

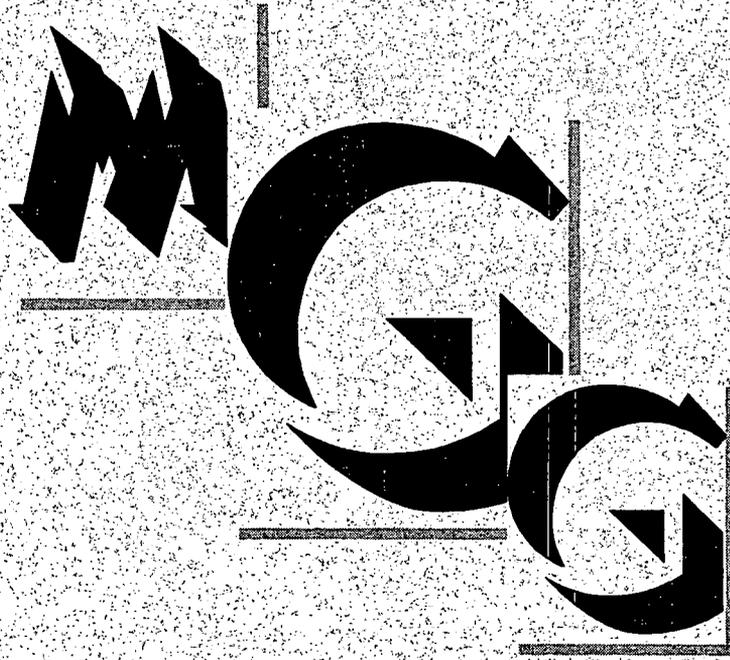
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NSTC GREAT LAKES, IL  
5090.3a

ENVIRONMENTAL GEOPHYSICAL INVESTIGATIONS ELECTROMAGNETIC SURVEY FORT  
SHERIDAN IL  
11/6/1997  
MIDWEST GEOMAR GEOPHYSICS, INC

*Jenny Rose*  
1

# MIDWEST GEOMAR GEOPHYSICS

Associate of Geomar Geophysics, Ltd.  
Ontario, Canada



**PROFESSIONAL  
ENVIRONMENTAL GEOPHYSICAL INVESTIGATIONS**



## **ELECTROMAGNETIC SURVEY**

Fort Sheridan  
Illinois

Test Pit Areas:  
Manhole SD-7  
Test Pit # 6 (Triangle Area)  
Test Pit (Treatment Plant Area)  
Test Pit # 7

Prepared by:

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Attn.: Doug Close

November 6, 1997

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Color Contour Maps

## **1. Introduction**

An electromagnetic survey was conducted at several locations on the property known as Fort Sheridan, IL. The 1st. area is described as a Test Pit Area Manhole SD - 7, the second is Test Pit # 6 (Triangle Area), the third is the Treatment Plant Test Pit Area, and the final area is the Test Pit # 7. The area maps provided to us by Stone & Webster are included as a part of this report.

MidWest Geomar Geophysics, Inc. employed the electromagnetic instruments, Geonics EM-31 and EM-61, to perform detailed measurements with the aim of mapping buried metallic objects and delineating areas of soil conductivity changes possibly due to land fill activities.

## **2. Objectives**

The electromagnetic investigation at the sites located at Fort Sheridan was carried out with the following specific objectives:

- to conduct a high resolution EM-31 & EM-61 survey within the site.
- to map areas of buried metallic material.
- to delineate zones of potential Landfill activities.
- to identify potential exposure pathways

## **3. The Electromagnetic (inductive) Method**

The electromagnetic instrument works on the principle of induction, using two coils (antennas); a transmitter and a receiver. Both coils are fixed in the same plane and are used near the surface of the earth. An alternating voltage applied to the transmitter coil causes electrical eddy currents to be induced in the earth. The electrical currents flowing in the earth are proportional to electrical conductivity of the medium. These currents in turn, generate a secondary magnetic field that is detected and measured by the receiver. Since this technique is a non contact method (i.e. not in contact with the ground) the measurements are very reliable and highly repeatable and therefore suitable for monitoring purposes.

## **4. Instrumentation**

The Geonics EM31-DL electromagnetic induction instrument was used in a vertical dipole mode during the survey. In the vertical dipole mode configuration, the instrument has a depth

penetration of about 6 meters. Two components of the Secondary Magnetic Field were measured simultaneously. The first, is the quad-phase component which indicates soil electrical conductivity and is measured in millisiemens per meter (mS/m). The second is the Inphase component which is related to the soil magnetic susceptibility (i.e. the ratio between the Primary and Secondary Magnetic Fields) and is measured in parts per thousand (ppt). Data was recorded using a 16 bit digital data logger. The Geonics EM61 is a high sensitivity high resolution time-domain instrument which is used to detect both ferrous and nonferrous metallic objects. It consists of a powerful transmitter that a pulsed primary magnetic field, which induces eddy currents in nearby metallic objects. The decay of these currents is measured by two receiver coils mounted on the coil assembly. The responses are recorded and displayed by an integrated digital data logger as a two channel information. By making the measurement at a relatively long time after termination of the primary pulse, the response is practically independent of the electrical conductivity of the ground.

The EM61 can detect a single 200 liter (55 gal) drum at a depth of over 3 meters. The EM61 is excellent in pinpointing a target, and can be used in close proximity to metallic fences or buildings. The instrument is equipped with an opto-counter which triggers the instrument every 19 cm.

## **5. Field Procedures**

Prior to taking measurements, a survey grid (10 X 20 feet) was prepared in the field. The Southwest corner of the surveyed area was selected as a reference point (0,0), and may not show on the map, if it is located outside the survey area.. The survey grid is plotted on Map 5 for future reference. Using the grid for control, EM31 survey lines were laid out at a 5 foot parallel spacing. Using the grid for control, EM-61 survey was conducted on a 2.5' parallel spacing. The EM31 data was collected in continuous mode with a time interval of 0.5 seconds, which corresponds to approximately 1 foot between readings. A fiducial marker was used every 20 feet (matching the survey grid) along the survey lines. The EM-61 data was collected in wheel mode, with a set wheel rotation used to collect data. A fiducial marker was inserted every 20 feet. The very narrow line separation and fine spacing between the readings resulted in excellent resolution of the computer generated maps.

## 6. Data Processing

Data files were transferred from the digital data logger to a PC computer and reviewed in the field. Both Geonics and Geomar software programs DAT31 and DIGGI were used in data reduction and preparation for contouring. A Geosoft Mapping System was used to process the data points in the production of the final color contour maps of EM31 & EM-61 measurements.

### 7a. Results Test Pit Area Manhole SD - 7

Five color contour maps of the site were prepared at a scale of 1" - 10' and include the most important topographical features in the study area.

- Map 1a EM61 Response map, Channel B,
- Map 1b Map of EM 61 Differential Channel Response with near surface objects removed
- Map 1c Map of the EM31 Quad-phase component (apparent soil conductivity),
- Map 1d EM31 Inphase response map
- Map 1e Located anomalies Map which indicates areas of potential interest, (depicts results of interpretation of both, EM31 and EM61 data sets).

The electromagnetic data shows relatively uniform distribution of EM61 response (Maps 1a and 1b), and the EM31 data Quad-phase (conductivity) and Inphase response (Maps 1c and 1d). Anomalous EM61 and EM31 readings can be observed in N-E and S-E portions of the site. These anomalies likely represent interference originated by the building located on the North and a chain link fence located South of the surveyed area. Strong interference can be observed in the area adjacent to a sewer drain in the central portion of the study area.

The EM31 conductivity (Quad-phase data shows relatively uniform response within the site with values ranging from 30 to 34 mS/m (Map 1c). The data collected does not allow us to establish any conductivity background levels. These conductivity values may indicate relatively uniform fine grain soil with possible silt and clay content.

One anomalous zone of high EM61 response (Maps 1a and 1b) that may indicate a large buried metallic object was detected during the survey. This is marked by a magenta zone and labeled A on Map 1e. This anomaly may indicate a substantial buried metallic or steel reinforced

concrete structure. A small anomaly **E** (marked by a red circle) and a possible linear anomaly (dashed red line on Map 1e) may be associated with this anomalous zone.

Two anomalies indicating the presence of linear features were detected during the survey. The most indicative anomalies are marked by solid red lines, and anomalies that are not well delineated are denoted by dashed red lines on Map 1e.

Linear anomaly labeled **B** is relatively well delineated and it may be associated with a buried pipe leading to a sewer drain. Its amplitude is relatively low at its N-W end and that may indicate its greater depth at this location. It is possible that three small anomalies labeled **F**, **G**, and **H** may indicate small metallic objects buried along this linear feature.

The anomaly marked by a red line and labeled **C** may represent a buried pipe as well. This anomaly may be associated with a buried metallic object represented by anomaly **D** (red circle on Map 1e).

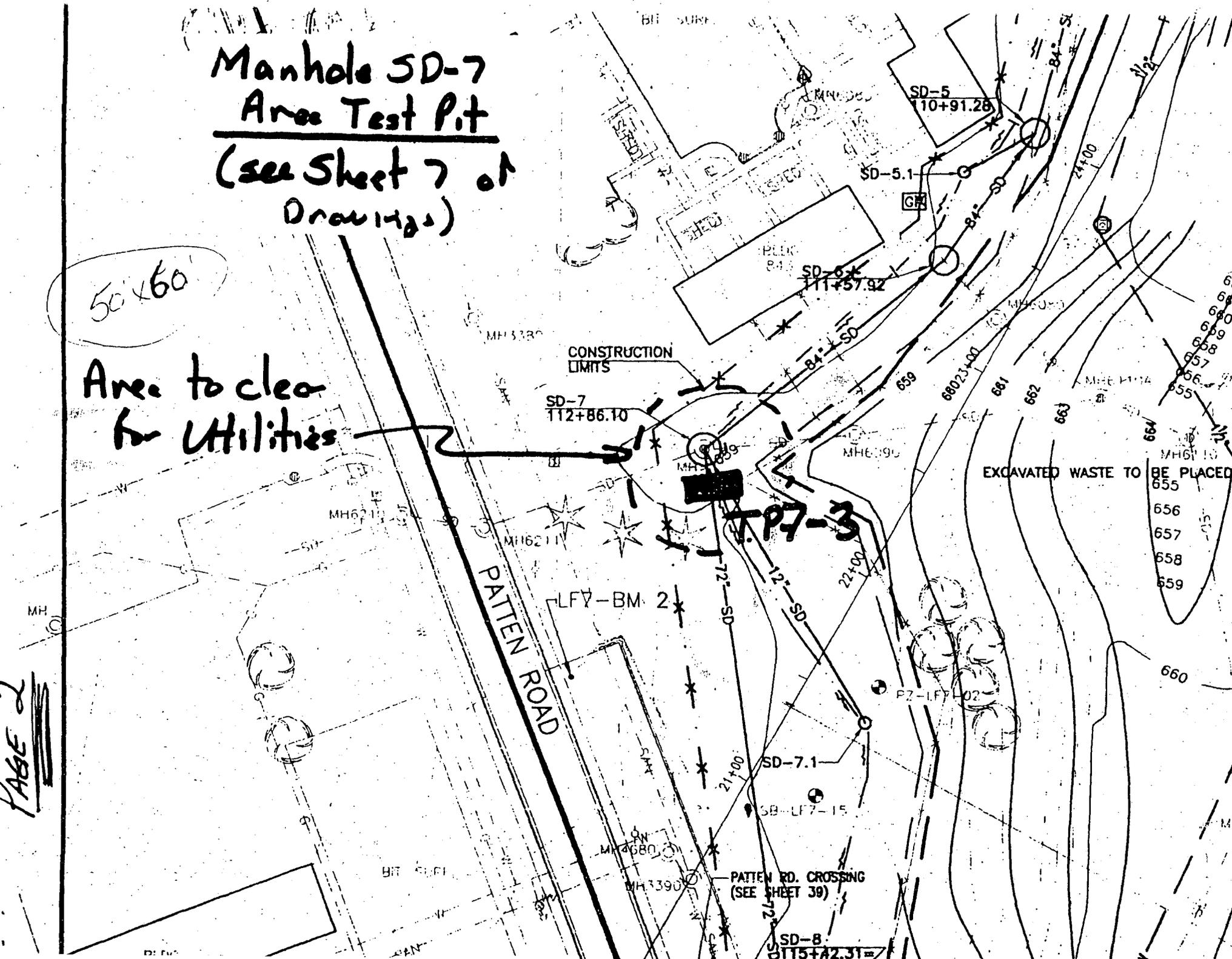
A number of isolated anomalies indicating buried metallic targets were detected. Anomalies representing buried objects are marked by red circles, while those indicating shallow or on the surface objects are marked by yellow circles on Map 1e. These anomalies indicate the presence of relatively small objects. The most substantial of the anomalies marked by red circles are labeled **D**, **E**, **F**, **G**, and **H** on Map 1e.

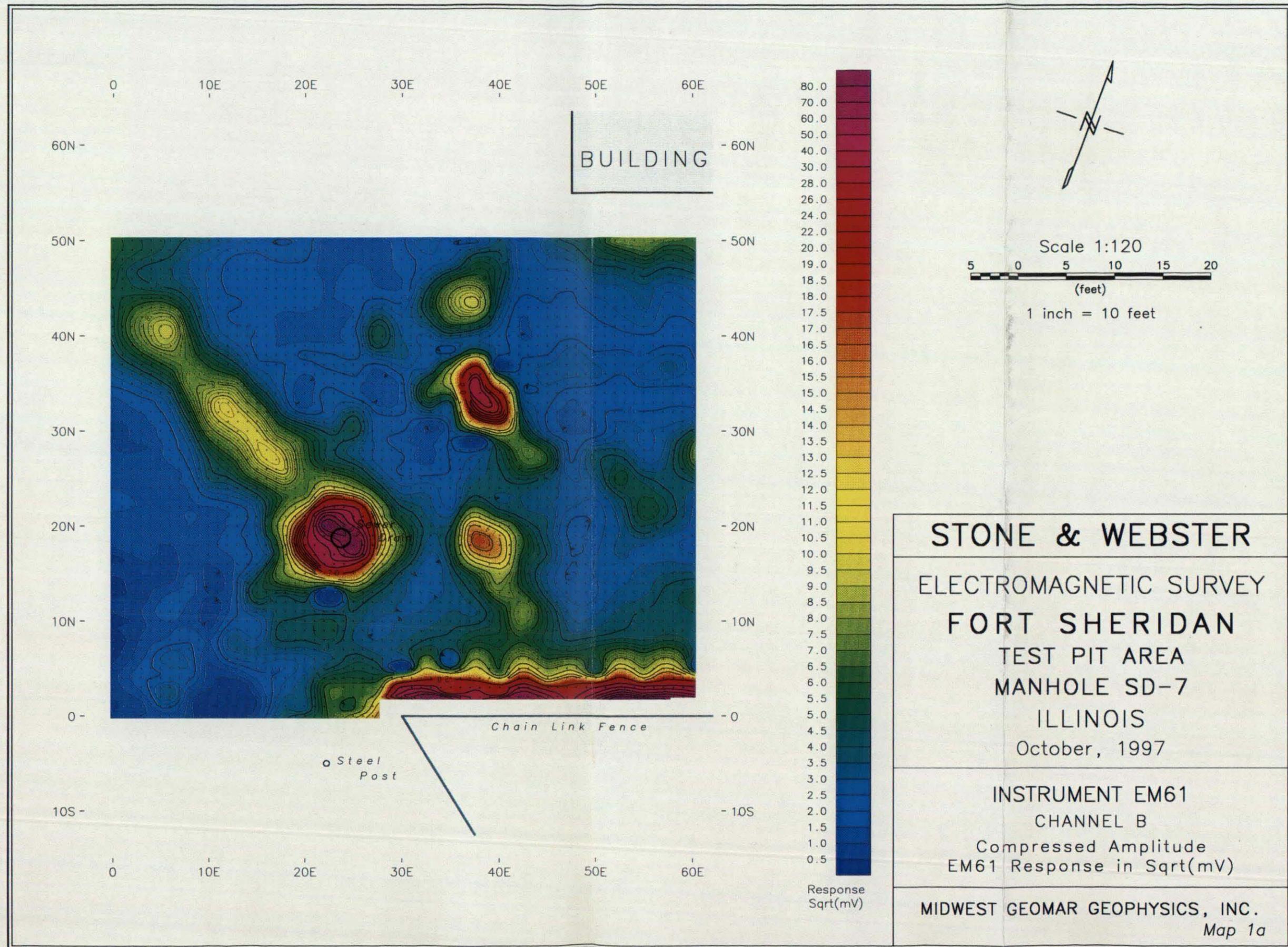
Manhole SD-7  
Area Test Pit  
(see Sheet 7 of Drawings)

