

ENVIRONMENTAL CONSULTING & MANAGEMENT

**ROUX ASSOCIATES INC**



25 CORPORATE DRIVE  
SUITE 230  
BURLINGTON, MASSACHUSETTS 01803 TEL: 781-270-6600 FAX: 781-270-9066

Superfund Records Center  
SITE: Industri-Plex 002  
BREAK: 3.4  
OTHER: 42722

May 24, 2002

Mr. D. Michael Light  
Industri-Plex Site Remedial Trust  
c/o Solutia, Inc.  
575 Maryville Centre Drive  
St. Louis, Missouri 63141

Re: Source Area Investigation  
Industri-Plex Site  
Woburn, Massachusetts

Dear Mr. Light:

This interim letter report has been prepared by Roux Associates, Inc. (Roux Associates) to present the results of the supplemental Source Area Investigation activities recently conducted at the Industri-Plex Superfund Site in Woburn, Massachusetts. As requested by the U.S. Environmental Protection Agency, soil gas and geophysical surveys were conducted in three additional areas of the Industri-Plex Superfund Site to further evaluate the potential for sources of benzene and/or toluene to be present in these areas. The study areas, shown in Figure 1, include:

- An approximately 150-foot by 400-foot area encompassing the southern third of the Sacco property at 41 Atlantic Avenue ("Sacco Study Area");
- An approximately 200-foot by 350-foot area encompassing the storage yard used by the ABC Roofing Company (located at the western end of the building at 110 Commerce Way) and part of the Boston Edison right of way ("ABC Roofing Study Area"); and
- An irregularly shaped, approximately 120,000-square-foot area encompassing the parking lot at the northern end of the former Digital facility and other parts of the Boston Edison right of way ("Former Digital Study Area").

Soil gas surveys were conducted at all three study areas by Pine & Swallow Associates, Inc. (PSA), of Groton, Massachusetts, with oversight provided by Roux Associates. (Note: PSA also inadvertently collected five soil gas samples along a transect previously laid out within the Boston Edison right of way; this area has been incorporated into the "Former Digital Study Area.") Tabulated results of the soil gas surveys are included in PSA's report, which is provided Attachment 1. Benzene concentrations detected in soil gas at the three study areas are depicted in Figures 2 through 4. In these figures, a grid of squares was drawn overlaying the sampling grid, with the sampling point in the center of

Mr. D. Michael Light  
May 24, 2002  
Page 2

each square. Each square was assigned a color to indicate the range of the benzene concentration detected at the corresponding sampling point. The concentration range represented by the various colors is shown in each figure. As shown in all three figures, no significant concentrations of benzene were detected in soil gas in any of the three study areas.

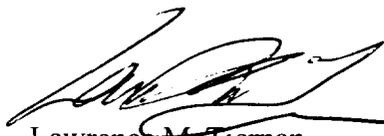
Geophysical surveys were performed at all three study areas by Geophysics GPR International, Inc., of Westford, Massachusetts, with oversight by Roux Associates. The geophysical surveys included metal detection (EM-61) and ground penetrating radar (GPR) surveys. Graphical plots of the geophysical data are included in the Geophysics GPR International report provided in Attachment 2. The degree of correspondence between the soil gas and geophysical anomalies is shown in Figures 5 and 6 and Plate 1, which were created by superimposing the color-coded soil gas grids from Figures 2 through 4 onto the EM-61/GPR plots provided by Geophysics GPR International. As shown in Figures 5 and 6 and Plate 1, there is only slight correspondence between the few low-level benzene detections and the geophysical anomalies.

Sincerely,

ROUX ASSOCIATES, INC.



Anne Guimont  
Staff Assistant Geologist



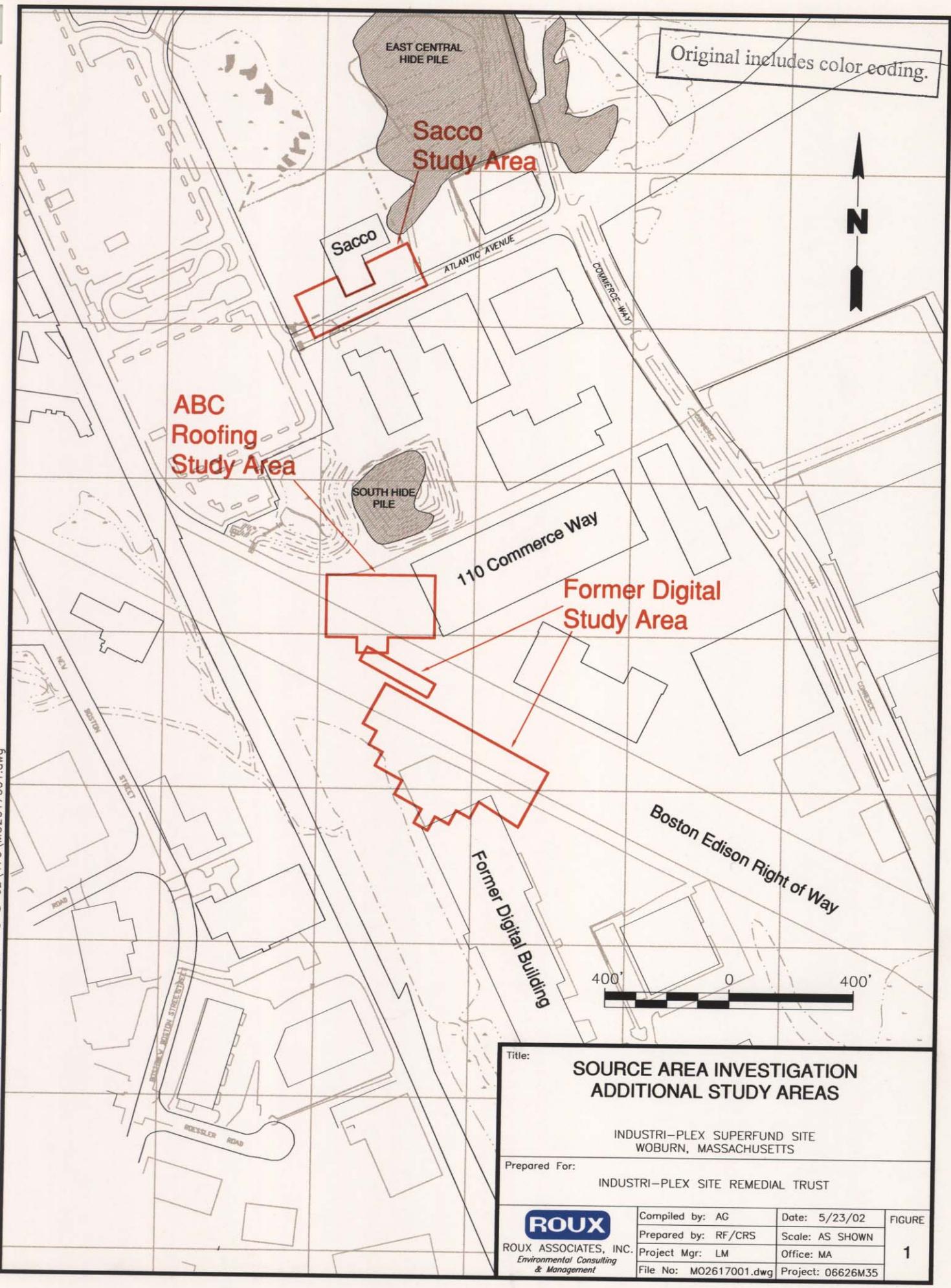
Lawrence McTiernan  
Principal Hydrogeologist/Project Manager

Attachments

**FIGURES**

N:\PROJECTS\Solutia\_066\M0066M\M026M\MAVERICK - 5-8-02\170\M02617001.dwg

Original includes color coding.

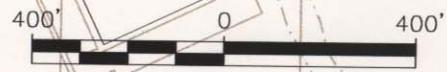


Title: **SOURCE AREA INVESTIGATION  
ADDITIONAL STUDY AREAS**

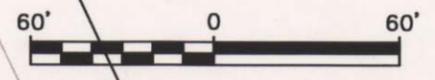
INDUSTRI-PLEX SUPERFUND SITE  
WOBURN, MASSACHUSETTS

Prepared For:  
INDUSTRI-PLEX SITE REMEDIAL TRUST

|  |                        |                   |                        |
|--|------------------------|-------------------|------------------------|
| <br><b>ROUX</b><br>ROUX ASSOCIATES, INC.<br><i>Environmental Consulting<br/>&amp; Management</i> | Compiled by: AG        | Date: 5/23/02     | FIGURE<br><br><b>1</b> |
|  | Prepared by: RF/CRS    | Scale: AS SHOWN   |                        |
|  | Project Mgr: LM        | Office: MA        |                        |
|  | File No: M02617001.dwg | Project: 06626M35 |                        |



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Benzene Concentrations (ppmv)

- 10-100
- Not Detected (<10)

Original includes color coding.

|  |                        |                   |                    |
|--|------------------------|-------------------|--------------------|
| <b>Title:</b> CONCENTRATIONS OF BENZENE IN SOIL GAS - SACCO STUDY AREA                   |                        |                   |                    |
| INDUSTRI-PLEX SUPERFUND SITE<br>WOBURN, MASSACHUSETTS                                    |                        |                   |                    |
| <b>Prepared For:</b> INDUSTRI-PLEX SITE REMEDIAL TRUST                                   |                        |                   |                    |
| <b>ROUX</b><br>ROUX ASSOCIATES, INC.<br><i>Environmental Consulting &amp; Management</i> | Compiled by: AG        | Date: 5/22/02     | FIGURE<br><b>2</b> |
|  | Prepared by: RF/CRS    | Scale: AS SHOWN   |                    |
|  | Project Mgr: LM        | Office: MA        |                    |
|  | File No: M02617006.dwg | Project: 06626M35 |                    |

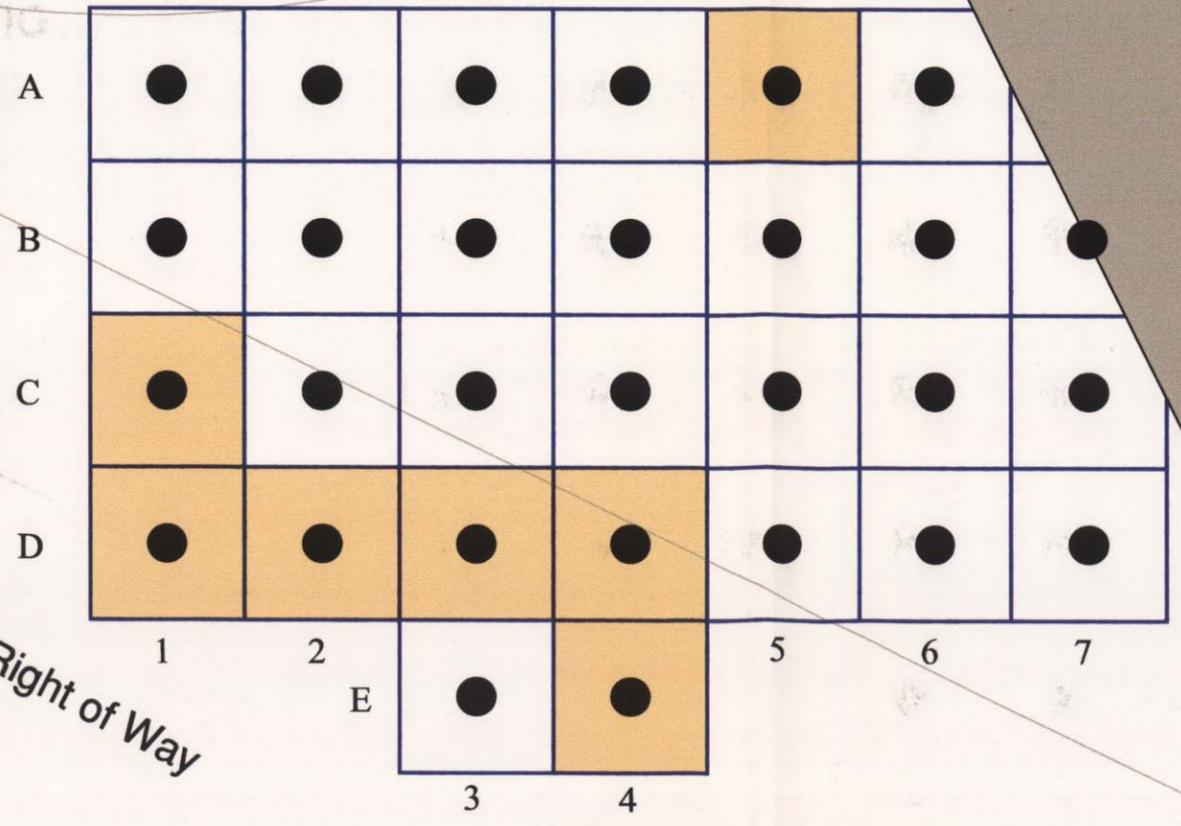
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South Hide Pile

