 and A60	Buried metal object/ metallic debris
TP69	1780 E, 230 N, to 1795 E, 210 N	Strong - EM31 (metal detection), strong - EM61 (metal detection)	To verify Anomalies A59 and A60	Buried metal object/ metallic debris
TP70	1810 E, 175 to 200 N	Strong - EM61 (metal detection)	To verify Anomaly A61	Metallic debris/refuse
<u>AREA 4</u>				
TP71	0 to 20 W, 270 N	Strong - EM31 (metal detection), weak EM61(metal detection), flanked by moderate EM31 (conductivity)	To verify Anomalies A62, A63 and A64	Buried metal object/ refuse
TP72	0 to 20 W, 220 N	Strong - EM31 (metal detection), weak EM61(metal detection), flanked by moderate EM31 (conductivity)	To verify Anomalies A62, A63 and A64	Buried metal object/ refuse
TP73	20 to 40 W, 180 N	Strong - EM31 (metal detection), weak EM61(metal detection), flanked by moderate EM31 (conductivity)	To verify Anomalies A62, A63 and A64	Buried metal object/ refuse

APPENDIX B

HEALTH AND SAFETY PLAN



HEALTH AND SAFETY PLAN

**GM POWERTRAIN – BEDFORD PLANT
105 GM DRIVE
BEDFORD, INDIANA**

EPA ID# IND 006036099

**Prepared for:
GENERAL MOTORS CORPORATION**

**JUNE 12, 2001
REF. NO. 13968 (6)**

**Prepared by:
Conestoga-Rovers
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1.0 GENERAL

An investigation program will be implemented at the General Motors Powertrain (GM) Bedford Plant (Facility) located in Bedford, Indiana. The activities outlined in the Scope of Work (SOW) will involve drilling and sampling within and outside the limits of the Facility. During this program, personnel may come in contact with soil, sediment, groundwater, surface water, and other materials/debris that may contain hazardous materials. This Health & Safety Plan (HASP) has been developed to minimize the potential for exposures to field personnel and serves as the general HASP for the Bedford RCRA Facility Investigation (RFI). This HASP is provided as a starting point for the use of any personnel completing RFI activities potentially encountering contaminated materials. All contractors and subcontractors should develop HASPs which are specific to their SOW and are expected to take responsibility for the health and safety of their employees. A contractor or subcontractor may agree to follow the provisions contained in this HASP, but must still provide a written SOW that details their activities and health and safety procedures that will be implemented as part of their activities

This HASP is designed to ensure the following:

- i) that field personnel are not adversely exposed to the constituents of concern as well as the physical and biological hazards present;
- ii) that public welfare or the environment are not adversely impacted by migration of contaminated materials due to work activities; and
- iii) that operations, procedures, and equipment will meet the requirements of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, and the applicable subparts of 29 CFR 1926 and 29 CFR 1910.

For the purpose of this HASP, all investigative activities carried out at the Facility involving contact with potentially contaminated materials will be considered contaminated operations requiring personal protective equipment (PPE).

Investigation operations at the Bedford Facility will be conducted in accordance with the provisions of the HASP. Cost and/or scheduling considerations will not be considered as justification for modifying this plan.

2.0 FACILITY CHARACTERIZATION AND HAZARD ANALYSIS

The Bedford Facility is located at 105 GM Drive, in Bedford, Indiana as depicted in [Figure 1](#). The Facility is located in a commercial and industrial setting. A Facility plan is included as [Figure 2](#) of this HASP.

The Bedford Facility is an active facility and has been operating as an aluminum foundry since 1942. Current products include transmission cases, engine blocks, and pistons.

A summary of the constituents of concern that have been identified and their related health effects are presented in [Table 1](#) of this HASP.

The activities to be performed as part of the SOW may include:

- oversight of soil boring advancement;
- oversight of monitoring well installation; and
- sampling activities.

Risks associated with these activities will be minimized by implementing engineering controls, safe work practices, and the proper use of personal protective equipment (PPE). [Table 2](#) summarizes the potential hazards associated with activities at the Facility.

3.0 **BASIS**

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, CFR, Parts 1910 and 1926 (29 CFR 1910 and 1926) including the amended sections in 29 CFR 1910.120 and current Recommended Exposure Limits (RELs) as provided by the National Institute for Occupational Safety and Health (NIOSH) provide the basis for this HASP. Some of the specifications within this section are in addition to OSHA regulations and reflect the positions of the United States Environmental Protection Agency (USEPA), the American Conference of Governmental Industrial Hygienists (ACGIH) and the United States Coast Guard (USCG) regarding procedures required to ensure safe operations at potential hazardous waste sites.

The safety and health of the public and field personnel and the protection of the environment will take precedence over cost and schedule considerations for all project work.

4.0 RESPONSIBILITIES AND ADMINISTRATION

The following individuals are designated to carry out stated job responsibilities for the onsite engineer, CRA, related to this project.

-Senior Project Engineer:	James McGuigan
-Project Manager:	William Steinmann
-Project Industrial Hygienist:	Matthew Lazaric
-Project Geologist	TBD

A field individual will be designated as the Health and Safety Officer (HSO). The HSO will supervise the implementation of the HASP and will be responsible for all decisions regarding operations and work stoppages due to health and safety considerations.

The responsibilities of the HSO are as follows:

- i) be responsible for controlling and maintaining access to the work area;
- ii) be responsible for implementation of the HASP at the initiation of field work;
- iii) conduct the pre-entry safety briefing for all field personnel with regard to the HASP and other safety requirements to be observed during field sampling, including:
 - a) potential hazards,
 - b) personal hygiene principles,
 - c) PPE,
 - d) respiratory protection equipment usage, and
 - e) emergency response procedures.
- iv) review and modify the HASP as more information becomes available concerning the hazardous materials involved;
- v) supervision and enforcement of safety equipment usage;
- vi) supervision and inspection of equipment cleaning;
- vii) personnel training in safety equipment usage and emergency procedures;
- viii) monitoring of the health and safety program under direction of an industrial hygienist;
- ix) suspend work activity if unsafe working conditions develop;
- x) inform employees, nearby workers, and visitors of the nature of chemical exposure risk as required by the "Right-to-Know" Law;

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- xi) recommend a medical examination when required for an employee;
- xii) coordination of the Emergency Response Plan (Section 15.0);
- xiii) assure that safety equipment is provided, maintained and accessible to field personnel;
- xiv) maintain a log with a sign in/out sheet for personnel performing activities and visitors entering the work areas;
- xv) assure that employees comply with the "buddy system" while working at the Facility;
- xvi) investigate all accidents, injuries, illnesses, spills, fires, incidents, and near misses; and
- xvii) Ensure all subcontractors have a Health and Safety Plan.

5.0 MEDICAL SURVEILLANCE

In accordance with requirements detailed in 29 CFR 1910.120(f), all personnel who may be exposed to potentially hazardous materials will have received, within one year prior to starting field activities, medical surveillance by a licensed physician or physician's group.

Medical records for CRA field personnel will be maintained at the Niagara Falls, New York office. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the employee's suitability for work.

All personnel involved in field work will have all necessary medical examinations prior to commencing work which requires respiratory protection or exposure to hazardous materials. Personnel not obtaining medical certification will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to field work or when accidental exposure to elevated concentrations of contaminants occurs.

6.0 TRAINING

All field personnel shall complete training sessions in accordance with 29 CFR 1910.120(e). This training shall consist of a minimum of 40 hours of instruction and three days of actual field experience under the direct supervision of a trained, experienced supervisor. Documentation will be maintained in the site trailer stating that all field personnel have complied with this regulation.

Prior to commencing work activities, a pre-entry safety briefing will be conducted. Topics covered during the pre-entry safety briefing will include:

- i) health and safety hazards;
- ii) level of PPE required;
- iii) safe use of equipment;
- iv) decontamination procedures; and
- v) emergency response procedures.

CRA personnel who attend this briefing will sign the HASP Acknowledgment Form presented as [Appendix A](#). Any visitors to the Facility entering the exclusion zone will be required to undergo the same training program discussed above and will be required to sign a Visitor's Signoff Sheet ([Appendix A](#)) certifying they have completed the appropriate training and have read this HASP.

All personnel working under the RFI at the Bedford Facility shall attend regular safety ("tailgate") meetings. These meetings will be conducted by the HSO, and will cover specific health and safety issues, field activities, changes in field conditions, and a review of topics covered in the pre-entry briefing. Topics discussed in the safety meetings will be documented along with the signatures of personnel who attend.