50' x 60'

Area to clear  
for Utilities

PAGE 2



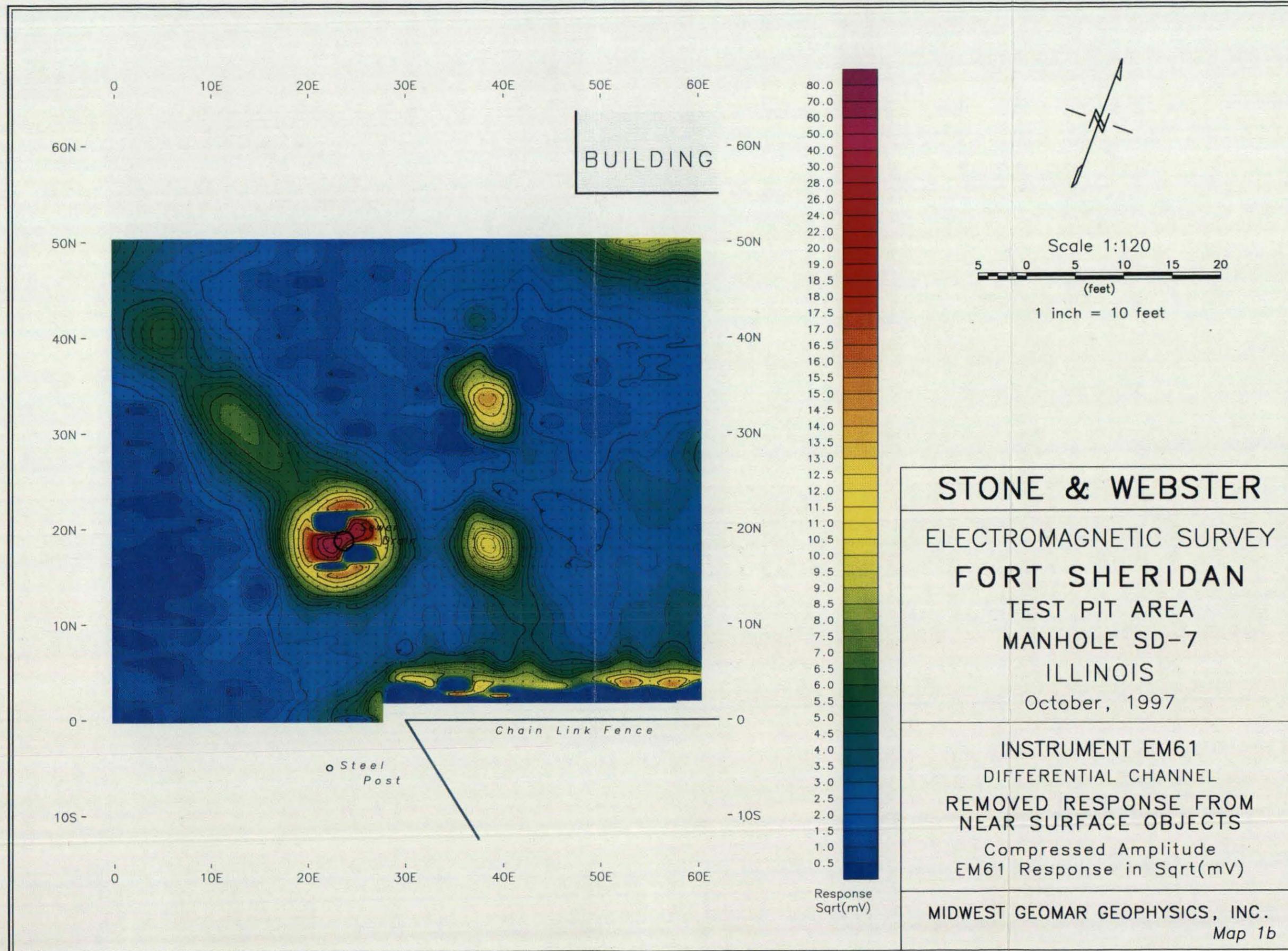


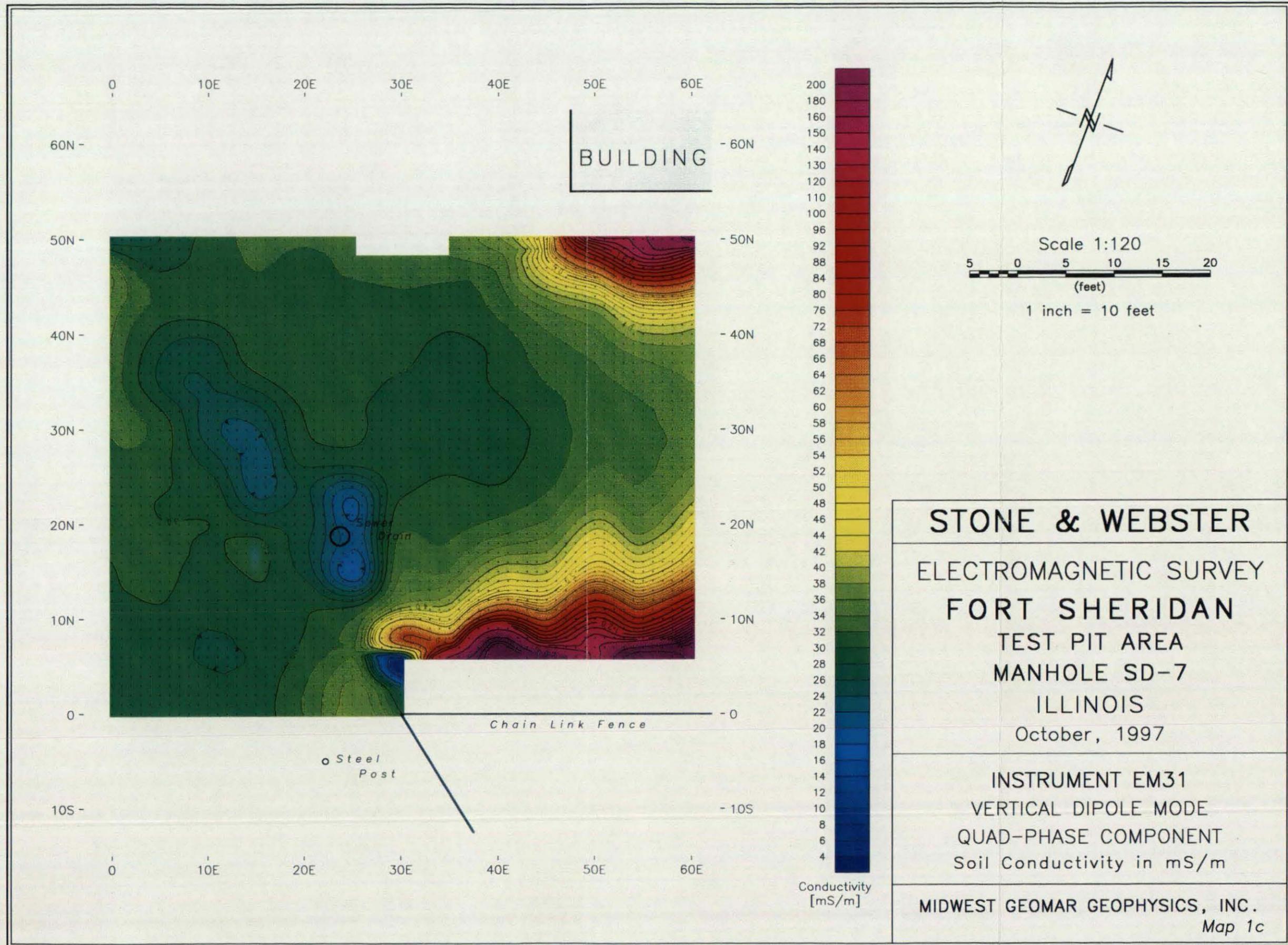
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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 MANHOLE SD-7  
 ILLINOIS  
 October, 1997

INSTRUMENT EM61  
 CHANNEL B  
 Compressed Amplitude  
 EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 1a



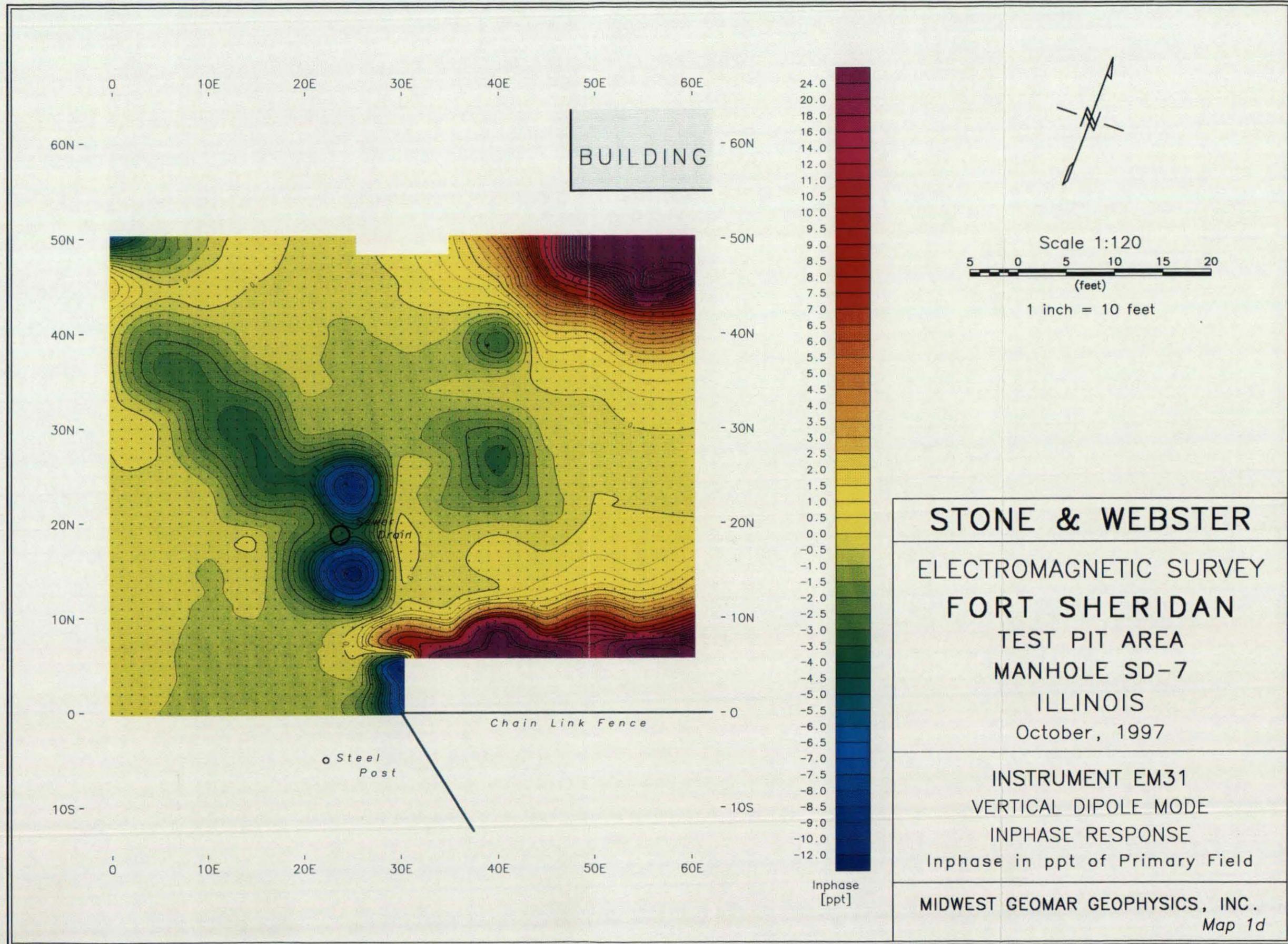


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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 MANHOLE SD-7  
 ILLINOIS  
 October, 1997

INSTRUMENT EM31  
 VERTICAL DIPOLE MODE  
 QUAD-PHASE COMPONENT  
 Soil Conductivity in mS/m

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 1c

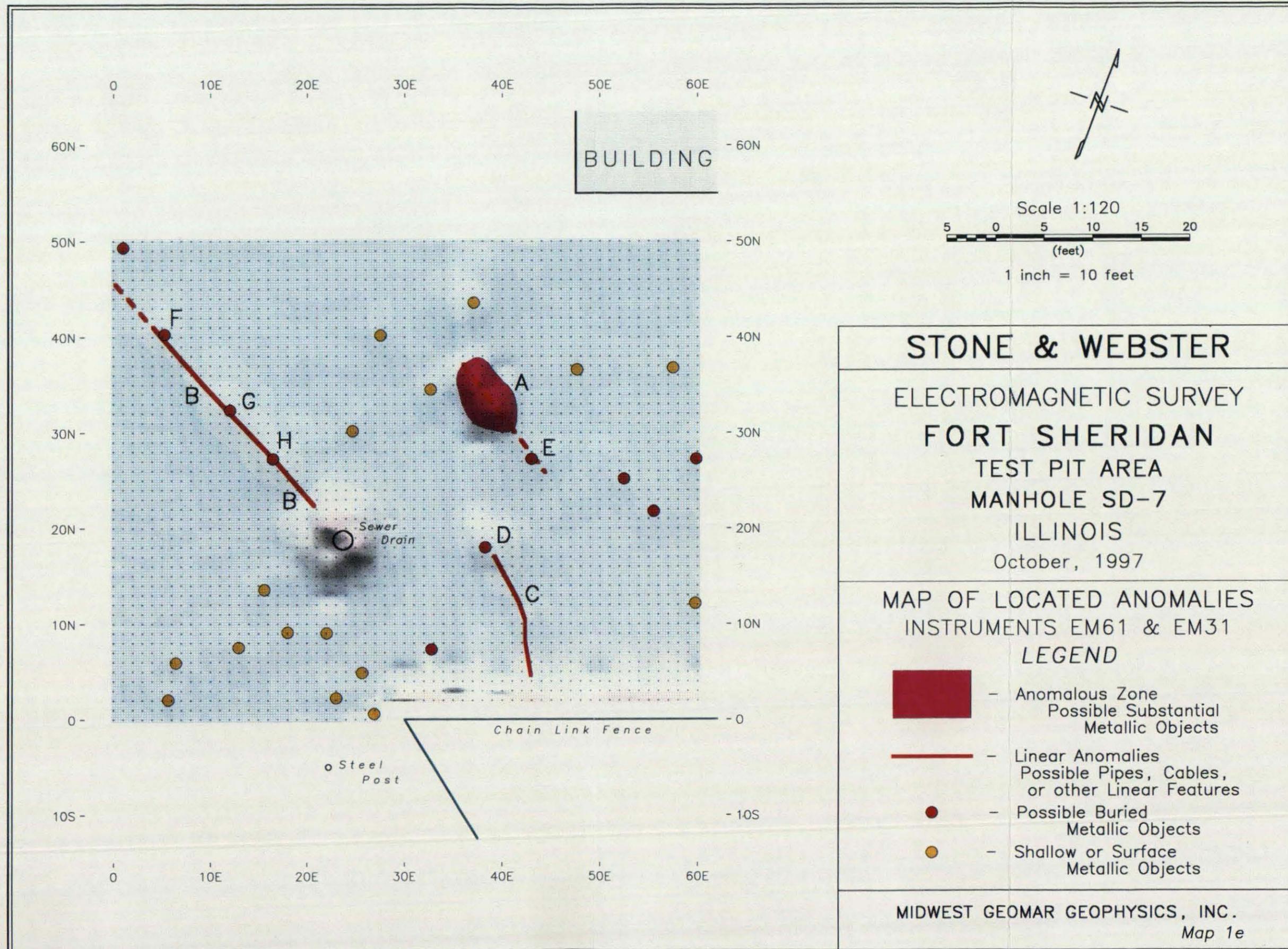


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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 MANHOLE SD-7  
 ILLINOIS  
 October, 1997

INSTRUMENT EM31  
 VERTICAL DIPOLE MODE  
 INPHASE RESPONSE  
 Inphase in ppt of Primary Field

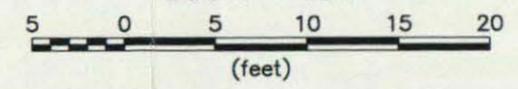
MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 1d



BUILDING



Scale 1:120



1 inch = 10 feet

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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 MANHOLE SD-7  
 ILLINOIS  
 October, 1997

## MAP OF LOCATED ANOMALIES INSTRUMENTS EM61 & EM31 LEGEND

-  - Anomalous Zone  
Possible Substantial  
Metallic Objects
-  - Linear Anomalies  
Possible Pipes, Cables,  
or other Linear Features
-  - Possible Buried  
Metallic Objects
-  - Shallow or Surface  
Metallic Objects

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 1e

## 7b. Results Test Pit # 6 (Triangle)

Five color contour maps of the site were prepared at a scale of 1" - 30' and include the most important topographical features in the study area.