ABC Roofing  
(110 Commerce Way)

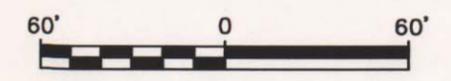
Boston Edison Right of Way



Benzene Concentrations (ppmv)

- 10-100
- Not Detected (<10)

Original includes color coding.



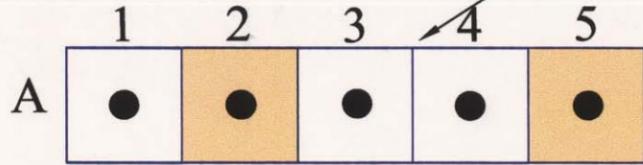
|  |                        |                   |                 |
|--|------------------------|-------------------|-----------------|
| <b>Title:</b> CONCENTRATIONS OF BENZENE IN SOIL GAS - ABC ROOFING STUDY AREA             |                        |                   |                 |
| INDUSTRI-PLEX SUPERFUND SITE<br>WOBURN, MASSACHUSETTS                                    |                        |                   |                 |
| <b>Prepared For:</b> INDUSTRI-PLEX SITE REMEDIAL TRUST                                   |                        |                   |                 |
| <b>ROUX</b><br>ROUX ASSOCIATES, INC.<br><i>Environmental Consulting &amp; Management</i> | Compiled by: AG        | Date: 5/23/02     | FIGURE<br><br>3 |
|  | Prepared by: RF/CRS    | Scale: AS SHOWN   |                 |
|  | Project Mgr: LM        | Office: MA        |                 |
|  | File No: M02617004.dwg | Project: 06626M35 |                 |

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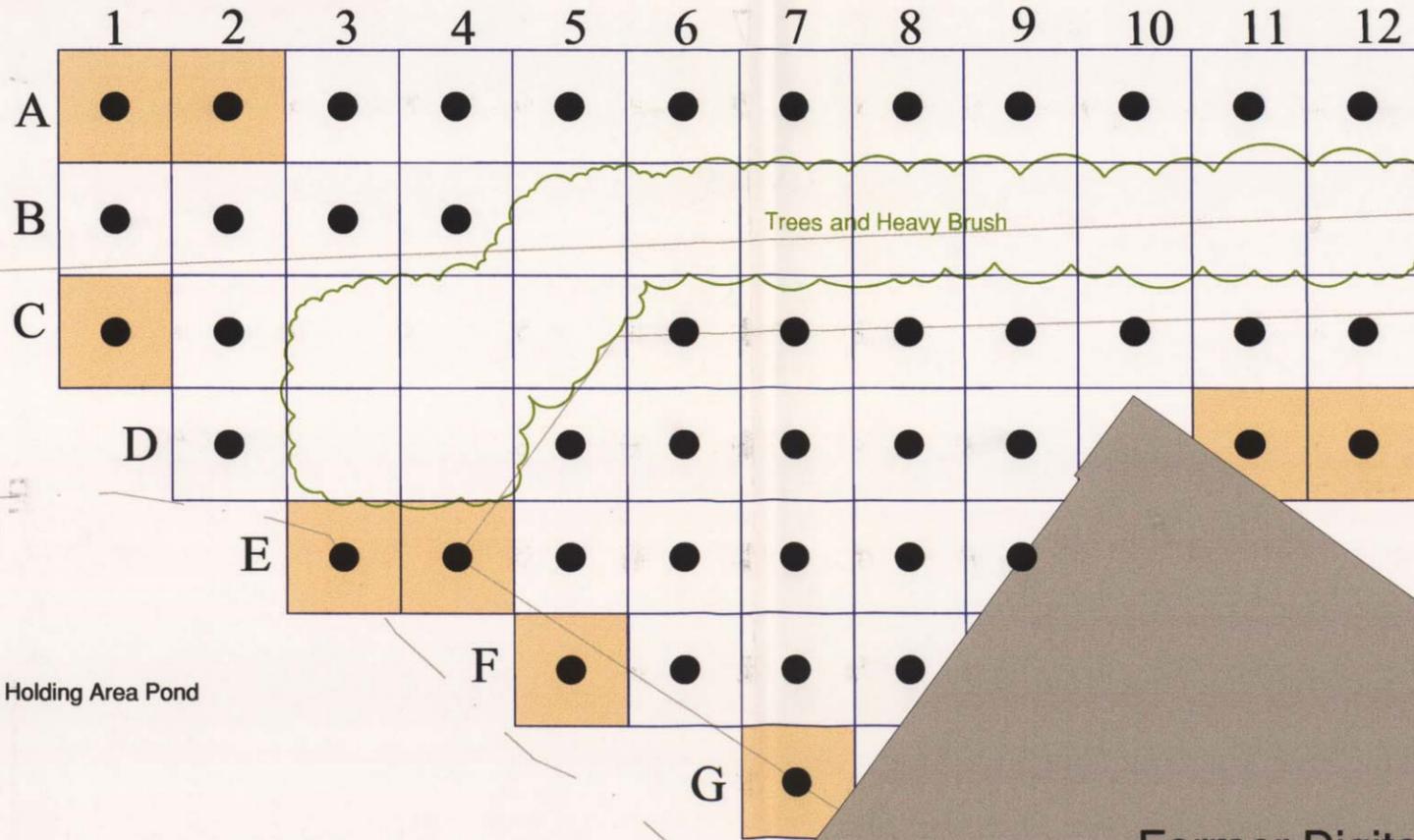


96 Commerce Way

Digital "DM" Grid



Boston Edison Right of Way



Digital "D" Grid

Trees and Heavy Brush

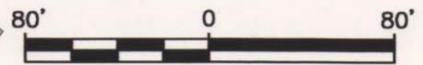
Hall's Brook Holding Area Pond

Former Digital Building

Benzene Concentrations (ppmv)

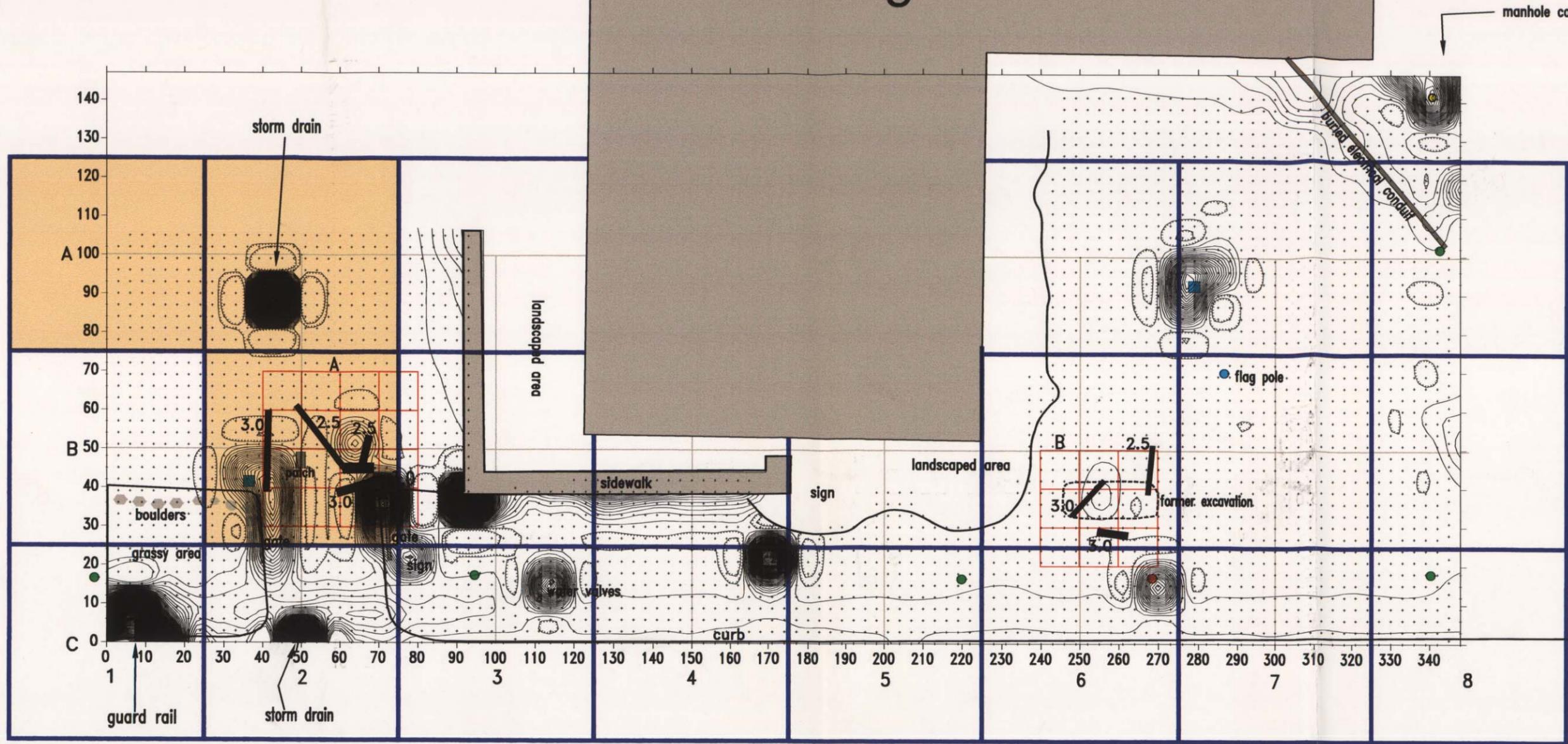
- 10-100
- Not Detected (<10)

Original includes color coding.



|   |                        |                   |             |
|---|------------------------|-------------------|-------------|
| Title: CONCENTRATIONS OF BENZENE IN SOIL GAS - FORMER DIGITAL STUDY AREA      |                        |                   |             |
| INDUSTRI-PLEX SUPERFUND SITE<br>WOBURN, MASSACHUSETTS                         |                        |                   |             |
| Prepared For: INDUSTRI-PLEX SITE REMEDIAL TRUST                               |                        |                   |             |
| <br>ROUX ASSOCIATES, INC.<br><i>Environmental Consulting &amp; Management</i> | Compiled by: AG        | Date: 5/22/02     | FIGURE<br>4 |
|   | Prepared by: RF/CRS    | Scale: AS SHOWN   |             |
|   | Project Mgr: LM        | Office: MA        |             |
|   | File No: M02617005.dwg | Project: 06626M35 |             |

# Sacco Building

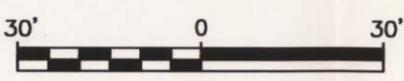
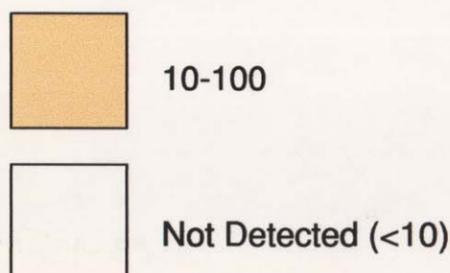


Original includes color coding.

