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INSTALLATION RESTORATION PROGRAM GEOPHYSICAL SURVEY INFORMAL TECHNICAL INFORMATION REPORT NAS FORT WORTH TX

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NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 223

11-3517-0111

INSTALLATION RESTORATION PROGRAM (IRP)
RCRA FACILITY INVESTIGATION

GEOPHYSICAL SURVEY
INFORMAL TECHNICAL INFORMATION REPORT

Carswell Air Force Base, Fort Worth, Texas

June 1994

Final

PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
CARSWELL AIR FORCE BASE, TEXAS 76127

UNITED STATES AIR FORCE
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BASE CLOSURE RESTORATION DIVISION (HQ AFCEE/ERB)
BROOKS AIR FORCE BASE, TEXAS 78235-5328

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

223002

June 20, 1994

Mr. Chris Hobbins
Air Force Center for
Environmental Excellence
Base Closure Restoration Division (ESB)
8001 Inner Circle Drive, Suite 2
Brooks AFB, Texas 78235

Subject: **Geophysical Survey Report ITIR**
Carswell Air Force Base
Fort Worth, Texas
Contract No. F33615-D-90-4008, Delivery Order 0011
LEGS Project No. 11-3517-0111

Dear Mr. Hobbins:

Law Environmental, Inc., is please to submit to you the Informal Technical Information Report (ITIR) of Geophysical Surveys performed at an abandoned gas station and near a POL area at Carswell Air Force Base.

If you have any questions or comments, please let us know.

LAW ENVIRONMENTAL, INC.

John F. O'Brien
Project Manager

John M. Callaham, P.G.
Senior Geophysicist

Joseph R. Wilson, Ph.D., P.G.
Technical Principal

E. Fred Sharpe with permission by
E. Fred Sharpe, Jr., P.E.
Principal

Enclosure

3517-0111.13

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223003

INSTALLATION RESTORATION PROGRAM (IRP)
RCRA FACILITY INVESTIGATION
GEOPHYSICAL SURVEY
INFORMAL TECHNICAL INFORMATION REPORT

FOR

CARSWELL AFB
FORT WORTH, TEXAS

JUNE 1994

Prepared by:

Law Environmental, Inc.
114 TownPark Drive
Kennesaw, Georgia 30144

CONTRACTOR CONTRACT NO. F33615-90-D-4008 DELIVERY ORDER NO. 0011

United States Air Force
Air Force Center For Environmental Excellence
Base Closure Restoration Division (HQ AFCEE/ESB)
Brooks Air Force Base, Texas 78235-5328
Mr. Chris Hobbins (Team Chief)

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1.0 INTRODUCTION

Geophysical surveys were performed at two sites at Carswell AFB in Fort Worth, Texas. The objective of the geophysical surveys was to help locate potential steel underground storage tanks and metallic utilities. The results were used for planning the continuing site activities.

Three geophysical instruments were used: a Gem Systems GSM-19 magnetometer, a Geonics EM61 high-sensitivity metal detector and a Metrotech pipe and cable locator. These instruments were chosen for their ability to detect shallow buried metallic objects. Multiple techniques are used to better resolve detected zones of buried metal. The GSM-19 magnetometer can detect buried ferromagnetic objects at varying depths depending on several factors such as survey orientation, target shape, target mass, and target composition. The EM61 can detect buried metallic objects in the upper five to ten feet of the subsurface depending on the target's size and shape. The pipe and cable locator is useful for mapping near-surface utilities. A brief description of each geophysical method is contained in Section 2.0 and more details are discussed in Appendix A.

2.0 FIELD ACTIVITIES

Geophysical surveys were conducted between March 7 and March 8, 1994, at two sites designated as the Abandoned Gas Station and the POL area. This section describes the general geophysical survey methods common to both sites, and specific details and survey spacing for each site.

2.1 GEOPHYSICAL EQUIPMENT

The magnetometer surveys were conducted using a GEM Systems GSM-19G magnetic gradiometer. The instrument measures and records the total magnetic field intensity, vertical magnetic gradient, time, and geophysical survey grid coordinates at each station. A base station away from anomalous magnetic fields was periodically visited during each survey to allow detection of magnetic field drift and magnetic storms.

Other surveys were conducted using a Geonics EM61 high-sensitivity metal detector. The EM61 is a time-domain electromagnetic (EM) device that measures the decay in an induced secondary EM field with two sensors. The digital data recorder stores the two channels of data and the geophysics survey grid coordinates. Functionality checks of the EM61 were performed daily.