- Map 2a EM61 Response map, Channel B,
- Map 2b Map of EM 61 Differential Channel Response with near surface objects removed
- Map 2c Map of the EM31 Quad-phase component (apparent soil conductivity),
- Map 2d EM31 Inphase response map
- Map 2e Located anomalies Map which indicates areas of potential interest, (depicts results of interpretation of both, EM31 and EM61 data sets).

The electromagnetic data shows highly varying distribution of EM61 response (Maps 2a and 2b), and the EM31 data Quad-phase (conductivity) and Inphase response (Maps 2c and 2d). The highly varying EM31 conductivity data (Map 2c) does not allow us to establish and convincing conductivity background levels. This type on conductivity and Inphase (Map 2d) distribution may indicate highly varying subsurface material typical for fill areas as well as interference originated by numerous metallic objects. High values of soil conductivity (in a range of 50 mS/m and above) were measured in the N-E portion of the site (Map 2c). These high conductivity values may indicate soil with a high content of clay and a possible inorganic contamination of the soil material. In the remaining area of the site, conductivity varies from 0 to 100 mS/m. These changes appear to be associated with the presence of numerous metallic objects.

One anomalous zone of very high conductivity was detected in the central portion of the site. It is marked by a magenta zone and labeled **A** on Map 1e. This anomaly is likely affected by interference originated by metallic objects since it is located in the area of two possible pipes and other detected metallic objects (see Map 2a). However its high but uniform high amplitude (above 90 mS/m) indicated that this anomaly may indicate high conductivity of soil as well. In such case, anomaly **A** would be associated with possible inorganic contamination of the soil material.

Two anomalous zones of very high EM61 response (Map 2a) that may indicate large buried metallic structures were detected in the southern end of the site (under the road). These are marked by blue zones and labeled **D** on Map 2e. These zones may indicate substantial buried metallic or steel reinforced concrete structures. It should be noted that these two anomalies are of the same nature (amplitude and shape) and they are in rectangular shape aligned with the direction

of the street. It is possible that they represented an old reinforced concrete pad which was divided during constructing a trench for a possible pipe represented by anomaly **G** (Map 1e).

Two zones containing numerous metallic objects were delineated. These are marked by pink (zone labeled **B**) and light pink zones (labeled **C**) on Map 2e. Anomaly **B** appears to be associated with a group of relatively large metallic objects while anomaly **C** (which includes zone **B**) may represent several smaller buried metallic objects scattered over a larger area. Isolated anomalies that can be distinguished within these two zones are depicted by red (buried metallic targets) and yellow (shallow targets) circles on Map 2e. Type of distribution of anomalies within zones **B** and **C** indicates that these areas may contain buried wastes. Zone **B** contains likely a larger number of metallic objects of larger size than zone **C**. Anomaly **B** can be seen very well on both EM61 and EM31 data.

Numerous anomalies indicating the presence of linear features were detected during the survey. They are marked by solid red lines on Map 2e. It should be noted that most linear anomalies appear to be very well delineated. All of these anomalies may be associated with buried pipes.

Anomalies **M** and **N**, **K** and **L** may be associated with underground services running along the streets.

Anomalies **E** and **F** can be very well distinguished in the central and southern portion of the site, however in the northern area it is difficult to conclude whether they are running in parallel or they merged into a single pipe.

Amplitude and width of anomaly **G** indicates that this anomaly may represent multiple buried pipes.

Anomalies **T** and **S** may indicate short linear structures other than pipes.

Remaining linear anomalies are well delineated and they may represent buried pipes or other metallic objects of linear shape.

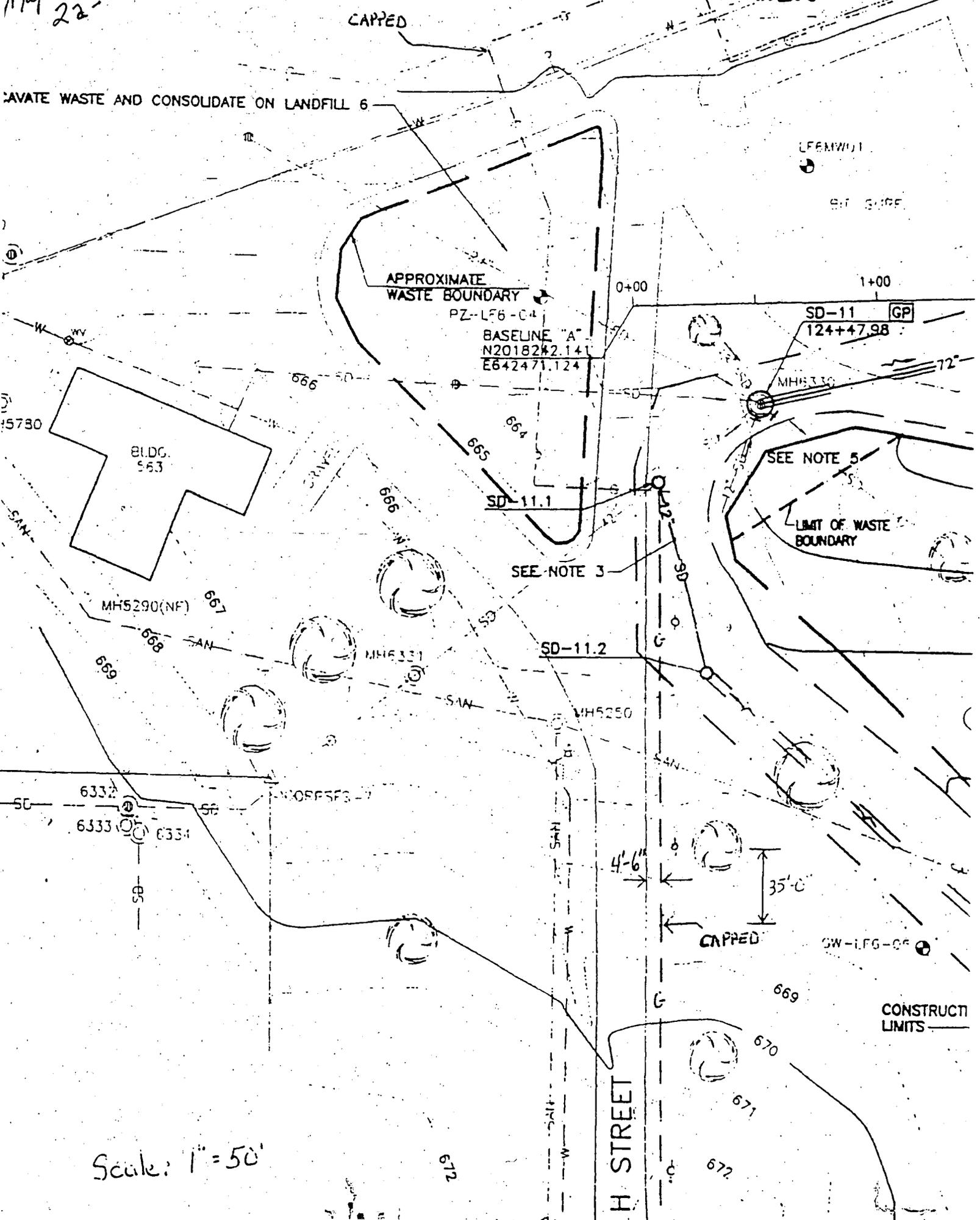
A comparison of linear features denoted on Map 2e with available plans of underground utilities would allow confirmation of their location and to distinguish unknown objects.

A number of isolated anomalies indicating buried metallic targets were detected. Anomalies representing buried objects are marked by red circles, while those indicating shallow or on the surface objects are marked by yellow circles on Map 2e. These anomalies indicate the presence of

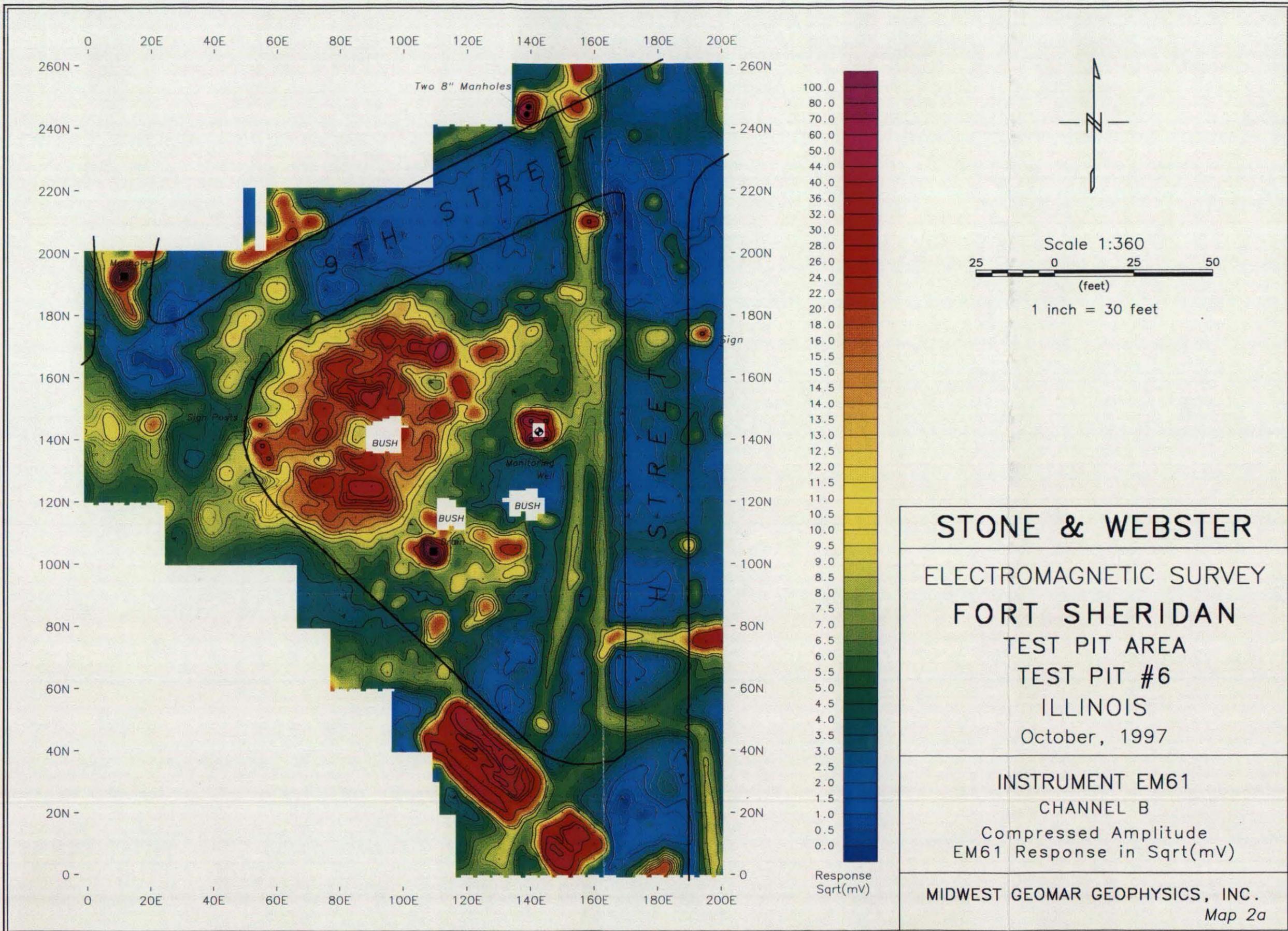
relatively small objects. The most substantial of these anomalies are marked by red circles and are labeled X on Map 2e.

# MODIFIED GAS LINE LOCATION

Map 22-e



Scale: 1" = 50'



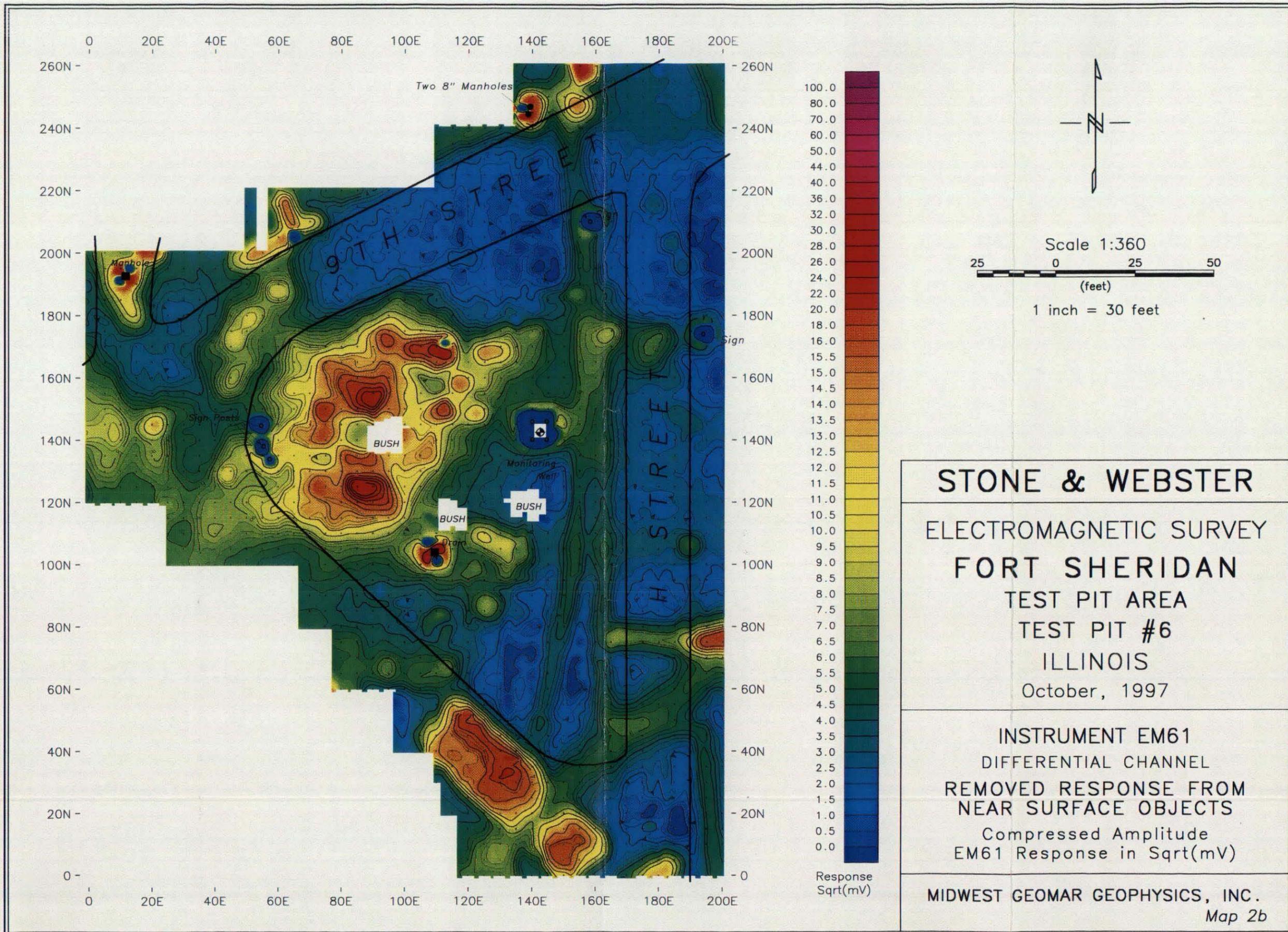
**STONE & WEBSTER**

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #6  
 ILLINOIS  
 October, 1997