7.0 WORK AREAS

As required, specific work areas (defined below) will be delineated by temporary fencing or a flagged line.

- a) Exclusion Zone (EZ) - This zone will include all areas where potentially contaminated soil or materials are to be handled and all areas where contaminated equipment or personnel travel.
- b) Contaminant Reduction Zone (CRZ) - This zone will occur at the interface of the EZ and Support Zone (SZ) and will provide access for the transfer of construction materials and field equipment to the EZ, the decontamination of vehicles prior to leaving the EZ, the decontamination of personnel and clothing prior to entering the SZ, and for the physical segregation of the SZ and EZ.
- c) Support Zone (SZ) - This area is the portion of the work area defined as the area outside the zone of significant air and soil contamination. The SZ will be clearly delineated and procedures implemented to prevent active or passive migration of contamination from the work area.

8.0 PERSONAL PROTECTIVE EQUIPMENT

Engineering controls and work practices designed to reduce and maintain employee exposure at or below the Permissible Exposure Limits (PELs) for the constituents of concern (Table 1) will be implemented. Whenever engineering controls and work practices are not feasible, a reasonable combination of engineering controls, work practices, and PPE shall be used to reduce and maintain employee exposure at or below the PELs for the contaminants of concern.

All field personnel shall be equipped with PPE appropriate for the nature of work being completed. All safety equipment and protective clothing shall be kept clean, well-maintained, and their integrity intact.

Safety equipment and apparel as required will be Level D, Modified Level D and Level C PPE (as determined by the action levels set forth in Section 9.0) within the Exclusion Zone. Any decision regarding the adjustment of PPE levels will be made by the Project Manager, in conjunction with the Project Industrial Hygienist (IH).

Level D PPE

<u>Type</u>	<u>Properties</u>	<u>Item</u>
Foot protection	Steel-toe/reinforced shank	Boots
Head protection	Meets ANSI Z89.1 standard	Hard hat
Hand protection	Puncture/tear resistant	Leather/cotton gloves
Eye protection	Meets ANSI Z87.1 standard	Glasses/goggles with side shields

Modified Level D PPE

<u>Type</u>	<u>Properties</u>	<u>Item</u>
Foot protection	Steel-toe/reinforced shank	Boots
Foot protection	Chemical resistant (latex)	Overboots
Head protection	Meets ANSI Z89.1 standard	Hard hat
Hand protection	Chemical resistant (nitrile)	Inner gloves
Hand protection	Chemical resistant, puncture/	Outer gloves
		tear resistant (nitrile)
Eye protection	Meets ANSI Z87.1 standard	Glasses/goggles with side shields
Body protection	Chemical resistant (tyvek)	Coverall

Level C PPE

<u>Type</u>	<u>Properties</u>	<u>Item</u>
Foot protection	Steel-toe/reinforced shank	Boots
Foot protection	Chemical resistant (latex)	Overboots
Head protection	Meets ANSI Z89.1 standard	Hard hat
Hand protection	Chemical resistant (nitrile)	Inner gloves
Hand protection	Chemical resistant, puncture/	Outer gloves
		tear resistant (nitrile)
Eye protection	Meets ANSI Z87.1 standard	Glasses/goggles with side shields
Body protection	Chemical resistant (tyvek)	Coverall
Respiratory protection	NIOSH approved	Full-face/half-face air-purifying respirator with organic vapor/acid gas/HEPA filter

Additional PPE guidelines to be implemented include:

- i) prescription eyeglasses in use at the Facility will be safety glasses with side shields;
- ii) protective gloves (leather palm) will be worn over nitrile gloves by field personnel involved in drilling activities;
- iii) during periods of respirator usage, respirator cartridges and filters will be changed daily, or upon breakthrough, whichever occurs first;
- iv) field personnel who have not passed a respirator fit test will not be permitted to enter or work in the EZ;
- v) personnel required to wear a respirator will not be permitted to have beards, long sideburns, or mustaches that interfere with the proper fit of the respirator;
- vi) all used PPE will be decontaminated or discarded at the end of each work day; and
- vii) duct tape will be used to ensure that disposable coveralls and gloves are tightly secured when personnel are working within the EZ.

9.0 RESPIRATOR PROGRAM

Prior to arriving at the Facility, all field personnel will have received training in the use of, and have been fit tested for a full-facepiece respirator. The written respiratory program that complies with 29 CFR 1910.134 is included as [Appendix B](#) to this HASP (copies of the certifications will be kept on file at the field trailer).

During intrusive activities (i.e. excavating), a photo-ionization detector (PID) will be used to monitor for organic vapors and some inorganic gases and a particulate monitor will be used to monitor particulate concentrations present in the breathing space. Background concentrations will be established prior to commencing work activities at each work location.

Sustained (greater than 5 minutes) air monitoring action levels to determine the level of respiratory protection necessary during field activities will be:

Sustained Photoionization

Organic Vapor Reading

Above Background

Protection Level

0 – 10 ppm

Level D, Modified Level D

10 – 125 ppm

full-facepiece air purifying
respirator (Level C)

>125 ppm

shut down activities

Sustained Particulate

Reading

Above Background

Protection Level

0 – 0.5 mg/m³

Level D, Modified Level D

0.5 – 2.5 mg/m³

full-facepiece air purifying
respirator (Level C)

>2.5 mg/m³

shut down activities

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Work will be stopped and the work area will be allowed to vent if monitoring indicates that organic vapors are present at concentrations which present Immediate Danger to Life and Health (IDLH) conditions, or in excess of the protection factor afforded by the air purifying respirator (whichever is lower). The action level to shut down activities has been decreased to a reasonable level for the work being conducted.

Air monitoring should continue, at a safe distance, if operations are stopped due to action level exceedences, to determine if a threat to the surrounding community exists.

10.0 JUSTIFICATION

The activities associated with the SOW are not expected to cause field personnel to be exposed to the constituents of concern in concentrations exceeding their respective PELs or RELs. The action levels have been calculated low enough so that the accuracy and sensitivity of the air monitoring equipment would not cause the field personnel to be inadvertently overexposed to the constituents of concern, even in a worst case scenario.

These action levels assume that all NIOSH criteria for using an air purifying respirator (APR) have been met. An APR can typically be worn in concentrations of up to 10 times the PEL for a given contaminant. Because of differences in sensitivities with direct reading instruments, a 50 percent safety factor is included when determining action levels. Therefore, the calculation to determine when a respirator should no longer be used is presented below (for a constituents of concern with PELs of 25 ppm and 0.5 mg/m³):

$$25 \text{ ppm (PEL)} \times 10 \text{ (protection factor)} \times 0.5 \text{ (50\% safety factor)} = 125 \text{ ppm}$$

$$0.5 \text{ mg/m}^3 \text{ (PEL)} \times 10 \text{ (protection factor)} \times 0.5 \text{ (50\% safety factor)} = 2.5 \text{ ppm}$$

The primary routes of exposure of contaminants to individuals performing field remediation tasks include direct contact, ingestion, and inhalation. The risk of exposure due to direct contact and ingestion will be minimized through the proper use of PPE as described in Section 8.0 and by exercising ordinary caution during sampling activities. In order to minimize exposure by the inhalation pathway, the respirator and air monitoring programs discussed in Sections 9.0 and 12.0 will be undertaken.

11.0 PERSONAL HYGIENE

All personnel performing or supervising work within the EZ shall observe and adhere to the personal hygiene-related provisions of this section.

Personnel found to be disregarding the personal hygiene-related provisions of this HASP will, at the discretion of the HSO, be barred from the Facility.

The following equipment/facilities are available for the personal hygiene of CRA's Facility personnel:

- i) suitable disposable outerwear, gloves, respiratory protection and footwear on a daily basis for the use of field personnel;
- ii) disposal containers for used disposable outerwear; and
- iii) potable water and a suitable sanitation facility.

The following regulations will be enforced for all personnel actively participating in the field sampling program:

- i) personnel will wear appropriate PPE when in the EZ;
- ii) used disposable outerwear will not be reused if deemed to be unsuitable to provide the necessary protection, and when removed, will be placed inside disposal containers provided for that purpose;
- iii) smoking, eating, and drinking will be prohibited within the EZ. These activities will be permitted only within designated areas; and
- iv) personnel will thoroughly cleanse their hands, face, neck area, and other exposed areas before smoking, eating, or drinking, and before leaving the CRZ.

12.0 AIR MONITORING

Air quality will be monitored at the initiation of each work activity and periodically thereafter.

The air monitoring program will consist of monitoring with a PID and a particulate monitor. Operation and calibration procedures will be according to manufacturers' instructions. Calibration and maintenance records will be kept in the field log.