A pipe and cable locator was used at the Abandoned Gas Station site to trace underground pipes or cables by energizing exposed pipes.

The computer files for the magnetometer and EM61 data were named according to the site designation, type of instrument, date, and a sequence letter to distinguish multiple data files obtained on the same day.

2.2 ABANDONED GAS STATION SITE FIELD ACTIVITIES

Geophysical surveys were conducted at the Abandoned Gas Station Site in order to detect possible remaining underground storage tanks. An area approximately 210 feet by 280 feet was gridded using fiberglass measuring tapes and spray paint. An outline of the geophysical survey area is shown on Figure 1.

The magnetometer survey was conducted along north-south trending traverses spaced about 10 feet apart with a reading taken every 10 feet along each traverse. Approximately 5,800 linear feet of magnetic data were collected with a total of 582 data points.

The EM61 survey was conducted along north-south trending traverses spaced about 10 feet apart with readings taken less than one foot apart along each traverse. EM61 data were also collected along several east-west trending cross traverses. About 11,000 linear feet of EM61 data were collected with a total of about 16,000 data points.

The pipe and cable locator was used to partially follow the path of pipes from where they protrude from the concrete pump island. This instrument was used in the conductive mode where the pipes were directly energized with electric current.

2.3 POL AREA FIELD ACTIVITIES

Geophysical surveys were conducted around the POL area in order to detect buried metallic utilities that may interfere with the soil gas survey. EM61 surveys were conducted along four traverses around the POL area where soil gas survey points will be performed. Four north-south trending traverses were laid out using fiberglass measuring tapes and a painted dot every 100 feet. The approximate locations of the EM61 survey lines are shown on Figure 2.

3.0 INTERPRETATION OF GEOPHYSICAL DATA

This section describes the interpretation methods and results for the magnetometer and EM61 surveys at both sites. Contour maps and stacked profile plots were prepared to aid in the interpretation of the geophysical data. Example stacked profile plots of these data are shown in Appendix B.

Survey lines and stations and zones of cultural interferences are discussed in Section 2.0. Anomalous zones depict areas of high EM61 response or where the total magnetic field intensity is significantly different from background or both. EM61 and magnetic anomalous zones are typically larger than the actual target causing the anomaly. It is not possible to distinguish between types of buried metal (e.g., reinforced concrete vs. steel drums) from these geophysical surveys alone.

3.1 ABANDONED GAS STATION SITE INTERPRETATION

Geophysical surveys were performed at the Abandoned Gas Station Site to help locate potential USTs. Geophysical anomalies indicative of buried piping, reinforced concrete and other buried metal have been identified in the survey area. The lateral extents of the interpreted anomalies are shown on Figure 1 as shaded zones. Some of these zones are further interpreted to contain buried metallic pipes. Nine zones of buried metal were identified at the site.

Five of the zones of buried metal were located north of the concrete pad and away from cultural interference. The three smallest zones are likely caused by small amounts of metal. The northernmost anomaly, marked A on Figure 1, is located at the south edge of the street. Anomaly B, east of Anomaly A, is large enough

to be caused by a small UST. Both anomalies A and B may be caused by any one of a variety of subsurface targets, such as reinforced concrete, scrap metal, USTs, etc.

Three zones of buried metal are located between the pump island and the substation. These likely are caused by discontinuous pipes or scrap metal.

One anomalous zone was located in the southwest corner of the site. It is interpreted to be associated with reinforced concrete observed in the area.

Cultural interferences were observed within the site, including a reinforced concrete pad surrounding the pump island, a chain link fence, transformer, and power lines. Areas near these objects contain geophysical anomalies; it is possible that a UST may be present and is masked within these areas.

3.2 POL AREA INTERPRETATION

An EM61 survey was performed around the POL area to help locate potential buried utilities along proposed ground-water screening survey locations. The locations of these survey lines are shown on Figure 2. Figure B-3, located in Appendix B, was used during the advancement of the probes for the ground-water screening in the area of the POL Tank Farm to assist in the selection of sampling locations. The geophysical survey was performed along the grid lines for the 33 potential ground-water probe locations. The proposed locations near the POL Tank Farm had been cleared for utilities and digging permits had been issued for the ground-water screening survey; however, in areas where the EM61 detected anomalies indicating the potential location of underground utilities or other objects, the proposed probe locations were deleted from the sampling grid. During the ground-water screening

in March 1994, 22 ground-water screening locations were sampled, and no utilities or other obstructions were encountered.