INSTRUMENT EM61  
 CHANNEL B

Compressed Amplitude  
 EM61 Response in  $\sqrt{\text{mV}}$

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 2a

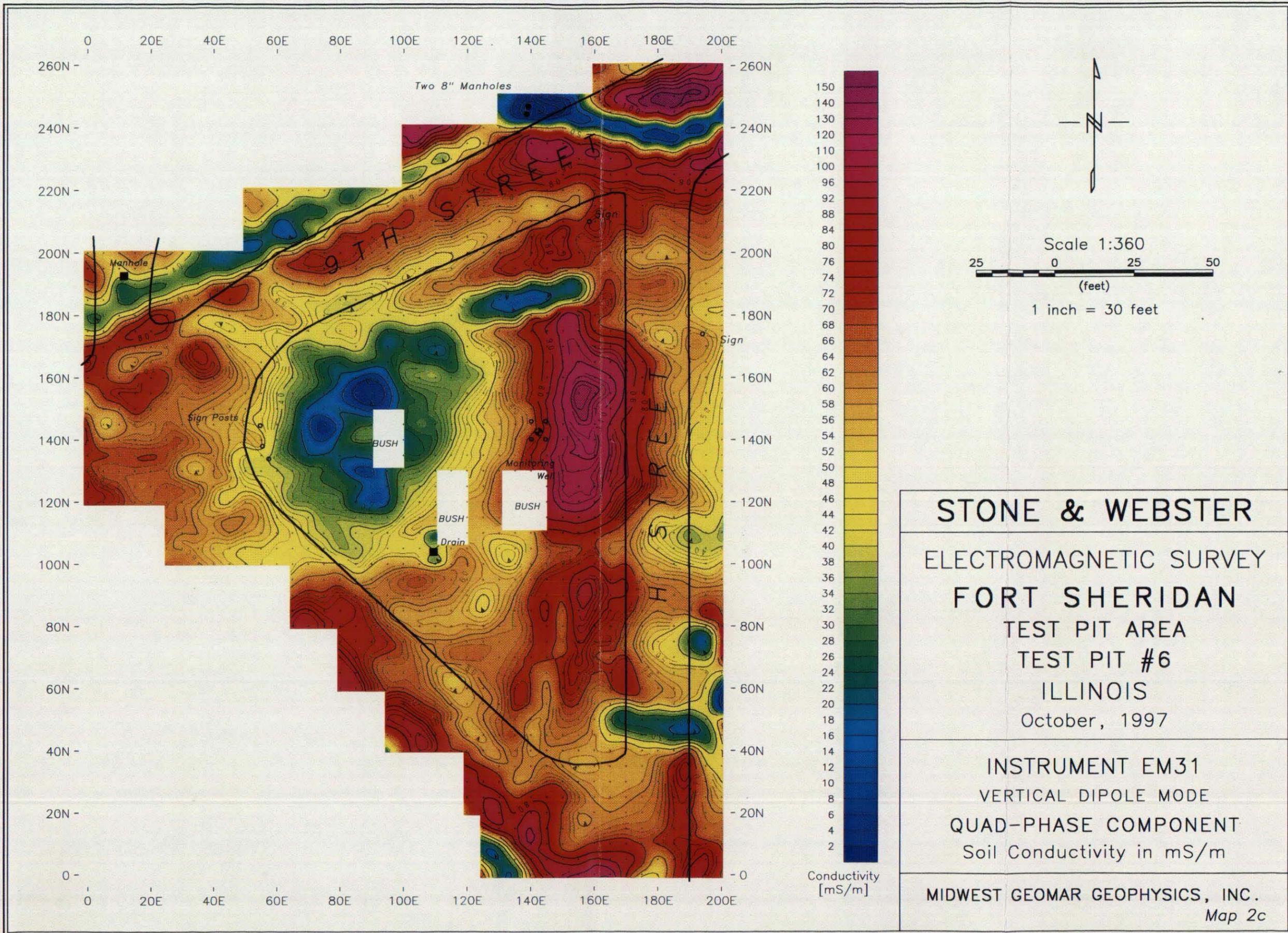


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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #6  
 ILLINOIS  
 October, 1997

INSTRUMENT EM61  
 DIFFERENTIAL CHANNEL  
 REMOVED RESPONSE FROM  
 NEAR SURFACE OBJECTS  
 Compressed Amplitude  
 EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 2b

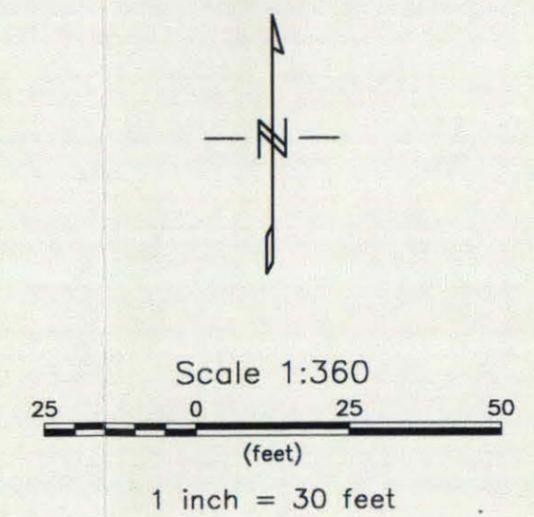
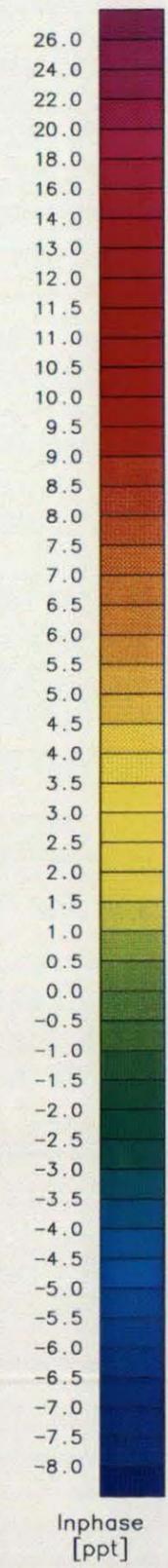
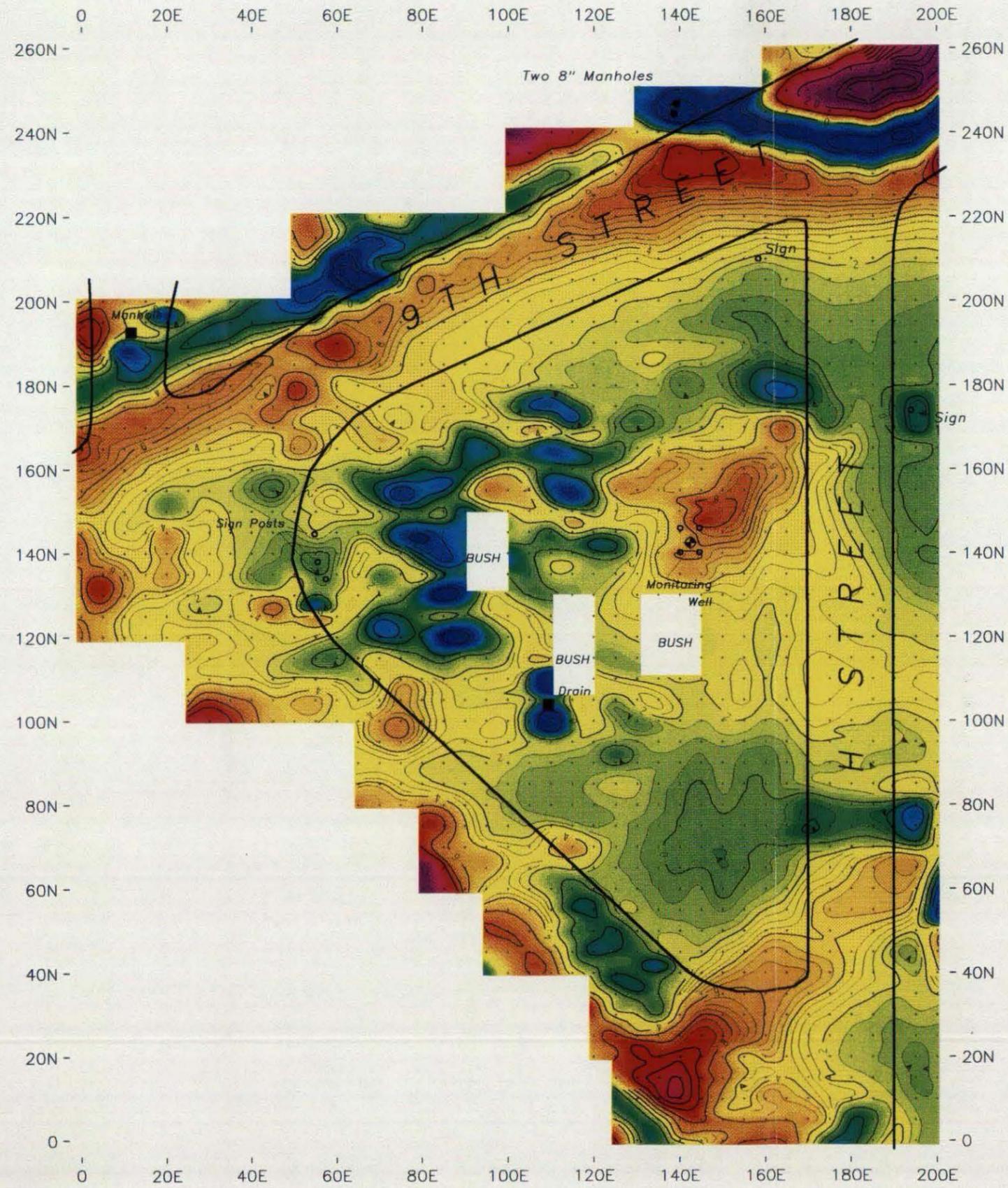
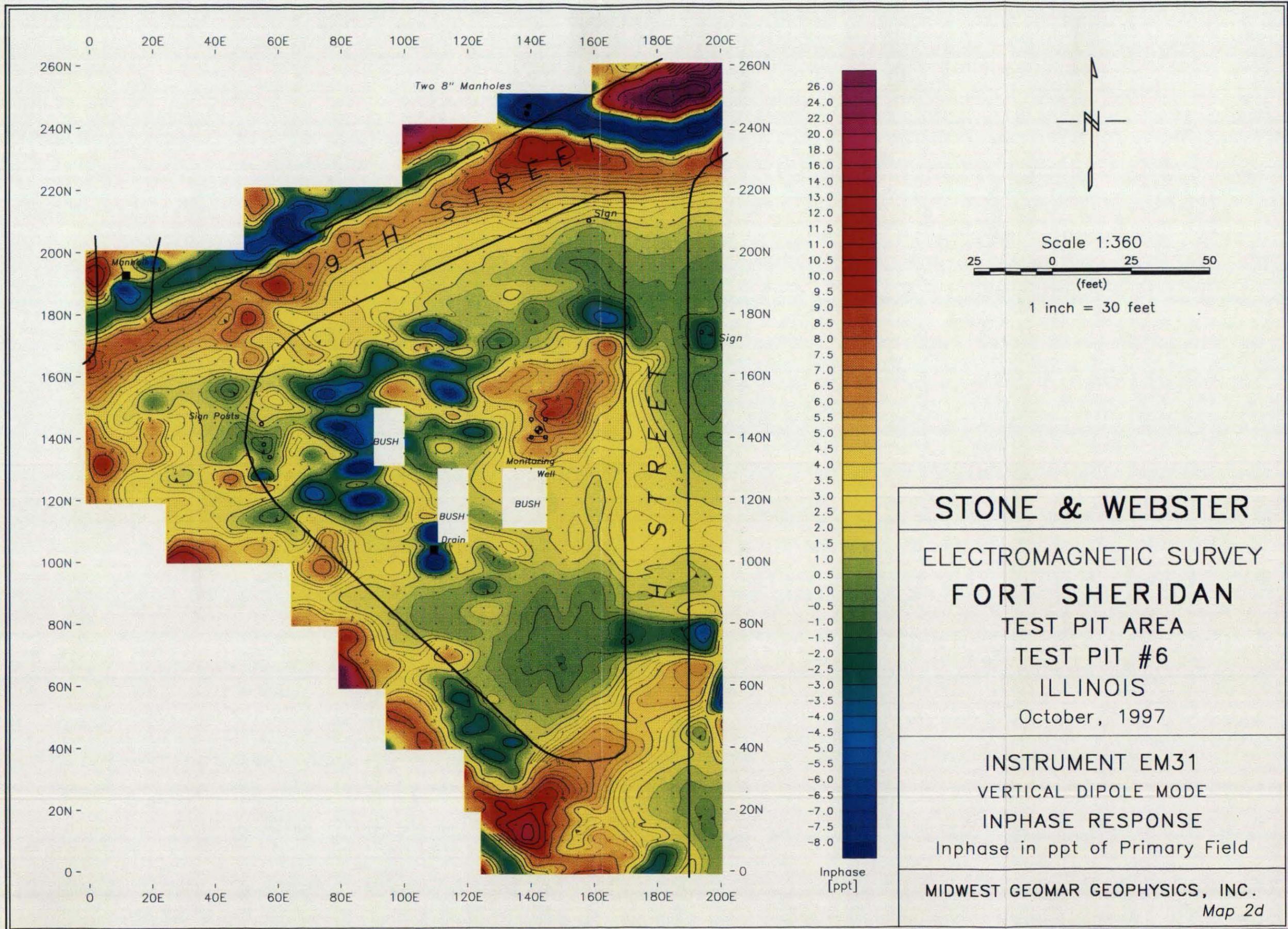


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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #6  
 ILLINOIS  
 October, 1997

INSTRUMENT EM31  
 VERTICAL DIPOLE MODE  
 QUAD-PHASE COMPONENT  
 Soil Conductivity in mS/m

MIDWEST GEOMAR GEOPHYSICS, INC.  
*Map 2c*

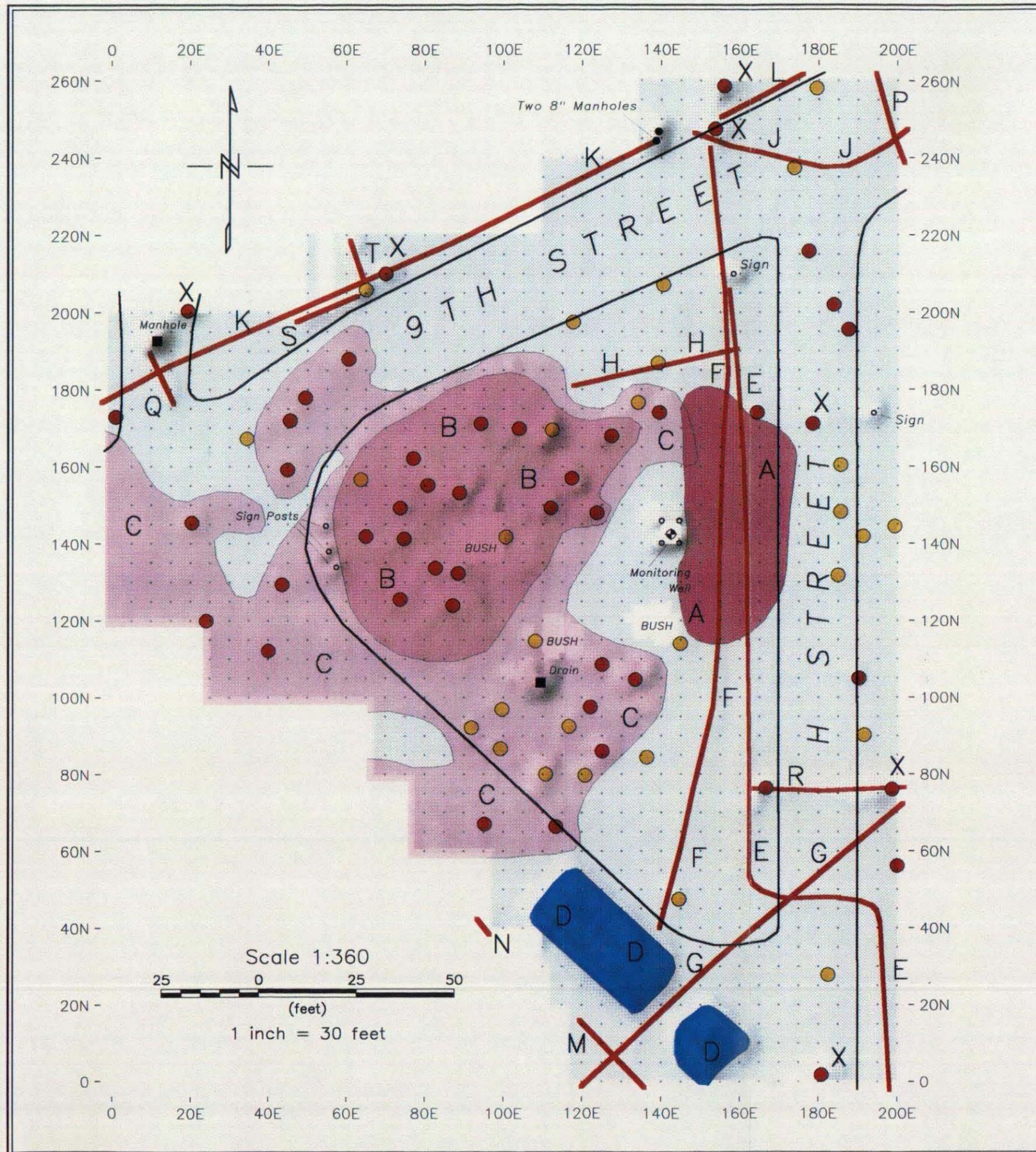


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ELECTROMAGNETIC SURVEY  
FORT SHERIDAN  
TEST PIT AREA  
TEST PIT #6  
ILLINOIS  
October, 1997

INSTRUMENT EM31  
VERTICAL DIPOLE MODE  
INPHASE RESPONSE  
Inphase in ppt of Primary Field

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 2d



# STONE & WEBSTER

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #6  
 ILLINOIS  
 October, 1997

## MAP OF LOCATED ANOMALIES INSTRUMENT EM61 & EM31 LEGEND

-  - Anomalous Zone  
High Soil Conductivity
-  - Anomalous Zone  
Possible Substantial  
Metallic Objects
-  - Anomalous Zone of  
Possible Buried Wastes  
Containing Substantial  
Buried Metallic or  
Concrete Objects
-  - Anomalous Zone  
Possible Buried Wastes  
Containing Metallic  
Objects
-  - Linear Anomalies  
Possible Pipes, Cables,  
or other Linear Features
-  - Possible Buried  
Metallic Objects
-  - Shallow or Surface  
Metallic Objects

investigated site may be a portion of a site containing buried wastes. Linear anomaly **M** (dashed red line) located within zone **B** may indicate a direction of a trench with buried wastes.