● hydrant  
 ● utility pole  
 ■ storm drain  
 + EM61 station  
 □ GPR scan area  
 3.0 Subsurface object detected with GPR (with approximate depth in feet).

Contour Interval: 20 mV.

### Benzene Concentrations (ppmv)



Title: COMPARISON OF SOIL GAS AND GEOPHYSICAL ANOMALIES - SACCO STUDY AREA  
 INDUSTRI-PLEX SUPERFUND SITE  
 WOBURN, MASSACHUSETTS

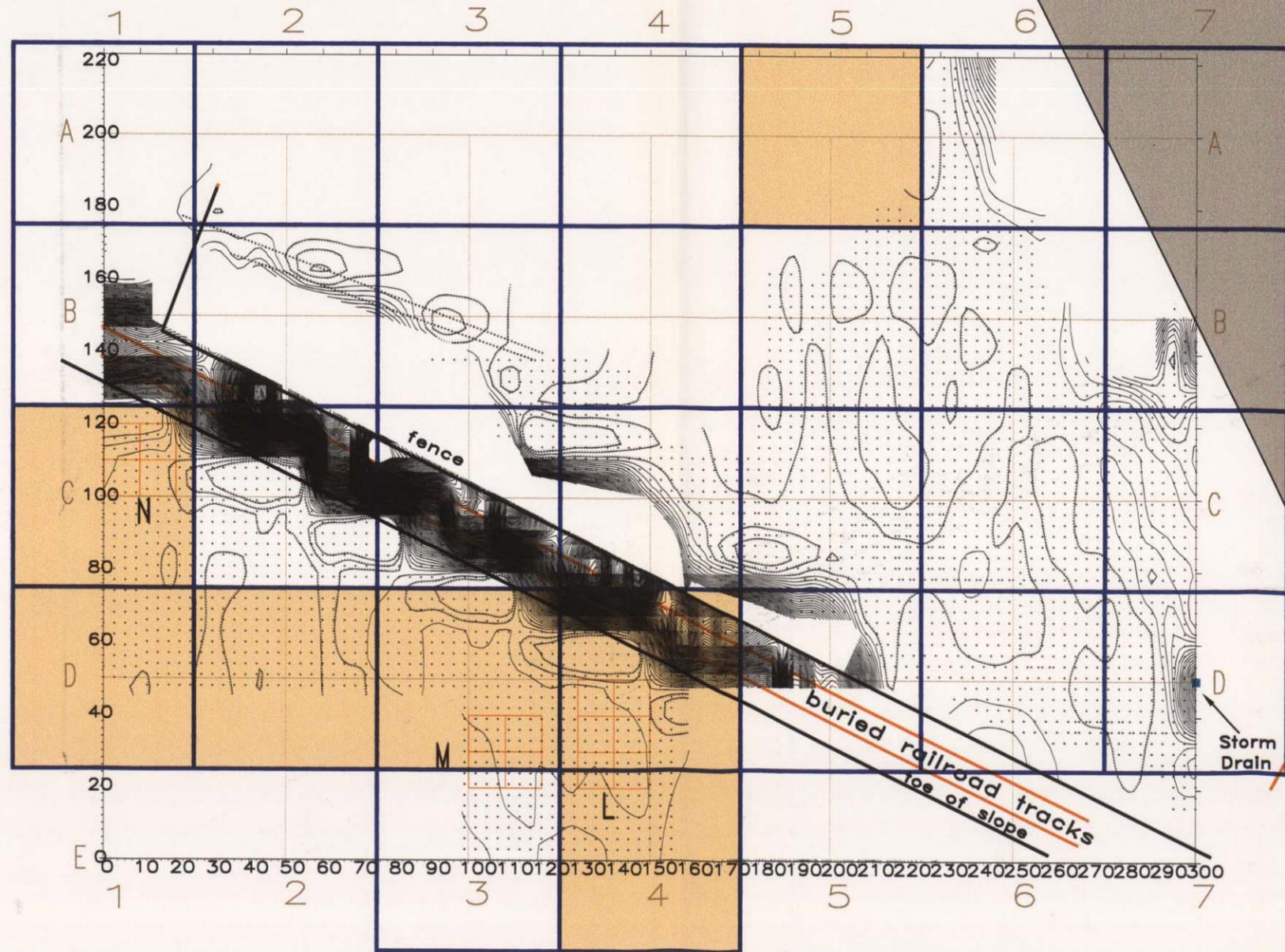
Prepared For: INDUSTRI-PLEX SITE REMEDIAL TRUST

|  |                        |                   |        |
|--|------------------------|-------------------|--------|
| <br>ROUX ASSOCIATES, INC.<br>Environmental Consulting & Management | Compiled by: AG        | Date: 5/22/02     | FIGURE |
|  | Prepared by: RF/CRS    | Scale: AS SHOWN   |        |
|  | Project Mgr: LM        | Office: MA        |        |
|  | File No: M02617002.dwg | Project: 06626M35 |        |

5

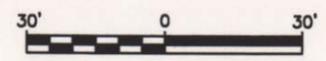
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ABC Roofing  
(110 Commerce Way)

Original includes color coding.



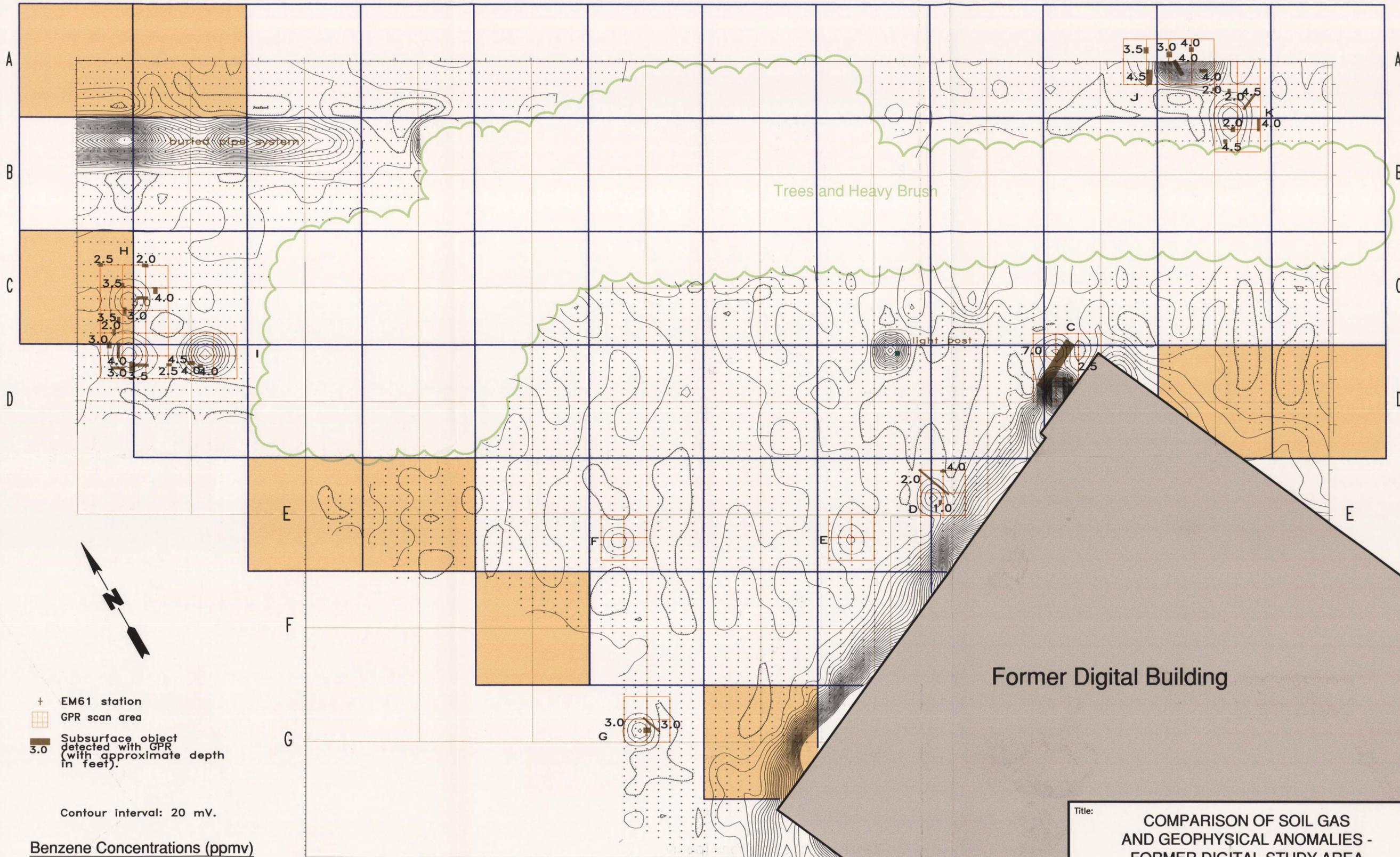
- + EM61 station
  - ☐ GPR scan area
  - ▬ Subsurface object detected with GPR (with approximate depth in feet).  
3.0
- Contour Interval: 20 mV.

- Benzene Concentrations (ppmv)**
- ☐ 10-100
  - ☐ Not Detected (<10)

|   |                            |                          |                     |
|---|----------------------------|--------------------------|---------------------|
| <p>Title:<br/><b>COMPARISON OF SOIL GAS AND GEOPHYSICAL ANOMALIES - ABC ROOFING STUDY AREA</b><br/>INDUSTRI-PLEX SUPERFUND SITE<br/>WOBURN, MASSACHUSETTS</p> |                            |                          |                     |
| <p>Prepared For:<br/>INDUSTRI-PLEX SITE REMEDIAL TRUST</p>  |                            |                          |                     |
| <br>ROUX ASSOCIATES, INC.<br>Environmental Consulting & Management  | <p>Compiled by: AG</p>     | <p>Date: 5/10/02</p>     | <p>FIGURE<br/>6</p> |
|   | <p>Prepared by: RF/CRS</p> | <p>Scale: AS SHOWN</p>   |                     |
|   | <p>Project Mgr: LM</p>     | <p>Office: MA</p>        |                     |
| <p>File No: M02617002.dwg</p>   |                            | <p>Project: 06626M35</p> |                     |



1 2 3 4 5 6 7 8 9 10 11 12

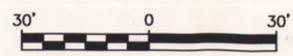


+ EM61 station  
 GPR scan area  
 Subsurface object detected with GPR (with approximate depth in feet).