Identification of volatile organic vapor or particulate levels in excess of the action levels cited in Section 9.0 shall be reported to the HSO who, in conjunction with the Project IH, will determine when PPE should be upgraded or operations be shut down and restarted.

If work is stopped because action levels have been exceeded, air monitoring will continue from a safe distance to determine if there is a threat to the surrounding community.

13.0 COMMUNICATIONS

Emergency numbers including the police department, fire department, ambulance, hospital, and appropriate regulatory agencies ([Table 3](#)) will be prominently posted near the Facility telephone(s).

To ensure familiarity with the hospital route, all personnel covered under this HASP will drive the route to the hospital, prior to the initiation of field activities.

14.0 EMERGENCY AND FIRST AID EQUIPMENT

Safety equipment will be available for use by field personnel and will be located and maintained in the SZ. The safety equipment will include, but is not limited to, the following:

- i) a portable emergency eye wash;
- ii) one ABC type dry chemical fire extinguishers; and
- iii) a first-aid kit for a minimum of 10 personnel.

15.0 EMERGENCY RESPONSE PLAN

Prior to commencing work activities, CRA will ensure that all of field personnel are briefed on emergency procedures. The emergency procedures are intended to provide immediate response to a serious occurrence such as injury, explosion or fire. A list of emergency contact numbers is presented as [Table 3](#) of this HASP.

In the event of injury to field personnel, the HSO is responsible for the following:

- i) evacuate all personnel upwind;
- ii) exit Facility;
- iii) contact the designated hospital and describe the injury;
- iv) decontaminate personnel if possible, and administer appropriate first aid. If personnel cannot be decontaminated, alert hospital to possible problems of contamination;
- v) transport personnel to the medical facility along a predefined route ([Figure 3](#)); and
- vi) notify GM plant personnel.

16.0 EQUIPMENT AND PERSONNEL DECONTAMINATION

During the field investigation program, procedures will be implemented to reduce the amount of contact of both personnel and equipment with potentially contaminated materials. These procedures include the following:

- i) proper work practices that will lead to minimal direct contact with potentially contaminated material; and
- ii) use of disposable equipment and clothing as much as practicable.

All equipment used for the collection of samples for chemical analysis will be cleaned according to the following protocol:

- wash and scrub with low phosphate detergent;
- tap water rinse;
- thorough rinse with deionized distilled water;
- air dry; and
- wrap in aluminum foil for transport.

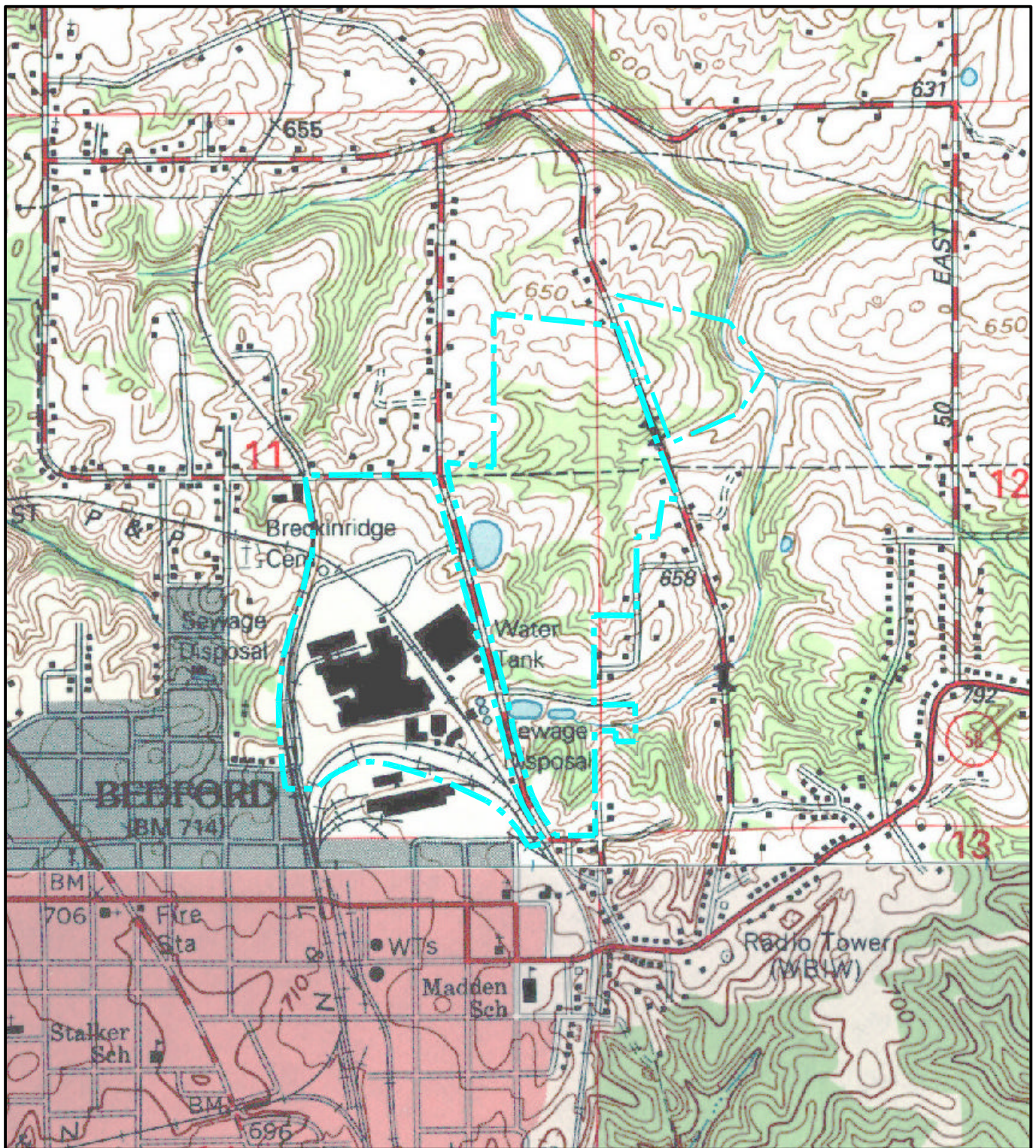
Tap water may be used from any municipal water treatment system. The use of an untreated water supply is not an acceptable substitute.

Personnel will remove their PPE and wash their hands, face, neck area and other exposed areas before entering the lunch and break areas to eat, drink, or smoke.

17.0 CONTAMINATION MIGRATION CONTROL

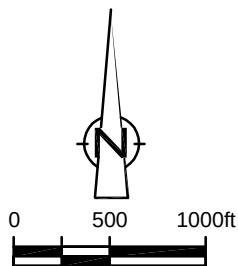
All vehicles and equipment used within the EZ shall be decontaminated in the CRZ as determined necessary by the HSO prior to leaving the Facility. Decontamination, when required, will consist of the thorough cleaning of those parts of the equipment which come in contact with potentially contaminated material. The HSO will certify that each piece of equipment has been decontaminated prior to removal from the Facility.

Personnel engaged in vehicle decontamination will wear PPE including suitable disposable clothing, respiratory protection, and face shields.



LEGEND:

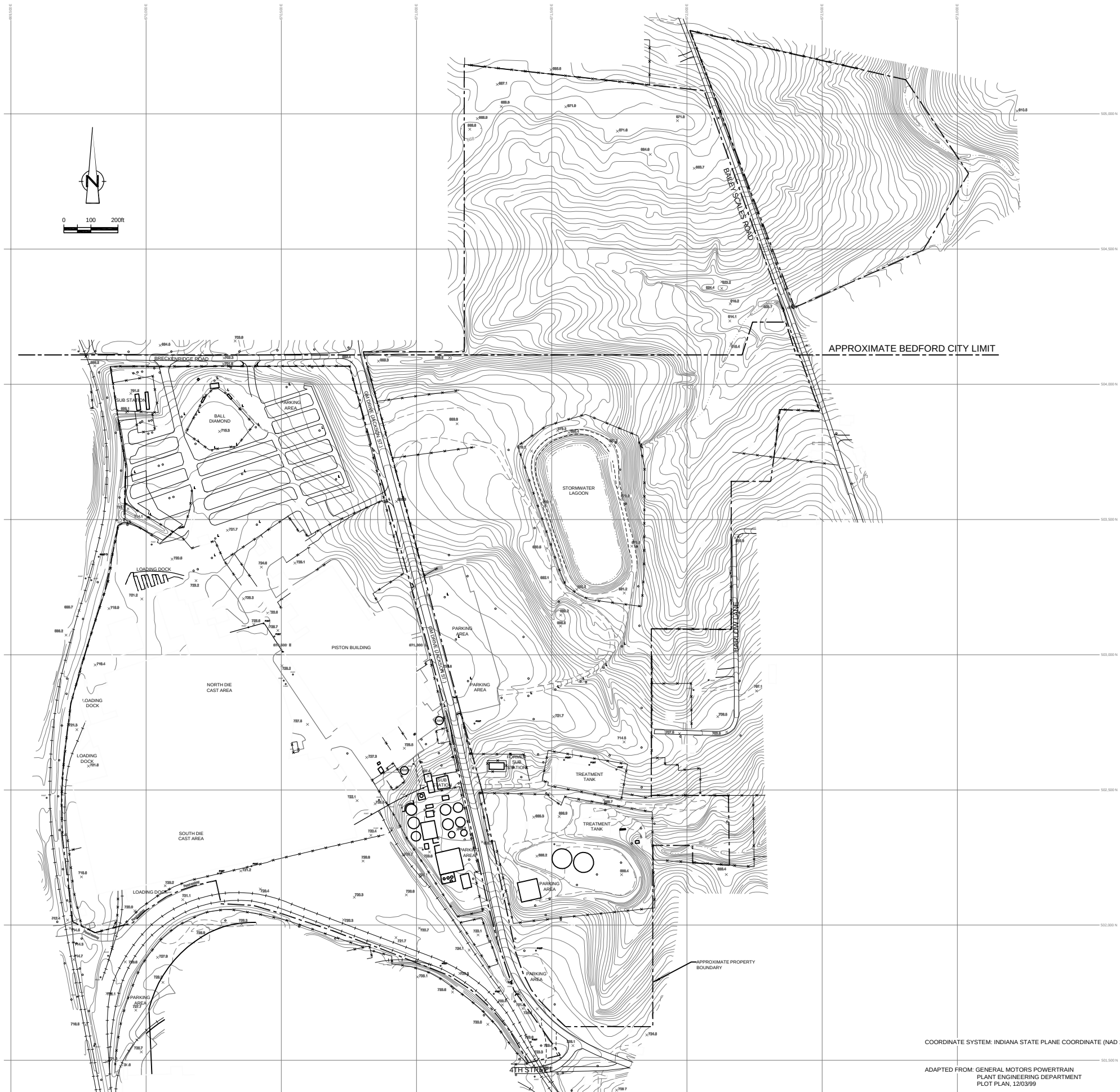
--- APPROXIMATE PROPERTY BOUNDARY



BASE SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE;
 BARTLETTSVILLE, INDIANA 1994
 BEDFORD EAST, INDIANA 1978
 BEDFORD WEST, INDIANA 1993
 OOLITIC, INDIANA 1987

figure 1

FACILITY LOCATION MAP
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



COORDINATE SYSTEM: INDIANA STATE PLANE COORDINATE (NAD 27)

ADAPTED FROM: GENERAL MOTORS POWERTRAIN
PLANT ENGINEERING DEPARTMENT
PLOT PLAN, 12/03/99

Nº	Revision	Date	Initial

LEGEND

- PROPERTY BOUNDARY
- BEDFORD CITY LIMIT
- FENCE LINE
- RAILROAD TRACKS
- DIRT ROADS
- ROADS / PAVED AREAS
- STREAM
- CONTOUR LINE

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



Approved

DRAWING STATUS

Status	Date	Initial

GM POWERTRAIN BEDFORD PLANT

BEDFORD, INDIANA

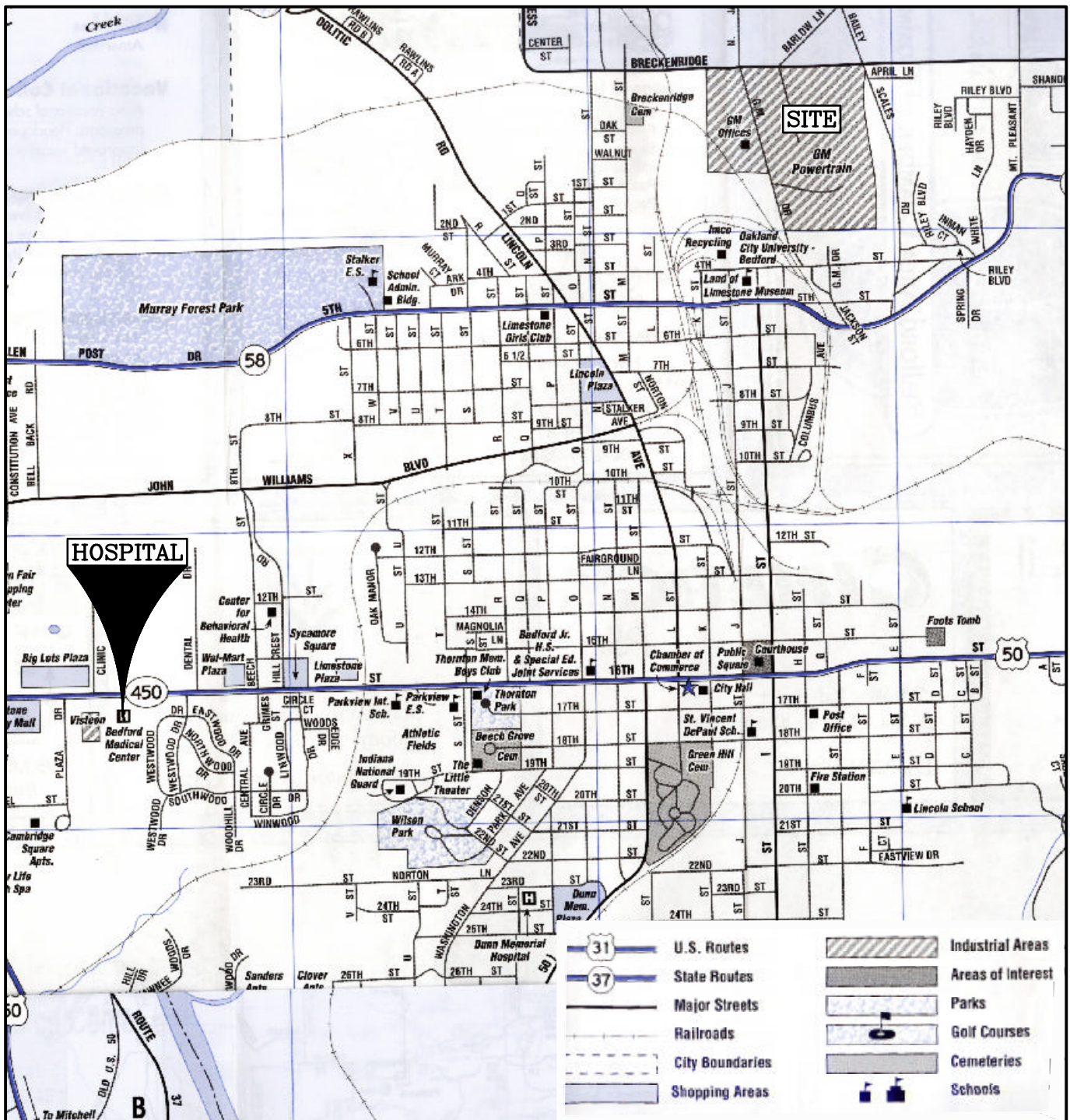
FACILITY PLAN



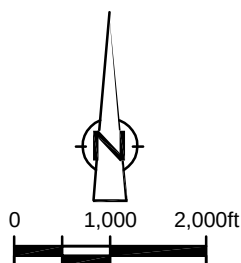
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: JAMES Mc GUIGAN	Reviewed By: DEBBIE RUNKLE	Date:
Scale: 1"=200'	Project N°: 13968-00	Report N°: 006
		Drawing N°: figure 2



BASE SOURCE: HAMPTON PUBLISHING CO.