Three anomalies indicating the presence of linear features were detected during the survey. They are marked by red lines and labeled **J, K, and L** on Map 3e. Anomalies that are not well delineated are denoted by dashed red lines. It should be noted that these three anomalies are detected mainly by the EM31 survey and indicates that these anomalies may represent a deeper located structure, or cables, small diameter pipes, pipes containing small amounts of metal (e.g. concrete sewer pipes), or other linear features.

A number of isolated anomalies indicating buried metallic targets were detected. Anomalies representing buried objects are marked by red circles, while those indicating shallow or on the surface objects are marked by yellow circles on Map 3e. These anomalies indicate the presence of relatively small objects. The most substantial of these anomalies marked by red circles are labeled **P** on Map 3e.

### 7c. Results Test Pit, Treatment Plant area

Five color contour maps of the site were prepared and include the most important topographical features in the study area.

- Map 1a EM61 Response map, Channel B,
- Map 1b Map of EM 61 Differential Channel Response with near surface objects removed
- Map 1c Map of the EM31 Quad-phase component (apparent soil conductivity),
- Map 1d EM31 Inphase response map
- Map 1e Located anomalies Map which indicates areas of potential interest, (depicts results of interpretation of both, EM31 and EM61 data sets).

The electromagnetic data shows highly varying distribution of EM61 response (Maps 3a and 3b), and the EM31 data Quad-phase (conductivity) and Inphase response (Maps 3c and 3d).

The highly varying EM31 Quad-phase data (Map 3c) allows us to establish conductivity background levels only in the southeastern portion of the site. Conductivity values measured in this area are in a range of 18 to 24 mS/m. These conductivity values may indicate very fine grain soil material. In the remaining area conductivity and Inphase (Map 3d ) distribution indicate highly varying subsurface material typical for fill area as well as interference originated by numerous metallic objects.

EM61 data (Maps 3a and 3b) indicate several groups of buried metallic objects. After data processing it can be observed that a number of anomalies associated with buried objects is smaller (Map 3b).

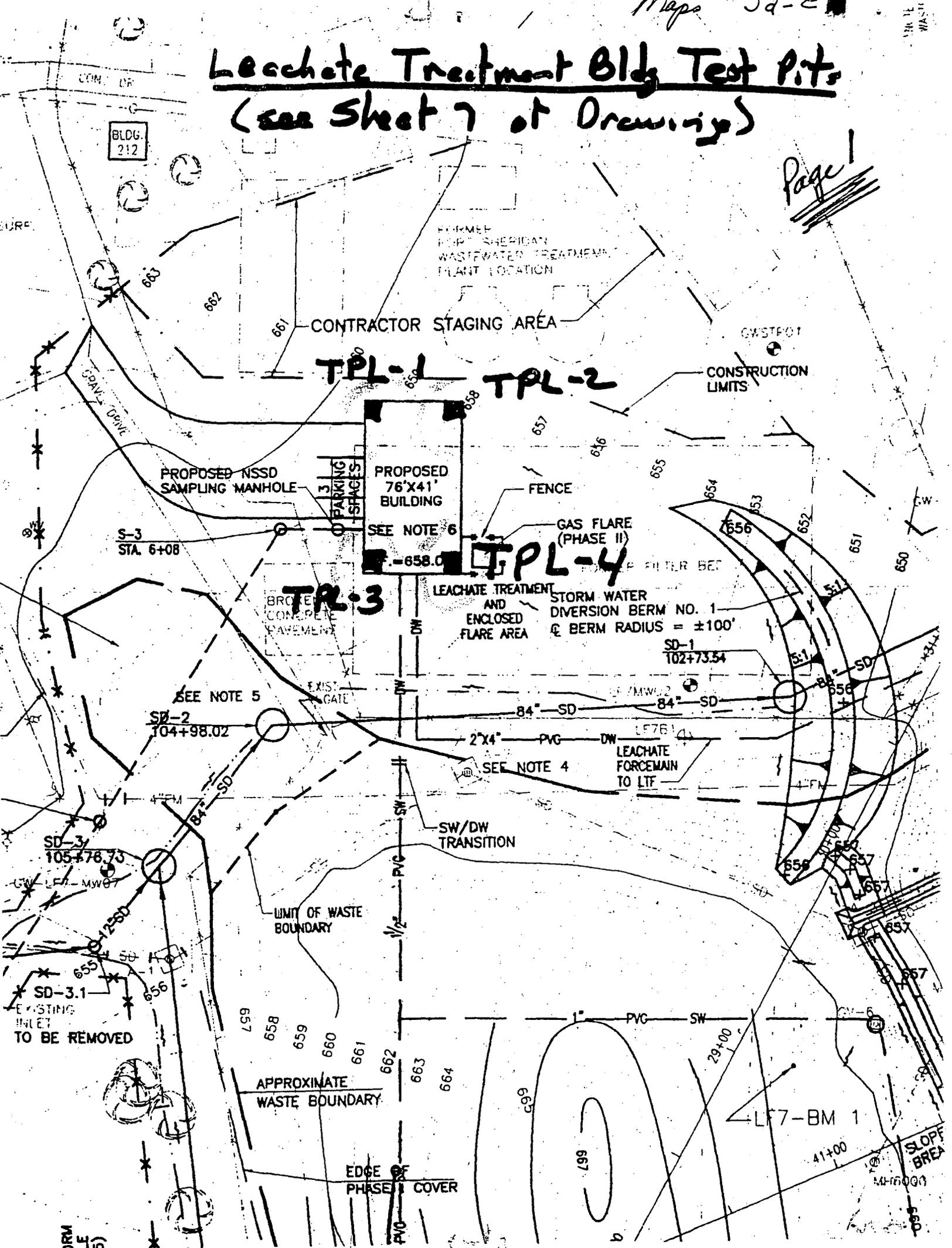
One anomalous zone of high EM61 response (Map 3a) that may indicate a large buried metallic structure was detected during the survey. This is marked by a magenta zone and labeled A on Map 3e. This zone may indicate substantial buried metallic or a steel reinforced concrete structure. Anomaly A appears to be located in the complex anomalous area. Therefore, it may represent several buried objects as well.

Several anomalous zones of significant EM61 response (Map 3a) that may be associated with groups of buried metallic objects were detected. These are marked by pink zones and labeled, B, C, D, E, F, and H on Map 3e. these zones may indicate numerous buried metallic or steel reinforced concrete structures. The distribution of these anomalies indicates that the

# Leachate Treatment Bldg Test Pits

(see Sheet 7 of Drawings)

Page 1



BLDG. 212

FORMER AMERICAN WASTEWATER TREATMENT PLANT LOCATION

CONTRACTOR STAGING AREA

CONSTRUCTION LIMITS

TPL-1 TPL-2

PROPOSED NSSD SAMPLING MANHOLE

PROPOSED 76'X41' BUILDING

FENCE

GAS FLARE (PHASE II)

SEE NOTE 6

S-3 STA. 6+08

TPL-3

LEACHATE TREATMENT AND ENCLOSED FLARE AREA

STORM WATER DIVERSION BERM NO. 1 & BERM RADIUS = ±100'

SD-1 102+73.54

SEE NOTE 5

SD-2 104+98.02

SEE NOTE 4

LEACHATE FORCE MAIN TO LTF

SW/DW TRANSITION

LIMIT OF WASTE BOUNDARY

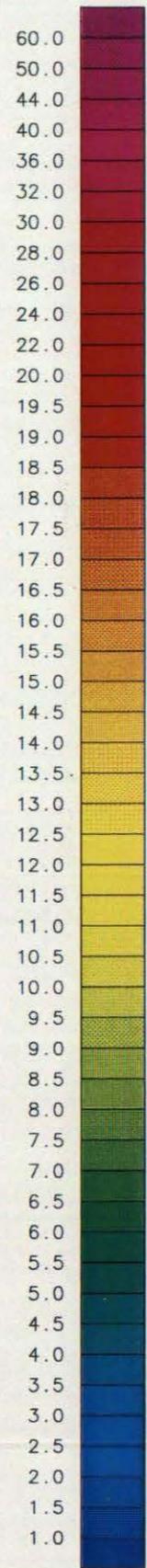
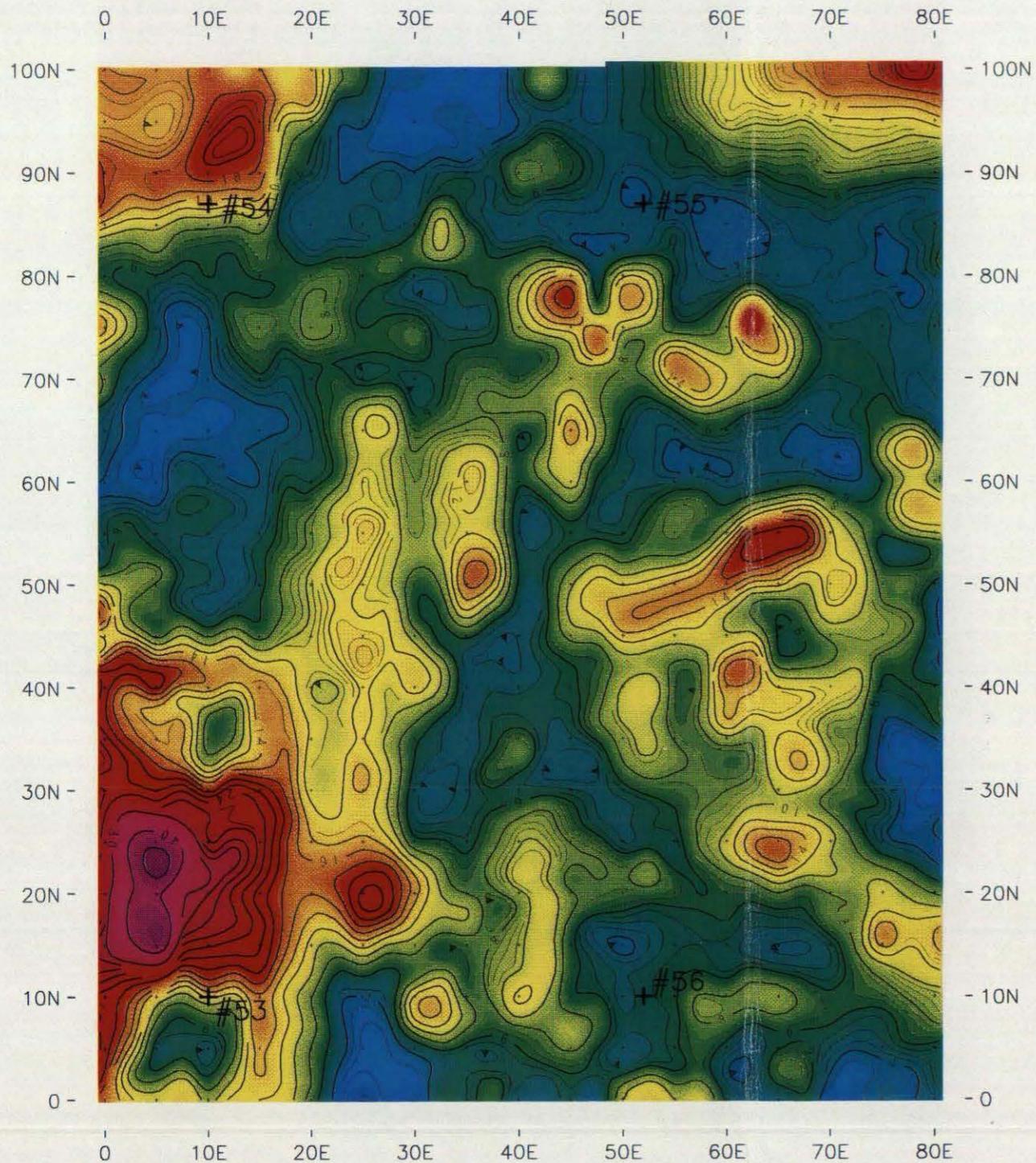
SD-3.1 EXISTING INLET TO BE REMOVED

APPROXIMATE WASTE BOUNDARY

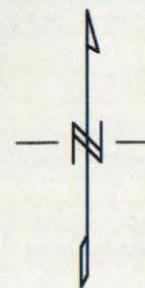
EDGE OF PHASE I COVER

L7-BM 1

SLOPE BREAK



Response  
Sqrt(mV)



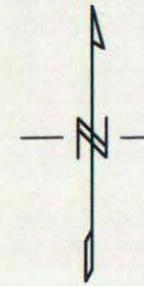
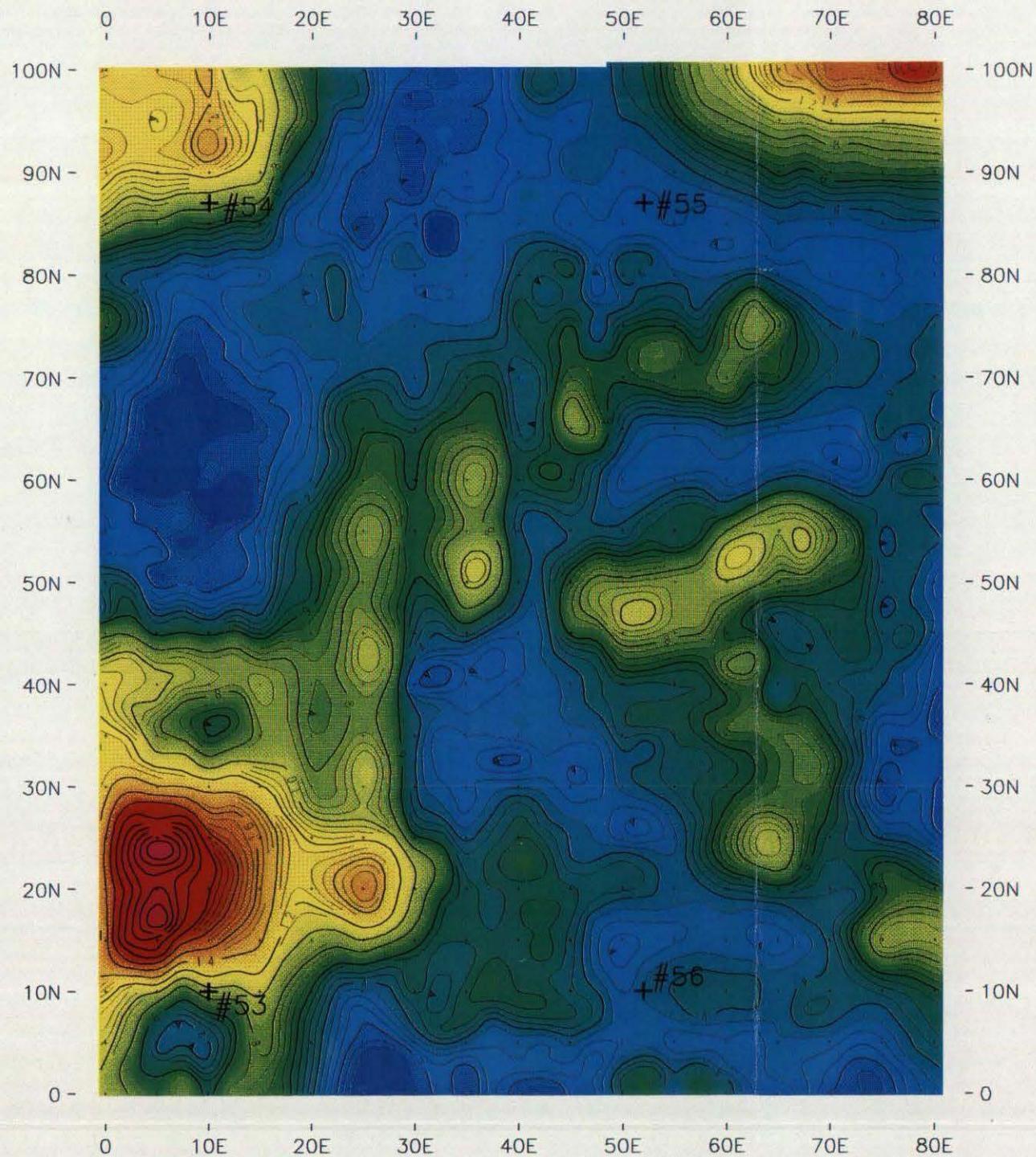
Scale 1:180  
10 0 10 20 30  
(feet)  
1 inch = 15 feet