Contour interval: 20 mV.

**Benzene Concentrations (ppmv)**

10-100  
 Not Detected (<10)



Former Digital Building

|  |                        |                   |                   |
|--|------------------------|-------------------|-------------------|
| Title:   |                        |                   |                   |
| <b>COMPARISON OF SOIL GAS AND GEOPHYSICAL ANOMALIES - FORMER DIGITAL STUDY AREA</b>      |                        |                   |                   |
| INDUSTRI-PLEX SUPERFUND SITE<br>WOBURN, MASSACHUSETTS                                    |                        |                   |                   |
| Prepared For:  |                        |                   |                   |
| INDUSTRI-PLEX SITE REMEDIAL TRUST  |                        |                   |                   |
| <b>ROUX</b><br>ROUX ASSOCIATES, INC.<br><i>Environmental Consulting &amp; Management</i> | Compiled by: AG        | Date: 5/10/02     | PLATE<br><b>1</b> |
|  | Prepared by: RF/CRS    | Scale: AS SHOWN   |                   |
|  | Project Mgr: LM        | Office: MA        |                   |
|  | File No: MO2617003.dwg | Project: 06626M35 |                   |

**ATTACHMENTS**

**ATTACHMENT 1**

Soil Gas Report

**Limited Subsurface Investigation  
Solutia Site  
Woburn, Massachusetts**

**Prepared for**

**Roux Associates, Inc.  
25 Corporate Drive, Suite 230  
Burlington, MA 01801**

**Prepared by**

**PINE & SWALLOW ASSOCIATES, INC.  
Environmental Scientists, Engineers and Designers**

**867 Boston Road  
Groton, MA 01450  
978-448-9511**

**May 6, 2002**

**PSA Reference Number: 01173.2**

# ***Pine & Swallow Associates, Inc.***

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***Environmental Science, Engineering and Design***

867 Boston Road, Groton, MA 01450  
(978) 448-9511 Fax (978) 448-6645  
[www.pineandswallow.com](http://www.pineandswallow.com)

Principals: Robert N. Pine, P.E.  
John C. Swallow, Ph.D., LSP

May 6, 2002

Heather Trent  
Roux Associates, Inc.  
25 Corporate Drive, Suite 230  
Burlington, MA 01801

**RE: Solutia Site, Woburn, Massachusetts**

Dear Heather,

In accordance with the proposal dated May 24, 2001, enclosed is our report on additional subsurface investigations performed at the Solutia Site, Woburn, Massachusetts. This report summarizes the equipment and procedures employed by PSA for soil gas sampling as well as the results of on-site gas chromatographic analyses of soil gas.

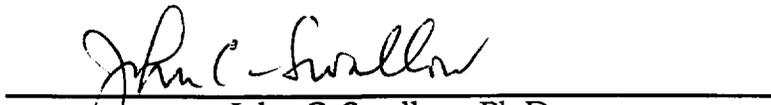
We appreciated the opportunity to work with you and thank you for engaging our services for this project. If there are any questions, please do not hesitate to call.

Sincerely yours,  
**Pine & Swallow Associates, Inc.**



---

Gregory Rotondi  
Field Chemist



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John C. Swallow, Ph.D.  
Director of Environmental Sciences

# ***Pine & Swallow Associates, Inc.***

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***Environmental Science, Engineering and Design***

867 Boston Road, Groton, MA 01450  
(978) 448-9511 Fax (978) 448-6645  
[www.pineandswallow.com](http://www.pineandswallow.com)

*Principals: Robert N. Pine, P.E.  
John C. Swallow, Ph.D., LSP*

## **Limited Subsurface Investigation Solutia Site Woburn, Massachusetts**

### **I. INTRODUCTION AND PROGRAM SUMMARY**

On April 29, 30 and May 1 and 3, 2002, Pine & Swallow Associates, Inc. (PSA) conducted additional subsurface investigations of the Solutia Site, Woburn Massachusetts. The purpose of PSA's effort was to assist Roux Associates, Inc. in assessing soil gas conditions at the site. Details of equipment and procedures for soil gas sampling and results of on-site gas chromatographic (GC) analyses of soil gas for selected volatile organic compounds are enclosed.

#### **Program Summary**

PSA's study included soil gas sampling at 101 locations at three areas of the site. Soil gas samples were collected from two to three feet below ground surface (BGS) and were analyzed with a Hewlett Packard GC for benzene and toluene in PSA's mobile laboratory.

All installation and sampling locations were chosen by Roux Associates, Inc. field personnel. All analyses were performed in PSA's field laboratory for compounds determined by Roux Associates, Inc.'s program.

## II. FIELD INVESTIGATION METHODS AND PROCEDURES

### SOIL GAS INVESTIGATION

#### Soil Gas Equipment and Methods

Soil gas analysis refers to gas chromatographic (GC) analysis of the soil atmosphere (soil gas) to detect volatiles originating from contaminated soil, from a contaminant groundwater plume or from pure product floating on the groundwater surface. Soil gas analysis allows comparison of concentrations of volatile constituents over an array of test locations to indicate pertinent dimensions of a discharge or plume.

Soil gas samples were obtained by driving a half-inch, steam-cleaned, hollow steel probe fitted with a drive point to a selected depth below grade with one of PSA's VibraDrills and by hand held equipment. The probe was then pulled back and a rod used to drive the point beyond the end of the probe, thereby creating a sampling cavity.

Samples were collected by sealing the top of the sampling probe with a tubing adapter which connects to a monitoring panel and vacuum pump. Ten volumes of air were purged from the sampling system by use of an electric or battery powered pump. During purging, flow and pressure measurements were recorded.

To collect a soil gas sample for GC analysis, the well is purged to allow the sample aliquot to be representative of the sample depth. The sampling vial is then introduced on to the sampling line using new needles and sample line. The well is then isolated from both vacuum pump and the well by sealing the tubing from both sides. After the sampling probe pressure had equilibrated to ambient atmospheric pressure the sample pump is turned on and the line is reopened to allow the soil gas aliquot to pass through the sample vial. The sample is then trapped in the crimp top vial by isolating the sample line from the pump and well the vial is then removed and the sample delivered immediately to the

mobile laboratory. Samples were logged in by the chemist with a chain of custody form which includes the vial ID, sampling location and sample depth, and analyzed according to PSA's analytical SOP.

### **FIELD CHEMISTRY**

PSA utilizes Hewlett Packard 5890 gas chromatographs and a Tekmar 7000/7050 Static Headspace and Autosampler to analyze soil, water and soil gas matrices for a variety of organic environmental contaminants. Gas chromatography (GC) technology physically separates the components of a contaminated matrix and the contaminants are then identified using compound-specific detectors. PSA's GC instrumentation currently employs three different detection modes. The electron capture detector (ECD) is primarily used to identify electromagnetic molecules such as chlorinated, brominated and fluorinated compounds. The photoionization detector (PID) is effective in the determination of aromatic and/or aliphatic contaminants such as benzene, toluene, ethylbenzene and xylenes (BTEX). The flame ionization detector (FID) identifies hydrocarbon-containing molecules such as polynuclear aromatic hydrocarbons and petroleum fuel constituents. Analysis is conducted in accordance with PSA's Standard Operating Procedures (SOPs).

The following are typical autosampler analytical conditions. Auto Sampler: Tekmar 7000/7050 Static Headspace and Autosampler:

|                |                    |
|----------------|--------------------|
| Equilibrate:   | 60°C for 4 min     |
| Vortex Mix:    | 1.0 min            |
| Stabilize:     | 2.0 min            |
| Pressurize:    | 14 psi for 0.3 min |
| Equilibration: | 0.3 min.           |

An appropriate analytical capillary column is selected for the suite of analytes under study. Once the sample is prepared for analysis and introduced into the GC's heated inlet injection port, it is transported in its gaseous form to the analytical column. As a sample slug migrates through this column, its various components interact with the column film to become temporarily adsorbed and subsequently desorbed. Each compound in the test sample

transits the column at a different rate which is temperature controlled and enhanced, hence creating a unique retention time. Each compound also elicits a unique response from the detectors. These responses are translated within the data collection system in the form of peaks which are assigned height and area values relative to analyses of analytical standards. This data is subsequently evaluated to determine concentration of the target analyte within the sample matrix.

The following are typical GC analytical conditions. GC: Hewlett Packard 5890A. Column: Restek RTX-502.2, 30-m, 0.53- $\mu$ m ID, 2.0/mm film thickness fused silica capillary column.

|                                |              |
|--------------------------------|--------------|
| Carrier Gas:                   | Helium       |
| Flow Rate:                     | 10-13 ml/min |
| Initial Column Temperature:    | 40°C         |
| Initial Column Holding Time:   | 2 min        |
| Ramp Rate:                     | 10°C/min     |
| Final Temperature:             | 130°C        |
| Final Hold Time:               | 1 min        |
| Approximate GC Cool Down Time: | 10 min       |

NOTE: The typical run time under these conditions is 20 minutes.

Identification and quantification of target analytes detected in the sample are achieved by retention time comparisons to reference standards formulated with analytical grade compounds of known concentrations. In this way, unknowns detected during sample analyses can be identified and concentrations calculated.

For all analyses, blank samples from syringes, sampling equipment and reagents are analyzed periodically to ensure sample and method integrity. Daily check standards are run to verify instrument stability, calibration, sensitivity and performance. Duplicate analyses and replicate sample injections are routinely conducted to support method accuracy and analytical precision.

## **Soil Gas Program**

One hundred and one locations chosen by Roux Associates, Inc. field personnel were sampled for soil gas at depths ranging from two to three feet BGS using PSA's K100 VibraDrill. Soil gas samples were analyzed for benzene and toluene at the direction of Roux Associates, Inc. field personnel on a Hewlett Packard 5890 GC in PSA's field laboratory.

Results of soil gas analyses for the compounds selected by Roux Associates, Inc. field representatives and performed at the Solutia Site, Woburn are tabulated in the Appendix.

This report is submitted subject to the limitations stated in the Appendix.

**APPENDIX**

**Limitations and Conditions**

**PSA Standard Abbreviations**

**Soil Gas Logs**

**Analytical Results**

## LIMITATIONS AND CONDITIONS

1. The observations described in this report were made under the conditions stated. The conclusions presented in the report were based solely upon the services described and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. The report has been prepared in accordance with generally accepted hydrogeological and hydrochemical practices. No other warranty, express or implied, is made.
2. Negative findings for the presence of volatile organic compounds using soil atmosphere analysis are not positive or absolute proof that disposal or discharge of chemicals has not occurred in the past at the sampled locations or anywhere else on the site. Negative findings are not positive or absolute proof that migration, seepage or any other movement of chemicals is not occurring at the sampled locations or elsewhere on the site.
3. Chemical conditions reported herein reflect conditions at the locations tested within the limitations of the methods used. Such conditions can vary rapidly from area to area. No warranty is expressed or implied that chemical conditions other than those reported do not exist within the site.
4. At those locations where volatile organic compounds were reported, chemicals other than those reported may be present. Chemical analyses have been performed for specific parameters during this assessment. However, additional chemical constituents not searched for during the current study may be present in soil and/or groundwater at the site.
5. This report has been prepared for Roux Associates, Inc. solely for use in an environmental evaluation of property at the Solutia Site, Woburn, Massachusetts.

## PSA STANDARD ABBREVIATIONS

Abbreviations which may have been used in this report and in the MicroWell logs.

|           |                                |
|-----------|--------------------------------|
| mg/Kg     | milligrams per kilogram        |
| mg/L      | milligrams per liter           |
| ppb       | parts per billion              |
| ppm       | parts per million              |
| µg/g      | micrograms per gram            |
| µg/Kg     | micrograms per kilogram        |
| µg/L      | micrograms per liter           |
| "         | inches (in)                    |
| '         | feet (ft)                      |
| cm        | centimeters                    |
| m         | meters                         |
| mL        | milliliters                    |
| yd        | yards                          |
| BGS       | below ground surface           |
| D-NAPL    | dense non-aqueous phase liquid |
| GC        | gas chromatograph              |
| L-NAPL    | light non-aqueous phase liquid |
| OVM       | organic vapor meter            |
| Pipe ID   | internal diameter of pipe      |
| Pipe OD   | external diameter of pipe      |
| Sample ID | sample identification number   |
| TOC       | top of casing                  |
| Well ID   | well identification number     |
| WL        | water level                    |

## Soil Gas Field Logs

## SOIL GAS FIELD LOG

| <b>Project: ISRT/Woburn</b>         |                 |                        | <b>Date: 4/29/02</b>              |                   |                       |
|-------------------------------------|-----------------|------------------------|-----------------------------------|-------------------|-----------------------|
| <b>Project #: 01173</b>             |                 |                        | <b>Weather: Cloudy 45 degrees</b> |                   |                       |
| <b>Client Name: Roux Associates</b> |                 |                        | <b>Field Personnel: GR/DF/MC</b>  |                   |                       |
| <b>Sample ID</b>                    | <b>Location</b> | <b>Sampling Method</b> | <b>Sampling Depth</b>             | <b>Flow (CFH)</b> | <b>Pressure (PSI)</b> |
| A-6                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| A-5                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| B-2                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| B-3                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-4                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-5                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-6                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| D-6                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| D-7                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| B-4                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| B-5                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| B-6                                 | ABC roofing     | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| E-5                                 | Digital         | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| D-5                                 | Digital         | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
| G-6                                 | Digital         | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| D-6                                 | Digital         | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| E-6                                 | Digital         | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-7                                 | Digital         | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-8                                 | Digital         | Lost point             | 2.5'-3.0'                         |                   |                       |
| D-9                                 | Digital         | Lost point             | 2.5'-3.0'                         | 45                | 5                     |
| C-9                                 | Digital         | Lost point             | 2.5'-3.0'                         | 50                | 5                     |
|                                     |                 |                        |                                   |                   |                       |
|                                     |                 |                        |                                   |                   |                       |
|                                     |                 |                        |                                   |                   |                       |

## SOIL GAS FIELD LOG

| Project: ISRT/Woburn         |          |                 | Date: 4/30/02             |            |                |
|------------------------------|----------|-----------------|---------------------------|------------|----------------|
| Project #: 01173             |          |                 | Weather: Fair 47 degrees  |            |                |
| Client Name: Roux Associates |          |                 | Field Personnel: GR/DF/MC |            |                |
| Sample ID                    | Location | Sampling Method | Sampling Depth            | Flow (CFH) | Pressure (PSI) |
| E-7                          | Digital  | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| D-7                          | Digital  | Lost point      | 0.5'-1.0'                 | 45         | 5              |
| G-7                          | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| F-6                          | Digital  | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| F-7                          | Digital  | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| F-8                          | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| E-8                          | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| E-9                          | Digital  | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| D-8                          | Digital  | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| C-10                         | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-11                         | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-12                         | Digital  | Lost point      | 1.5'-2.5'                 | 45         | 5              |
| D-12                         | Digital  | Lost point      | 2.0'-2.5'                 |            |                |
| D-11                         | Digital  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-2                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-1                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| A-1                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| A-2                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| A-3                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-3                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| A-8                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-8                          | Sacco's  | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| B-7                          | Sacco's  | Lost point      | 2.5'-3.0'                 | 45         | 5              |
|                              |          |                 |                           |            |                |

## SOIL GAS FIELD LOG

| Project: ISRT/Woburn         |             |                 | Date: 5/1/02              |            |                |
|------------------------------|-------------|-----------------|---------------------------|------------|----------------|
| Project #: 01173             |             |                 | Weather: Fair 50 degrees  |            |                |
| Client Name: Roux Associates |             |                 | Field Personnel: GR/DF/MC |            |                |
| Sample ID                    | Location    | Sampling Method | Sampling Depth            | Flow (CFH) | Pressure (PSI) |
| A-6                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| A-7                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| B-6                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| B-5                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| B-4                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-3                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-4                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-5                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-6                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-7                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-8                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-2                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| C-1                          | Sacco's     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| A-1                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-1                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-2                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-3                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| D-4                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| D-5                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| B-7                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-7                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| D-1                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| C-1                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |
| D-2                          | ABC roofing | Lost point      | 2.5'-3.0'                 | 45         | 5              |



## SOIL GAS FIELD LOG

| Project: ISRT/Woburn         |             |                 | Date:5/3/02               |            |                |
|------------------------------|-------------|-----------------|---------------------------|------------|----------------|
| Project #: 01173             |             |                 | Weather: Fair 60 degrees  |            |                |
| Client Name: Roux Associates |             |                 | Field Personnel: GR/DF/MC |            |                |
| Sample ID                    | Location    | Sampling Method | Sampling Depth            | Flow (CFH) | Pressure (PSI) |
| A-3                          | Digital     | Lost point      | 1.5'-2.0'                 | 50         | 5              |
| A-4                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| A-5                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| A-6                          | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| A-8                          | Digital     | Lost point      | 1.5'-2.0'                 | 50         | 5              |
| A-9                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| A-10                         | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| A-11                         | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| A-12                         | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| A-7                          | Digital     | Lost point      | 1.5'-2.0'                 | 45         | 5              |
| B-4                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| B-3                          | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| B-2                          | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| B-1                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| C-1                          | Digital     | Lost point      | 2.0'-2.5'                 | 45         | 5              |
| C-2                          | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| D-2                          | Digital     | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| E-3                          | Digital     | Lost point      | 1.0'-1.5'                 | 45         | 5              |
| E-4                          | Digital     | Lost point      | 1.0'-1.5'                 | 45         | 5              |
| F-5                          | Digital     | Lost point      | 1.0'-1.5'                 | 50         | 5              |
| A-2                          | ABC roofing | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| A-3                          | ABC roofing | Lost point      | 2.0'-2.5'                 | 50         | 5              |
| A-4                          | ABC roofing | Lost point      | 2.0'-2.5'                 | 50         | 5              |
|                              |             |                 |                           |            |                |

## **Analytical Results**

**ISRT WOBURN SITE  
MOBILE LABORATORY ANALYSIS  
SOIL GAS RESULTS**

ppbv

| Sample ID        | Depth     | Date    | Benzene | Toluene | Location |
|------------------|-----------|---------|---------|---------|----------|
| A-6a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| A-5a             | 2.5'-3.0' | 4/29/02 | 13      | BDL     | ABC      |
| B-2a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| B-3a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| C-4a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| C-5a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| C-6a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| D-6a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| D-7a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| B-4a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| B-5a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| B-6a             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | ABC      |
| D-5d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| E-5d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| C-6d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| D-6d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| E-6d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| C-7d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| C-8d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| D-9d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| C-9d             | 2.5'-3.0' | 4/29/02 | BDL     | BDL     | DIGITAL  |
| E-7d             | 1.5'-2.0' | 4/30/02 | BDL     | 20      | DIGITAL  |
| D-7d             | 0.5'-1.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| G-7d             | 2.5'-3.0' | 4/30/02 | 14      | BDL     | DIGITAL  |
| F-6d             | 1.5'-2.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| F-7d             | 1.5'-2.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| F-8d             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| E-8d             | 1.5'-2.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| E-9d             | 1.5'-2.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| D-8d             | 2.0'-2.5' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| C-10d            | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| C-11d            | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| C-12d            | 1.5'-2.0' | 4/30/02 | BDL     | BDL     | DIGITAL  |
| D-12d            | 2.0'-2.5' | 4/30/02 | 16      | 15      | DIGITAL  |
| D-11d            | 2.5'-3.0' | 4/30/02 | 15      | BDL     | DIGITAL  |
| B-2s             | 2.5'-3.0' | 4/30/02 | 14      | BDL     | SACCO    |
| B-1s             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | SACCO    |
| A-1s             | 2.5'-3.0' | 4/30/02 | 16      | BDL     | SACCO    |
| A-2s             | 2.5'-3.0' | 4/30/02 | 20      | BDL     | SACCO    |
| A-3s             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | SACCO    |
| B-3s             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | SACCO    |
| A-8s             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | SACCO    |
| B-8s             | 2.0'-2.5' | 4/30/02 | BDL     | BDL     | SACCO    |
| B-7s             | 2.5'-3.0' | 4/30/02 | BDL     | BDL     | SACCO    |
| A-6s             | 1.5'-2.0' | 5/1/02  | BDL     | BDL     | SACCO    |
| A-7s             | 1.0'-1.5  | 5/1/02  | BDL     | 61      | SACCO    |
| B-6s             | 1.5'-2.0' | 5/1/02  | BDL     | 19      | SACCO    |
| B-5s             | 1.5'-2.0' | 5/1/02  | BDL     | 16      | SACCO    |
| Detection Limits |           |         | 10      | 15      |          |

**ISRT WOBURN SITE  
MOBILE LABORATORY ANALYSIS  
SOIL GAS RESULTS**

ppbv

| Sample ID       | Depth     | Date   | Benzene | Toluene | Location |
|-----------------|-----------|--------|---------|---------|----------|
| B-4s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-3s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-4s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-5s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-6s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-7s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-8s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-2s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| C-1s            | 1.5'-2.0' | 5/1/02 | BDL     | BDL     | SACCO    |
| A-1a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| B-1a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| C-2a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| C-3a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| D-4a            | 2.5'-3.0' | 5/1/02 | 16      | BDL     | ABC      |
| D-5a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| B-7a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| D-1a            | 2.5'-3.0' | 5/1/02 | 18      | BDL     | ABC      |
| C-7a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| C-1a            | 2.5'-3.0' | 5/1/02 | 16      | BDL     | ABC      |
| D-2a            | 2.5'-3.0' | 5/1/02 | 30      | BDL     | ABC      |
| D-3a            | 2.5'-3.0' | 5/1/02 | 15      | BDL     | ABC      |
| E-3a            | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | ABC      |
| E-4a            | 2.5'-3.0' | 5/1/02 | 15      | BDL     | ABC      |
| A-1dm           | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | DIGITAL  |
| A-2dm           | 2.5'-3.0' | 5/1/02 | 28      | BDL     | DIGITAL  |
| A-3dm           | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | DIGITAL  |
| A-4dm           | 2.5'-3.0' | 5/1/02 | BDL     | BDL     | DIGITAL  |
| A-5dm           | 2.5'-3.0' | 5/1/02 | 14      | BDL     | DIGITAL  |
| A-1d            | 2.5'-3.0' | 5/1/02 | 14      | BDL     | DIGITAL  |
| A-2d            | 2.5'-3.0' | 5/1/02 | 15      | BDL     | DIGITAL  |
| A-3d            | 1.5'-2.0' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-4d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-5d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-6d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-8d            | 1.5'-2.0' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-9d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-10d           | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-12d           | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-11d           | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| A-7d            | 1.5'-2.0' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| B-4d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| B-2d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| B-3d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| B-1d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| C-1d            | 2.0'-2.5' | 5/3/02 | 13      | BDL     | DIGITAL  |
| D-2d            | 2.0'-2.5' | 5/3/02 | BDL     | BDL     | DIGITAL  |
| Detection Limts |           |        | 10      | 15      |          |

**ISRT WOBURN SITE  
MOBILE LABORATORY ANALYSIS  
SOIL GAS RESULTS**

**ppbv**

| <b>Sample ID</b>       | <b>Depth</b> | <b>Date</b> | <b>Benzene</b> | <b>Toluene</b> | <b>Location</b> |
|------------------------|--------------|-------------|----------------|----------------|-----------------|
| C-2d                   | 2.0'-2.5'    | 5/3/02      | BDL            | BDL            | DIGITAL         |
| E-3d                   | 2.0'-2.5'    | 5/3/02      | 14             | BDL            | DIGITAL         |
| E-4d                   | 2.0'-2.5'    | 5/3/02      | 13             | BDL            | DIGITAL         |
| F-5d                   | 1.0'-1.5'    | 5/3/02      | 14             | BDL            | DIGITAL         |
| A-2a                   | 2.0'-2.5'    | 5/3/02      | BDL            | BDL            | ABC             |
| A-3a                   | 2.0'-2.5'    | 5/3/02      | BDL            | BDL            | ABC             |
| A-4a                   | 2.0'-2.5'    | 5/3/02      | BDL            | BDL            | ABC             |
| <b>Detection Limts</b> |              |             | 10             | 15             |                 |

Notes:

BDL = Below Detection Limit

**ATTACHMENT 2**

Geophysics Report



May 15, 2002

GPR Contract No. B02365

Mr. Lawrence McTiernan  
Roux Associates, Inc.  
25 Corporate Drive, Suite 230  
Burlington, MA 01803

**Subject:** Geophysical Investigations, Industri-Plex Site, Woburn, Massachusetts

Dear Mr. McTiernan,

Geophysics GPR International, Inc., under a directive of Roux Associates, Inc. performed geophysical investigations in three areas at the Industri-Plex site in the city of Woburn, Massachusetts.

Metal detection (EM61) and ground penetrating radar (GPR) surveys were completed to locate subsurface metallic objects that might include underground storage tanks (USTs), buried drums, or other possible sources of groundwater contamination.

#### **Site and Area Conditions**

The Industri-Plex site is a heavily industrialized area located in Woburn, Massachusetts, west of Interstate Route 93 and north of Interstate Route 95. The survey covered three areas: a paved and grass covered site at 41 Atlantic Avenue (Sacco site), paved, grassy, and gravel covered areas at 36 Cabot Road (Digital site), and paved and gravel covered areas at 110 Commerce Road (ABC site).

The Sacco site survey area covered approximately 30,000 square feet, and includes paved parking and lawn areas adjacent to an existing building.

The Digital site is separated for the purposes of this report into two survey areas, designated the South and North sections. The South and North sections are separated by a stream and a heavily wooded zone. The South section covers approximately 48,000 square feet and includes asphalt paved parking and access areas adjacent to an existing building. The North section covers approximately 27,500 square feet and includes grassy and gravel covered areas to the north of the paved parking lot. The North section is further subdivided into two smaller survey areas, separated by a zone of heavy brush.

The ABC site covers approximately 27,000 square feet and includes asphalt paved access and storage areas adjacent to an existing building, as well as an adjacent gravel covered area. The paved and gravel areas are separated by a chain link fence.

## **METHODS OF INVESTIGATION**

### **Metal Detection (EM61) Method**

The metal detection (EM61) method employs an electromagnetic (EM) energy source and sensors to measure the response of buried metals by generating an EM pulse 150 times per second and measuring during the off-time between pulses. After each pulse, secondary EM fields are briefly induced in the moderately conductive soils, and for a longer time in the surface and buried metallic objects.

During the measuring time between each EM pulse, the system waits until the response from the soils dissipates, and then measures the prolonged metal response. By sensing only the response from the buried metal, the EM61 detects targets that would be otherwise missed.

The depth of penetration at a typical site for small objects, such as a single metallic drum, is about ten feet below ground surface. Larger objects, such as a UST, can be detected at greater depths, with the depths of penetration generally limited to about twenty feet.

### **Ground Penetrating Radar (GPR) Method**

The GPR method employs high-resolution radar to detect buried objects and subsurface stratigraphy. Many of the principles of GPR are similar to that of the seismic reflection method used in oil and gas exploration. The transmitting component of the antenna emits brief pulses of electromagnetic energy into the ground. Between pulse cycles, the receiving component of the antenna records energy that has been reflected back to the surface.

Radar waves are reflected by boundaries between materials with differing electrical properties (dielectric constants), such as geologic contacts, buried objects, and voids. The dielectric constant is controlled by factors such as water content, density, and composition. The depth of penetration is limited by the operating frequency (MHz) of the transmitter and the electrical conductivity of the ground.

### **Equipment**

The metal detection survey was accomplished using a Geonics EM61 metal detector. Each reading of the subsurface response, with one coil for near-surface response and another coil for deeper penetration, was automatically stored in a Polycorder 720 data logger with the coordinates of the station, time, date, and statistical error. The data were transferred to a computer for further processing.

The ground penetrating radar (GPR) survey was accomplished using a GSSI SIR-10A+ system equipped with a 500 MHz antenna. Data was monitored during acquisition for quality control, and stored digitally and downloaded to a computer for processing, review, and

interpretation.

### **Survey Procedure**

Grid systems were established at each site with a Trimble GPS system by Maverick Construction personnel. Grid nodes were interpolated between GPS stations and were marked at 10 foot intervals with paint. Site features such as buildings, utilities, etc. were referenced to grid coordinates during the surveys.

EM61 surveys were carried out at the Sacco site on April 29, 2002, at the ABC site on April 30 and May 3, 2002, and at the Digital site May 1, 2002 (South section) and May 3, 2002 (North section). Readings were collected at 3 foot intervals, along grid lines spaced 3 feet apart (Sacco and ABC sites) and 5 feet apart (Digital site).

Data collected during the EM61 surveys was downloaded, processed, contoured, and analyzed for anomalous responses that could indicate the presence of buried metal objects. The locations in which these anomalous responses were observed were then subjected to GPR scans in order to further characterize and delineate possible source objects. GPR surveys were carried out on May 6, 2002. In each selected area continuous scans were made at 5 foot intervals along grid lines spaced 5 feet apart, in orthogonal directions. Closer spaced scans were made in areas of particular interest.

### **Interpretation and Accuracy**

EM61 readings were downloaded to a computer and processed. Differential calculations were performed to help exclude signals from near surface metallic objects. The resulting values were contoured at various intervals, and the contour maps were examined for significant anomalies. The selected anomalies were located by grid coordinates, and areas were marked off around them.

Radar scans were then made at various intervals, in orthogonal directions over each marked off area. Interpretation was performed by examination of the records during the course of the survey. Extra scans were made wherever necessary. The scans were performed with the 500 MHz antenna to provide the best combination of resolution and depth of investigation at this site. A site for direct calibration of the radar system was not available. Depths of penetration were estimated based on experience at similar sites. Depth of penetration was estimated at approximately 6 to 8 feet.

In general, the accuracy of both EM61 and GPR methods is within one to two feet horizontally and vertically.

## **RESULTS**

### **Sacco Site (Figure 1)**

EM61 data collected at the Sacco site was processed and contoured to provide the map of Figure 1. The contour map shows the variation of the measured parameter across the site: EM61 millivolt response, the standard value for this type of survey.

Examination of Figure 1 reveals the following features. EM61 anomalies are generally distinct and have relatively high amplitude. The majority of these anomalies correspond to surface features including steel gates, storm drain grates, water supply valves, a guard rail, metal signs, and a fire hydrant. Two areas were selected for GPR scans, designated A and B on Figure 1.

GPR scans in area A revealed six possible subsurface objects, at estimated depths of 2.5 – 3.0 feet. One of these (oriented approximately north – south along the west edge of the scanned area) may represent a large diameter storm drainpipe. Characteristics of radar signals from the remaining subsurface objects suggest the presence of a small cluster of metal debris objects, possible sections of pipe or similar objects, and/or possible small drums centered around grid coordinate (45N, 65E).

GPR scans in area B revealed three possible subsurface objects at estimated depths of 2.5 – 3.0 feet. Characteristics of radar signals recorded in this area suggest the possibility of sections of pipe or similar objects, as well as a backfilled excavation.

### **Digital Site – South Section (Figure 2)**

EM61 data collected at the Digital South section site was processed and contoured to provide the map of Figure 2. Examination of Figure 2 reveals the following features.

A somewhat variable overall level of background response at this site suggests the presence of widely scattered small metal debris in the subsurface.

EM61 anomalies at this site are generally of relatively low amplitude, with the exception of a high amplitude response along the edge of and corresponding to the site building, a localised high amplitude anomaly at the northerly corner of the building, and a localised high amplitude anomaly at the location of a metal light post.

Five areas were selected for GPR scans, designated C, D, E, F, and G.

Area C includes the location of the high amplitude anomaly mentioned above at the northerly corner of the building. In area C two small objects were detected at an estimated depth of 2.5 feet. GPR signal characteristics suggest that they may be small sections of pipe or similar

objects. A possible larger object was detected in this area at an estimated depth of 7 feet. Radar signals from this object were not conclusive due to high amplitude reflections from surrounding materials. This object may represent a possible UST, large diameter pipe, or may indicate side reflections from the footing of the building.

GPR scans in area D revealed three small subsurface objects at estimated depths of 1.0 – 4.0 feet. Radar signal characteristics suggest the presence of a possible small diameter pipe section, and possible small metal debris.

GPR scans in areas E and F revealed no apparent subsurface metal objects, however in both areas small steel pipes embedded in the pavement were observed, indicating likely sources of the low amplitude EM61 anomalies.

GPR scans in area G revealed two small subsurface objects at an estimated depth of 3.0 feet. Radar signal characteristics in this area suggest the presence of small diameter pipe section, and a small object located near the EM61 anomaly peak representing possible metal debris.

#### **Digital Site – North Section (Figures 3A, 3B)**

Portions of the North section site were inaccessible due to the presence of heavy brush and other obstructions. EM61 data collected at the Digital North section site was processed and contoured to provide the map of Figures 3A and 3B. Examination of the Figures reveals the following features.

Similar to the South section, the overall background variability in EM61 response in this area suggests the presence of scattered small metal debris in the subsurface. A large linear anomaly adjacent and parallel to the “B” grid line represents the location of a buried pipe system indicated at the surface by a series of valves.

Four areas were selected for GPR scans, designated H, I, J, and K on Figures 3A and 3B.

GPR scans in area H revealed 13 small subsurface objects at estimated depths of 2.0 – 4.5 feet. Radar signal characteristics in this area suggest that these objects most likely consist of metal debris.

GPR scans in area I were inconclusive due to poor penetration and signal attenuation near the surface. With the exception of small zones, penetration in this area was estimated at 2.5 feet or less. It is possible that a low mound covering this area may consist largely of clay-silt or similar materials, inhibiting penetration by radar waves. Two small objects were detected near the edge of the mound at estimated depths of 4.0 feet. Signal characteristics suggest that these objects may represent metal debris.

GPR scans in area J revealed six possible subsurface objects at estimated depths of 3.0 – 4.5

feet. Radar signal characteristics indicate that most of these objects likely consist of metal debris. Signals centered at grid points (298N, 484E) and (294N, 471E) display characteristics that suggest possible large pipe sections, small drums, or similar objects.