DIRECTIONS

GO SOUTH ON GM DRIVE (0.6 miles)
TURN RIGHT ONTO IN-58 (0.5 miles)
TURN LEFT ONTO LINCOLN AVE. (0.7 miles)
TURN RIGHT ONTO US-50 (1.3 miles)

figure 3

HOSPITAL ROUTE MAP GM POWERTRAIN BEDFORD FACILITY *Bedford, Indiana*

TABLE 1

POTENTIAL CONSTITUENTS OF CONCERN (Currently known)
GENERAL MOTORS POWERTRAIN - BEDFORD PLANT
BEDFORD, INDIANA

Contaminant	REL	PEL	IDLH	IP (eV)	Flammability Range	Routes of Exposure	Symptoms of Exposure	Other
Polychlorinated biphenyls	0.001 mg/m ³	0.5 mg/m ³	5 mg/m ³	NL	NA	Inhalation, Ingestion, Contact	Eye irritant; chloracne; liver damage; reproductive effects	Skin Absorptive
Benzene	0.1 ppm	1 ppm	500 ppm	9.24	1.2% - 7.8%	Inhalation, Ingestion, Contact	Eye, skin, nose irritant; headache, nausea, giddiness, fatigue, anorexia, exhaustion, depression	Skin Absorptive
Ethylbenzene	100 ppm	100 ppm	800 ppm	8.76	0.8% - 6.7%	Inhalation, Ingestion, Contact	Eye, skin, mucous membrane irritation; headache, dermatitis, narcosis, coma	None
Toluene	100 ppm	200 ppm	500 ppm	8.82	1.1% - 7.1%	Inhalation, Ingestion, Contact	Eye and nose irritant; fatigue, confusion, euphoria, dizziness, headache, dilated pupils, tearing, nervousness, muscle fatigue, insomnia, parasthesia, dermatitis	Skin Absorptive
Xylene, total	100 ppm	100 ppm	900 ppm	8.44 - 8.56	0.9% - 7.0%	Inhalation, Ingestion, Contact	Eye, skin, throat, and nose irritant; dizziness, excitement, drowsiness, Incoordination, staggering, corneal vacuolization, anorexia, nausea, vomit, abdominal pain, dermatitis	Skin Absorptive
Ammonia	25 ppm	50 ppm	300 ppm	10.18	15% - 28%	Inhalation, Ingestion, Contact	Eye, nose, and throat irritant; breathing difficulty; wheezing; chest pain; pulmonary edema; pink frothy saliva; skin burns; vesiculation; frostbite	None
Fuel Oil	100 mg/m ³	NL	NL	NL	0.7% - 5%	Inhalation, Ingestion, Contact	Eye, nose, and throat irritant; burning sensation in the chest; headache; nausea; weakness; restlessness; incoordination; confusion; drowsiness; vomiting; diarrhea; dermatitis; chemical pneumonia	None
Sodium Hydroxide	2 mg/m ³	2 mg/m ³	10 mg/m ³	NA	NA	Inhalation, Ingestion, Contact	Eye, skin, mucous membrane irritation; pneumonitis; eye, skin burns; temporary loss of hair	None

Notes: NA - Not Applicable

NL - Not Listed

REL - Recommended Exposure Limit (NIOSH)

PEL - Permissible Exposure Limit (OSHA)

IDLH - Immediate Danger to Life and Health (OSHA)

IP - Ionization Potential

ppm - parts per million

mg/m³ - milligrams per cubic meter

eV - electron volts

TABLE 2
HAZARD ANALYSIS
GENERAL MOTORS POWERTRAIN - BEDFORD PLANT
BEDFORD, INDIANA

<u>Field Activities</u>	<u>Hazards</u>	<u>Prevention</u>
Monitoring Well Installation, and Soil Boring Oversight	Chemical hazards due to inhalation and dermal contact	Proper use of PPE
	Exposure to temperature extremes	Monitor for heat or cold stress
	Physical hazards associated with operation of excavation and drilling equipment	Maintain a safe distance from equipment
		Avoid overhead power lines (20 feet)
		Check for and mark underground utilities
	Physical hazards including steep grades and unstable surfaces while transporting heavy equipment	Use "buddy system" during field activities
	Biological Hazards	Proper PPE, exercising ordinary caution, use of "buddy system"
Surface-Water and /or Stream Sampling	High noise level	Use hearing protection
	Slip, trip, fall	Clean mud, snow or grease from shoes and equipment
	Hazards associated with sampling from a boat	Proper use of life jackets and /or flotation devices
		Sampling from a boat is to be performed from the bow or stern from a seated or stable position training in use of equipment Train personnel in boat and water safety
	Hazards associated with electroshocking	Exercise ordinary caution, use of "buddy system" during field activities
	Slip, trip, and fall	Exercise ordinary caution, use of "buddy system" during field activities
	Exposure to temperature extremes	Monitor for heat or cold stress
	Biological Hazards	Proper PPE, exercising ordinary caution, use of "buddy system"

TABLE 2
HAZARD ANALYSIS
GENERAL MOTORS POWERTRAIN - BEDFORD PLANT
BEDFORD, INDIANA

Residential Well Surveying (Door-to-Door)	Slip, trip, and fall	Keep all pathways clear from obstruction
	Biological Hazards	Proper PPE, exercising ordinary caution, use of "buddy system"
	Exposure to temperature extremes	Monitor for heat or cold stress
Stream Surveying / Walking	Slip, trip, and fall	Exercise ordinary caution, use of buddy System during field activities
		In wooded locations watch footing on loose rock and debris
	Biological Hazards	Proper PPE, exercising ordinary caution, use of "buddy system"
	Exposure to temperature extremes	Monitor for heat or cold stress
Sampling Activities	Exposure to temperature extremes	Monitor for heat or cold stress
	Chemical hazards due to inhalation and dermal contact	Proper use of PPE
	Biological Hazards	Proper PPE, exercising ordinary caution, use of "buddy system"

TABLE 3

**EMERGENCY CONTACTS
GENERAL MOTORS POWERTRAIN - BEDFORD PLANT
BEDFORD, INDIANA**

<u>Agency/Firm</u>	<u>Emergency Telephone Number</u>	<u>Business Telephone Number</u>
<u>Local Emergency Services</u>		
Fire Department	911	
Police Department	911	
Ambulance	911	
Hospital (Regional Medical Center) 2900 16th Street Bedford, IN 47421		(812) 275-1200
National Poison Center		(800) 942-5969
National Response Center		(800) 424-8802
CRA Industrial Hygienist - Matthew Lazaric		(773) 380-9933
CRA Senior Project Engineer / Advisor - James McGuigan		(773) 380-9933
CRA Project Manager - William Steinmann		(773) 380-9933
On-Site Contacts		
- Michael Scalzi		(812) 279-7334
- Kimberly Dobosenski		(812) 279-7404

Directions to the Hospital:
(REFER TO FIGURE 3)

Go south on GM Drive (0.6 miles)
Turn right onto IN-58 (0.5 miles)
Turn left onto Lincoln Ave. (0.7 miles)
Turn right onto US-50 (1.3 miles)

Total Distance:

3.1 miles

Travel Time:

7 minutes

July 12, 2001

APPENDIX A

HEALTH AND SAFETY PLAN ACKNOWLEDGMENT FORM / VISITOR SIGNOFF FORM

July 12, 2001

APPENDIX A

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

The following employees have read and understood the attached Health and Safety Plan:

Name

Employer

Date

[illegible]

July 12, 2001

VISITOR REVIEW

Each visitor to the Facility pertaining to the specified SOW shall sign this form after the pre-entry briefing is completed and before being permitted access to the Facility. A copy of this signed form shall be kept at the Facility, and the original sent to the HSO.

VISITOR SIGNOFF

I have attended a pre-entry briefing outlining the specific health and safety provisions for the SOW.

I have received a copy of the Health and Safety Plan. I have read the Plan, and will comply with the provisions contained therein.

_____	_____	_____
Name (printed)	Signature	Date

Witness:

_____	_____	_____
Name (printed)	Signature	Date

ACTING SAFETY OFFICER:

This person has provided verification of current OSHA 40-Hour hazardous waste site worker training.

_____	_____	_____
Name (printed)	Signature	Date

TRAINING ACKNOWLEDGEMENT FORM

Please Print:

NAME: _____

ADDRESS: _____

SOCIAL SECURITY NUMBER: _____

EMPLOYER: _____

JOB SITE: _____

I have attended and understood the mandatory initiation session for the above-referenced job site. This program referenced the following topics:

- i) known potential hazards;
- ii) level of personal protection equipment required;
- iii) emergency procedures; and
- iv) explanation of the basics of the HASP.

I further confirm that I have the required 40 hours of training to comply with 29 CFR 1910.120 and have a respirator for which I have been fit tested.

Signature: _____

Date: _____

July 12, 2001

APPENDIX B

RESPIRATORY PROTECTION PROGRAM

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1.0 RESPIRATORY PROTECTION

1.1 PRACTICE

The primary control of respiratory hazards shall be accomplished, whenever feasible, through the use of engineering controls, hazard substitution, revised work practices or other administrative controls. However, when such controls are not feasible, appropriate respiratory protection shall be used in accordance with the procedures established in this Standard Operating Procedure (SOP). Any deviation from the requirements set forth must have approval from an Industrial Hygienist (IH).

1.1.1 AUTHORIZATION

CRA employees requiring respiratory protection must have authorization from an IH. Office management shall notify an IH of respirator needs. The work situation will then be assessed and a respirator will be issued based on the hazard(s) the individual is exposed to. Reassessment of the hazard and the individual's needs will be repeated periodically.

1.1.2 MEDICAL SURVEILLANCE

All personnel designated to use respirators must successfully complete a physical exam as part of the medical requirements placed on persons exposed to hazardous substances and for users of respiratory protection (29 CFR 1910.134 and 1910.120). The medical exam will be repeated annually. All medical data will be reviewed by a consulting occupational physician. The physician will generate a written opinion on the suitability of the employee to wear a respirator.

1.1.3 AIR QUALITY

When air supplied respirators are used, the breathing air shall meet the Compressed Gas Association (CGA-CG7.1) Standards for Grade D breathing air or better.

1.1.4 AIR CYLINDERS

Cylinders used to supply breathing air are tested and maintained as prescribed in Shipping Container Specifications (49 CFR 178). Self-Contained Breathing Apparatus (SCBA) cylinders have approximately 2400-psi of pressure when full. Compressed air

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cylinders are visually inspected annually and hydrostatically tested once every five years for steel cylinders and once every three years for composite cylinders. These test dates are stamped on the cylinder for future reference.

1.2 FIT TESTING

1.2.1 QUALITATIVE OR QUANTITATIVE FIT TESTING

Fit testing of the respirator will be conducted by an IH or other designated, trained personnel following the medical evaluation. All users of respirators must be fit tested to ensure proper protection. Only the brand and size a person is fitted for is allowed to be used in the field. **DO NOT SUBSTITUTE RESPIRATORS FOR A BRAND AND SIZE THAT YOU HAVE NOT BEEN PROPERLY FITTED FOR.** The fit test will be accomplished quantitatively for full face APRs. Records will be maintained by the Corporate IH with copies available in CRA field offices for audit purposes. After fit testing, the employee will be issued an authorization card. This card serves as a reference for the proper type of respirator to use as well as prima facie proof of proper medical and training clearance for regulatory purposes. The user shall have the card available at any time when on CRA business where respiratory protection is used or hazardous waste cleanup sites are being entered.

1.2.2 POSITIVE & NEGATIVE FIT TESTING

All personnel will be instructed in the proper method of testing respirator fit by use of the **Positive & Negative** pressure test. This test is to be done by the user each and every time a respirator is donned. This test is performed to help the wearer assess respirator function and find gross leaks between the face and facepiece. This positive-negative pressure test checks the presence and functioning of the respirator valves as well as leakage that may occur due to improper cartridge seal or respirator face fit.

1.2.2.1 POSITIVE PRESSURE

- 1) Block off the exhalation valve cover openings.

MSA: Exhalation valve cover can be blocked with the palm of the hand.

Scott: Exhalation valve covers have front openings as well as four small side openings. These openings are difficult to block off with the hands. However, a small piece of flexible material such as Saran wrap or latex can be used.

North: Exhalation valve cover has long narrow openings around its perimeter. These can be blocked by encircling the fingers around the valve cover.

- 2) The person exhales gently, creating a slight positive pressure within the facepiece. The positive pressure should be maintained for at least 10 seconds.
- 3) If no outward leakage is detected, the person has passed the test.
- 4) If leakage is detected (usually felt as a cool sensation against the skin or a loss of pressure), the respirator is either malfunctioning or a gross leak between the face and facepiece is present. The following should be done when a failure occurs: Re-don or readjust the respirator.

If the facepiece continues to lose pressure, although previous positive or negative pressure tests performed with that respirator had passed, it is probably malfunctioning. Consult Industrial Hygiene. It is also possible that there are new scars or wrinkles, beard growth, missing teeth or dentures, significant weight gain or loss, etc. to cause gross leakage into the facepiece. When such new conditions exist, reevaluation of the respirator in a test atmosphere is necessary.

1.2.2.2 NEGATIVE PRESSURE

- 1) Block off the respirator cartridge inlet openings.

MSA: Cartridges can be blocked with the palms of the hands or with disposable latex gloves.

Scott: Cartridges can be blocked by using the palms of the hands or with gloves.

North: Cartridges can be blocked only with gloves.

- 2) Inhale gently, holding the negative pressure for at least 10 seconds.
- 3) If no inward leakage of air is detected, the person has passed the test.
- 4) If leakage is detected, see 4 above.

1.2.3 EXCEPTIONS

1.2.3.1 FACIAL HAIR

Any individual with facial hair which protrudes into the sealing surface of the masks will be refused fitting. Fitting, issuance, and use will be based on clean-shaven faces only. Employees with facial hair which interferes with respirator fit will not be permitted to work where respiratory protection must be worn.

1.2.3.2 GLASSES

Employees who wear prescription glasses and must wear a full-face respirator shall be fitted with special eyeglass adapters. Contact lenses will not be permitted when worn with any type of respiratory protection.

1.3 TRAINING

Proper training of respirator users is required to insure that all respirators will provide adequate protection against respiratory hazards and so that the user will understand the device's limitations. The training will include the following elements:

- 1) An explanation of the nature of respiratory hazards and what may happen if the respirator is not used properly.
- 2) A description of what engineering and administrative controls may be utilized to reduce the effects of the respiratory hazard and why respirators are required.
- 3) An explanation of the various types of respirators and why specific types have been selected.
- 4) A discussion of the function, capabilities, and limitations of respirator cartridges.
- 5) Instruction in the inspection, fit, and maintenance of the respirator.
- 6) Instructions in recognizing and handling emergency situations.

1.4 MAINTENANCE AND CARE OF RESPIRATORS

A program for the maintenance and care of respirators will include the following:

- 1) Inspection for defects;
- 2) Cleaning and disinfecting;

- 3) Repair/miscellaneous maintenance; and
- 4) Storage.

1.4.1 INSPECTION FOR DEFECTS

Employees shall inspect their respirators before each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to ensure that it is in satisfactory condition. SCBA shall be inspected monthly if kept for emergency response (i.e., long duration site remediation).

Inspection shall include a check of the tightness of the connections and the condition of the face piece, headbands, valves, breathing tubes and canisters. Rubber or elastic parts shall be inspected for pliability and signs of deterioration. Any respirator with worn or defective parts will be immediately taken out of service.

Before and after each use, respirators will be inspected for the following:

- 1) Tightness of connections and condition of the facepiece;
- 2) The headstraps or head harness should be examined for: breaks, loss of elasticity, broken or malfunctioning buckles and attachments, and excessively worn head-harness serrations that might permit slippage;
- 3) Valves and valve seats;
- 4) Connecting tube and canisters, air or oxygen cylinders;
- 5) Rubber or elastomer parts for pliability and deterioration; and
- 6) Regulators, fittings and gauges.

The following contains inspection information for various types of respirators.

Air Purifying Respirators

- 1) Check rubber facepiece for dirt, pliability of rubber, deterioration and cracks, tears, holes or distortion from improper storage.
- 2) Check straps for breaks, tears, loss of elasticity, broken snaps and proper tightness.
- 3) Check valves (exhalation and inhalation) for holes, warpage, cracks, etc. After removing its cover, the exhalation valve should be examined for: foreign material, distortion, defective or missing valve cover, or improper installation of valve into the valve seat.

- 4) Check filters or cartridges for dents, corrosion, etc. (loose or missing gaskets, improperly seated cartridges).
- 5) Check for cracked or badly scratched lenses in full facepieces; incorrectly mounted lens, broken or missing mounting clips.

Atmosphere-Supplying Respirators

- 1) Check appropriate items above.
- 2) Check air supply system for breaks or kinks in supply hoses and detachable coupling attachments.
- 3) Follow manufacturer's recommendations for the specific equipment.
- 4) Check air supply level and warning devices.

1.4.2 CLEANING AND DISINFECTING

The respirator must be washed after each day's use. If the respirator is shared it must be disinfected according to the manufacturer's instructions. Organic solvents of any kind must not be used for cleaning. Air purifying filters must not be wetted.

1.4.2.1 CLEANING

- 1) Remove any filters, cartridges or canisters and, if required by the manufacturer, straps and speaking diaphragms from the facepiece. Remove regulators on airline or SCBA.
- 2) Wash respirator parts excluding cartridges and canisters in warm (not to exceed 140°F), soapy water or in a product specifically designed by respirator manufacturers for this purpose. A plastic bristle hand brush may be helpful in removing dirt from respirator parts.
- 3) Rinse all parts thoroughly in warm water.
- 4) Air dry all parts.
- 5) Reassemble the respirator and insert new cartridges if needed.
- 6) Place the respirator in a plastic bag or container and seal it for storage. The respirator facepiece should be stored in its normal position so as not to distort the elastomer.

1.4.2.2 DISINFECTION

- 1) Disinfection should be done with a cleaner/disinfection agent purchased from the respirator vendor. If that material is not available the following NIOSH procedures can be followed:
 - a) Immerse the respirator body for two minutes in a 50 ppm chlorine solution (about 2 ml bleach to 1 liter of water). Rinse thoroughly in clean water and air dry.
 - b) Immerse the respirator body for two minutes in an aqueous solution of iodine (add 0.8 ml of iodine in 1 liter water). The iodine is about 7% ammonium and potassium iodide, 45% alcohol and 48% water. Rinse thoroughly in clean water and air dry.
- 2) Immersion times have to be limited to minimize damage to the respirator. The solutions can age rubber and rust metal parts.

NOTE: The air-purifying elements must be removed from the respirator prior to cleaning and sanitizing the respirator. Never allow the air-purifying elements to come in contact with water or cleaning/sanitizing solution.

1.4.3 STORAGE

Respirators must be stored to protect them from contamination and mechanical damage at all times when not in use. New, cleaned or reconditioned respirators are to be kept in a clean, sealed plastic bag or container, stored in a normal position. The plastic bag should be labeled with the users name. A suitable cabinet or drawer should be used to protect respirators and supplies from dirt, extremes of temperature or bright sunlight. They are not to be left in vehicles or on perimeter fences, in change sheds, etc.

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APPENDIX C

HEAT STRESS AND COLD STRESS PROCEDURES

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1.0 COLD STRESS

1.1 OVERVIEW

Fatal exposures to cold have been reported in employees failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6 degrees Fahrenheit (°F), can be life threatening. A drop in core temperature to 95°F or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind-chill must be considered as it contributes to the effective temperature. The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the Health and Safety Officer to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

1.2 PREDISPOSING FACTORS

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- Dehydration: The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- Fatigue During Physical Activity: Exhaustion reduces the body's ability to constrict blood vessels resulting in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- Age: Some older and very young individuals may have an impaired ability to sense cold.

- Alcohol Consumption: Alcohol dilates the blood vessels near the skin surface resulting in excessive body heat loss.
- Sedative Drugs: Sedatives may interfere with the transmission of impulses to the brain, thereby interfering with the body's physiological defense against cold. Some prescription drugs may react the same way.
- Poor Circulation: Vasoconstriction of peripheral vessels reduces blood flow to the skin surface.
- Heavy Work Load: Heavy work loads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur.
- The Use of PPE: PPE usage which traps sweat inside the PPE may increase an individual's susceptibility to cold stress.
- Lack of Acclimatization: Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions.
- History of Cold Injury: Previous injury from cold exposures may result in increased cold sensitivity.

1.3 PREVENTION OF COLD STRESS

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- Acclimatization: Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiologic changes are usually minor and require repeated uncomfortably cold exposures to induce them.
- Fluid and Electrolyte Replenishment: Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids.

- Eating a Well-Balanced Diet: Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high energy foods throughout the day.
- Warm Clothing: It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.

The parts of the body most important to keep warm are the feet, hands, head and face. As much as 40 percent of body heat can be lost when the head is exposed.

Recommended clothing includes:

- Inner layers (t-shirts, shorts, socks) should be of a thin, thermal insulating material.
- Wool or thermal trousers. Denim is not a good protective fabric.
- Felt-lined, rubber-bottomed, leather-upper boots with a removable felt insole is preferred. Change socks when wet.
- Wool shirts/sweaters should be worn over inner layer.
- A wool cap is good head protection. Use a liner under a hard hat.
- Mittens are better insulators than gloves.
- Face masks or scarves are good protection against wind.
- Tyvek/poly-coated Tyvek provides good wind protection.
- Wear loose fitting clothing, especially footwear.
- Carry extra clothing in your vehicle.
- Shelters with heaters should be provided for the employees' rest periods if possible. Sitting in a heated vehicle is a viable option. Care should be taken that the exhaust is not blocked and that windows are partially open to provide ventilation.
- At temperatures of 30°F (-1°C) or lower, cover metal tool handles with thermal insulating material if possible.
- Schedule work during the warmest part of the day if possible, rotate personnel and adjust the work/rest schedule to enable employees to recover from the effects of cold stress.

1.3.1 EMPLOYEE EDUCATION

Employees have already been trained to recognize and treat the effects of cold stress during their 40-hour training. Signs, symptoms, and treatment of cold stress should be reviewed in project safety meetings where applicable. The buddy system will help in preventing cold stress once the employees are trained to recognize the signs and symptoms of cold stress.

1.3.2 COLD STRESS PREVENTION GUIDELINES

It may not be practically feasible to implement all the above prevention measures. Follow the guidelines given below when the ambient air temperature is -5°F (-20°C) or lower:

- Contact the Project Manager (PM) or the industrial hygienist to determine if the project team should be working in such temperatures;
- Dress warm;
- Replenish fluids and electrolytes at regular intervals;
- Provide shelter from the cold; and
- Adjust work/rest schedules.

1.3.3 ADJUST WORK-REST SCHEDULES

Follow the work/rest schedule on [Table C.1](#). It is based on the cooling power of air that is a function of wind speed and ambient air temperature.

1.4 FIRST-AID TREATMENT GUIDELINES

The following describes symptoms of different stages in cold stress and the related first-aid treatment guidelines.

1.4.1 **FROSTBITE**

Stages

Incipient (frost nip)	May be painless. Tips of ears, nose, cheeks, fingers, toes, chin affected. Skin blanched white.
Superficial	Affects skin/tissue just beneath skin; turns purple as it thaws. Skin is firm, waxy; tissue beneath is soft, numb.
Deep	Tissue beneath skin is solid, waxy, white with purplish tinge. Entire tissue depth is affected.

First-Aid

Incipient	Warm by applying firm pressure - blow warm breath on spot or submerge in warm water (102°F to 110°F) (39°C to 43°C). Do not rub the area.
Superficial	Provide dry coverage, steady warmth; submerge in warm water.
Deep	Hospital care is needed. Do not thaw frostbitten part if needed to walk on. Do not thaw if there is danger of refreezing. Apply dry clothing over frostbite. Submerge in water; do not rub.

1.4.2 **GENERAL HYPOTHERMIA**

Stages

- Shivering
- Indifference
- Decreased Consciousness
- Unconsciousness
- Death

Symptoms

- Muscle Tension
- Uncontrollable Shivering
- Glassy Stare
- Decreased Muscle Function
- Speech Distortion
- Blue, Puffy Skin
- Slow Pulse
- Shallow Breathing
- Coordination Loss
- Stumbling
- Forgetfulness
- Freezing Extremities
- Dilated Pupils
- Fatigue

Emergency Response

- Keep person dry; replace wet clothing;
- Apply external heat to both sides of patient using available heat sources, including other bodies;
- Give warm liquids - not coffee or alcohol - after shivering stops and if conscious;
- Handle gently;
- Transport to medical facility as soon as possible; and
- If more than 30 minutes from a medical facility, warm person with other bodies.

2.0 HEAT STRESS

2.1 OVERVIEW

Heat induced occupational illnesses, injuries and reduced productivity occur in situations in which the total heat load (environmental plus metabolic) exceeds the body's capacities to maintain normal body functions without excessive strain. Heat stress is the sum of the heat generated in the body plus the heat gained from the environment minus the heat lost from the body to the environment. The body's response to heat stress is called heat strain. The level of heat stress at which excessive heat strain will result depends on the heat tolerance of the individual. Certain predisposing factors may reduce an individual's ability to tolerate heat stress.

Using PPE may put a hazardous waste worker at an increased risk of developing heat stress. Health effects may range from heat rash or heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions such as temperature and relative humidity, protective clothing which limits natural heat loss through perspiration, workload and the individual characteristics of the worker.

It is the responsibility of the project team members to inform the HSO or industrial hygienist if any of the predisposing factors listed below apply to them. This enables the HSO to monitor the individual if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a heat related illness or disorder.

2.2 PREDISPOSING

Predisposing factors that will increase the individual's susceptibility to heat stress are listed below:

- Lack of Physical Fitness: Such individuals experience more physiological strain including a higher heart rate, a higher body temperature, less efficient sweating and slightly higher oxygen consumption as compared to fit individuals.
- Obesity: Overweight individuals produce more heat per unit surface area than thin individuals and have a lowered ability to dissipate heat.
- Age: Older individuals may have a decreased ability to cope with heat stress.
- Dehydration: Dehydrated individuals will have a decreased ability to cool the body by sweating. Diarrhea can cause dehydration.

- Alcohol, Medications and Drug Use: Alcohol consumption may dehydrate individuals and certain medications/drugs may act as diuretics. Hence, the individual may have a decreased ability to lose heat by sweating.
- Infection, Sunburn, Illness and Certain Chronic Diseases: These factors may interfere with the body's normal mechanisms to lose heat.
- Heart Conditions or Circulatory Problems: Heat stress may place an additional strain on the heart and circulatory system that could harm the individual as well as decrease the individual's physiologic response.
- Low Salt Diet: Could affect the individual's electrolyte balance.
- Pregnancy
- Previous History of Heat Stroke or Heat Exhaustion: May increase the individual's susceptibility to heat stress.
- Heavy Work Load: Will generate metabolic heat thereby increasing the heat stress placed on the individual
- The Use of PPE Over Light Summer Clothing: This will decrease the ability of an individual to lose heat by sweating, as evaporative cooling can no longer occur.
- Lack of Acclimatization: Acclimatization is the gradual introduction of workers into a hot environment to allow their bodies to physiologically adjust to hot working conditions. Acclimatized individuals generally have lower heart rates and lower body temperatures. In addition, they sweat sooner and more profusely and even have more dilute sweat (thereby losing less electrolytes) than non-acclimatized individuals.

2.3 PREVENTION OF HEAT STRESS

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing heat stress related disorders. These include fluid and electrolyte replenishment, the provision of shelter from the sun and heat, work schedule adjustment, the use of cooling devices, acclimatization, heat stress monitoring and employee education, as discussed below:

- Fluid and Electrolyte Replenishment: Personnel should drink about 16 ounces of water before starting work and drink water at every break. To encourage water consumption, cool water and disposable cups should be made available. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, personnel should be encouraged to drink more. Replacing body fluids with Gatorade is an

option. It is advisable to have Gatorade available if the air temperature is 70°F (21°C) or more and the workers are performing tasks with a moderate to heavy work load in chemical resistant clothing.

- Shelter From the Sun and Heat: Air-conditioned (if possible) or shaded areas should be made available for rest periods. Sitting in an air-conditioned truck is an acceptable option.
- Work Schedule Adjustment: Scheduling work for early mornings and/or late afternoons will avoid the hottest parts of the day and reduce the heat stress placed on personnel. Rotation of personnel will help reduce overexertion of workers and adjusting the work-rest schedule will help personnel recover from the effects of heat stress periodically.
- Use of Cooling Devices: The use of cooling devices like field showers, hose-down areas or cooling vests should be considered for project tasks that involve heavy work loads in chemical resistant clothing.
- Acclimatization: Acclimatization is the gradual introduction of workers into a hot environment to allow their body to physiologically adjust to hot working conditions. Acclimatized individuals generally have lower heart rates and lower body temperatures. In addition, they sweat sooner and more profusely and even have more dilute sweat (thereby losing less electrolytes) than non-acclimatized individuals.
- Heat Stress Monitoring: Monitoring hot environments for potential heat stress should be initiated when the ambient air temperature is in excess of 70°F (21°C). There are several ways to monitor heat stress: measuring heart rate, oral temperature, loss of body weight, and the Wet Bulb Globe Temperature using a Reuter-Stokes or Quest Electronics heat stress monitor.
- Employee Education: Workers have already been trained to recognize and treat the effects of heat stress during the 40-hour training course. Signs, symptoms, and treatment of heat stress should be discussed in safety meetings. The buddy system will help in preventing heat stress once the employees are trained to recognize the signs and symptoms of heat stress.

2.3.1 PREVENTION PRACTICES

It may not be practically feasible to implement all of the above prevention measures. The following has been developed as a field guide for use in actual field situations.

Ambient air temperature is 70°F (21°C) or more:

- Replenish fluids and electrolytes. Drink cool (50°F to 60°F/10°C to 15°C) fluids hourly. The fluids should be caffeine-free and non-alcoholic. Do not wait until you are thirsty. Your normal thirst mechanism is not sufficient to overcome the effects of dehydration. If you feel thirsty, you are already becoming dehydrated.
- Provide shelter from the sun and heat.

Ambient air temperature is 70°F (21°C) or more and chemical-resistant clothing is being used:

- Same as above;
- Adjust work schedules if feasible; and
- Initiate heat stress monitoring and/or the use of cooling devices.

2.3.2 HEAT STRESS MONITORING

Heat stress monitoring may be performed by monitoring the heart rate. Heart rate should be measured at the beginning of the work shift, at regular intervals and at the start of each rest period.

- 1) If the heart rate is <110 beats per minute (bpm), personnel may continue the current work/rest schedule.
- 2) If the heart rate is >110 bpm, take a 10 minute break. Monitor heart rate at the end of the rest period. If not <110 bpm, rest until the heart rate is <110 bpm. Reduce the current work time between breaks by approximately one hour. If the next scheduled monitoring session shows a heart rate of >110 bpm once again, reduce the work time between breaks by one hour.

2.4 HEAT STRESS FIRST AID

2.4.1 HEAT CRAMPS

Cause: Excessive water loss/electrolyte imbalance.

Symptoms

Muscular pain in arms, legs,
abdomen
Faintness, dizziness, exhaustion
Normal temp, cool moist skin
person

First-Aid Guidelines

Administer sips of Gatorade (1/2 glass
every 15 minutes)
Do not massage cramping muscles Relax

2.4.2 HEAT EXHAUSTION

Cause: Large amount of water loss; blood circulation diminishes.

Symptoms

Moist, clammy, skin, usually pale
Dilated pupils
Weak, dizzy, nauseous, headache
Normal or low body temperature

First-Aid Guidelines

Move to a cool place
Apply cold, wet compresses to skin
Raise feet 8 to 12 inches
Administer sips of Gatorade (1/2 glass
every 15 minutes)
Get medical attention

2.4.3 HEAT STROKE

Cause: Body overheats; temperature rises; no sweating occurs

Symptoms

No sweating occurs

Dry, hot skin, usually red
Constricted pupils
Hot body temperature
(105°F to 110°F/40.5°C to 43.5°C)
Strong, rapid pulse
Unconsciousness may occur
Muscular twitching

First-Aid Guidelines

Get emergency medical assistance ASAP

Remove from sunlight
Wet down body with cool water or rubbing alcohol
Elevate head/shoulders
Wrap in wet, cold wrapping
Once cooled to 102°F (38.9°C), stop cooling measures

TABLE C.1

**WORK/REST SCHEDULE
FOR AN EIGHT HOUR WORK SHIFT**

<i>Air Temperature with Sunny Sky</i>		<i>Work/Break Schedule (Minutes)</i>				
<i>°F</i>	<i>°C</i>	<i>No Wind</i>	<i>5 mph Wind</i>	<i>10 mph Wind</i>	<i>15 mph Wind</i>	<i>20 mph Wind</i>
-05 to -09	-20 to -23	110 / 10	110 / 10	75 / 10	55 / 10	40 / 10
-10 to -14	-23 to -26	110 / 10	75 / 10	55 / 10	40 / 10	30 / 10
-15 to -19	-26 to -28	75 / 10	55 / 10	40 / 10	30 / 10	Stop
-20 to -24	-29 to -31	55 / 10	40 / 10	30 / 10	Stop	Stop
-25 to -29	-32 to -34	40 / 10	30 / 10	Stop	Stop	Stop
-30 to -34	-35 to -37	30 / 10	Stop	Stop	Stop	Stop
-35 & Below	-38 & Below	Stop	Stop	Stop	Stop	Stop

Note:

This table addresses the health hazards related to cold weather work. The practicality of working under a work / rest schedule, together with the ability of the necessary equipment to function properly in cold weather, may be more restrictive than the health hazards and also need to be considered.

The cold stress schedule applies to light or sedentary work activities. Light to moderate work activities can be moved down one level, moderate to heavy work activities can be moved down two levels if workers are acclimated, have proper protective clothing and show no signs of cold stress.

0 - 5 mph Wind:	Light flag moves.
5 mph Wind:	Raises newspaper sheet.
10 mph Wind:	Light flag fully extended.
20 mph Wind:	Blowing and drifting snow.