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ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
TEST PIT AREA  
TREATMENT PLANT  
ILLINOIS  
October, 1997

INSTRUMENT EM61  
CHANNEL B  
Compressed Amplitude  
EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 3a



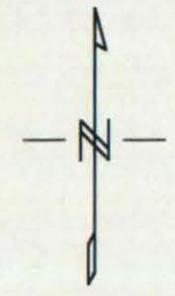
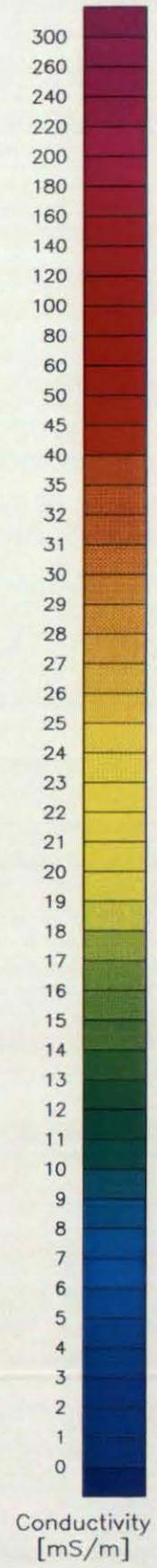
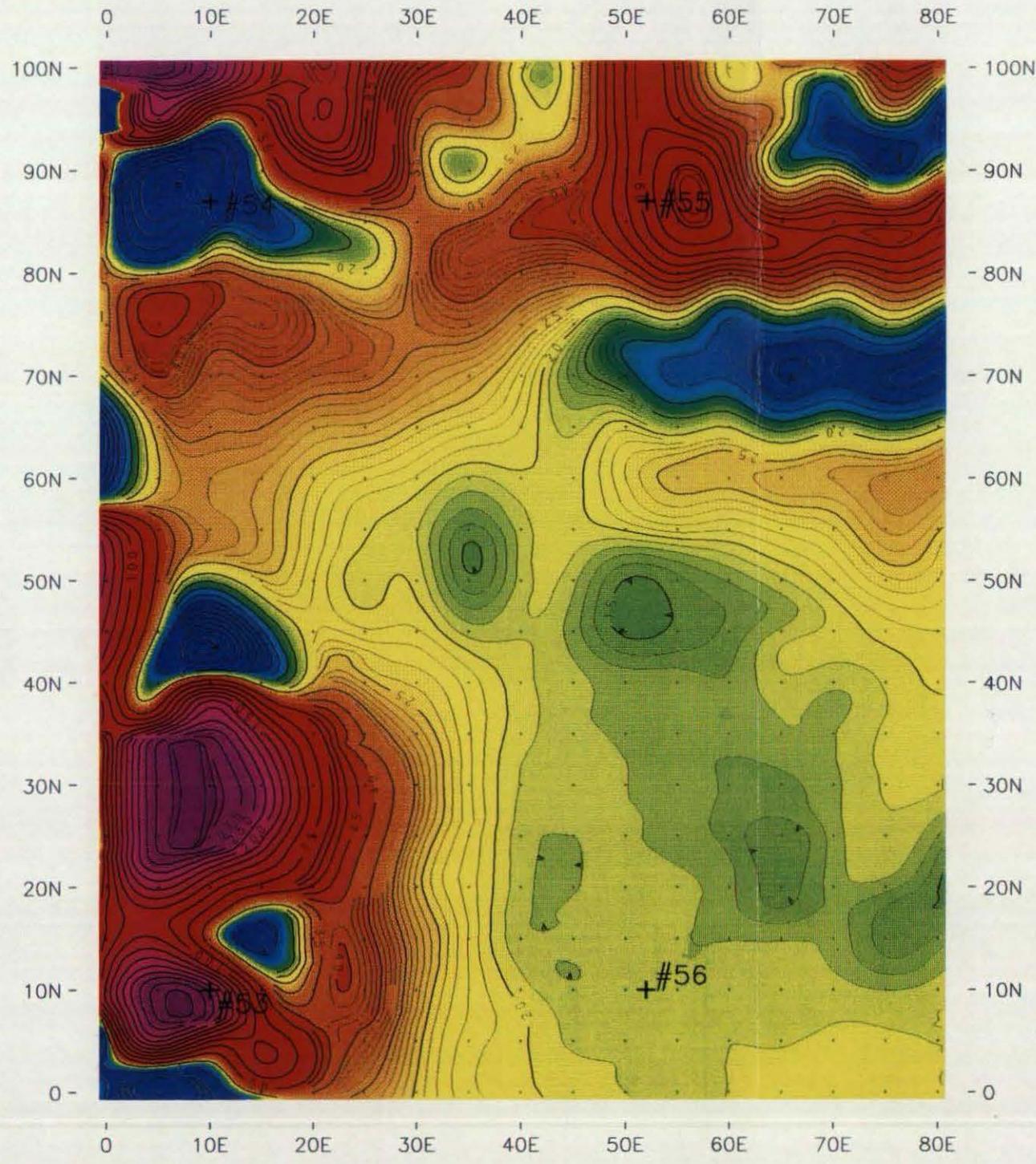
Scale 1:180  
10 0 10 20 30  
(feet)  
1 inch = 15 feet

## STONE & WEBSTER

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TREATMENT PLANT  
 ILLINOIS  
 October, 1997

INSTRUMENT EM61  
 DIFFERENTIAL CHANNEL  
 REMOVED RESPONSE FROM  
 NEAR SURFACE OBJECTS  
 Compressed Amplitude  
 EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 3b

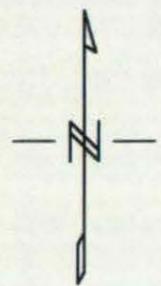
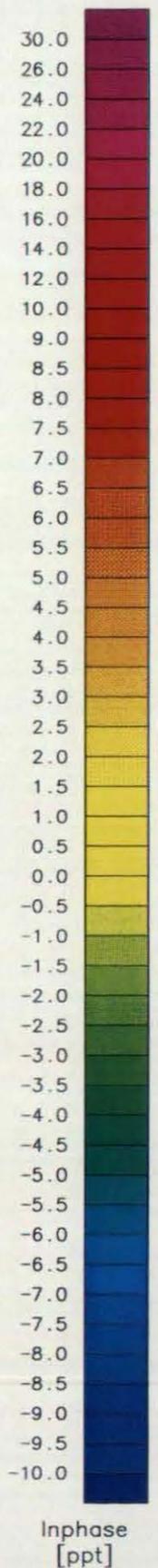
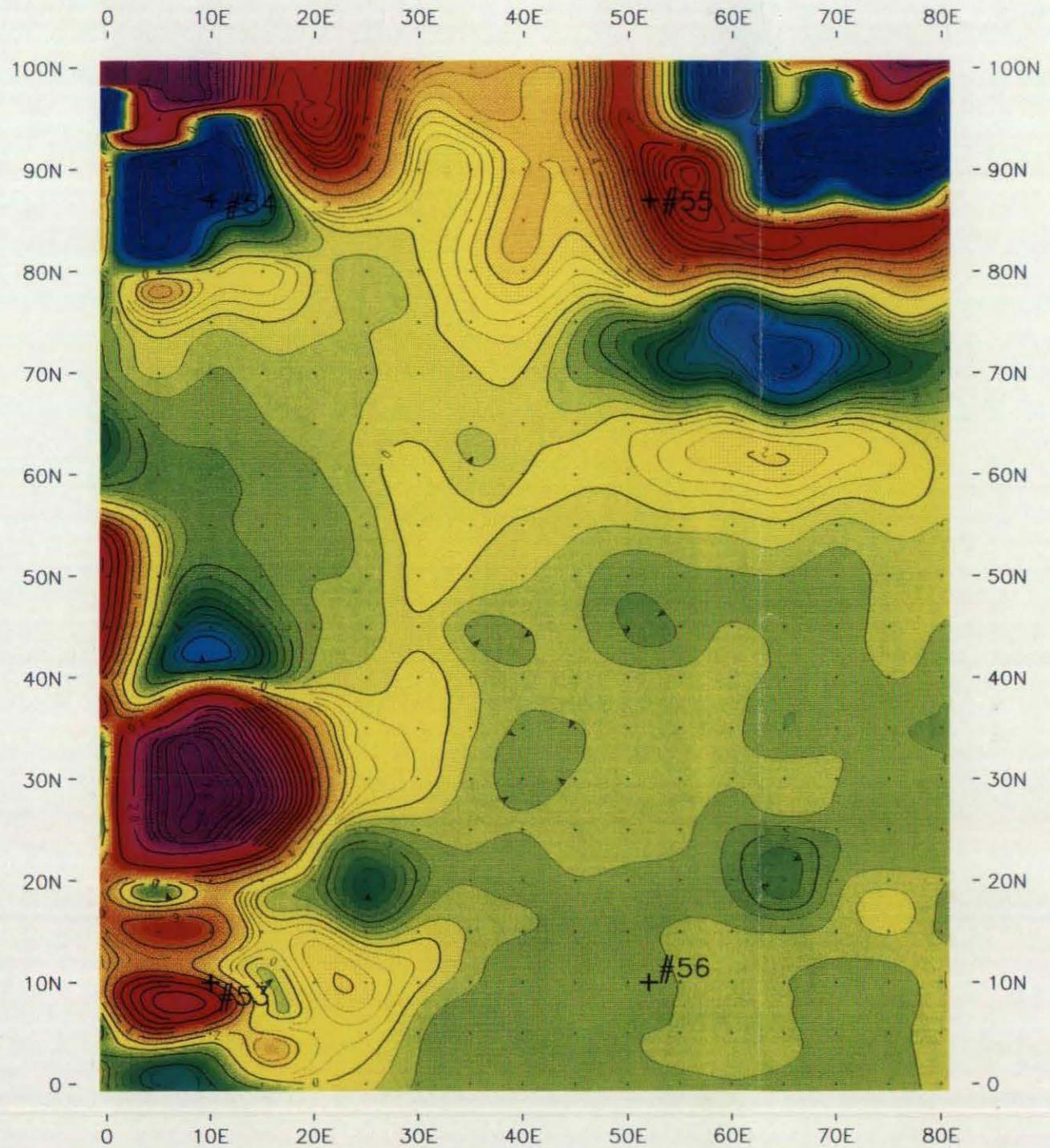


Scale 1:180  
10 0 10 20 30  
(feet)  
1 inch = 15 feet

**STONE & WEBSTER**  
ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
TEST PIT AREA  
TREATMENT PLANT  
ILLINOIS  
October, 1997

INSTRUMENT EM31  
VERTICAL DIPOLE MODE  
QUAD-PHASE COMPONENT  
Soil Conductivity in mS/m

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 3c



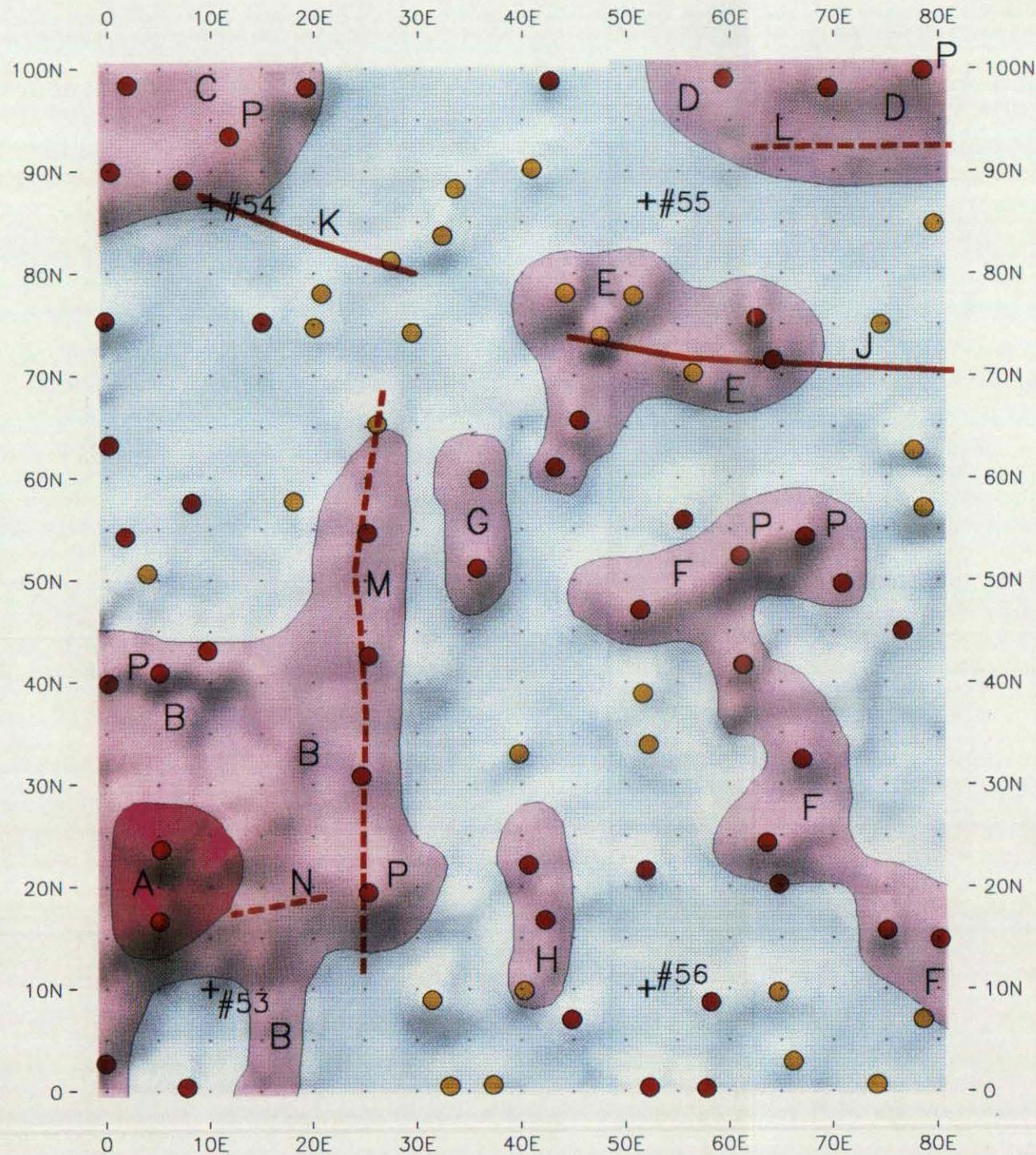
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 (feet)  
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**STONE & WEBSTER**

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TREATMENT PLANT  
 ILLINOIS  
 October, 1997

INSTRUMENT EM31  
 VERTICAL DIPOLE MODE  
 INPHASE RESPONSE  
 Inphase in ppt of Primary Field

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 3d



# STONE & WEBSTER

ELECTROMAGNETIC SURVEY

FORT SHERIDAN

TEST PIT AREA

TREATMENT PLANT

ILLINOIS

October, 1997

## MAP OF LOCATED ANOMALIES INSTRUMENT EM61 & EM31

### LEGEND

-  - Anomalous Zone  
Possible Substantial  
Metallic Objects
-  - Anomalous Zone of  
Possible Buried Wastes  
Containing Substantial  
Buried Metallic or  
Concrete Objects
-  - Linear Anomalies  
Possible Pipes, Cables,  
or other Linear Features
-  - Possible Buried  
Metallic Objects
-  - Shallow or Surface  
Metallic Objects

MIDWEST GEOMAR GEOPHYSICS, INC.