GPR scans in area K revealed six possible subsurface objects at estimated depths of 2.0 – 4.5 feet. Radar signal characteristics in this area indicate that these objects most likely consist of metal debris, small pipe sections, or similar objects.

#### **ABC Site (Figure 4)**

Portions of the ABC site were inaccessible due to the presence of a chain link fence cutting diagonally across the survey area, and pallets of roofing materials stored between the building and the fence by the existing business.

Analysis of EM61 data collected at the ABC site suggested that interference from an external source produced some reduction in data quality from the upper antenna of the instrument. During the data reduction process it became apparent that data from the lower antenna was relatively unaffected. Accordingly, lower antenna values were contoured to produce the map of Figure 4. (Contour maps for all surveyed areas use lower antenna values). Examination of Figure 4 reveals the following features.

Similar to the Digital site, overall variable background response suggests the presence of widely scattered small metal debris in the subsurface. A high amplitude linear anomaly located between the chain link fence and the toe of the adjacent slope is due to the presence of both the fence and of buried railroad tracks running parallel to it. It should be noted that the presence of the steel rails resulted in saturation of the EM signal in that area, and that subsurface information below the tracks is not available.

A high amplitude anomaly is associated with a storm drain grate located at grid point D7.

No other significant metallic anomalies were observed. As a quality assurance measure, several areas were selected for GPR scans using upper antenna values (designated L, M, and N on Figure 4). No subsurface objects were detected on any scans.

Geophysics GPR International is pleased to have performed this geophysical service and welcomes the opportunity to work with your firm.

Sincerely,

  
\_\_\_\_\_  
Mark Kick  
Regional Manager

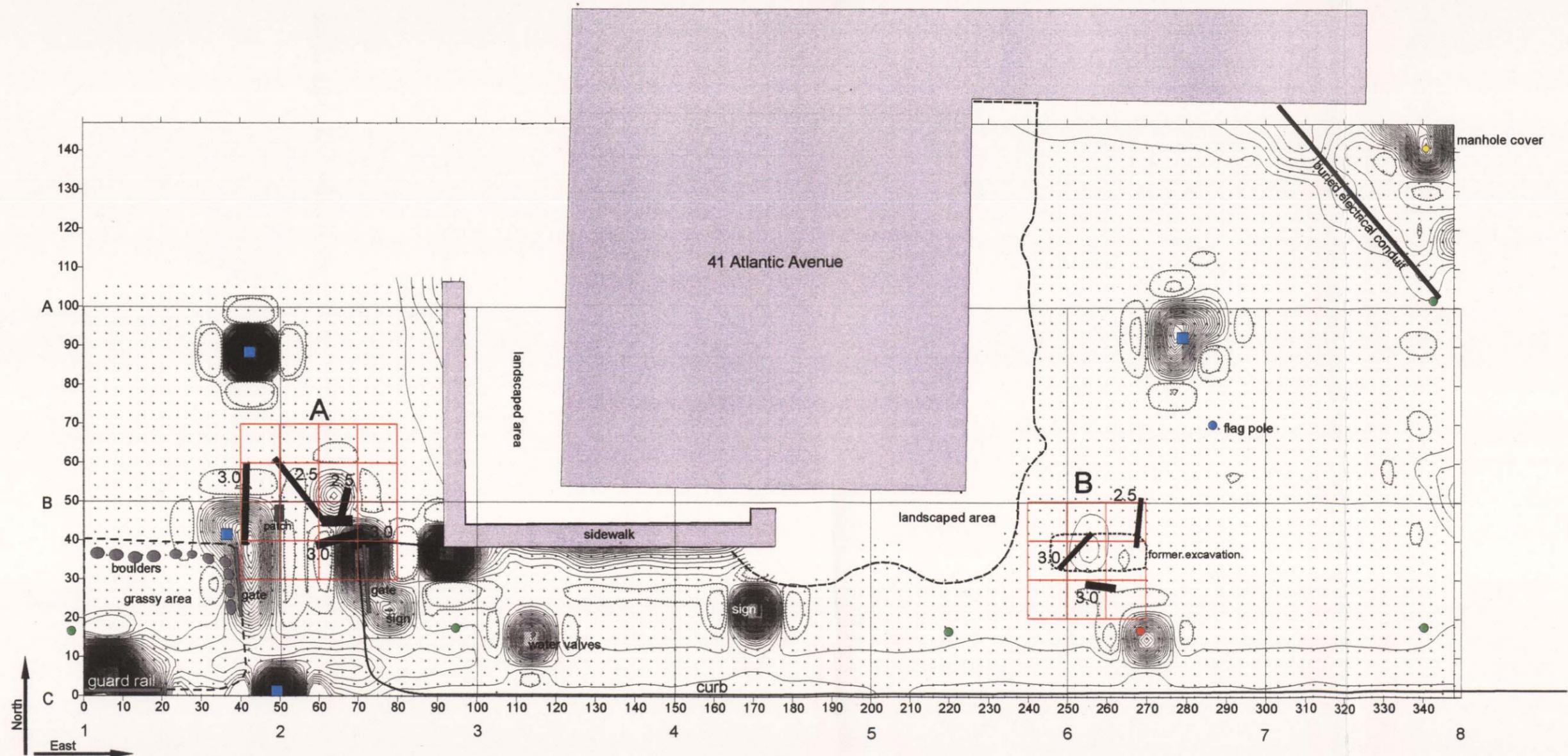
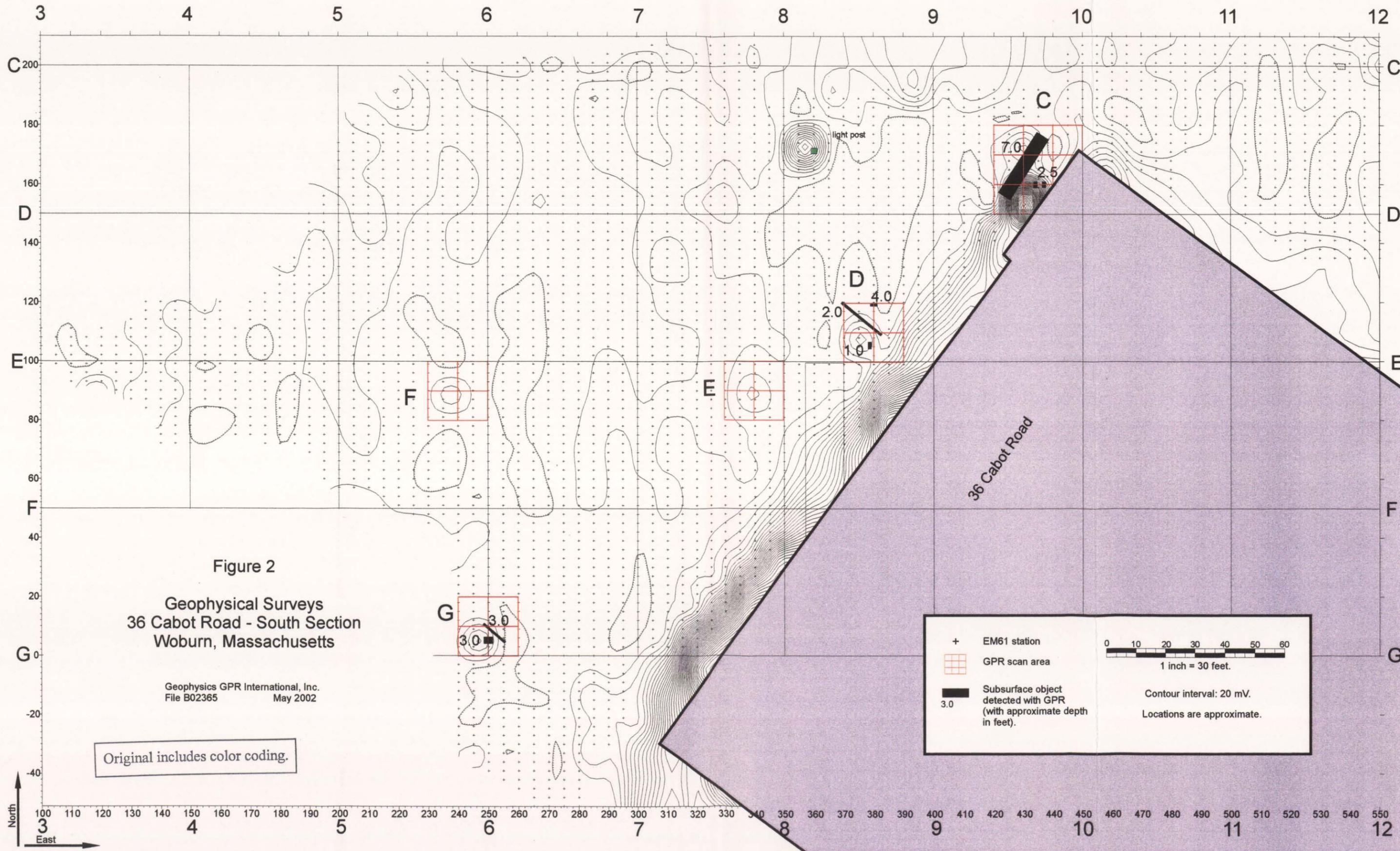


Figure 1  
 Geophysical Surveys  
 41 Atlantic Avenue  
 Woburn, Massachusetts

Geophysics GPR International, Inc.  
 File B02365 May 2002

Original includes color coding.