Cultural interferences in the survey area included reinforced concrete, railroad tracks, steel drums, power lines, fences, and fire hydrants.

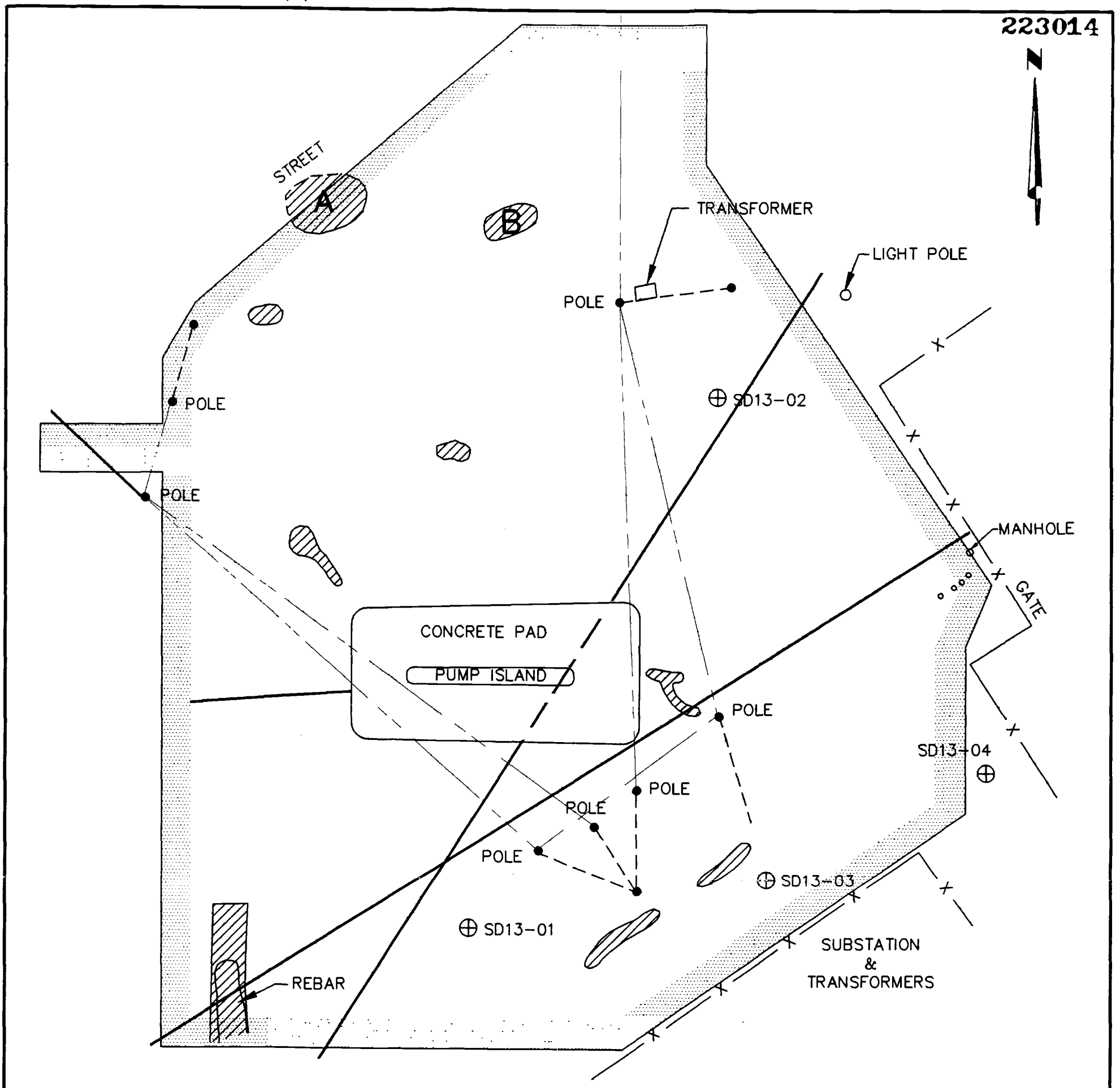
TAB

FIGURES

FIGURES

FILE: CARSWELL/GEO-ANOM DATE:04/01/94

223014



LEGEND

- INTERPRETED ZONES OF BURIED METAL
- INTERPRETED BURIED PIPE OR CABLE
- ⊕ SD13-01 MONITORING WELL
- UTILITY POLE AND GUY WIRE
- OVERHEAD LINE
- CYCLONE FENCE
- LIMITS OF GEOPHYSICAL SURVEY