Map 3e

#### 7d. Results Test Pit Area # 7

Five color contour maps of the site were prepared and include the most important topographical features in the study area.

- Map 1a EM61 Response map, Channel B,
- Map 1b Map of EM 61 Differential Channel Response with near surface objects removed
- Map 1c Map of the EM31 Quad-phase component (apparent soil conductivity),
- Map 1d EM31 Inphase response map
- Map 1e Located anomalies Map which indicates areas of potential interest, (depicts results of interpretation of both, EM31 and EM61 data sets).

The electromagnetic data shows highly varying distribution of EM61 response (Maps 4a and 4b), and the EM31 data Quad-phase (conductivity) and Inphase response (Maps 4c and 4d).

The highly varying EM31 conductivity data (Map 4c) does not allow us to establish any convincing conductivity background level. This type of conductivity and Inphase (Map 4d) distribution may indicate highly varying subsurface material typical for fill areas as well as interference originated by numerous metallic objects.

Anomalous areas of very high conductivity were detected in the central portion of the site. These are marked by pink zones and labeled **E, F, and G** on Map 4e. These anomalies are likely affected by interference originated by metallic objects since their amplitude is well above 200 mS/m (Map 4c). However its high but uniform high amplitude may indicate high conductivity of soil as well. In such cases high conductivity anomalies would be associated with possible inorganic contamination of soil material.

One anomalous zone of very high EM61 response (Map 4a) that may indicate a large buried metallic structure was detected in the central portion of the site. This is marked by a magenta zone and labeled **A** on Map 4e. Smaller but still significant targets may be associated with anomalies marked by larger red circles (Map 4e) labeled **M**.

Three anomalous zones of significant EM61 response (Map 4a) that may be associated with groups of buried metallic objects were detected. These are marked by light pink zones and labeled **B, C, and E** on Map 4e. These zones may indicate numerous buried metallic or concrete structures. The distribution of these anomalies indicates that the investigated site may contain

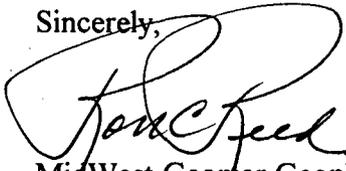
buried wastes. Linear anomaly **J** (red line) located within zone **B** may indicate a direction of a trench with buried wastes.

Four anomalies indicating the presence of linear features were detected during the survey. They are marked by red lines and labeled **H, J, K, and L** on Map 4e. Anomaly **L** that is not well delineated is denoted by dashed red lines. It should be noted that anomaly **K** is detected mainly by the EM31 survey and indicates that it may represent a deeper located structure, or cable, small diameter pipe, pipe containing small amounts of metal (e.g. concrete sewer pipe), or other linear feature.

A number of isolated anomalies indicating buried metallic targets were detected. Anomalies representing buried objects are marked by red circles, while those indicating shallow or on the surface objects are marked by yellow circles on Map 4e. These anomalies indicate the presence of relatively small objects, however anomalies marked by larger red circles and labeled **M** may be associated with substantial targets.

We appreciate the opportunity to have been of service to you, should you have any question regarding the information presented, please do not hesitate to contact the undersigned.

Sincerely,



Mid West Geomar Geophysics, Inc.  
By Ron C. Reed, President

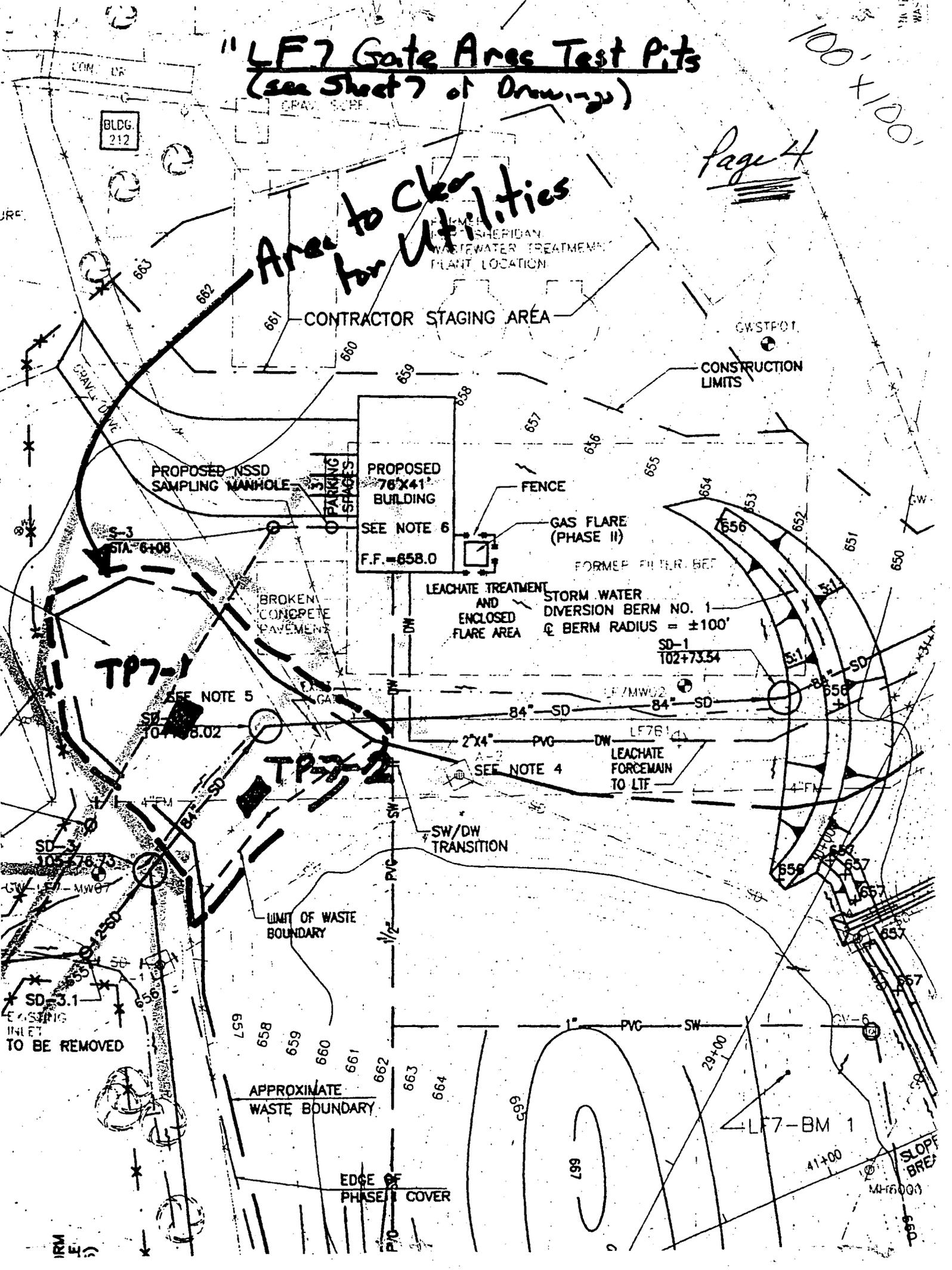
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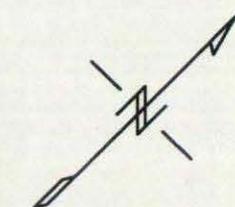
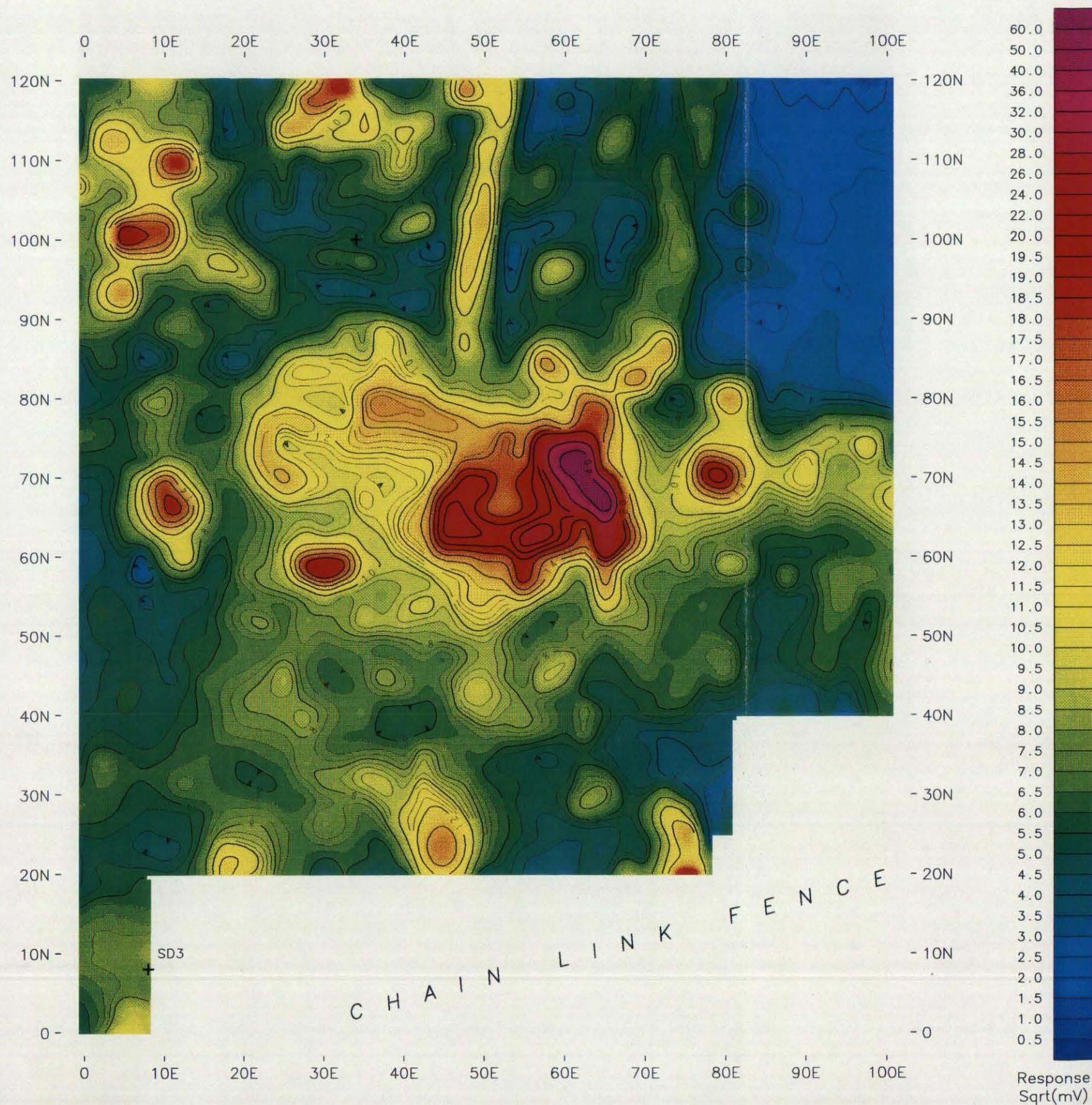
(see sheet 7 of drawings)

100' x 100'

Page 4

Area to Clear for Utilities





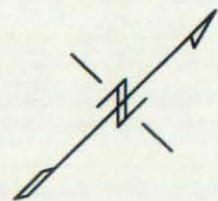
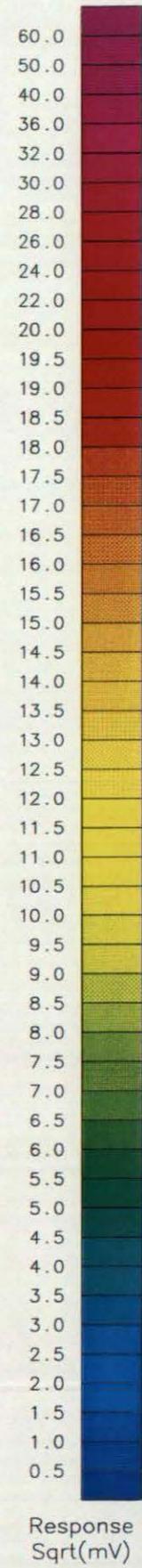
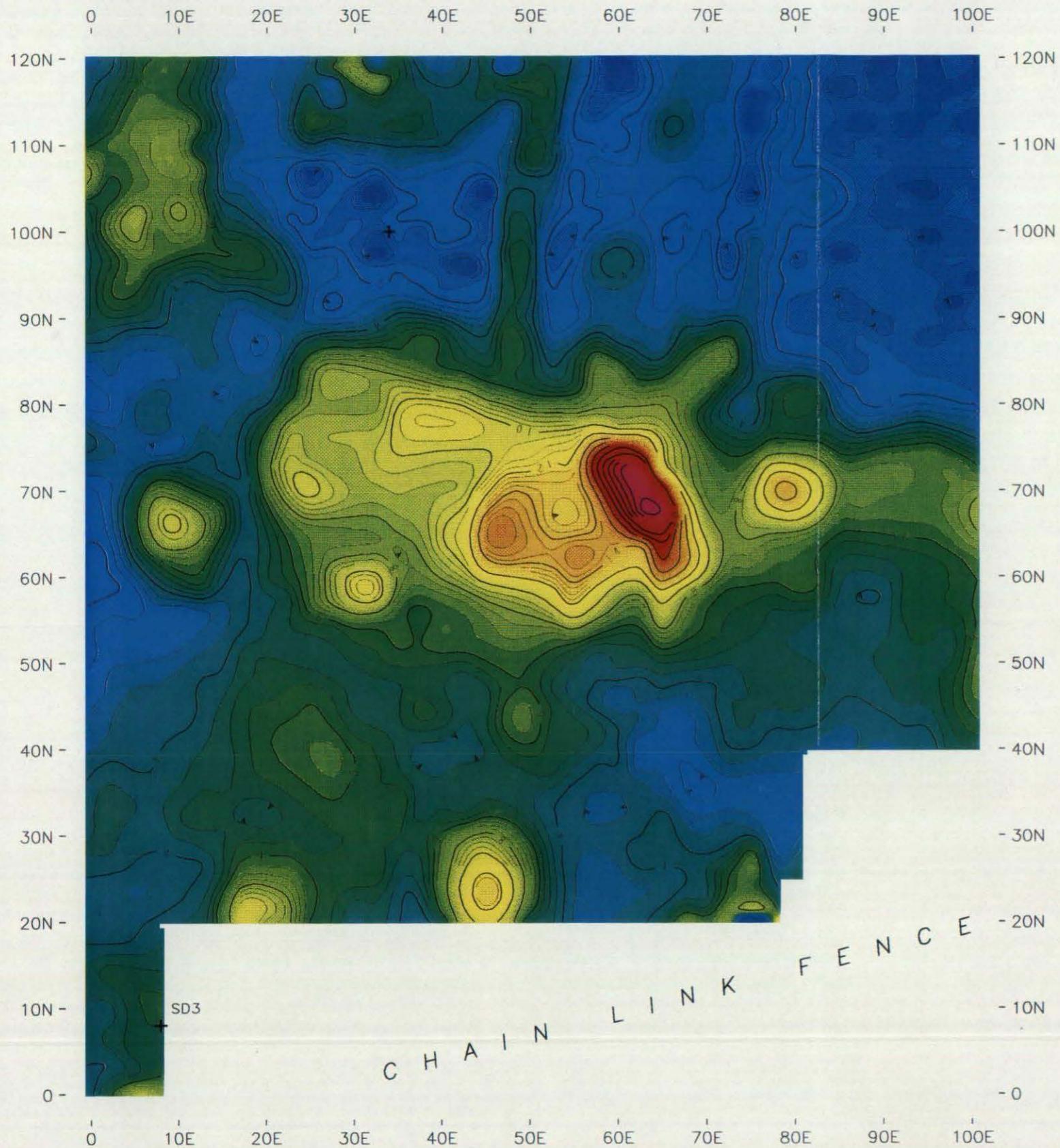
Scale 1:180  
10 0 10 20 30  
(feet)  
1 inch = 15 feet