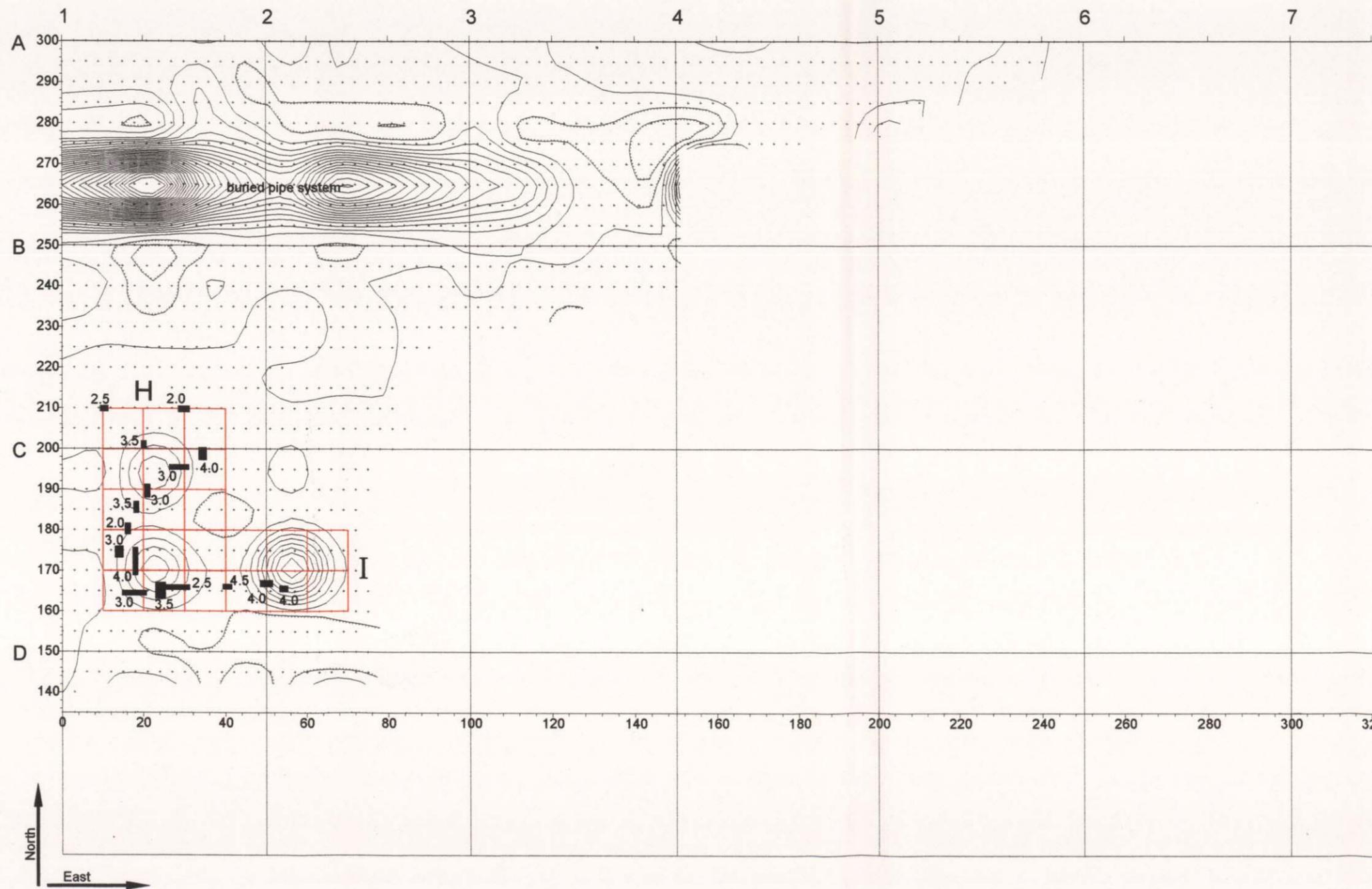


Figure 3B  
→

|   |   |                            |
|---|---|----------------------------|
| + | EM61 station  | <p>1 inch = 30 feet.</p>   |
|   | GPR scan area   |                            |
|   | Subsurface object detected with GPR (with approximate depth in feet). | Contour interval: 20 mV.   |
|   |   | Locations are approximate. |

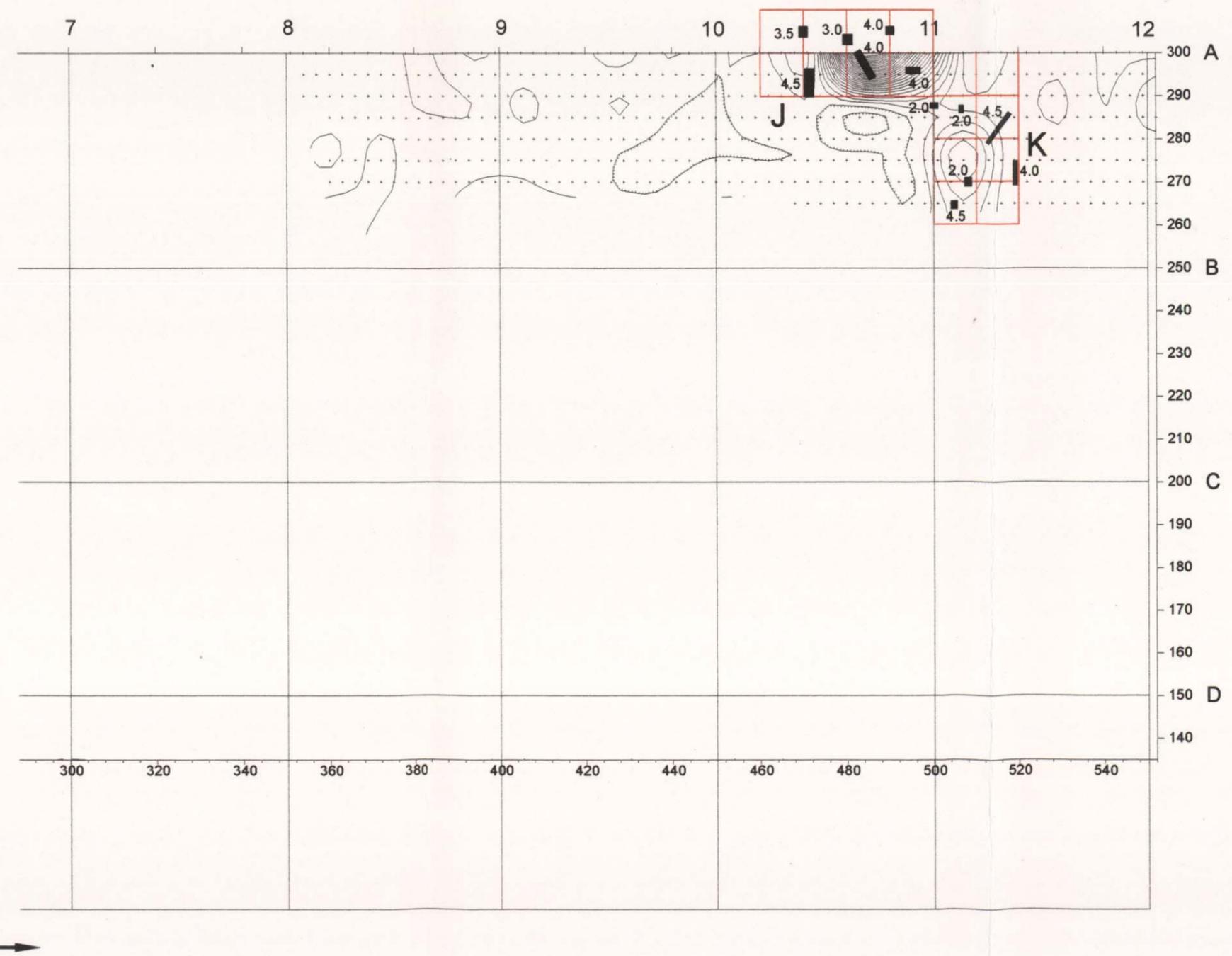
Figure 3A

Geophysical Surveys  
36 Cabot Road - North Section  
Woburn, Massachusetts

Geophysics GPR International, Inc.  
File B02365 May 2002

Original includes color coding.

Figure 3A  
←



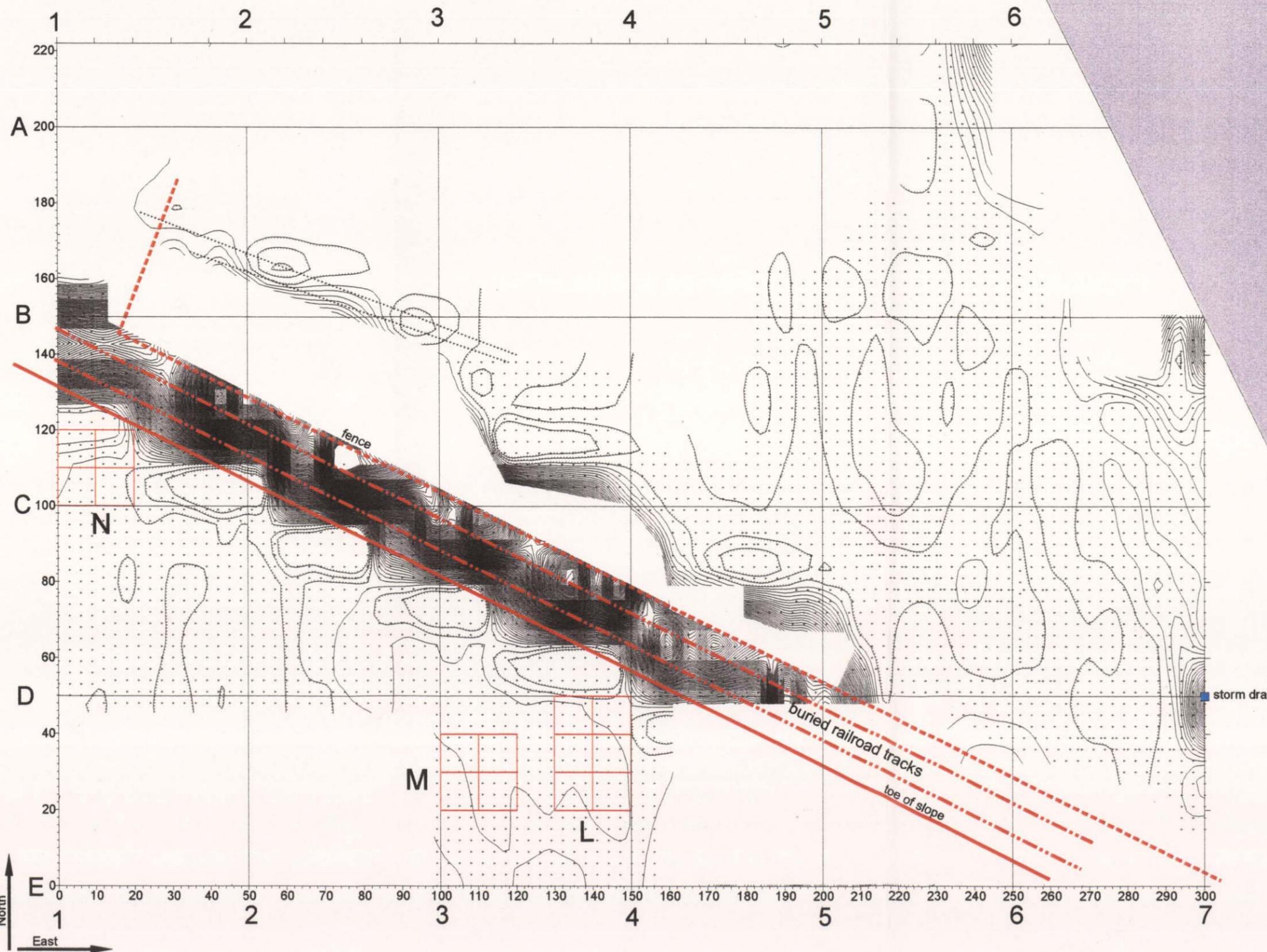
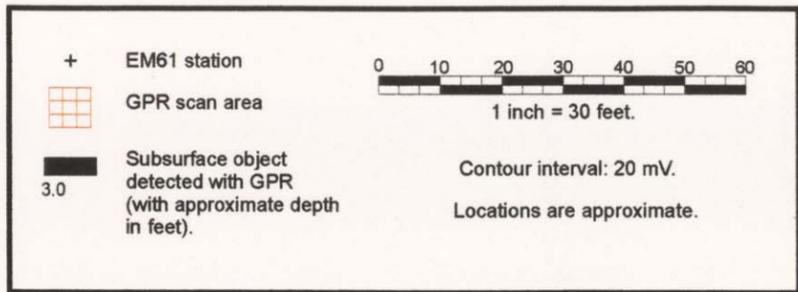
|   |   |                            |
|---|---|----------------------------|
| + | EM61 station  | <p>1 inch = 30 feet.</p>   |
|   | GPR scan area   |                            |
|   | Subsurface object detected with GPR (with approximate depth in feet). | Contour interval: 20 mV.   |
|   |   | Locations are approximate. |

Figure 3B

Geophysical Surveys  
36 Cabot Road - North Section  
Woburn, Massachusetts

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Original includes color coding.



110 Commerce Way

Figure 4

Geophysical Surveys  
110 Commerce Way  
Woburn, Massachusetts

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Original includes color coding.