0 30 60

APPROXIMATE SCALE IN FEET

CARSWELL AFB

FORT WORTH, TEXAS

LAW
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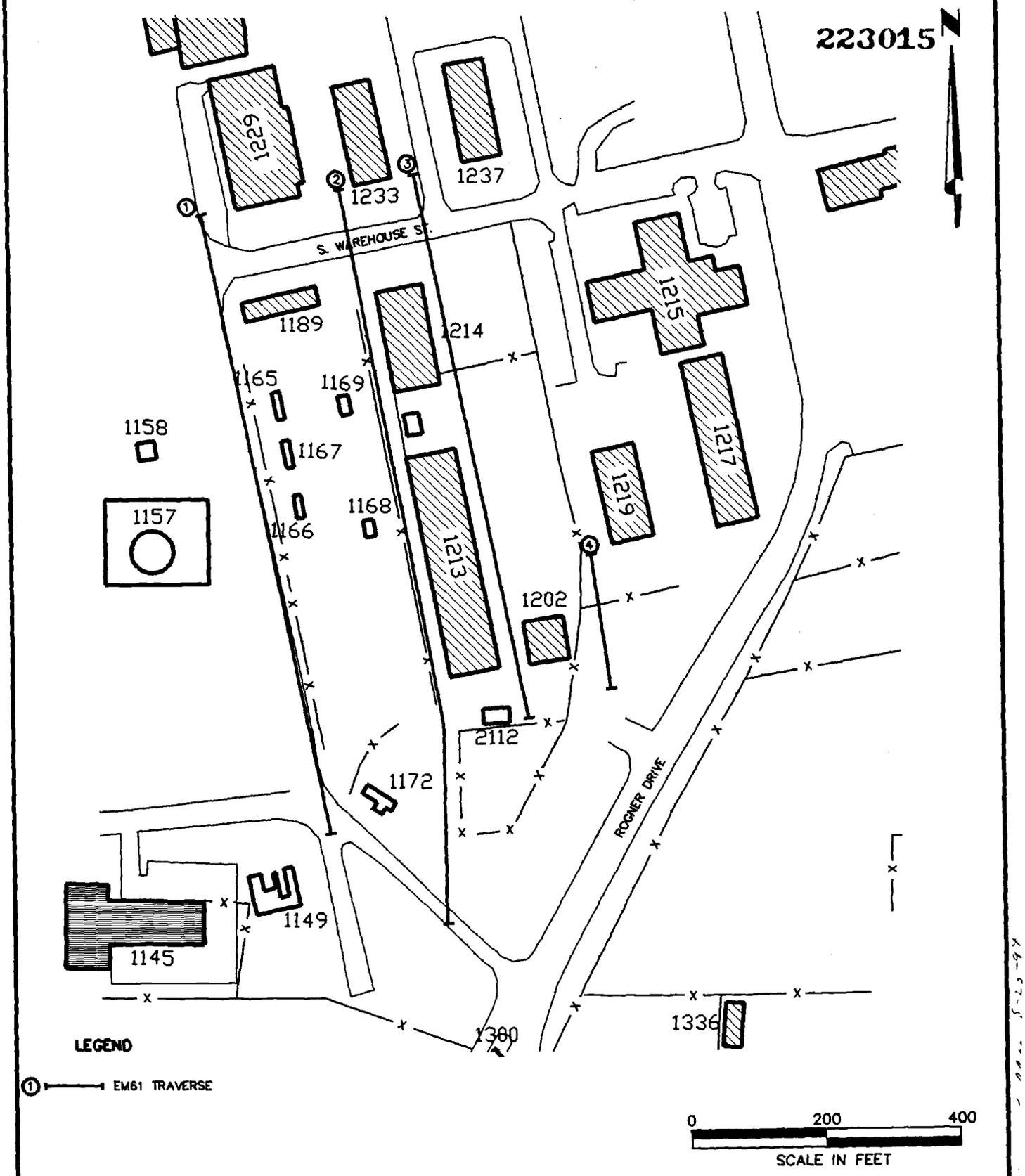
INTERPRETATION OF GEOPHYSICAL ANOMALIES ABANDONED SERVICE STATION SITE