**STONE & WEBSTER**

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
TEST PIT AREA  
TEST PIT #7  
ILLINOIS  
October, 1997

INSTRUMENT EM61  
CHANNEL B  
Compressed Amplitude  
EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 4a



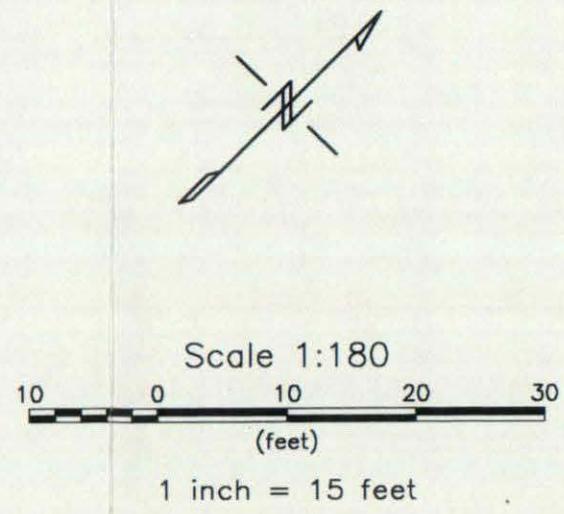
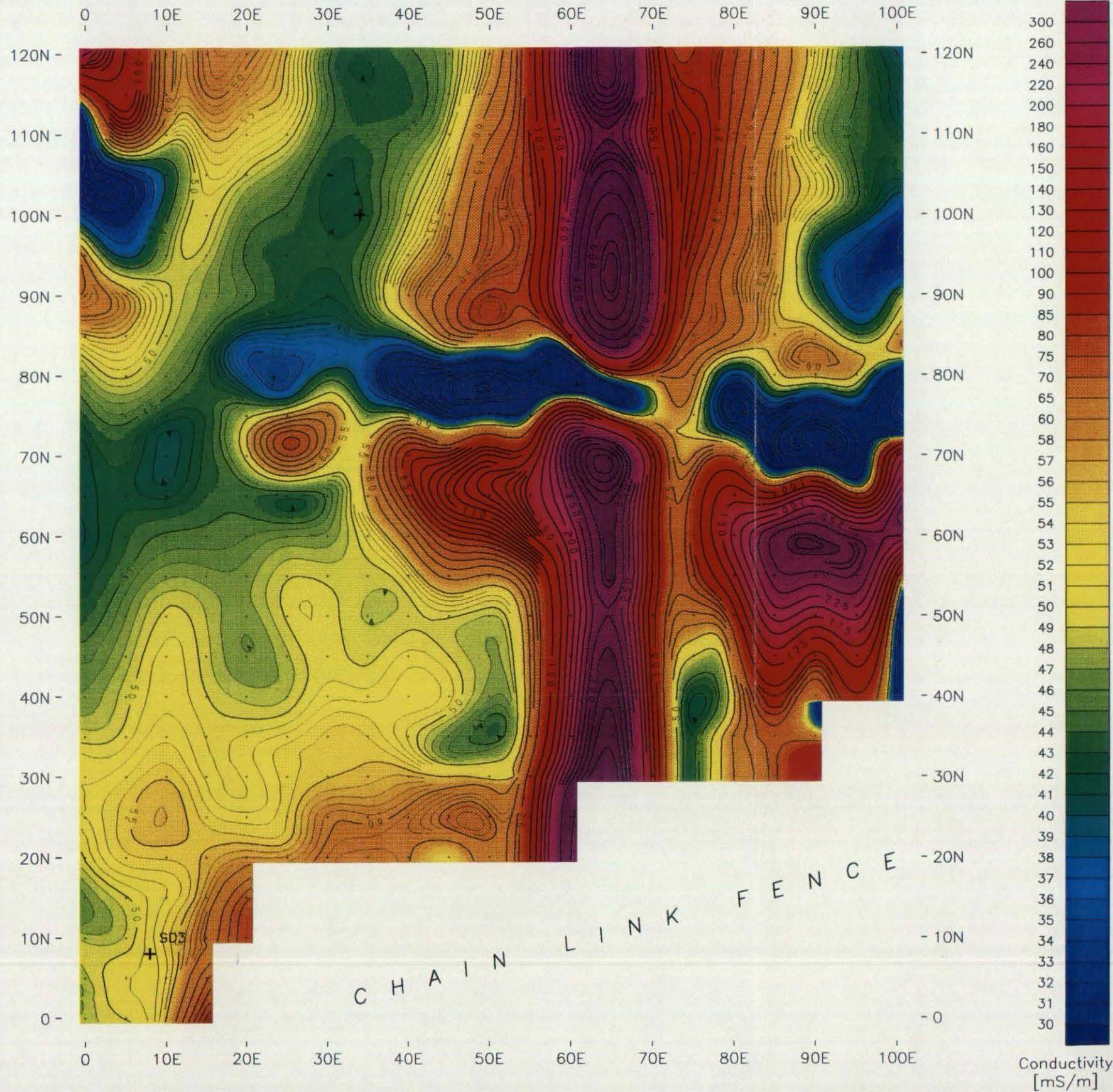
Scale 1:180  
10 0 10 20 30  
(feet)  
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**STONE & WEBSTER**

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
TEST PIT AREA  
TEST PIT #7  
ILLINOIS  
October, 1997

INSTRUMENT EM61  
DIFFERENTIAL CHANNEL  
REMOVED RESPONSE FROM  
NEAR SURFACE OBJECTS  
Compressed Amplitude  
EM61 Response in Sqrt(mV)

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 4b

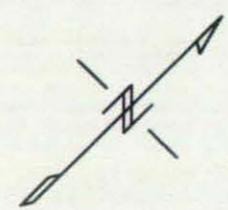
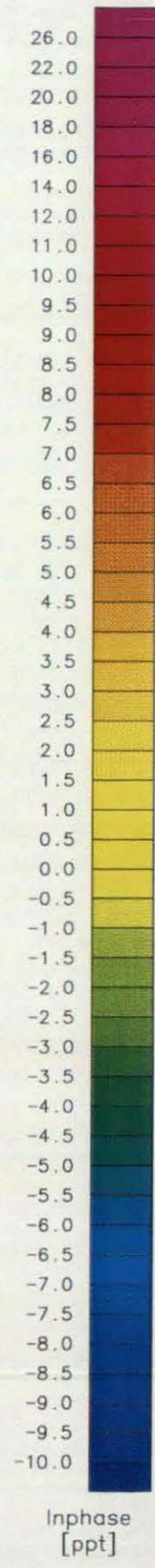
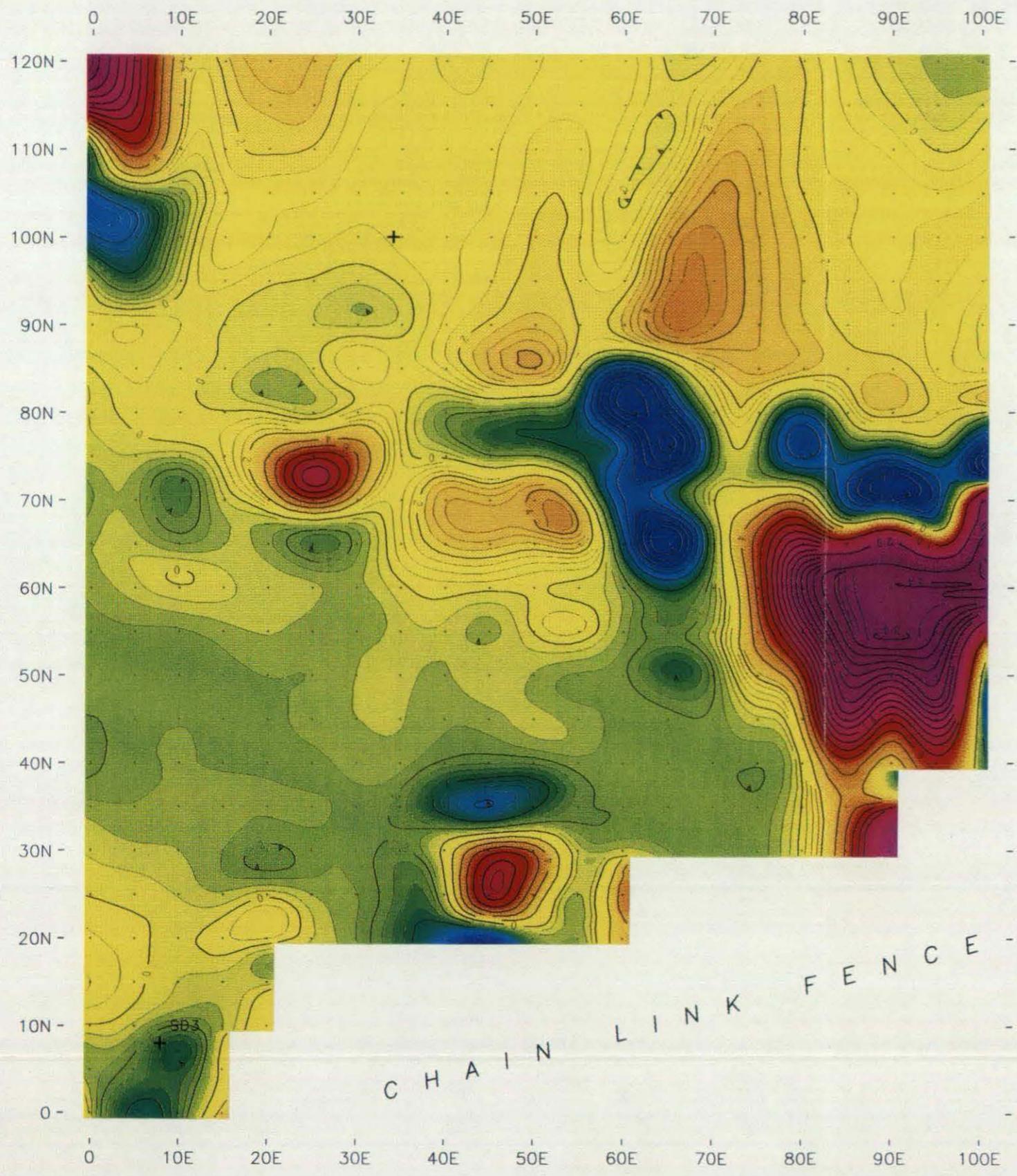


**STONE & WEBSTER**

ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
TEST PIT AREA  
TEST PIT #7  
ILLINOIS  
October, 1997

INSTRUMENT EM31  
VERTICAL DIPOLE MODE  
QUAD-PHASE COMPONENT  
Soil Conductivity in mS/m

MIDWEST GEOMAR GEOPHYSICS, INC.  
Map 4c

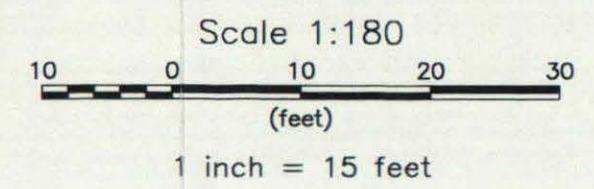
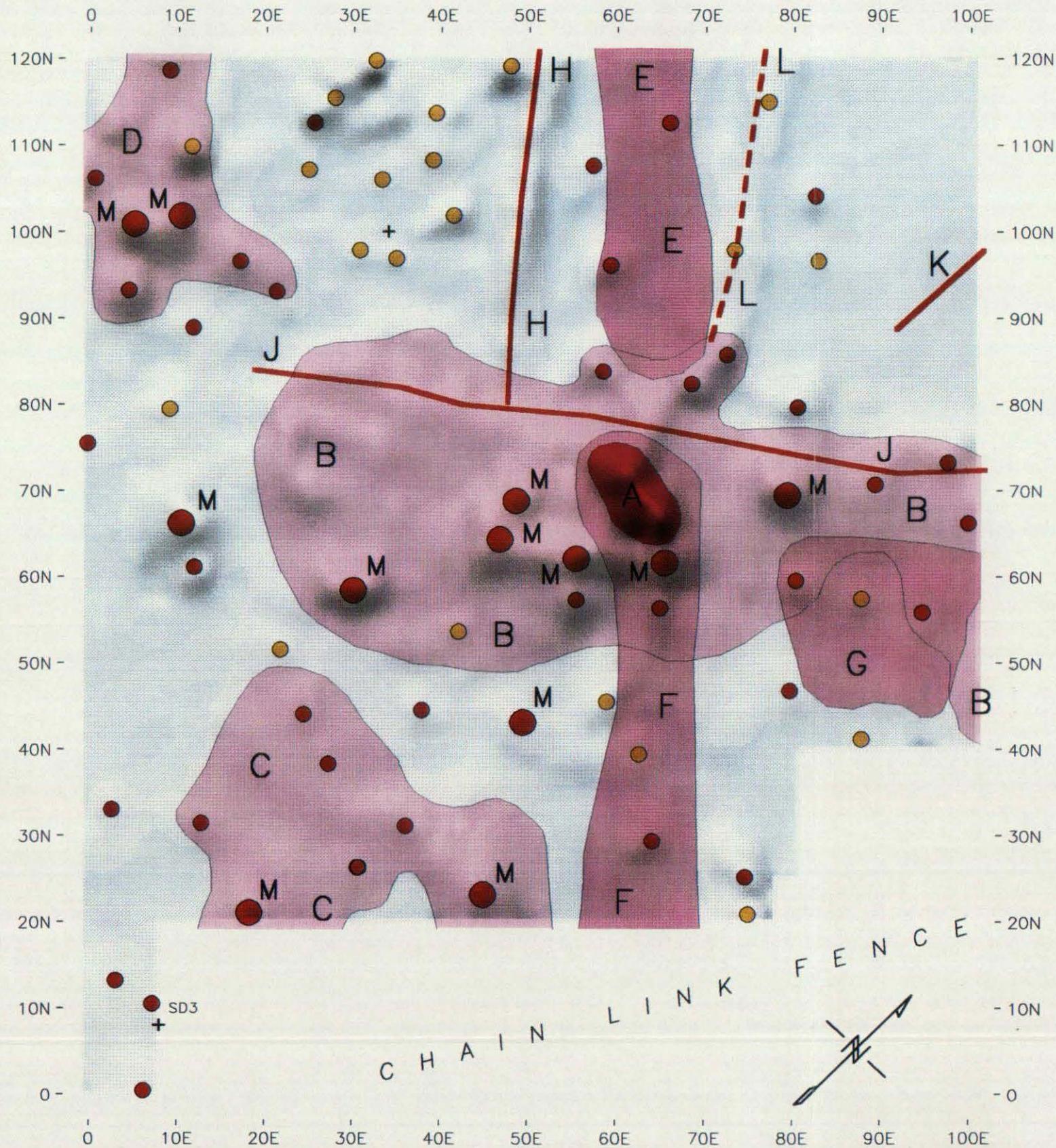


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 10 0 10 20 30  
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**STONE & WEBSTER**  
 ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #7  
 ILLINOIS  
 October, 1997

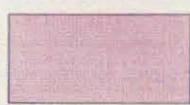
INSTRUMENT EM31  
 VERTICAL DIPOLE MODE  
 INPHASE RESPONSE  
 Inphase in ppt of Primary Field

MIDWEST GEOMAR GEOPHYSICS, INC.  
 Map 4d



**STONE & WEBSTER**  
 ELECTROMAGNETIC SURVEY  
**FORT SHERIDAN**  
 TEST PIT AREA  
 TEST PIT #7  
 ILLINOIS  
 October, 1997

MAP OF LOCATED ANOMALIES  
 INSTRUMENT EM61 & EM31  
**LEGEND**

-  - Anomalous Zone  
High Soil Conductivity
-  - Anomalous Zone  
Possible Substantial  
Metallic Objects
-  - Anomalous Zone  
Possible Buried Wastes  
Containing Metallic  
Objects
-  - Linear Anomalies  
Possible Pipes, Cables,  
or other Linear Features
-  - Possible Buried  
Metallic Objects
-  - Shallow or Surface  
Metallic Objects