JOB NO. 11-3517-0111 FIGURE 1

223014

FILE: CARSWELL\SITE-MAP DATE: 04/12/94 PLOT SCALE: 1=200



CARSWELL AFB	LAW ENGINEERING AND ENVIRONMENTAL SERVICES	LOCATION OF EM61 TRAVERSES - POL AREA
		JOB NO. 11-3517-0111 FIGURE 2

223016

TAB

APPENDIX A

APPENDIX A
GEOPHYSICAL METHODS

Magnetometer

A magnetometer measures the earth's magnetic field. The intensity of the earth's field is measured in nanoteslas (nT) with the total field typically being about 50,000 nT in the United States. Buried metallic objects perturb the local magnetic field and produce short wavelength anomalies. The amplitude and shape of single anomalies allow an estimate of the depth and mass of the buried metallic objects. Anomaly shapes and amplitudes are dependent upon latitude of the site and shape and composition of the target. Superimposed anomalies may occur at locations of multiple metallic objects. The magnetometer may also be affected by cultural "noise" such as power lines, fences, and buildings. If there is too much cultural "noise," no useful data can be collected.

There are different types of magnetometers that measure the earth's field (either total field intensity or a component) in various ways. Typically, a portable proton precession magnetometer is used. This magnetometer is designed to use the principle of spinning protons precessing in a fluid to measure the magnetic field. The spinning protons are temporarily aligned by applying a local magnetic field generated by a current in a coil of wire. Removal of the current causes the protons to precess about the earth's magnetic field. This precession generates a small signal in the coil of wire that has a frequency proportional to the total magnetic field intensity. Measurements are taken at discrete locations.

A magnetic gradiometer is often used instead of a conventional magnetometer. A magnetic gradiometer measures the magnetic field in the same way, but has two detectors at different distances above the ground. Measurements from both detectors are taken simultaneously and the total field intensity and the difference between the detectors are recorded. This type of magnetometer is often used to locate buried metallic objects.

"Magnetic storms" are natural phenomena that occur from time to time. In order to test for magnetic storms and magnetic drift a "base station" is typically reoccupied every one to three hours on longer surveys, or at the beginning and end of a traverse on shorter surveys. Such a reoccupation generally yields values within a few nanoteslas of the original reading. During a storm, data collected should be used with caution.

EM61

The EM61 is a non-ground-contacting high-sensitivity time-domain metal detector manufactured by Geonics, Ltd. This instrument is designed to detect buried metal directly beneath it and yet be insensitive to interference from nearby surface metal such as fences, buildings, cars, etc. The EM61 generates a pulsed primary magnetic field that induces eddy currents in nearby metallic objects. Two receiver coils at different distances from the ground measure the decay of the eddy currents with time. The measuring instrument compares the transmitted and received signals and produces an output voltage related to the presence of metallic objects.

The response is not linear with depth, but is dependent upon several factors such as the size, shape, and depth of the metallic object. The EM61 can detect both ferrous and nonferrous metallic objects. The EM61 may be affected by cultural "noise" such as fences, power lines, metallic debris, etc. within a five to ten foot radius.

The EM61 is connected to a digital data recorder and the data from both channels are stored along with the line number and station numbers. The data are recorded in one of three modes. The first mode is at regular times with the station location determined by event markers entered by the operator. The second mode allows the operator to record data at specified distances while the station location is updated by the recorder. The third mode involves attaching wheels to the transmitter/receiver that automatically records data at specific intervals (about 0.62 feet) along the survey line.

Buried metallic objects are identified by increased readings from either channel. The readings are not affected by nonmetallic conductive targets such as saltwater or conductive plumes. While recording data in the field, the operator can identify buried targets by listening to an audio speaker that has a response proportional to the signal output.

After data have been recorded, they are downloaded and processed using the DAT61 computer software supplied by Geonics, Ltd. Further processing and plotting is accomplished using other software.

Pipe and Cable Locator

One tool for locating buried pipes is a Model 480 pipe and cable locator manufactured by Metrotech. This instrument can be used in two modes. The conductive mode uses direct contact energizing of conductive pipes or wires. The energized pipe or wire can then be traced on the surface using the receiver unit. Energized conductors can sometimes be traced through intervening reinforced concrete. The induction mode uses the transmitter to induce an

energizing current rather than through direct contact. The receiver is then used to trace the location of the conductor on the surface. Depending on the conductivity of the soil, the Metrotech Model 480 can locate near-surface conductive utilities within a few inches.

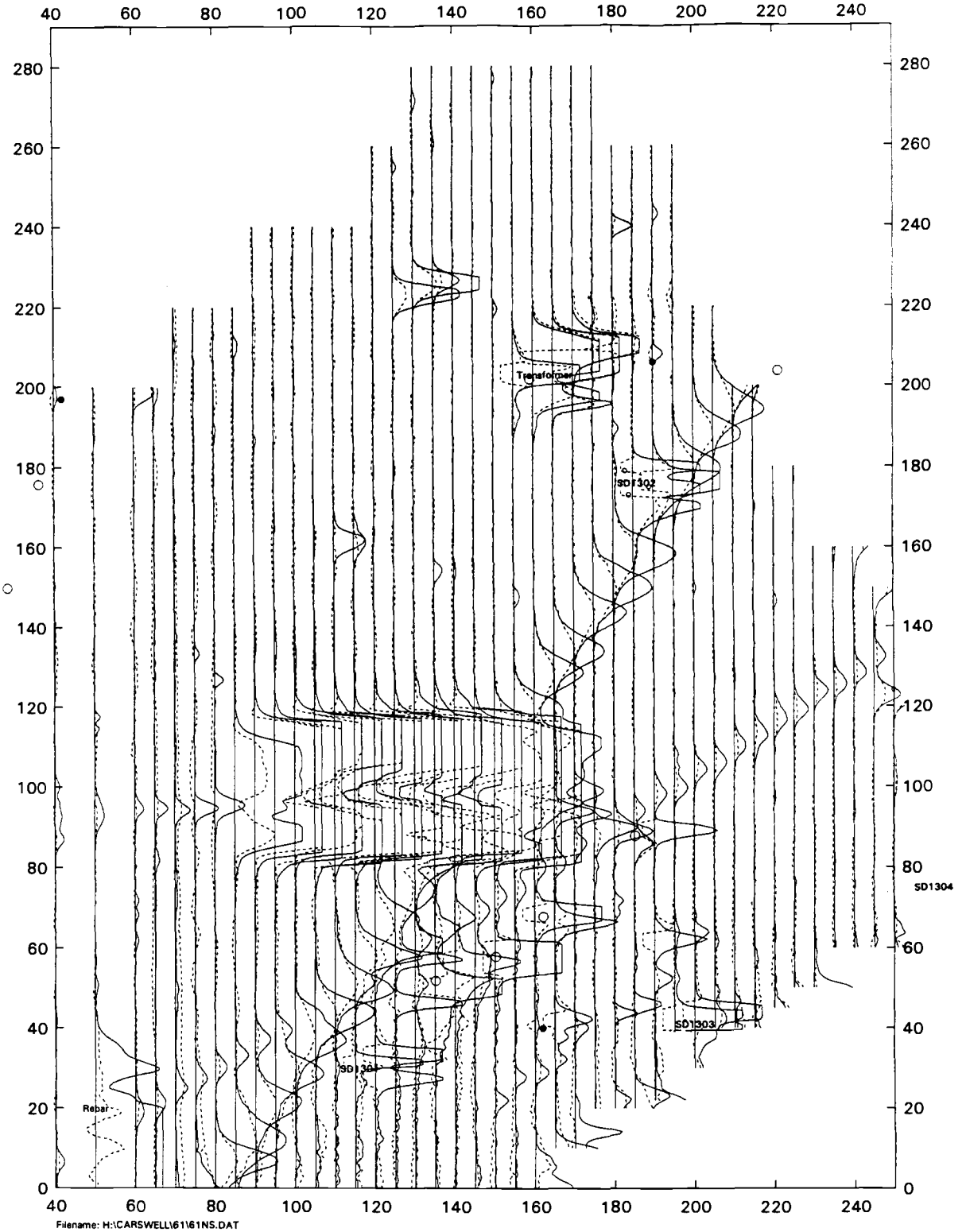
223021

TAB

APPENDIX B

APPENDIX B
PLOTS OF GEOPHYSICAL DATA

223023



LEGEND

——— CHANNEL 2

····· DIFFERENCE (CHANNEL 1 - CHANNEL 2)

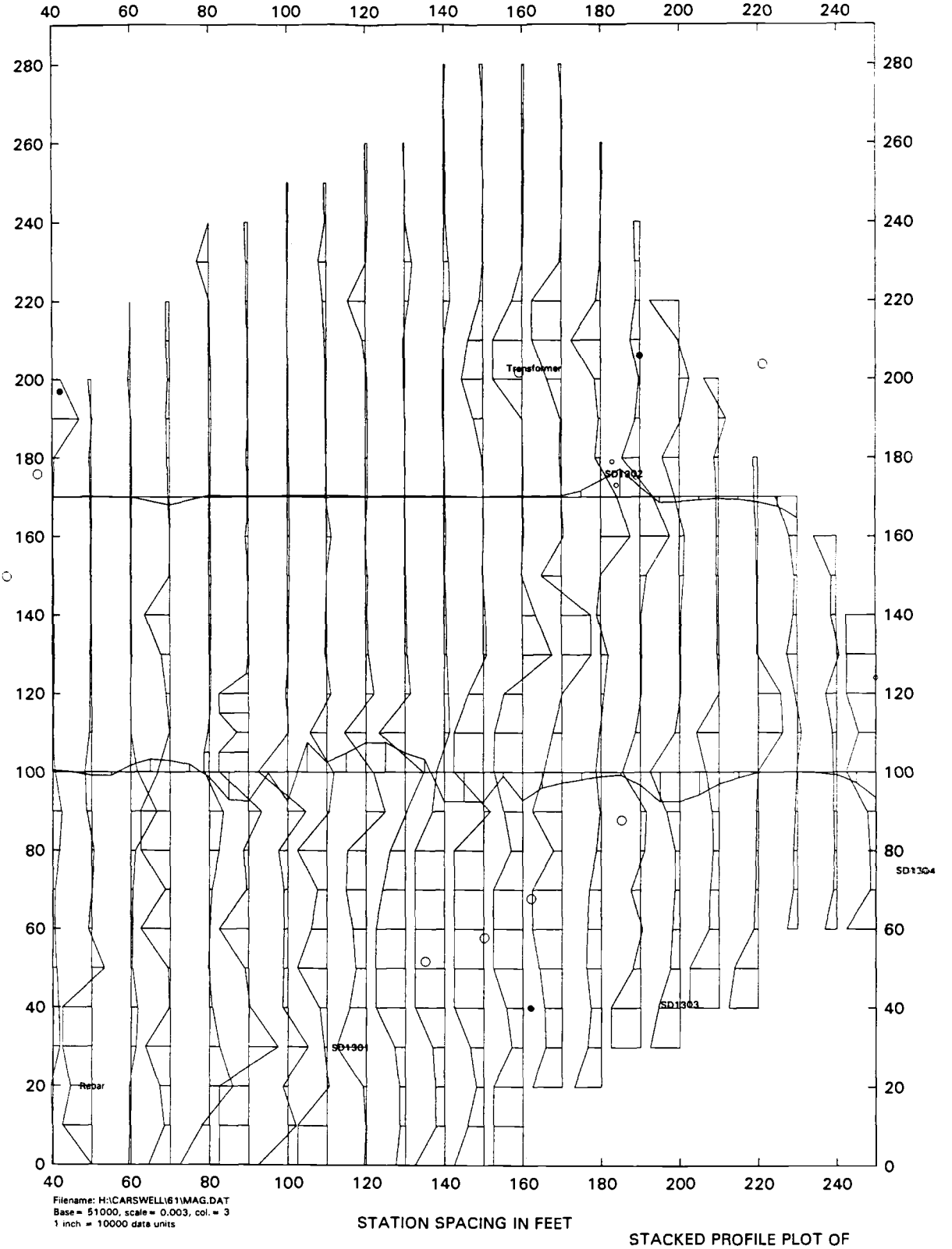
DATA SCALE 1 INCH = 1000mV

STACKED PROFILE PLOT
OF EM61 DATA
ABANDONED GAS STATION SITE

JOB NO. 11-3517-0111 FIGURE B-1

By ghc 5/23/94
I gan 5-21-94

223024

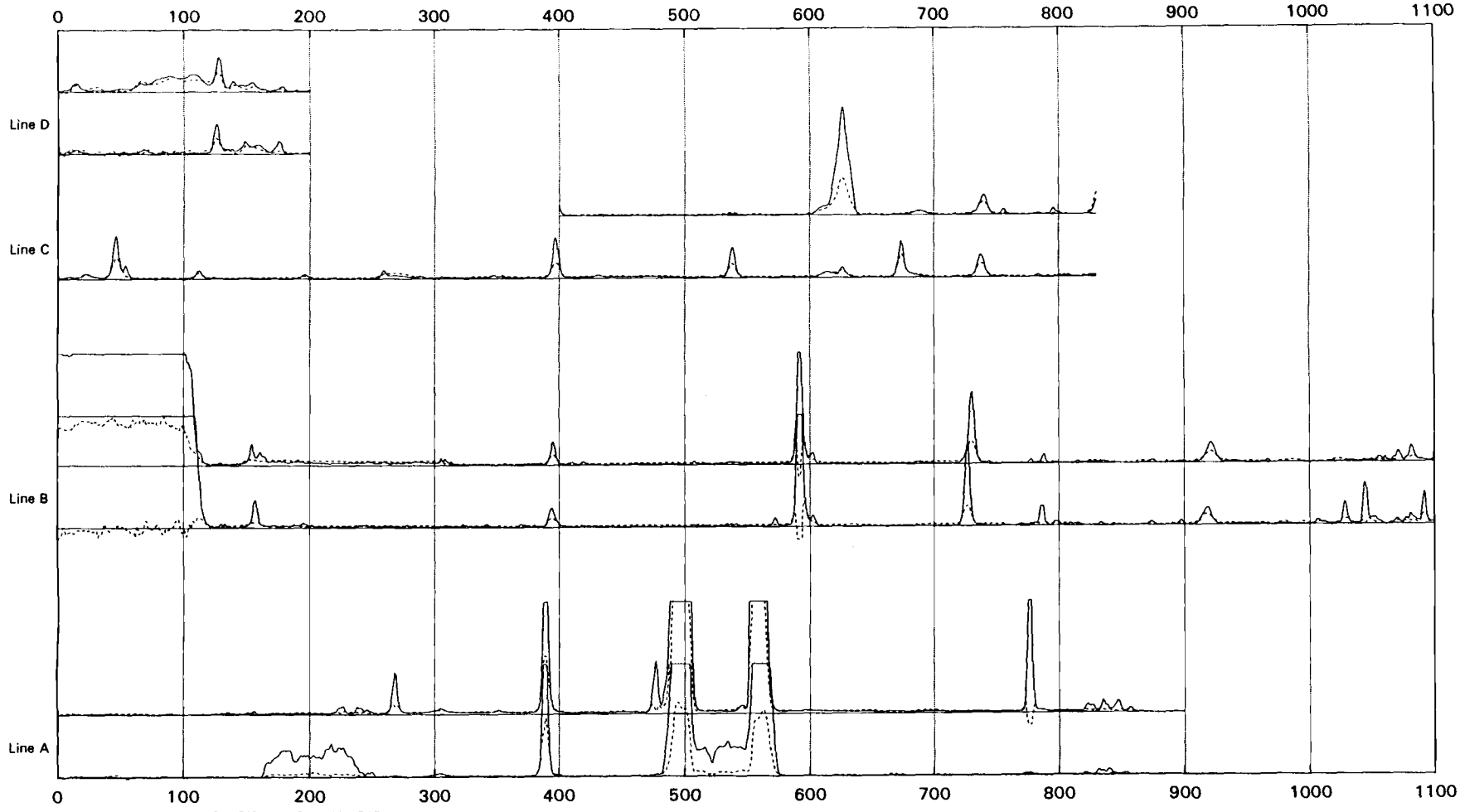


STACKED PROFILE PLOT OF
TOTAL MAGNETIC FIELD INTENSITY
ABANDONED GAS STATION SITE

DATA SCALE 1 INCH = 10,000 nT
DATA BASELINE = 51,000 nT
DATA CLIPPED ABOVE 53,500 nT and BELOW 48,500 nT

JOB NO. 11-3517-0111 FIGURE B-2

By gmc 5/23/91
✓ gmc 5-23-91



Filename: H:\LTSUSERS\5553\JOBS\CARSWELL\61\POL\ALL.DAT
Base = 0, scale = 0.1, col. = 4, Max = 900, Min = -100
1 inch = 1000 data units

STATION SPACING IN FEET

LEGEND

——— CHANNEL 2

..... DIFFERENCE (CHANNEL 1 - CHANNEL 2)

DATA SCALE 1 INCH = 1000mV

STACKED PROFILE PLOT
OF EM61 DATA
POL SITE

Ag. gmc 5/23/94
gmc 5-21-94

JOB NO. 11-3517-0111 FIGURE B-3

223025

223026

223027

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

223028

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE