



**U.S. Army
Environmental
Center**

**FORT DEVENS
SITE INVESTIGATION
FOR GROUPS 2, 7 &
HISTORIC GAS STATIONS**

**REVISED FINAL SITE INVESTIGATION REPORT
DATA ITEM A009**

**VOLUME II OF IV
REPORT TEXT**

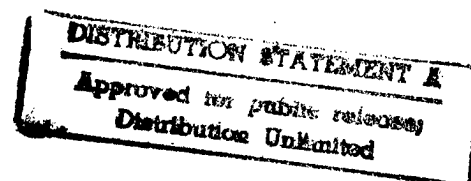
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**U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND**

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**FORT DEVENS
REVISED FINAL SITE INVESTIGATION REPORT
GROUPS 2, 7 & HISTORIC GAS STATIONS**

Volume II of IV
Report Text

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6.0 STUDY AREA 43 - HISTORIC GAS STATIONS

The following section presents the findings and recommendations of the SI field investigations conducted at the 19 historic gas station sites, and SSI field investigations at eight historic gas stations, which make up SA 43. These sites were part of an installation-wide fuel distribution and motor pool system installed in the early 1940s and discontinued in the early 1950s. All of the historic gas station sites are located on the Main Post portion of Fort Devens (Figure 6.1-1).

Additional data for each of the SA 43 historic gas station sites (43B through 43S) was gathered under the Areas Requiring Environmental Evaluation (AREE) 61 - Maintenance and Waste Accumulation Areas program. The following is a list of corresponding AREE 61 and SA 43 site designations:

43 B	=	61 AQ
43 C	=	Part of 61 F
43 D	=	61 AR
43 E	=	61 AS
43 F	=	61 C
43 G	=	61 G
43 H and I	=	61 I
43 J	=	61 AF
43 K	=	61 O
43 L	=	61 P
43 M	=	61 Q
43 O	=	61 S
43 P	=	61 T
43 Q	=	61 U
43 R	=	61 AT
43 S	=	61 V

The results of the AREE 61 investigation completed at each SA 43 are not included in this report.

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6.1 STUDY AREA 43A

6.1.1 Study Area Background and Conditions

SA 43A was the former central distribution facility for all of the historic gas stations. It was located in what is now the Petroleum, Oil, and Lubricant (POL) Storage yard across Market Street from the Defense Reutilization Marketing Office Building 204 (DRMO; Study Area 32), and between Antietam Street, Cook Street, and Market Street (Figure 6.1-2). Gasoline was delivered to this facility by railroad tank cars and was off-loaded into above ground storage tanks (ASTs) and USTs. From there it was transported by truck to the individual historic gas stations. The distribution facility consisted of the main gasoline station building (Building T-401), the gasoline pumphouse (P-186), and seven storage tanks totaling 76,000 gallons [three 12,000 gallon USTs, two 12,000 gallon ASTs, and two 8,000 gallon ASTs] (Barbour, 1941) (see Figure 6.1-2).

The four ASTs, originally located in a pit behind Building T-401, were removed between 1965 and 1972 (Detrick, 1991). There is no other data available on the removal of these ASTs. A total of five USTs, consisting of four 12,000 gallon USTs and one 10,000 gallon UST, were excavated from the site in 1989 and 1990 (EA, 1990). The 12,000 gallon USTs and the 10,000 gallon UST had apparently been used at the site for fuel-oil storage; however, no records of these USTs were available. The remaining three USTs were located beneath the historic gasoline pumphouse (Building P-186), and it is likely that they were used for gasoline storage, only, during the 1940s.

After removal of the USTs and 800 cubic yards of contaminated soil, confirmatory soil samples were collected from the excavation and analyzed for TPHC. The highest TPHC concentration was 237 milligrams per kilogram (mg/kg) (Environmental Applications [EA], 1990). The excavations were backfilled and no further soil removal occurred at this area.

In October 1990, a limited hydrogeological assessment of the POL site was conducted (GZA Remediation, Inc. [GZAR], 1990). GZAR concluded that "no significant fuel contamination remains in the vicinity of the former leaking underground storage tanks." However, GZAR's investigation did not include the western part of the POL area, where the ASTs and the main gasoline station (Building T401) were formerly located.

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SECTION 6

Five new USTs were installed at the POL storage yard, in 1991. These USTs are currently used to store fuel for military vehicles used on Fort Devens.

In 1992, a limited soil removal for surface soil contamination, was completed. Soil was removed from around the existing pump and valve pit which is used to fill fuel distribution trucks. The area around the pump and valve pit and the existing UST refill pipes was paved to act as a containment structure for future spills.

6.1.2 Site Investigation Program Summary

The SI at SA 43a was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992b) and in conformance to the provisions of the POP (ABB-ES, 1992a). The field sampling program at SA 43A was designed to investigate the nature and distribution of subsurface soil and, if possible, groundwater contamination. Subsurface soil samples were collected for field analysis at two areas within SA 43A (see Figure 6.1-2). SA 43A was divided into two areas due to the different site conditions at each area. Area 1, located at the corner of Antietam Street and Cook Street, is comprised of the former gas station (Building T-401) and the area around the former ASTs. Area 2 consists of the active POL storage yard and the former gasoline pumphouse and historic USTs (see Figure 6.1-2).

The field investigation at each area consisted of a surficial geophysical investigation, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the soil samples collected with the TerraProbe unit, soil borings to collect subsurface soil samples for laboratory analysis, and a geodetic survey to locate the TerraProbe points and soil borings. The soil samples collected with the TerraProbe unit were analyzed on a GC for BTEX and on an IR unit for TPHC. The TPHC analysis used a slightly modified version of USEPA Method 418.1 (see Section 3.2.3 for details).

Area 1. The surficial geophysical investigation was conducted at Area 1 consisting of a metal detector survey, a magnetometer survey, and a GPR survey. These surveys were designed to determine if there were any abandoned USTs or associated piping present at Area 1 (Figure 6.1-3).

A total of 22 soil samples were collected from eight TerraProbe points at Area 1 (see Figure 6.1-3). The remaining eight proposed TerraProbe points were not sampled due to difficult subsurface conditions encountered in the initial eight points. Eight soil samples were collected from 0 feet to 2 feet, and five soil samples were collected from 11 feet to 21 feet for field analysis, nine soil samples were collected between 25 feet and 32 feet bgs, which appears to be the approximate depth of the water table at Area 1. All of the subsurface soil samples were analyzed in the field for BTEX and TPHC.

Two subsurface soil samples were collected for laboratory analysis from one soil boring (43A-92-01X) drilled at Area 1 (see Figure 6.1-3). Soil samples were collected from 0 feet to 2 feet and 27 feet to 29 feet bgs. Both soil samples were analyzed for VOCs, TPHC, and lead.

Area 2. The surficial geophysical investigation was conducted at Area 2 consisting of a metal detector survey, a magnetometer survey, and a GPR survey (Figure 6.1-4). These surveys were designed to determine if there were any abandoned USTs or associated piping present at Area 2.

A total of 22 soil samples were collected from nine TerraProbe points for field analysis (see Figure 6-4). The remaining point, TP-19, was not sampled. Three soil samples were collected from TerraProbe points at 0 feet to 2 feet, and nine soil samples were collected from 11 feet to 16 feet, and ten soil samples were collected from 22 feet to 28 feet, which appears to be the approximate depth of the groundwater table at Area 2. All of the subsurface soil samples were analyzed in the field for BTEX and TPHC.

Two subsurface soil samples were collected for laboratory analysis from the one soil boring (43A-92-02X) drilled at Area 2 (see Figure 6.1-4). Soil samples were collected from 10 feet to 12 feet and 25 feet to 27 feet bgs. Both soil samples were analyzed for VOCs, TPHC, and lead. The three existing monitoring wells around Area 2 (POL-1, POL-2, and POL-3) were not sampled as part of the SI field investigation. However, the wells have been sampled in the past and the results are presented below.

SECTION 6

6.1.3 Field Investigation Results and Observations

The soils at SA 43A consisted of poorly graded sand with trace amounts of silt. The soil boring 43A-92-01X at Area 1 was advanced to 32 feet bgs and the soil boring 43A-92-02X at Area 2 was advanced to 29 feet. The water table was encountered at 26.8 feet at Area 1 and at 26.1 feet at Area 2. Because no groundwater monitoring wells were installed as part of this SI field investigation, the aquifer properties and groundwater quality at SA 43A could not be determined. Soil boring logs are provided in Appendix B.

Area 1. The geophysical surveys performed at Area 1 did not indicate the presence of any abandoned USTs or associated piping. The geophysical measurements collected during the surveys are provided in Appendix L.

Eight soil samples were collected from 0 feet to 2 feet and five soil samples were collected from 11 feet to 21 feet for field analysis. No BTEX compounds were detected in any of these samples, however, TPHC was detected at 180 ppm in the 2 foot sample collected from TP-04. No other TPHC was detected (Table 6.1-1; Figure 6.1-5 and 6.1-6). Nine soil samples were collected from depths of 25 feet to 32 feet bgs, which appears to be the approximate depth of the groundwater table at Area 1. BTEX compounds and TPHC were detected in TP-12, only. Toluene, ethylbenzene and xylenes were detected, with a total concentration of 57,000 ppb, and TPHC was detected at 4,000 ppm. No benzene was detected (see Table 6.1-1; Figure 6.1-7).

Two subsurface soil samples were collected for laboratory analysis from 43A-92-01X (Figure 6.1-8). No VOCs or TPHC were detected in the 0 foot to 2 foot sample. Lead was detected above the established Fort Devens background concentration at 120 $\mu\text{g/g}$ in this sample. VOCs and TPHC were detected in the soil sample collected from 27 feet to 29 feet. Tetrachloroethylene was detected at 0.01 $\mu\text{g/g}$ and TPHC was detected at 44.1 $\mu\text{g/g}$. Lead was detected at 6.05 $\mu\text{g/g}$ which was below the established background concentration (Table 6.1-2; see Figure 6.1-8).

Area 2. The geophysical surveys completed at Area 2 indicated the location of the active fiberglass USTs, but did not identify any abandoned USTs or associated piping. The geophysical measurements collected during the surveys are presented in Appendix L.

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Three soil samples were collected from three TerraProbe points at 0 feet to 2 feet bgs. No BTEX compounds were detected in any of the samples, but TPHC was detected in all three ranging from 610 ppm to 1,200 ppm (see Table 6.1-1; Figure 6.1-9). Nine soil samples were collected from 11 feet to 16 feet at Area 2. No BTEX compounds or TPHC were detected in any of these samples (Figure 6.1-10). Ten soil samples were collected from 22 feet to 28 feet, which appears to be the approximate depth of the groundwater table at Area 2. Toluene, ethylbenzene, and xylenes were detected in several samples collected from this depth. TPHC was detected in six of the 10 samples ranging from <52 ppm to 180,000 ppm (see Table 6.1-1; Figure 6.1-11).

Two subsurface soil samples were collected for laboratory analysis from 43A-92-02X (Figure 6.1-12). No VOCs or TPHC were detected in the 10 foot sample. Xylene was detected at 0.03 $\mu\text{g/g}$ and TPHC was detected at (10,900 $\mu\text{g/g}$) in the 25 foot to 27 foot sample. Lead was not detected above the established background concentration in either of the samples collected (see Table 6.1-2; see Figure 6.1-12).

The existing monitoring wells (POL-1, POL-2, and POL-3) were sampled by Ecology and Environment (E&E) personnel in early 1993. The groundwater samples were analyzed for VOC, SVOCs, inorganics (POL-1 and POL-3), and hardness. Chloroform and di-n-butylphthalate were detected in POL-1 and POL-3. Chloroform in POL-3 at 0.73 $\mu\text{g/L}$ and di-n-butylphthalate in POL-1 at 4.0 $\mu\text{g/L}$. Trichloroethene and/or xylene were detected in each sample (Table 6.1-3; see Figure 6.1-12). Each of the inorganic analytes detected were above the established Fort Devens background; these samples were unfiltered. A filtered inorganics sample was also collected from POL-3. The results of this sample showed only two inorganic analytes, calcium and sodium, above the established Fort Devens background (see Table 6.1-3).

6.1.4 Nature and Distribution of Contamination (Field Analytical and Laboratory Results)

Area 1. The objective of the field sampling program at Area 1 was to investigate the presence or absence of soil and groundwater contamination caused by spills or leaks associated with the historic gas station. The primary concern at Area 1 was that fuel-related contaminants had percolated through the soil to the groundwater. To evaluate the migration pathways surface soil and subsurface soil samples,

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SECTION 6

including subsurface soil samples from the water table, were collected and analyzed in the field and at an off-site laboratory. The results of the surface soil and intermediate subsurface soil samples (0 feet to 21 feet), collected for field analysis, appear to indicate that spills and/or leaks associated with the former ASTs, did not cause a significant amount of contamination in and around Area 1. However, elevated concentrations of fuel-related contaminants were detected in the field analysis sample collected at the water table from TP-12. This contamination appears to be a result of an upgradient (Area 2 to the northeast) source due to the lack of shallow soil contamination. The laboratory results did not correlate well with the field analysis sample, however, TPHC was detected at the water table above the laboratory detection limit.

Area 2. The objective of the field sampling program at Area 2 was to investigate the presence or absence of soil and groundwater contamination caused by spills or leaks from former USTs which were associated with the historic gas station. The primary concern at Area 2 was that the fuel-related contaminants had percolated through the soil to the groundwater. To evaluate the migration pathways, surface soil and subsurface soil samples, including subsurface soil samples from the water table, were collected and analyzed in the field and at an off-site laboratory. The results of the surface soil samples indicated the presence of TPHC around the existing pump and valve pit. This contaminated soil has subsequently been removed from the site during the 1992 soil removal. The intermediate subsurface soil samples (11 feet to 16 feet) appear to indicate that spills and/or leaks associated with the refueling activities in the POL storage yard, have not caused a significant amount of soil contamination at these depths at Area 2. However, elevated concentrations of fuel-related contaminants were detected at the water table in six of the ten subsurface soil samples collected for field analysis. Laboratory analysis of the subsurface soil sample collected from the water table confirmed these results. This contamination appears to be a result of leaks and residual soil contamination associated with one or more of the former USTs. It appears, from the soil results from Area 1, that the contaminants from Area 2 are migrating to the southwest along the top of the water table.

Groundwater samples were collected from the existing monitoring well as part of the Group 1B field investigation. The results of these groundwater samples showed that a fuel-related compound and a solvent were present in the groundwater at the existing monitoring well locations. Inorganic analytes detected above their established background appeared to be caused by abundant TSS.

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However, based on these results and the results of the soil samples collected at the water table at Area 1 and Area 2, it appears that groundwater contamination is present at 43A.

6.1.5 Source Evaluation and Migration Potential

Fuel-related VOCs and TPHC were detected in subsurface soil samples collected at the water table at Area 1 and Area 2. No groundwater samples were collected for field or laboratory analysis during the 1992 SI field investigation; however, groundwater samples collected as part of the Group 1B investigation, from existing monitoring wells, indicate the presence of a fuel-related compound and a solvent-related compound in the groundwater at this site. The primary transport mechanism for the contaminants detected at this site is via dissolved phase or free product in the groundwater.

6.1.6 Preliminary Human Health Risk Evaluation

Field-screening of 23 shallow and intermediate depth TerraProbe soil samples revealed no measurable concentrations of BTEX to a depth of 21 feet. TPHC was detected above the method detection limit in three of these 23 samples, ranging from 180 ppm to 1,200 ppm. When these results are compared to the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline, there appears to be no significant risk to public health from soil contamination at SA 43A.

At depths below 21 feet, the approximate water table depth, field-screening results from 16 TerraProbe soil samples indicate significant contamination from toluene, ethylbenzene, and xylenes in soils primarily located in the active POL yard (Area 2). Additionally, TPHC levels range up to 23,000 ppm. These results are clearly indicative of significant groundwater contamination from petroleum products.

Two confirmatory borings by ABB-ES support the field-screening results. Shallow soils in both Area 1 (43A-92-01X) and Area 2 (43A-92-02X) showed little TPHC contamination, although lead was detected at 120 $\mu\text{g/g}$ at the surface in Area 1. However, below 25 feet a soil sample from each boring showed TPHC contamination, with the Area 1 sample being relatively low at 44 $\mu\text{g/g}$ and the Area 2 sample confirming groundwater contamination at 10,900 $\mu\text{g/g}$. Although

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SECTION 6

the concentration of lead in the surface soil (120 $\mu\text{g/g}$) exceeds the background level, it is below the interim cleanup level of 500 to 1,000 ppm for lead.

6.1.7 Conclusions and Recommendations

Although human health risks are not significant and ecological risks are not relevant to the subsurface environment of this study area, it is apparent from the data collected that the groundwater quality (and subsurface soil in the saturated zone) at SA 43A has been adversely impacted by historical activities.

Based on these findings, it is recommended that an RI/FS be conducted at this study area to further define the distribution of contamination and evaluate the need for clean up. It is also recommended that this study area be administratively transferred to Group 1B due to its geographical location.

TABLE 6.1-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE A

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTX	BEN* ppb	TOI* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
AREA 1												
43TSA02XX201XF	43A	SOIL	TP-02	2	<52	0	ND	ND	ND	ND	ND	
43TSA02X2501XF	43A	SOIL	TP-02	25	<55	0	ND	ND	ND	ND	ND	
43TSA04XX201XF	43A	SOIL	TP-04	2	180	0	ND	ND	ND	ND	ND	
43TSA04X2901XF	43A	SOIL	TP-04	29	<57	0	ND	ND	ND	ND	ND	
43TSA06XX201XF	43A	SOIL	TP-06	2	<54	0	ND	ND	ND	ND	ND	
43TSA06X1101XF	43A	SOIL	TP-06	11	<58	0	ND	ND	ND	ND	ND	
43TSA06X2501XF	43A	SOIL	TP-06	25	<52	0	ND	ND	ND	ND	ND	
43TSA10XX201XF	43A	SOIL	TP-10	2	<55	0	ND	ND	ND	ND	ND	
43TSA10X1101XF	43A	SOIL	TP-10	11	<52	0	ND	ND	ND	ND	ND	
43TSA10X2801XF	43A	SOIL	TP-10	28	<62	0	ND	ND	ND	ND	ND	
43TSA11XX201XF	43A	SOIL	TP-11	2	<52	0	ND	ND	ND	ND	ND	
43TSA11X2901XF	43A	SOIL	TP-11	29	<52	0	ND	ND	ND	ND	ND	
43TSA11X3201XF	43A	SOIL	TP-11	32	<55	0	ND	ND	ND	ND	ND	
43TSA12XX201XF	43A	SOIL	TP-12	2	<52	0	ND	ND	ND	ND	ND	
43TSA12X1401XF	43A	SOIL	TP-12	14	<55	0	ND	ND	ND	ND	ND	
43TSA12X2801XF	43A	SOIL	TP-12	28	4000	57000	ND	9100	11000	30000	6900	

NOTES:

* = ND denotes a non detect or concentrations below 5 ppb.

** = ND denotes a non detect or concentrations below 10 ppb

*** = Detection of Noncalibrated Petroleum Hydrocarbons

= Study area

**TABLE 6.1-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE A**

**SITE INVESTIGATION REPORT
FORT DEVENS, MA**

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSA14XX201XF	43A	SOIL	TP-14	2	< 52	0	ND	ND	ND	ND	ND	
43TSA14X1101XF	43A	SOIL	TP-14	11	<51	0	ND	ND	ND	ND	ND	
43TSA14X2101XF	43A	SOIL	TP-14	21	< 56	0	ND	ND	ND	ND	ND	
43TSA14X2601XF	43A	SOIL	TP-14	26	< 55	0	ND	ND	ND	ND	ND	
43TSA16XX201XF	43A	SOIL	TP-16	2	<54	0	ND	ND	ND	ND	ND	
43TSA16X2601XF	43A	SOIL	TP-16	26	< 52	0	ND	ND	ND	ND	ND	
AREA 2												
43TSA17XX101XF	43A	SOIL	TP-17	1	1200	0	ND	ND	ND	ND	ND	*** PHC's Detected
43TSA18X1301XF	43A	SOIL	TP-18	13	<53	0	ND	ND	ND	ND	ND	
43TSA18X2601XF	43A	SOIL	TP-18	26	3400	220	ND	ND	37	130	54	*** PHC's Detected
43TSA20X1501XF	43A	SOIL	TP-20	15	<62	0	ND	ND	ND	ND	ND	
43TSA20X1601XF	43A	SOIL	TP-20	16	<55	0	ND	ND	ND	ND	ND	
43TSA20X2501XF	43A	SOIL	TP-20	25	<65	0	ND	ND	ND	ND	ND	
43TSA20X2601XF	43A	SOIL	TP-20	26	<62	0	ND	ND	ND	ND	ND	
43TSA21X1101XF	43A	SOIL	TP-21	11	<52	0	ND	ND	ND	ND	ND	
43TSA21X2301XF	43A	SOIL	TP-21	23	23000	22400	ND	2000	2700	13000	4700	
43TWA21X2501XF	43A	SOIL	TP-21	25	180000	190	ND	ND	44	110	34	*** PHC's Detected

NOTES:

* = ND denotes a non detect or concentrations below 5 ppb.

** = ND denotes a non detect or concentrations below 10 ppb

*** = Detection of Noncalibrated Petroleum Hydrocarbons

= Study area

TABLE 6.1-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE A

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA#	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSA22X1501XF	43A	SOIL	TP-22	15	<52	0	ND	ND	ND	ND	ND	
43TSA22X2301XF	43A	SOIL	TP-22	23	<52	0	ND	ND	ND	ND	ND	
43TSA22X2801XF	43A	SOIL	TP-22	28	21000	7600	ND	610	1600	3200	2200	
43TSA23X1501XF	43A	SOIL	TP-23	15	<54	0	ND	ND	ND	ND	ND	
43TSA24X201XF	43A	SOIL	TP-24	2	610	0	ND	ND	ND	ND	ND	
43TSA24X1501XF	43A	SOIL	TP-24	15	<55	0	ND	ND	ND	ND	ND	
43TSA24X2601XF	43A	SOIL	TP-24	26	<65	0	ND	ND	ND	ND	ND	
43TSA25X1501XF	43A	SOIL	TP-25	15	<53	0	ND	ND	ND	ND	ND	
43TSA25X2201XF	43A	SOIL	TP-25	22	<63	0	ND	ND	ND	ND	ND	
43TSA26X201XF	43A	SOIL	TP-26	2	610	0	ND	ND	ND	ND	ND	
43TSA26X1301XF	43A	SOIL	TP-26	13	<51	0	ND	ND	ND	ND	ND	
43TSA26X2601XF	43A	SOIL	TP-26	26	1600	260	ND	9.2	33	140	77	*** PHC's Detected,

NOTES:

- * = ND denotes a non detect or concentrations below 5 ppb.
- ** = ND denotes a non detect or concentrations below 10 ppb
- *** = Detection of Noncalibrated Petroleum Hydrocarbons
- # = Study area

TABLE 6.1-2
INORGANIC AND ORGANIC COMPOUNDS IN SOIL
SA 43A - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACK - GROUND	BORING DEPTH	43A-92-01X		43A-92-02X	
			0	27	10	25
ORGANICS (ug/g)						
ACETONE			< 0.0008	< 0.0008	< 0.0008	< 0.0008
TETRACHLOROETHYLENE/TETRACHLOROETHENE			< 0.0008	0.01	< 0.0008	< 0.0008
XYLENES			< 0.0015	< 0.0015	< 0.0015	0.03
INORGANICS (ug/g)						
LEAD	48.4		120.0	6.05	3.73	3.42
OTHER (ug/g)						
TOTAL ORGANIC CARBON			NA	653.0	NA	10500.0
TOTAL PETROLEUM HYDROCARBONS			< 27.9	44.1	< 27.9	10900.0

NOTES:

TABLE LISTS DETECTED ANALYTES ONLY -
SEE PROJECT ANALYTE LIST FOR SUMMARY
< = LESS THAN DETECTION LIMIT SHOWN
NA = NOT ANALYZED

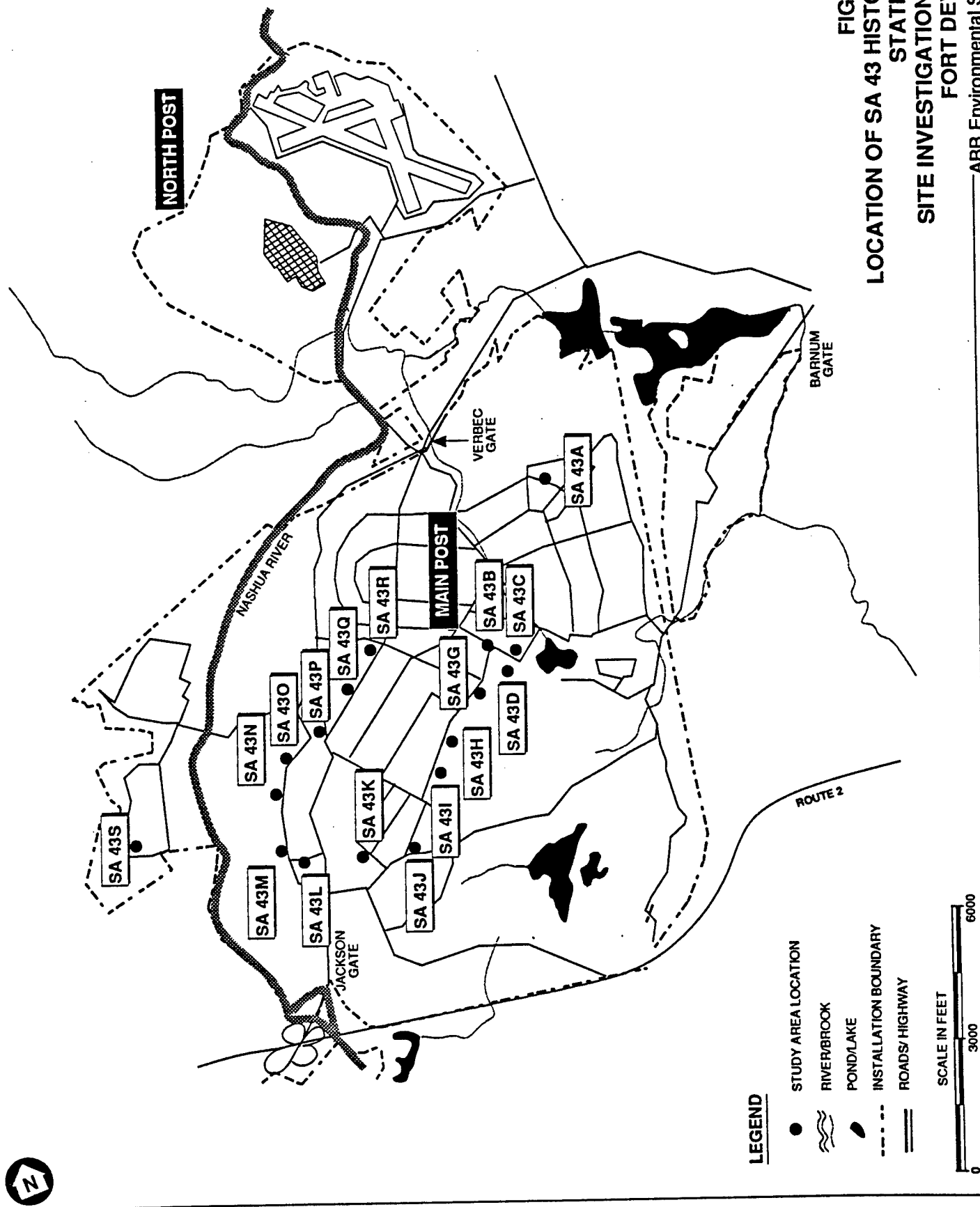
TABLE 6.1-3
ANALYTES IN GROUNDWATER
GROUP 1A RESULTS NEAR HISTORIC GAS STATIONS - SA 43A

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACK - GROUND	POL-1	POL-2	POL-3	POL-3 FILTERED
ORGANICS (ug/L)					
CHLOROFORM		< 0.5	< 0.5	0.73	< 0.5
DI-N-BUTYL PHTHALATE		4.0	< 3.7	< 3.7	< 3.7
TRICHLOROETHENE		0.73	< 0.5	19.0	< 0.5
XYLENES		< 0.84	1.3	< 0.84	< 0.84
INORGANICS (ug/L)					
ALUMINUM	6870.0	70900.0	NA	116000.0	< 141.0
ARSENIC	10.5	650.0	NA	68.4	< 2.54
BARIUM	39.6	256.0	NA	623.0	15.6
CALCIUM	14700.0	25700.0	NA	45900.0	22200.0
COBALT	25.0	44.3	NA	81.8	< 25.0
CHROMIUM	14.7	114.0	NA	169.0	< 6.02
COPPER	8.09	107.0	NA	116.0	< 8.09
IRON	9100.0	90200.0	NA	213000.0	< 38.8
POTASSIUM	2370.0	17400.0	NA	37100.0	1840.0
MAGNESIUM	3480.0	17400.0	NA	34300.0	2660.0
MANGANESE	291.0	2430.0	NA	5760.0	3.99
SODIUM	10800.0	10400.0	NA	15100.0	11700
NICKEL	34.3	111.0	NA	144.0	< 34.3
LEAD	4.25	160.0	NA	180.0	1.95
VANADIUM	11.0	85.8	NA	176.0	< 11.0
ZINC	21.1	329.0	NA	738.0	< 21.1
OTHER (ug/L)					
TOTAL HARDNESS		62600.0	NA	113000.0	NA

NOTES:
TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST FOR SUMMARY
< = LESS THAN DETECTION LIMIT SHOWN
NA = NOT ANALYZED
= VALUE ABOVE BACKGROUND LEVEL

FIGURE 6.1-1
LOCATION OF SA 43 HISTORIC GAS
STATION SITES
SITE INVESTIGATION REPORT
FORT DEVENS, MA
 ABB Environmental Services, Inc.



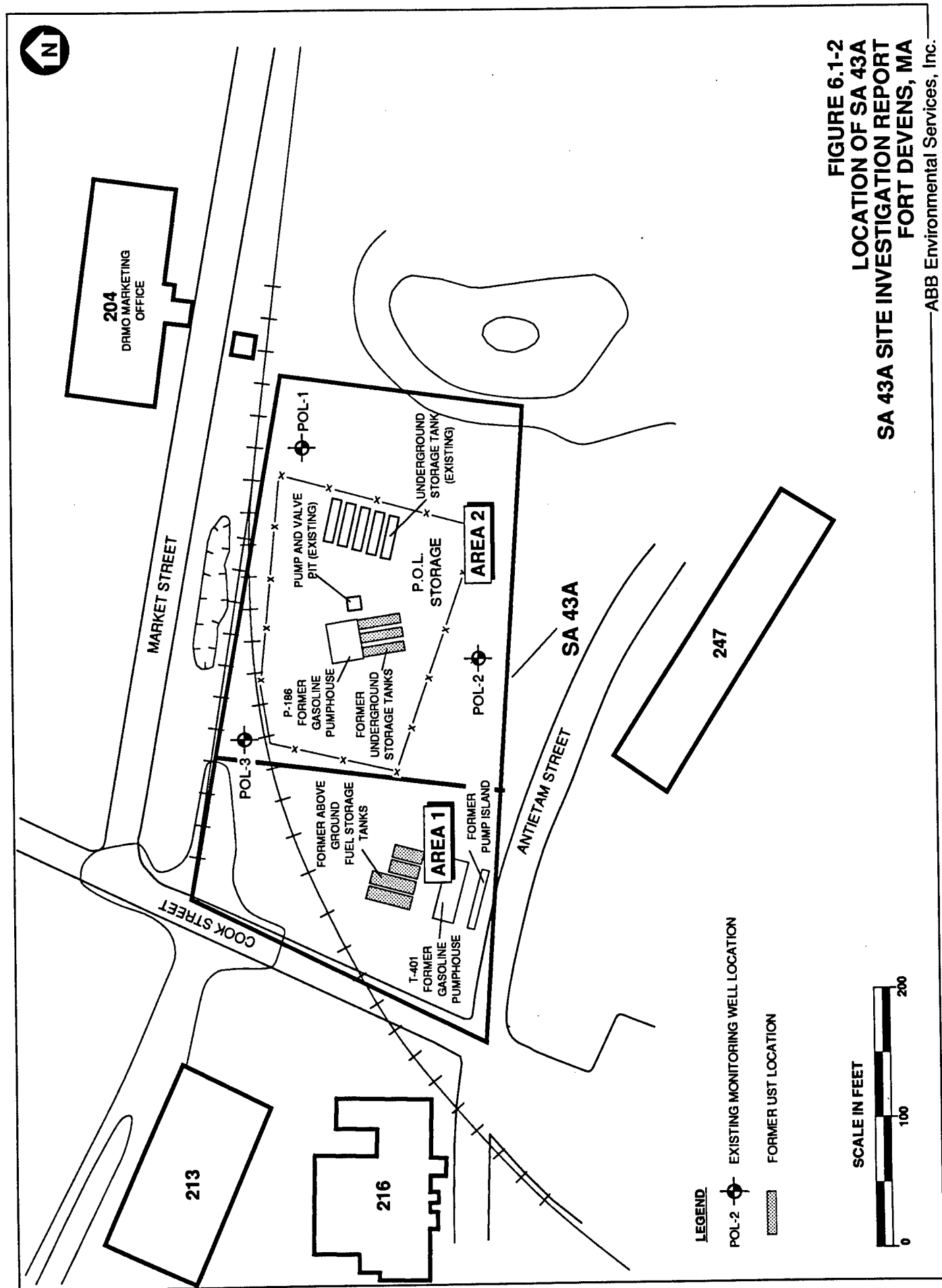


FIGURE 6.1-2
LOCATION OF SA 43A
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA
 ABB Environmental Services, Inc.

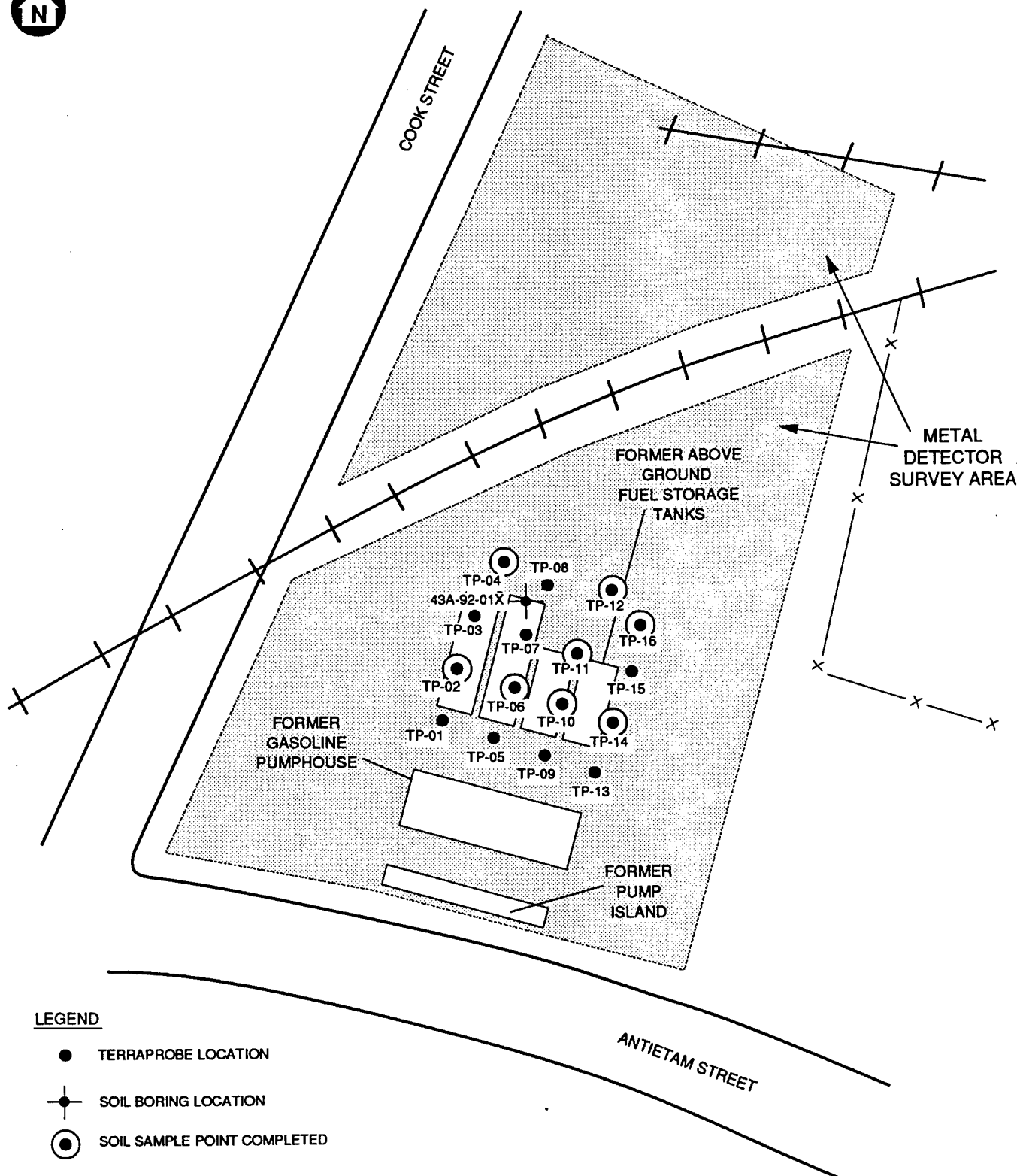


FIGURE 6.1-3
AREA 1 SOIL BORING AND
TERRAPROBE LOCATIONS
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



MARKET STREET

POL-3

POL-1

P-186
FORMER
GASOLINE
PUMPHOUSE

PUMP AND
VALVE PIT
(EXISTING)

TP-25

TP-24

TP-23

TP-17

FORMER
UNDERGROUND
STORAGE
TANKS

TP-19

TP-18

TP-20

TP-26

43A-92-02X

TP-21

TP-22

UNDERGROUND
STORAGE TANK
(EXISTING)

P.O.L.
STORAGE

AREA OF SURFICIAL
GEOPHYSICAL
SURVEYS

FENCE

GATE

POL-2

LEGEND

- TERRAPROBE LOCATION
- POL-2 ● EXISTING MONITORING WELL
- SOIL BORING LOCATION
- SOIL SAMPLING POINT COMPLETE

SCALE IN FEET



FIGURE 6.1-4
AREA 2 MONITORING WELL, SOIL BORING
AND TERRAPROBE LOCATIONS
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

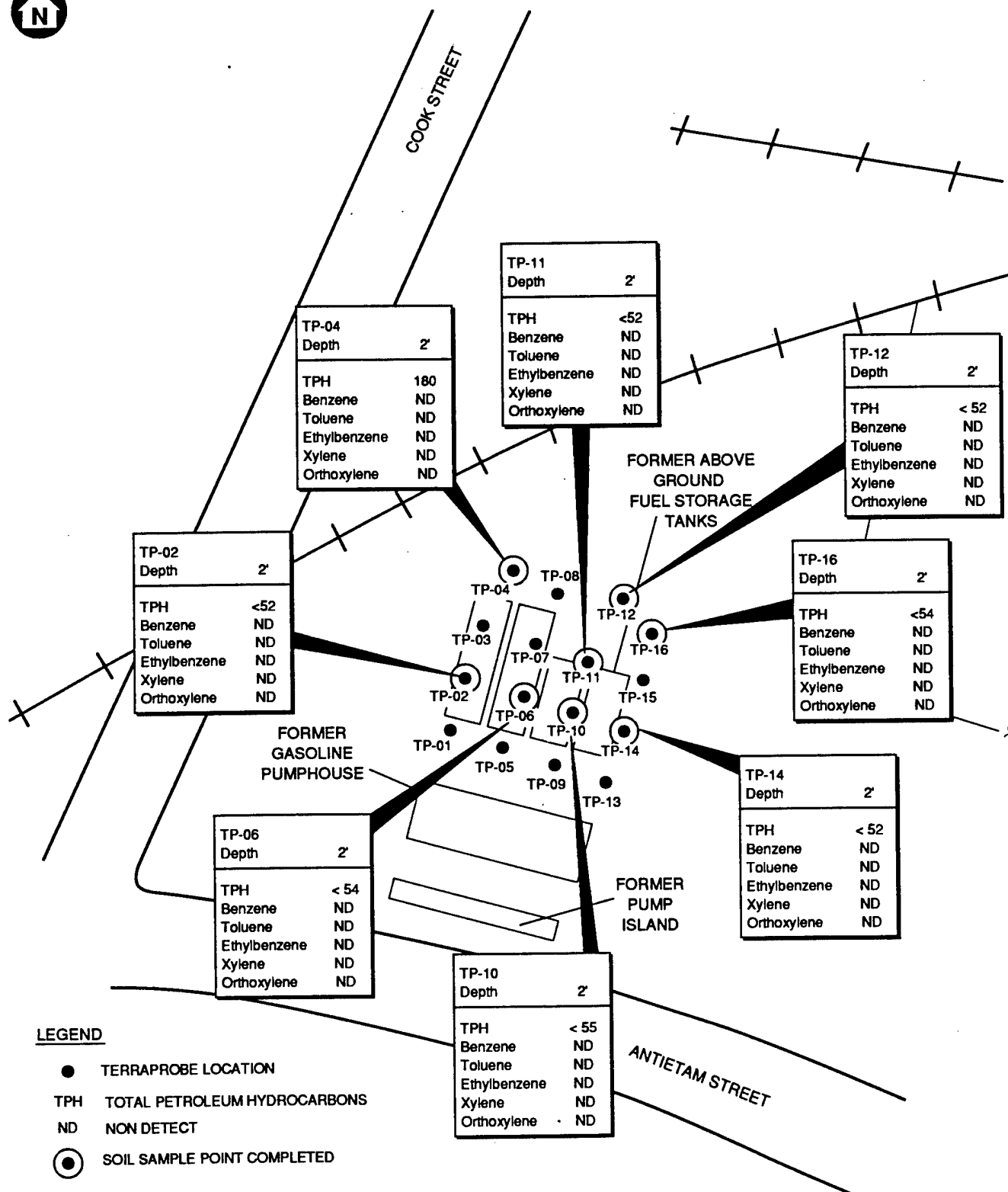


FIGURE 6.1-5
AREA 1 FIELD SCREENING RESULTS
DEPTH AT 0 TO 2 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

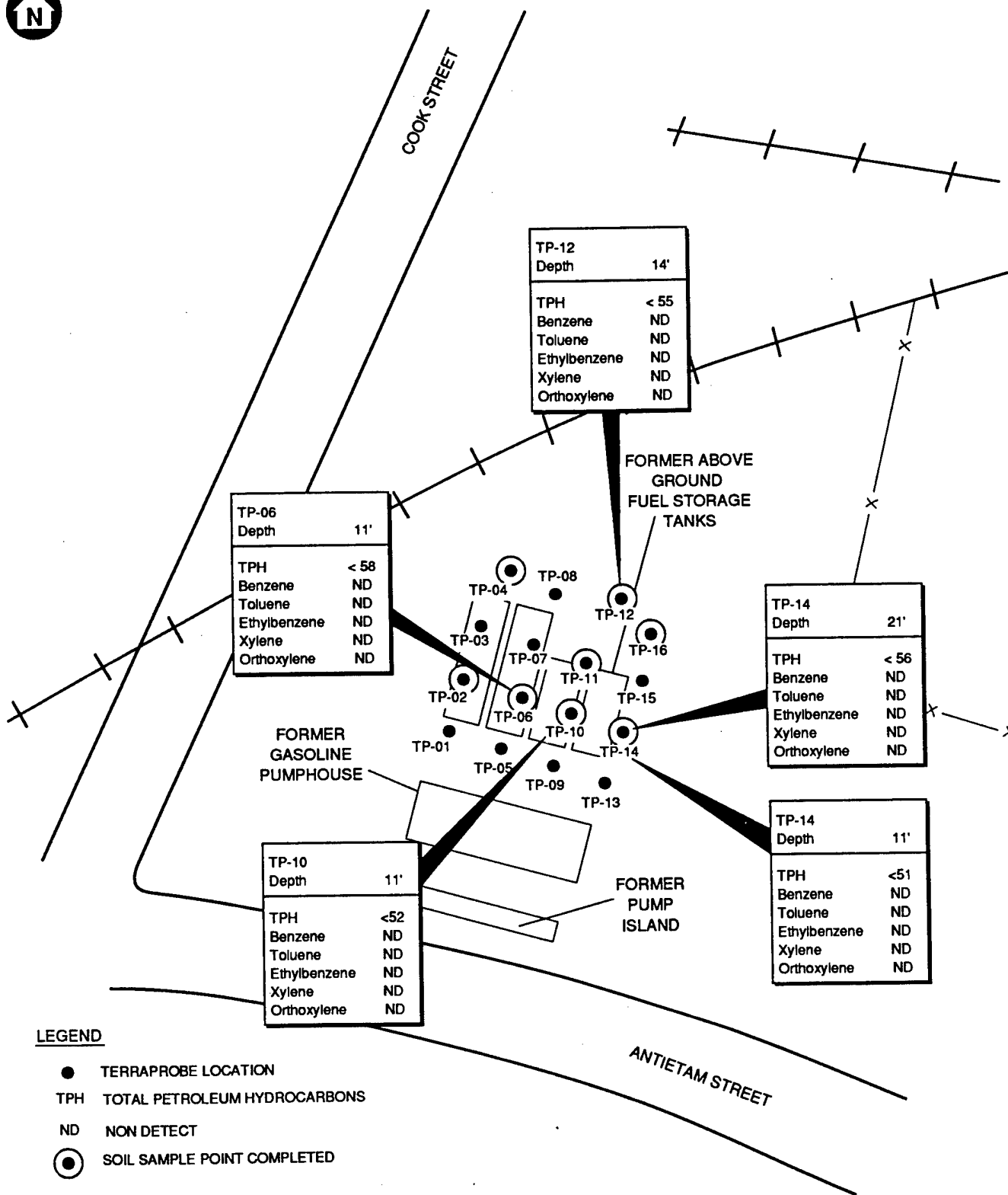
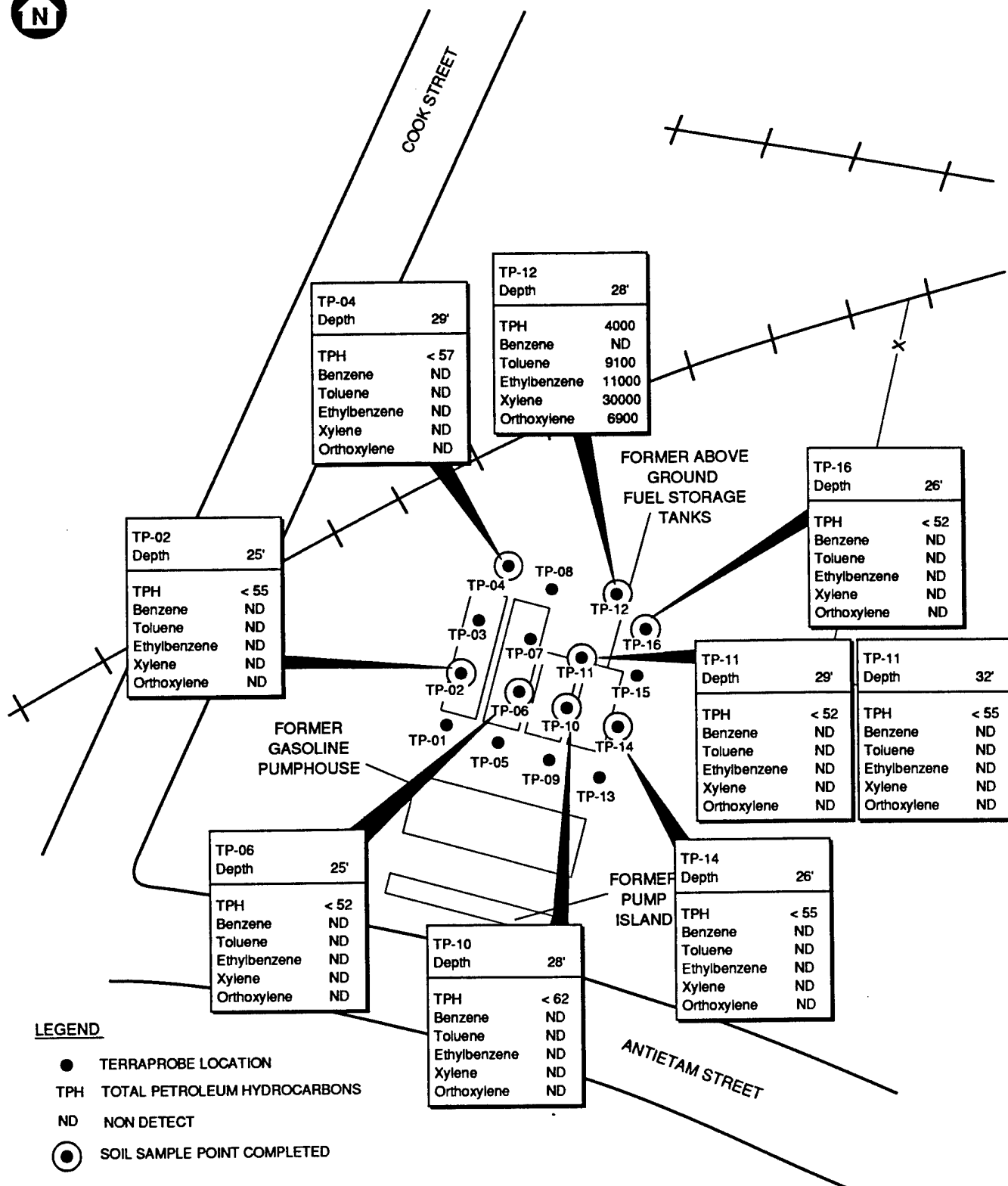


FIGURE 6.1-6
AREA 1 FIELD SCREENING RESULTS
DEPTH AT 11 TO 21 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



NOTES

TPH CONCENTRATIONS IN ppm
BTEX CONCENTRATIONS IN ppb

SCALE IN FEET

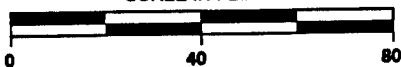
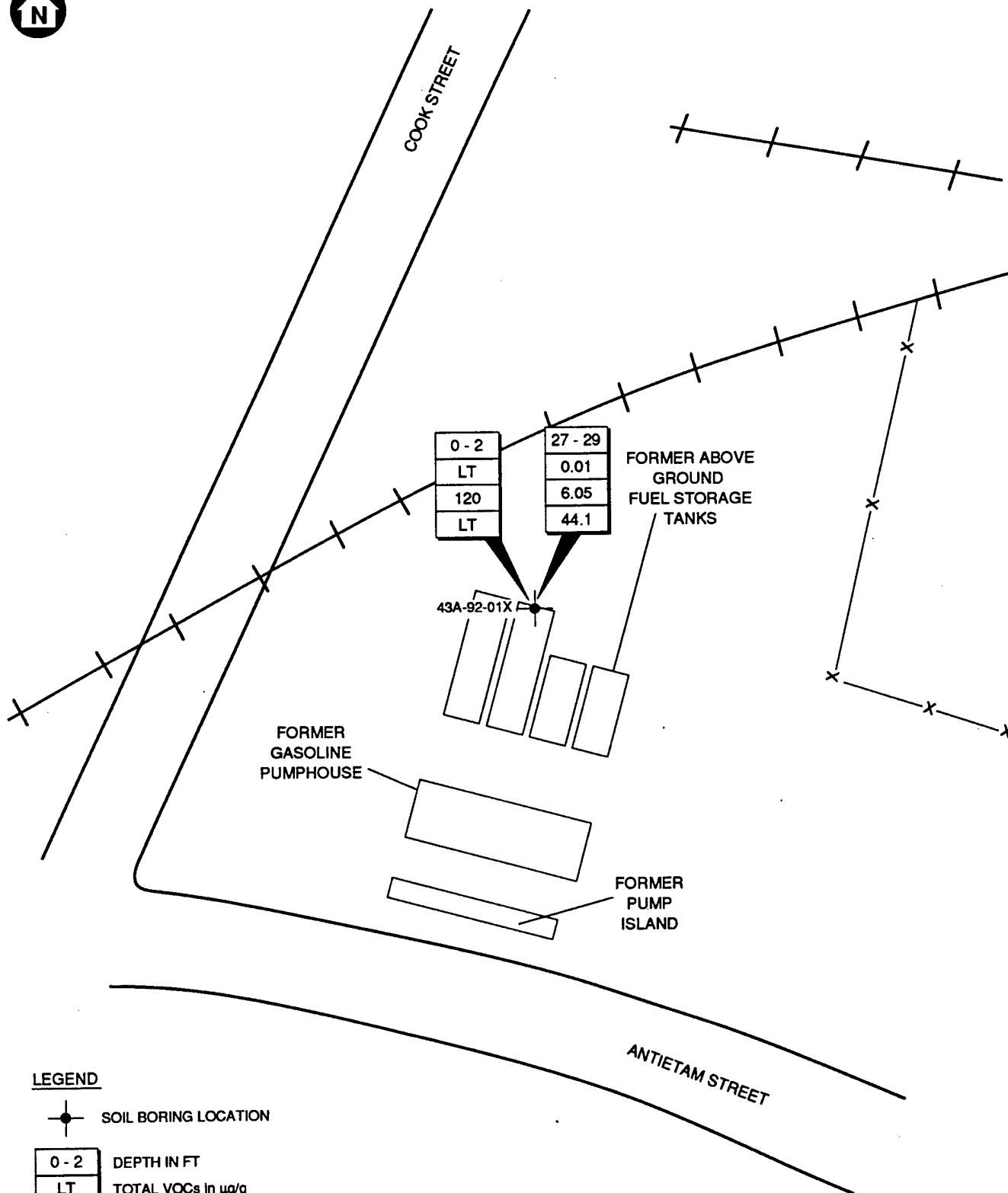


FIGURE 6.1-7
AREA 1 FIELD SCREENING RESULTS
DEPTH AT 25 TO 32 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND



SOIL BORING LOCATION

0 - 2
LT
9.1
LT

DEPTH IN FT

TOTAL VOCs in $\mu\text{g/g}$

LEAD in $\mu\text{g/g}$

TPHC in $\mu\text{g/g}$

LT

LESS THAN DETECTION LIMIT

SCALE IN FEET

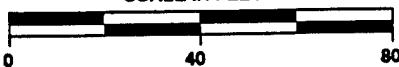
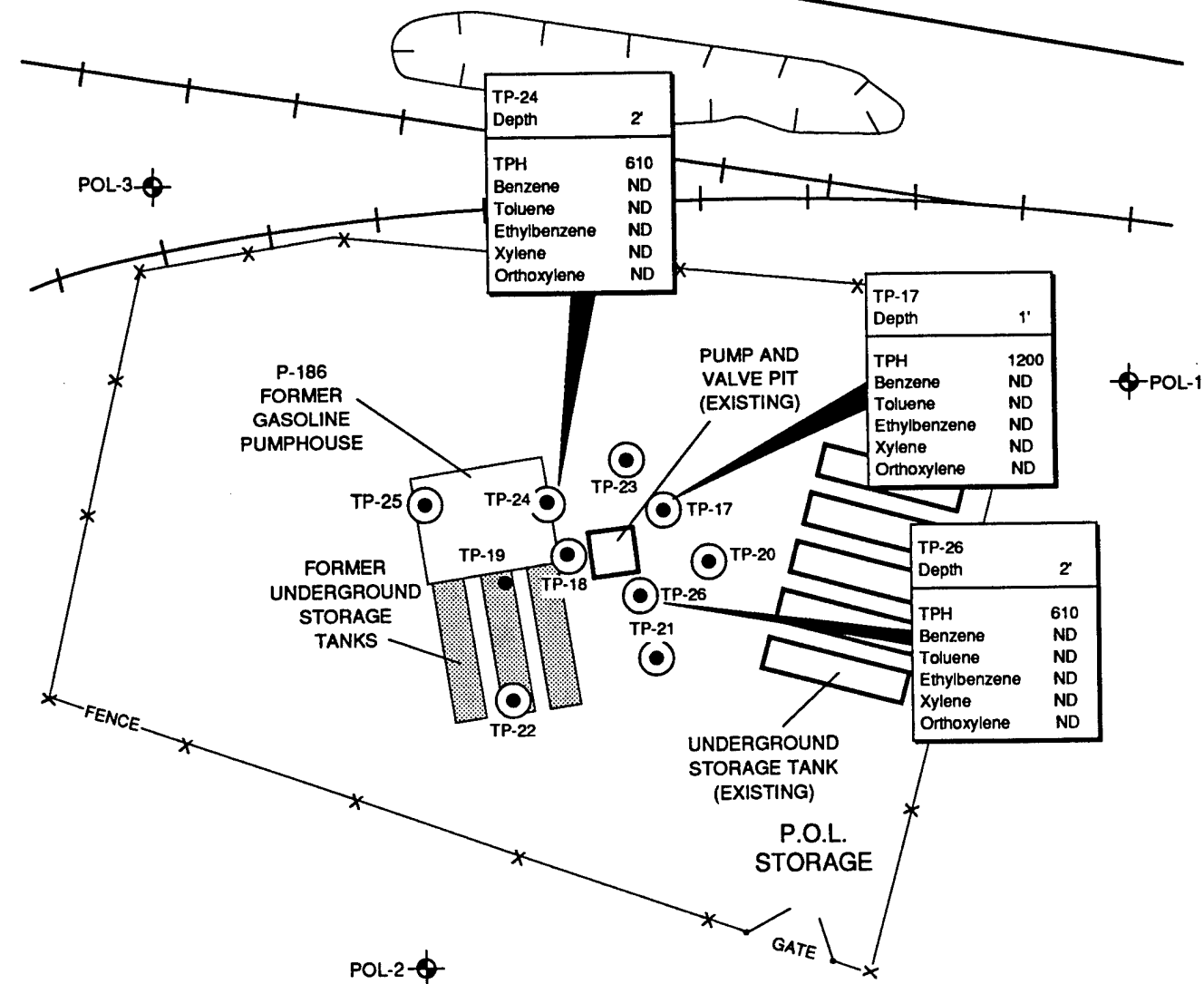


FIGURE 6.1-8
AREA 1 ANALYTES IN SOIL
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



MARKET STREET



LEGEND

- TERRAPROBE LOCATION
- POL-2 ● EXISTING MONITORING WELL
- TPH TOTAL PETROLEUM HYDROCARBONS
- ND NON DETECT
- SOIL SAMPLING POINT COMPLETE

NOTES

TPH CONCENTRATIONS IN ppm
BTEX CONCENTRATIONS IN ppb

SCALE IN FEET

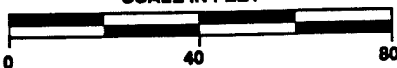


**FIGURE 6.1-9
AREA 2 FIELD SCREENING RESULTS
DEPTH AT 0 TO 2 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.



MARKET STREET

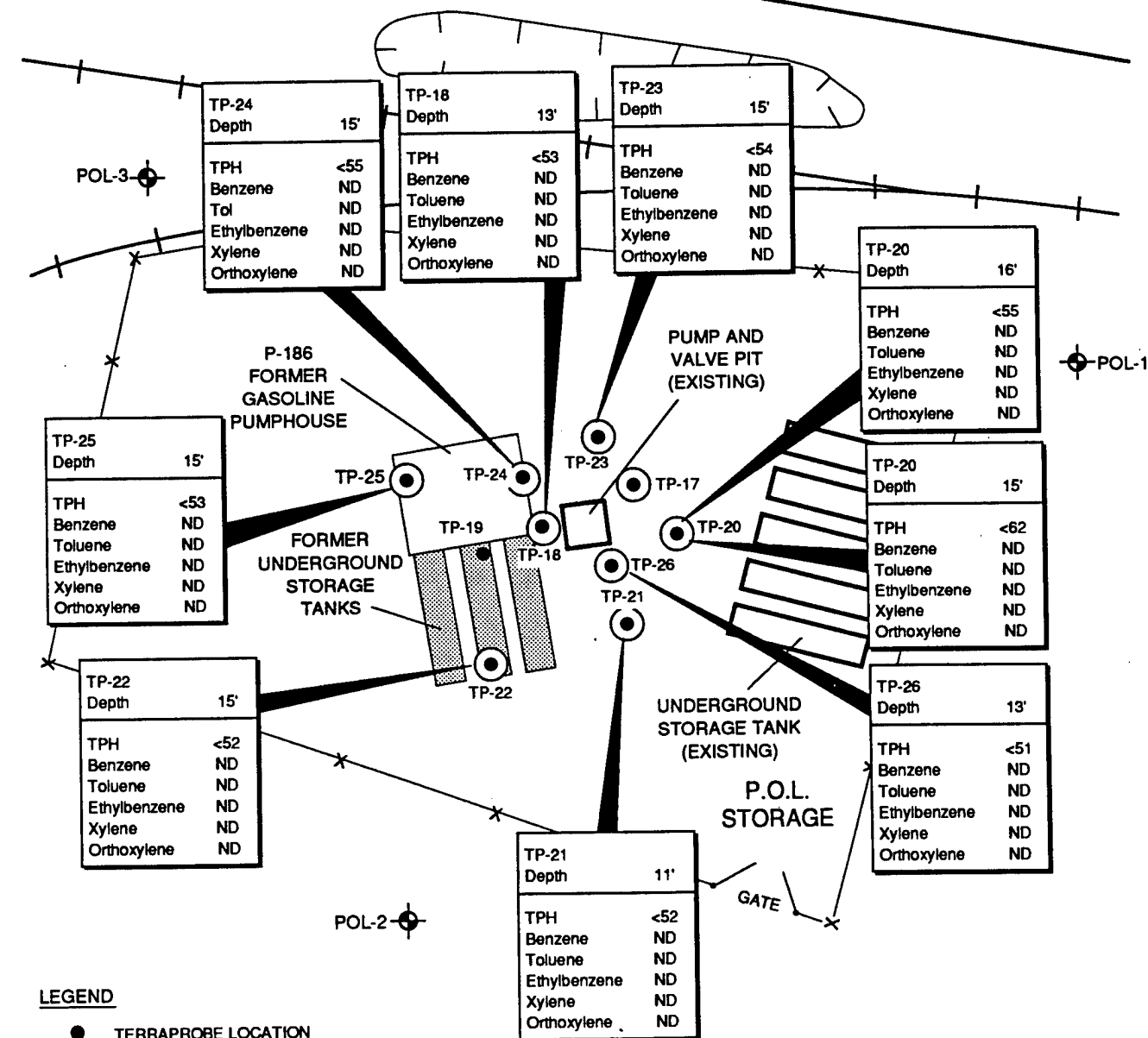


FIGURE 6.1-10
AREA 2 FIELD SCREENING RESULTS
DEPTH AT 11 TO 16 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



MARKET STREET

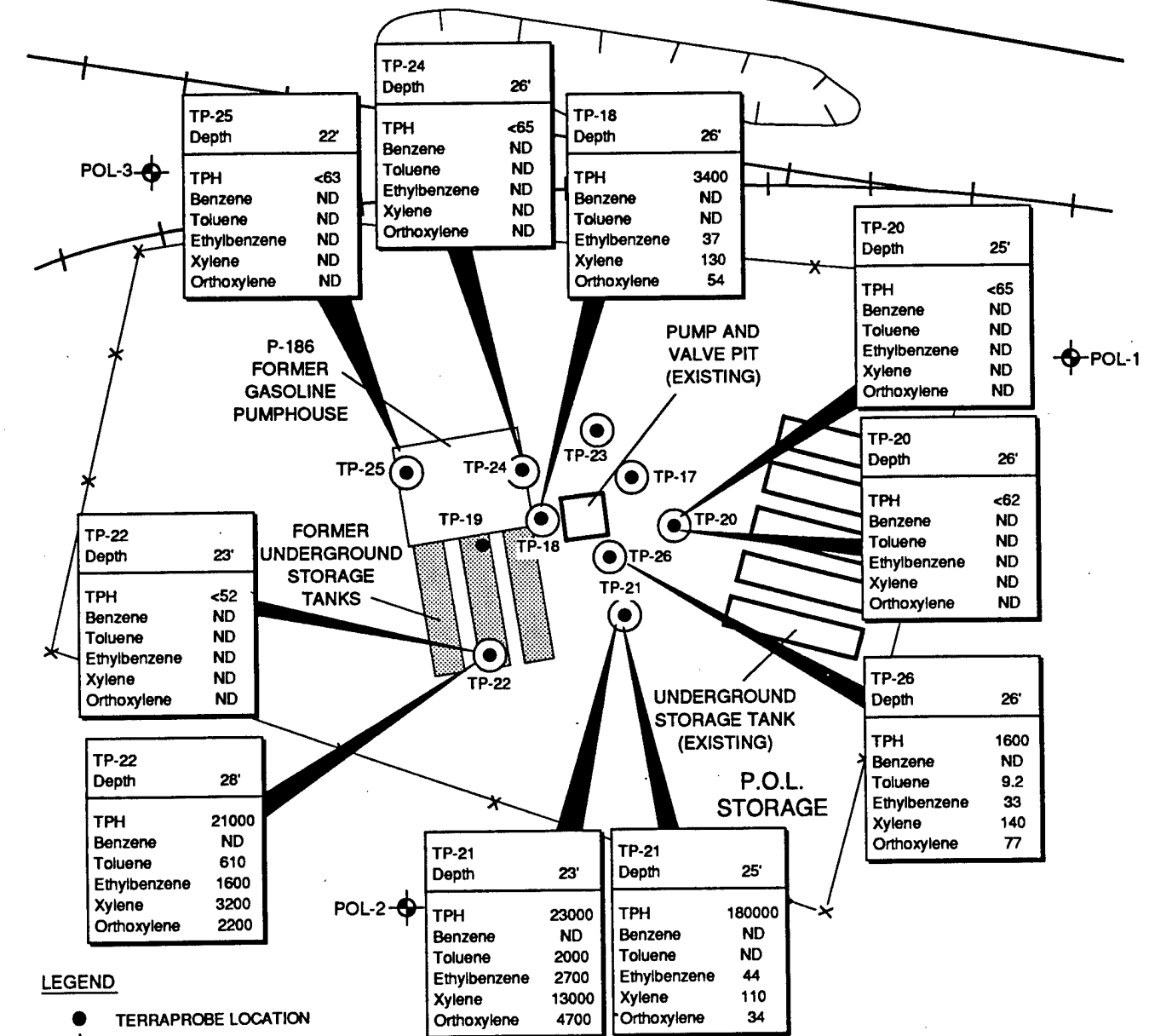
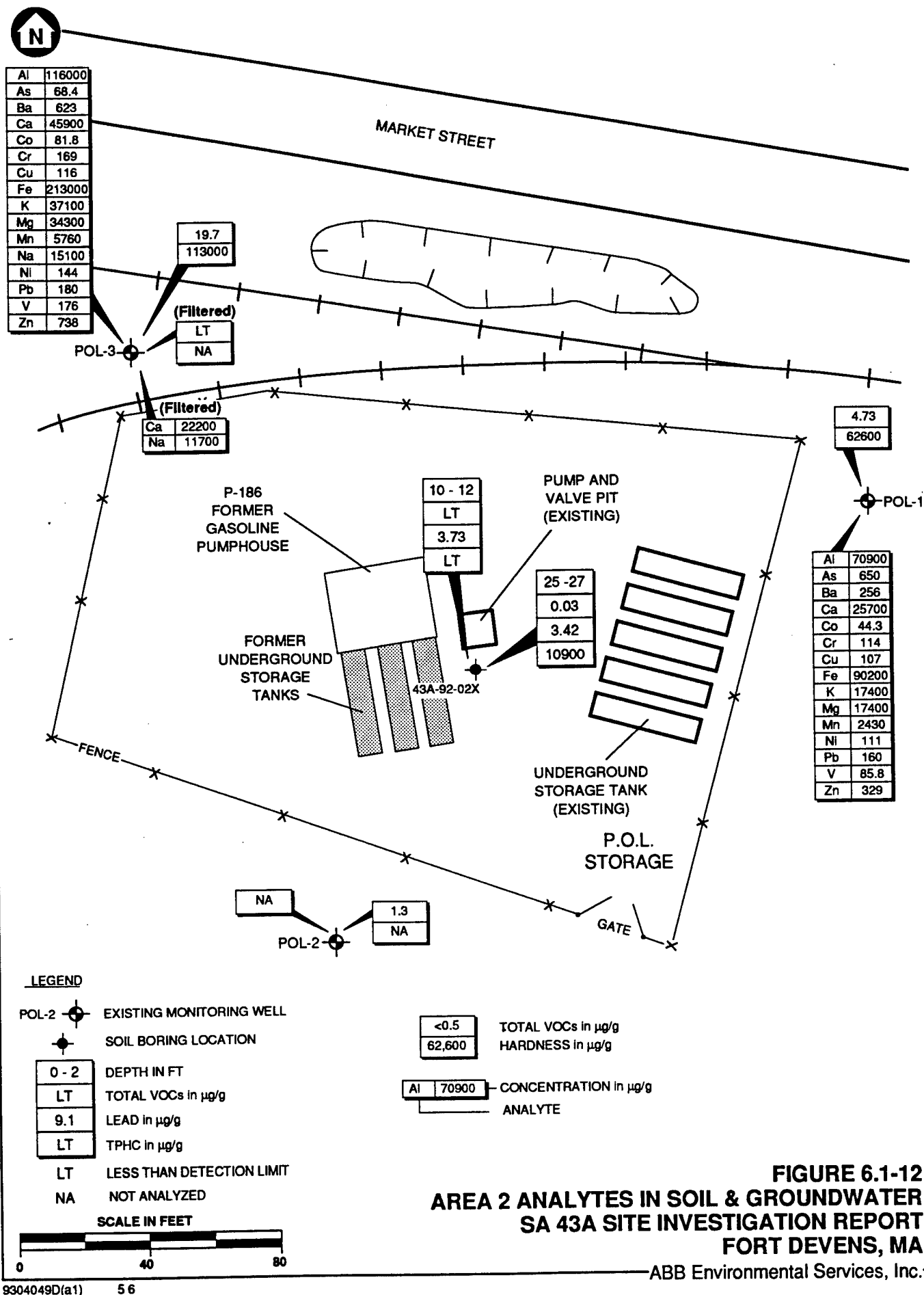


FIGURE 6.1-11
AREA 2 FIELD SCREENING RESULTS
DEPTH AT 22 TO 28 FT
SA 43A SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



6.2 STUDY AREA 43B

6.2.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43B consisted of a pump island and a small gasoline pumphouse. The gas station was a Type A design with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool and therefore, there was no evidence of the exact location of the historic gas station or that the UST had been removed. The reported location of this historic gas station was at the northern end of an access road that presently connects Queenstown Road and the Access Road to Patch Road (Figure 6.2-1). No buildings are presently located at the site and the site is covered with grass.

6.2.2 Site Investigation Program Summary

The SI at SA 43B was performed in accordance with the Final SI Historic Gas Stations Task Order Work Plan (ABB-ES, 1992b) and in conformance to the provisions of the POP (ABB-ES, 1992a). A field investigation was conducted to determine if the UST had been removed and if any residual contamination was still present in the subsurface soil. The program consisted of a surficial geophysical survey to determine if any abandoned USTs were present, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring to collect subsurface soil samples for off-site laboratory analysis. Table 6.2-1 summarizes the activities completed during the SI.

The geophysical investigation at SA 43B consisted of a metal detector survey, a magnetometer survey, and a GPR survey. The investigation covered an area 120 feet by 100 feet (see Figure 6.2-1).

Ten TerraProbe points were completed to investigate the presence or absence of residual soil contamination (see Figure 6.2-1). A total of 24 soil samples were collected for field analysis. Seven soil samples were collected from 5 feet and another seven soil samples were collected from 9 feet bgs. Ten soil samples were

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SECTION 6

collected from the water table at 15 feet. The field analysis performed on these samples consisted of a GC analysis for BTEX, and an IR scan for TPHC.

Two subsurface soil samples were collected for laboratory analysis from one soil boring (43B-92-01X) drilled at SA 43B (see Figure 6.2-1). These samples were analyzed for PAL VOCs, TPHC, and lead.

6.2.3 Supplemental Site Investigation Program Summary

The SSI at SA 43B was performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The following sections describe the field activities completed at SA 43B during the SSI. Table 6.2-1 summarizes the activities completed during the SSI.

The objective of subsurface soil sampling program at SA 43B was to investigate the nature of the contamination detected during the SI. The SSI at SA 43B consisted of drilling one soil boring (XBB-93-02X) adjacent to TP-08, completed during the SI, in which elevated TPHC concentrations were detected (see Figure 6.2-1). Four soil samples were collected from the boring and submitted for laboratory analysis consisting of PAL VOCs, lead, and TPHC. The soil samples were collected 4 feet, 10 feet (plus one duplicate) and 14 feet bgs. These depths were chosen to replicate the depths of the field analytical samples collected during the SI.

6.2.4 Field Investigation Results and Observations

The soil at SA 43B appears to be a well-graded silty sand to the bottom of the boring (16 feet bgs) (Table 6.2-2). The water table was encountered at 15 feet bgs. No monitoring wells were installed at this site during either field program and as a result, aquifer properties and groundwater quality were not determined. Soil boring logs are presented in Appendix B.

The results of the geophysical survey conducted at SA 43B did not indicate the presence of any abandoned UST(s). The geophysical measurements collected in the field are presented in Appendix L.

6.2.5 Nature and Distribution of Contamination (Field Screening and Off-Site Laboratory Results)

The objective of the field sampling program at SA 43B was to determine the presence or absence of residual subsurface soil contamination. Soil samples were collected from the water table and analyzed in the field, as well as in the laboratory, in an attempt to determine if the groundwater had been impacted by the historical use of this SA. The primary concern at this SA was that residual fuel contamination, left in the soil after the UST had been removed, may be migrating to the water table and impacting the groundwater quality.

Seven soil samples were collected at a depth of 5 feet bgs from seven TerraProbe points during the SI. Toluene, ethylbenzene, and xylenes were detected in only one sample (TP-08) and TPHC was detected in four soil samples (TP-02, TP-03, TP-07, and TP-08) (see Figure 6.2-2). The detection of TPHC in these four samples from 5 feet is questionable due to the reported presence of asphalt chips in each of the samples. The asphalt was noticed in the samples by the ABB-ES field chemist, after the samples had been analyzed. Based on this finding, it does not appear that the results of the TPHC screening represent actual concentrations of TPHC in the soils at these locations. A total of seven soil samples were also collected at 9 feet bgs from seven TerraProbe points. No BTEX compounds were detected but TPHC was detected in three of the samples. The TPHC results from the soil samples collected from TP-08 at 9 feet (1,500 ppm) is also questionable due to asphalt in the sample, and may not represent actual TPHC concentrations in the soil at this depth. The results from the other two samples (130 ppm at TP-05 and 760 ppm at TP-03) do appear to represent TPHC concentrations at 9 feet (Figure 6.2-3). Ten soil samples were collected from the groundwater table at 15 feet. No BTEX compounds were detected in any of the samples but TPHC was detected at 230 ppm in the one sample collected from TP-02 (Figure 6.2-4). The field analytical results are presented in Table 6.2-3.

Two subsurface soil samples were collected for off-site laboratory analysis from the SI soil boring 43B-92-01X (Figure 6.2-5). Soil samples were collected from 8 feet to 10 feet and 14 feet to 16 feet bgs. No VOCs were detected in either sample. TPHC was detected in the soil sample collected from 8 feet to 10 feet bgs but was not detected in the sample collected from 14 feet to 16 feet bgs. The results of the off-site laboratory analysis appear to indicate that some residual TPHC contamination may be present at approximately 8 feet bgs, but it does not

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SECTION 6

appear that similar contamination is present in the soil at the water table (Table 6.2-4; see Figure 6.2-5).

The results of the off-site laboratory analysis for the SSI soil samples collected from boring XBB-93-02X, indicated the presence of TPHC at 84.2 $\mu\text{g/g}$ and xylene at 0.004 $\mu\text{g/g}$ in the 4-foot sample, trichlorofluoromethane at 0.006 $\mu\text{g/g}$ and TPHC at 85.4 in the 10-foot sample, 393 $\mu\text{g/g}$ in the duplicate sample collected from the 10-foot sample, and <31.7 $\mu\text{g/g}$ in the 14-foot sample. The results of the lead analysis showed that concentrations were below the Fort Devens background concentration in each sample. Based on these results it appears that the TPHC concentrations detected in the SI field analytical samples were based on asphalt chips in the sample, as reported, not residual TPHC contamination (see Table 6.2-4; Figure 6.2-5).

6.2.6 Source Evaluation and Migration Potential

The results of the laboratory analysis completed during the SSI indicated the presence of low concentrations of VOCs in the soil sample collected in the duplicate soil sample collected from 10 feet bgs. TPHC results indicated the presence of TPHC in the soil sample collected from 4 feet, 10 feet and the 10-foot duplicate. No VOCs or TPHC were detected in the soil sample collected from the water table. Lead concentrations were below the Fort Devens background concentration in each soil sample. The results of the soil sample collected from the water table indicated the elevated TPHC concentrations detected at TP-08 during the SI were associated with asphalt chips, as reported. These results also show that residual TPHC contamination has not migrated to the water table and does not appear to be impacting groundwater quality at this site.

6.2.7 Preliminary Human Health Risk Evaluation

The subsurface soil data collected during the SSI was not included in this human health PRE because it does not alter the findings of the PRE presented in the Final SI Report.

The summary statistics for the human health PRE are presented in Table 6.2-5. No tank was detected at this location. Field-screening of 24 shallow and intermediate depth TerraProbe soil samples revealed no measurable

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concentrations of BTEX to a depth of 10 feet, with the exception of TP-8 (5 ft). TPHC was detected above the method detection limit in seven of these 24 samples, ranging from 130 ppm to 2,000 ppm (the highest values are from suspected asphalt chips in the sample). A comparison of these results against the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline indicates that there should be no significant risk to public health from soil contamination at SA 43B.

At a depth below 15 feet, the approximate water table depth, field-screening results from 10 soil samples indicate no BTEX contamination. TPHC was detected above the method detection limit in one of these 10 samples, at 230 ppm.

A confirmatory boring by ABB-ES supports the field-screening results. A soil sample at 8 feet in the boring through the suspected tank location (43B-92-01X) showed residual TPHC contamination at 177 $\mu\text{g/g}$, well below the commercial/industrial screening concentration of 1,800 $\mu\text{g/g}$. At 14 feet, the TPHC level was below the detection limit. Concentrations of lead did not exceed the established Fort Devens background concentration. These results clearly indicate that little residual contamination exists at SA 43B from petroleum products.

6.2.8 Conclusions and Recommendations

Based on the results of the data collected during the SI and the SSI, NFA is recommended for historic gas station B.

TABLE 6.2-1
SUMMARY OF TECHNICAL APPROACH
SA 43B - HISTORIC GAS STATION B

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-10	* IN AND AROUND FORMER UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* COLLECT SOIL SAMPLES FOR OFF-SITE LABORATORY ANALYSIS	43B-92-01X	* ADJACENT TO HIGHEST FIELD ANALYTICAL RESULT
SSI PROGRAM			
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* COLLECT SOIL SAMPLES FOR OFF-SITE LABORATORY ANALYSIS	XBB-93-02X	* CONFIRM SI FIELD ANALYTICAL RESULTS

TABLE 6.2-2
SUMMARY OF SOIL BORINGS
SA 43B - HISTORIC GAS STATION B
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (FEET BGS)	REFERENCE SAMPLE INTERVALS (FEET BGS)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43B-92-01X	16	0-2		SW	BKG	
		5-7		SW-SM	BKG	
		8-10	8-10	SW-SM	BKG	
		10-12		SW	BKG	
		12-14		GW-SW	BKG	
		14-16	14-16	GW-SW	BKG	
XBB-93-02X	16	0-2		SW	BKG	
		2-4		SW-SM	BKG	
		4-6	4-6	SW-SM	BKG	
		6-8		SW-SM	BKG	
		8-10		SW-SM	BKG	
		10-12	10-12	SW	BKG	
		12-14		GW-SW	BKG	
		14-16	14-16	GW-SW	BKG	

NOTES:

bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site.

TABLE 6.2-3
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43B - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-01	TP-02	TP-02	TP-02	TP-03	TP-03	TP-03	TP-03	TP-04
	TSB0115F 15 FT	TSB0205F 5 FT	TSB0209F 9 FT	TSB0215F 15 FT	TSB0305F 5 FT	TSB0309F 9 FT	TSB0315F 15 FT	TSB0405F 5 FT	
ORGANICS									
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER									
TOTAL PETROLEUM HYDROCARBONS	< 56	530	< 55	230	140	760	< 60	< 60	< 60

Notes:
< = Less than detection limit.

TABLE 6.2-3
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43B - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-04		TP-05		TP-05		TP-05		TP-06		TP-06	
	TSB0409F	15 FT	TSB0413P	15 FT	TSB0505F	5 FT	TSB0509F	9 FT	TSB0605F	5 FT	TSB0609F	9 FT
ORGANICS												
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER												
TOTAL PETROLEUM HYDROCARBONS	< 54	< 60		< 60	130		< 59		< 60		< 55	< 60

Notes:

< = Less than detection limit.

TABLE 6.2--3
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43B -- HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-07	TP-07	TP-07	TP-08	TP-08	TP-08	TP-08	TP-09	TP-10
	TSB0705F	TSB0709F	TSB0715F	TSB0805F	TSB0809F	TSB0813F	TSB0913F	TSB1015F	
	5 FT	9 FT	15 FT	5 FT	9 FT	15 FT	15 FT	15 FT	15 FT
ORGANICS									
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	9.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	6.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p--XYLENE	< 0.1	< 0.1	< 0.1	37	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o--XYLENE	< 0.1	< 0.1	< 0.1	19	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER									
TOTAL PETROLEUM HYDROCARBONS	1200	< 55	< 60	2000	1500	< 60	< 56	< 56	< 56

Notes:

< = Less than detection limit.

TABLE 6.2-4
ANALYTES IN SUBSURFACE SOIL
SA 43B - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE (ug/g)	SSI				SI	
	XBB-93-02X 4 FT	XBB-93-02X 10 FT	XBB-93-02X DUP 10 FT	XBB-93-02X 14 FT	43B-92-01X 8 FT	43B-92-01X 14 FT
TRICHLOROFLUOROMETHANE	< 0.006	0.006	0.007	< 0.006	< 0.006	< 0.006
*XYLENES	0.004	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
LEAD	13	0.4	10.2	7.49	14	5.42
OTHER (ug/g)						
*TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	501
TOTAL PETROLEUM HYDROCARBONS	84.2	85.4	393	< 28.7	177	< 27.9

Notes:

< = Less than detection limit.

TABLE 6.2-5
HUMAN HEALTH PRE EVALUATION OF SUBSURFACE SOIL
SA 43B - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		SOIL BACKGROUND CONCENTRATION [b] (µg/g)	MAXIMUM EXCEEDS BACKGROUND ?	REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION (µg/g)	MCP S-2 (µg/g)	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE (µg/g)	MAXIMUM (µg/g)					
ORGANICS								
TRICHLOROFLUOROMETHANE	2/6	0.007	0.007	NA	-	310000	NA	NO
XYLENES	1/6	0.004	0.004	NA	-	1000000	500	NO
INORGANICS								
LEAD	6/6	8.418	14	48.4	NO	500	600	NO
OTHER								
TOTAL PETROLEUM HYDROCARBONS	4/6	184.9	393	NA	-	1680	2500	NO

Notes:

[a] Subsurface soil (3 to 15 feet) from sample locations 43B-92-01X (2 depths) and XBB-93-02X (3 depths, 1 duplicate).

[b] Base-wide background soil inorganics database.

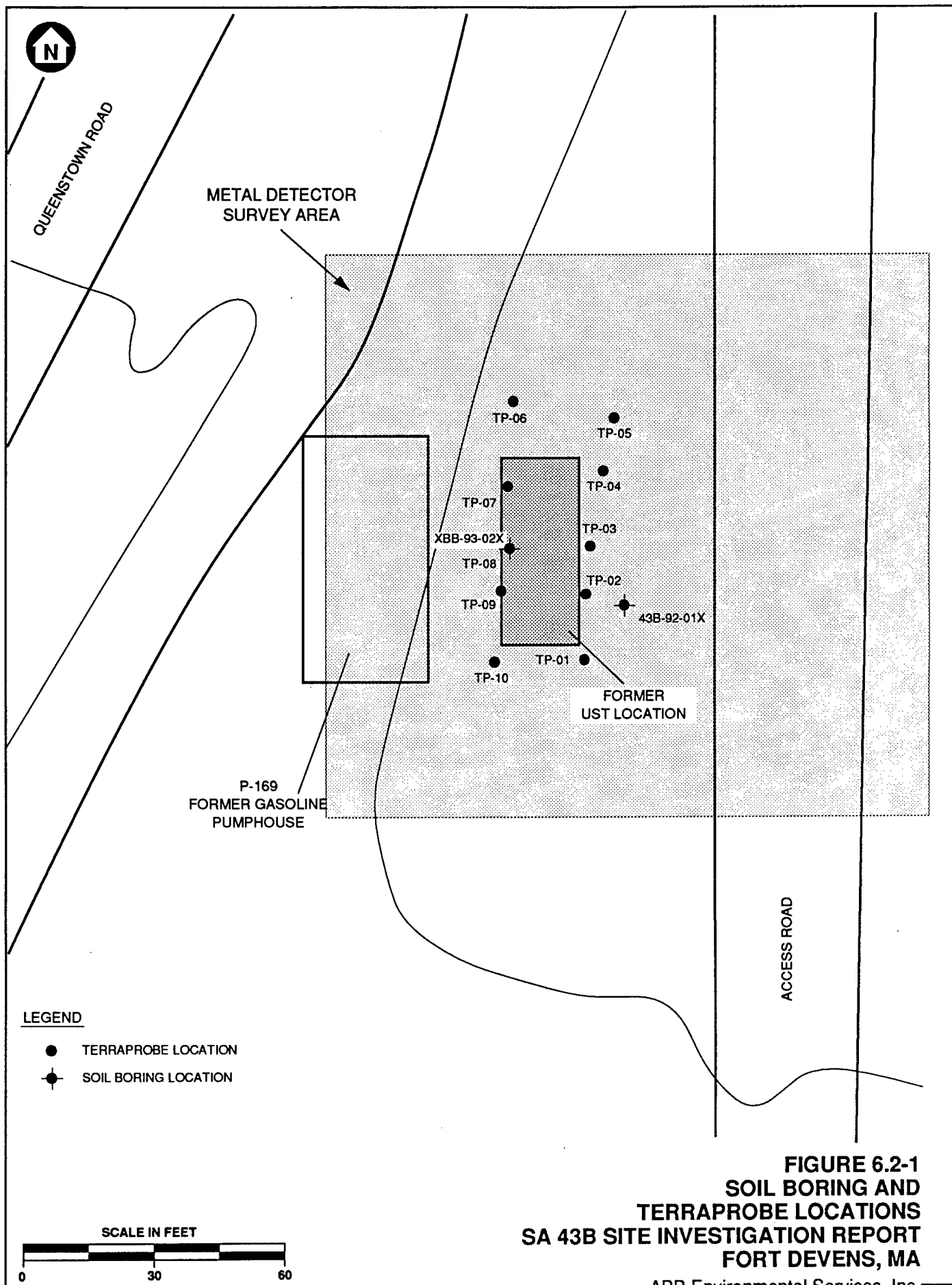
NA = not available

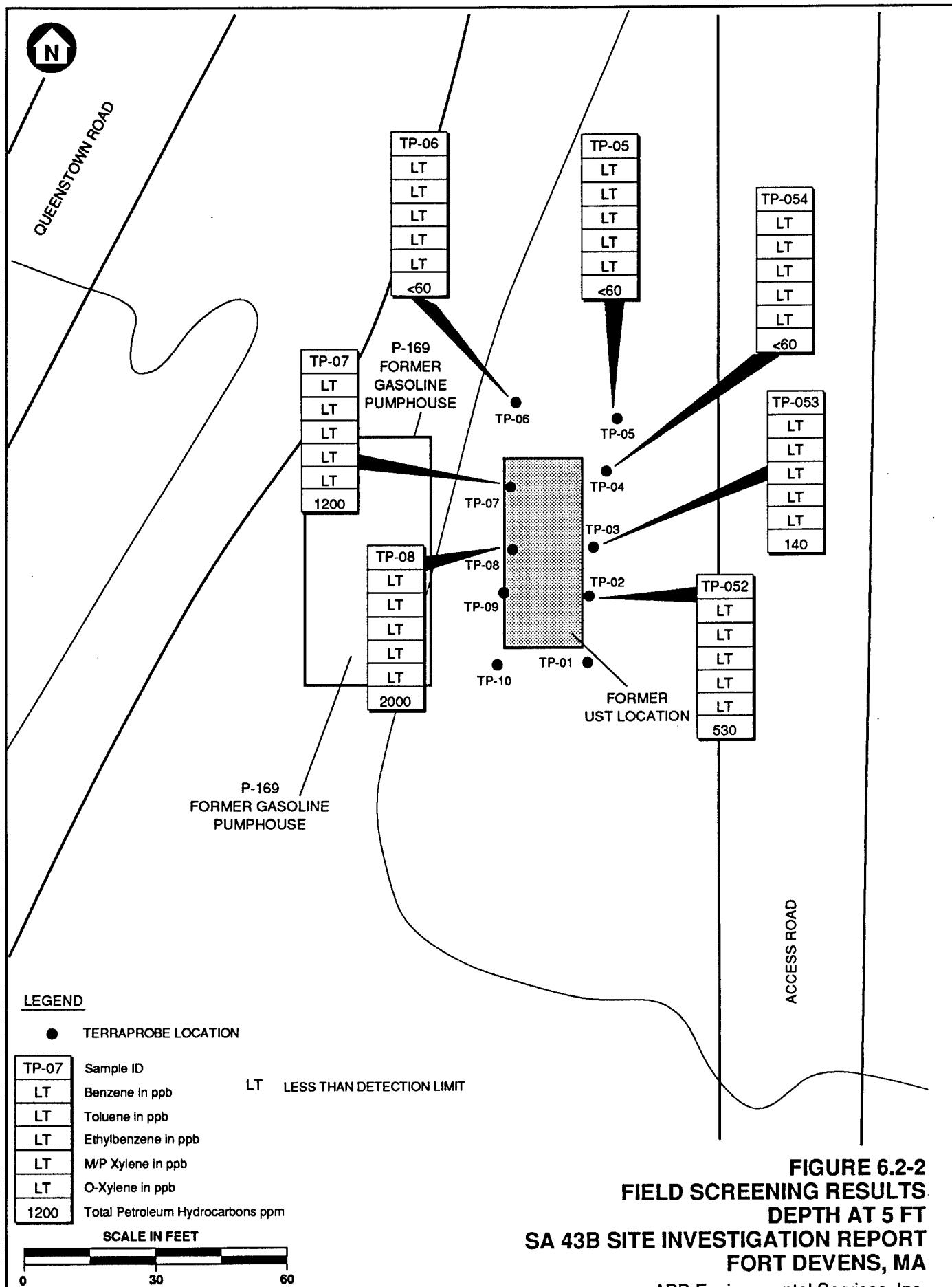
µg/g = micrograms per gram

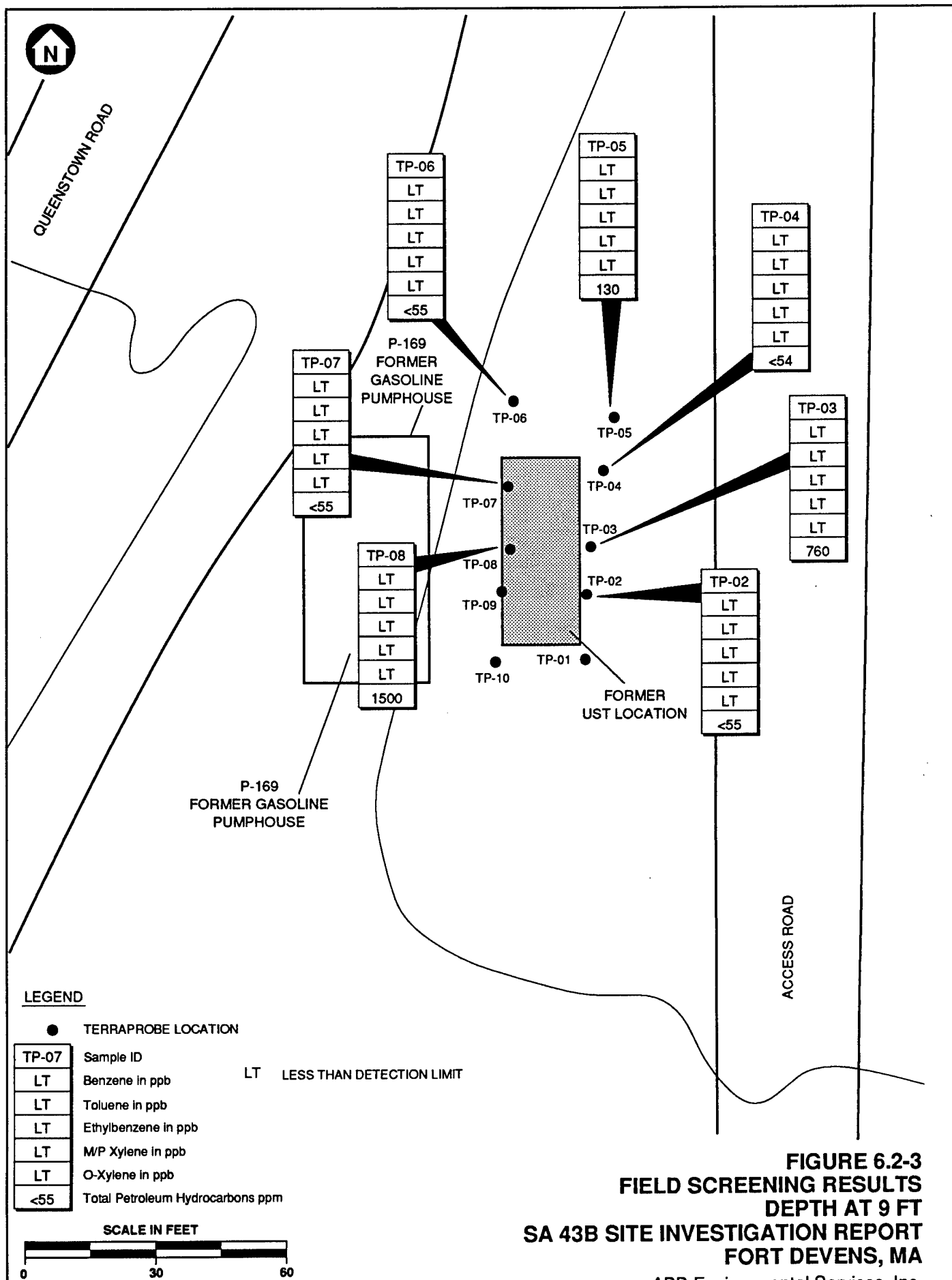
- = not applicable

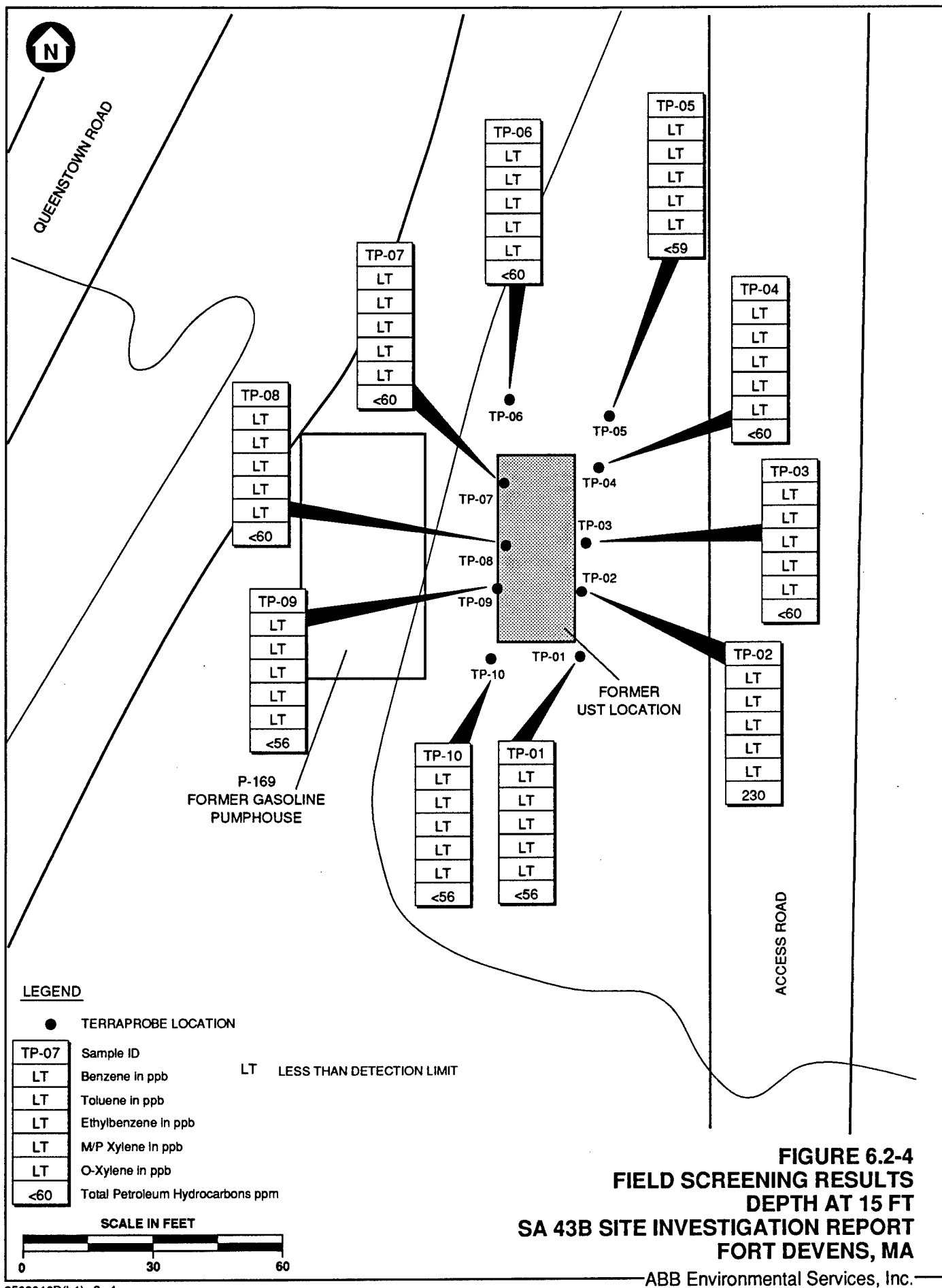
Shaded compounds exceed standard or guideline.

MCP = Massachusetts Contingency Plan









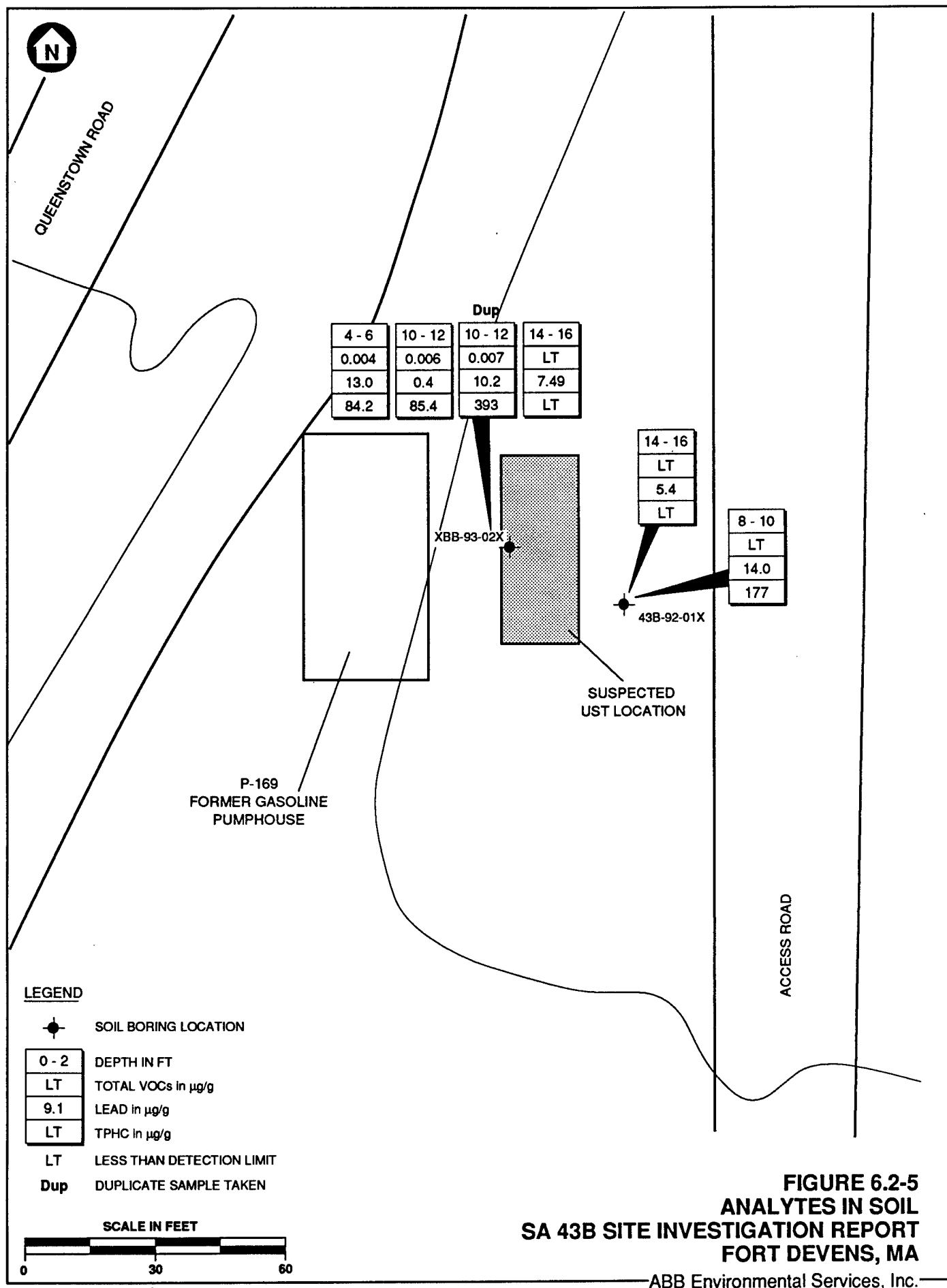


FIGURE 6.2-5
ANALYTES IN SOIL
SA 43B SITE INVESTIGATION REPORT
FORT DEVENS, MA

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6.3 STUDY AREA 43C

6.3.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43C consisted of a pump island and a small gasoline pumphouse. Based on historic records, the gas station was a Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool and therefore, there was no evidence that the UST had been removed. The pumphouse (Building 3459) was still present at this SA prior to the SI field investigation. This SA is located approximately 500 feet south of SA 43B and on the same access road (Figure 6.3-1). The pumphouse appeared to be constructed of corrugated steel and some piping was present in the building. The building was secured by a locked metal door. The area around the pumphouse is a gravel parking lot (see Figure 6.3-1).

6.3.2 Study Area Investigation Program Summary

The SI field investigation program consisted of a surficial geophysical program which included a metal detector and GPR survey (Figure 6.3-2).

6.3.3 Field Investigation Results and Observations

The geophysical investigation conducted at SA 43C indicated that one abandoned UST was present on the southern side of the existing pumphouse (see Figure 6.3-1). The metal detector was used first to locate the UST and then the GPR survey identified the ends and the sides of the UST. The geophysical measurements collected in the field are presented in Appendix L.

This UST was added to the installation's UST removal program and on August 27, 1992, a 5,000 gallon UST was removed by ATEC Environmental Consultants (ATEC). Tank contents at the time of removal consisted of fuel and water. Groundwater was observed in the UST excavation at approximately 10 feet bgs. At the time of the tank removal, ATEC performed field screening on eight soil samples (SS-1 through SS-8) collected from the excavation walls at

ABB Environmental Services, Inc.

SECTION 6

depths of 5 feet to 6 feet bgs (see Figure 6.3-2). The headspace of the soil samples was screened with a PID for total VOCs and a Non-Dispersive Infrared (NDIR) Analyzer was used to screen for TPHC. The PID results ranged from nondetected to 0.2 ppm, and TPHC levels were 20.5 to 287 ppm (ATEC, 1992a) (Table 6.3-1). ATEC also collected one soil and one groundwater sample from the excavation for confirmatory laboratory analysis. The soil sample was analyzed for TPHC and the groundwater sample was analyzed for VOCs and TPHC. These samples were analyzed by a non-AEC certified laboratory and the data does not reside in the IRDMIS. No VOCs were detected in the groundwater sample and TPHC results were below the detection limit of the method (see Table 6.3-1). ABB-ES collected one composite soil sample from the bottom of the excavation. This sample was analyzed for TPHC using USEPA Method 418.1 at ABB-ES' Wakefield, Massachusetts laboratory. TPHC was detected at 78.2 ppm (see Table 6.3-1). Based on ATEC's sampling results, ATEC backfilled the excavation and no further site investigation was conducted (ATEC, 1992a).

6.3.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

Fuel-related soil contamination was not observed or detected in the soil or groundwater after the UST was removed from SA 43C. Based on these results it appears that the contents of the former UST did not adversely impact the soil or groundwater quality at SA 43C.

6.3.5 Preliminary Human Health Risk Evaluation

The UST at SA 43C was discovered by ABB-ES and pulled by ATEC during the SI. Prior to backfilling, ATEC collected 8 soil samples from the excavation walls which were screened for TPHC by the NDIR method. TPHC levels ranged from 20.5 ppm to a maximum value of 287 ppm. The TPHC level in a confirmatory soil sample collected by ABB-ES for TPHC analysis by USEPA Method 418.1 was 78.2 $\mu\text{g/g}$. A comparison of these results against the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline indicates that there should be no significant risk to public health from soil contamination at SA 43C.

6.3.6 Conclusions and Recommendations

Fuel-related soil contamination was not observed or detected by ATEC in the soil after the UST was removed from SA 43C. It appears that the contents of the former UST did not adversely impact the soil or groundwater quality at SA 43C. Based on the results of the field investigation and sampling conducted by ABB-ES and by ATEC during a tank removal at SA 43, NFA is recommended for this historic gas station site.

TABLE 6.3-1
ATEC/ABB-ES FIELD SCREENING RESULTS
SA 43C - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY	
	PID (ppm)	NDIR (ppm)	VOC (ppm)	TPHC (ppm)
SS-1	0.2	232	N/A	N/A
SS-2	ND	20.5	N/A	N/A
SS-3	ND	29.3	N/A	N/A
SS-4	ND	99.2	N/A	N/A
SS-5	ND	287	N/A	N/A
SS-6	ND	96.7	N/A	N/A
SS-7	0.2	72.5	N/A	N/A
SS-8	ND	42.1	N/A	N/A
LSS-1	N/A	N/A	N/A	0.0
LWS-1	N/A	N/A	ND	0.0
XCE-92-01X	N/A	N/A	N/A	78.2

NOTES:

SS = ATEC field screening soil sample

LSS = ATEC laboratory soil sample

LWS = ATEC laboratory water sample

XCE-92-01X = ABB-ES laboratory composite soil sample

ND = Non detect

N/A = Not analyzed

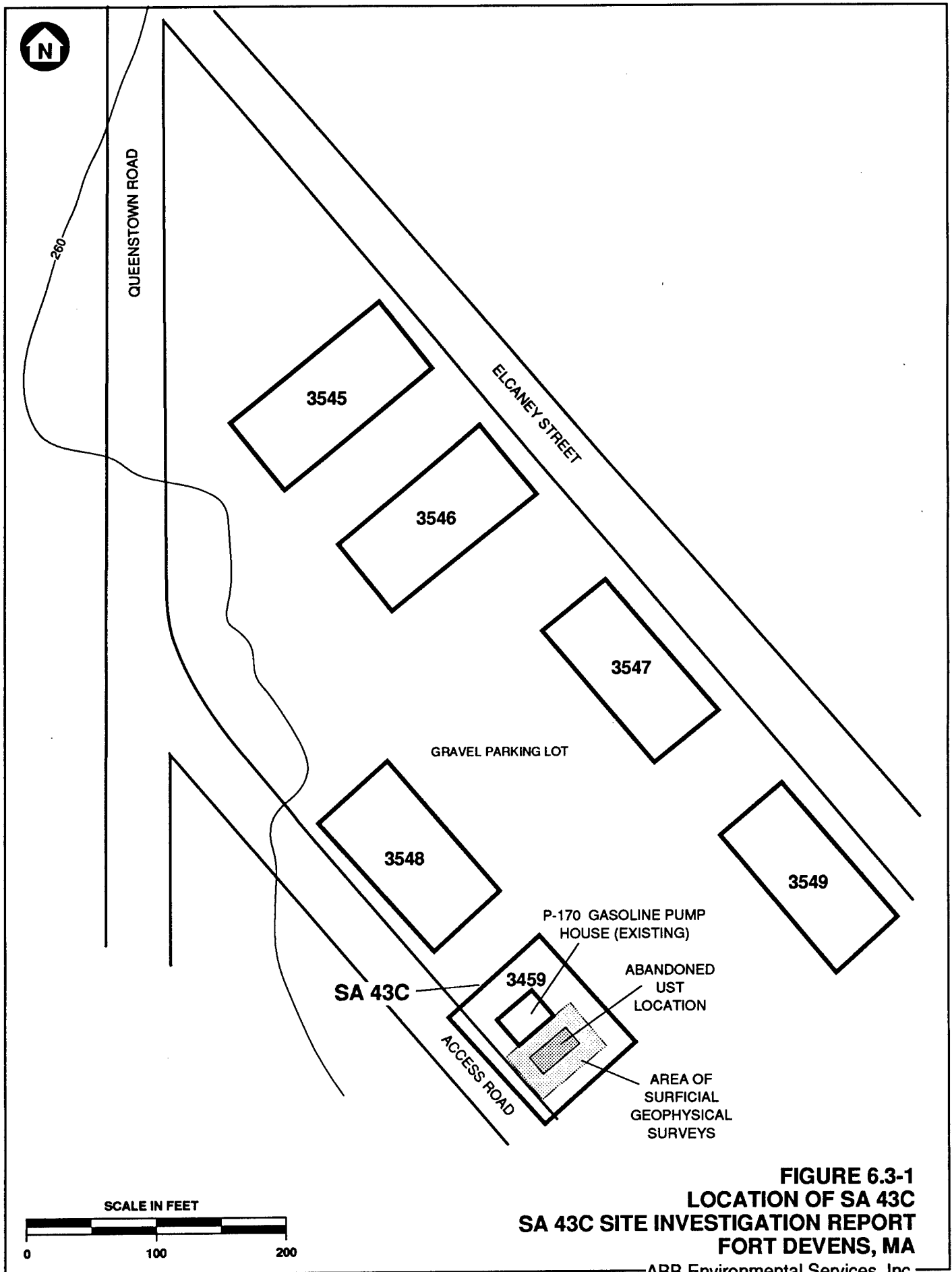
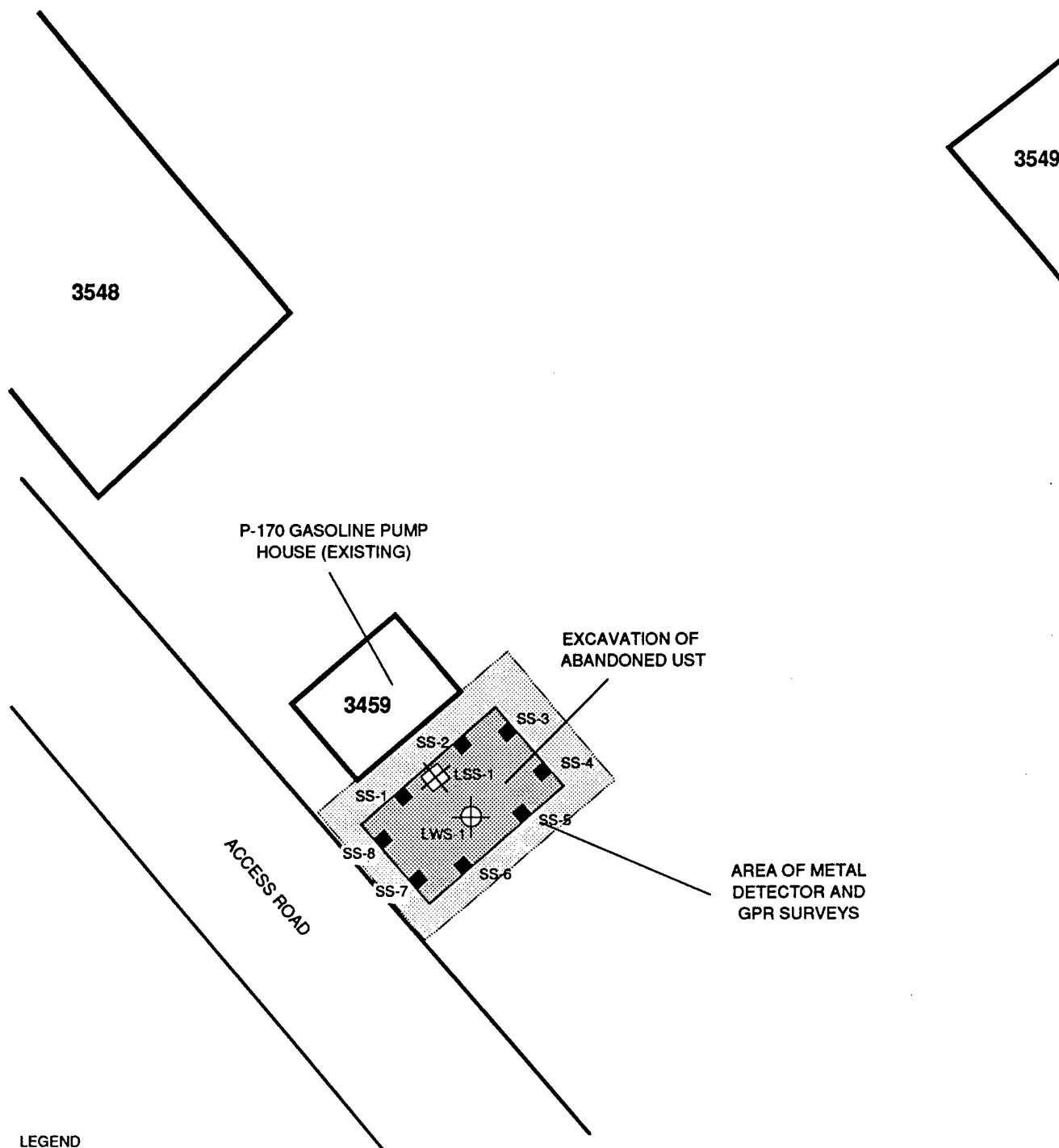


FIGURE 6.3-1
LOCATION OF SA 43C
SA 43C SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND

-  ATEC FIELD SCREENING LOCATIONS
-  ATEC LABORATORY SOIL SAMPLE LOCATION
-  ATEC LABORATORY WATER SAMPLE LOCATION



FIGURE 6.3-2
ATEC SAMPLE LOCATIONS
SA 43C SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.4 STUDY AREA 43D

6.4.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43D consisted of a pump island and a small gasoline pumphouse. This was described as a Type B station with two USTs (5,000 gallon or 5,140 gallon, apiece), located on each side of the pump island and oriented parallel to it. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool and therefore, there was no evidence that the USTs had been removed. Neither the pumphouse nor pump island were present at this SA prior to the SI field investigation. This SA was reportedly located approximately 200 feet southwest of SA 43C and approximately 600 feet south of SA 43B. The area around SA 43D is presently being used as an equipment storage yard for a U.S. Army medical unit. The entire yard is paved and surrounded by a fence with a locked gate. The gate to the yard is located on the eastern side of the yard and opens onto the same access road on which SA 43B and 43C are located (Figure 6.4-1).

6.4.2 Site Investigation Program Summary

The SI at SA 43D was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992b) and in conformance to the provisions of the POP (ABB-ES, 1992a). A field investigation was conducted at SA 43D to determine if any abandoned USTs were present at the site, and if any residual contamination was present in the subsurface soil and/or groundwater. The program consisted of a surficial geophysical survey, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring to collect subsurface soil samples for laboratory analysis. Table 6.4-1 summarizes the activities completed during the SI.

The geophysical investigation at SA 43D consisted of a metal detector survey and a GPR survey. The investigation was centered on the location identified in the MEP and covered an area 50 feet wide and 75 feet long (see Figure 6.4-1).

Ten TerraProbe points were completed at SA 43D to investigate the presence or absence of residual soil contamination away from the UST excavation. One soil

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SECTION 6

sample was collected from the water table at each TerraProbe point for field analysis. The field analysis performed on these samples consisted of a GC analysis for BTEX, and an IR scan for TPHC (Figure 6.4-2).

Two subsurface soil samples were collected for laboratory analysis from one soil boring (43D-92-01X) drilled at SA 43D. Both of the soil samples were analyzed for PAL VOCs, TPHC, and lead. Table 6.4-1 summarizes the activities completed during the SI.

6.4.3 Supplemental Site Investigation Program Summary

The SSI at SA 43D was performed in accordance with the Task Order Work Plan (ABB-ES, 1993b) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992a). The following sections describe the field activities completed at this historic gas station during the SSI. Table 6.4-1 summarizes the activities completed during the SSI.

A total of 19 SSI TerraProbe points were advanced east of the TerraProbe point locations completed during the SI (see Figure 6.4-2). These points were designed to further define the horizontal and vertical distribution of contaminants detected during the SI. Up to two soil samples were collected from each TerraProbe point (one from the water table and one from the capillary zone above the water table). The samples were analyzed in the field for BTEX and TPHC. Each TerraProbe point location was surveyed.

Based on the results of the TerraProbe survey, four groundwater monitoring wells were installed to monitor upgradient and downgradient groundwater quality (see Figure 6.4-1). Soil samples were collected from the water table in each of the monitoring well borings to determine if site-related contaminants had migrated with the groundwater and impacted soil quality. These samples were submitted for laboratory analysis consisting of PAL VOCs, SVOCs, lead, TPHC, and TOC. The screen of each monitoring well was placed so that it intersected the water table to monitor for free product and allow for seasonal groundwater fluctuations. Each monitoring well location was surveyed. Table 6.4-2 summarizes the monitoring well construction at SA 43D.

Two rounds (Round Three and Four) of groundwater samples were collected from the monitoring wells installed during the SSI. Round Three groundwater

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samples were collected from October 1993 and Round Four was collected in January 1994. The samples from each round were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, lead (both filtered and unfiltered), TPHC, and TSS.

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were performed. The tests consisted of a rising and falling head test. Each exploration was surveyed after completion.

6.4.4 Field Investigation Results and Observations

The results of the SI geophysical surveys at SA 43D indicated the presence of two abandoned USTs, located side by side, on the eastern side of the storage yard (see Figure 6.4-1). These USTs were added to the installation's UST removal program and on September 8, 1992, ATEC removed the two 5,000 gallon USTs. Tank contents at the time of removal consisted of fuel and water (ATEC, 1992b). Both of the USTs were half submerged in groundwater at the time of the removal. Once the soil was removed from the top of the USTs, it was apparent from visual observations, that fuel-related contamination was present in the soil at the water table. ATEC performed field screening (PID headspace and NDIR screening) on eight soil samples (SS-1 through SS-8) collected from the excavation at depth 5 to 6 feet bgs (Figure 6.4-3). Headspace results indicated VOC concentrations ranging from non detect (ND) to 12.0 ppm, and TPHC concentrations ranged from 15.9 to 1132.6 ppm (ATEC, 1992b) (Table 6.4-3). Based on the results of ATEC's sampling and screening, ATEC personnel removed additional soil from the excavation in an attempt to remove the remaining contaminated soil. The lateral distribution of the contamination was not determined using headspace screening, during this cleanup process. Because of this, Fort Devens Environmental Management Office (EMO) personnel decided to stop the cleanup process, line the excavation with polyethylene sheeting, and backfill the excavation with clean soil. ATEC collected five additional soil samples (LRS-1 through LRS-4) and one groundwater sample (LWS-1) after the additional soil had been removed (see Figure 6.4-3). These samples were submitted for laboratory analysis of VOCs, TPHC, and 13 TCLP metals. Results of these analyses indicated that residual TPHC and VOCs were present in the soil and groundwater in the excavation (see Table 6.4-3)

SECTION 6

The soil encountered at SA 43D included poorly graded to well graded sands with some silty. A peat layer was also encountered at 9.5 to 11.5 feet bgs in XDM-93-01X and XDM-93-02X. The water table was encountered at 4 to 9 feet bgs, and bedrock was not encountered (Table 6.4-4).

No groundwater monitoring wells were installed as part of this SI field program. However, four monitoring wells were installed during the SSI field program. The new monitoring wells have been included in several installation-wide synoptic water-level rounds at Fort Devens. The water levels from the November 8, 1993 water level round have been chosen to represent the groundwater conditions at SA 43D. The results of that water-level round are presented in Table 6.4-5. The inferred groundwater flow appears to be moving to the north-northeast towards Robbins Pond (Figure 6.4-4).

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were performed. The tests consisted of a rising and falling head test. Calculated hydraulic conductivities ranged from $1.5E^{-02}$ centimeters per second (cm/sec.) at XDM-93-03X to $1.6E^{-05}$ cm/sec. at XDM-93-02X. The hydraulic conductivity for each monitoring well is presented in Table 6.4-5.

6.4.5 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.4.5.1 Soil. The objective of the field sampling program at SA 43D was to determine if any abandoned UST(s) were present at the SA and if the historic use of the site as a gas station had adversely impacted the soil and/or groundwater quality. The primary concern at this SA was that the contents of the abandoned USTs had adversely impacted the groundwater quality in this area of the Main Post.

After the UST excavation was backfilled, ABB-ES completed 10 TerraProbe points to the water table and a total of nine soil samples were collected (Figure 6.4-5). Ethylbenzene and xylenes were detected in the sample collected from TP-10, and TPHC levels ranged from 110 ppm at TP-01 to 1,615 ppm at TP-10 (Table 6.4-6; Figure 6.4-5). The highest concentrations of contaminants were detected on the southern and eastern side of the UST excavation.

Nine TerraProbe points were advanced east of the former USTs, to better define the distribution of fuel related contaminants detected during the SI. Subsurface soil samples were collected from 8 and 9 feet bgs. Total concentrations of TEX, ranged from below the detection limit to 3,500 ppb in the 8-foot samples from TP-14, and below the detection limit to 1,900 ppb in the 9-foot samples at TP-12. Benzene was also detected in the 8 and 9-foot soil samples collected from TP-12 at concentrations of 220 and 440 ppb, respectively. TPHC concentrations ranged from 130 to 4,500 ppm in the 8-foot samples at TP-14 and <58 to 750 ppm in the 9-foot samples at TP-12 (see Table 6.4-6; Figures 6.4-5, and 6.4-6).

No VOC or SVOC were detected in the soil samples collected from 43D-92-01X for off-site laboratory analysis. Lead was detected below the Fort Devens background, TPHC was not detected, and the TOC value associated with the 10-foot sample was at 1,040 $\mu\text{g/g}$.

The results of the off-site laboratory analysis for the soil samples collected from the monitoring well borings completed during the SSI are presented in Table 6.4-7 and Figure 6.4-7. One subsurface soil sample was collected from 10 feet (water table) in each of the four monitoring well borings (XDM-93-01X through XDM-93-04X). One VOC (Toluene at 0.012 $\mu\text{g/g}$) was detected in the soil sample collected from XDM-93-01X. Acetone and di-n-butyl phthalate (common laboratory contaminants) were the only other organic compounds detected; however, these compounds are not considered site-related contaminants. TPHC was detected at 50.7 $\mu\text{g/g}$ in the soil sample collected from XDM-93-04X. Lead was detected below the Fort Devens background concentration in each sample.

6.4.5.2 Groundwater. The results of the off-site laboratory analysis for Rounds Three and Four groundwater samples are presented in Table 6.4-8 and Figure 6.4-8. No VOCs, SVOCs, or TPHC were detected in any of the samples collected from Round Three. Benzene was detected at 0.88 $\mu\text{g/L}$ in the Round Four sample collected from XDM-93-01X and bis(2-hexylmethyl)phthalate (a common laboratory contaminant) was detected at 8.2 $\mu\text{g/L}$ at XDM-93-04X. No other PAL SVOCs nor TPHC was detected in the Round Four samples. Lead concentrations were below the Fort Devens background concentrations in both the filtered and the unfiltered samples in both rounds of sampling except for the Round Four unfiltered duplicate from XDM-93-02X which showed a concentration slightly above background at 5.21 $\mu\text{g/L}$.

SECTION 6

6.4.6 Source Evaluation and Migration Potential

The results of the field analysis indicated that residual VOCs (benzene, toluene, ethylbenzene, and xylenes) as well as TPHC contamination is present in the soil above and at the water table east-northeast of the former historic gas station. It also appears that these contaminants have migrated, via groundwater flow, from the former abandoned USTs to the soils approximately 50 feet north and east of the former USTs. The contaminants detected in the soil above the water table appears to be a result of contaminated groundwater fluctuating up into the soil, and contaminating the soil.

The results of soil samples collected from monitoring well borings drilled upgradient and downgradient of SA 43D, indicate that the contaminants detected in the soil east of the site have not impacted the soil quality downgradient of the site.

The results of the groundwater sampling did not indicate the presence of any SVOC, TPHC, or lead contamination. Benzene was detected in one of the Round Four samples at 0.88 $\mu\text{g/L}$. It appears that the contaminants detected during the field analytical program have not impacted the groundwater quality downgradient of SA 43D.

6.4.7 Preliminary Human Health Risk Evaluation

The Final SI Report (ABB-ES, 1993a) evaluated TerraProbe and boring subsurface soil samples collected during the SI. BTEX was detected in one TerraProbe sample. TPHC was detected above the method detection limit in six of nine TerraProbe samples, ranging from 110 ppm to 1,615 ppm. Soil samples from a confirmatory boring showed no evidence of residual TPHC contamination at both 5-feet and 10-feet. These results indicate that little residual contamination exists in the unsaturated zone from petroleum products. A comparison of the results against available risk-based commercial/industrial concentration values indicates no significant risk to public health from soil contamination at SA 43D.

During the SSI, fifteen TerraProbe subsurface soil samples and one soil boring sample were evaluated. The results for individual samples are shown in Tables 6.4-6 and 6.4-7. Table 6.4-9 combines and summarizes the data and compares the analytical results to commercial/industrial and Category S-2 soil

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guidelines described above. BTEX does not exceed guidelines. TPHC was detected above guideline concentrations in three of the fourteen samples in which it was detected. Lead was analyzed for in the soil boring and detected at 5.04 $\mu\text{g/g}$ which is below both Region III commercial soil and MCP S-2 soil guideline concentrations (Table 6.4-9). In conclusion, concentrations of TPHC in subsurface soil may pose a potential risk to human health under certain commercial/industrial exposure scenarios.

Benzene was detected in one groundwater sample at a concentration of 0.88 $\mu\text{g/L}$ below USEPA action level for benzene (see Table 6.4-8). No other organic contaminants were detected in groundwater samples collected from SA 43D. Unfiltered groundwater samples were analyzed for lead, which was detected in three of the four samples. The maximum concentration, 3.25 $\mu\text{g/L}$, did not exceed the USEPA action level of 15 $\mu\text{g/L}$. Lead was not detected in the filtered samples. Concentrations of lead in groundwater, then, do not pose a potential threat to human health (Table 6.4-10).

6.4.8 Conclusions and Recommendations

The contaminant profile established during the SI and the SSI is consistent with the reported military use and UST removal report for this site. As noted above, the primary concern at SA 43D has been the residual contamination due to releases from the former USTs which have been removed. Sampling and analysis of subsurface soil and groundwater, during the SI and the SSI, found contaminants derived from petroleum hydrocarbons associated with fuels stored at this site. The human health PRE indicated that soil in areas south and east of the former USTs were above the S-2 MCP soil standard. However, the PRE shows that contaminant concentrations in groundwater do not pose an unacceptable risk to public health. Because of the lack of potential exposure of ecological receptors to site-related contaminants, and due to the fact that no wetlands are located at or near this SA, no ecological PRE was completed for SA 43D.

Based on the findings of the PRE, a soil removal action is recommended for SA 43D to remediate the TPHC contamination detected in the subsurface soil.

TABLE 6.4-1
SUMMARY OF TECHNICAL APPROACH
SA 43D - HISTORIC GAS STATION D

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-10	* IN AND AROUND FORMER USTs
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* CHARACTERIZE SOILS CONTAMINATION * COLLECT SOIL SAMPLES FOR OFF-SITE LABORATORY ANALYSIS	XDB-92-01X	* THROUGH FORMER UST GRAVE
SSI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-11 THRU TP-19	* EAST OF SI POINTS
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* INSTALL MONITORING WELLS * CHARACTERIZE SOILS CONTAMINATION	XDM-93-01X XDM-93-02X XDM-93-03X XDM-93-04X	* UPGRADIENT * DOWNGRADIENT
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	* MONITOR GROUNDWATER LEVELS * MONITOR GROUNDWATER QUALITY * DETERMINE AQUIFER CONDUCTIVITIES	XDM-93-01X XDM-93-02X XDM-93-03X XDM-93-04X	* UPGRADIENT * DOWNGRADIENT

TABLE 6.4-2
MONITORING WELL COMPLETION DETAILS
SA 43D - HISTORIC GAS STATION D

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (FEET BGS)	WELL SCREEN ELEVATION (Feet NGVD)	COMPLETION DEPTH (FEET BGS)	CONSTRUCTION MATERIAL
XDM-93-01X	HOLLOW STEM AUGER	NA	SOIL	3.8-13.8	252.7-242.7	14.5	4" ID PVC
XDM-93-02X	HOLLOW STEM AUGER	NA	SOIL	3.0-13.0	252.9-242.9	14	4" ID PVC
XDM-93-03X	HOLLOW STEM AUGER	NA	SOIL	5.0-15.0	248.8-238.8	16	4" ID PVC
XDM-93-04X	HOLLOW STEM AUGER	NA	SOIL	4.1-14.1	249.9-239.6	15	4" ID PVC

NA = Not Applicable

TABLE 6.4-3
ATEC FIELD SCREENING/LABORATORY RESULTS
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Sample No.	Field Screening		Laboratory	
	PID (ppm)	NDIR (ppm)	VOC (ppm)	TPHC (ppm)
SS-1	1	46.3	NA	NA
SS-2	ND	27.3	NA	NA
SS-3	1	24.2	NA	NA
SS-4	12	15.9	NA	NA
SS-5	1.5	59.5	NA	NA
SS-6	ND	82.8	NA	NA
SS-7	10	1132.6	NA	NA
SS-8	ND	18.6	NA	NA
LRS-1	ND	NA	NA	ND
LRS-2	0.2	NA	0.005	119
LRS-3	ND	NA	NA	35
LRS-4	1.0	NA	NA	ND
LWS-1	NA	NA	ND	35

Notes:

SS = ATEC field screen soil sample
LRS = ATEC laboratory soil sample
LWS = ATEC laboratory water sample
NA = Not analyzed
ND = Non detect

TABLE 6.4-4
SUMMARY OF SOIL BORINGS
SA 43D - HISTORIC GAS STATION D
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (FEET BGS)	REFERENCE SAMPLE INTERVALS (FEET BGS)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43D-92-01X	10.8	5-7 10-12	5-7 10-12	SP GW	BKG BKG	
XDM-93-01X	16.5	1-3 4.5-6.5 9.5-11.5 14.5-16.5	9.5-11.5	SP SP SP-PT SP	BKG BKG BKG BKG	
XDM-93-02X	14	1-3 4.5-6.5 9.5-11.5	9.5-11.5	SP SP PT	BKG BKG BKG	
XDM-93-03X	16	0-2 5-7 10-12 14-16	10-12	SP SP SW SP-SM	BKG BKG BKG BKG	
XDM-93-04X	17	0-2 5-7 10-12 15-17	10-12	SP SP SW SW	BKG BKG BKG BKG	

NOTES:

bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site.

TABLE 6.4-5
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 43D - HISTORIC GAS STATION D

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (FEET BGS)	ELEVATION OF WATER (FEET NGVD)	CONDUCTIVITY
				HVORSLEV ² (CM/SEC)
XDM-93-01X	256.55	1.31	255.24	1.4E-05
XDM-93-02X	255.72	5.35	250.37	1.6E-05
XDM-93-03X	256.39	6.38	241.38	1.5E-02
XDM-93-04X	255.91	6.70	240.24	4.0E-03

Notes:

bgs = below ground surface

cm/sec = centimeters per second

NGVD = National Geodetic Vertical Datum

1 = elevation of top of pvc

2 = averaged value of two tests

Groundwater elevations from March 30, 1994.

synoptic water level round

TABLE 6.4-6
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43D - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-01	TP-02	TP-04	TP-05	TP-06	TP-07	TP-08	TP-09	TP-10	TP-12	TP-12	TP-13
	TSD0109F	TSD0709F	TSD0409F	TSD0509F	TSD0609F	TSD0709F	TSD0809F	TSD0909F	TSD1009F	TSD1208F	TSD1209F	TSD1308F
ORGANICS (ppb)	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	8 FT	9 FT	8 FT
BENZENE	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	220	440	< 0.2
TOLUENE	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	72	57	< 0.2
ETHYLBENZENE	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	19	< 14	150	< 0.2
m/p-XYLENE	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	88	240	870	< 0.2
o-XYLENE	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	43	180	440	< 0.2
OTHER (ppm)												
TOTAL PETROLEUM HYDROCARBONS	110	200	<46	<58	160	<54	510	360	1615	2600	750	190

Notes:
< = Less than detection limit.

TABLE 6.4-6
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-13	TP-14	TP-14	TP-15	TP-15	TP-16	TP-16	TP-17	TP-17	TP-18	TP-19	TP-19
ORGANICS (ppb)	TSD1309F 9 FT	TSD1403F 8 FT	TSD1409F 9 FT	TSD1508F 8 FT	TSD1509F 9 FT	TSD1608F 8 FT	TSD1609F 9 FT	TSD1708F 8 FT	TSD1709F 9 FT	TSD1809F 9 FT	TSD1908F 8 FT	TSD1910F 10 FT
BENZENE	<0.3	<120	<0.4	<13	<0.1	<11	<0.1	<0.4	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.3	<120	<0.4	<13	<0.1	<11	0.6	<0.4	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.3	<120	<0.4	120	<0.1	80	20	<0.4	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.3	2200	<0.4	680	2.0	1700	130	5.6	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.3	1300	<0.4	160	0.7	1500	57	14	<0.1	0.7	<0.1	<0.1
OTHER (ppm)												
TOTAL PETROLEUM HYDROCARBONS	130	4500	360	4200	74	170	410	150	<58	290	58	130

Notes:
< = Less than detection limit.

TABLE 6.4-7
SUMMARY OF ANALYTES IN SUBSURFACE SOIL
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI				SI		
		XDM-93-01X 10 FT	XDM-93-02X 10 FT	XDM-93-03X 10 FT	XDM-93-04X 10 FT	43D-92-01X 5 FT	43D-92-01X 10 FT	
ORGANICS (ug/g)								
ACETONE		0.42	0.2	< 0.017	< 0.017	< 0.017	< 0.017	
DI-N-BUTYL PHTHALATE		< 0.061	0.19	0.16	0.085	<0.061	<0.061	
TOLUENE		0.012	< 0.004	< 0.001	< 0.001	< 0.001	< 0.001	
INORGANICS (ug/g)								
LEAD	36.9	6.15	5.04	1.84	6.11	3.49	7.89	
OTHER (ug/g)								
TOTAL ORGANIC CARBON		138000	13800	1120	1970	NA	1040	
TOTAL PETROLEUM HYDROCARBONS		< 28.7	< 28.7	< 28.7	50.7	< 27.7	< 27.9	

Notes:

< = Less than detection limit.

TABLE 6.4-8
ANALYTES IN GROUNDWATER
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	XDM-93-01X				XDM-93-02X				
	BACKGROUND	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4
ORGANIC (µg/L)									
BENZENE		NA	< 0.5	NA	0.8	NA	< 0.5	NA	< 0.5
BIS(2-ETHYLMETHYL)PHTHALATE		NA	< 0.6	NA	< 0.6	NA	< 0.6	NA	< 0.6
INORGANICS (µg/L)									DUP
LEAD	4.25	< 1.26	2.28	< 1.26	1.52	< 1.26	< 1.26	< 1.26	3.69
OTHER (µg/L)									< 1.26
TOTAL SUSPENDED SOLIDS		NA	80000	NA	40000	NA	11000	NA	13000
									NA

Notes:
 < = Less than detection limit.
 NA = Not analyzed.

TABLE 6.4-8
ANALYTES IN GROUNDWATER
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XDM-93-03X				XDM-93-04X			
		UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 4	FILTERED ROUND 4	UNFILTERED ROUND 3	FILTERED ROUND 3	UNFILTERED ROUND 4	FILTERED ROUND 4
ORGANIC (µg/L)									
BENZENE		< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA
BIS(2-ETHYLMETHYL)PHTHALATE		< 0.6	NA	< 0.6	NA	< 0.6	NA	< 0.6	NA
INORGANICS (µg/L)		DUP							
LEAD	4.25	5.21	< 1.26	3.25	< 1.26	1.41	< 1.26	2.28	< 1.26
OTHER (µg/L)									
TOTAL SUSPENDED SOLIDS		10000	NA	60000	NA	88000	NA	43000	NA
									53000

Notes:
< = Less than detection limit.
NA = Not analyzed.

TABLE 6.4-9
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SUBSURFACE SOIL
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
ORGANICS (ug/kg)						
BENZENE	2/16	330	440	99000	10000	NO
TOLUENE	3/16	43.2	72	200000000	90000	NO
ETHYLBENZENE	4/16	92.5	150	100000000	80000	NO
m/p--XYLENE*	8/16	728.5	2200	1000000000	800000	NO
o--XYLENE*	9/16	405.8	1500	1000000000	800000	NO
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	14/16	1000	4500	1680	2500	YES

Notes:

[a] Subsurface soil (3 to 15 feet) based on field analytical samples TP-12 to TP-19 and soil boring XDM-93-02X.

ug/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

MCP = Massachusetts Contingency Plan

Shaded compounds exceed standard or guideline.

* = analyte from field screening samples

TABLE 6.4-10
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF GROUNDWATER
SA 43D - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		GROUNDWATER BACKGROUND CONCENTRATION (µg/L)	MAXIMUM EXCEEDS BACKGROUND ?	DRINKING WATER STANDARD/ GUIDELINE [b] (µg/L)	MAXIMUM EXCEEDS STANDARD/ GUIDELINE ?
		AVERAGE (µg/L)	MAXIMUM (µg/L)				
ORGANICS							
BENZENE	1/9	0.88	0.88	-	-	5	NO
INORGANICS							
LEAD	6/9	3.27	5.21	4.25	YES	15	NO

Notes:

[a] Unfiltered samples from XDM-93-01X to XDM-93-04X.

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

NA = not available

µg/L = micrograms per liter

- = not applicable

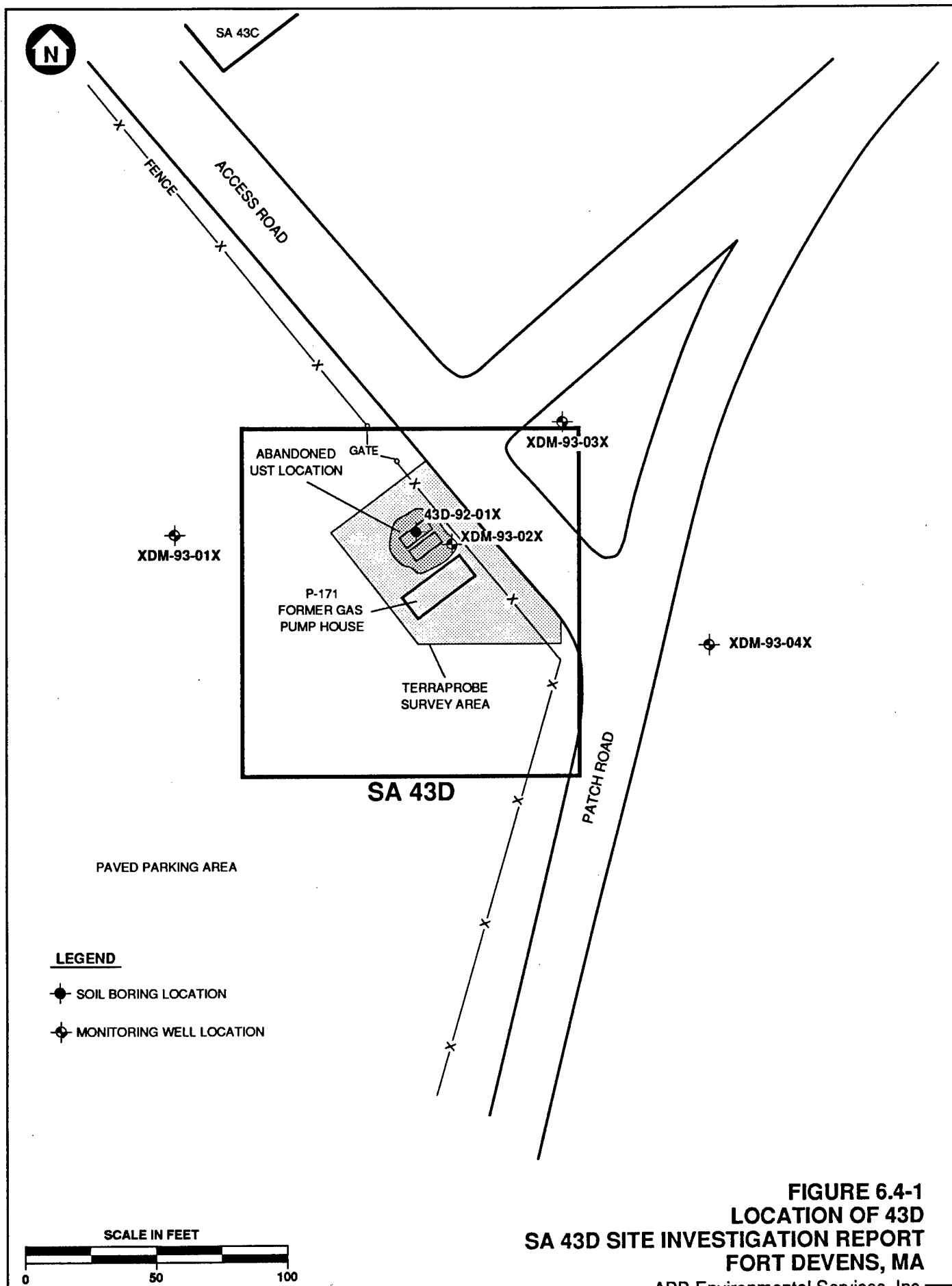
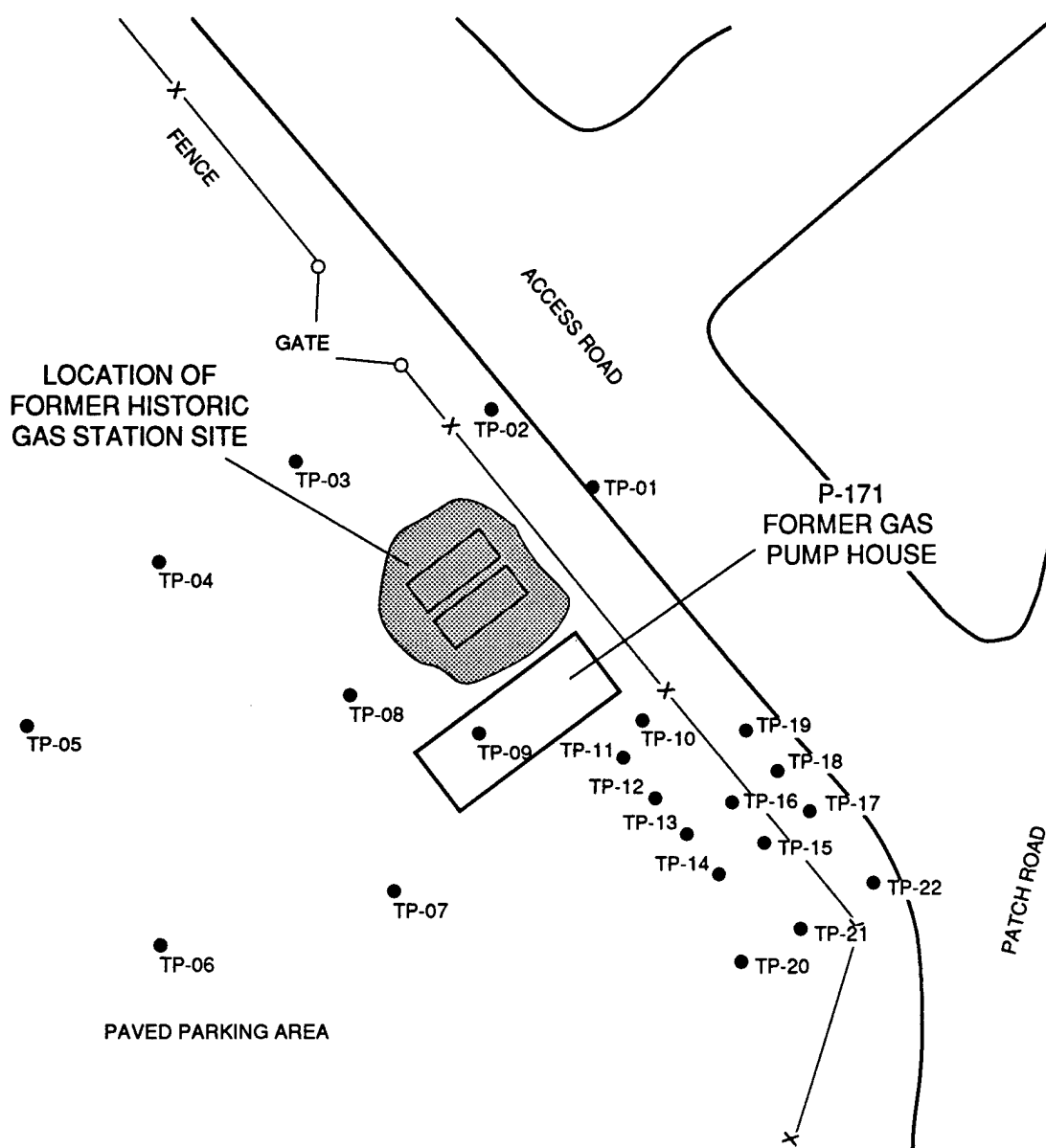


**FIGURE 6.4-1
LOCATION OF 43D
SA 43D SITE INVESTIGATION REPORT
FORT DEVENS, MA**

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LEGEND

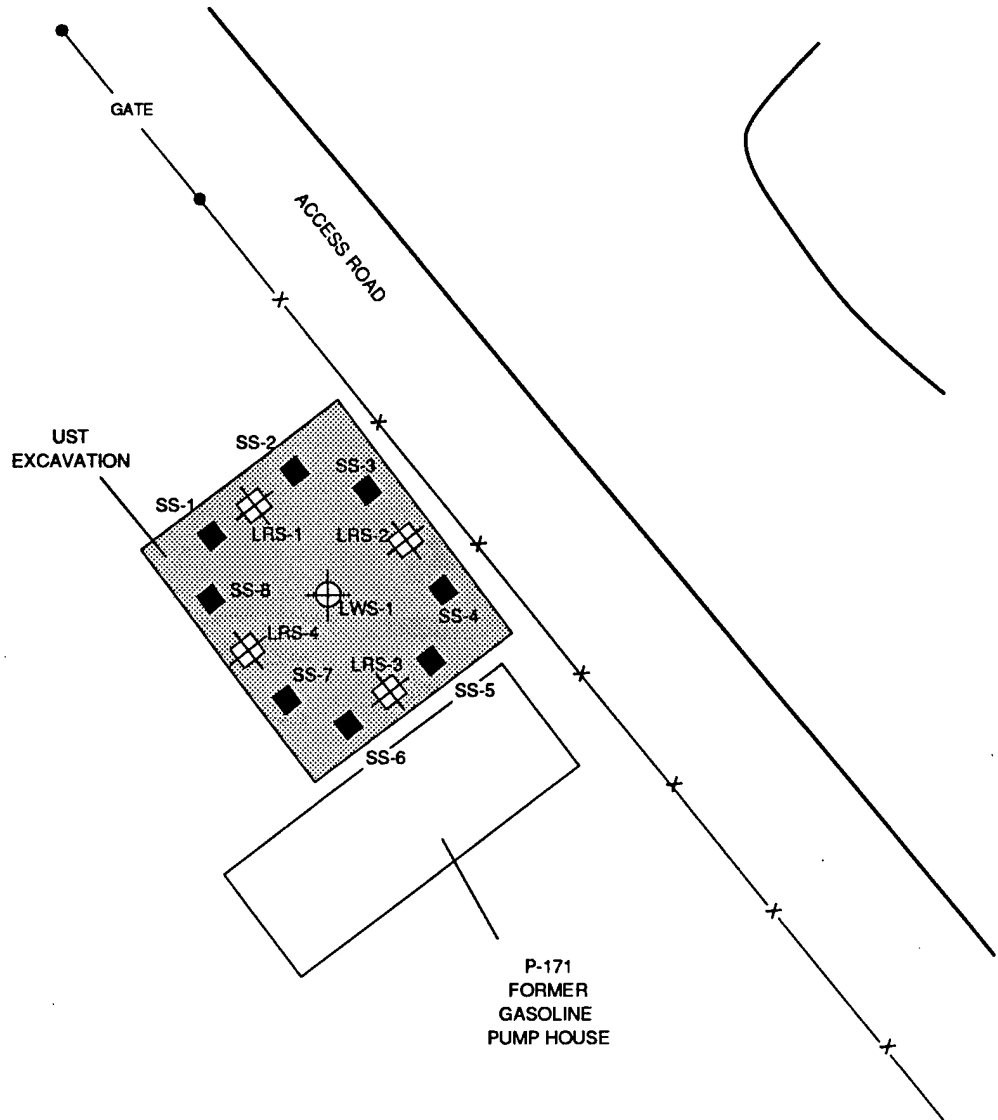
● TERRAPROBE LOCATION

SCALE IN FEET



FIGURE 6.4-2
TERRAPROBE POINT LOCATIONS
SA 43D SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND



ATEC FIELD SCREENING LOCATIONS



ATEC LABORATORY SOIL SAMPLE LOCATION



ATEC LABORATORY WATER SAMPLE LOCATION

SCALE IN FEET

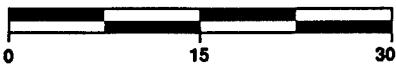
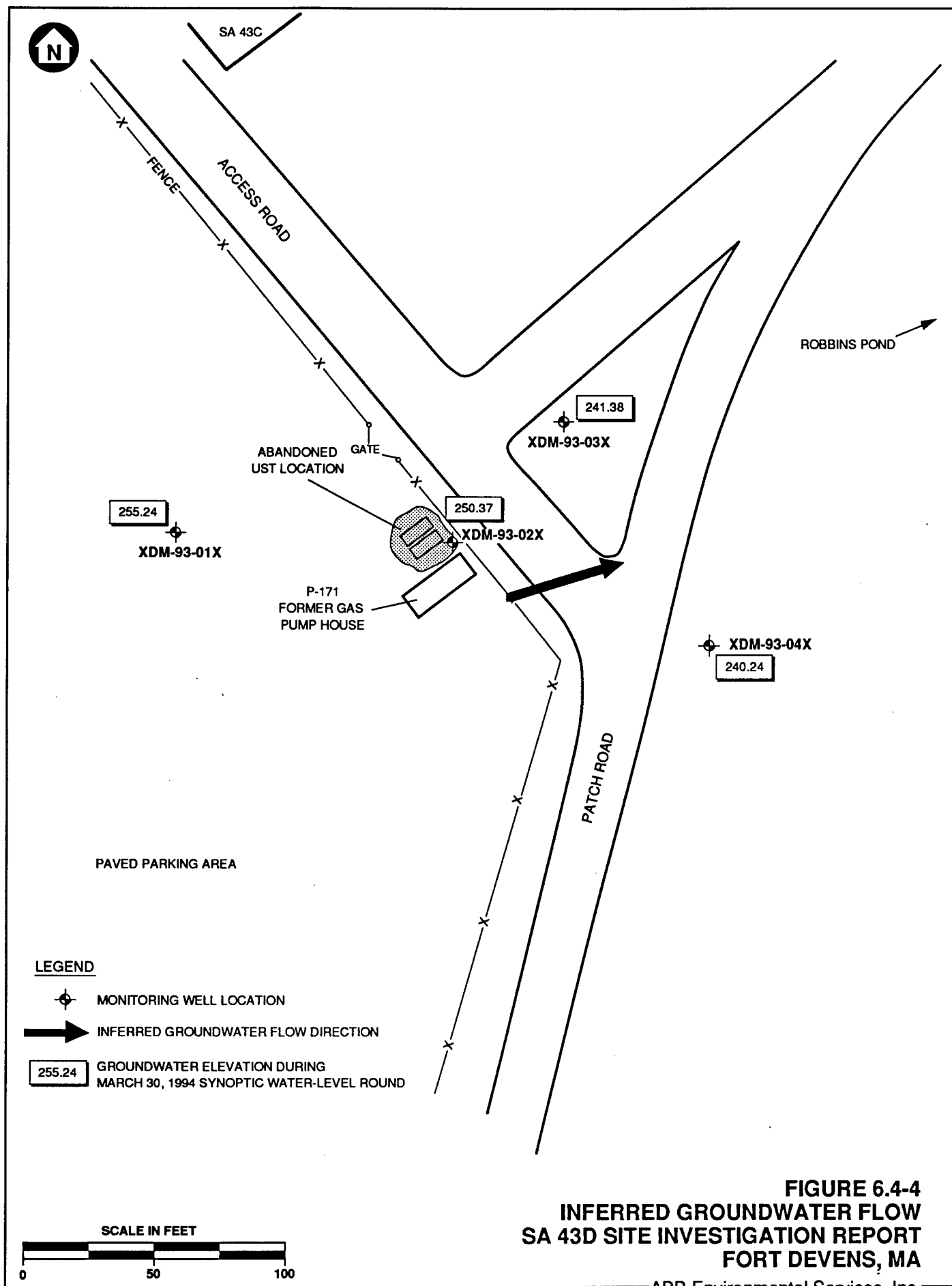
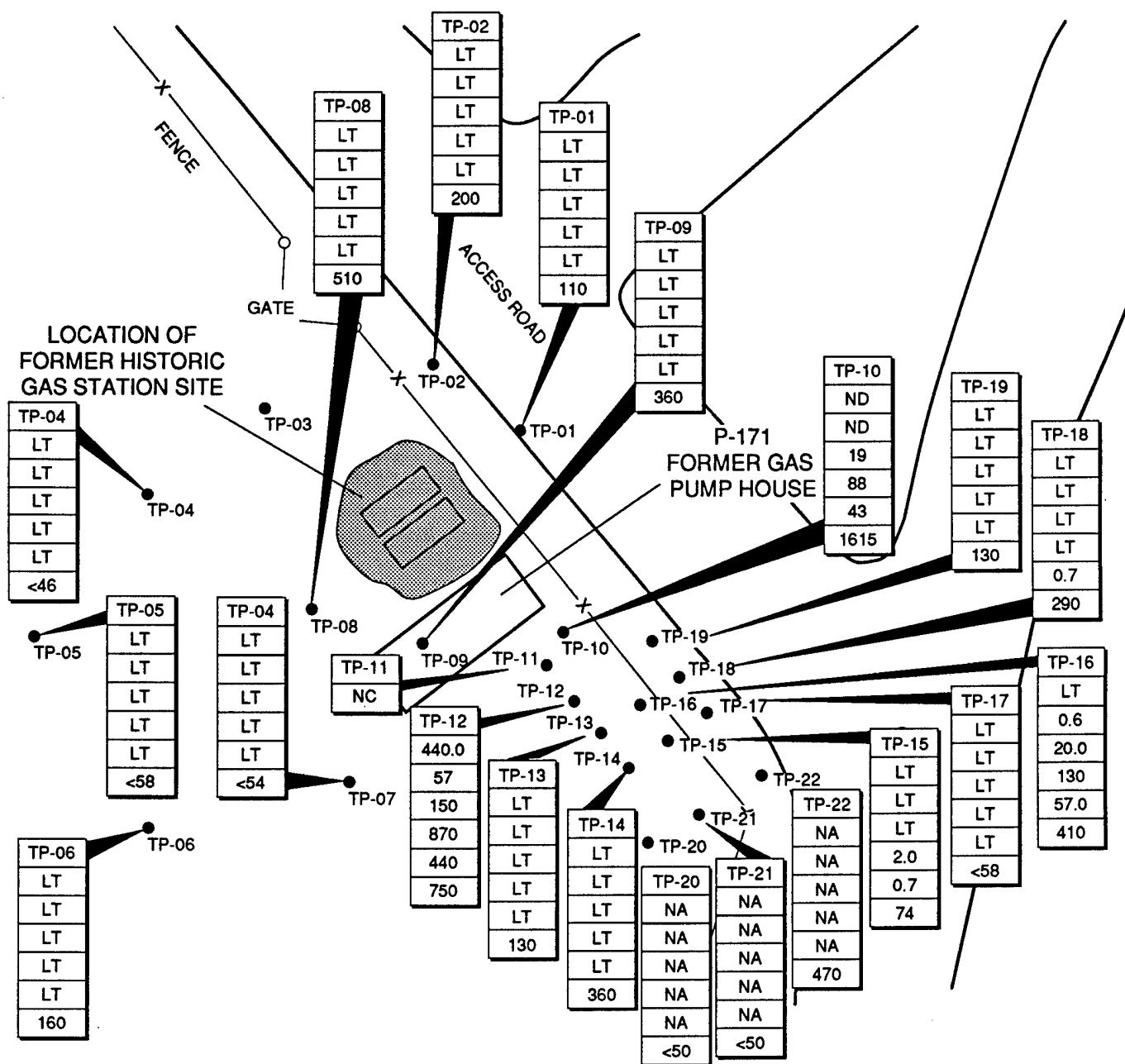


**FIGURE 6.4-3
ATEC-EC FIELD
SCREENING LOCATIONS
SA 43D SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.



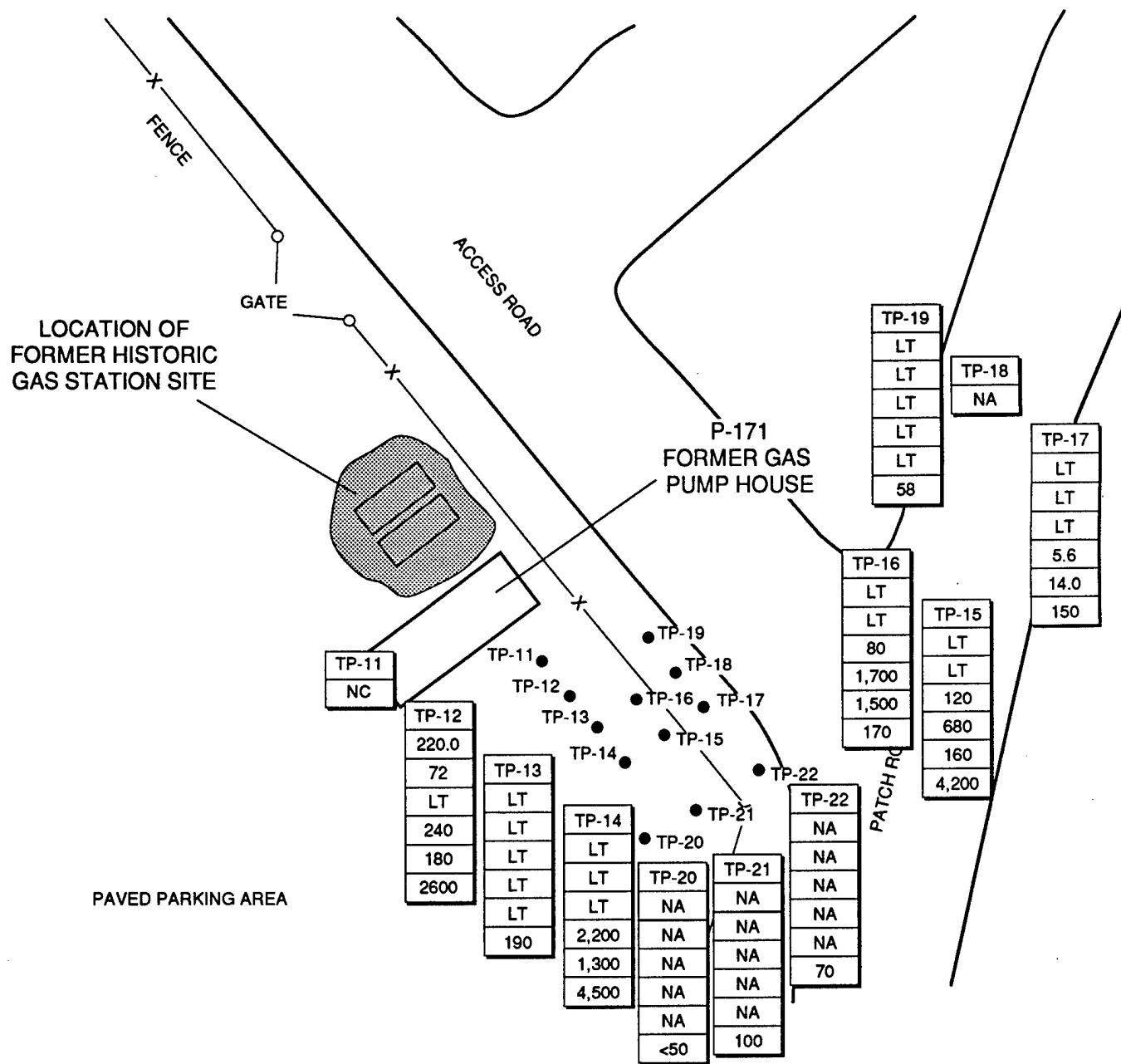


● TERRAPROBE LOCATION

SCALE IN FEET

0 25 50

-ABB Environmental Services, Inc.:



LEGEND



TERRAPROBE LOCATION

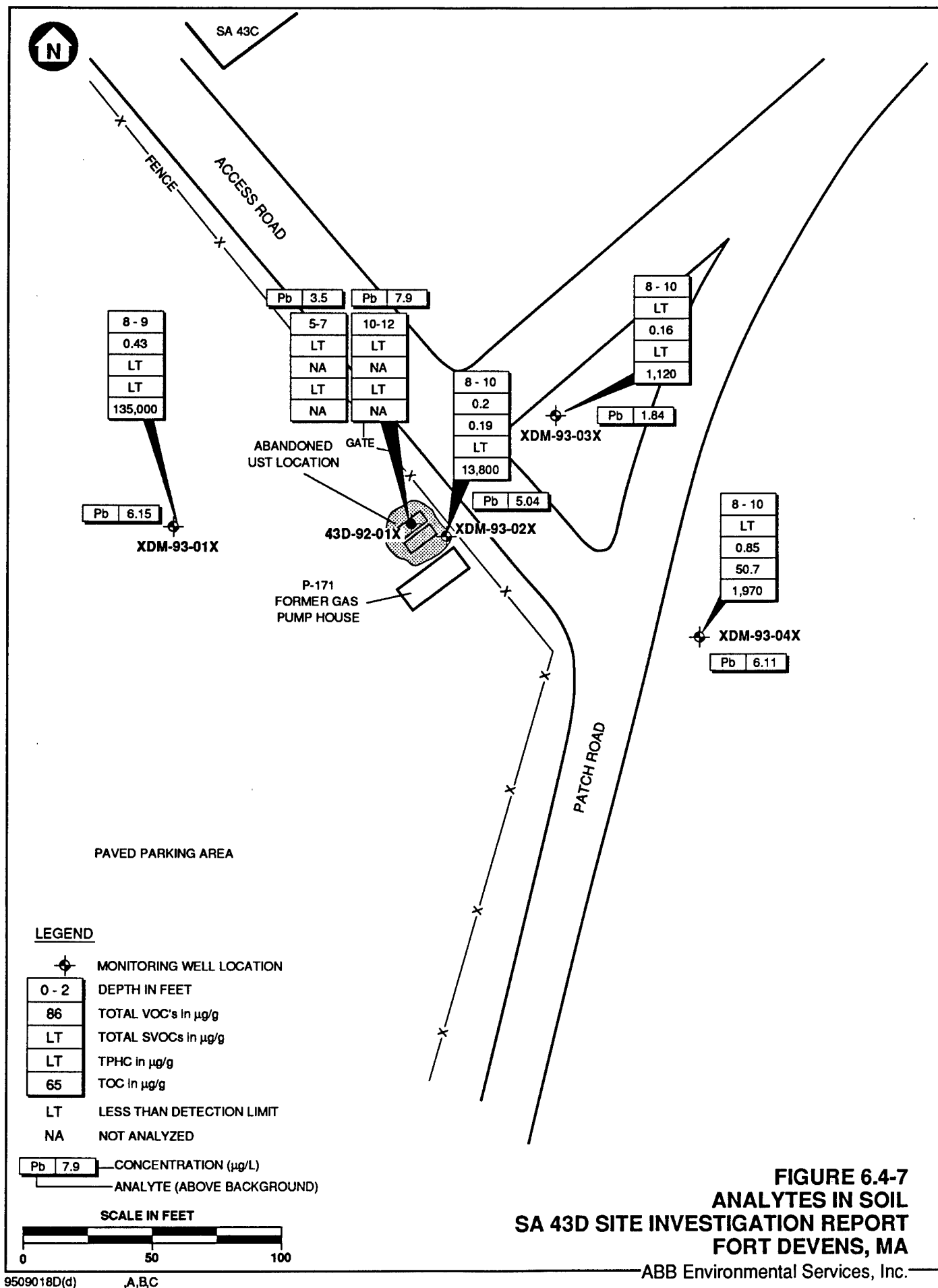
TP-01	Sample ID
LT	Benzene in ppb
LT	Toluene in ppb
LT	Ethylbenzene in ppb
LT	M/P Xylene in ppb
LT	O-Xylene in ppb
60	TOTAL Petroleum Hydrocarbons ppm

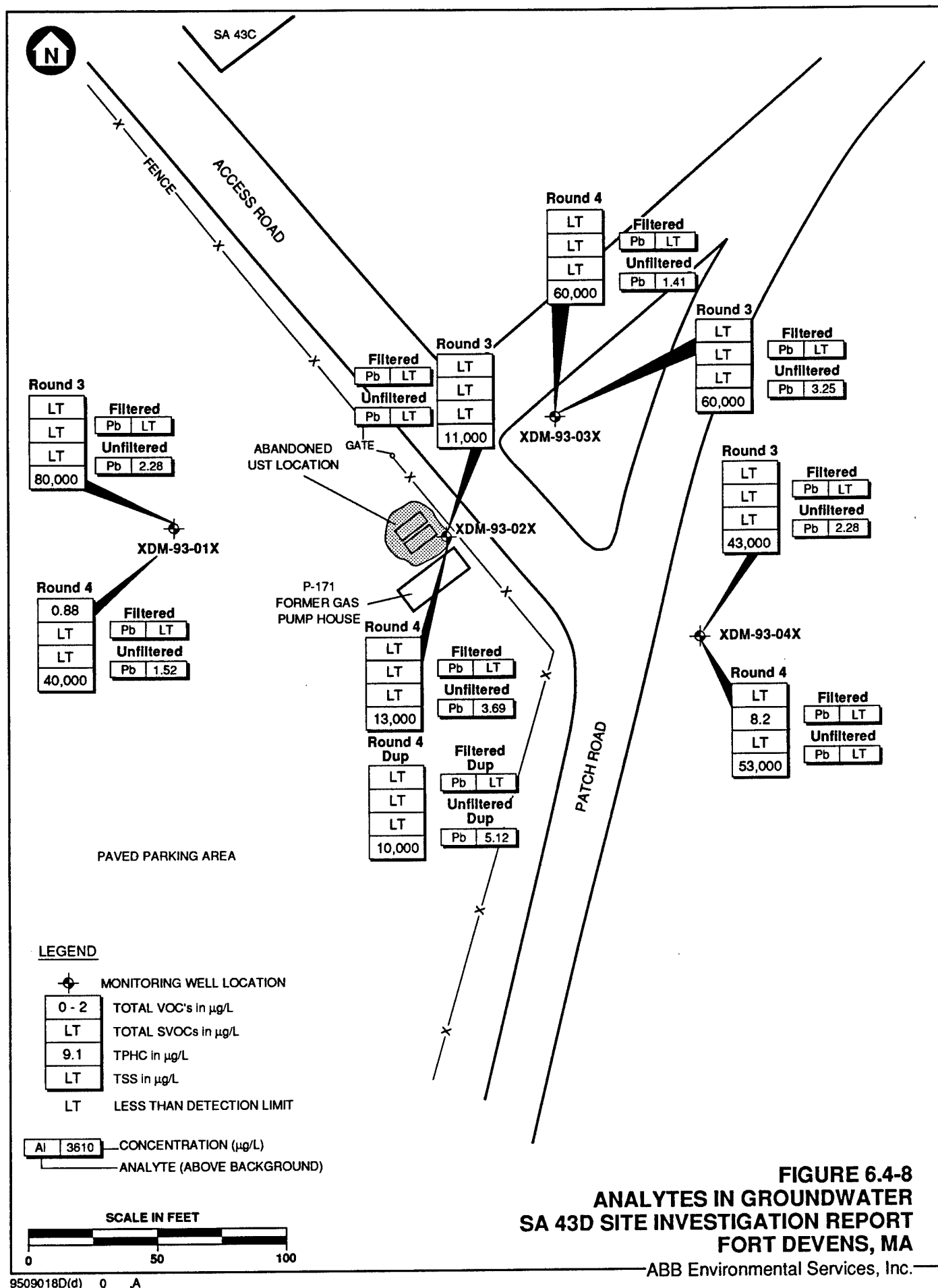
NA NOT ANALYZED
NC NOT COLLECTED
LT LESS THAN DETECTION LIMIT

SCALE IN FEET



FIGURE 6.4-6
FIELD ANALYTICAL RESULTS DEPTH AT 8 FT.
SA 43D SITE INVESTIGATION REPORT
FORT DEVENS, MA





6.5 STUDY AREA 43E

6.5.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43E consisted of a pump island and a small gasoline pumphouse. Based on historic records the gas station was a Type A station and appears to have had one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. The area where SA 43E was reportedly located is presently a paved parking lot for Buildings 2000 and 2020 (Shawmut Bank) located in the central portion of the Main Post (Figure 6.5-1).

6.5.2 Study Area Investigation Program Summary

The SI field investigation program was a surficial geophysical program consisting of a metal detector and GPR survey (see Figure 6.5-1).

6.5.3 Field Investigation Results and Observations

The geophysical investigation conducted at SA 43E indicated that one abandoned UST was present on the northern side of the Building 2020 (see Figure 6.5-1). The geophysical measurements collected in the field are presented in Appendix L. The metal detector was used first to locate the UST and then the GPR survey identified the ends and the sides of the UST. This UST was added to the installation's UST removal program and on September 3, 1992 a 5,000 gallon UST was removed by ATEC. Tank contents at the time of removal consisted of only gasoline (ATEC, 1992c). No visually contaminated soil was observed in the excavation, and groundwater was not encountered. At the time of the tank removal ATEC performed field screening on 10 soil samples collected from the excavation walls at depths of 5 to 6 feet (Figure 6.5-2). The headspaces of each soil sample was screened with a PID for total VOCs, and NDIR was used to screen for TPHC. The PID headspace screening showed VOC concentrations ranging from 0.2 ppm to 0.5 ppm. TPHC was detected at concentrations ranging from 4.8 ppm to 43.5 ppm (Table 6.5-1). ABB-ES collected one composite soil sample from the bottom of the excavation. This sample was analyzed at ABB-ES'

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SECTION 6

Wakefield, Massachusetts laboratory for TPHC using USEPA Method 418.1, and the concentration was 85 ppm (see Table 6.5-1). Based on the results of ATEC's sampling and analysis, ATEC backfilled the excavation. Because TPHC levels were less than 100 ppm, no further site investigation was conducted.

6.5.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

Fuel-related soil contamination was not observed in the UST excavation or detected in the soil after the UST was removed from SA 43E. Based on these results it appears that the contents of the former UST did not adversely impact the soil or groundwater quality at SA 43E.

6.5.5 Preliminary Human Health Risk Evaluation

The UST at SA 43E was discovered by ABB-ES and pulled by ATEC during the SI. Prior to backfilling, ATEC collected 8 soil samples from the excavation walls which were screened for TPHC by the NDIR method. TPHC levels ranged from 4.8 ppm to a maximum value of 43.5 ppm in the UST wall samples. The TPHC level in a confirmatory soil sample collected by ABB-ES for TPHC analysis by USEPA Method 418.1 was 85 $\mu\text{g/g}$. Based on a comparison of these results against the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline, there should be no significant risk to public health from soil contamination at SA 43E.

6.5.6 Conclusions and Recommendations

Limited field investigation conducted by ABB-ES and sampling conducted by ATEC during the UST removal operation at SA 43E indicated that historical petroleum use and underground storage at this location has not adversely impacted soil or groundwater. Therefore, NFA is recommended for this historic gas station.

TABLE 6.5-1
ATEC FIELD SCREENING RESULTS
SA 43E - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY	
	PID (ppm)	NDIR (ppm)	VOC (ppm)	TPHC (ppm)
SS-1	0.5	16.9	N/A	N/A
SS-2	0.2	43.5	N/A	N/A
SS-3	ND	6.2	N/A	N/A
SS-4	ND	17.7	N/A	N/A
SS-5	ND	22.1	N/A	N/A
SS-6	ND	5.6	N/A	N/A
SS-7	ND	4.8	N/A	N/A
SS-8	ND	7.7	N/A	N/A
SS-9	0.5	24.5	N/A	N/A
SS-10	0.5	12.1	N/A	N/A
LSS-1	N/A	N/A	ND	< 21.0
LSS-2	N/A	N/A	ND	127.0
XEE-92-01X	N/A	N/A	N/A	85.0

NOTES:

SS = ATEC field screening soil sample

LSS = ATEC laboratory soil sample

ND = Non-detect

N/A = Not analyzed

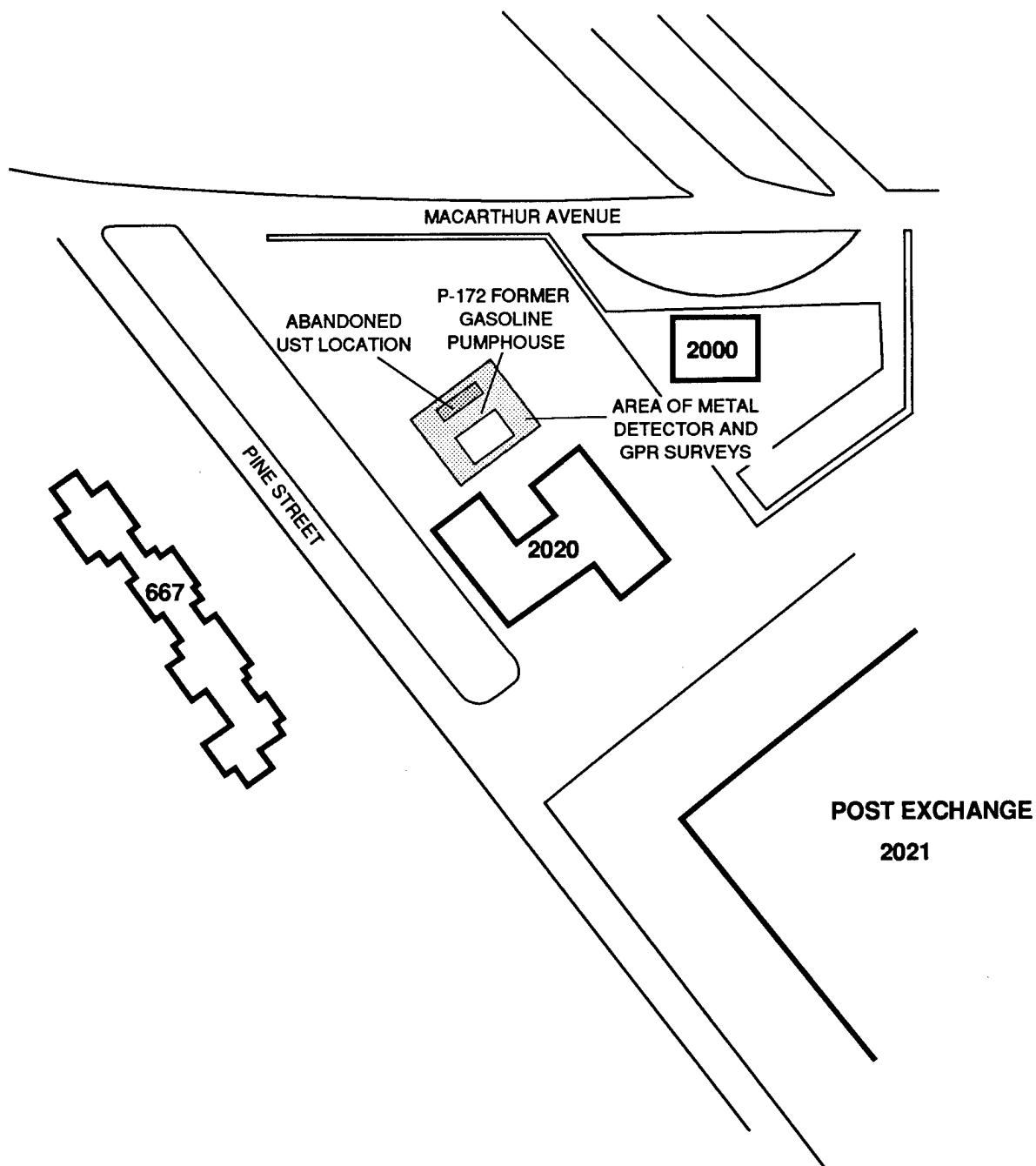
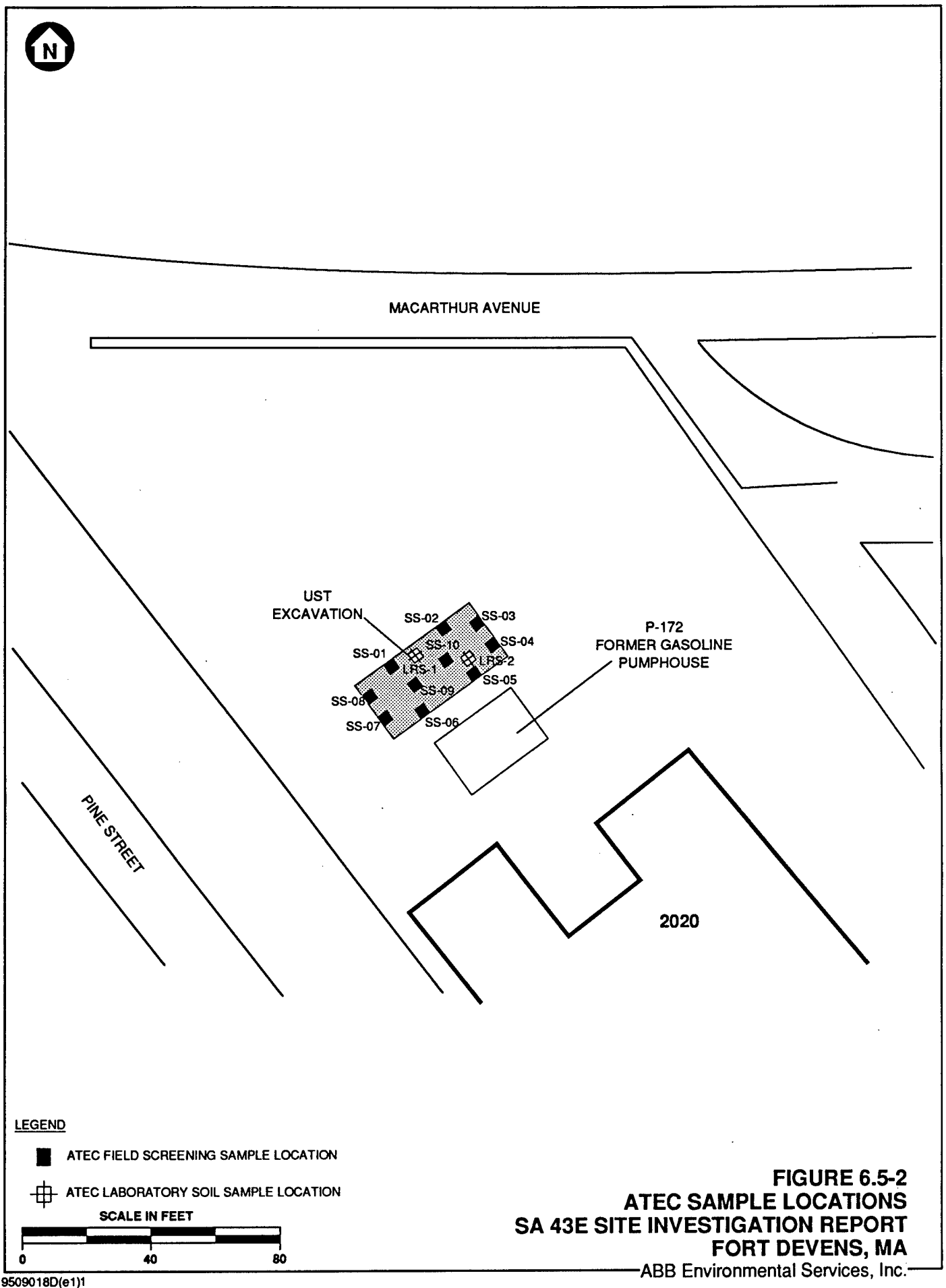


**FIGURE 6.5-1
LOCATION OF SA 43E
SA 43E SITE INVESTIGATION REPORT
FORT DEVENS, MA**

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6.6 STUDY AREA 43F

6.6.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43F consisted of a pump island and a small gasoline pumphouse. The gas station was Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. The location of the historic gas station at SA 43F was within the footprint of what is now the Post Exchange (PX) Main Store (Building 2021). The PX is located in the central portion of the Main Post approximately 250 feet south east of SA 43E (Figure 6.6-1). Fort Devens records documents that the gasoline UST and associated fill pipes and concrete collars were removed prior to the construction of the PX (Army and Air Force Exchange Service [AAFES], 1973).

6.6.2 Site Investigation Program Summary

A field investigation was conducted at SA 43F to determine if residual soil contamination was still present in the subsurface soil. The program consisted of collecting subsurface soil samples and soil-gas samples for field analysis.

Surficial geophysical surveys were not conducted at SA 43F due to the fact that the former historic gas station is located under the present PX building.

Nine TerraProbe points were advanced along the three accessible sides of the PX building to seek evidence of possible migration of residual contamination away from the site of the historic gas station (see Figure 6.6-1).

Seven soil samples were collected from 9 feet, three soil samples were collected from 15 feet and one soil sample was collected from 20. Only one soil sample was collected from 20 feet due to subsurface obstructions. All of the soil samples collected from SA 43F were analyzed in the field for BTEX and TPHC. The water table was not reached in any of the soil sampling TerraProbe points. Because of this, soil-gas samples were collected from all nine locations and field screened for BTEX only. No soil borings or monitoring wells were completed at this site.

SECTION 6

6.6.3 Field Investigation Results and Observations

Seven soil samples were collected from 9 feet to analyze the shallow soil for fuel-related contaminants. BTEX was not detected in any of the samples and TPHC was detected in TP-04 at 87 ppm (Figure 6.6-2). Three soil samples were collected from 15 feet and one soil sample was collected from 20 feet. No BTEX were detected in any of the samples and TPHC was detected in only the sample collected from 15 feet bgs at TP-05 at 250 ppm (Figure 6.6-3). Because the TerraProbe borings met refusal without encountering groundwater, the sampling logic established for SA 43 required that soil-gas samples be collected. Nine soil-gas samples were collected and field screened for BTEX only. BTEX was not detected in any of the soil samples collected from SA 43F (Figure 6.6-4). Table 6.6-1 presents the field analysis results for SA 43F.

6.6.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

The objective of the field investigation at SA 43F was to determine if the former historic gas station activities had adversely impacted the soil or groundwater quality in the area around SA 43F. Based on the results of the subsurface soil sampling program and the field analysis it does not appear that the past activities at SA 43F have impacted the soil quality away from the former UST location.

6.6.5 Preliminary Human Health Risk Evaluation

The tank at this location was removed in approximately 1973. Field-screening of 11 TerraProbe soil samples revealed no measurable concentrations of BTEX to a depth of 20 feet. TPHC was detected above the method detection limit in two of these 11 samples, at 87 ppm and 250 ppm. Nine TerraProbe soil gas sampling stations were established. No measurable concentrations of BTEX were encountered. Comparing the measured TPHC results against the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline indicates that there should be no significant risk to public health from soil contamination at SA 43F.

6.6.6 Conclusions and Recommendations

The objective of the field investigation at SA 43F was to determine if the former historic gas station activities had adversely impacted the soil or groundwater quality in the area around SA 43F. Based on the results of the subsurface soil sampling program and the field analysis, it does not appear that the past activities at SA 43F have impacted the soil quality in the vicinity of the former UST location. Therefore, NFA is recommended at this historic gas station.

TABLE 6.6-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE F

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA#	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTEX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSF04XX901XF	43F	SOIL	TP-04	9	87	0	ND	ND	ND	ND	ND	
43TSF05XX901XF	43F	SOIL	TP-05	9	< 55	0	ND	ND	ND	ND	ND	
43TSF05X1501XF	43F	SOIL	TP-05	15	250	0	ND	ND	ND	ND	ND	
43TSF06XX901XF	43F	SOIL	TP-06	9	< 55	0	ND	ND	ND	ND	ND	
43TSF06XX901XF	43F	SOIL	TP-06	15	< 55	0	ND	ND	ND	ND	ND	
43TSF07XX901XF	43F	SOIL	TP-07	9	< 55	0	ND	ND	ND	ND	ND	
43TSF07X1501XF	43F	SOIL	TP-07	15	< 55	0	ND	ND	ND	ND	ND	
43TSF08XX901XF	43F	SOIL	TP-08	9	< 55	0	ND	ND	ND	ND	ND	
43TSF09XX901XF	43F	SOIL	TP-09	9	< 55	0	ND	ND	ND	ND	ND	
43TSF10XX901XF	43F	SOIL	TP-10	9	< 55	0	ND	ND	ND	ND	ND	
43TSF10X2001XF	43F	SOIL	TP-10	20	< 55	0	ND	ND	ND	ND	ND	
43TGF02XX801XF	43F	GAS	TP-02	9	NA	0	ND	ND	ND	ND	ND	
43TGF03XX801XF	43F	GAS	TP-03	9	NA	0	ND	ND	ND	ND	ND	
43TGF04XX801XF	43F	GAS	TP-04	9	NA	0	ND	ND	ND	ND	ND	
43TGF05XX801XF	43F	GAS	TP-05	9	NA	0	ND	ND	ND	ND	ND	
43TGF06XX801XF	43F	GAS	TP-06	9	NA	0	ND	ND	ND	ND	ND	
43TGF07XX801XF	43F	GAS	TP-07	9	NA	0	ND	ND	ND	ND	ND	
43TGF08XX801XF	43F	GAS	TP-08	9	NA	0	ND	ND	ND	ND	ND	
43TGF09XX801XF	43F	GAS	TP-09	9	NA	0	ND	ND	ND	ND	ND	
43TGF10XX801XF	43F	GAS	TP-10	9	NA	0	ND	ND	ND	ND	ND	

NOTES:

* = ND denotes a non detect or concentrations below 5 ppb.

** = ND denotes a non detect or concentrations below 10 ppb

= Study area

GAS = Soil gas

NA = Not applicable

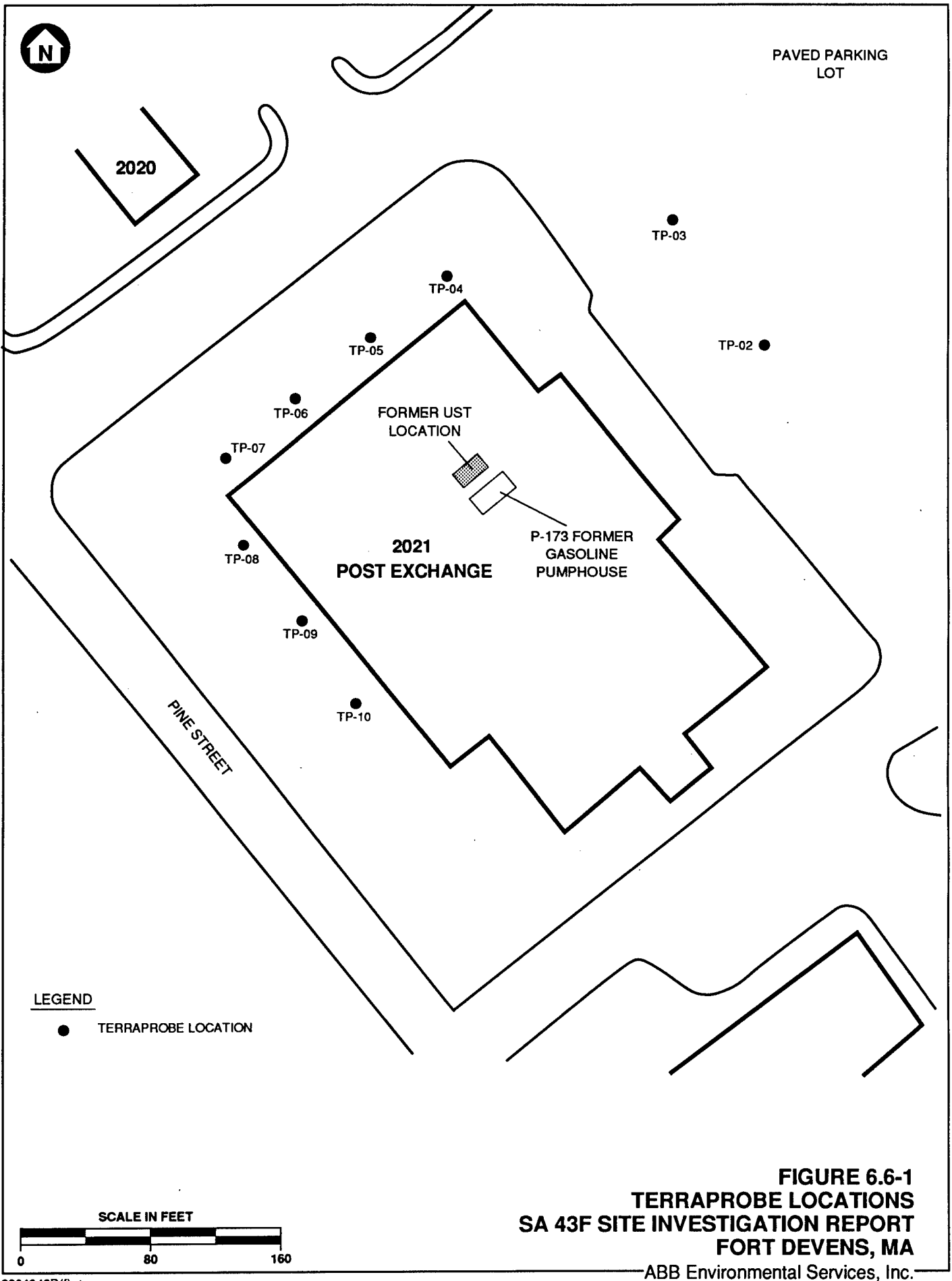
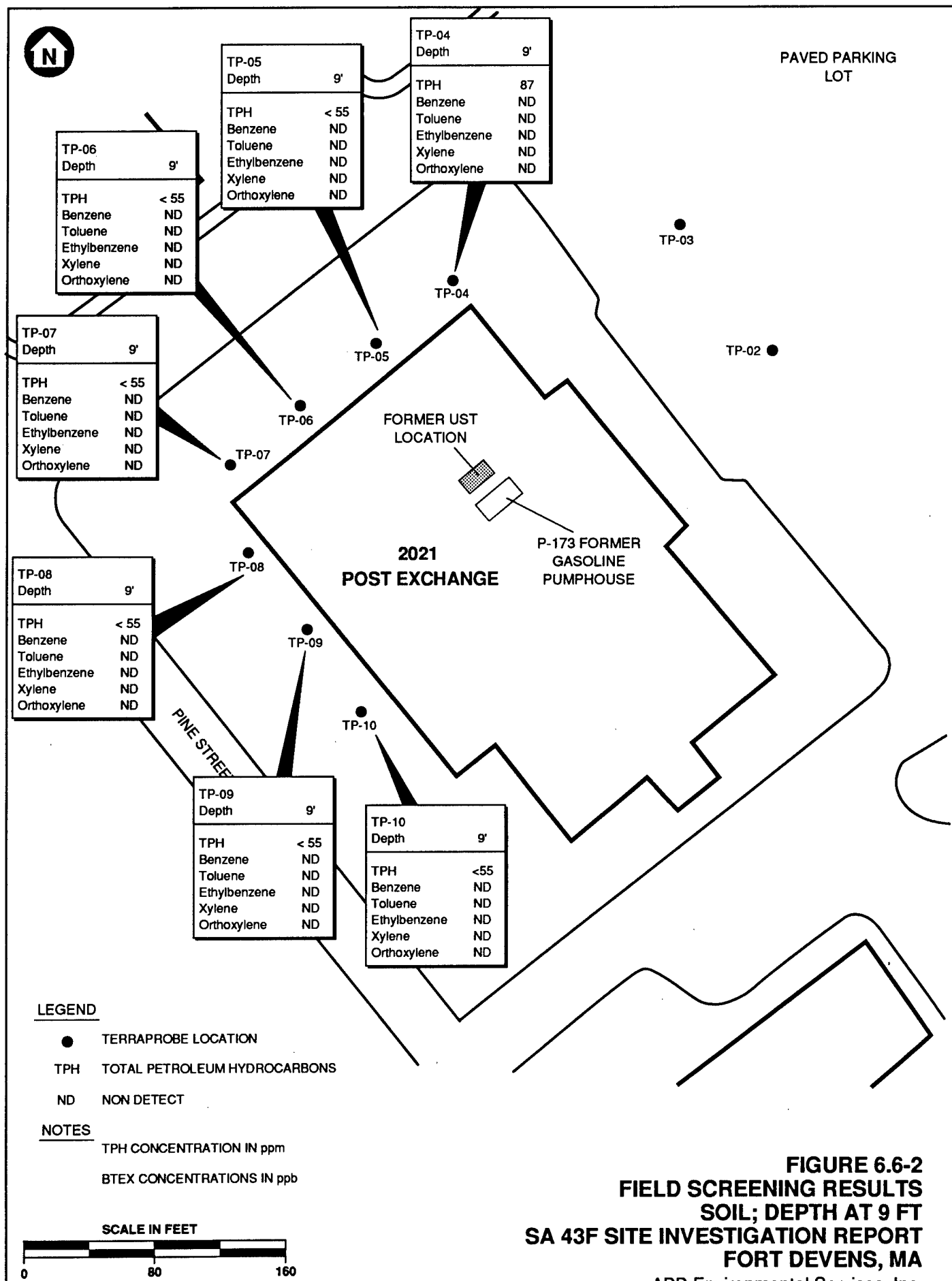


**FIGURE 6.6-1
TERRAPROBE LOCATIONS
SA 43F SITE INVESTIGATION REPORT
FORT DEVENS, MA**

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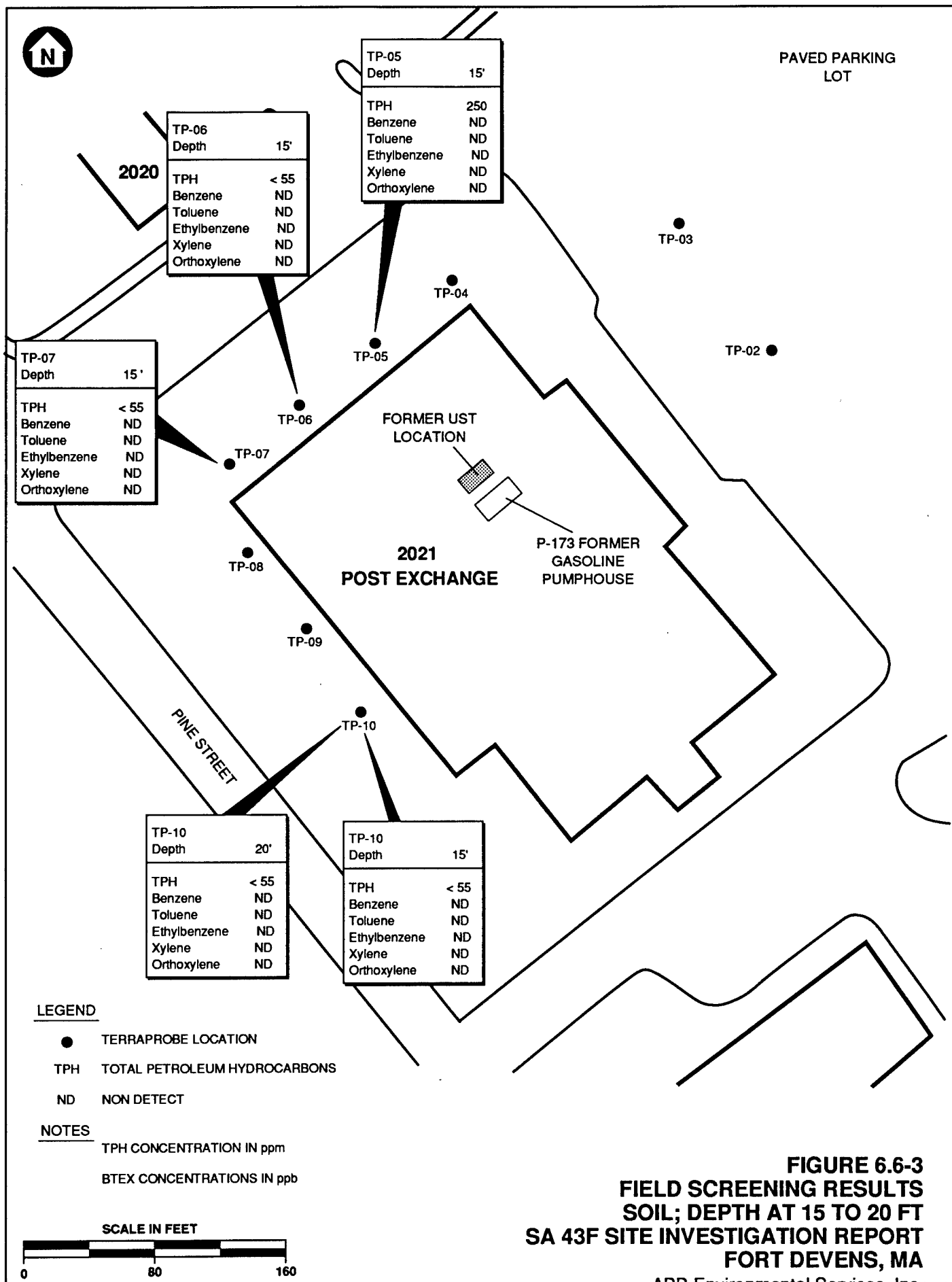


FIGURE 6.6-3
FIELD SCREENING RESULTS
SOIL; DEPTH AT 15 TO 20 FT
SA 43F SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

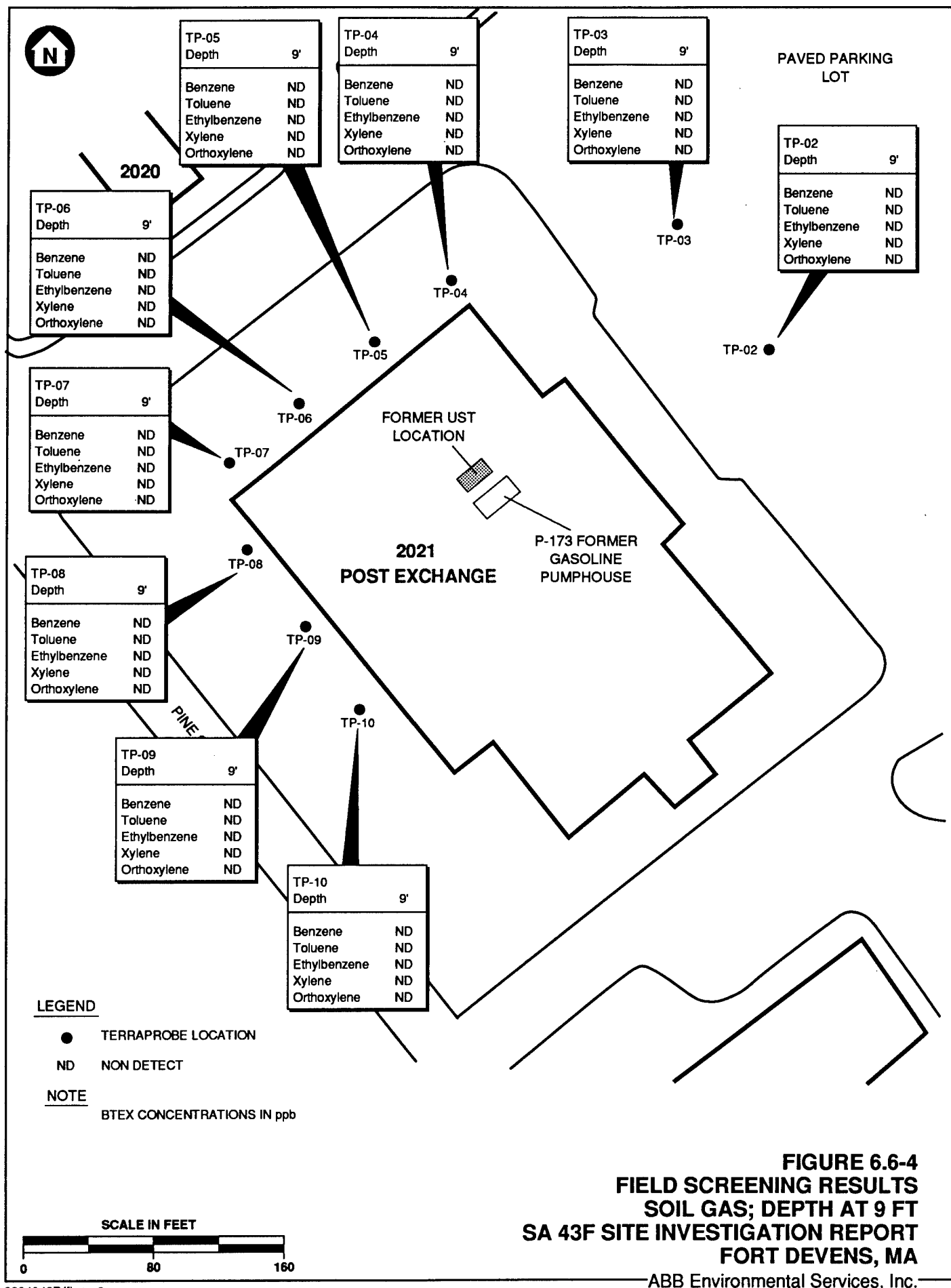


FIGURE 6.6-4
FIELD SCREENING RESULTS
SOIL GAS; DEPTH AT 9 FT
SA 43F SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.7 STUDY AREA 43G

6.7.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43G consisted of a pump island and a small gasoline pumphouse. The gas station was reportedly a Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. The area where SA 43G was reportedly located is presently an unpaved area located behind Building 2009 and south of the installation's active gas station in the central portion of the Main Post (Figure 6.7-1).

The AAFES gas station was added to SA 43G after the SI was completed, to further define the distribution of contamination detected during the past gasoline UST removals (completed in 1990), as well as, the contaminants detected during the stations waste oil UST removal completed in 1992. The AAFES gas station is located approximately 200 feet north of SA 43G and is comprised of the service station (Building 2008) three active 10,000 gallon USTs, and associated pump islands (see Figure 6.7-1).

The five former gasoline USTs were removed by a Fort Devens contractor on October 15 through 19, 1990. The removal was overseen and a report of the removal activities was prepared by Nobis Engineering (Nobis). The Nobis report stated that three 9,000 and two 10,000 gallon USTs were removed from the north side of the AAFES gas station. The USTs, and associated piping, were inspected by Nobis personnel upon removal. Some surficial rusting and minor pitting was observed along the sides and bottom of the USTs, but no visual indication of holes or leaks were reported (Nobis, 1990).

Soil samples were collected from the UST excavations by Nobis, and screened in the field with a PID. Up to 10 soil samples were collected from each UST excavation. Concentration of VOCs ranged from ND to 5,290 ppm. Based on these field screening results Nobis collected two soil samples from each of the UST excavations for off-site laboratory analysis consisting of TPHC using USEPA's method 418.1. The results of the off-site laboratory analysis indicated

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SECTION 6

TPHC concentration ranging from 100 to 3,713 mg/kg. These TPHC concentrations exceeded the MADEP soil standards policy #WSC-400-89 for remediation of contaminated soil (Nobis, 1990).

Because of the elevated TPHC concentrations detected during the UST removals, a soil removal, subsurface soil and groundwater investigation was completed at the AAFES gas station on October 24 through December 13, 1990. A report of the findings of these activities was prepared by Nobis. The investigation was divided into three activities; soil borings and soil sampling for field analysis, soil excavation and removal and groundwater monitoring well installation, and sampling (Nobis, 1991).

The first activity was comprised of 15 soil borings, and subsurface soil sampling, for field screening of total VOCs, using a PID. The soil borings were located in and around the former gasoline USTs mentioned above. The results of the field screening indicated total VOCs ranging from ND to 2,817 ppm. The total VOC concentrations reportedly increased with depth. The highest concentrations of total VOCs were detected in soil samples collected from soil borings located on the southeast, or downgradient side of the former gasoline USTs (Nobis, 1991).

The second activity was a contaminated soil excavation and removal. Based on the results of the soil samples collected during the UST removals and the soil boring program, the soil excavation activity began removing soil from the northwest portion of the former UST area. The soil was removed, screened for total VOCs using a PID, and stockpiled on polyethylene sheeting in a vacant parcel of land southeast of Building 2008. Approximately 1,400 tons of soil was excavated from the former UST excavation as well as areas around the initial excavation. The removal excavation was extended vertically downward to approximately 20 feet (the extent of the excavator). The continuous total VOC screening of soil removed from the excavation, showed concentrations ranging from ND to 2,500 ppm. Reportedly, the highest concentrations were in the southwestern and northern portions of the excavation. Upon completion of the soil excavation, Nobis personnel collected 22 soil samples from the walls of the excavation. The soil samples were submitted for laboratory analysis consisting of TPHC using USEPA method 418.1. The results of the soil samples indicated that TPHC concentrations ranged from 39 to 569 mg/kg in the soil left in the excavation. The former UST excavation was backfilled with approximately 1,400 tons of "clean" soil on December 13, 1990. A total of seven soil samples were

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collected from the stockpiled soils and submitted for laboratory analysis consisting of TPHC and total VOCs. The results reportedly indicated that the stockpiled soil was below 1,800 ppm of TPHC. Based on these results the soil was removed from the site on November 19, 20 and 21, 1990 by Alky Enterprises, Inc. of Greenland, New Hampshire; and transported to Brox Paving Materials, Inc. in Hudson, New Hampshire. The manifests are presented in Appendix E of the Nobis report (Nobis, 1991).

The third phase of the investigation at the AAFES gas station was the installation of seven groundwater monitoring wells (AAFES-1D through AAFES-7). One monitoring well (AAFES-3) was installed in an apparent upgradient location while the remaining six monitoring wells were installed to monitor downgradient groundwater quality. The monitoring wells were sampled by Nobis on December 12, 1990. The samples were analyzed for TPHC only, using USEPA method 418.1. TPHC levels ranged from 1.7 to 5.1 mg/L. The results of the groundwater sampling did not exceed the MADEP action levels for remediation for low environmental impact areas (Nobis, 1991).

On May 27, 1992 ATEC, under contract to Fort Devens, removed a 500 gallon waste oil UST from behind Building 2008. The waste oil UST, and it's associated piping, were in "good condition" upon inspection by ATEC personnel. Groundwater was not encountered in the UST excavation. The soil removed from the side walls and bottom of the UST excavation, was reported as "visibly contaminated" and produced a "strong septic odor". Soil samples were collected from the excavation by ATEC personnel, for field screening consisting of PID headspace and TPHC screening, via IR. The results of the PID field screening showed total VOCs ranging from ND to 48.0 ppm and TPHC concentrations ranging from 6.3 to 28,745.5 ppm. Soil excavated from the waste oil UST removal had similar total VOC and TPHC concentrations (ATEC, 1992).

One soil sample (LSS-1) was collected from the wall of the excavation and another soil sample (LSS-2) was collected from the bottom of the excavation, for laboratory analysis. The samples were analyzed for VOCs, SVOC, Priority Pollutant Metals, and TPHC. The results of the laboratory analyses indicated that chlorinated solvents (tetrachloroethene (152 (LSS-1) and (31 ppb) (LSS-2), and 1,1,1-trichloroethane (11 ppb in LSS-2)) were present in the samples, as well as, xylenes (69 ppb in LSS-2) and methylene chloride (36 and 23 ppb). Bis(2-ethylhexyl)phthalate (2,640 (LSS-1) and 4,170 ppb (LSS-2)) and pyrene

ABB Environmental Services, Inc.

SECTION 6

(2,840 (LSS-1) and 2,670 (LSS-2)) were the only two SVOCs detected. TPHC was detected in each sample at 35,100 and 23,200 ppm, respectively. The metals analysis showed that the Priority Pollutant Metals were within the Fort Devens background concentrations (ATEC, 1992).

6.7.2 Site Investigation Program Summary

The SI at SA 43G was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). Table 6.7-1 summarizes the activities completed during the SI.

A field investigation was conducted at SA 43G to determine if the UST had been removed and if any residual contamination was still present in the subsurface soil. The program consisted of a surficial geophysical survey, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring to collect subsurface soil samples for off-site laboratory analysis (Figure 6.7-2).

Eleven TerraProbe points were advanced in and around the former UST location (see Figure 6.7-2). Three soil samples were collected from 9 feet to analyze the soil at or near the estimated bottom of the former UST. Four soil samples were collected from 11 feet and 12 feet, which was the depth of TerraProbe refusal at this site. All of the subsurface soil samples collected with the TerraProbe unit were analyzed in the field for BTEX and TPHC. The water table was not encountered in any of the TerraProbe points prior to probe refusal. Because groundwater was not reached, ten soil-gas samples were collected from 8 feet (just above the estimated bottom of the tank excavation). The soil-gas samples were analyzed for BTEX only.

One soil boring (43G-92-01X) was drilled to the water table, so that subsurface soil samples could be collected for laboratory analysis. The samples were analyzed in the laboratory for VOCs, TPHC, and lead (see Figure 6.7-2). All SI explorations were surveyed.

6.7.3 Supplemental Site Investigation Program Summary

The SSI at SA 43G was performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The following sections describe the field activities completed at this historic gas station during the SSI. Table 6.7-1 summarizes the activities completed during the SSI.

The SSI at SA 43G was conducted at the historic gas station G as well as at the AAFES gas station. To better define the distribution of contamination at SA 43G, the site was subdivided in three areas. Area 1 was comprised of historic gas station G. Area 2 included the areas around the active gasoline USTs, and Area 3 included the area in and around the former waste oil UST (see Figure 6.7-1).

Area 1. A total of five TerraProbe points were advanced west of the TerraProbe points completed at the historic gas station G during the SI. These points were located to further define the horizontal distribution of contaminants detected during the SI (see Figure 6.7-2). Up to two soil samples were collected from each TerraProbe point. The samples were analyzed in the field for BTEX and TPHC.

Based on the results of the supplemental TerraProbe survey at historic gas station G, one soil boring (XGB-93-09X) was advanced adjacent to the TerraProbe point with the highest concentration of contamination. A total of three soil samples were collected from this soil boring. The soil samples from this boring were analyzed for PAL VOCs, SVOCs, inorganics, TPHC, and TOC (see Figure 6.7-2).

Area 2. A total of 23 TerraProbe points were completed in the Area 2 gas station. These points were concentrated around the active gasoline USTs to determine if residual soil contamination was present (Figure 6.7-3). Up to two soil samples were collected from each point and analyzed in the field for BTEX and TPHC.

The results of the TerraProbe survey at Area 2 were, used to locate three soil borings (XGB-93-05X through XGB-93-07X) at "hot spots" in Area 2 (see Figure 6.7-3). Up to three soil samples were collected from each soil boring for

SECTION 6

laboratory analysis. The soil samples from these borings were analyzed for PAL VOCs, SVOCs, inorganics, TPHC, and TOC.

Area 3. A total of 10 TerraProbe points were completed Area 1 at the AAFES gas station. These points were concentrated in and around the former waste oil UST (see Figure 6.7-3). Up to two soil samples were collected from each point and analyzed in the field for BTEX and TPHC.

The results of the TerraProbe survey at the Area 1 were used to locate two soil borings (XGB-93-03X and XGB-93-04X) at "hot spots" in Area 1 (see Figure 6.7-3). Up to three soil samples were collected from each soil boring for laboratory analysis. The soil samples from these borings were analyzed for PAL VOCs, SVOCs, inorganics, TPHC, and TOC.

Two groundwater monitoring wells (XGM-93-01X and XGM-93-02X) were installed around Areas 2 and 3 to supplement the existing groundwater monitoring well network. These new monitoring wells were installed to monitor upgradient (XGM-93-01X) and downgradient (XGM-93-02X) groundwater quality (see Figure 6.7-1). Monitoring well XGM-93-02X was also installed to replace the existing monitoring well AAFES-4 which had been dry historically. The screen of both monitoring wells was placed below the top of bedrock so that it would intercepted the water table to monitor for free product and allow for seasonal groundwater fluctuations. Due to the location of the water table in this portion of the installation, the newly installed and the existing monitoring wells were installed across the bedrock/soil interface. Elevated PID measurements were recorded on the drilling water and development water from XGM-93-02X, and from the development water from AAFES-1D, AAFES-2, and AAFES-6 (see Figure 6.7-1). Table 6.7-2 summarizes the construction of the SI monitoring wells at SA 43G and monitoring well installation diagrams are presented in Appendix C.

Two rounds (Round Three and Four) were collected from each of the AAFES monitoring wells, except for AAFES-4 which was dry during both round, and the two newly installed SSI monitoring wells. Round Three groundwater samples were collected in October 1993 and Round Four was collected in January 1994. These samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics (both filtered and unfiltered), TPHC, and TSS.

ABB Environmental Services, Inc.

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were performed. The tests consisted of a rising and falling head test. All SSI exploration locations were surveyed.

One sediment sample was collected from below a storm drain outfall that collects rain water runoff from SA 43G (Figure 6.7-1). The sediment sample was submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics, TPHC, TOC, and grain size.

6.7.4 Field Investigation Results and Observations

The results of the geophysical surveys completed during the SI did not indicate that an abandoned UST was present at SA 43G. The results of the geophysical surveys are presented in Appendix L.

The soil encountered at SA 43G ranged from silty sand (fill) to a sandy silt with fine to medium gravel (glacial till). The depth of bedrock ranged from 20.5 to 34.5 feet bgs. Rock core samples were collected from the monitoring well borings (XGM-93-01X and XGM-93-02X). The bedrock was classified as a meta siltstone or phyllite. The water table was encountered at 27 to 30 feet bgs (Table 6.7-3). The boring logs associated with SA 43G are presented in Appendix B.

Calculated hydraulic conductivities ranged from $1.8E^{-05}$ centimeters per second (cm/sec.) at XGM-93-01X to $5.2E^{-06}$ cm/sec. at XGM-93-02X. The hydraulic conductivity results are presented in Table 6.7-4.

The new monitoring wells were included in the November 8, 1993 synoptic water-level round at Fort Devens. The inferred groundwater flow, based upon this water-level round, appears to be flowing to the east (Figure 6.7-4).

6.7.5 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.7.5.1 Soil. Three subsurface soil samples were collected from 9 feet. This depth was chosen to analyze the soil at or near the estimated bottom of the former UST. BTEX was not detected in any of the 9 foot samples, but TPHC was detected at TP-04 and TP-11 at 830 ppm and 130 ppm, respectively (Figure 6.7-5). Four soil samples were collected from 11 feet to 12 feet. BTEX

SECTION 6

was not detected in any of the samples, but TPHC was detected in the 11 foot samples collected from TP-10 and TP-11 at concentrations of 130 ppm and 190 ppm, respectively (Figure 6.7-6). Groundwater was not encountered in any of the TerraProbe points advanced at SA 43G. Consequently, ten soil-gas samples were collected from a depth of 8 feet bgs (just above the estimated bottom of the tank excavation). The soil-gas samples were analyzed for BTEX only. BTEX was not detected in any of the soil-gas samples collect from SA 43G (Figure 6.7-7). Table 6.7-5 presents the field analysis data.

The results of the field analysis for soil samples collected from Area 1 during the SSI, indicated that residual TPHC contamination was present in the soil at this site to a depth of 10 feet bgs. The results from the two soil samples collected from TP-39 showed TPHC concentrations at 740 ppm at 10 feet and 2,000 ppm at 11 feet. TPHC was also detected in the 10-foot samples from TP-35, TP-37 and TP-38 at concentrations ranging from 190 to 400 ppm. No BTEX was detected in the soil samples collected from Area 1 (Table 6.7-6; see Figures 6.7-8 and 6.7-9).

Xylene (the only VOC detected) was detected at 6.3 ppb in only one (TP-13 at 10 feet) of the 23 soil sample collected from TerraProbe points located in Area 2. TPHC concentrations ranged from below the detection limit to 5,800 ppm. The concentrations were highest in the soil samples collected from the north and east/downgradient of the active gasoline USTs (i.e., TP-19, TP-31 and TP-32). Concentrations of BTEX contamination appeared to be confined to the area in and around the former waste oil UST and an apparent sand and gas trap in Area 3. Benzene was detected in the 10 to 11-foot soil sample collected from TP-08, only. Total BTEX ranged from below the detection limit to 32,930 ppb. TPHC concentrations ranged from below the detection limit to 8,500 ppm (see Table 6.7-6; Figures 6.7-8 and 6.7-9).

One soil boring was drilled to the water table during the SI adjacent to TP-04, which had the highest concentration of TPHC at 830 ppm, to determine if the TPHC contamination detected during the TerraProbe survey had migrated to the water table. Analytical soil samples were collected from depths of 10 feet to 12 feet and 20 feet to 22 feet bgs. Groundwater was encountered at 18 feet bgs and the boring was advanced to 22 feet bgs. No VOCs or TPHC were detected in either sample, and lead was present in each sample below the background concentration (Table 6.7-7, Figure 6.7-10).

ABB Environmental Services, Inc.

SSI off-site laboratory subsurface soil samples were collected from similar depths as those collected during the SSI TerraProbe survey. No contaminants of concern were detected in any of the soil samples collected from the soil boring (XGB-93-09X) drilled in Area 1. All TPHC concentrations were below the detection limit in these soil samples (see Table 6.7-7; Figure 6.7-10).

The results of the off-site laboratory analyses for soil samples collected from Area 2 showed low concentrations of VOCs (acetone and/or trichlorofluoromethane, (freon) common laboratory contaminants. SVOCs, consisting of predominantly PAHs were detected in the 8-foot soil sample collected from XGB-93-05X. The remaining SVOCs were bis(2-ethylhexyl)phthalate or di-n-butyl phthalate which are common laboratory contaminants. TPHC was detected at 185 $\mu\text{g/g}$ in the 8-foot sample from XGB-93-05X and in the 12-foot sample at XGB-93-06X. The results of the laboratory analyses in Area 3 indicated some low concentrations of VOCs from samples collected from soil borings XGB-93-03X and XGB-93-04X. These borings were drilled in or adjacent to the former waste oil UST and the existing sand and gas trap. Bis(2-ethylhexyl)phthalate and di-n-butyl phthalate (common laboratory contaminants) were the only SVOCs detected in Area 3. TPHC concentrations ranged from <52 to 1,020 ppm in the soil samples collected from Area 3. One soil boring (XGB-93-08X) was drilled between the AAFES gas station and historic gas station G to determine if contaminants from either area had impacted the subsurface soil quality at this location. No organic contaminants of concern were detected in any of the subsurface soil samples collected from XGB-93-08X (see Table 6.7-7; Figure 6.7-10).

Inorganic analytes were detected above the Fort Devens background concentration in each of the soil samples collected from SA 43G. The greatest number of analytes and the highest concentrations were detected in XGB-93-04X (12-foot sample), XGB-93-08X (8-foot and 17-foot samples) and XGB-93-09X (12-foot sample) (see Table 6.7-8; Figure 6.7-11).

6.7.5.2 Groundwater. The results of the laboratory analyses for the Round Three and Four groundwater sampling are presented in Table 6.7-9 and Figures 6.7-12 and 6.7-13. The results of the off-site laboratory analysis for each round showed the presence of several VOCs (including acetone, benzene, ethylbenzene, toluene, xylenes, PCE, and 1,2-DCA in the groundwater samples collected from the downgradient and crossgradient monitoring wells (AAFES-1D, AAFES-2,

SECTION 6

AAFES-5, AAFES-6, AAFES-7 and XGM-93-02X). Total VOCs ranged from 0.86 $\mu\text{g/L}$ at AAFES-7 to 11,500 $\mu\text{g/L}$ at AAFES-2 during Round Three. Bis(2-hexylmethyl) phthalate (a common laboratory contaminant) was detected at 6.3 $\mu\text{g/L}$ in the sample collected from AAFES-7. Total VOCs ranged from 1.6 $\mu\text{g/L}$ at AAFES-7 to 12,400 $\mu\text{g/L}$ at AAFES-2 during Round Four. Bis(2-hexylmethyl) phthalate (a common laboratory contaminant) was detected at 6.3 $\mu\text{g/L}$ in the Round Three sample collected from AAFES-7, and at 5.0 $\mu\text{g/L}$ in the Round Four sample collected from XGM-93-01X. Several SVOCs (1-methylnaphthalene, naphthalene and phenanthrene) were also detected in the downgradient groundwater samples. Total SVOCs ranged from 2.5 $\mu\text{g/L}$ at AAFES-6 to 4,080 $\mu\text{g/L}$ at AAFES-2 in the Round Three samples.

Several SVOCs (1-methylnaphthalene, naphthalene and phenanthrene) were also detected in the downgradient groundwater samples. Total SVOCs ranged from 1.7 $\mu\text{g/L}$ at AAFES-6 to 4,020 $\mu\text{g/L}$ at AAFES-2 in the Round Four samples. TPHC was detected in the downgradient groundwater samples and the sample collected from the upgradient monitoring well AAFES-3, at concentrations ranging from 190 to 44,000 $\mu\text{g/L}$ in Round Three and from 230 to 120,000 $\mu\text{g/L}$ in Round Four. No VOCs, SVOCs or TPHC were detected in the samples collected from the upgradient monitoring wells (XGM-93-01X) installed during the SSI. Several inorganic analytes were detected above the Fort Devens groundwater background concentrations in both the unfiltered and the filtered samples during both round of sampling (see Table 6.7-9; Figure 6.7-13 and 6.7-14). Approximately 0.10 feet of free product was measured in AAFES-2 prior to the Round Three groundwater sampling. No free product was measured in any of the monitoring wells sampled during Round 4.

6.7.5.3 Sediment. The results of the SSI off-site laboratory analyses are presented in Table 6.7-10 and Figure 6.7-15. One sediment sample was collected from the outfall of the storm drain which drains the paved area at the AAFES gas station. This storm water outfall flows into an open ditch which runs southeast to an unnamed stream, located on the east side of Patch Road, that eventually empties into Robbins Pond. No VOCs or SVOCs were detected in this sample. Several inorganic analytes were detected at notable concentrations. TPHC was detected at 448 $\mu\text{g/g}$. A surface water sample was not collected due to insufficient surface water volume during sampling.

6.7.6 Source Evaluation and Migration Potential

It appears that past leaks and spills from former USTs have impacted soil and groundwater quality at Areas 2 and 3 and that contaminants detected in the soil are a continuing source of contaminations which are percolating to the groundwater, and moving downgradient with the groundwater flow. The replacement of the active gasoline USTs in 1990 and the subsequent removal of the waste oil UST, does not appear to have stopped the source of contaminants detected in the groundwater. It appears that the soil east of the active USTs, at the former waste oil UST location and the existing sand and gas trap for Building 2008, contains contaminants which continue to adversely impact groundwater quality below the AAFES gas station.

Additional TPHC contamination detected at Area 1 does not appear to have impacted the soil or groundwater quality below historic gas station G.

Elevated TPHC was detected in the sediment sample collected from the outfall which drains the parking/refueling area at the AAFES gas station. The elevated TPHC concentration (448 $\mu\text{g/g}$) appears to be caused by runoff of small fuel spills associated with the AAFES gas station activities. Based on the TPHC concentration and lack of any associated VOCs, SVOCs, or elevated lead concentration, it appears that the sediment in this area has been moderately impacted by the AAFES gas station surface water runoff.

6.7.7 Preliminary Human Health Risk Evaluation

SA 43G has been divided into three areas to more accurately characterize contamination: Area 1 is the historic gas station, Area 2 includes the area around the active AAFES gas station USTs, and Area 3 is the former waste oil UST.

Area 1 Subsurface Soil. During the SI, field-screening of TerraProbe soil samples revealed no measurable concentrations of BTEX. Comparing the measured TPHC results against the calculated risk-based commercial/industrial concentration value of 1,800 $\mu\text{g/g}$ for gasoline indicates no significant risk to public health from soil contamination at SA 43G.

During the SSI, 10 additional TerraProbe samples and three confirmatory soil boring samples were analyzed for Area 1. The results for the individual samples

SECTION 6

appear in Tables 6.7-5 through 6.7-8. Table 6.7-11 combines and summarizes the field and off-site laboratory analytical data and compares it to Region III commercial and MCP Category S-2 soil guidelines. No BTEX was detected. TPHC was detected in 7 of 12 samples, but only the maximum concentration of 2000 ppm exceeded the calculated guideline for gasoline. All concentrations of TPHC were below the MCP Category S-2 soil guideline. Inorganics detected in the soil boring were below guidelines with the exception of arsenic which was above background and exceeded both Region III and MCP Category S-2 soil guidelines of 1.6 and 30 ppm, respectively. It is unlikely, however, that arsenic was derived from the past practices at Area 1.

Area 2 Subsurface Soil. No samples were taken in Area 2 during the SI. During the SSI, 22 TerraProbe samples and five soil boring samples were analyzed. The results for the individual samples appear in Tables 6.7-5 through 6.7-8. Table 6.7-11 combines and summarizes the field and laboratory analytical data and compares it to Region III commercial and MCP Category S-2 soil guidelines. Toluene and xylene were detected at TP-13 and TP-31 at concentrations below guidelines. TPHC was detected in 15 of 26 samples, but only the maximum concentration of 5,800 ppm in one sample exceeded the calculated guideline for gasoline and the MCP Category S-2 soil guideline for TPHC. All other detected concentrations of TPHC were below these guidelines. All detected concentrations of inorganics are below Region III and MCP S-2 soil guidelines with the exception of beryllium. Beryllium was detected in 4 of 5 samples and all detected concentrations exceeded the Region III guideline of 0.67 ppm and the MCP S-2 guideline of 0.8 ppm. In conclusion, concentrations of TPHC in subsurface soil at one location at Area 2 of SA 43G may pose a potential threat to human health. Although beryllium exceeded both risk-based guidelines, it is unlikely that beryllium was derived from the petroleum releases at Area 2.

Area 3 Subsurface Soil. No samples were taken in Area 3 during the SI. During the SSI, 11 TerraProbe samples and four soil boring samples were analyzed. The results for the individual samples appear in Tables 6.7-5 through 6.7-8. Table 6.7-11 combines and summarizes the field and laboratory analytical data and compares it to Region III commercial and MCP Category S-2 soil guidelines. Benzene, toluene, ethylbenzene, and xylene were detected at concentrations below guidelines. TPHC was detected in 11 of 14 samples. The concentrations of 8,500 ppm detected at TP-02 and 3,300 ppm at TP-08 exceeded the calculated guideline for gasoline and the MCP Category S-2 soil guideline for TPHC. All

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other detected concentrations of TPHC were below these guidelines. Inorganics detected were below guidelines with the exception of arsenic which was above background and exceeded both Region III and MCP Category S-2 soil guidelines of 1.6 and 30 ppm, respectively, in two samples. In conclusion, concentrations of TPHC in subsurface soil at Area 2 may pose a potential threat to human health. It is unlikely, however, that arsenic was derived from the petroleum releases at Area 3.

Groundwater. Table 6.7-12 presents summary statistics for groundwater associated with SA 43G and drinking water standards/guidelines for comparison. Only data for unfiltered samples is reported.

Several organic compounds were detected in the groundwater associated with Areas 2 and 3: 1,2-DCA, 2-methylnaphthalene, acetone, benzene, bis(2-ethylhexyl)phthalate, ethylbenzene, naphthalene, phenanthrene, PCE, toluene, xylenes, and TPHC. Acetone and bis(2-ethylhexyl)phthalate were each detected in one to two of 16 samples. These two compounds are common laboratory contaminants and are not believed to be site-related. Regardless, the concentration of acetone did not exceed the Massachusetts guideline and bis(2-ethylhexyl)phthalate at $6.3 \mu\text{g/L}$ was just above the federal MCL of $6 \mu\text{g/L}$. Toluene, xylene, PCE, and 1,2-DCA were not detected at concentrations that exceeded a standard or guideline. Both benzene and ethylbenzene were detected at concentrations exceeding their respective federal MCL. Although the PAHs do not have federal or state standards or guidelines, naphthalene does have a Region III tap water concentration of $1,500 \mu\text{g/L}$. The maximum concentration of naphthalene does exceed this health-protective concentration. Finally, both the average and maximum concentrations of TPHC exceed the MCP GW-1 standard of $1,000 \mu\text{g/L}$.

The maximum concentrations of all inorganic analytes detected in groundwater were greater than the Fort Devens background concentrations for groundwater. Nine analytes were detected at concentrations above their respective drinking water standard/guideline. Aluminum, iron, and manganese were detected in 16 of 16 samples and the average concentration of each exceeded its respective USEPA secondary MCL. (Secondary MCLs are set for aesthetic or economic reasons, not health reasons.) The average concentration of sodium exceeds its Massachusetts guideline. Maximum concentrations of antimony, arsenic, chromium and nickel exceed their respective federal MCLs, although the average concentration of

SECTION 6

antimony and chromium does not. The average concentration of lead is above the USEPA action level. Filtered samples were also collected for inorganic analysis, and TSS analysis was also conducted on an unfiltered groundwater sample, from each monitoring well. The results of the filtered inorganic analysis showed that several inorganic analytes were detected above the Fort Devens background. However, only manganese was detected above the drinking water standard. TSS results also show high concentrations of suspended solids in each sample. The results of these two analyses appear to indicate that the elevated inorganic concentration, detected in the unfiltered samples, was a result of TSS not releases from SA 43G.

Based on this screening-level analysis, the use of this groundwater as a source of drinking water would pose potential human health risks based on concentrations of benzene, ethylbenzene, TPHC, naphthalene, arsenic, antimony, chromium and nickel.

Sediment. No organic compounds were detected in the one sediment sample that was taken (Table 6.7-13). TPHC was detected at 448 $\mu\text{g/g}$ which is less than the MCP S-1 standard of 500 $\mu\text{g/g}$, but exceeds the calculated residential concentration for gasoline.

Of the inorganic analytes detected in the sediment, only arsenic exceeds a guideline. The detected concentration of 7.5 $\mu\text{g/g}$ is greater than the Region III residential soil concentration but less than the MCP S-1 standard. The use of residential soil standards is a conservative approach taken in the absence of health-based guidelines specifically for sediment. Exposure to contaminants in this ditch sediment would be much less than that in a residential setting. The concentration of arsenic and TPHC associated with SA 43G sediment is not expected to present a risk to public health under present or foreseeable future uses of the SA.

6.7.8 Conclusions and Recommendations

Based on the results of the SI, the SSI and the human health PRE, no further action is recommended for Area 1 (historic gas station G). However, an RI/FS is recommended to further assess the groundwater and soil contamination detected at Areas 2 and 3.

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TABLE 6.7-1
SUMMARY OF TECHNICAL APPROACH
SA 43G - HISTORIC GAS STATION G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-11	* IN AND AROUND FORMER HGS D UST GRAVE
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* CHARACTERIZE SOILS CONTAMINATION * COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	43G-92-01X	* LOCATED AT TERRAPROBE SURVEY "HOT SPOT"
SSI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-39	* AROUND ACTIVE GAS USTs AND FORMER WASTE OIL UST * WASTE OIL UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* INSTALL MONITORING WELLS * CHARACTERIZE SOILS CONTAMINATION * COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	XGB-93-03X XGB-93-04X XGB-93-05X XGB-93-06X XGB-93-07X XGB-93-08X XGB-93-09X XGM-93-01X XGM-93-02X	* LOCATED AT TERRAPROBE SURVEY "HOT SPOTS"
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	* MONITOR GROUNDWATER LEVELS * MONITOR GROUNDWATER QUALITY * DETERMINE AQUIFER CONDUCTIVITIES		* LOCATED BETWEEN AREA 1 AND AAPES * LOCATED AT TERRAPROBE SURVEY "HOT SPOTS" * UPGRADIENT * DOWNGRADIENT
SEDIMENT SAMPLING	* COLLECT SAMPLE FOR LABORATORY ANALYSIS	XGD-93-02X	* STORM DRAIN OUTFALL

TABLE 6.7-2
MONITORING WELL COMPLETION DETAILS
SA 43G - HISTORIC GAS STATION G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (Feet bgs)	WELL SCREEN ELEVATION (Feet NGVD)	COMPLETION DEPTH (Feet bgs)	CONSTRUCTION MATERIAL
XGM-93-01X	NA	ROCK CORE	BEDROCK	10-20	234.8 - 224.8	20.5	4" ID PVC
XGM-93-02X	NA	ROCK CORE	BEDROCK	15-25	237.2 - 227.4	26	4" ID PVC

NA = Not Applicable

TABLE 6.7-3
SUMMARY OF SOIL BORINGS
SA 43G - HISTORIC GAS STATION G
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43G-92-01X	22	5-7 10-12 15-17 20-22	10-12	SW SW SW SM	BKG BKG BKG BKG	
XGB-93-03X	25	1-3 5-7 8-10 12-14 15-17 20-22 25-27	8-10 12-14	GP SP GP SP SW SM-ML SM-ML	BKG BKG 8 25.2 BKG 488 245.7	Total VOCs measured in headspace Total VOCs measured in headspace
XGB-93-04X	25	1-3 5-7 8-10 12-14 15-17 20-22	8-10 12-14	GP SP SP SP SW SM-ML	BKG BKG 220.1 BKG 15.1 3.3	Total VOCs measured in headspace No Recovery Refusal at 26-feet
XGB-93-05X	28	0-2 5-7 8-10 12-14 15-17 20-22 25-27	8-10 12-14 20-22 25-27	SW SW SP SP SW SM SM	BKG BKG BKG BKG BKG BKG BKG	Refusal at 28-feet
XGB-93-06X	25.5	0-2 5-7 8-10 12-14 15-17 20-22 25-25.5	8-10 12-14	SP SP SP SW-SM SW-SM SW-SM	BKG BKG BKG BKG BKG BKG	Refusal on phyllite at 25.5-feet
XGB-93-07X	20.5	1-3 5-7 8-10 10-12 12-14 15-17 20-20.5	10-12	SP-SM SP-SM SW-GW SW-GW SW-GW SW SM	BKG BKG BKG BKG 8.4 BKG BKG	Insufficient recovery for analytical Chunk of asphalt caught in spoon Refusal at 20.5-feet

**TABLE 6.7-3
SUMMARY OF SOIL BORINGS
SA 43G - HISTORIC GAS STATION G
SITE INVESTIGATION REPORT
FORT DEVENS, MA**

EXPLORATION ID	COMPLETION DEPTH (feet bgs)	REFERENCE SAMPLE INTERVALS (feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
XGB-93-08X	27.5	1-3		SP	BKG	
		5-7		SW	BKG	
		8-10	8-10	SW	BKG	
		10-12		SW-SM	BKG	
		12-14	12-14	SW-SM	BKG	
		15-17		SW-SM	BKG	
		17-19	17-19	SW-SM	BKG	
		19-21	19-21	SM	BKG	
		25-27		SM	BKG	Refusal at 27.5-feet
XGB-93-09X	29.7	1-3		SW	BKG	
		5-7		SW	BKG	
		8-10	8-10	SP	BKG	
			12-14	GW-SW	BKG	
		15-17		SP-SM	BKG	
		20-22	20-22	SM	BKG	
		25-26.2		SM-PHYL	BKG	Refusal at 29.5-feet
XGM-93-01X	34	0-2		SP-FILL	BKG	
		4-6		SW-SM	BKG	
		9-11		SW	BKG	
		14-16		SM	BKG	
			19-21	ML-PHYL	BKG	
		24-26		SM-PHYL	BKG	
		29-30		ML-PHYL	BKG	Phyllite reamed w/ rollerbit to 34-feet
XGM-93-02X	38	0-2		SP	BKG	
		4-6		SP	BKG	
		9-11		SW	BKG	
		14-16		SP-SW	BKG	
		19-21		SW	BKG	
			24-26	SM	BKG	
		29-31		SM	BKG	
		34-34.5		SM-PHYL	8.2	PID = 8 ppm at mouth of borehole Phyllite bedrock at 34.5-feet

NOTES: bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system

ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site

TABLE 6.7-4
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 43G – HISTORIC GAS STATION G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (Feet bgs)	ELEVATION OF WATER (Feet NGVD)	CONDUCTIVITY
				HVORSLEV ² (cm/sec)
XGM-93-01X	27.69	27.69	285.93	1.8E-05
XGM-93-02X	30.50	30.51	279.40	5.2E-06

Notes:

bgs = below ground surface

cm/sec = centimeters per second

NGVD = National Geodetic Vertical Datum

1 = elevation of top of pvc.

2 = averaged value of two tests.

Groundwater elevations from November 8, 1993.

Synoptic water level round.

TABLE 6.7-5
SI FIELD ANALYTICAL RESULTS SUBSURFACE SOIL/SOIL GAS SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE - SOIL (ppb)		TP-04	TP-04	TP-09	TP-09	TP-10	TP-10	TP-11	TP-11
DEPTH		9 FT	12 FT	10 FT	11 FT	11 FT	11 FT	9 FT	10 FT
BENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER (ppm)									
TOTAL PETROLEUM HYDROCARBONS		830	< 54	< 54	< 54	130	130	130	190

ANALYTE - SOIL GAS (ppb)		TP-01	TP-02	TP-03	TP-04	TP-05	TP-06	TP-07	TP-08	TP-09	TP-10
DEPTH		8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT
BENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Notes:

< = Less than detection limit.

TABLE 6.7-6
SSI FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-01 TSG0110F 10 FT	TP-02 TSG0209F 9 FT	TP-02 TSG0210F 10 FT	TP-02 TSG0211F 11 FT	TP-03 TSG0309F 9 FT	TP-03 TSG0310F 10 FT	TP-04 TSG0410F 10 FT	TP-05 TSG0510F 10 FT	TP-07 TSG0710F 10 FT
ORGANICS									
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	1.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	4.9	< 0.1
ETHYLBENZENE	< 0.1	4.4	< 0.1	< 0.1	< 0.1	< 0.1	1.3	13	< 0.1
m/p-XYLENE	< 0.1	8.8	0.3	< 0.1	< 0.1	< 0.1	3.4	120	< 0.1
o-XYLENE	< 0.1	12	< 0.1	< 0.1	< 0.1	0.8	2.4	58	< 0.1
OTHER									
TOTAL PETROLEUM HYDROCARBONS	< 52	8500	210	120	960	NA	110	110	< 51

TABLE 6.7-6
SSI FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-08	TP-10	TP-13	TP-14	TP-18	TP-19	TP-19	TP-19	TP-20	TP-20
	TSG0810F	TSG1010F	TSG1310F	TSG1410F	TSG1809F	TSG1909F	TSG1910F	TSG2009F	TSG2011F	
ORGANICS	10 FT	10 FT	10 FT	10 FT	9 FT	9 FT	10 FT	9 FT	11 FT	
BENZENE	140	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	290	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	14000	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	13000	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	5500	< 0.1	6.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER										
TOTAL PETROLEUM HYDROCARBONS	3300	< 54	74	500	140	200	2300	< 52	560	

TABLE 6.7-6
SSI FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-21	TP-22	TP-23	TP-24	TP-25	TP-26	TP-26	TP-28	TP-29
ORGANICS	TSG2109F	TSG2213F	TSG2309F	TSG2409F	TSG2509F	TSG2609F	TSG2611F	TSG2811F	TSG2909F
BENZENE	9 FT < 0.1	13 FT < 0.1	9 FT < 0.1	9 FT < 0.1	9 FT < 0.1	9 FT < 0.1	11 FT < 0.1	11 FT < 0.1	9 FT < 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER									
TOTAL PETROLEUM HYDROCARBONS	NA	160	64	130	< 53	< 53	< 53	< 53	950

TABLE 6.7-6
SSI FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-30 TSG3009F 9 FT	TP-30 TSG3010F 10 FT	TP-31 TSG3109F 9 FT	TP-32 TSG3209F 9 FT	TP-33 TSG3309F 9 FT	TP-34 TSG3409F 9 FT	TP-35 TSG3510F 10 FT	TP-35 TSG3511F 11 FT	TP-36 TSG3610F 10 FT
ORGANICS									
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	1.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	0.9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	1.0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER									
TOTAL PETROLEUM HYDROCARBONS	460	120	5800	230	< 54	< 54	400	< 53	< 52

TABLE 6.7-6
SSI FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43G - HISTORIC GAS STATIONS G

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-36 TSG3611F 11 FT	TP-37 TSG3710F 10 FT	TP-37 TSG3711F 11 FT	TP-38 TSG3810F 10 FT	TP-38 TSG3811F 11 FT	TP-39 TSG3910F 10 FT	TP-39 TSG3911F 11 FT
ORGANICS							
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER							
TOTAL PETROLEUM HYDROCARBONS	< 52	270	54	190	52	740	2000

Notes:

< = Less than detection limit.

TABLE 6.7-7
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						
	XGB-93-03X 8 FT	XGB-93-03X 12 FT	XGB-93-03X 20 FT	XGB-93-04X 8 FT	XGB-93-04X 12 FT	XGB-93-04X 25 FT	XGB-93-05X 8 FT
ORGANICS (ug/g)							
ACETONE	< 0.017	< 0.017	< 0.017	< 0.08	< 0.017	0.024	0.047
ETHYLBENZENE	< 0.002	< 0.002	0.002	0.03	< 0.002	< 0.002	< 0.002
TOLUENE	< 0.001	< 0.001	< 0.001	0.02	< 0.001	< 0.001	< 0.001
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	0.006	0.03	< 0.006	< 0.006	0.01
XYLENES	0.008	< 0.002	0.019	0.6	< 0.002	< 0.002	< 0.002
2-METHYLNAPHTHALENE	< 0.5	< 0.049	0.17	0.72	< 0.049	< 0.049	< 0.5
ACENAPHTHYLENE	< 0.3	< 0.033	< 0.033	< 0.3	< 0.033	< 0.033	5
ANTHRACENE	< 0.3	< 0.033	< 0.033	< 0.3	< 0.033	< 0.033	4
BENZO [A] ANTHRACENE	< 2	< 0.17	< 0.17	< 2	< 0.17	< 0.17	7
BENZO [A] PYRENE	< 2	< 0.25	< 0.25	< 2	< 0.25	< 0.25	10
BENZO [B] FLUORANTHENE	< 2	< 0.21	< 0.21	< 2	< 0.21	< 0.21	30
BENZO [G,H,I] PERYLENE	< 2	< 0.25	< 0.25	< 2	< 0.25	< 0.25	3
BENZO [K] FLUORANTHENE	< 0.7	< 0.066	< 0.066	< 0.7	< 0.066	< 0.066	6
BIS (2-ETHYLHEXYL) PHTHALATE	< 6	< 0.62	0.96	< 6	< 0.62	< 0.62	< 6
CHRYSENE	< 1	< 0.12	< 0.12	< 1	< 0.12	< 0.12	10
DI-N-BUTYL PHTHALATE	< 0.6	0.48	0.76	< 0.061	0.45	0.36	< 0.6
FLUORANTHENE	< 0.7	< 0.068	< 0.068	< 0.7	< 0.068	< 0.068	20
FLUORENE	< 0.3	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	1
INDENO [1,2,3-C,D] PYRENE	< 3	< 0.29	< 0.29	< 3	< 0.29	< 0.29	4
NAPHTHALENE	< 0.4	< 0.037	< 0.037	0.46	< 0.037	< 0.037	0.5
PHENANTHRENE	< 0.3	< 0.033	< 0.033	< 0.3	< 0.033	< 0.033	10
PYRENE	< 0.3	< 0.033	< 0.033	< 0.3	< 0.033	< 0.033	10
OTHER (ug/g)							
TOTAL ORGANIC CARBON	NA	NA	1590	NA	NA	845	27400
TOTAL PETROLEUM HYDROCARBONS	359	59.2	62.6	1020	213	40.8	185

Notes:
< = Less than detection limit.

TABLE 6.7-7
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						
	XGB-93-05X 12 FT	XGB-93-05X 25 FT	XGB-93-06X 8 FT	XGB-93-06X 12 FT	XGB-93-07X 10 FT	XGB-93-08X 8 FT	XGB-93-08X 12 FT
ORGANICS (ug/g)							
ACETONE	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.0177
ETHYLBENZENE	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	< 0.006	0.006	0.007	0.009	0.01
XYLENES	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
2-METHYLNAPHTHALENE	< 0.049	< 0.049	< 0.049	< 0.2	< 0.049	< 0.049	< 0.049
ACENAPHTHYLENE	< 0.033	< 0.033	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033
ANTHRACENE	< 0.033	< 0.033	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033
BENZO [A] ANTHRACENE	< 0.17	< 0.17	< 0.17	< 0.8	< 0.17	< 0.17	< 0.17
BENZO [A] PYRENE	< 0.25	< 0.25	< 0.25	< 1	< 0.25	< 0.25	< 0.25
BENZO [B] FLUORANTHENE	< 0.21	< 0.21	< 0.21	< 1	< 0.21	< 0.21	< 0.21
BENZO [G,H,I] PERYLENE	< 0.25	< 0.25	< 0.25	< 1	< 0.25	< 0.25	< 0.25
BENZO [K] FLUORANTHENE	< 0.066	< 0.066	< 0.066	< 0.3	< 0.066	< 0.066	< 0.066
BIS (2-ETHYLHEXYL) PHTHALATE	< 0.62	< 0.62	< 0.62	< 3	< 0.62	< 0.62	< 0.62
CHRYSENE	< 0.12	< 0.12	< 0.12	< 0.6	< 0.12	< 0.12	< 0.12
DI-N-BUTYL PHTHALATE	0.43	0.56	0.52	0.6	< 0.061	0.25	0.15
FLUORANTHENE	< 0.068	< 0.068	< 0.068	< 0.3	< 0.068	< 0.068	< 0.068
FLUORENE	< 0.033	< 0.033	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033
INDENO [1,2,3-C,D] PYRENE	< 0.29	< 0.29	< 0.29	< 1	< 0.29	< 0.29	< 0.29
NAPHTHALENE	< 0.037	< 0.037	< 0.037	< 0.2	< 0.037	< 0.037	< 0.037
PHENANTHRENE	< 0.033	< 0.033	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033
PYRENE	< 0.033	< 0.033	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033
OTHER (ug/g)							
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	< 28.7	< 28.7	< 28.5	158	< 28.8	< 28.7	< 28.8

Notes:

< = Less than detection limit.

TABLE 6.7-7
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						SI	
	XGB-93-08X 17 FT	XGB-93-09X 8 FT	XGB-93-09X 12 FT	XGB-93-09X 20 FT	XGM-93-01X 19 FT	XGM-93-02X 24 FT	43G-92-01X 10 FT	43G-92-01X 20 FT
ORGANICS (ug/g)								
ACETONE	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017
ETHYLBENZENE	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROFLUOROMETHANE	< 0.006	0.006	0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
XYLENES	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
2-METHYLNAPHTHALENE	< 0.049	< 0.049	< 0.049	< 0.049	< 0.049	< 0.049	< 0.5	< 0.5
ACENAPHTHYLENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.3	< 0.3
ANTHRACENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.3	< 0.3
BENZO [A] ANTHRACENE	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
BENZO [A] PYRENE	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
BENZO [B] FLUORANTHENE	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21
BENZO [G,H,I] PERYLENE	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
BENZO [K] FLUORANTHENE	< 0.066	< 0.066	< 0.066	< 0.066	< 0.066	< 0.066	< 0.066	< 0.066
BIS (2-ETHYLHEXYL) PHTHALATE	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62
CHRYSENE	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12
DI-N-BUTYL PHTHALATE	0.18	0.27	0.27	0.49	0.88	< 0.061	< 0.061	< 0.061
FLUORANTHENE	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068
FLUORENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
INDENO [1,2,3-C,D] PYRENE	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29
NAPHTHALENE	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037
PHENANTHRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
PYRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
OTHER (ug/g)								
TOTAL ORGANIC CARBON	1250	NA	NA	687	2490	576	NA	436
TOTAL PETROLEUM HYDROCARBONS	< 28.7	< 28.7	< 28.7	< 28.7	< 28.8	< 28.8	< 27.7	< 27.9

Notes:
< = Less than detection limit.

TABLE 6.7-8
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI						SSI					
		XGB-93-03X 8 FT	XGB-93-03X 12 FT	XGB-93-03X 20 FT	XGB-93-04X 8 FT	XGB-93-04X 12 FT	XGB-93-04X 25 FT	XGB-93-05X 8 FT	XGB-93-05X 12 FT	XGB-93-05X 25 FT	XGB-93-06X 8 FT		
INORGANIC (µg/g)													
ALUMINUM	15000.0	11200	5100	7520	10000	9040	9270	5340	12200	5550	3770		
ANTIMONY		< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09		
ARSENIC	21.0	17	31	19	51	28	14	16	21	8.53	8.21		
BARIUM	42.5	23.5	14.6	23.3	53.3	29.2	25	22.9	56.5	20	21.5		
BERYLLIUM	0.347	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.964	1.38	1.25	0.996		
CADMIUM	2.0	< 0.7	< 0.7	< 0.7	2.61	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7		
CALCIUM	1400.0	1130	405	554	1570	1000	1930	1190	660	614	651		
CHROMIUM	31.0	21.2	17.4	19.2	46	36.8	23.1	32	37.4	11.7	8.89		
COBALT	N/A	5.26	6.99	11	3.56	9.93	7.03	4.56	9.94	6.1	1.67		
COPPER	8.39	10.2	9.09	27.1	29.2	17.3	15.3	14.4	11.3	9.66	6.54		
IRON	15000.0	11300	9660	21700	10400	19300	17600	10700	15300	12100	9460		
LEAD	36.9	14	5.12	8.6	11	57	8.5	50	8.8	5.29	3.8		
MAGNESIUM	5600.0	2250	2550	3330	4760	6100	3910	2850	5570	1900	1590		
MANGANESE	300.0	229	239	501	86.6	267	194	130	324	280	81.7		
NICKEL	14.0	19.5	22.4	40.8	20.4	38.3	24.1	20.3	33.4	21.2	6.08		
POTASSIUM	1700	568	774	995	1180	1340	702	2580	760	1440	1440		
SODIUM	131.0	296	287	254	342	419	373	283	267	268	306		
VANADIUM	28.7	15.1	8.24	8.18	18.3	19.9	12.8	14.3	26.3	8.73	11.6		
ZINC	35.3	21.3	21.3	33.8	87.6	36.6	31.6	208	33.9	24.1	18.2		

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.7-8
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI						SSI						SI		
		XGB-93-06X	XGB-93-07X	XGB-93-08X	XGB-93-08X	XGB-93-08X	XGB-93-08X	XGB-93-09X	XGB-93-09X	XGB-93-09X	XGB-93-09X	XGB-93-09X	XGB-93-09X	10 FT	43G-92-01X	43G-92-01X
INORGANIC (µg/g)		12 FT	10 FT	8 FT	12 FT	17 FT	8 FT	12 FT	12 FT	20 FT	19 FT	24 FT	7870	10 FT		20 FT
ALUMINUM	15000.0	4220	8410	12000	2440	11600	4010	26600	8700	3380	7870	< 1.09	NA	NA		NA
ANTIMONY		< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	4.01	1.51	< 1.09	< 1.09	< 1.09	NA	NA		NA
ARSENIC	21.0	7.15	8.07	52	49	45	37	41	32	34	13	41	NA	NA		NA
BARIUM	42.5	22.5	66.5	34.4	7.16	42.6	10.2	89.3	28.1	22.6	28.2	28.2	NA	NA		NA
BERYLLIUM	0.347	1.08	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NA	NA		NA
CADMIUM	2.0	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	NA	NA		NA
CALCIUM	1400.0	867	2900	895	304	1330	456	5190	1030	13000	698	698	NA	NA		NA
CHROMIUM	31.0	12.8	28	45.5	9.86	60.2	13	93.7	21.2	9.63	19.3	19.3	NA	NA		NA
COBALT	NA	< 1.42	7.71	13.2	3.5	12.6	4.43	18.7	16.6	11.3	6.75	6.75	NA	NA		NA
COPPER	8.39	7.98	10.8	20.7	4.16	31.8	8.76	37.5	27.9	17.8	11.1	11.1	NA	NA		NA
IRON	15000.0	11400	14600	21200	5250	22200	7910	34000	30300	25900	16100	16100	NA	NA		NA
LEAD	36.9	4.44	3.58	20	12	12	5.73	13	15	12	6.26	6.26	8.8	8.8		8.19
MAGNESIUM	5600.0	1760	5670	8870	1840	8960	2470	13700	3860	2780	3280	3280	NA	NA		NA
MANGANESE	300.0	89.5	264	372	121	407	138	632	621	880	331	331	NA	NA		NA
NICKEL	14.0	6.25	21.2	53.9	12.7	55.7	18.9	87	69.6	50.3	24.1	24.1	NA	NA		NA
POTASSIUM	1700	1420	4290	2470	576	3060	621	6170	1160	612	1240	1240	NA	NA		NA
SODIUM	131.0	292	330	290	489	291	285	1280	345	338	390	390	NA	NA		NA
VANADIUM	28.7	14	24.1	25.1	5.49	22.6	6.86	51	11.8	5.78	11.8	11.8	NA	NA		NA
ZINC	35.3	21.5	33.7	45.6	12.1	48.4	17.4	68	62.3	53.8	34	34	NA	NA		NA

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.7-9
ANALYTES IN GROUNDWATER
SA 43G - HISTORIC GAS STATION G / AAFES GAS STATION
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	ROUND 3		ROUND 4		ROUND 5		ROUND 6		ROUND 7		ROUND 8	
	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991	AAFE-ID 9879991
PORT DEVENS BACKGROUND CONCENTRATIONS	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT
ANALYTE	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT	MEASUREMENT
CHLORIDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHOSPHATE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SULFATE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL METALS (pp/L)												
Aluminum	6870	5710	141	141	141	141	141	141	141	141	141	141
Antimony	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03
Arsenic	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Boron	39.6	45.3	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Calcium	14700	81400	63300	63300	63300	63300	63300	63300	63300	63300	63300	63300
Chromium	14.7	11.1	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02
Cobalt	25.0	25	25	25	25	25	25	25	25	25	25	25
Copper	8.09	14.1	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09
Iron	9100	17400	10900	10900	10900	10900	10900	10900	10900	10900	10900	10900
Lead	4.25	11.8	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
Magnesium	3480	17200	7350	7350	7350	7350	7350	7350	7350	7350	7350	7350
Manganese	291	17200	7350	7350	7350	7350	7350	7350	7350	7350	7350	7350
Mercury	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243
Nickel	54.3	48.7	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3
Potassium	2370	3360	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910
Sodium	10800	37100	31200	31200	31200	31200	31200	31200	31200	31200	31200	31200
Vanadium	11.0	11	11	11	11	11	11	11	11	11	11	11
Zinc	21.1	42.5	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
PAL SEMI-VOLATILE ORGANICS (pp/L)												
2-methylpyridine	30	17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis (2-ethylhexyl) Phthalate	4.8	4.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	90	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	0.5	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL VOLATILE ORGANICS (pp/L)												
Polystyrene	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-dichloroethane	10	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	300	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	100	600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	10	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	200	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	60	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Isobutyl Ketone/Isopropylacetone	90	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene / Tetrachloroethane	40	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	70	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene / Trichloroethane	10	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	40	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL WATER QUALITY PARAMETERS (pp/L)												
Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate, Nitrite, Specific	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen By Kjeldahl Method	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	NA	480000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Hardness	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Suspended Solids	1370000	280000	NA	1670000	NA	2900000	NA	3210000	NA	19000	NA	19000
OTHER (pp/L)												
Total Petroleum Hydrocarbons	925	NA	1200	NA	44000	NA	120000	NA	3170	NA	190	190

TABLE 6.7-9
ANALYTES IN GROUNDWATER
SA 43G - HISTORIC GAS STATION G / A/FES GAS STATION
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	ROUND 4		ROUND 3		ROUND 4		ROUND 3		ROUND 4		ROUND 3		ROUND 4		ROUND 3	
	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004	AAFTS-3 6/2/2004
PALE CATIONS/ANIONS (pp/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL METALS (pp/L)																
Aluminum	6870	141	F	11700	<	141	F	67400	<	141	F	33900	<	141	F	27800
Antimony	3.03	3.03	F	2.95	<	3.03	F	6.94	<	3.03	F	5.93	<	3.03	F	3.03
Arsenic	10.3	2.54	F	45.1	<	2.54	F	11.9	<	2.54	F	94	<	10.3	F	140
Berkelium	39.6	5	F	238	<	18.4	F	467	<	19.8	F	11.3	<	14.4	F	61.8
Calcium	14700	37500	F	58800	<	46000	F	50200	<	37100	F	72700	<	56300	F	54800
Chromium	14.7	6.02	F	256	<	6.02	F	261	<	6.02	F	106	<	6.02	F	49.9
Cobalt	23.0	25	F	223	<	25	F	199	<	25	F	83.6	<	25	F	25
Copper	8.09	8.09	F	276	<	8.09	F	205	<	8.09	F	91.5	<	8.09	F	8.09
Iron	9100	38.8	F	404000	<	38.8	F	316000	<	43.1	F	106000	<	8060	F	83600
Lead	4.25	1.26	F	170	<	1.26	F	170	<	1.26	F	32.9	<	1.26	F	15.3
Magnesium	3480	2890	F	29000	<	7880	F	25000	<	5820	F	37700	<	21000	F	7880
Manganese	291	9.36	F	8380	<	2690	F	8190	<	761	F	8400	<	6390	F	1540
Mercury	0.243	243	F	0.243	<	243	F	0.243	<	243	F	0.243	<	243	F	0.243
Nickel	34.3	34.3	F	1140	<	34.3	F	901	<	34.3	F	62.3	<	34.3	F	86.4
Potassium	2370	1990	F	21500	<	2440	F	24000	<	2200	F	8390	<	2430	F	5130
Sodium	10800	67100	F	88400	<	83400	F	87100	<	83900	F	63700	<	64200	F	15400
Vanadium	11.0	11	F	119	<	11	F	111	<	11	F	39.3	<	11	F	24.8
Zinc	21.1	21.1	F	844	<	21.1	F	823	<	21.1	F	229	<	21.1	F	22.7
PAL SEMI-VOLATILE ORGANICS (pp/L)																
2-methylphenanthrene	NA	NA	<	1.7	NA	<	1.7	NA	<	NA	<	6.3	NA	<	1.7	NA
Bis (2-ethylhexyl) Phthalate	NA	NA	<	4.8	NA	<	4.8	NA	<	NA	<	4.8	NA	<	4.8	NA
Naphthalene	NA	NA	<	0.5	NA	<	0.5	NA	<	NA	<	2.5	NA	<	0.5	NA
Phenanthrene	NA	NA	<	0.5	NA	<	0.5	NA	<	NA	<	0.5	NA	<	0.5	NA
PAL VOLATILE ORGANICS (pp/L)																
toluene	NA	NA	<	NA	NA	<	NA	NA	<	NA	<	NA	NA	<	NA	NA
1,2-dichloroethane	NA	NA	<	NA	NA	<	NA	NA	<	NA	<	NA	NA	<	NA	NA
Acetone	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	5	NA	<	0.5	NA
Benzene	NA	NA	<	13	NA	<	13	NA	<	NA	<	51	NA	<	13	NA
Carbon Disulfide	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	13	NA	<	0.5	NA
Chloroform	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	0.5	NA	<	0.5	NA
Ethylbenzene	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	0.5	NA	<	0.5	NA
Methylene Chloride	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	34	NA	<	0.5	NA
Methyl Isobutyl ketone/propylene oxide	NA	NA	<	3	NA	<	2.3	NA	<	NA	<	2.3	NA	<	2.3	NA
Trichloroethylene / Tetrachloroethane	NA	NA	<	3	NA	<	3	NA	<	NA	<	3	NA	<	3	NA
Toluene	NA	NA	<	3.8	NA	<	7	NA	<	NA	<	1.6	NA	<	1.6	NA
Trichloroethylene / Trichloroethane	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	0.5	NA	<	0.5	NA
Trichloroethane	NA	NA	<	5	NA	<	0.5	NA	<	NA	<	0.5	NA	<	0.5	NA
Trichloroethene	NA	NA	<	1.4	NA	<	1.4	NA	<	NA	<	1.4	NA	<	1.4	NA
PAL WATER QUALITY PARAMETERS (pp/L)																
Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia Nitrogen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen Specific	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen By Kjeldahl Method	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Hardness	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Suspended Solids	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OTHER (pp/L)																
Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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Trichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						

...:\PDS\TTABLM3QA CGW WKL

3

TABLE 6.7-10
ANALYTES IN SEDIMENT
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SITE ID:	XGD-93-02X
INORGANICS (ug/g)		
ALUMINUM		3710
ARSENIC		7.5
BARIUM		17.2
CALCIUM		1610
CHROMIUM		13.3
COBALT		2.63
COPPER		15.3
IRON		11400
LEAD		24
MAGNESIUM		1840
MANGANESE		119
NICKEL		9.87
POTASSIUM		697
SODIUM		298
VANADIUM		9.84
ZINC		70.7
OTHER (ug/g)		
TOTAL ORGANIC CARBON		8970
TOTAL PETROLEUM HYDROCARBONS		448

TABLE 6.7-11
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SUBSURFACE SOIL
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
Area 1 [a]						
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS		7/12	529.4	2000	2500	REGION III
Area 2 [b]						
ORGANICS (ug/kg)						
TOLUENE	1/27	-	1.3	200000000	90000	NO
m/p-XYLENE*	1/22	-	0.9	1000000000	800000	NO
o-XYLENE*	2/22	3.7	6.3	1000000000	800000	NO
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS		15/26	738.7	5800	2500	YES
Area 3 [c]						
ORGANICS (ug/kg)						
BENZENE	1/15	-	140	99000	10000	NO
TOLUENE	4/15	74.1	290	200000000	90000	NO
ETHYLBENZENE	4/15	3504.7	14000	100000000	80000	NO
m/p-XYLENE*	5/11	2626.5	13000	1000000000	800000	NO
o-XYLENE*	5/11	1114.6	5500	1000000000	800000	NO
XYLENES (TOTAL)**	2/4	0.3	0.6	1000000000	800000	NO
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS		11/14	1360	8500	2500	YES

Notes:

[a] Subsurface soil (3 to 15 feet) for Area 1 based on field analytical samples TP-35 through TP-39 and soil boring XGB-93-09X.
[b] Subsurface soil (3 to 15 feet) for Area 2 based on field analytical samples TP-12 through TP-34 and soil boring XGB-93-05X.
[a] Subsurface soil (3 to 15 feet) for Area 3 based on field analytical samples TP-01 through TP-11 and soil borings XGB-93-03X and XGB-93-04X.

ug/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

- = not applicable

MCP = Massachusetts Contingency Plan

Shaded compounds exceed standard or guideline.

* = analytes from field screening samples.

** = analyte from laboratory analytical samples.

TABLE 6.7-12
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF GROUNDWATER
SA 43G - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		GROUNDWATER BACKGROUND CONCENTRATION (µg/L)	MAXIMUM EXCEEDS BACKGROUND?	DRINKING WATER STANDARD/ GUIDELINE [b] (µg/L)	MAXIMUM EXCEEDS STANDARD/ GUIDELINE?
		AVERAGE (µg/L)	MAXIMUM (µg/L)				
ORGANICS							
1,2-DICHLOROETHANE	1/16	2.6	2.6	NA	-	5	NO
2-METHYLNAPHTHALENE	5/16	1429.3	5000	NA	-	NA	-
ACETONE	2/16	75.5	100	NA	-	3000	NO
BENZENE	8/16	872.8	2000	NA	-	5	YES
BIS(2-ETHYLHEXYL) PHTHALATE	1/16	6.3	6.3	NA	-	6	YES
ETHYLBENZENE	6/16	420	1000	NA	-	700	YES
NAPHTHALENE	8/16	828.03	4000	NA	-	1500	YES
PHENANTHRENE	2/16	50	80	NA	-	NA	-
TETRACHLOROETHYLENE	2/16	5.4	7.0	NA	-	5	NO
TOLUENE	7/16	264.4	800	NA	-	1600	NO
XYLENES	8/16	3487.9	9000	NA	-	10000	NO
INORGANICS							
ALUMINUM	16/16	23403	71700	6870	YES	50-200	YES
ANTIMONY	8/16	5.5	79	3.03	YES	6	YES
ARSENIC	15/16	58.8	210	10.5	YES	50	YES
BARIUM	15/16	159.5	538	39.6	YES	2000	NO
CALCIUM	16/16	65206	107000	14700	YES	NA	-
CHROMIUM	15/16	92.5	296	14.7	YES	100	YES
COBALT	9/16	122.5	222	25	YES	NA	-
COPPER	14/16	95.4	376	8.09	YES	1300	NO
IRON	16/16	102139	406000	9100	YES	300	YES
LEAD	15/16	48.3	170	4.25	YES	15	YES
MAGNESIUM	15/16	21931.8	37400	3480	YES	NA	-
MANGANESE	16/16	9255	24400	291	YES	50	YES
MERCURY	6/16	0.396	0.692	0.243	YES	2	NO
NICKEL	15/16	321.4	1140	34.3	YES	100	YES
POTASSIUM	16/16	8095	21500	2370	YES	NA	-
SODIUM	16/16	62581.2	110000	10800	YES	28000	YES
VANADIUM	10/16	49.61	119	11	YES	260	NO
ZINC	15/16	251.4	944	21.1	YES	5000	NO
OTHER							
TOTAL PETROLEUM HYDROCARBONS		11/16	11453.1	44000	-	1000	YES

Notes:

[a] Groundwater based on unfiltered samples from AAFES-1D, AAFES-2, AAFES-3, AAFES-5 to AAFES-7, XGM-93-01X and XGM-93-02X.

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

NA = not available

µg/L = micrograms per liter

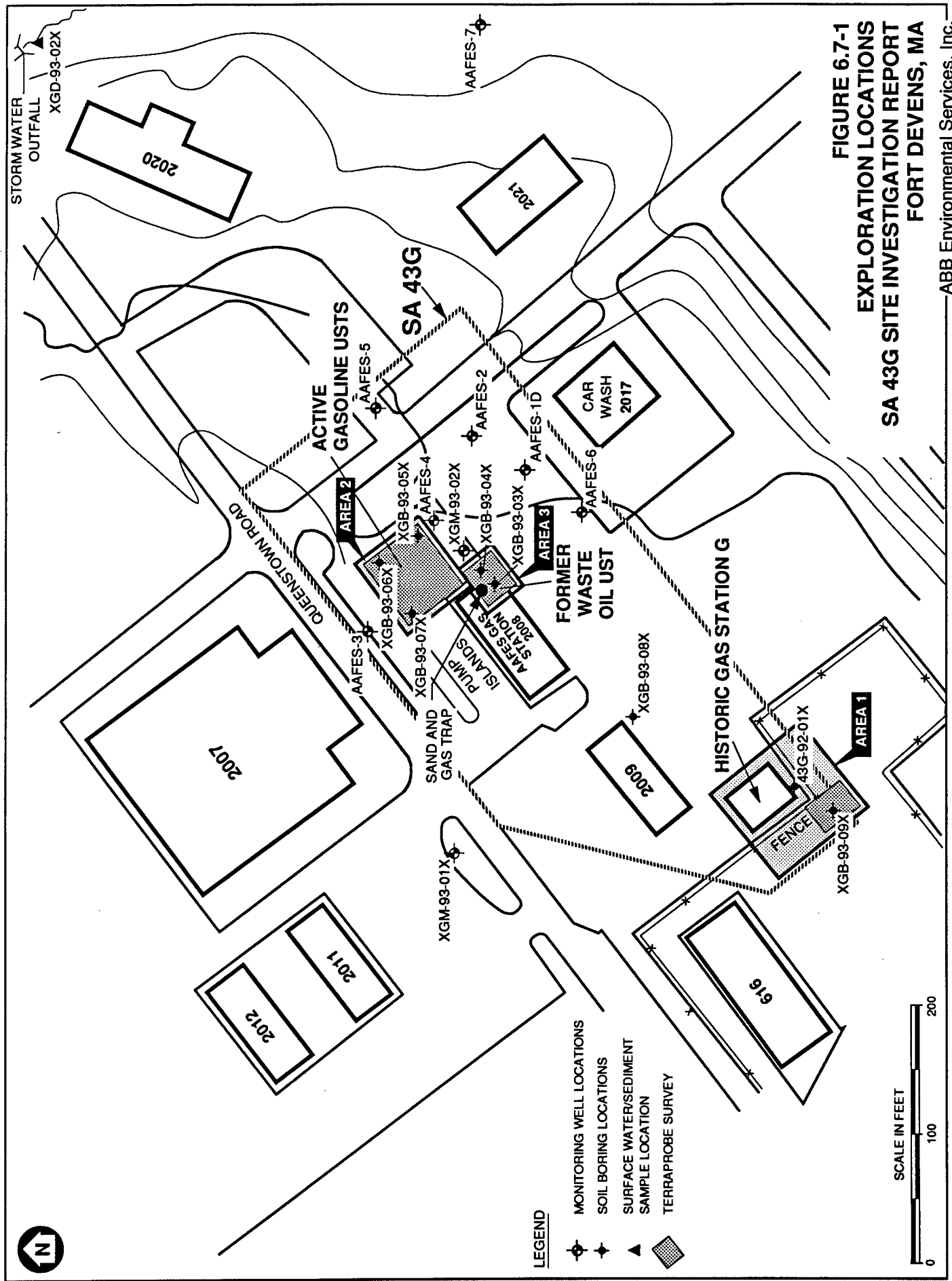
- = not applicable

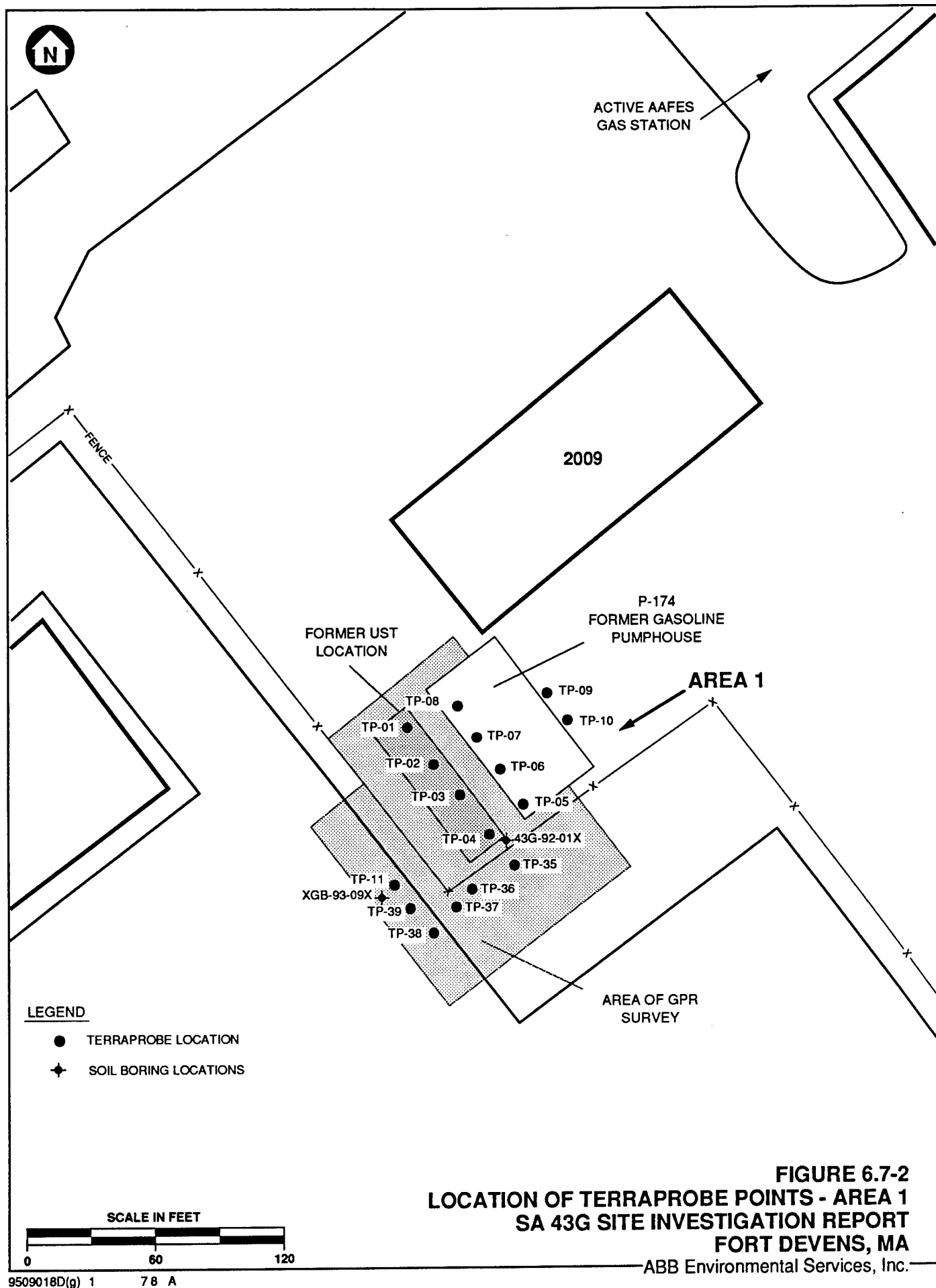
Shaded compounds exceed standard or guideline.

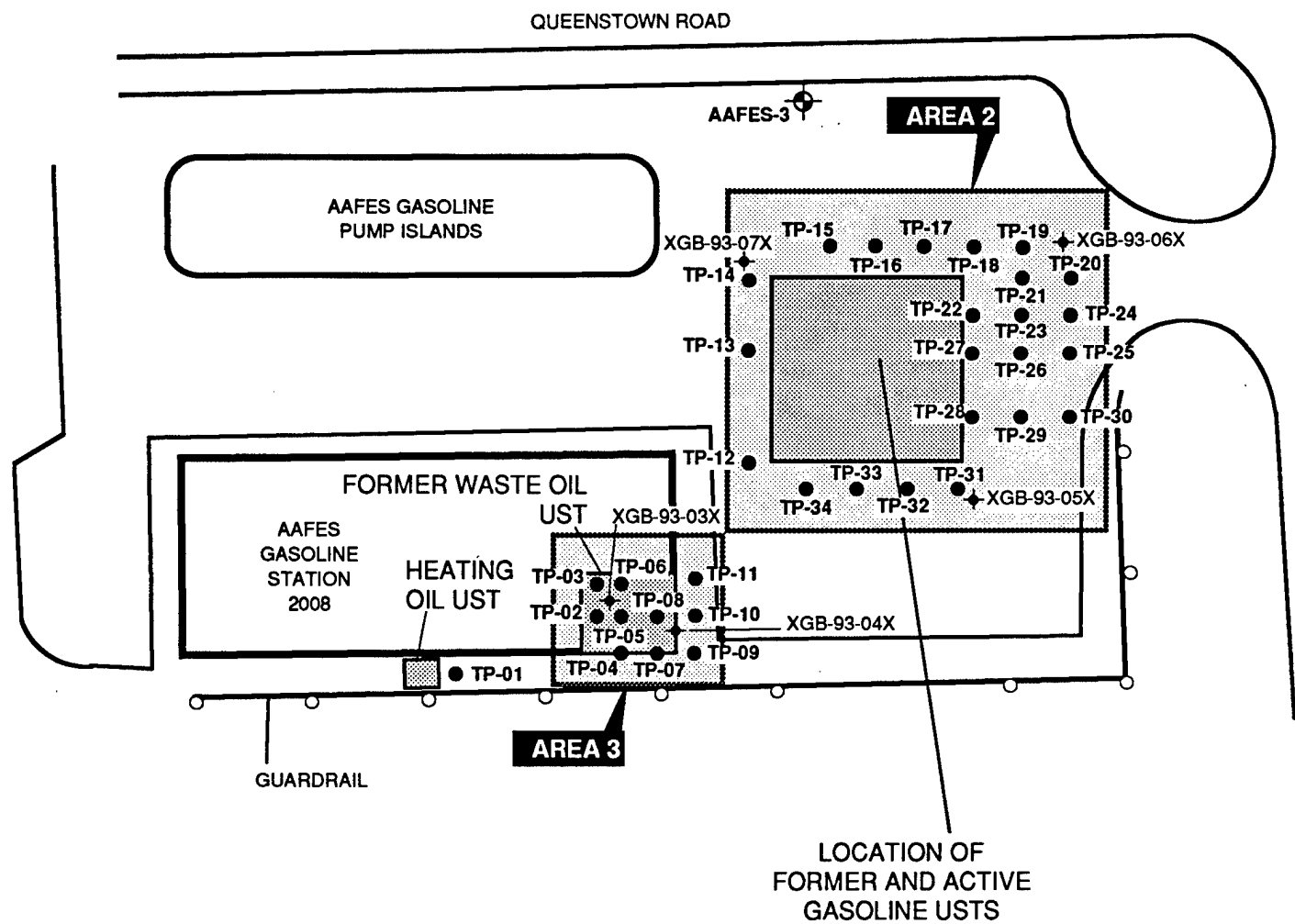
TABLE 6.7-13
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SEDIMENT
SA 43G - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		REGION III RESIDENTIAL SOIL CONCENTRATION (ug/g)	MCP S-1 STANDARD (ug/g)	MAXIMUM EXCEEDS GUIDELINES ?
		AVERAGE (ug/g)	MAXIMUM (ug/g)			
INORGANICS						
ALUMINUM	1/1	3710	3710	23000	NA	NO
ARSENIC	1/1	7.5	7.5	0.36	30	REGION III
BARIUM	1/1	17.2	17.2	5500	NA	NO
CALCIUM	1/1	1610	1610	NA	NA	-
CHROMIUM	1/1	13.3	13.3	390	200	NO
COBALT	1/1	2.63	2.63	NA	NA	-
COPPER	1/1	15.3	15.3	2900	NA	NO
IRON	1/1	11400	11400	NA	NA	-
LEAD	1/1	24	24	500	300	NO
MAGNESIUM	1/1	1840	1840	NA	NA	-
MANGANESE	1/1	119	119	390	NA	NO
NICKEL	1/1	9.87	9.87	1600	300	NO
POTASSIUM	1/1	697	697	NA	NA	-
SODIUM	1/1	298	298	NA	NA	-
VANADIUM	1/1	9.84	9.84	550	NA	NO
ZINC	1/1	70.7	70.7	23000	2500	NO
OTHER						
TOTAL PETROLEUM HYDROCARBONS	1/1	448	448	375	500	REGION III

Notes:
[a] = Sediment from sampling location XGD-93-02X.
NA = not available
- = not applicable
ug/g = micrograms per gram
MCP = Massachusetts Contingency Plan
Shaded compounds exceed standard or guideline.







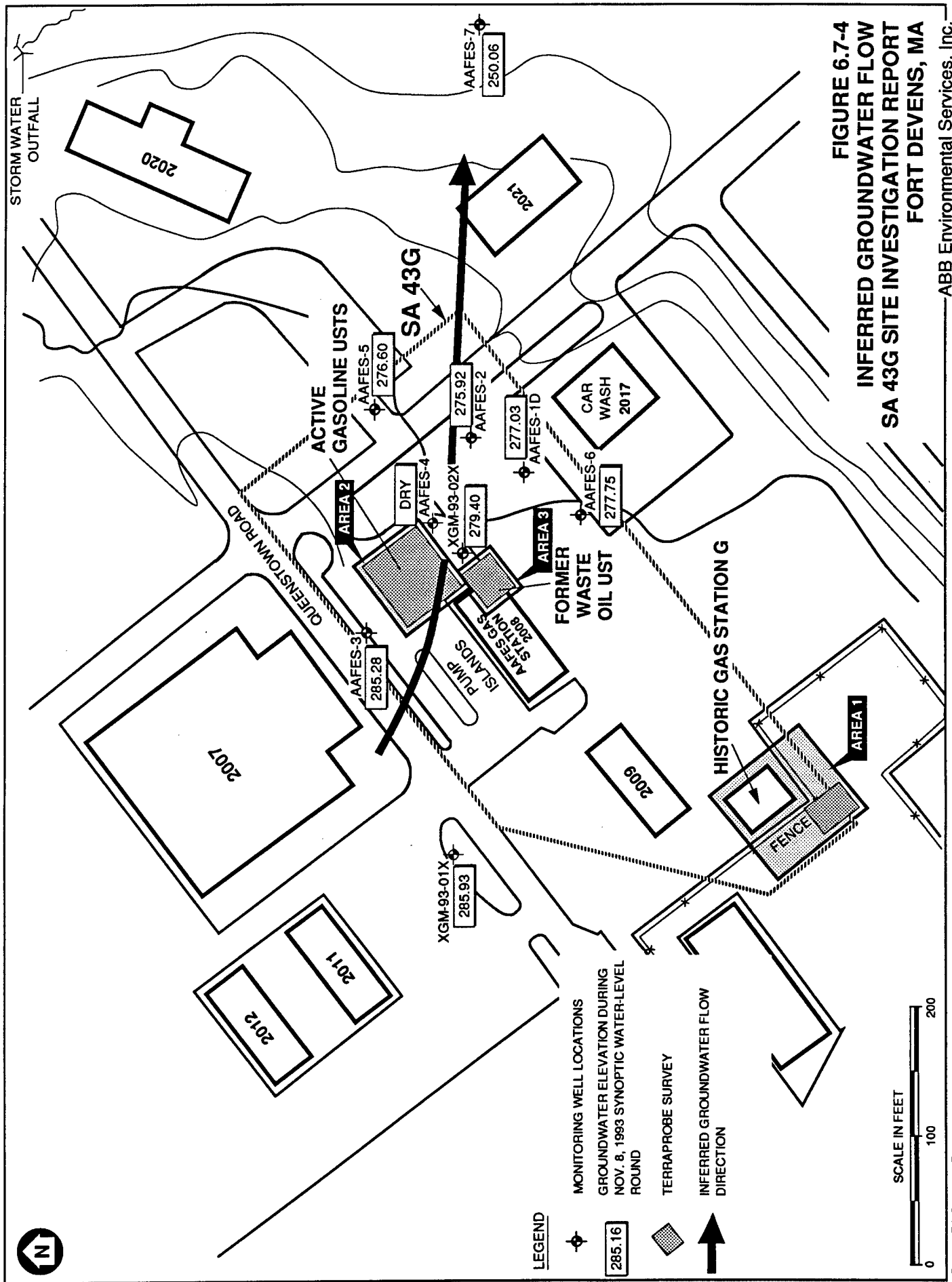
LEGEND

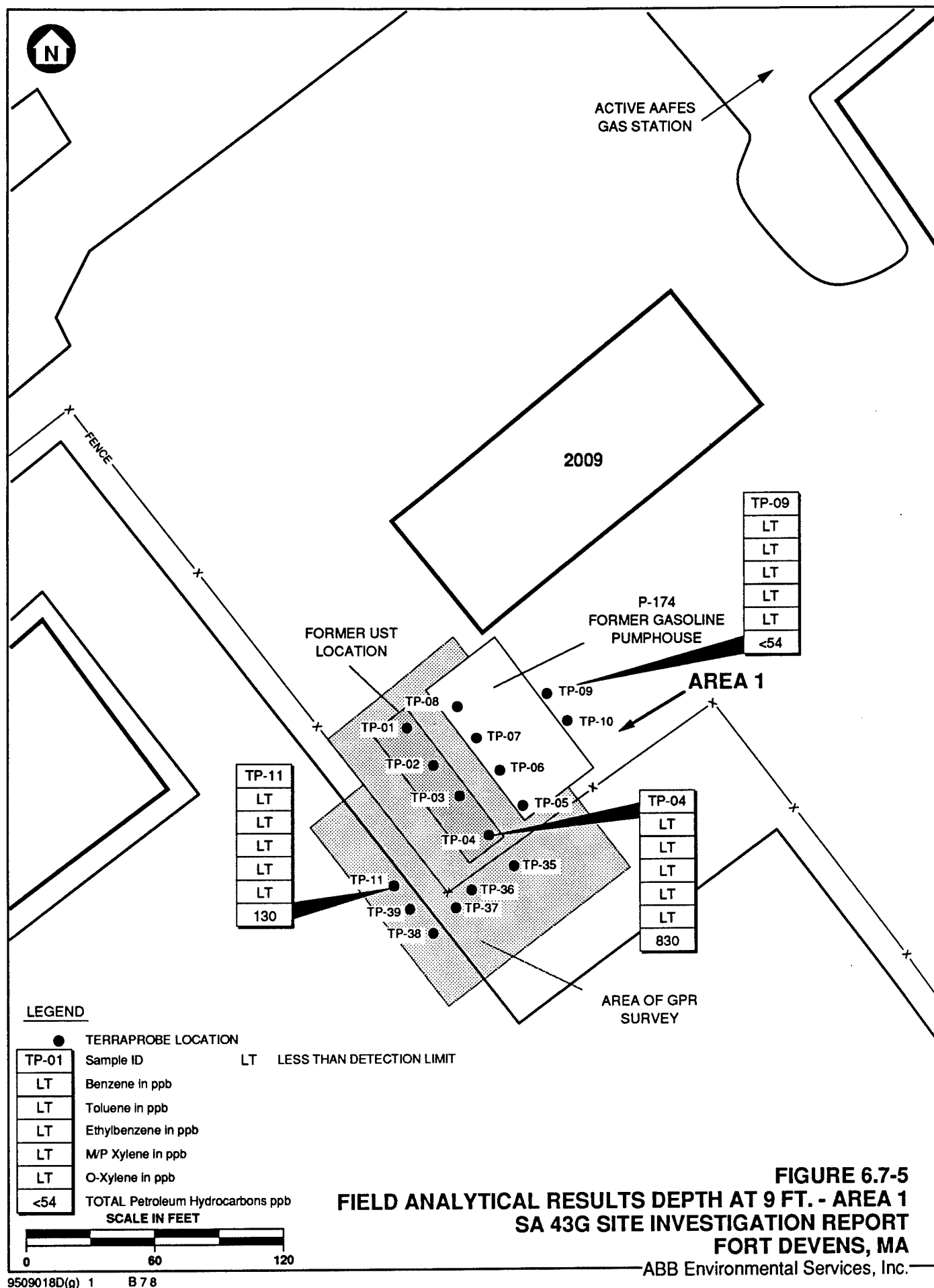
- TERRAPROBE LOCATIONS
- ⊕ MONITORING WELL LOCATION
- ✦ SOIL BORING LOCATIONS

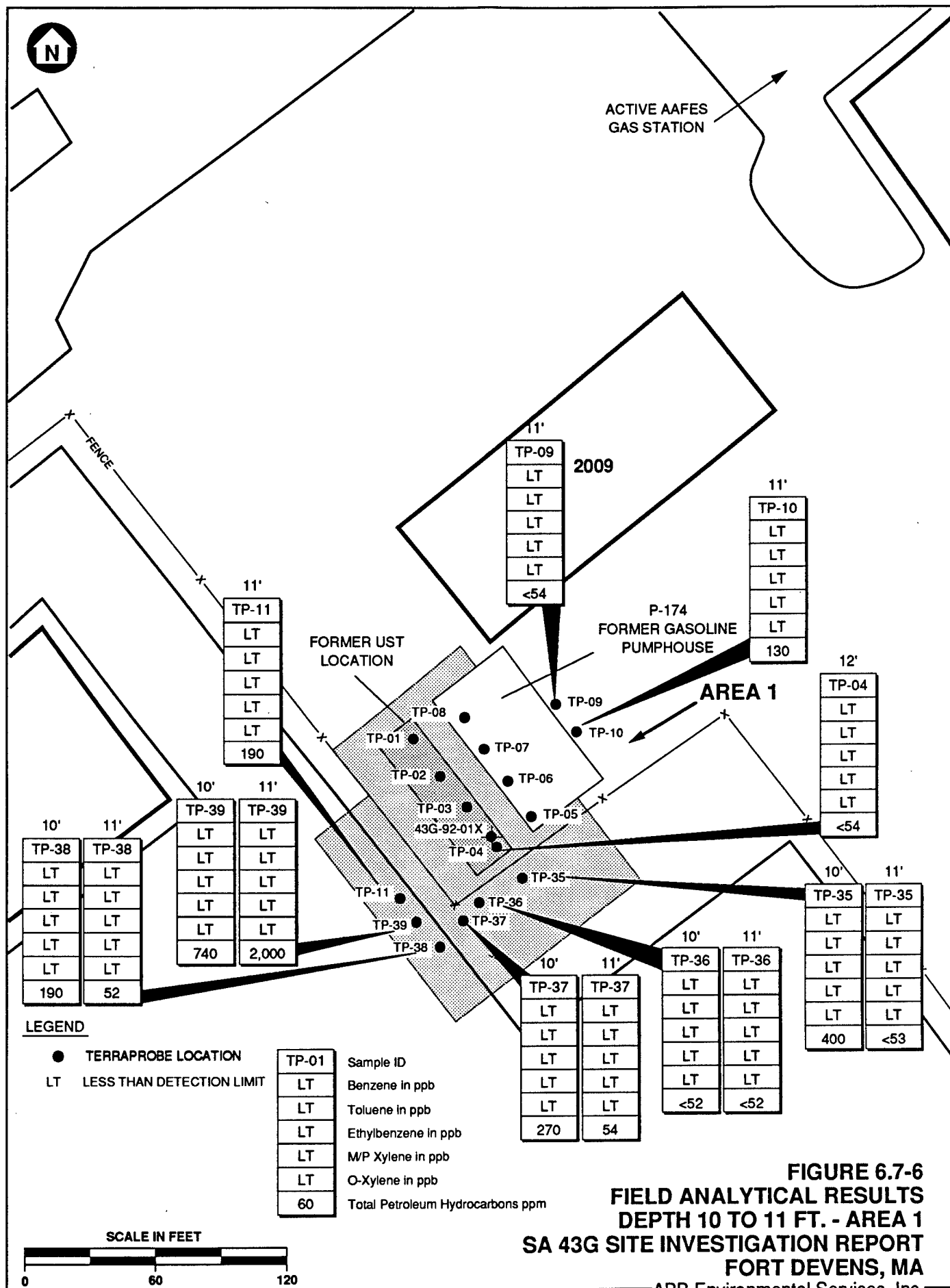


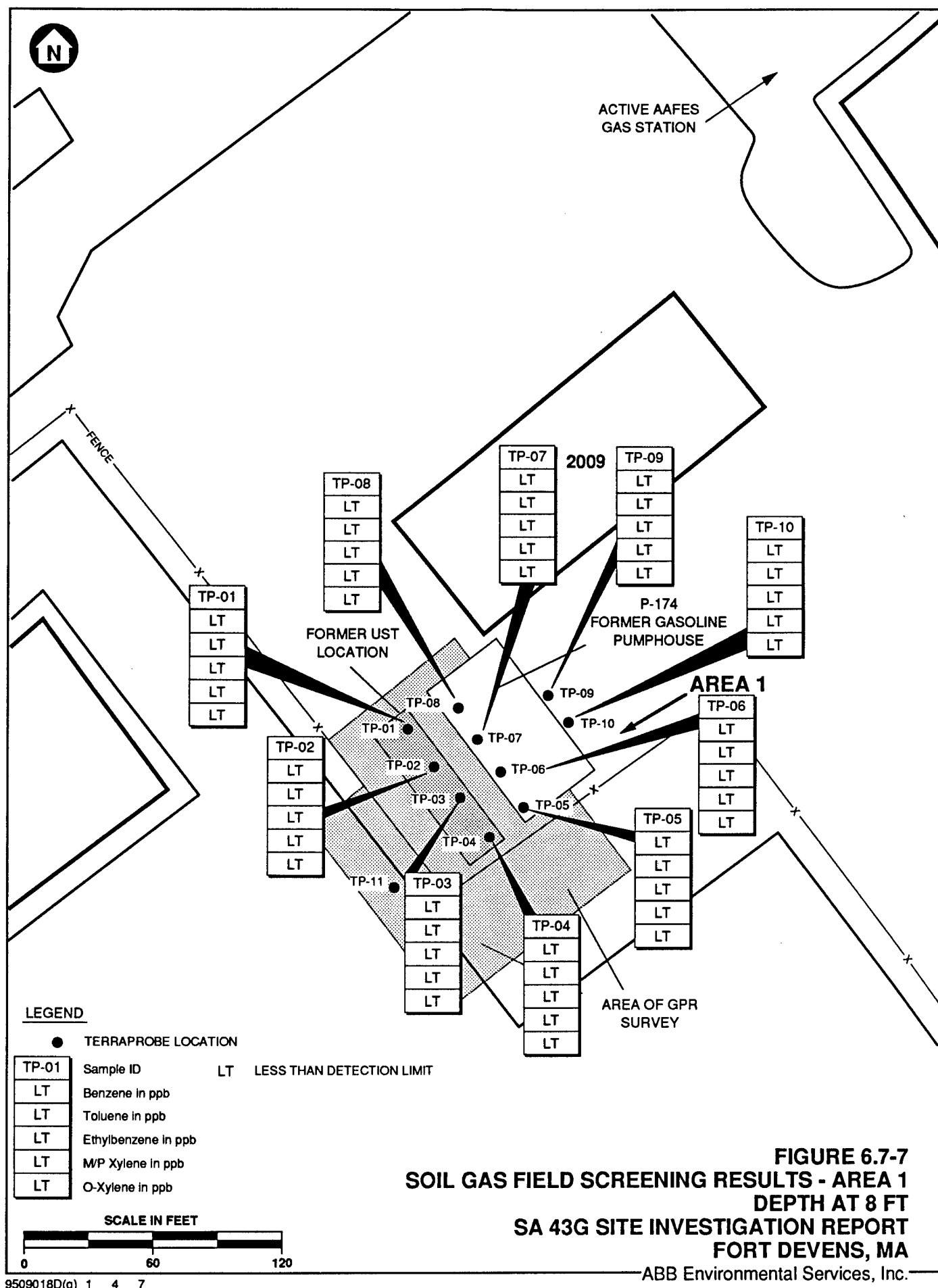
FIGURE 6.7-3
TERRAPROBE LOCATIONS - AREAS 2 AND 3
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.









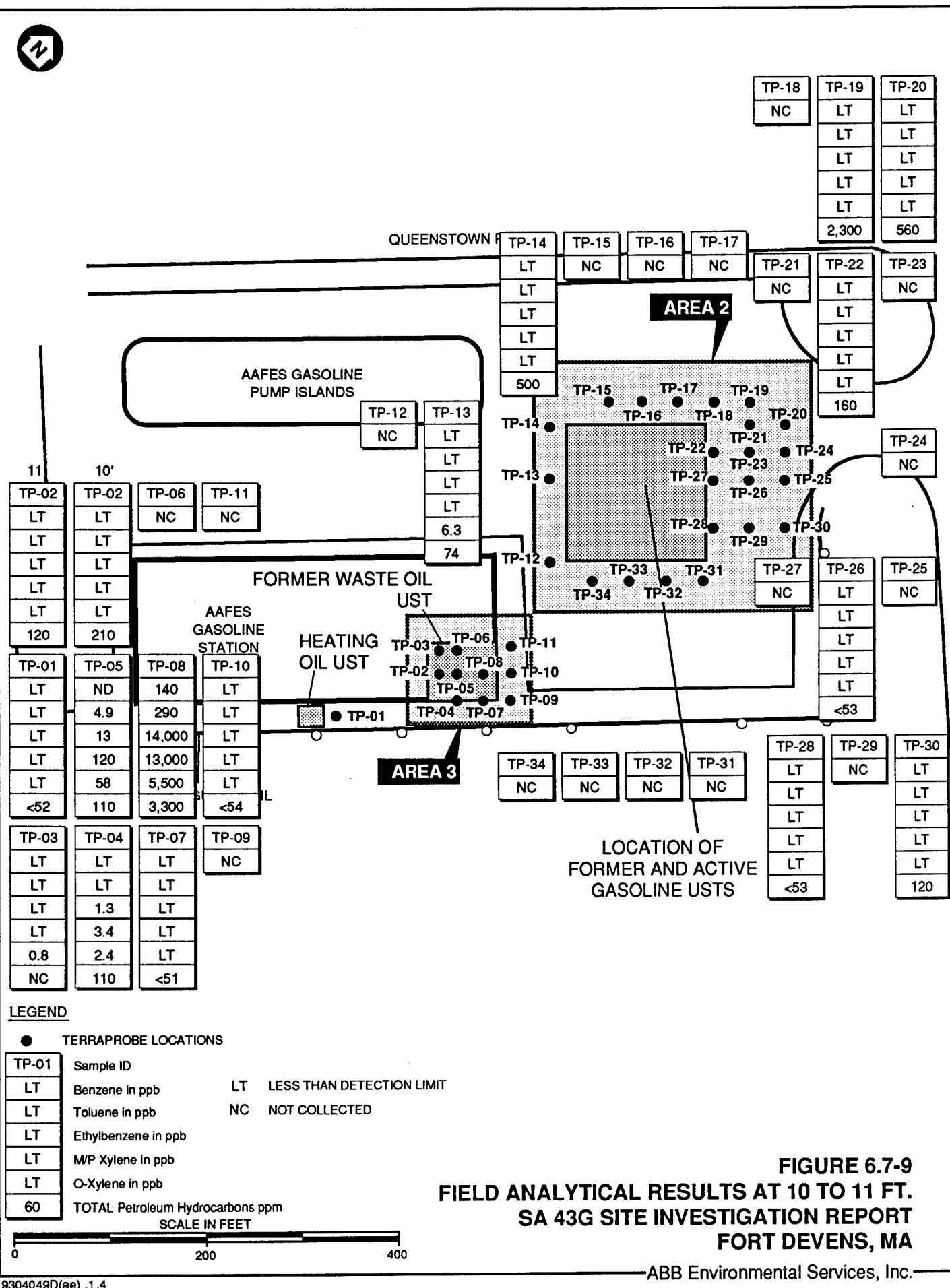
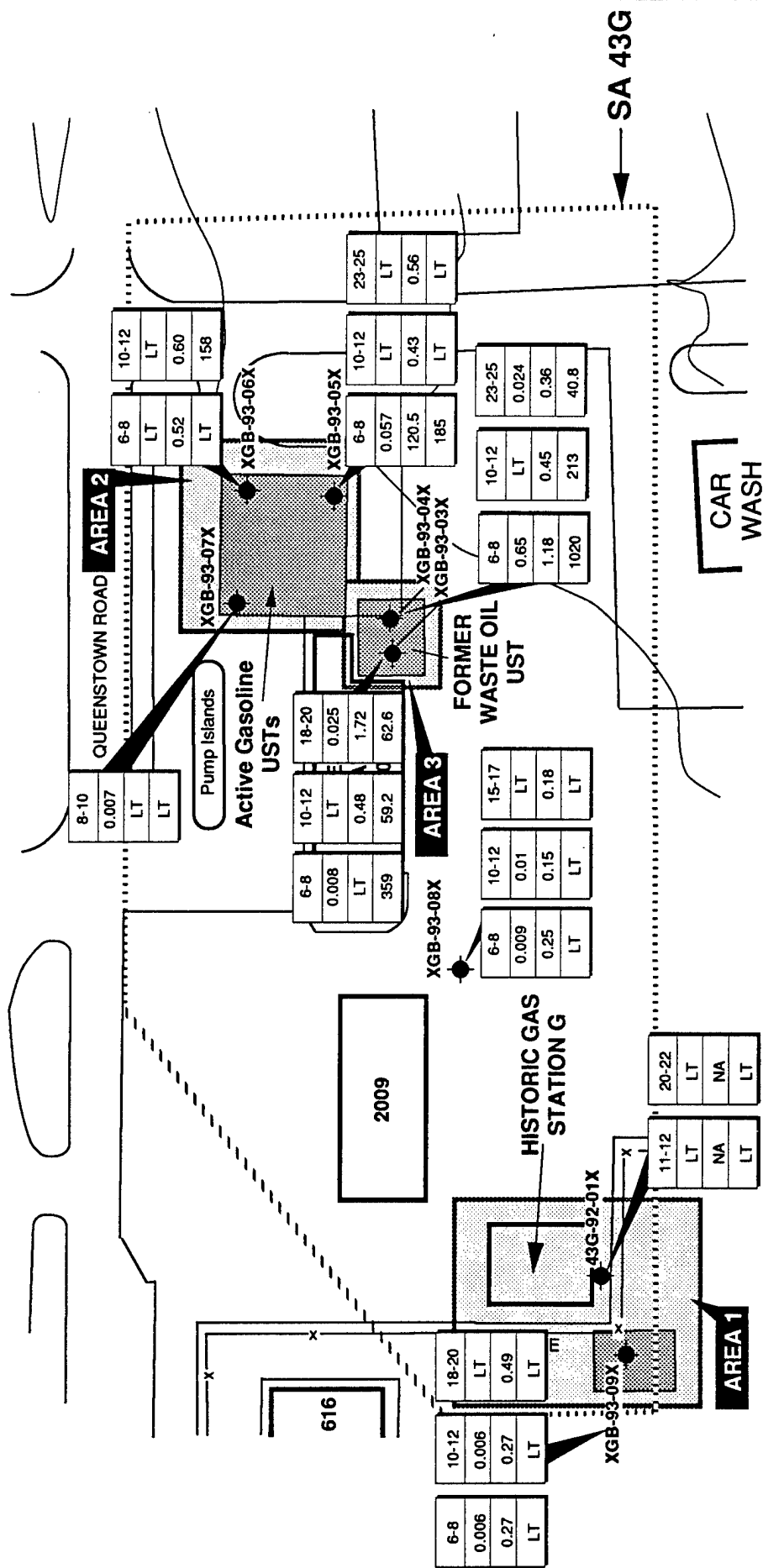


FIGURE 6.7-9
FIELD ANALYTICAL RESULTS AT 10 TO 11 FT.
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA

-ABB Environmental Services, Inc.:

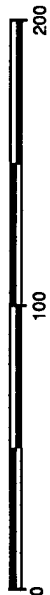


LEGEND

● SOIL BORING LOCATIONS

◆ TERRAPROBE SURVEY

SCALE IN FEET



2-4
LT
LT
LT

SAMPLE DEPTH IN FT
TOTAL VOCs in µg/g
TOTAL SVOCs in µg/g
TPHC in µg/g

LT

LESS THAN DETECTION LIMIT

FIGURE 6.7-10
ORGANIC COMPOUNDS IN SOIL
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA

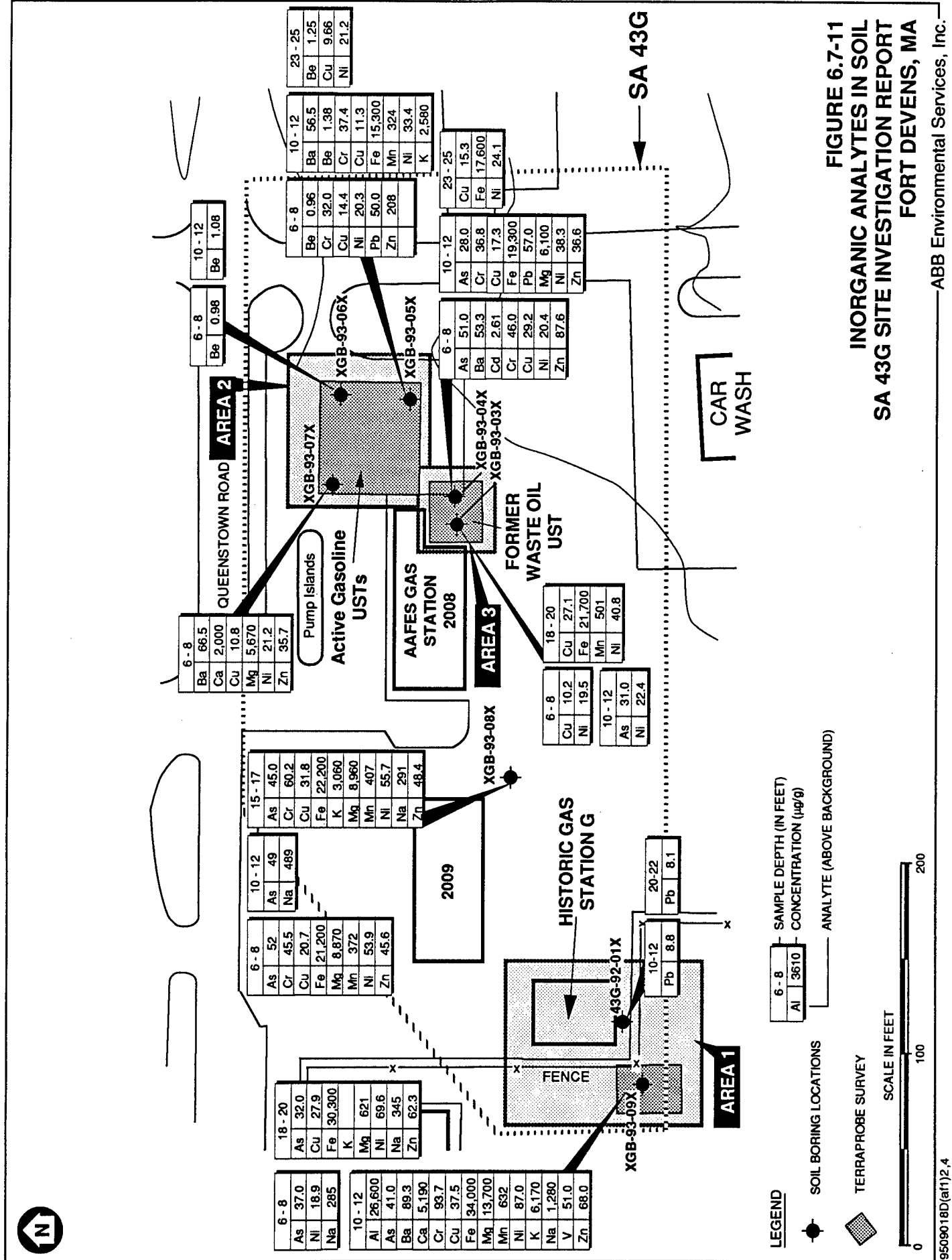
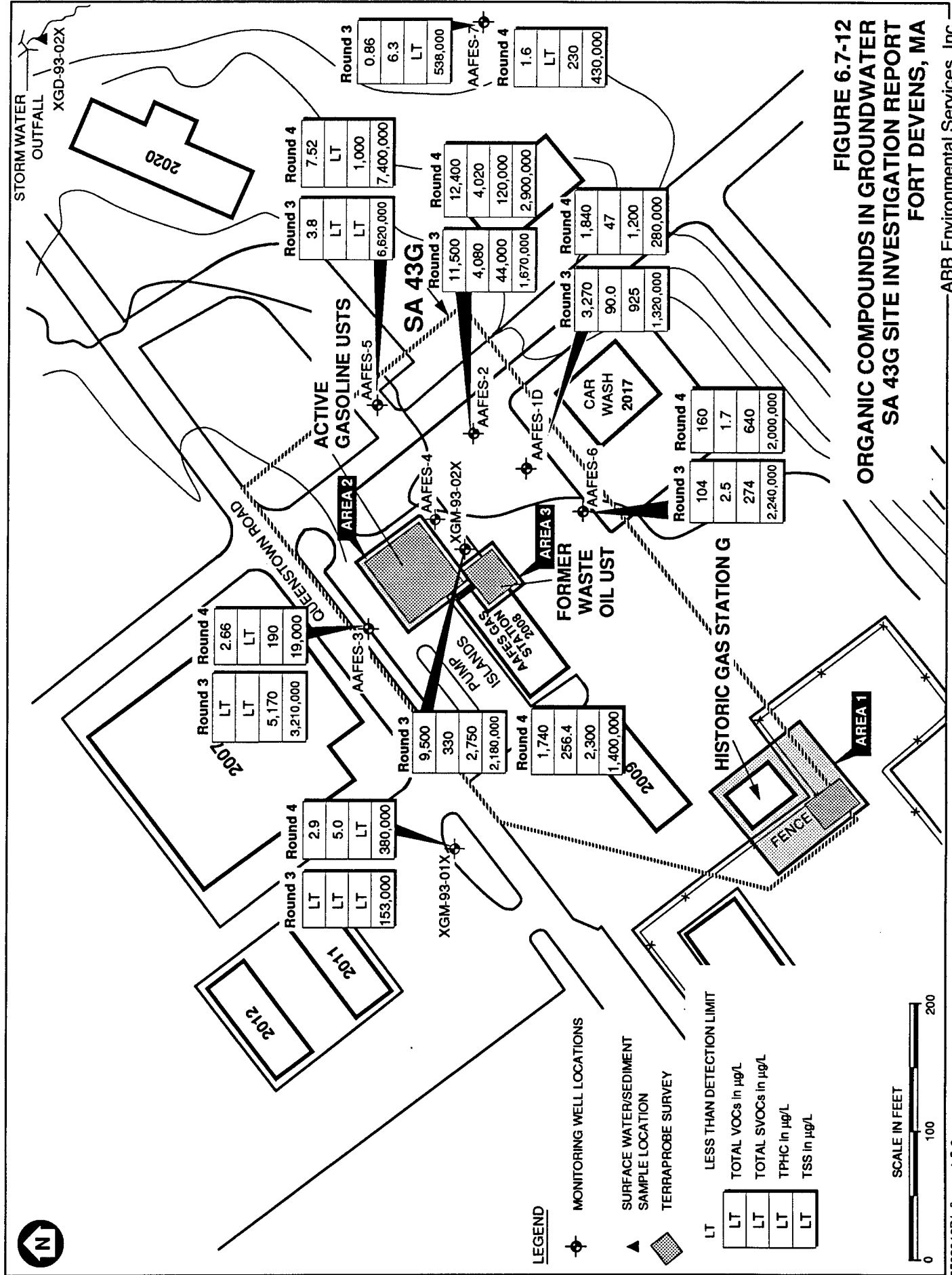


FIGURE 6.7-11
INORGANIC ANALYTES IN SOIL
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA



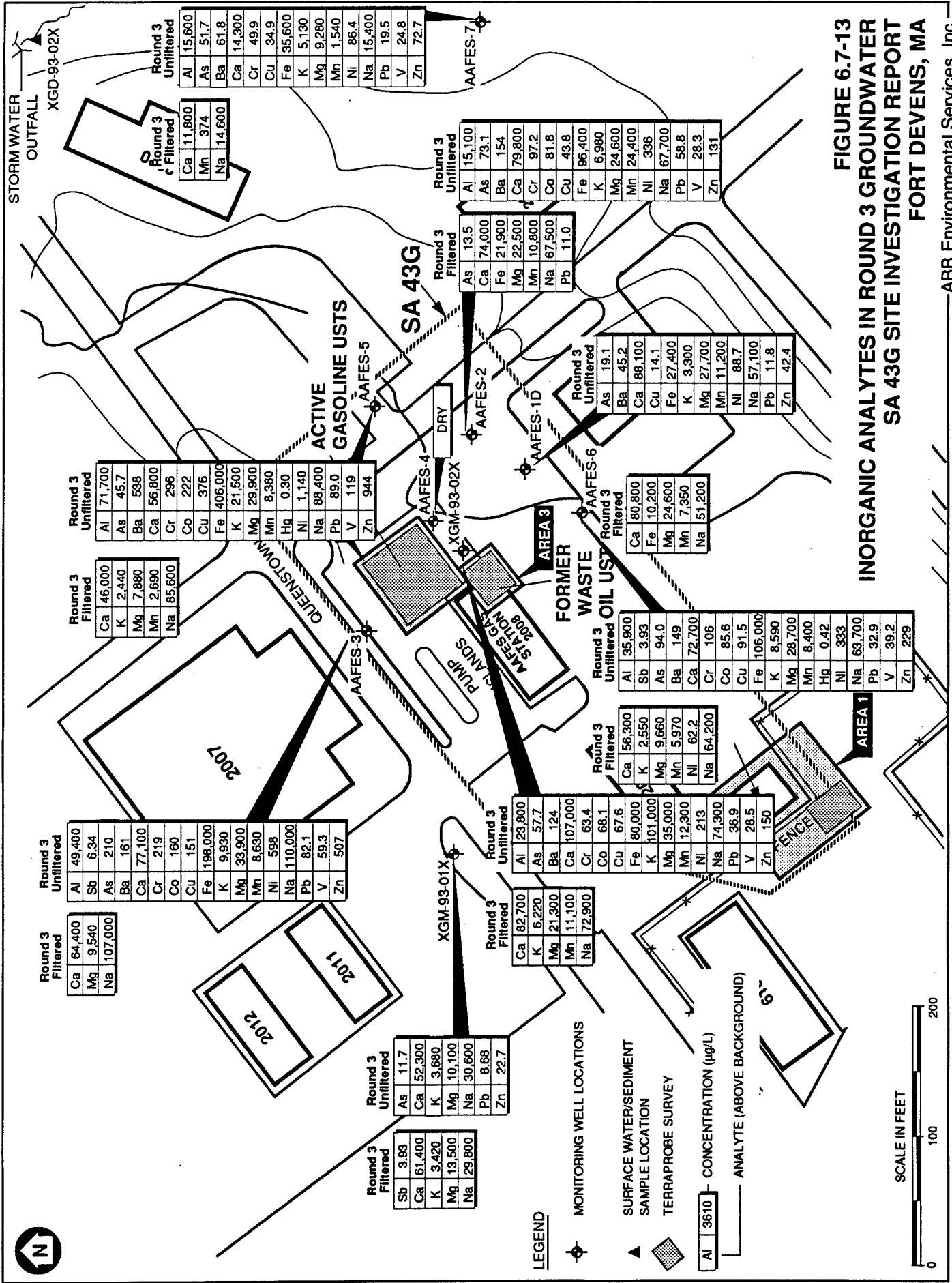
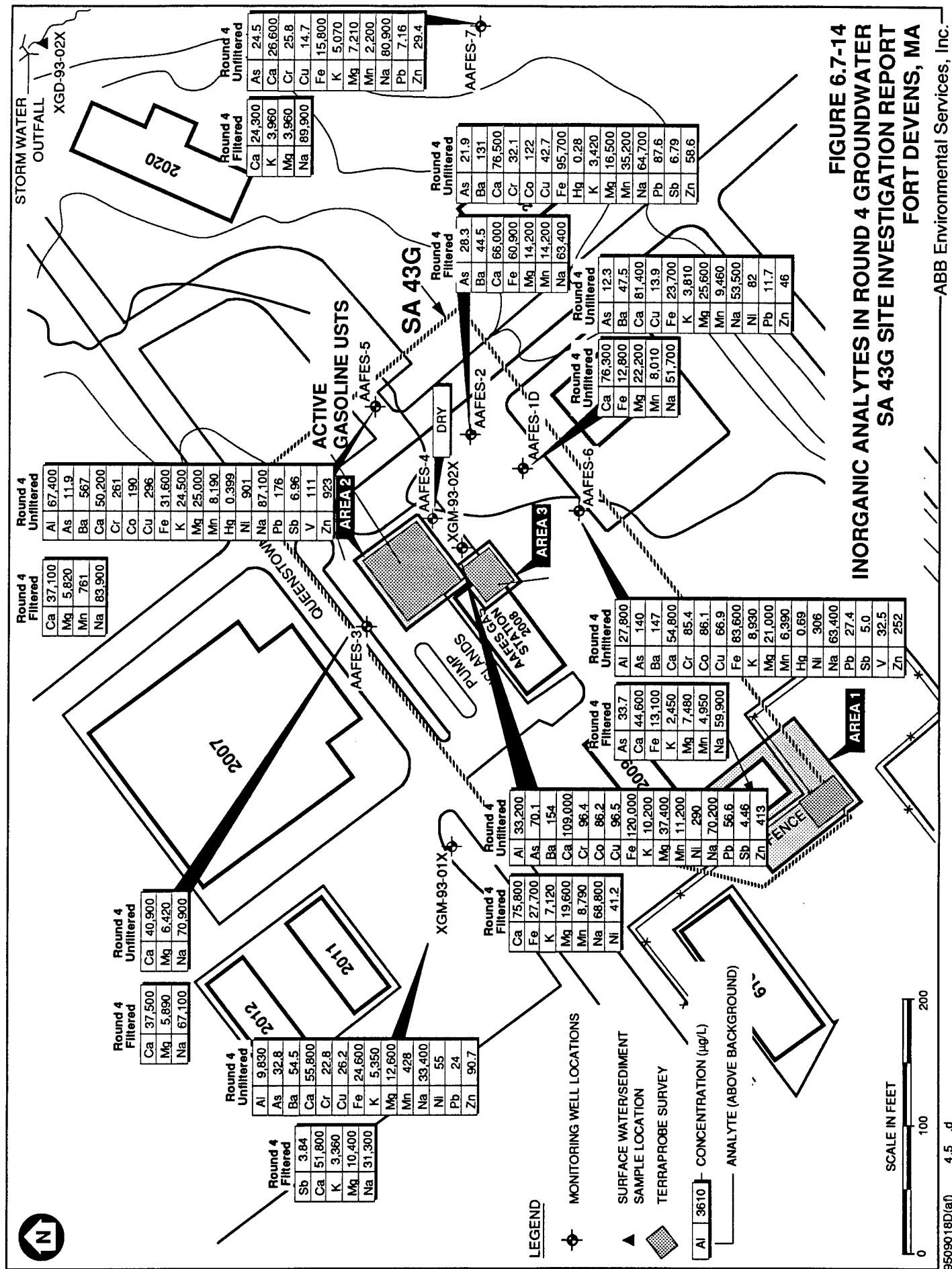


FIGURE 6.7-13
INORGANIC ANALYTES IN ROUND 3 GROUNDWATER
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA



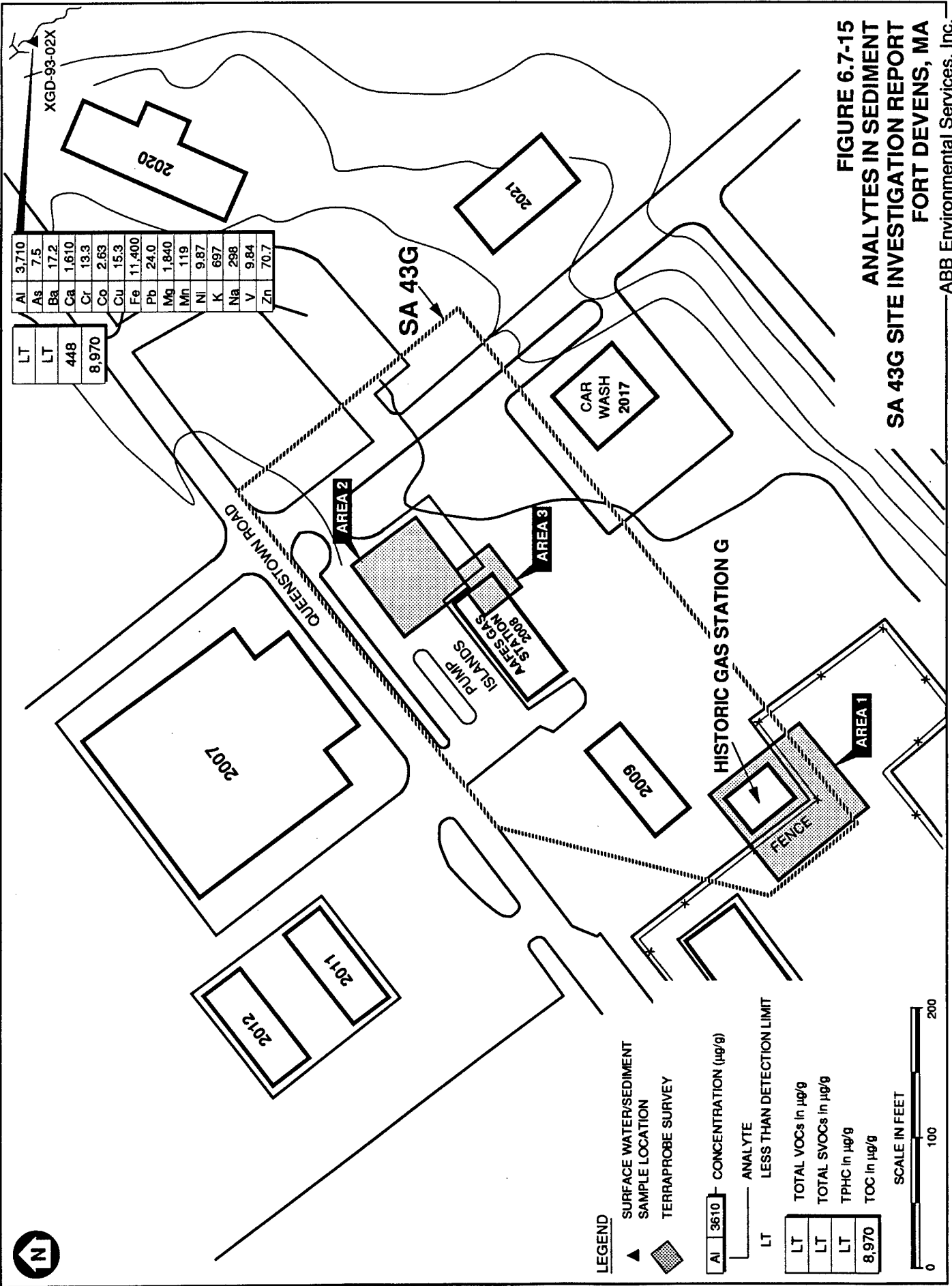


FIGURE 6.7-15
ANALYTES IN SEDIMENT
SA 43G SITE INVESTIGATION REPORT
FORT DEVENS, MA
 ABB Environmental Services, Inc.

6.8 STUDY AREAS 43H AND 43I

6.8.1 Study Area Background and Conditions

Historic gas station 43H was located approximately 500 feet northwest of 43I along Queenstown Road in the central portion of the Main Post (Figure 6.8-1). Due to the fact that these historic gas stations are located so close to each other and are within the same existing motor pool/maintenance area, they will be presented together in this report. The structures at each historic gas station consisted of a pump island and a small gasoline pumphouse. Both of the gas stations were Type A station-designs with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. Reportedly, a second UST was added to the station at SA 43I. This second UST came from historic gas station 43P when that station was decommissioned in 1945. The stations were used during World War II as vehicle motor pools to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of these motor pools or the removal of the associated USTs.

The area along Queenstown Road where SA 43H and 43I were located, is presently a large paved area (approximately 10 acres) used for the storage and maintenance of military vehicles. The area is surrounded by a chain-link fence with locked gates on the northwestern side of the yard. SA 43H was reportedly located between Queenstown Road and Building 602 which is presently a vehicle maintenance building. SA 43I was reportedly located approximately 60 feet north of Building 603 which is also presently used as a vehicle maintenance building (see Figure 6.8-1).

In April and May 1992, three diesel-fuel USTs (one 5,000 gallon and two 10,000 gallon) were removed by ATEC from the 43H motor pool yard, approximately 150 feet southwest of the historic gas station (Area 2 on Figure 6.8-1). After the removal of visibly contaminated soil, ATEC collected confirmatory soil samples from the excavations. VOCs measured by ATEC in soil headspace by PID ranged from ND to 18.6 ppm, and TPHC levels were ND to 6,198 ppm (ATEC, 1992e, 1992f, and 1992g).

In May 1992, one 5,000 gallon diesel-fuel UST was removed by installation personnel from the motor pool yard around SA 43I, approximately 500 feet

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SECTION 6

northeast of the historic gas station (Area 2 on Figure 6.8-1). After the removal of visibly contaminated soil, confirmatory soil samples were collected from the excavation, and VOCs measured in soil headspace by PID ranged from ND to 3.7 ppm, and TPHC levels were ND to 73.8 ppm (ATEC, 1992g).

In October 1992, an estimated 10 to 25 gallons of diesel fuel leaked from a tracked vehicle onto unpaved ground approximately 400 feet southeast of SA 43H (Miller, 1992). The area is within the fenced motor pool yard in which SA 43H is located. The leak was stopped, and contaminated soil was excavated to a depth of 6 feet. Total VOCs measured by PID ranged from 6 to 240 ppm at that depth, and installation personnel have concluded that those levels indicate contamination from sources other than the subject diesel fuel leak (Miller, 1992).

6.8.2 Site Investigation Program Summary

The SI at SA 43H and I was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The field investigation programs at SA 43H and SA 43I were designed to determine if any abandoned UST(s) were present at either site and determine if residual soil contamination was present. The programs consisted of surficial geophysical surveys, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and soil borings to collect subsurface soil samples for off-site laboratory analysis. Table 6.8-1 summarizes the activities completed during the SI.

Surficial geophysical surveys were conducted at both SA 43H and 43I to determine if any abandoned UST(s) were present. The geophysical surveys consisted of a metal detector and GPR survey. The surficial geophysical surveys conducted at SA 43H covered an area 50 feet wide and 150 feet long on the northern side of Building 602 (Figure 6.8-2). The surficial geophysical surveys at SA 43I covered an area approximately 50 feet wide and 75 feet long north of Building 603 (Figure 6.8-3).

A total of six subsurface soil samples were collected from three TerraProbe points at SA 43H, to determine if fuel-related contaminants were present at the site (see Figure 6.8-2). Three soil samples were collected from 8 feet to 9 feet, the approximate depth of the former UST; two soil samples were collected from

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11 feet to 12 feet, and one from 25 feet in TP-01. The soil samples from 11 feet and 25 feet in TP-01 were collected in an attempt to reach the water table below this site. However, groundwater was not encountered. Consequently, seven soil-gas samples were collected to further investigate the nature and distribution of potential contamination. The soil samples were analyzed in the field for BTEX and TPHC, while the soil-gas samples were analyzed in the field for BTEX only.

One soil boring (43H-92-01X) was drilled to collect subsurface soil samples for laboratory analysis. The water table was not reached prior to encountering bedrock in this soil boring, so a soil sample from the water table could not be collected. One soil sample was collected from 9 feet (below the estimated depth of the former UST) for laboratory analysis for PAL VOCs, TPHC, and lead (see Figure 6.8-2). The surficial geophysical surveys conducted at SA 43I covered an area 50 feet wide and 75 feet long at the northern corner of Building 603 (see Figure 6.8-2).

Ten TerraProbe points were advanced at SA 43I to determine if residual fuel-related contaminants were present at the site (see Figure 6.8-3). A total of 16 soil samples were collected. Nine soil samples were collected from 9 feet to 11 feet to analyze the soil at or near the estimated bottom of the UST. Seven soil samples were collected from 20 feet to 32 feet in an attempt to reach the water table and determine if contaminants had migrated to the water table. Groundwater was not encountered in any of the TerraProbe points advanced at SA 43I. Because groundwater was not reached, four soil-gas samples were collected. Soil samples were analyzed for BTEX and TPHC, while soil-gas samples were analyzed for BTEX only.

One soil boring (43I-92-01X) was drilled to the water table, and two subsurface soil samples were collected for laboratory analysis of PAL VOCs, TPHC, and lead (see Figure 6.8-3).

6.8.3 Supplemental Site Investigation Program Summary

The SSI at SA 43H and I was performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b).

SECTION 6

The objective of subsurface soil sampling program at SA 43H and I was to investigate the presence or absence of fuel-related contamination generated by the activities at the motor pools. The program was designed to assess the vertical and horizontal distribution of contamination at the potential source areas with TerraProbe points, soil borings, groundwater monitoring wells, and surface water and sediment sampling. The primary concern at this site was that a potential release of contaminants associated with past and present activities had potentially impacted the subsurface soils, the groundwater, surface water, and sediment quality at this site. Possible contaminant types include petroleum hydrocarbons associated with diesel fuel and/or fuel oil, and waste oil. A field GC was used to analyze the samples collected from the TerraProbe points for the VOCs BTEX. An IR was used to analyze for TPHC. Table 6.8-1 summarizes the activities completed during the SS1.

A record search of Fort Devens design drawing for the motor pools at SA 43H and I was conducted prior to the initiation of the SSI field activities. This search indicated that several areas of potential contamination existed at each motor pool. These areas included the sand and gas traps located outside of Buildings 601, 602, 603, and 604, existing heating oil USTs at buildings 602 and 603, former waste oil UST excavations at each motor pool, and the diesel-fuel dispensing islands (see Figure 6.8-1).

The sand and gas traps are underground structures used to collect the waste fuel, oil and spills generated in the repair bays in each of the above mentioned buildings. The sand and gas traps are constructed of concrete sides and bottom and are approximately 5 feet in diameter and 9.5 feet deep. The sand and gas traps at each building were installed flush to the ground and they are accessed by a manhole. A 2-inch overflow pipe connects the sand and gas traps for Buildings 601 and 602 as well as Building 603 and 604. These pipes are located approximately 2 feet from the top of each sand and gas trap and appear to have been used for overflows, only. The floor drains in each of the building is tied to a discharge pipe which leads outside of the building to the sand and gas traps. The waste fuel and oil flow into the traps where they are stored for collection. The sand and gas traps outside of Building 601 and 602 are presently tied together with a 2-inch underground pipe leading from the sand and gas trap at 602 to the sand and gas trap for 601, and then into a sanitary sewer west of Building 601. The design drawing for this system showed that previously these sand and gas traps overflows were tied to the storm sewer system located east of Building 601

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(Figure 6.8-4). This storm sewer was sampled under the AREE 70 program and the results of that sampling can be found in the Final Storm Sewer Evaluation (AREE 70) Report (Arthur D. Little (ADL), 1995). The sand and gas traps in front of Buildings 603 and 604 are presently tied into the sanitary sewer, however, the design drawings showed that previously these sand and gas traps had an overflow pipe which drained to an overflow outfall east of Building 604 (Figure 6.8-5). The outfall is still in existence, however, the overflow pipes to the outfall have been sealed off at the sand and gas traps.

To present the data from each potential source area more clearly, the site was subdivided into 4 areas. Area 1 was comprised of Buildings 603 and 604, Area 2 was made-up of the former diesel fuel dispensing islands and USTs, Area 3 included Buildings 601 and 602, and Area 4 was the diesel fuel spill site (see Figure 6.8-1). Areas 1 and 3 were subdivided into smaller units to facilitate the investigation and allow for disposition of smaller units within the areas. Within Area 1, the heating oil UST will be referred to as Area 1a, the former waste oil UST will be referred to as Area 1b and the sand and gas traps will be Area 1c (see Figure 6.8-5). The same subdivision was followed in Area 3 (see Figure 6.8-4).

A GPR survey was conducted at each the potential source areas identified in the record search. The GPR survey enabled accurate and safe location of the TerraProbe locations at each location, and gave accurate location of the underground features at each potential source area.

A total of 89 TerraProbe points were completed between the four areas at SA 43H and I. The following section summarizes the field activities completed in each area. To focus the investigation at each source area, the motor pools were divided into four areas.

Area 1. The field analytical investigation at Area 1 was comprised of 18 TerraProbe points located around the sand and gas traps, the heating oil UST and in and around the excavation for the former waste oil UST (see Figure 6.8-5). Three TerraProbe points (TP-17, TP-18 and TP-19) were completed in Area 1a. A total of 11 TerraProbe points (TP-04 through TP-13) were completed in and around the former waste oil UST in Area 1b. Six points (TP-01 through TP-03 and TP-15 through TP-16) were completed around the sand and gas traps in Area 1c. Up to two subsurface soil samples were collected from each of the

SECTION 6

TerraProbe points. Soil samples were collected from below the bottom of the sand and gas traps (approximately 8 to 10 feet bgs), and from below the suspected bottom of the former waste oil and heating oil USTs (approximately 8 feet).

Area 2. The field analytical investigation at Area 2 consisted of 32 Terraprobe points (TP-19 through TP-37 and TP-78 through TP-90) in and around the former diesel fuel dispensing islands and associated USTs (Figure 6.8-6). At the time of the investigation two of the five USTs (located east of Building 606) were still in place. Because of this the TerraProbe points were placed around the dispensing island and the USTs. Soil samples were collected from below the suspected depth of the former and existing USTs (approximately 8 feet bgs).

Area 3. The field analytical investigation at Area 3 was comprised of 36 TerraProbe points located around the sand and gas traps, the heating oil UST and in and around the excavation for the former waste oil UST (see Figure 6.8-4). Five TerraProbe points (TP-42 through TP-46) were completed in Area 3a. A total of 24 TerraProbe points (TP-50 through TP-74) were completed in and around the former waste oil UST in Area 3b. Six points (TP-47 through TP-49 and TP-75 through TP-77) were completed around the sand and gas traps in Area 3c. Up to two subsurface soil samples were collected from each of the TerraProbe points. Soil samples were collected from below the bottom of the sand and gas traps (approximately 8 to 10 feet bgs), and from below the suspected bottom of the waste oil and heating oil USTs (approximately 8 feet).

Area 4. The field analytical investigation at Area 4 consisted of five TerraProbe points (TP-91 through TP-94) located around the reported diesel-fuel spill location (Figure 6.8-7). Soil samples were collected from only 5 feet bgs due to gravel and cobbles encountered in the soil at this area.

After the TerraProbe survey in each area was completed, a total of 10 soil borings (XHB-93-02X through XHB-93-11X) were completed. The location of each soil boring was based on the field analytical results obtained from the TerraProbe survey in each area (see Figures 6.8-4 through 6.8-7). Up to three subsurface soil samples were collected from each boring. The shallow soil samples collected from each boring were collected from depths similar to those used during the TerraProbe survey, so that confirmatory laboratory analysis results might be obtained. Where possible, soil samples were also obtained from the water table and/or the top of bedrock to determine the concentration of potential

ABB Environmental Services, Inc.

contaminants at or near the water table. Subsurface soil samples were also collected from the five monitoring well borings. One soil sample was collected from the screened interval from four of the monitoring well borings (XIM-93-01X, XIM-93-04X through XIM-93-06X), while three subsurface soil samples were collected from XIM-93-02X located downgradient of the former diesel fuel dispensing islands and associated USTs. Each of the subsurface soil samples were submitted for laboratory analysis consisting of PAL VOCs, SVOCs, inorganics, TPHC, and TOC.

A total of five groundwater monitoring wells (XIM-93-01X, XIM-93-02X, XIM-93-04x through XIM-93-06X) were installed at SA 43H and I (see Figure 6.8-1). Monitoring well XIM-93-01X was installed in an apparent upgradient location while XIM-93-04X through XIM-93-06X were installed at what appeared to be downgradient locations. Monitoring well XIM-93-02X was installed east/downgradient of the former diesel fuel dispensing islands (Area 2) to determine if contaminants detected in this area, during the TerraProbe survey, had impacted the groundwater quality. The well screen in each monitoring well was placed so that it intersected the water table to allow for the monitoring of free product and seasonal groundwater level fluctuations. Two monitoring wells (XIM-93-01X and XIM-93-06X) were installed in the bedrock, while the remaining three monitoring wells (XIM-93-02X, XIM-93-04X and XIM-93-05X) were installed in overburden soils. The monitoring well construction at SA 43H and I are summarized in Table 6.8-2 and the well installation diagrams are presented in Appendix C.

Two rounds (Round Three and Four) of groundwater samples were collected during the SSI. Round Three groundwater samples were collected in September 1993 and Round Four samples were collected in January 1994. Both rounds of samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics (both filtered and unfiltered), TPHC, and TSS.

Two surface water samples (XHD-93-02X and XHD-93-03X) were collected from the storm water outfalls located southeast of the motor pools (see Figure 6.8-1). No surface water sample was collected from sample location XHD-93-01X due to a lack of surface water at this location during the sampling event. The surface water samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics.

SECTION 6

Three sediment samples (XHD-93-01X through XHD-93-03X) were collected from the storm water outfalls located southeast of the motor pools (see Figure 6.8-1). Sediment samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics, TPHC, and TOC. Surface water and sediment samples were collected from similar locations during the AREE 70 program. The results from that program will not be repeated here but can be found in the Final Storm Sewer Evaluation (AREE 70) Report (ADL, 1995).

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were performed. The tests consisted of a rising and falling head test. All SSI exploration locations were surveyed.

6.8.4 Field Investigation Results and Observations

The soil below SA 43I appears to be comprised of a poorly sorted sand with medium gravel and silt. Bedrock was encountered at depths ranging from 27 to 41 feet bgs. The bedrock encountered was classified as a metasiltstone or phyllite. Table 6.8-3 summarizes the field observation and the soil type encountered at each soil boring location. The soil boring was advanced to 35.5 feet bgs. Refusal, apparently bedrock, was encountered at 34.5 feet bgs and groundwater was encountered at 34.1 feet bgs. The soil borings for SA 43H and SA 43I are provided in Appendix B.

The results of the geophysical surveys conducted during the SI did not indicate that an abandoned UST was present at either SA 43H or 43I. The results of the geophysical surveys are presented in Appendix L.

Calculated hydraulic conductivities in the bedrock monitoring wells ranged from $2.1E^{-02}$ cm/sec. at XIM-93-01X to $6.5E^{-07}$ cm/sec. at XIM-93-06X. The hydraulic conductivities in the monitoring wells installed in overburden soils ranged from $3.0E^{-02}$ cm/sec at XIM-93-04X to $3.9E^{-04}$ cm/sec at XIM-93-05X. The results of the hydraulic conductivity tests are presented in Table 6.8-4 and summarized in Appendix A.

The monitoring wells at SA 43H and I have been included in several installation-wide water-level rounds. For the purposes of this report the November 8, 1993 synoptic water-level round was chosen to represent the water table conditions at these SA. The results of that round are presented in

ABB Environmental Services, Inc.

Table 6.8-4. The inferred groundwater flow appears to be moving to the east-southeast (Figure 6.8-8).

6.8.5 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.8.5.1 Soil. BTEX was not detected in the subsurface soil samples collected from historic gas station H during the SI. However, TPHC was detected in the 9 foot sample collected from TP-05 at a concentration of 1,400 ppm and in the 12 foot sample from TP-10 at a concentration of 91 ppm (Figure 6.8-9). BTEX was not detected in the soil-gas samples collected (Figure 6.8-10). Table 6.8-5 presents the results of the field analysis.

BTEX was not detected in the nine subsurface soil samples collected from 9 feet to 11 feet bgs at historic gas station I during the SI. TPHC was detected in four of the soil samples ranging from 85 ppm at 11 feet in TP-06 to 300 ppm at 11 feet in TP-03 (Figure 6.8-11). BTEX nor TPHC were detected in the six subsurface soil samples collected from 20 feet to 32 feet bgs (Figure 6.8-12). BTEX was not detected in the four soil-gas samples collected from SA 43I (Figure 6.8-13). Table 6.8-5 presents the field analysis data for SA 43I.

The results of the SSI field analysis are presented in Table 6.8-5 and Figures 6.8-14 through 6.8-20. The following subsection present the results of the field analysis conducted on soil samples collected each area.

Area 1. TerraProbe points completed in Area 1a indicated that TPHC contamination was not present in the samples collected from 8 feet bgs, while TPHC was present in the soil below the heating oil UST at concentrations ranging from 230 to 600 ppm in the 9 to 10 foot samples (see Figures 6.8-14 and 6.8-15). The results of the field analysis in Area 1b showed that residual TPHC contamination was present at 9 to 10 feet and 10 to 11 feet bgs in the center of the former waste oil UST excavation. Concentrations of TPHC ranged from <53 to 3,100 ppm (see Figure 6.8-15). The results of soil samples collected around and below the sand and gas traps at 8 feet and 9 to 10 feet bgs indicated that TPHC was present at concentrations ranging from <53 to 16,000 ppm at the sand and gas trap in front of Building 603, and at concentrations ranging from <53 to 1,200 ppm at the sand and gas trap in front of Building 604 (see Figures 6.8-14 and 6.8-15).

SECTION 6

Area 2. Thirty-eight TerraProbe points were completed in Area 2 and subsurface soil samples were collected from 8 to 10 feet bgs. The results of the field analysis conducted on the soil samples collected from Area 2 indicated that low concentrations of toluene and xylenes were present along with higher concentration of TPHC, to a depth of 10 feet, at isolated areas in and around the former diesel USTs (see Figures 6.8-16 and 6.8-17).

Area 3. TerraProbe points completed in Area 3a indicated that TPHC contamination was present in the soil below the heating oil UST at concentrations ranging from <52 to 2,500 ppm (Figures 6.8-18 and 6.8-19). The results of the field analysis in Area 3b showed that residual TPHC contamination was present in the center and northern end of the former waste oil UST excavation. Concentrations of TPHC ranged from <53 to 480 ppm. The results of soil samples collected around and below the sand and gas traps at Area 3c, indicated that there was low concentrations (0.4 to 0.6 ppb) of m-p xylene and orthoxylene. TPHC was also detected at concentration ranging from <52 to 1,900 ppm at the sand and gas trap in front of Building 601, and at concentrations ranging from <52 to 1,300 ppm at the sand and gas trap in front of Building 602 (see Figures 6.8-18 and 6.8-19).

Area 4. Four TerraProbe points were completed in this area. Due to probe refusal the points were only advanced to 10 feet bgs. Of the soil samples collected from this depth, one sample (TP-94) had a detectable concentration of orthoxylene at 3.1 ppb and TPHC at 92 ppm. Soil samples could only be collected from around the perimeter of the spill site due to soft soil conditions at the time of the TerraProbe survey (see Figure 6.8-20).

The results of the SSI off-site laboratory analyses for the subsurface soil samples collected from SA 43 are presented in Tables 6.8-6 and 6.8-7 and Figures 6.8-21 through 6.8-24. Based on the results of the TerraProbe survey in each area, a soil boring program, consisting of 10 borings, was designed and completed. Results from SI borings are also included in these sections.

Area 1. Soil boring 43H-92-01X was drilled adjacent to TP-05 to collect confirmatory laboratory analytical samples. This location was chosen because the highest TPHC concentration (1,400 ppm) was detected at this location. One sample was collected from 9 feet bgs. No VOCs were detected, TPHC was detected at a concentration of 154 ppm and lead was detected at a concentration

ABB Environmental Services, Inc.

below the established background (Table 6.8-6; Figure 6.8-21). The soil boring was advanced to 26 feet bgs, but the water table was not encountered prior to refusal. Because of this a soil sample from the water table could not be collected or submitted for analysis.

Three soil borings (XHB-93-02X through XHB-93-04X) were completed in Area 1. One soil boring was advanced adjacent to each of the sand and gas traps in Areas 1c, and the third boring was drilled through the middle of the excavation of the former waste oil UST at Area 1b. The depth of the shallow soil samples collected from each of these borings was based on the results of the TerraProbe survey. Due to the nature of the soils in this portion of the installation, each of the soil borings in Area 1 were terminated, due to auger refusal, prior to reaching the water table or bedrock. The results of the off-site laboratory analyses indicated the presence of several inorganic analytes above the Fort Devens background concentrations as well as VOCs and TPHC contamination. Low concentrations of common laboratory contaminants trichlorofluoromethane and/or di-n-butylphthalate were detected in each of the Area 1 soil samples. Toluene ($0.004 \mu\text{g/g}$) and TCE ($0.034 \mu\text{g/g}$) were detected in the 8-foot soil samples from XHB-93-04X. Residual TPHC contamination was detected in the 10-foot sample ($234 \mu\text{g/g}$) collected from the grave of the former waste oil UST in Area 1b, however a deeper soil sample could not be collected due to auger refusal. TPHC contamination was confirmed around and below the sand and gas trap located outside of Building 603. Soil samples results from XHB-93-02X showed concentrations of TPHC decreasing with depth, ranging from $1,110 \mu\text{g/g}$ in the 10 to 12-foot sample to $49.2 \mu\text{g/g}$ in the 33 to 35-foot soil sample. TPHC was also detected at $126.0 \mu\text{g/g}$ in the duplicate sample collected from 33 to 35 feet bgs at XHB-93-02X. TPHC contamination detected in the TerraProbe samples collected around the sand and gas trap outside of Building 604, was not confirmed in the soil samples collected from boring XHB-93-04X.

Several inorganic analytes were also detected above their Fort Devens background concentration. TPHC contamination was not confirmed around the sand and gas trap outside of Building 604. The contamination detected in the TerraProbe samples were collected from 11 feet bgs and the deepest soil boring sample was collected from 8 to 10 feet bgs, due to auger refusal (see Table 6.8-6 and 6.8-7; Figure 6.8-21).

SECTION 6

Area 2. Two soil borings (XHB-93-05X and XHB-93-06X) were completed in Area 2. These borings were located in the footprint of the former diesel UST grave to confirm the results of the TerraProbe survey, and attempt to determine the vertical distribution of the contamination. Subsurface soil samples were collected from 12 and 20 feet bgs in the XHB-93-05X boring, and from 10, 15 and 22 feet bgs in the XHB-93-06X boring. The results of the laboratory analysis indicated the presence of low concentrations of three PAHs and several inorganic analytes above the Fort Devens background in the samples collected from the XHB-93-05X boring. No VOCs were detected. TPHC concentrations detected in the laboratory samples were two orders of magnitude lower (<28.7 to $74.0 \mu\text{g/g}$) than those detected in the field analytical soil samples. The results of the laboratory soil samples collected from the XHB-93-06X boring were comparable to those detected in the field analytical samples. No VOCs or SVOCs were detected, however, elevated TPHC concentrations were detected in each of the three soil samples. The deepest soil sample (22 feet bgs) had a TPHC concentration of $131 \mu\text{g/g}$. Several inorganic analytes were detected above their Fort Devens background concentration. No soil boring were advanced around the existing diesel USTs because these USTs had not been removed and it was the Army's opinion that soil borings should be completed after the USTs were removed (see Tables 6.8-6 and 6.8-7; Figure 6.8-22).

Area 3. Soil boring 43I-92-01X was drilled to confirm the field analysis results. The boring was drilled adjacent to TP-03, which had the highest TPHC concentration at 300 ppm. Two soil samples, one from 9 feet to 11 feet bgs and one from the water table, 34 feet to 36 feet bgs, were collected for laboratory analysis. No VOCs or TPHC were detected and lead concentrations were below the established background (Table 6.8-5; Figure 6.8-21).

Four soil borings (XHB-93-07X through XHB-93-10X) were completed in Area 3. These borings were located adjacent to the heating oil UST in Area 3a, at the north end of Area 3b and adjacent to each of the sand and gas traps in Area 3c. The depth of the soil samples collected from each of these borings was determined based on the results of the TerraProbe survey. Due to the nature of the soils in this portion of the installation, each of the soil borings in Area 3 were terminated, due to auger refusal, prior to reaching the water table or bedrock. Because of this the soil samples collected from the soil borings did not exactly correspond with those soil samples collected during the TerraProbe survey. The results of the laboratory analyses indicated the presence of TPHC and several

ABB Environmental Services, Inc.

inorganic analytes above their Fort Devens background concentrations. TPHC contamination detected in the field analytical soil samples (i.e., TP-48, TP-75, and TP-77) was confirmed with the result from the 6-foot soil samples collected from XHB-93-07X (102 $\mu\text{g/g}$), and the 8-foot soil sample result from XHB-93-10X (71.9 $\mu\text{g/g}$) (see Tables 6.8-6 and 6.8-7; Figure 6.8-23).

Area 4. Only one soil boring (XHB-93-11X) was completed in Area 4. Only one soil sample (from 5 feet bgs) was collected from this boring due to auger refusal. The only organic compounds detected was di-n-butyl phthalate, a common laboratory contaminant, at 0.3 $\mu\text{g/g}$. No site-related contaminants were detected in this sample (see Tables 6.8-6 and 6.8-7; Figure 6.8-24).

6.8.5.2 Groundwater. The results of the SSI off-site laboratory analyses for the Round Three and Four groundwater samples are presented in Table 6.8-8 and Figures 6.8-25 and 6.8-26. Round Three groundwater samples were collected from each of the five newly installed monitoring wells. The results of the Round Three off-site laboratory analysis indicated the presence of TPHC at 270 $\mu\text{g/L}$ in XIM-93-02X. TPHC was not detected in the Round Four sample from XIM-93-02X nor any of the other Round Four samples. Bis (2-ethylhexyl)phthalate and chloroform were also detected in several samples during both rounds, however, these are common laboratory contaminants and were not considered site-related contaminants. No other organic compound were detected in any of the Round Three or Four samples. Several inorganic analytes were detected above their Fort Devens background concentrations in the unfiltered samples collected during both rounds of sampling. However, only calcium, magnesium, arsenic, sodium, potassium, and antimony were detected above their Fort Devens background concentrations in the filtered samples.

6.8.5.3 Surface Water. The results of the laboratory analyses for the surface water samples collected are presented in Table 6.8-9 and Figure 6.8-27. Two surface water samples (XHD-93-02X and XHD-93-03X) were collected from the storm water outfalls, located east of SA 43 H and I, which drain from Queenstown Road, the parking area and the wash racks located at SA 43H and I. These storm drains empty into drainage ditches that flow east to the unnamed tributary of Robins Pond. Chloroform and bis(2-ethylhexyl)phthalate were the only organic compounds detected, and these are common laboratory contaminants and are not considered site-related. Several inorganic analytes were detected at notable concentrations.

SECTION 6

6.8.5.4 Sediment. The results of the laboratory analyses for the sediment samples collected are presented in Table 6.8-10 and Figure 6.8-28. Three sediment samples (XHD-93-01X through XHD-93-03X) were collected from the storm water outfalls on the east side of SA 43 H and I. Sediment samples XHD-93-02X and XHD-93-03X were collected at the same locations as the surface water samples mentioned above. Sediment sample XHD-93-01X was collected from the overflow outfall of the sand and gas trap connected to Buildings 603 and 604. At the time this sample was collected it appeared that the pipe had not been used in the recent past. Each of the VOCs detected (acetone, chloroform, methylene chloride, and trichlorofluoromethane) are considered common laboratory contaminants and will not be discussed as site-related. No SVOCs were detected in any of the sediment samples collected. TPHC was detected at concentrations ranging from 398 $\mu\text{g/g}$ at XHD-93-03X to 24,100 $\mu\text{g/g}$ at XHD-93-01X. TOC concentrations ranged from 1,410 $\mu\text{g/g}$ at XHD-93-02X to 138,000 $\mu\text{g/g}$ at XHD-93-01X. These high TOC concentrations may explain the elevated TPHC concentrations. Several inorganic analytes were detected at notable concentrations.

6.8.6 Source Evaluation and Contaminant Migration Potential

TPHC was the primary contaminant detected during the TerraProbe survey and field analytical program at each of the suspected contaminant source areas at SA 43H and I. TPHC concentration was detected in soil samples collected around the sand and gas traps and in the excavations of the former waste oil USTs at Areas 1b and 1c and at Areas 3b and 3c. It appears that fuel-related contaminants have leaked from the sand and gas traps in these areas. The off-site laboratory results of subsurface soil samples collected from these areas indicate that the contamination appears to be localized around the bottom of the sand and gas traps, and in the soils at the bottom of the former waste oil UST excavation. It does not appear that contaminants have migrated to the groundwater in Area 1. TPHC contamination was also detected around the existing heating oil UST at Area 3a. Results from field analysis indicated that TPHC contamination was present in the soils in and around the former fuel dispensing islands and associated USTs in Area 2. Off-site laboratory results confirmed the field analysis and showed that TPHC contamination had apparently percolated to the water table below Area 2. TPHC was detected at low concentration in the soils samples collected at the diesel-fuel spill site behind SA 43H and I.

The only VOC and SVOC detected in the groundwater samples collected from SA 43H and I were common laboratory contaminants (chloroform, trichlorofluoromethane, and bis(2-ethylhexyl)phthalate). TPHC was detected in Round Three groundwater sample collected from XIM-93-02X (located downgradient of Area 2) at a concentration of 270 $\mu\text{g/L}$. TPHC was not detected in the Round Four sample from this monitoring well. However, the results of the groundwater samples collected from the downgradient monitoring wells did not indicate that the TPHC detected in Round Three in XIM-93-02X has adversely impacted groundwater quality downgradient of the site. Several inorganics were detected above their Fort Devens background concentrations in the filtered and unfiltered samples. However, the background exceedances do not appear to be a result of past site activities. Instead they appear to be caused by elevated TSS and site-specific background (see Table 6.8-8; Figure 6.8-25 and 6.8-26).

The results of the surface water and sediment samples collected from the two stormwater outfalls which drain the parking area at SA 43H and I, indicates that the activities in the motor pools, and Queenstown Road, have impacted the sediment/surface soil quality at the storm water outfalls. However, it does not appear that the contaminants detected in the surface water and sediment samples are impacting local wetlands.

6.8.7 Preliminary Human Health Risk Evaluation

Analysis of TerraProbe and confirmatory boring samples collected from the historic gas stations during the SI indicated residual contamination at concentrations which would pose no significant risk to public health. However, during the SSI, the area of investigation was expanded. SA 43H and I was divided into four areas to more accurately characterize contamination. These areas are described fully in Section 6.8.1, above.

Area 1 Subsurface Soil. Area 1 has been divided in 3 areas: Area 1a, the heating oil UST; Area 1b, waste oil UST; and Area 1c, sand and gas traps outside Buildings 603 and 604. Individual field analytical results for TerraProbe samples are presented in Table 6.8-5; and off-site laboratory results for soil borings samples are presented in Table 6.8-6 and 6.8-7. The individual results are summarized on Table 6.8-11 where they are compared to Region III and MCP Category S-2 guidelines. The PRE for each area is discussed below.

SECTION 6

Area 1a. Six TerraProbe samples were taken at Area 1a (heating oil UST). No BTEX was detected. TPHC was detected in each of the three samples that were analyzed for TPHC. The maximum concentration of TPHC detected, 600 mg/kg, is below guidelines. No soil samples were collected for off-site laboratory analysis from this area.

Area 1b. Data for Area 1b (former waste oil UST excavation) is based on eight TerraProbe and one soil boring soil sample. No BTEX was detected in either the field or off-site analytical samples. TPHC was detected in 6 of 9 samples. The average TPHC concentration (983.2 mg/kg) did not exceed the MCP S-2 soil guideline nor did the maximum concentration exceed the calculated risk-based fuel oil concentration. However, the maximum TPHC concentration (3,100 mg/kg) did exceed MCP S-2 soil guideline (see Table 6.8-11). Inorganics detected in soil boring samples from Area 1b are detailed in Table 6.8-11. Of the inorganics detected above background concentrations, beryllium (1.76 mg/kg) exceeded the Region III guideline of 0.67 mg/kg and the MCP S-2 soil guideline of 0.8 mg/kg.

Area 1c. Data for Area 1c (the sand and gas traps) comprises nine TerraProbe and four soil boring samples. Xylenes were detected in one TerraProbe sample at concentrations below guidelines and toluene was detected in a soil boring sample at a concentration below guidelines. TPHC was detected in nine of 12 samples. Both the maximum and the average TPHC concentration exceeded guidelines. Inorganics detected in soil boring samples from Area 1c are detailed in Table 6.8-11. Of the inorganics detected above background concentrations, the average and maximum concentrations for beryllium (1.57 and 1.9 mg/kg) exceeded the Region III guideline of 0.67 mg/kg and the MCP S-2 soil guideline of 0.8 mg/kg. The average and maximum concentration of arsenic (41.7 and 89.0 mg/kg) also exceeded the Region III guideline of 1.6 mg/kg and the MCP S-2 soil guideline of 30 mg/kg. However, it is unlikely that beryllium and arsenic concentrations are related to petroleum releases at Area 1c.

In summary for Area 1, subsurface soils TPHC concentrations at Area 1c could pose a potential risk to human health. The maximum TPHC concentration detected above the MCP S-2 soil guideline in Area 1b, do not appear to indicative of the overall residual TPHC concentration in this area. Using the average concentration of TPHC detected in this area (which was below the MCP S-2 soil guideline and appear to be more representative of actual conditions) it does not

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appear that the TPHC concentrations detected in Area 1b will pose a potential risk to human health under current or proposed future use scenarios.

Area 2 Subsurface Soils. Forty-two TerraProbe and four soil boring samples were taken at Area 2. Individual sample results for TerraProbe samples are displayed in Table 6.8-5 and for soil borings in Table 6.8-6 and 6.8-7. The individual results are summarized on Table 6.8-11 where they are compared to Region III and MCP Category S-2 soil guidelines. Toluene and xylenes were detected in a small number of samples at concentrations well below guidelines. TPHC was detected in 33 of 43 samples, but concentrations did not exceed guidelines. Inorganics detected in soil boring samples from Area 2 are detailed in Table 6.8-10. Of the inorganics detected above background concentrations, the average and maximum concentrations of beryllium (1.5 and 2.1 mg/kg) exceeded the Region III guideline of 0.67 mg/kg and the MCP S-2 soil guideline of 0.8 mg/kg. The average and maximum concentrations of arsenic (33.5 and 42.0 mg/kg) exceed the Region III guideline of 1.6 mg/kg and the MCP S-2 soil guideline of 30 mg/kg. However, it is unlikely that arsenic and beryllium concentrations are related to petroleum release at Area 2. In summary, it does not appear that unacceptable risks to public health exist at Area 2.

Area 3 Subsurface Soils. Area 3 has been divided in 3 subareas: Area 3a, the heating oil UST; Area 3b, waste oil UST; and Area 3c, sand and gas traps. Individual sample results for TerraProbe samples are displayed in Table 6.8-5 and for soil borings in Table 6.8-6 and 6.8-7. The individual results are summarized on Table 6.8-11 where they are compared to Region III and MCP Category S-2 guidelines. The PRE for each area is discussed below.

Area 3a. Area 3a (heating oil UST) is represented by ten TerraProbe and two soil boring samples. BTEX was not detected in these samples. TPHC was detected in six of ten samples. The concentration of TPHC in one sample exceeded the MCP S-2 soil guideline. Inorganics detected in soil boring samples from Area 3a are detailed in Table 6.8-10. Of the inorganics detected above background concentrations, the average and maximum concentrations of beryllium (0.75 and 0.8 mg/kg) exceeds the Region III guideline of 0.67 mg/kg. The maximum concentration of beryllium was equal to the MCP S-2 soil guideline of 0.8 ppm. The maximum and average concentration of arsenic (36.8 and 42.0 mg/kg) exceeded the Region III guideline of 1.6 mg/kg and the MCP S-2 soil

SECTION 6

guideline of 30 mg/kg. However, it is unlikely that arsenic and beryllium concentrations are related to petroleum releases at Area 3a.

Area 3b. Area 3b (former waste oil UST excavation) is represented by 24 TerraProbe and two soil boring samples. Xylene is detected in one TerraProbe sample at a concentration well below guidelines. TPHC is detected in seven of 26 samples, but none exceed the guideline concentrations. Inorganics detected in soil boring samples from Area 3b are detailed in Table 6.8-7. Of the inorganics detected above background concentrations, the average and maximum arsenic concentrations (32.5 and 33 mg/kg) exceeded the Region III guideline of 1.6 mg/kg and the MCP S-2 soil guideline of 30 mg/kg. However, the concentrations of arsenic detected at Area 3b do not appear related to petroleum releases at this area (see Table 6.8-11).

Area 3c. Area 3c (sand and gas traps) is represented by seven TerraProbe and three soil boring samples. Xylenes are detected at concentrations well below guidelines. TPHC is detected in six of ten samples, but none exceed the guideline concentrations. Inorganics detected in soil boring samples from Area 3c are detailed in Table 6.8-7. Of the inorganics detected above background concentrations, the average and maximum concentrations of arsenic (31 and 32 mg/kg) exceed the Region III guideline of 1.6 mg/kg and the MCP S-2 soil guideline of 30 mg/kg. However, it is unlikely that these concentrations are related to the activities at Area 3c (see Table 6.8-11).

In summary for Area 3, potential risk to human health from contact with subsurface soil is possible as a result of concentrations of TPHC at Area 3a.

Area 4 Subsurface Soil. Five TerraProbe and one soil boring sample represent Area 4. Xylene and TPHC were detected in one TerraProbe sample (TP-94) at concentrations well below their respective guidelines. Inorganics detected in soil boring samples from Area 4 are detailed in Table 6.8-7. None exceed guideline concentrations. In summary, it appears that contact with subsurface soil at Area 4 does not pose any potential human health risk (see Table 6.8-11).

Table 6.8-12 presents summary data based on five unfiltered groundwater samples from SA 43H and I along with drinking water standards/guidelines for comparison. The organics detected were bis(2-ethylhexyl)phthalate, chloroform, trichlorofluoromethane, and TPHC. Bis(2-ethylhexyl)phthalate was detected in

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one of five samples at 6.7 $\mu\text{g/L}$, slightly exceeding its federal MCL of 6 $\mu\text{g/L}$. However, bis(2-ethylhexyl)phthalate is a common laboratory contaminant and is not believed to be site-specific. Chloroform did trichlorofluoromethane did not exceed the federal/Region III MCL. The single detection of TPHC did not exceed the MCP GW-1 standard.

All of the inorganics detected in groundwater exceeded established base-wide background concentrations. Average concentrations of aluminum, iron and manganese exceed their respective secondary MCLs, which are based on aesthetic or economic considerations rather than health. The maximum concentration of sodium (28,600 $\mu\text{g/L}$) slightly exceeds the Massachusetts guideline of 28,000 $\mu\text{g/L}$. In filtered groundwater samples, fewer inorganics were detected, concentrations were generally lower than in unfiltered samples, and no concentrations exceeded guidelines.

Based on this screening, it does not appear that groundwater poses a potential risk to human health.

Tables 6.8-13 and 6.8-14 present summary statistics for surface water and sediment associated with SA 43H and I.

The organic compounds bis(2-ethylhexyl)phthalate and chloroform were detected in surface water. These are common laboratory contaminants and are not believed to be site-related contaminants. In any case, the detected concentrations of these two compounds do not exceed their respective drinking water standard or guideline.

Concentrations of aluminum, iron, and manganese detected in surface water exceed their respective USEPA secondary MCLs. (Secondary MCLs are based on aesthetic or economic conditions and are not health-based.) Sodium concentrations exceed the Massachusetts guideline. The maximum concentration of lead exceeds the USEPA action level. The use of drinking water guidelines for comparison to surface water concentrations in a drainage outfall is a conservative approach and is used due to a lack of available health-based guidelines for exposure to surface water. The magnitude and frequency of exposure to surface water associated with SA 43H and I would be expected to be much less than that upon which drinking water guidelines are based. As a result, it is not likely that

SECTION 6

an individual would encounter inorganic analyte concentrations that would pose a threat to public health.

Acetone, chloroform, methylene chloride, and trichlorofluoromethane were detected in the sediment at SA 43H and I. The detected concentrations did not exceed Region III residential soil concentrations or MCP S-1 soil standards. In any case, these compounds are common laboratory contaminants and are not believed to be site-related contaminants. The maximum concentration of TPHC of 23,800 $\mu\text{g/g}$ detected at XHD-93-01X exceeds the MCP S-1 TPH standard and the calculated concentration for gasoline. Concentrations in the other two sediment samples, 430 $\mu\text{g/g}$ and 398 $\mu\text{g/g}$ are below these guidelines.

Of the inorganic analytes detected in the sediment, arsenic, beryllium, lead and manganese exceed Region III residential soil concentrations and MCP S-1 soil standards. Antimony and chromium are detected at concentrations in excess of the MCP S-1 soil standard. The use of residential soil standards is a conservative approach taken in the absence of health-based guidelines specifically for sediment. Exposure to contaminants in this sediment would be much less than that in a residential setting. The residential soil concentrations assume exposure occurs 350 days per year for 30 years. The concentrations of analytes associated with SA 43H and I sediment are not expected to present a risk to public health under present or foreseeable future uses of the SA.

6.8.8 Conclusions and Recommendations

Based on the results of the SSI data and the findings of the human health PRE, a removal action is recommended at sand and gas traps at Areas 1c (including the sand and gas trap outfall), and the heating oil UST in Area 3a. NFA is recommended for historic gas station H, I, Areas 1a, 1b, 2, 3b, 3c, and 4.

TABLE 6.8-1
SUMMARY OF TECHNICAL APPROACH
SA 43H AND I - HISTORIC GAS STATIONS H AND I

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRA PROBE	COLLECT SOIL AND SOIL GAS SAMPLES FOR FIELD ANALYSIS AT BOTH 43H AND I	TP-01 THRU TP-10	IN AND AROUND LOCATION OF FORMER HISTORIC GAS STATIONS AT BOTH 43H AND I
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	- CHARACTERIZE SOILS CONTAMINATION - COLLECT SOIL SAMPLES FOR OFF-SITE LABORATORY ANALYSIS	43H-92-01X 43I-92-01X	LOCATED AT TERRAPROBE SURVEY "HOT SPOTS"
SSI PROGRAM			
TERRA PROBE	COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-94	- AROUND SUSPECTED CONTAMINANT SOURCE AREAS - LOCATED AT TERRAPROBE SURVEY "HOT SPOTS"
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	- INSTALL MONITORING WELLS - CHARACTERIZE SOILS CONTAMINATION - COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	XHB-93-02X XHB-93-03X XHB-93-04X XHB-93-05X XHB-93-06X XHB-93-07X XHB-93-08X XHB-93-09X XHB-93-10X XHB-93-11X	
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	- MONITOR GROUNDWATER LEVELS - MONITOR GROUNDWATER QUALITY - DETERMINE AQUIFER CONDUCTIVITIES	XIM-93-01X XIM-93-02X XIM-93-04X XIM-93-05X XIM-93-06X	- UPGRADIENT - DOWNGRADIENT
SURFACE WATER/SEDIMENT SAMPLING	COLLECT SAMPLE FOR LABORATORY ANALYSIS	XHD-93-01X XHD-93-02X XHD-93-03X	STORM DRAIN OUTFALL

TABLE 6.8-2
MONITORING WELL COMPLETION DETAILS
SA 43H AND I - HISTORIC GAS STATIONS H AND I

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (Feet bgs)	WELL SCREEN ELEVATION (Feet NGVD)	COMPLETION DEPTH (Feet bgs)	CONSTRUCTION MATERIAL
XIM-93-01X	DRIV AND WASH CASING	ROCK CORE	BEDROCK	25.7 - 35.7	297.3 - 287.3	32.2	4" ID PVC
XIM-93-02X	HOLLOW STEM AUGER	NA	SOIL	29.5 - 39.5	293.3 - 283.3	40.5	4" ID PVC
XIM-93-04X	HOLLOW STEM AUGER	NA	SOIL	39.3 - 49.3	289.7 - 279.7	49.5	4" ID PVC
XIM-93-05X	HOLLOW STEM AUGER	NA	SOIL	17.5 - 27.5	297.3 - 287.3	30.0	4" ID PVC
XIM-93-06X	DRIV AND WASH CASING	ROCK CORE	BEDROCK	30.5 - 40.5	282.3 - 272.3	41.0	4" ID PVC

NA= Not Applicable

TABLE 6.8-3
SUMMARY OF SOIL BORINGS
SA 43H AND I - HISTORIC GAS STATIONS H AND I
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43H-92-01X	26	4-6	9-11	SW	BKG	
		9-11		SW	BKG	
		14-16		SP/SM	BKG	
		16-18		SP/SM	BKG	
		18-20		SP/SM	BKG	
		20-22		SP/SM	BKG	
43H-92-01X	35	22-24	9-11	SP/SM	BKG	
		24-26		SW	BKG	
		4-6		SP	BKG	
		9-11		SP	BKG	
		14-16		SP	BKG	
		19-21		SP	BKG	
XHB-93-02X	37	24-26	34-36	SW	BKG	
		26-28		SW	BKG	
		29-31		SW	BKG	
		34-36		SW	BKG	
		0-2		SW	BKG	
		5-7		SW-SM	BKG	No Recovery
XHB-93-03X	15.5	8-10	12-14 15-17	SP-SM	7.8	
		10-12		SP-SM	8.2	
		12-14		SW-SM	1.2	
		15-17		SP	BKG	
		20-22		SP	BKG	
		25-27		SP	BKG	
XHB-93-04X	17	30-32	35-37	SM	BKG	
		35-37		SM	BKG	
		1-3		SW	BKG	
		5-7		SP	BKG	
		8-10		SP	BKG	
		10-12		SW	9.7	No recovery, refusal at 15.5-feet
XHB-93-05X	24	15-15.5	8-10 10-12	SW	9.7	No recovery, refusal at 15.5-feet
		0-2		SW-SM	BKG	
		5-7		SM	BKG	
		8-10		SM	BKG	
		10-12		SM	BKG	
		15-17		SW	BKG	Refusal at 17-feet
XHB-93-05X	24	0.5-2.5	12-14 20-22	SW	BKG	
		5-7		SP	BKG	
		10-12		SP	BKG	
		12-14		GP	BKG	
		15-17		SW-GW	BKG	
		20-22		SW-GW	BKG	No recovery, refusal at 24.2-feet
XHB-93-05X	24	24-24.2	20-22	SW-GW	BKG	No recovery, refusal at 24.2-feet
		24-24.2		SW-GW	BKG	No recovery, refusal at 24.2-feet
		24-24.2		SW-GW	BKG	No recovery, refusal at 24.2-feet
		24-24.2		SW-GW	BKG	No recovery, refusal at 24.2-feet
		24-24.2		SW-GW	BKG	No recovery, refusal at 24.2-feet
		24-24.2		SW-GW	BKG	No recovery, refusal at 24.2-feet

TABLE 6.8-3
SUMMARY OF SOIL BORINGS
SA 43H AND I - HISTORIC GAS STATIONS H AND I
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
XHB-93-06X	24	0-2 5-7 10-12 15-17 20-22 22-24		SP SP SP SP SP SP	BKG BKG 4 4 BKG BKG	Refusal at 24-feet
XHB-93-07X	33.4	0.3-2.3 6-8 10-12 15-17 20-22 23-25 30-32 33-33.4	6-8 15-17 23-25	SW SW GW-GP SW SW SW -- SW	BKG 2 1 1 BKG BKG -- BKG	Total VOCs from headspace Total VOCs from headspace Total VOCs from headspace No recovery No recovery, refusal at 33.4-feet
XHB-93-08X	20.5	1-3 5-7 8-10 15-17 20-20.5	8-10 15-17	SW-SM SW-SM SW-SM SM PHYL	BKG BKG BKG BKG BKG	Refusal on bedrock at 20.5-feet
XHB-93-09X	17	0-2 6-8 10-12 15-17		SW SW-GW GP-SP SW	BKG BKG BKG BKG	Unable to advance augers past 15-feet
XHB-93-10X	28.5	1-3 5-7 8-10 15-17 20-22 25-27	8-10 20-22 25-27	SW-SM SW-SM SW SP SP SP	BKG BKG BKG BKG BKG BKG	Unable to collect reference sample
XHB-93-11X	17	0-2 5-7 10-12 15-17	5-7 10-12	SW-SM SW-SM SP SP	BKG BKG BKG BKG	Refusal on bedrock at 28.5-feet
XIM-93-01X	36.1	0-2 4-6 9-11 14-16 19-21 24-26 29-30.5		SM-SP SP SP-SM SP-SM SP-SM SP SM-SP	BKG BKG BKG BKG BKG BKG BKG	Refusal at 17-feet
			29-30.5	SM-SP	BKG	Rollercone phyllite 30.5 to 36.1-feet

TABLE 6.8-3
SUMMARY OF SOIL BORINGS
SA 43H AND I - HISTORIC GAS STATIONS H AND I
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (RPM)	COMMENTS
XIM-93-02X	40.5	1-3		SM-SP	5	
		4-6		SM-SP	BKG	
		9-11		SM	BKG	
		14-16		SM	BKG	
		19-21		--	--	No recovery
XIM-93-04X	49.5	24-26		SM	BKG	
		29-29.2		--	--	No recovery
		1-3		SP	BKG	
		4-6		SP	BKG	
		9-11		SP	BKG	
XIM-93-05X	31.4	14-16		SW-SM	BKG	
		19-21		SW-SM	BKG	
		24-26		SW	BKG	
		29-31		SW	BKG	
		34-36	34-36	SW	BKG	Advance 6-inch casing to 49.5-feet
XIM-93-06X	41	39-41		SW	BKG	
		0-2		SP	BKG	
		5-7	5-7	SP	BKG	
		10-12	10-12	SP	BKG	
		15-17		SP	BKG	
XIM-93-06X	41	20-22		SP	BKG	
		25-27	25-27	SP	BKG	
		30-31.3		SW	BKG	Spoon refusal at 31.3-feet
		0-2		SM	BKG	
		5-5.4		--	--	No recovery, boulder
XIM-93-06X	41	10-12		GM	BKG	
		15-17		SW	BKG	
		20-22		SW	BKG	
		25-27		SW	BKG	
		25-27		SW	BKG	Rollerbit bedrock from 28 to 41-feet

Notes: bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site

TABLE 6.8-4
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 43H AND I - HISTORIC GAS STATION H AND I

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (Feet bgs)	ELEVATION OF WATER (Feet NGVD)	CONDUCTIVITY HVORSLEV ² (cm/sec)
XIM-93-01X	325.37	28.39	296.98	1.1E-02
XIM-93-02X	322.41	26.94	295.47	3.2E-03
XIM-93-04X	331.05	43.91	287.14	3.0E-02
XIM-93-05X	316.81	24.29	292.52	3.9E-04
XIM-93-06X	315.37	29.37	286.00	6.5E-07

Notes: bgs = below ground surface
 cm/sec = centimeters per second
 NGVD = National Geodetic Vertical Datum
 1 = elevation of top of pvc
 2 = averaged value of two tests
 Groundwater elevations from November 8, 1993
 synoptic water level round

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H - SOIL						SA 43H - SOIL GAS					
	TP-44	TP-44	TP-45	TP-38	TP-38	TP-38	TP-41	TP-41	TP-44	TP-44	TP-48	TP-49
	TPH0409F 9 FT	TPH0412F 12 FT	TPH0509F 9 FT	TPH1009F 8 FT	TPH1011F 11 FT	TPH1025F 25 FT	TPH0106F 6 FT	TPH0106F 6 FT	TPH0406F 6 FT	TPH0406F 6 FT	TPH0406F 6 FT	TPH0406F 6 FT
ORGANICS (ppb)												
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)												
TOTAL PETROLEUM HYDROCARBONS	<55	91	1400	<55	<55	<55	NA	NA	NA	NA	NA	NA

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43I - SOIL													
	TP-41		TP-42		TP-43		TP-44		TP-45		TP-46		TP-47	
	TP1011P	TP1012OF	TP1013P	TP1021P	TP1022OF	TP1031P	TP1032P	TP1040P	TP1051P	TP1052P	TP1061P	TP1062P	TP1071P	TP1072P
	11 FT	20 FT	32 FT	11 FT	29 FT	11 FT	21 FT	9 FT	11 FT	32 FT	11 FT	31 FT	11 FT	11 FT
ORGANICS (ppb)														
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)														
TOTAL PETROLEUM HYDROCARBONS	<55	<55	<60	<55	<55	300	<55	<52	<50	<55	85	<55		180

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43I - SOIL				SA 43I - SOIL GAS											
	TP-08	TP-09	TP-04	TP-06	TP-10	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F	TP-015F
ORGANICS (ppb)	TPH0809F 9 FT	TPH0911F 11 FT	TPH0415F 15 FT	TPH0615F 15 FT	TPH1009F 9 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT	TPH015F 15 FT
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS	96	<55	NA	NA	NA	NA	NA	NA	NA	720	1700	16000	NA	2900	510	160

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analysis	SA 43H AND I - SOIL																					
	TP-06		TP-09		TP-09		TP-10		TP-11		TP-12		TP-14		TP-15		TP-16		TP-17		TP-18	
	TPH061F	11 FT	TPH090F	9 FT	TPH091F	11 FT	TPH101F	11 FT	TPH111F	11 FT	TPH121F	11 FT	TPH141F	11 FT	TPH151F	11 FT	TPH161F	11 FT	TPH170F	10 FT	TPH180F	8 FT
ORGANICS (ppb)																						
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)																						
TOTAL PETROLEUM HYDROCARBONS	55	450	3100	1900	<53	<55	<54	110	1200	<53	NA	230	NA									NA

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL													
	TP-18	TP-19	TP-19	TP-20	TP-21	TP-22	TP-23	TP-24	TP-25	TP-26	TP-27	TP-28	TP-29	
	TPH100F 10 FT	TPH100F 8 FT	TPH100F 10 FT	TPH200F 10 FT	TPH210F 10 FT	TPH220F 10 FT	TPH230F 10 FT	TPH240F 10 FT	TPH250F 10 FT	TPH260F 10 FT	TPH270F 10 FT	TPH280F 10 FT	TPH290F 10 FT	
ORGANICS (ppb)														
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
OTHER (ppm)														
TOTAL PETROLEUM HYDROCARBONS	240	NA	600	640	540	1100	<54	<55	<53	1300	<57	550	110	

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL																									
	TP-30		TP-31		TP-32		TP-33		TP-34		TP-34		TP-35		TP-36		TP-37		TP-38		TP-39		TP-40			
	TPH3010F	10 FT	TPH3110F	10 FT	TPH3210F	10 FT	TPH3310F	10 FT	TPH3409F	9 FT	TPH3410F	10 FT	TPH3411F	11 FT	TPH3512F	12 FT	TPH3610F	10 FT	TPH3710F	10 FT	TPH3810F	10 FT	TPH3910F	10 FT	TPH4010F	10 FT
ORGANICS (ppb)																										
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	<0.1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	1.5	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	1.4	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)																										
TOTAL PETROLEUM HYDROCARBONS	700	220	530	710	500	280	NA	<52	120	<55	350	<56														<56

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL															
	TP-41		TP-42		TP-43		TP-44		TP-45		TP-46		TP-47		TP-48	
	TPH410F	7 FT	TPH4207F	8 FT	TPH4308F	7 FT	TPH4407F	8 FT	TPH4507F	7 FT	TPH4607F	8 FT	TPH4707F	7 FT	TPH4803F	3 FT
ORGANICS (ppb)																
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS	290	NA	110	66	NA	480	54	<52	<53	760	2500	<55				330

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL											
	TP-48 TPH4007F 7 FT	TP-49 TPH4007F 7 FT	TP-50 TPH5008F 8 FT	TP-54 TPH5407F 7 FT	TP-54 TPH5408F 8 FT	TP-55 TPH5508F 8 FT	TP-56 TPH5608F 8 FT	TP-57 TPH5708F 8 FT	TP-59 TPH5904F 6 FT	TP-59 TPH5908F 8 FT	TP-60 TPH6009F 9 FT	TP-61 TPH6108F 8 FT
ORGANICS (ppb)												
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)												
TOTAL PETROLEUM HYDROCARBONS	1300	<52	<53	210	<53	<54	<54	<54	160	<53	<55	<55

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL													
	TP-41 TPH6109F 9 FT	TP-42 TPH6207F 7 FT	TP-43 TPH6309F 9 FT	TP-44 TPH6409F 9 FT	TP-45 TPH6509F 9 FT	TP-46 TPH6609F 9 FT	TP-47 TPH6709F 9 FT	TP-48 TPH6809F 9 FT	TP-49 TPH6904F 6 FT	TP-70 TPH7004F 6 FT	TP-71 TPH7108F 8 FT	TP-72 TPH7204F 6 FT	TP-73 TPH7304F 6 FT	
ORGANICS (ppb)														
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
OTHER (ppm)														
TOTAL PETROLEUM HYDROCARBONS	< 54	430	< 52	< 52	210	110	52	< 52	< 52	< 53	< 52	< 51	480	

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL															
	TP-74 TPH7406F	TP-75 TPH7508F	TP-76 TPH7608F	TP-77 TPH7708F	TP-78 TPH7808F	TP-79 TPH7908F	TP-80 TPH8008F	TP-88 TPH8809F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F	TP-91 TPH9109F
ORGANICS (ppb)	6 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT	8 FT
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	0.4	0.4	0.6	1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	<0.1	<0.1
OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS	52	80	<52	1900	66	940	330	NA	110	100	1100	530	450			

Notes:
< = Less than detection limit.

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL															
	TP-32	TP-33	TP-34	TP-35	TP-36	TP-37	TP-38	TP-39	TP-40	TP-41	TP-42	TP-43	TP-44	TP-45	TP-46	TP-47
	TPH209F 9 FT	TPH309F 8 FT	TPH409F 9 FT	TPH509F 8 FT	TPH609F 9 FT	TPH709F 8 FT	TPH809F 9 FT	TPH909F 8 FT	TPH009F 9 FT	TPH109F 8 FT	TPH209F 9 FT	TPH309F 8 FT	TPH409F 9 FT	TPH509F 8 FT	TPH609F 9 FT	TPH709F 8 FT
ORGANICS (ppb)																
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS	400	NA	270	770	150	<53	<54	580	2400	65	<54	930				

Notes:
< = Less than detection limit

TABLE 6.8-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	SA 43H AND I - SOIL							
	TP-21	TP-22	TP-23	TP-24	TP-24	TP-24	TP-24	
	TPH264F	TPH265F	TPH304F	TPH304F	TPH304F	TPH304F	TPH304F	
ORGANICS (ppb)	4 FT	5 FT	4 FT	4 FT	4 FT	4 FT	6 FT	
BENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
TOLUENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
ETHYLBENZENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
m/p-XYLENE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
o-XYLENE	<0.1	<0.1	<0.1	<0.1	3.1	<0.1	<0.1	
OTHER (ppm)								
TOTAL PETROLEUM HYDROCARBONS	<53	<52	<50		92		<54	

Notes:
< = Less than detection limit

TABLE 6.8-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						
	XHB-93-02X	XHB-93-02X	XHB-93-02X	XHB-93-02X	XHB-93-02X	XHB-93-03X	XHB-93-04X
	DUP 35 FT	12 FT	15 FT	35 FT	10 FT	8 FT	
ORGANICS ($\mu\text{g/g}$)							
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004
TRICHLOROETHYLENE	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.034
TRICHLOROFLUOROMETHANE	0.007	0.008	0.006	0.008	0.008	0.013	< 0.006
DI-N-BUTYL PHTHALATE	0.32	0.53	0.52	0.77	0.77	< 2	0.61
FLUORANTHENE	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 2	< 0.068
PHENANTHRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.8	< 0.033
PYRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.8	< 0.033
OTHER ($\mu\text{g/g}$)							
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	126	1110	242	49.2	234	< 28.7	

Notes:

< = Less than detection limit.

TABLE 6.8-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI					
	XHB-93-04X 10 FT	XHB-93-05X DUP 12 FT	XHB-93-05X 12 FT	XHB-93-05X 20 FT	XHB-93-06X 10 FT	XHB-93-06X 15 FT
ORGANICS (µg/g)						
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROETHYLENE	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
DI-N-BUTYL PHTHALATE	0.41	0.28	< 0.3	0.33	< 0.3	< 0.3
FLUORANTHENE	< 0.068	0.17	1	< 0.068	< 0.3	< 0.3
PHENANTHRENE	< 0.033	0.11	0.6	< 0.033	< 0.2	< 0.2
PYRENE	< 0.033	0.1	0.6	< 0.033	< 0.2	< 0.2
OTHER (µg/g)						
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	< 28.7	53.6	74	< 28.7	365	45.3

Notes:

< = Less than detection limit.

TABLE 6.8-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI					
	XHB-93-06X	XHB-93-07X	XHB-93-07X	XHB-93-07X	XHB-93-08X	XHB-93-08X
	22 FT	6 FT	15 FT	23 FT	8 FT	15 FT
ORGANICS ($\mu\text{g/g}$)						
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROETHYLENE	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	< 0.006	< 0.006	0.007	0.007
DI-N-BUTYL PHTHALATE	0.18	< 0.3	< 0.061	0.091	0.23	0.16
FLUORANTHENE	< 0.068	< 0.3	< 0.068	< 0.068	< 0.068	< 0.068
PHENANTHRENE	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033	< 0.033
PYRENE	< 0.033	< 0.2	< 0.033	< 0.033	< 0.033	< 0.033
OTHER ($\mu\text{g/g}$)						
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	130	102	< 28.7	35.2	< 28.7	< 28.8

Notes:

< = Less than detection limit.

TABLE 6.8-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						
	XHB-93-09X	XHB-93-10X	XHB-93-10X	XHB-93-10X	XHB-93-10X	XHB-93-10X	DUP 25 FT
	6 FT	15 FT	20 FT	8 FT	25 FT		
ORGANICS ($\mu\text{g/g}$)							
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROETHYLENE	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	0.007	< 0.006	0.006	< 0.006	< 0.006
DI-N-BUTYL PHTHALATE	0.25	0.42	< 0.061	0.15	0.23	0.29	0.29
FLUORANTHENE	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068
PHENANTHRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
PYRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
OTHER ($\mu\text{g/g}$)							
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	< 28.7	< 28.5	33.8	71.9	< 28.5	< 28.8	< 28.8

Notes:

< = Less than detection limit.

TABLE 6.8-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI				SI		
	XHB-93-11X 5 FT	XIM-93-02X 24 FT	XIM-93-04X 34 FT	XIM-93-05X 25 FT	43H-92-01X 9 FT	43I-92-01X 9 FT	43I-92-01X 34 FT
ORGANICS (µg/g)							
TOLUENE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRICHLOROETHYLENE	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
DI-N-BUTYL PHTHALATE	0.3	0.31	< 0.061	0.4			
FLUORANTHENE	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068	< 0.068
PHENANTHRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
PYRENE	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033
OTHER (µg/g)							
TOTAL ORGANIC CARBON	NA	NA	2890	1880	NA	NA	934
TOTAL PETROLEUM HYDROCARBONS	< 28.5	< 28.7	38.6	< 28.5	154	< 27.9	< 27.7

Notes:

< = Less than detection limit.

TABLE 6.8-7
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI					SSI				
		XHB-93-02X DUP 35 FT	XHB-93-02X 12 FT	XHB-93-02X 15 FT	XHB-93-02X 35 FT	XHB-93-03X 10 FT	XHB-93-04X 8 FT	XHB-93-04X 10 FT	XHB-93-05X DUP 12 FT	XHB-93-05X 12 FT	XHB-93-05X 20 FT
INORGANICS (u/g)											
ALUMINUM	15000.0	3050	8450	7830	4740	7890	10300	9230	6170	9100	7660
ARSENIC	21.0	23	89	33	22	22	16	18	36	23	41
BARUM	42.5	9.25	21.7	22.6	13.4	25.5	33.2	32.9	19.6	24.6	24.7
BERYLLIUM	0.347	< 0.5	1.79	1.9	1.02	1.76	1.65	1.52	0.745	2.14	1.89
CADMIUM	2.0	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
CALCIUM	14000.0	1090	1980	918	1260	850	683	687	741	1820	1700
CHROMIUM	31.0	6.43	29.4	29.4	10.6	25	22.3	22.4	19.9	35.8	51.2
COBALT	NA	3.6	12.2	9.96	4.74	9.38	8.43	6.57	10.3	12.4	14.2
COPPER	8.39	6.22	25.3	19.8	8.21	19	14.4	12.4	17.1	22.9	29.6
IRON	15000.0	5290	23400	20200	8580	18900	17900	15200	14900	19700	23100
LEAD	36.9	3.3	23	9.6	3.05	8.2	17	6.39	17	22	10
MAGNESIUM	56000.0	1100	5400	5850	1830	4740	3100	2450	2630	4240	6110
MANGANESE	300.0	142	279	511	195	322	665	782	635	600	639
NICKEL	14.0	11.5	53.5	44.2	16.4	38.8	37.3	27.8	37.3	48.0	64.3
POTASSIUM	17000.0	384	912	1170	556	736	314	270	633	694	936
SODIUM	131.0	268	332	278	392	273	323	329	261	304	296
VANADIUM	28.7	4.95	14.4	16.2	7.66	14.6	13.8	13.2	10.6	17	17.1
ZINC	35.3	11.1	57.4	39.9	17.5	89.4	35.6	29.9	28.5	42.4	40.2

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.8-7
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI										SSI			
		XHB-93-06X	XHB-93-06X	XHB-93-06X	XHB-93-07X	XHB-93-07X	XHB-93-07X	XHB-93-07X	XHB-93-08X	XHB-93-08X	XHB-93-08X	XHB-93-09X	XHB-93-09X	XHB-93-09X	XHB-93-09X
INORGANICS (ug/g)		10 FT	15 FT	22 FT	6 FT	15 FT	23 FT	8 FT	15 FT	6 FT	15 FT	6 FT	15 FT	6 FT	15 FT
ALUMINUM	15000.0	4770	8620	7760	5740	5960	10100	5090	12000	6660	5480				
ARSENIC	21.0	33	42	39	32	30	34	8.7	65	32	33				
BARIUM	42.5	12.6	21.1	17.6	16.7	24.8	42.4	17.9	41.9	38.3	22.4				
BERYLLIUM	0.347	1.43	< 0.5	0.59	0.55	< 0.5	< 0.5	0.66	0.84	< 0.5	< 0.5				
CADMIUM	2.0	< 0.7	< 0.7	< 0.7	0.831	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7				
CALCIUM	14000.0	523	1620	1260	1060	12200	5850	1480	2910	9160	7080				
CHROMIUM	31.0	17.4	45.5	26	18.8	32.1	58.7	20.7	71.9	31.9	22.5				
COBALT	NA	7.9	12.5	10.5	11.6	8.55	11.6	15	13.3	9.55	10.6				
COPPER	8.39	18.1	22	23.5	15.8	15.8	21.7	27.8	14.2	17.5	14.7				
IRON	15000.0	12900	22300	22000	13500	14100	20500	21000	22800	15900	13200				
LEAD	36.9	10	11	20	16	6.88	9.8	3.9	8.46	11	4.5				
MAGNESIUM	56000.0	2680	6990	5640	2920	5100	8850	3620	9800	5320	3910				
MANGANESE	300.0	179	664	461	444	321	607	622	556	384	265				
NICKEL	14.0	37.4	54.3	48.8	37.6	38	52.7	60.1	58.6	38.6	29.8				
POTASSIUM	17000.0	562	1320	617	736	1650	3540	660	3020	1960	1520				
SODIUM	131.0	257	319	276	320	307	296	232	286	291	280				
VANADIUM	28.7	9.45	15.8	15.2	11.1	15.4	24.8	8.02	27.4	18.4	13.6				
ZINC	35.3	27.4	40.1	46.8	46	32.9	40.4	40.8	49	39.3	32.1				

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.8-7
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROU	SSI					SSI					SI		
		XHB-93-10X 8 FT	XHB-93-10X 20 FT	XHB-93-10X 25 FT	XHB-93-10X DUP 25 FT	XHB-93-11X 5 FT	XIM-93-02X 24 FT	XIM-93-04X 34 FT	XIM-93-05X 25 FT	43H-92-01X 9 FT	43I-92-01X 9 FT	43I-92-01X 34 FT		
INORGANICS (ug/g)														
ALUMINUM	15000.0	5770	4280	1790	1550	4410	14200	6900	6810	NA	NA	NA		
ARSENIC	21.0	31	32	10	13	25	37	43	31	NA	NA	NA		
BARIUM	42.5	19	13.9	6.81	7.85	21.8	35.4	24.8	29.6	NA	NA	NA		
BERYLLIUM	0.347	0.62	0.68	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	NA	NA	NA		
CADMIUM	2.0	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	NA	NA	NA		
CALCIUM	1400.0	5630	14400	828	966	8810	3220	4470	1360	NA	NA	NA		
CHROMIUM	31.0	23.6	23.6	6.14	6.92	18	50.4	23.9	31.9	NA	NA	NA		
COBALT	NA	9.06	8.79	2.52	3.14	7.47	13.8	11.2	11.8	NA	NA	NA		
COPPER	8.39	16.8	20.3	6.31	7.55	26.1	29.2	23	25.1	NA	NA	NA		
IRON	15000.0	15700	15200	5470	5780	13400	23800	19200	20700	NA	NA	NA		
LEAD	36.9	7.3	6.4	2.18	2.62	5.3	15	17	11.5	13	3.65	7.02		
MAGNESIUM	5600.0	4150	4440	1150	985	3190	9600	4900	4860	NA	NA	NA		
MANGANESE	300.0	492	378	116	158	353	545	426	1490	NA	NA	NA		
NICKEL	14.0	38.6	38	11.6	12.9	30.7	54.1	45.2	53.9	NA	NA	NA		
POTASSIUM	1700.0	1060	869	281	372	1120	2690	1370	1030	NA	NA	NA		
SODIUM	131.0	238	270	225	221	251	505	347	335	NA	NA	NA		
VANADIUM	28.7	13.7	8.36	< 3.39	< 3.39	11.8	32.3	12.8	13.6	NA	NA	NA		
ZINC	35.3	50.7	30.4	11.6	13.1	28.1	43.2	41.6	36.7	NA	NA	NA		

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.8-8
ANALYTES IN GROUNDWATER
SA 43 H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XIM-93-01X				XIM-93-02X			
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4
ORGANICS (µg/L)									
BIS (2-ETHYLHEXYL) PHTHALATE		NA	< 4.8	NA	32	NA	< 4.8	NA	< 4.8
CHLOROFORM		NA	3.7	NA	1.3	NA	3.5	NA	1.5
TRICHLOROFLUOROMETHANE		NA	< 1.4	NA	2.7	NA	< 1.4	NA	1.5
INORGANICS (µg/L)									
ALUMINUM	6870	< 141	177	< 141	11700	< 141	2670	< 141	12100
ANTIMONY	3.03	< 3.03	< 3.03	< 3.03	< 3.03	3.66	< 3.03	2.95	< 3.03
ARSENIC	10.5	< 2.54	< 2.54	< 2.54	37.6	< 2.54	3.73	< 2.54	33.9
BARIUM	39.6	5.18	31.1	< 2.54	68.1	6.41	17.7	4.97	44.7
CALCIUM	14700	24200	25900	26800	30500	24800	30600	27800	30200
CHROMIUM	14.7	< 6.02	< 6.02	< 6.02	59.1	< 6.02	9.04	< 6.02	59.9
COPPER	8.09	< 8.09	< 8.09	< 8.09	38.9	< 8.09	< 8.09	< 8.09	31
IRON	9100	< 38.8	437	< 38.8	29500	48.7	5040	599	27200
LEAD	4.25	2.28	2.82	< 1.2	10.6	< 1.26	4.23	< 1.26	20.9
MAGNESIUM	3480	4010	4050	4320	9080	3940	5270	4530	10800
MANGANESE	291	6.2	9.08	< 2.75	387	9.77	107	5.56	578
POTASSIUM	2370	1110	2180	1570	5050	1760	1880	2290	4210
SODIUM	10800	24800	25400	21900	23400	26100	26500	25200	24400
VANADIUM	11.0	< 11	< 11	< 11	16.9	< 11	< 11	< 11	22.3
ZINC	21.1	< 21.1	< 21.1	< 21.1	215	< 21.1	34	< 21.1	61.7
OTHER (µg/L)									
TOTAL SUSPENDED SOLIDS		NA	17000	NA	66000	NA	264000	NA	290000
TOTAL PETROLEUM HYDROCARBONS		NA	< 201	NA	< 201	NA	270	NA	< 190

Notes:

< = Less than detection limit.

Shaded values exceed background limit.

TABLE 6.8-8
ANALYTES IN GROUNDWATER
SA 43 H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XIM-93-04X				XIM-93-05X			
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4
ORGANICS (µg/L)									
BIS(2-ETHYLHEXYL) PHTHALATE		NA	6.7	NA	< 4.8	NA	< 4.8	NA	< 4.8
CHLOROFORM		NA	1	NA	< 0.5	NA	2.1	NA	1.3
TRICHLOROFLUOROMETHANE		NA	< 1.4	NA	< 1.4	NA	< 1.4	NA	< 1.4
INORGANICS (µg/L)									
ALUMINUM	6870	< 141	6980	< 141	3340	< 141	7500	< 141	15800
ANTIMONY	3.03	< 3.03	< 3.03	< 3.03	< 3.03	< 3.03	< 3.03	< 3.03	< 3.03
ARSENIC	10.5	< 2.54	26.2	< 2.54	11.7	< 2.54	22	< 2.54	41.7
BARIUM	39.6	5.49	37.3	5.11	34.4	13.1	35.4	6.39	59.6
CALCIUM	14700	26400	28800	25300	34100	29900	31900	23800	26000
CHROMIUM	14.7	< 6.02	30.2	< 6.02	13	< 6.02	26.9	< 6.02	51.6
COPPER	8.09	< 8.09	20.6	< 8.09	< 8.09	< 8.09	15.7	< 8.09	31.6
IRON	9100	< 38.8	15200	< 38.8	6620	< 38.8	12600	< 38.8	28300
LEAD	4.25	< 1.26	9.33	< 1.26	5.53	< 1.26	7.81	< 1.26	19.4
MAGNESIUM	3480	4200	7270	4000	5280	4470	8820	3890	12600
MANGANESE	291	2.86	281	3.29	134	135	415	7.48	966
POTASSIUM	2370	1620	3530	1330	2570	2860	4250	1860	4780
SODIUM	10800	25500	26700	23700	24200	26800	28100	24600	24900
VANADIUM	11.0	< 11	19.5	< 11	< 11	< 11	22	< 11	28.5
ZINC	21.1	< 21.1	38.1	< 21.1	< 21.1	< 21.1	30.1	< 21.1	59.9
OTHER (µg/L)									
TOTAL SUSPENDED SOLIDS		NA	287000	NA	7800	NA	244000	NA	560000
TOTAL PETROLEIUM HYDROCARBONS		NA	< 190	NA	< 190	NA	< 192	NA	< 180

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.8-8
ANALYTES IN GROUNDWATER
SA 43 H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XIM-93-06X			
		FILTERED	UNFILTERED	FILTERED	UNFILTERED
		ROUND 3	ROUND 3	ROUND 4	ROUND 4
ORGANICS (µg/L)					
BIS (2-ETHYLHEXYL) PHTHALATE		NA	< 4.8	NA	< 4.8
CHLOROFORM		NA	< 0.5	NA	< 0.5
TRICHLOROFLUOROMETHANE		NA	< 1.4	NA	< 1.4
INORGANICS (µg/L)					
ALUMINUM	6870	< 141	< 141	< 141	279
ANTIMONY	3.03	5.09	< 3.03	8.3	6.16
ARSENIC	10.5	16.3	17.3	26.5	24.6
BARIUM	39.6	21.1	19.4	13.3	14.6
CALCIUM	14700	45100	38500	35600	36200
CHROMIUM	14.7	< 6.02	< 6.02	< 6.02	< 6.02
COPPER	8.09	< 8.09	35.1	< 8.09	< 8.09
IRON	9100	42.3	230	128	557
LEAD	4.25	< 1.26	4.45	< 1.26	2.6
MAGNESIUM	3480	13900	12200	10300	10300
MANGANESE	291	79.5	55.6	52.9	75.9
POTASSIUM	2370	4520	5240	4050	4060
SODIUM	10800	22200	25300	28300	28600
VANADIUM	11.0	< 11	< 11	< 11	< 11
ZINC	21.1	< 21.1	64.3	< 21.1	< 21.1
OTHER (µg/L)					
TOTAL SUSPENDED SOLIDS		NA	< 4000	NA	30000
TOTAL PETROLEUM HYDROCARBONS		NA	< 194	NA	< 180

Notes:
< = Less than detection limit.
Shaded values exceed background limit.

TABLE 6.8-9
ANALYTES IN SURFACE WATER
SA 43 H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SITE ID:	XHD-93-02X	XHD-93-03X
ORGANICS (ug/g)			
BIS (2-ETHYLHEXYL) PHTHALATE		< 4.8	4.7
CHLOROFORM		1	< 0.5
INORGANICS (ug/g)			
ALUMINUM		284	1410
ARSENIC		6.5	4.05
BARIUM		8.51	16.9
CALCIUM		26200	15200
CHROMIUM		< 6.02	8.14
COPPER		26.5	141
IRON		414	2710
LEAD		11.3	87
MAGNESIUM		2930	1660
MANGANESE		17.2	62.7
POTASSIUM		3300	2410
SODIUM		99300	5900
VANADIUM		17.2	14.4
ZINC		< 21.1	81.7

Notes:

< = Less than detection limit.

TABLE 6.8-10
ANALYTES IN SEDIMENT
SA43 H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SITE ID	XHD-93-01X	XHD-93-02X	XHD-93-03X
ORGANICS (ug/g)				
ACETONE		< 0.017	< 0.017	0.04
CHLOROFORM		0.002	< 0.001	< 0.001
METHYLENE CHLORIDE		0.023	< 0.012	< 0.012
TRICHLOROFLUOROMETHANE		0.041	< 0.006	0.009
INORGANICS (ug/g)				
ALUMINUM		2980	8500	5610
ANTIMONY		23.4	< 1.09	< 1.09
ARSENIC		71	9.21	6.29
BARIUM		13.1	341	26.1
BERYLLIUM		< 0.5	0.635	< 0.5
CADMIUM		< 0.7	27.7	< 0.7
CALCIUM		967	11500	1650
CHROMIUM		48.7	251	39.2
COBALT		2.95	24	3.33
COPPER		28	245	65
IRON		7070	31000	11700
LEAD		1900	38	90
MAGNESIUM		1670	4050	2670
MANGANESE		86	472	137
MERCURY		0.679	< 0.05	< 0.05
NICKEL		11.7	28.3	15.6
POTASSIUM		637	1590	631
SODIUM		404	1130	482
VANADIUM		9.43	28	14.3
ZINC		62.7	686	84.6
OTHER (ug/g)				
TOTAL ORGANIC CARBON		138000	1410	1950
TOTAL PETROLEUM HYDROCARBONS		23800	430	398

Notes:

< = Less than detection limit.

TABLE 6.8-11
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION?
		AVERAGE	MAXIMUM			
Area 1a [a]						
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	3/3	356.7	600	8180	2500	NO
Area 1b [b]						
INORGANICS (ug/kg)						
BERYLLIUM	1/1	1.76	1.76	0.67	0.8	YES
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	6/9	983.2	3100	8180	2500	MCP
Area 1c [c]						
ORGANICS (ug/kg)						
TOLUENE	1/13	-	0.000004	200000000	90000	NO
m/p-XYLENE*	1/9	-	3.6	1000000000	800000	NO
o-XYLENE*	1/9	-	2.0	1000000000	800000	NO
INORGANICS (ug/kg)						
BERYLLIUM	3/4	1.57	1.9	0.67	0.8	YES
ARSENIC	4/4	41.7	89.0	1.6	30	YES
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	9/12	2672.2	16000	8180	2500	YES
Area 2 [d]						
ORGANICS (ug/kg)						
TOLUENE	2/46	0.8	0.9	200000000	90000	NO
m/p-XYLENE*	5/42	0.84	1.5	1000000000	800000	NO
o-XYLENE*	4/42	0.9	1.4	1000000000	800000	NO
INORGANICS (ug/kg)						
BERYLLIUM	3/4	1.5	2.1	0.67	0.8	YES
ARSENIC	4/4	33.5	42.0	1.6	30	YES
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	33/43	516	2400	8180	2500	NO

TABLE 6.8-11
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
Area 3a [c]						
INORGANICS (ug/kg)						
BERYLLIUM	2/2	0.75	0.8	0.67	0.8	YES
ARSENIC	2/2	36.8	65.0	1.6	30	YES
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	6/10	661.7	2500	8180	2500	MCP
Area 3b [f]						
ORGANICS (ug/kg)						
m/p-XYLENE*	1/24	-	0.4	100000000	800000	NO
INORGANICS (ug/kg)						
ARSENIC	2/2	32.5	33.0	1.6	30	YES
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	7/26	236	480	8180	2500	NO
Area 3c [g]						
ORGANICS (ug/kg)						
m/p-XYLENE*	3/10	0.47	0.6	100000000	800000	NO
o-XYLENE*	1/10	-	0.6	100000000	800000	NO
INORGANICS (ug/kg)						
ARSENIC	3/3	31.0	32.0	1.6	30	YES

TABLE 6.8-11
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SUBSURFACE SOIL
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	6/10	630.7	1900	8180	2500	NO
Area 4 [h]						
ORGANICS (ug/kg)						
o-XYLENE*	1/6	-	3.1	100000000	80000	NO
INORGANICS (ug/kg)						
ARSENIC	1/1	25.0	25.0	1.6	30	REGION III
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	1/6	-	92	8180	2500	NO

Notes:

- [a] Subsurface soil (3 to 15 feet) for Area 1A based on field analytical samples TP-17 through TP-19.
- [b] Subsurface soil (3 to 15 feet) for Area 1B based on field analytical samples TP-05 through TP-13 and boring HXB-93-03X.
- [c] Subsurface soil (3 to 15 feet) for Area 1C based on field analytical samples TP-01 through TP-03, TP-14 through TP-16, and borings HXB-93-02X and HXB-93-04X.
- [d] Subsurface soil (3 to 15 feet) for Area 2 based on field analytical samples TP-19 through TP-37, TP-78 through TP-90, and soil boring XHB-93-05X and XHB-06X.
- [e] Subsurface soil (3 to 15 feet) for Area 3A based on field analytical samples TP-42 through TP-46 and soil boring XHB-93-08X.
- [f] Subsurface soil (3 to 15 feet) for Area 3B based on field analytical samples TP-50 through TP-73 and soil boring XHB-93-09X.
- [g] Subsurface soil (3 to 15 feet) for Area 3C based on field analytical samples TP-47 through TP-49, TP-75 through TP-77 and soil borings XHB-93-07X and XHB-93-10X.
- [h] Subsurface soil (3 to 15 feet) for Area 4 based on field analytical samples TP-91 through TP-94 and soil boring XHM-93-11X.

* = analyte from field analytical samples

ug/g = micrograms per gram

mg/kg = milligrams per kilogram

- = not applicable

MCP = Massachusetts Contingency Plan

Shaded compounds exceed standard or guideline.

TABLE 6.8-12
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF GROUNDWATER
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		GROUNDWATER BACKGROUND CONCENTRATION (ug/L)	MAXIMUM EXCEEDS BACKGROUND ?	DRINKING WATER STANDARD/ GUIDELINE [b] (ug/L)	MAXIMUM EXCEEDS STANDARD/ GUIDELINE ?
		AVERAGE (ug/L)	MAXIMUM (ug/L)				
ORGANICS							
BIS (2-ETHYLHEXYL) PHTHALATE	1/5	6.7	6.7	NA	-	6	YES
CHLOROFORM	4/5	2.575	3.7	NA	-	5	NO
INORGANICS							
ALUMINUM	4/5	4331.75	7500	6870	YES	50-200	YES
ARSENIC	4/5	17.308	26.2	10.5	YES	50	NO
BARIUM	5/5	28.18	37.3	39.6	NO	2000	NO
CALCIUM	5/5	31140	38500	14700	YES	NA	-
CHROMIUM	3/5	22.047	30.2	14.7	YES	100	NO
COPPER	3/5	23.8	35.1	8.09	YES	1300	NO
IRON	5/5	6701.4	15200	9100	YES	300	YES
LEAD	5/5	5.728	9.33	4.25	YES	15	NO
MAGNESIUM	5/5	7522	12200	3480	YES	NA	-
MANGANESE	5/5	173.536	415	291	YES	50	YES
POTASSIUM	5/5	3416	5240	2370	YES	NA	-
SODIUM	5/5	26400	28100	10800	YES	28000	YES
VANADIUM	2/5	20.75	22	11	YES	260	NO
ZINC	4/5	41.625	64.3	21.1	YES	5000	NO
OTHER							
TOTAL PETROLEUM HYDROCARBONS	1/5	270	270	NA	-	1000	NO

Notes:

[a] Groundwater based on unfiltered samples from XIM-93-01X to XIM-93-06X.

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

NA = not available

ug/L = micrograms per liter

- = not applicable

Shaded compounds exceed standard or guideline.

TABLE 6.8-13
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SURFACE WATER
SA 43H & I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		DRINKING WATER STANDARD/GUIDELINE [b] (ug/L)	MAXIMUM EXCEEDS DRINKING WATER STANDARD/GUIDELINE ?
		AVERAGE (ug/L)	MAXIMUM (ug/L)		
ORGANICS					
BIS (2 - ETHYLHEXYL) PHTHALATE	1/2	4.7	4.7	6	NO
CHLOROFORM	1/2	1	1	5	NO
INORGANICS					
ALUMINUM	2/2	847	1410	50-200	YES
ARSENIC	2/2	5.275	6.5	50	NO
BARIUM	2/2	12.705	16.9	2000	NO
CALCIUM	2/2	20700	26200	NA	-
CHROMIUM	1/2	8.14	8.14	100	NO
COPPER	2/2	83.75	141	1300	NO
IRON	2/2	1562	2710	300	YES
LEAD	2/2	49.15	87	15	YES
MAGNESIUM	2/2	2295	2930	NA	-
MANGANESE	2/2	39.95	62.7	50	YES
POTASSIUM	2/2	2855	3300	NA	-
SODIUM	2/2	52600	99300	28000	YES
VANADIUM	2/2	15.8	17.2	260	NO
ZINC	1/2	81.7	81.7	5000	NO

Notes:

[a] Surface water from sampling locations XHD-93-02X and XHD-93-03X.

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal or state standard or guideline is available, the Region III tap water concentration.

NA = not available

ug/L = micrograms per Liter

- = not applicable

Shaded compounds exceed standard or guideline.

TABLE 6.8-14
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF SEDIMENT
SA 43H&I - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		REGION III RESIDENTIAL SOIL CONCENTRATION (µg/g)	MCP S-1 STANDARD (µg/g)	MAXIMUM EXCEEDS GUIDELINES ?
		AVERAGE (µg/g)	MAXIMUM (µg/g)			
ORGANICS						
ACETONE	1/3	0.04	0.04	7800	3	NO
CHLOROFORM	1/3	0.002	0.002	100	0.1	NO
METHYLENE CHLORIDE	1/3	0.023	0.023	85	0.1	NO
TRICHLOROFLUOROMETHANE	2/3	0.025	0.041	23000	NA	NO
INORGANICS						
ALUMINUM	3/3	5696.667	8500	23000	NA	NO
ANTIMONY	1/3	23.4	23.4	31	10	MCP
ARSENIC	3/3	28.833	71	0.36	30	YES
BARIUM	3/3	126.733	341	5500	NA	NO
BERYLLIUM	1/3	0.635	0.635	0.15	0.4	YES
CADMIUM	1/3	27.7	27.7	39	30	NO
CALCIUM	3/3	4705.667	11500	NA	NA	-
CHROMIUM	3/3	112.967	251	390	200	MCP
COBALT	3/3	10.093	24	NA	NA	-
COPPER	3/3	112.667	245	2900	NA	NO
IRON	3/3	16590	31000	NA	NA	-
LEAD	3/3	676	1900	500	300	YES
MAGNESIUM	3/3	2796.667	4050	NA	NA	-
MANGANESE	3/3	231.667	472	390	NA	YES
MERCURY	1/3	0.679	0.679	23	10	NO
NICKEL	3/3	18.533	28.3	1600	300	NO
POTASSIUM	3/3	952.667	1590	NA	NA	-
SODIUM	3/3	672	1130	NA	NA	-
VANADIUM	3/3	17.243	28	550	NA	NO
ZINC	3/3	277.767	686	23000	2500	NO
OTHER						
TOTAL PETROLEUM HYDROCARBONS	3/3	8209.333	23800	375	500	YES

Notes:

[a] = Sediment from sampling locations XHD-93-01X to XHD-93-03X.

NA = not available

- = not applicable

µg/g = micrograms per gram

MCP = Massachusetts Contingency Plan

Shaded compounds exceed standard or guideline.

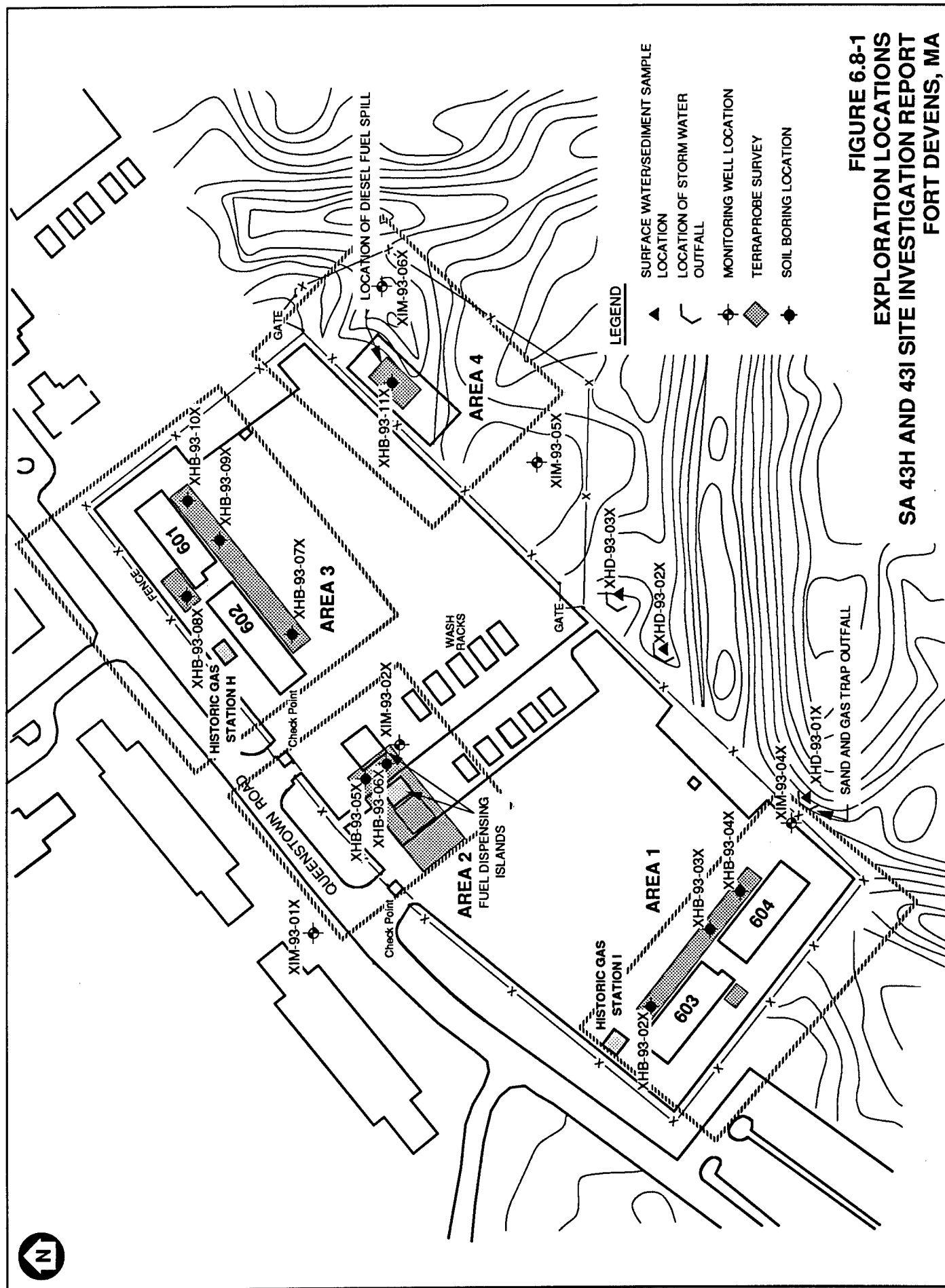


FIGURE 6.8-1
EXPLORATION LOCATIONS
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

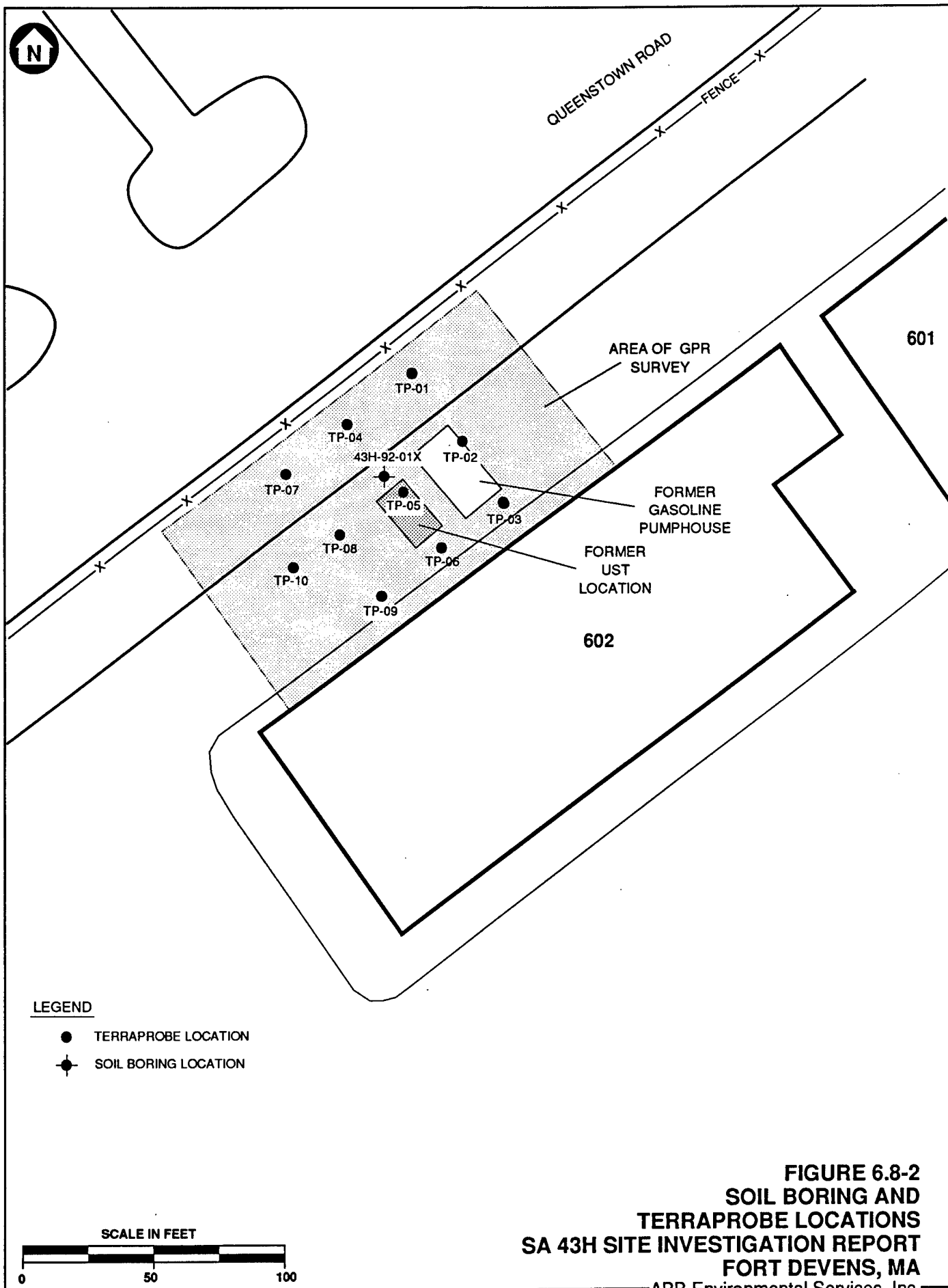
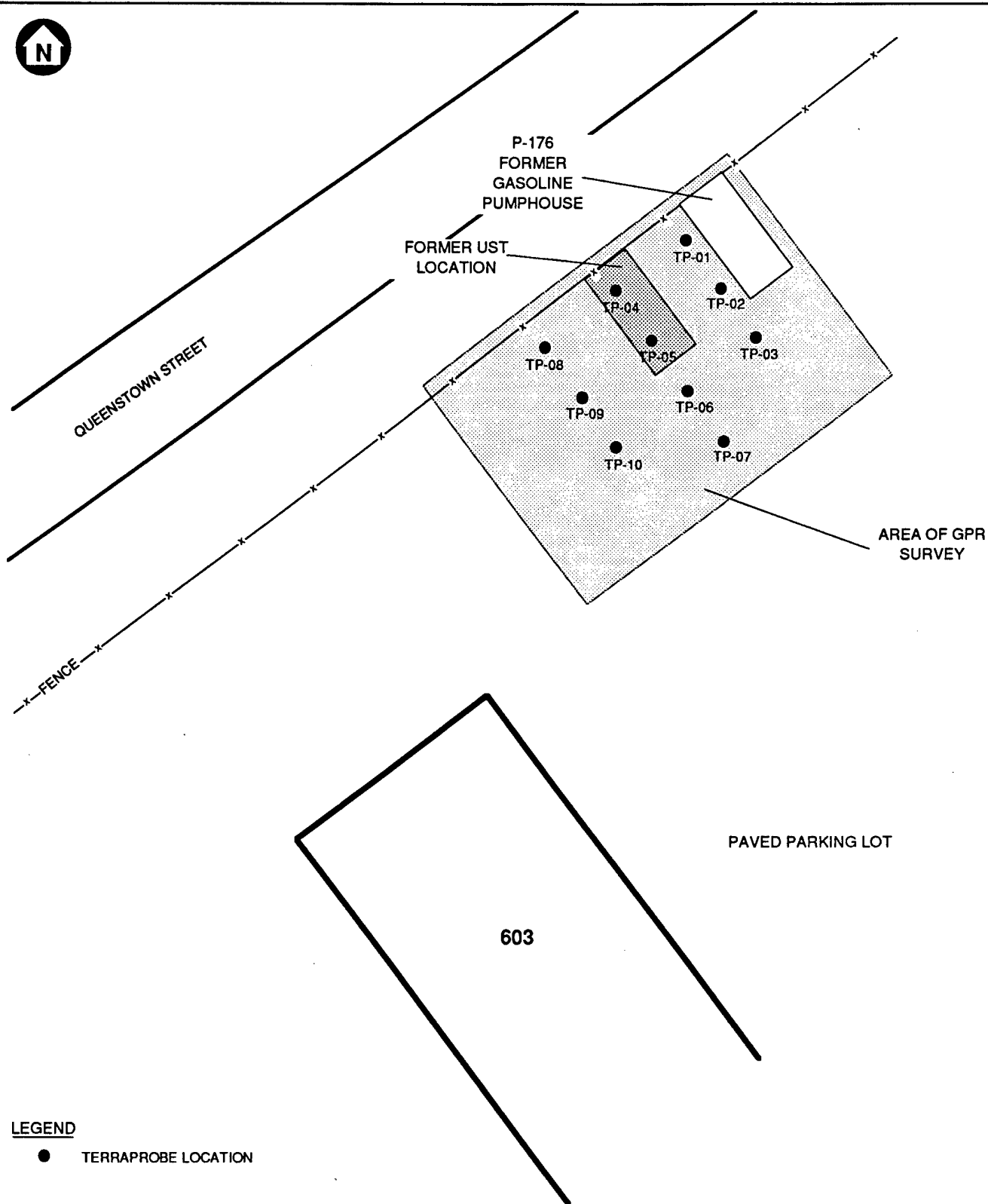


FIGURE 6.8-2
SOIL BORING AND
TERRAPROBE LOCATIONS
SA 43H SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND

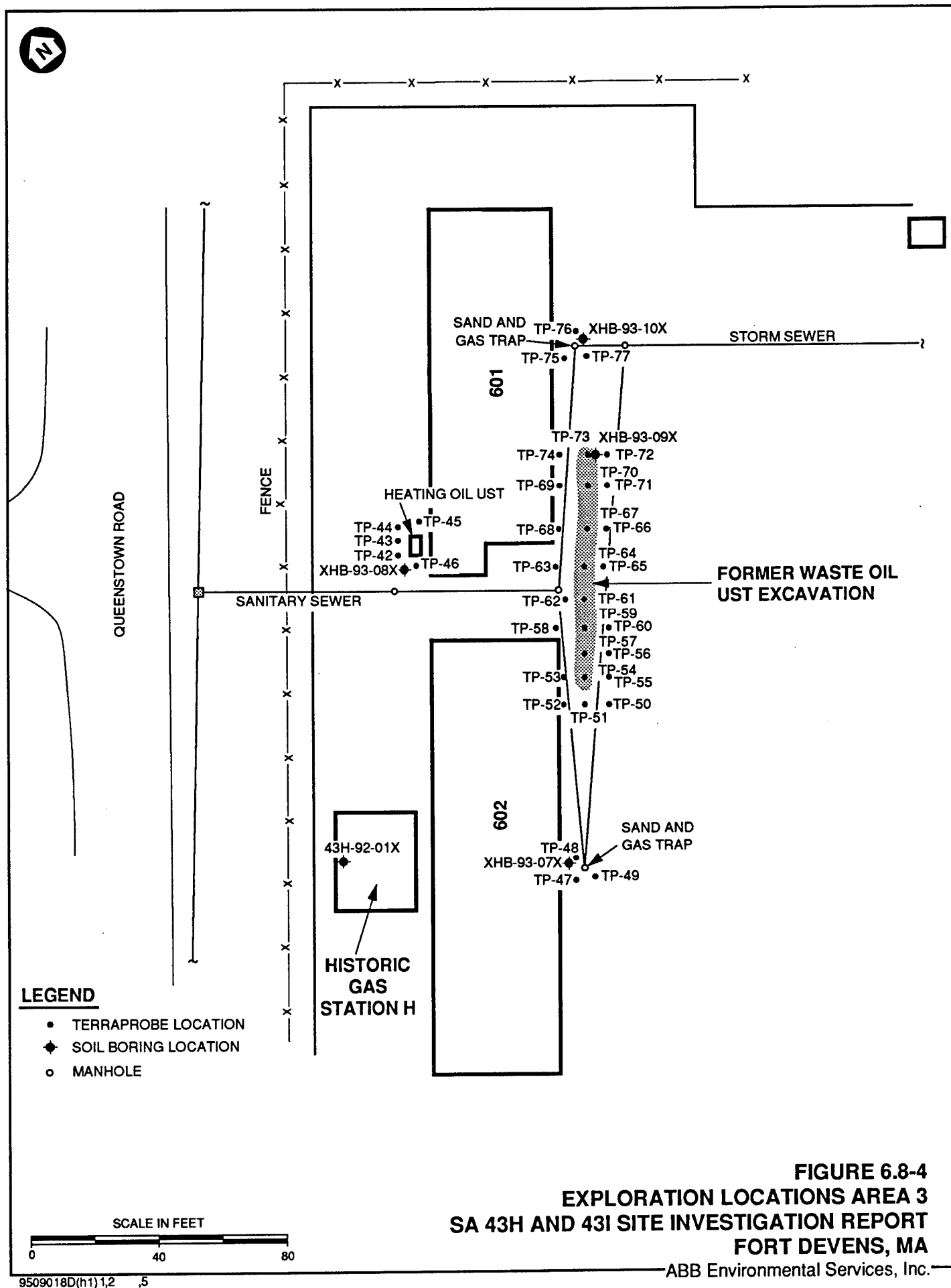
● TERRAPROBE LOCATION

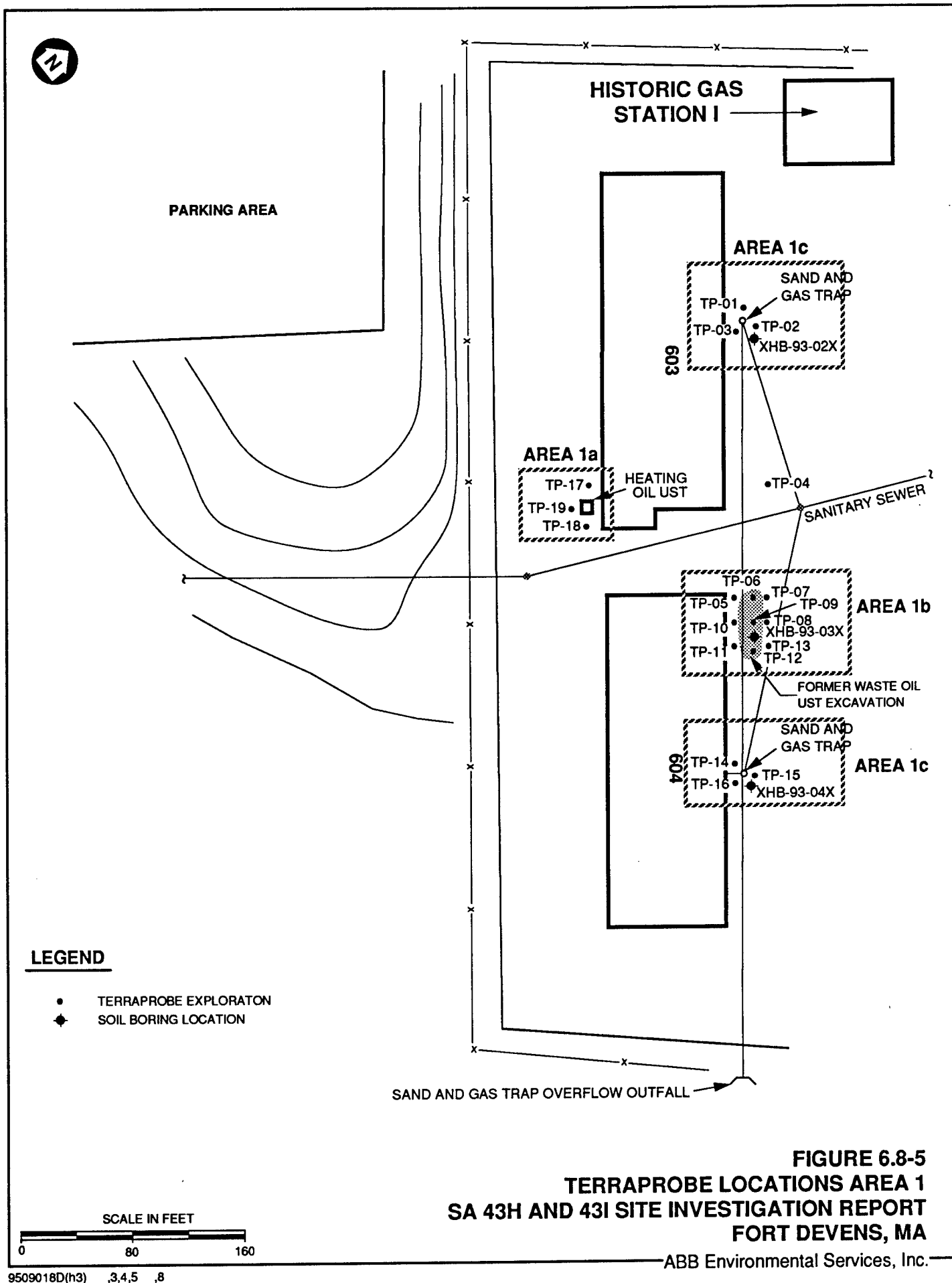
SCALE IN FEET

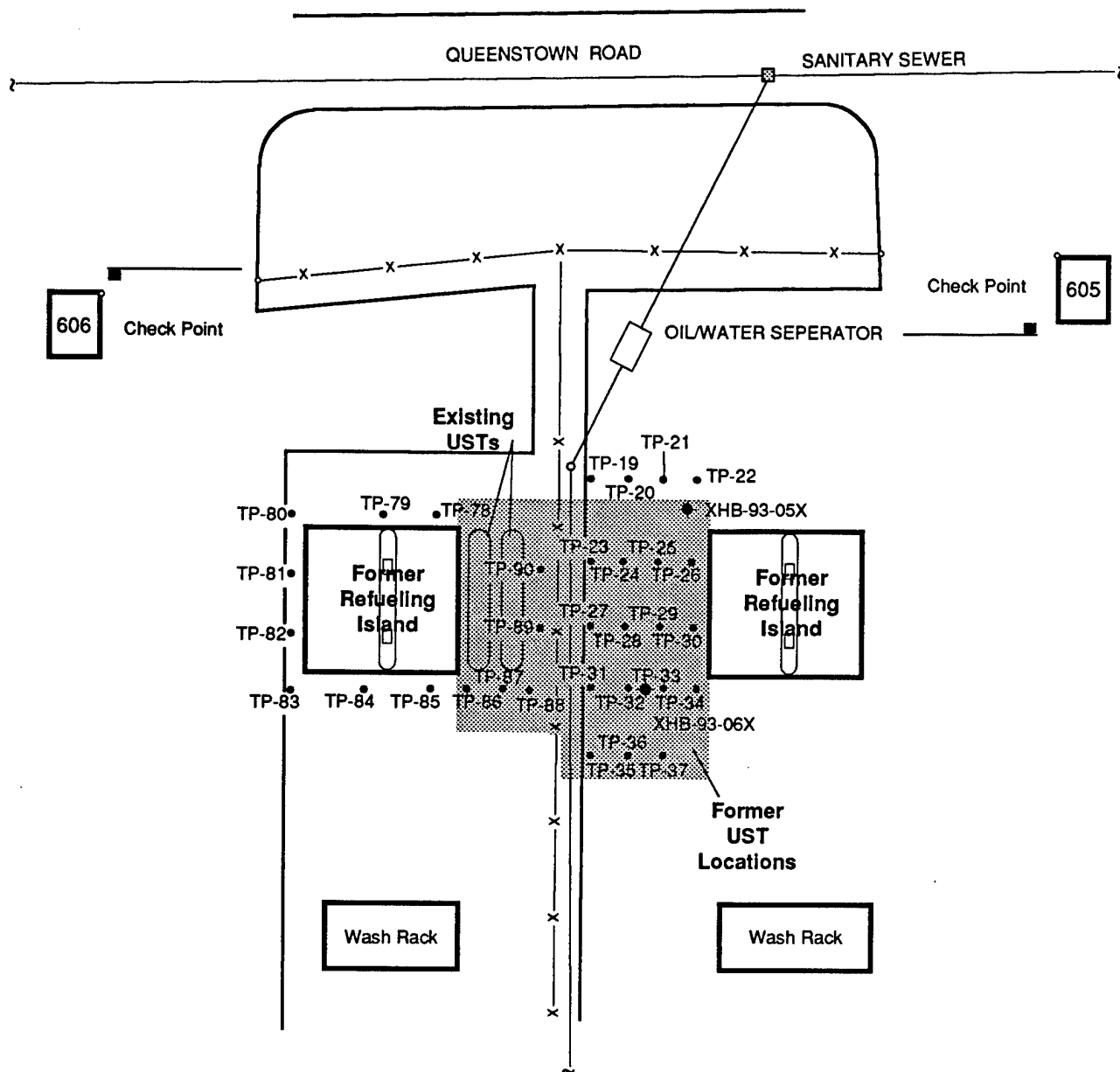


**FIGURE 6.8-3
TERRAPROBE LOCATIONS
SA 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.







LEGEND

- TERRAPROBE EXPLORATION
- ◆ SOIL BORING LOCATION

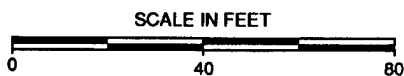
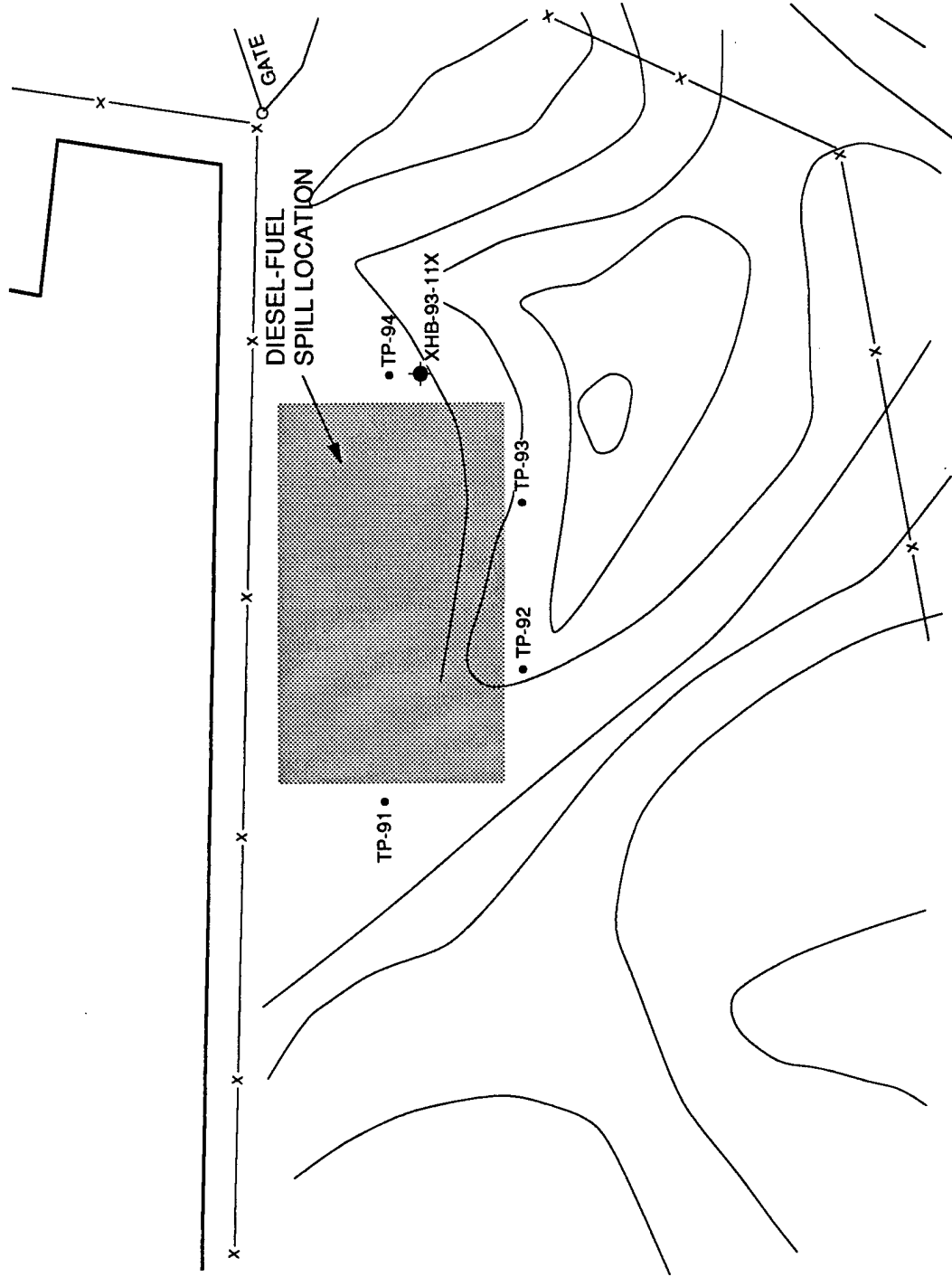


FIGURE 6.8-6
TERRAPROBE LOCATIONS AREA 2
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND

- TERRAPROBE LOCATIONS
- SOIL BORING LOCATION

APPROXIMATE
SCALE IN FEET

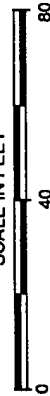


FIGURE 6.8-7
EXPLORATION LOCATIONS - AREA 4
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

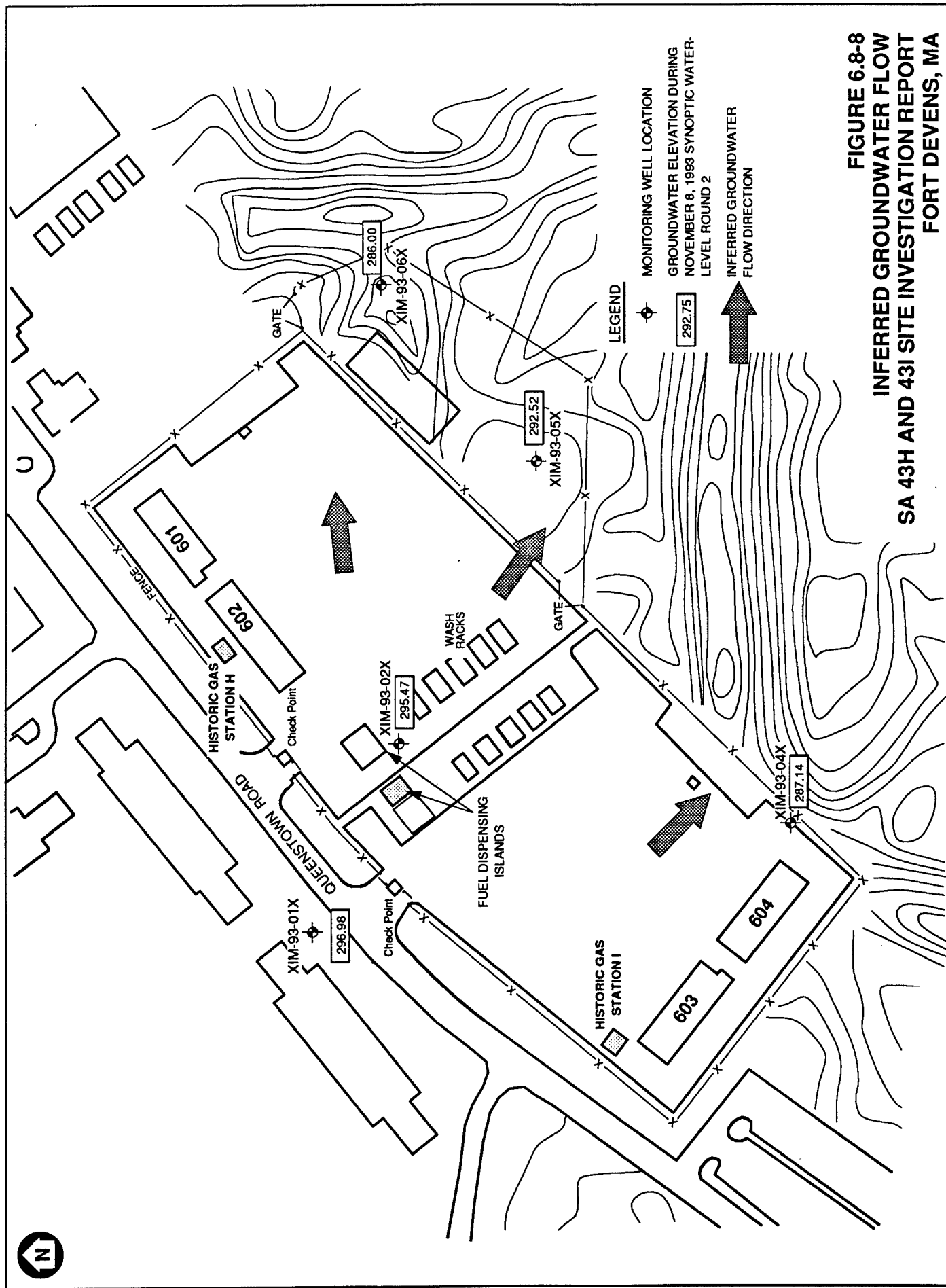
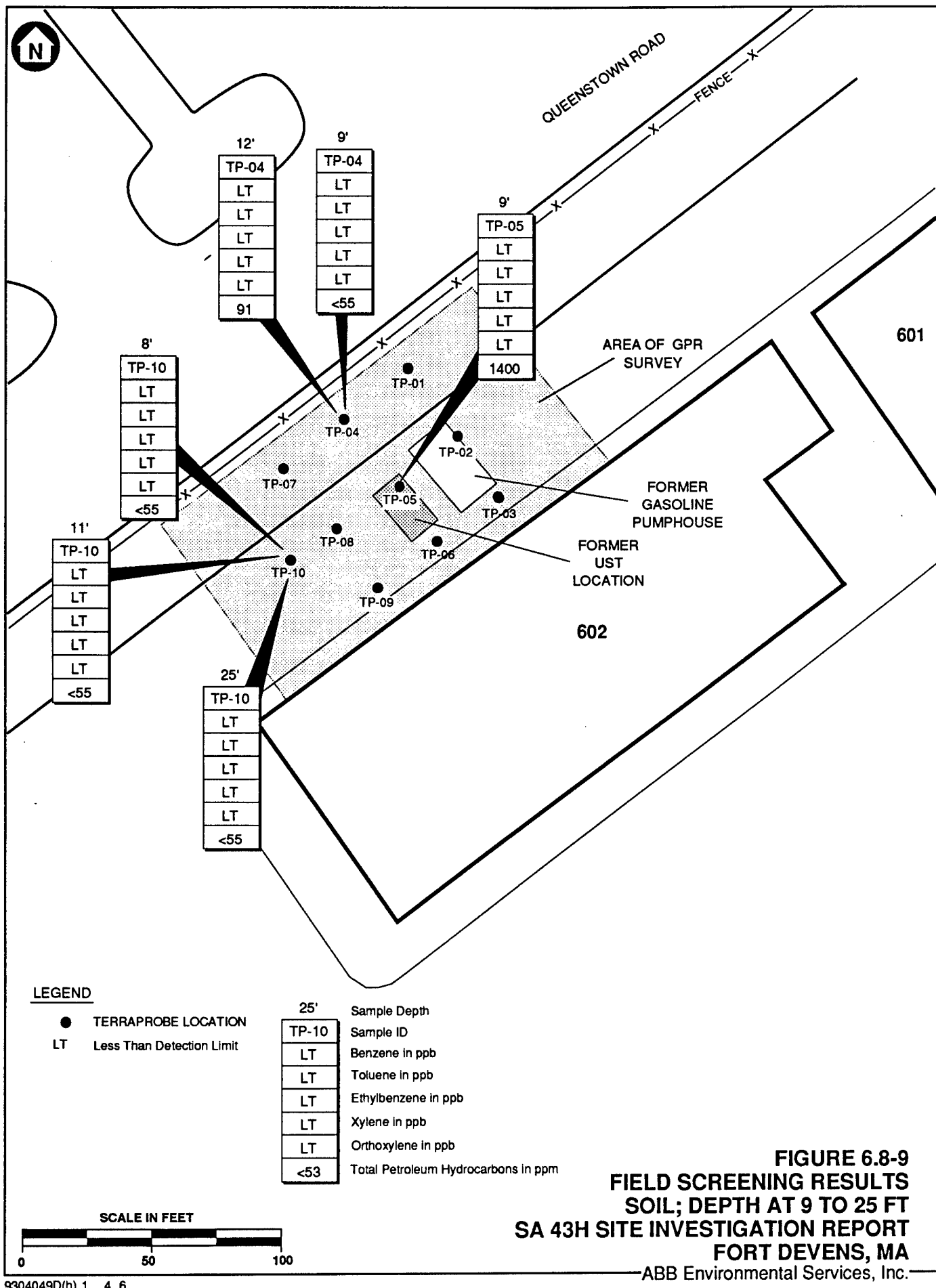
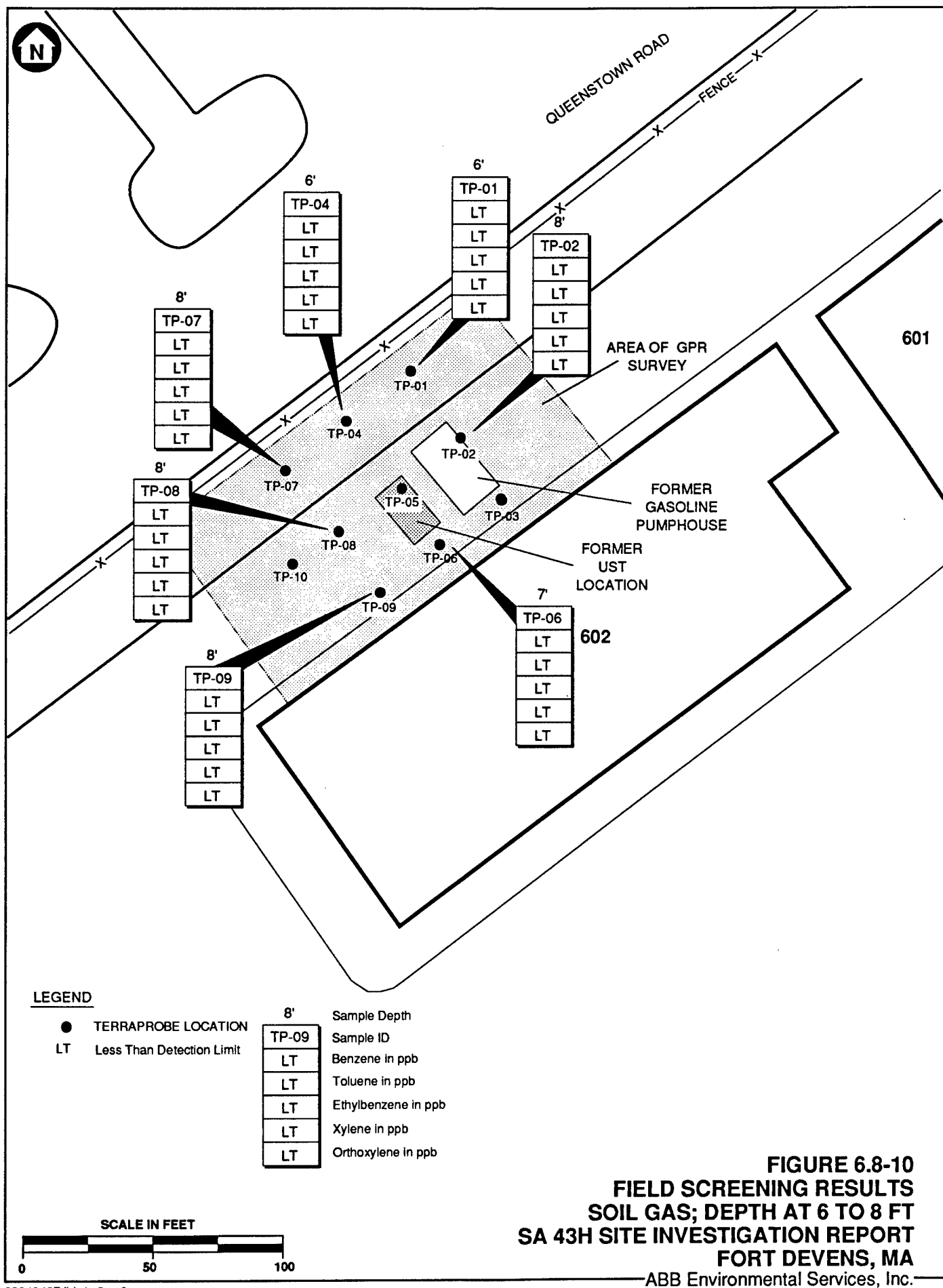
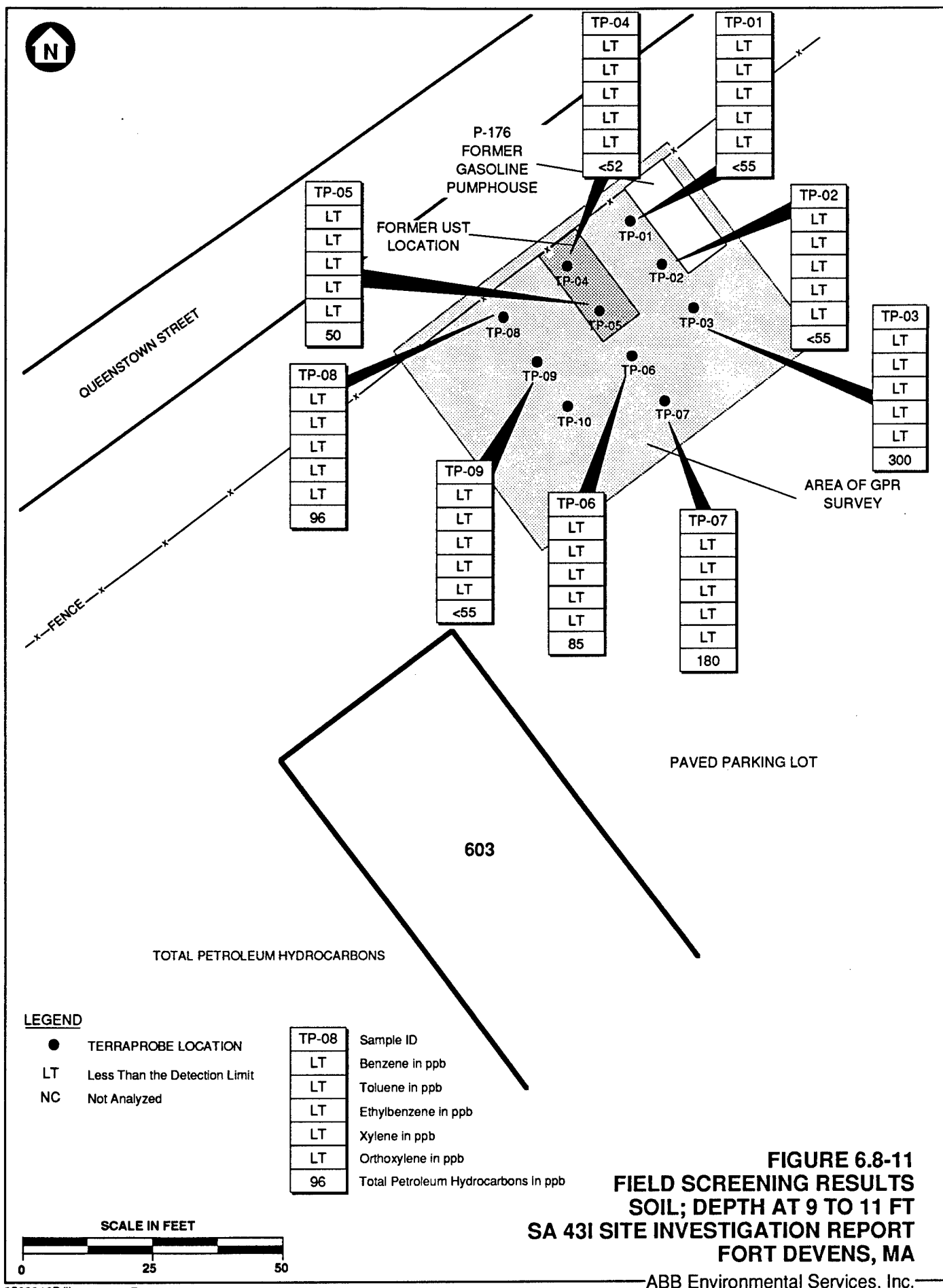
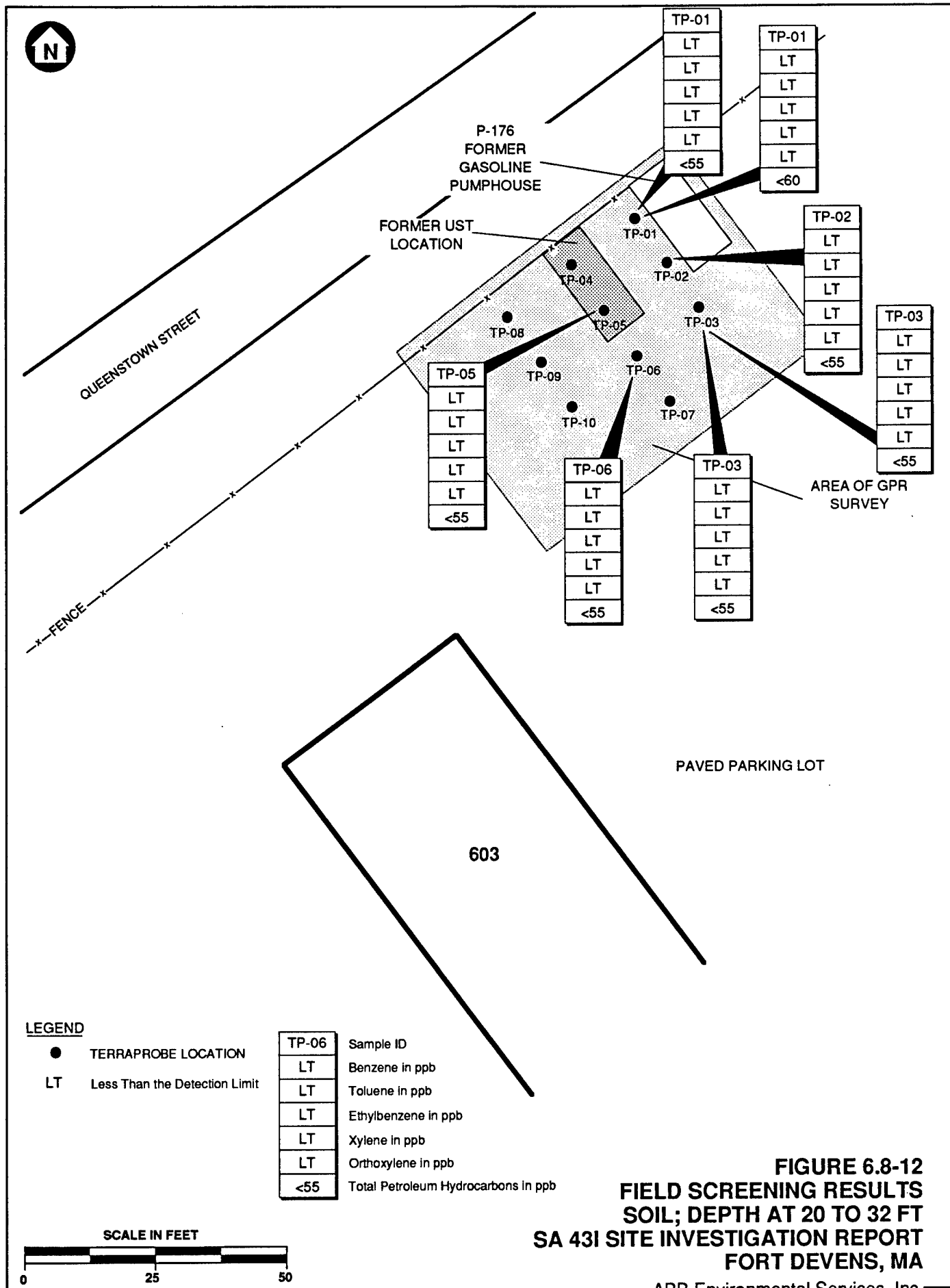


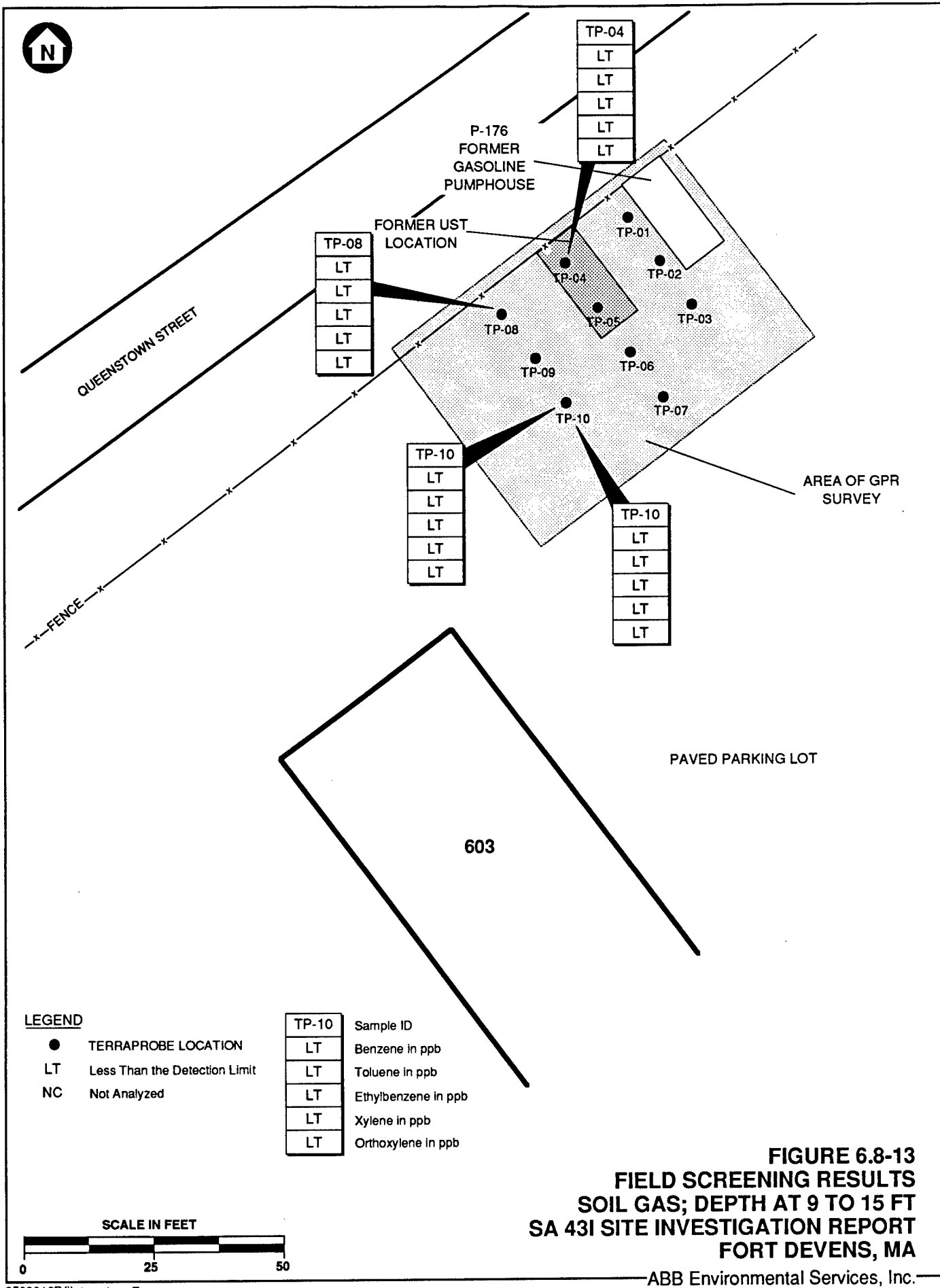
FIGURE 6.8-8
INFERRED GROUNDWATER FLOW
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA











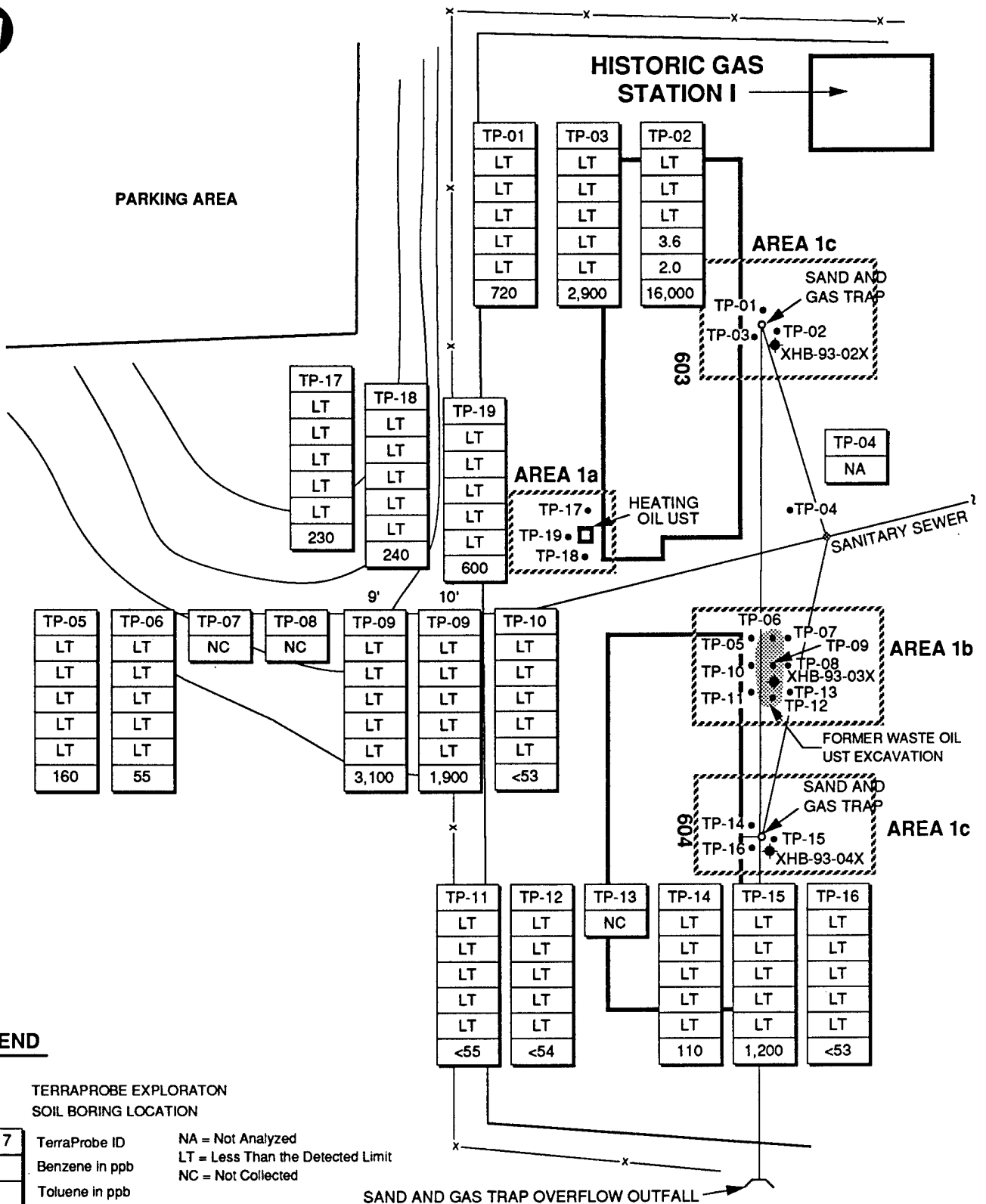
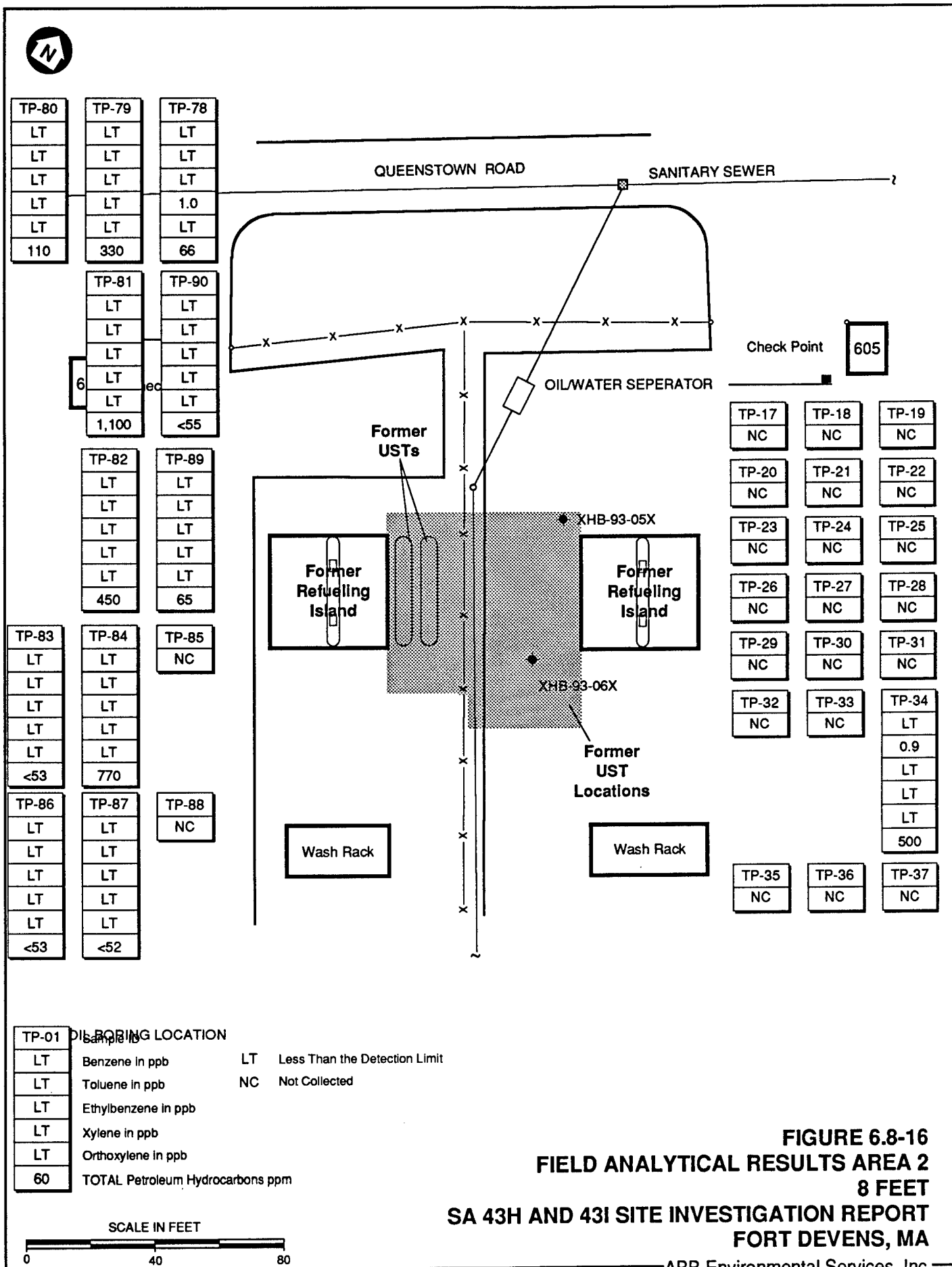


FIGURE 6.8-15
FIELD ANALYTICAL RESULTS AREA 1
9 TO 10 FEET
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



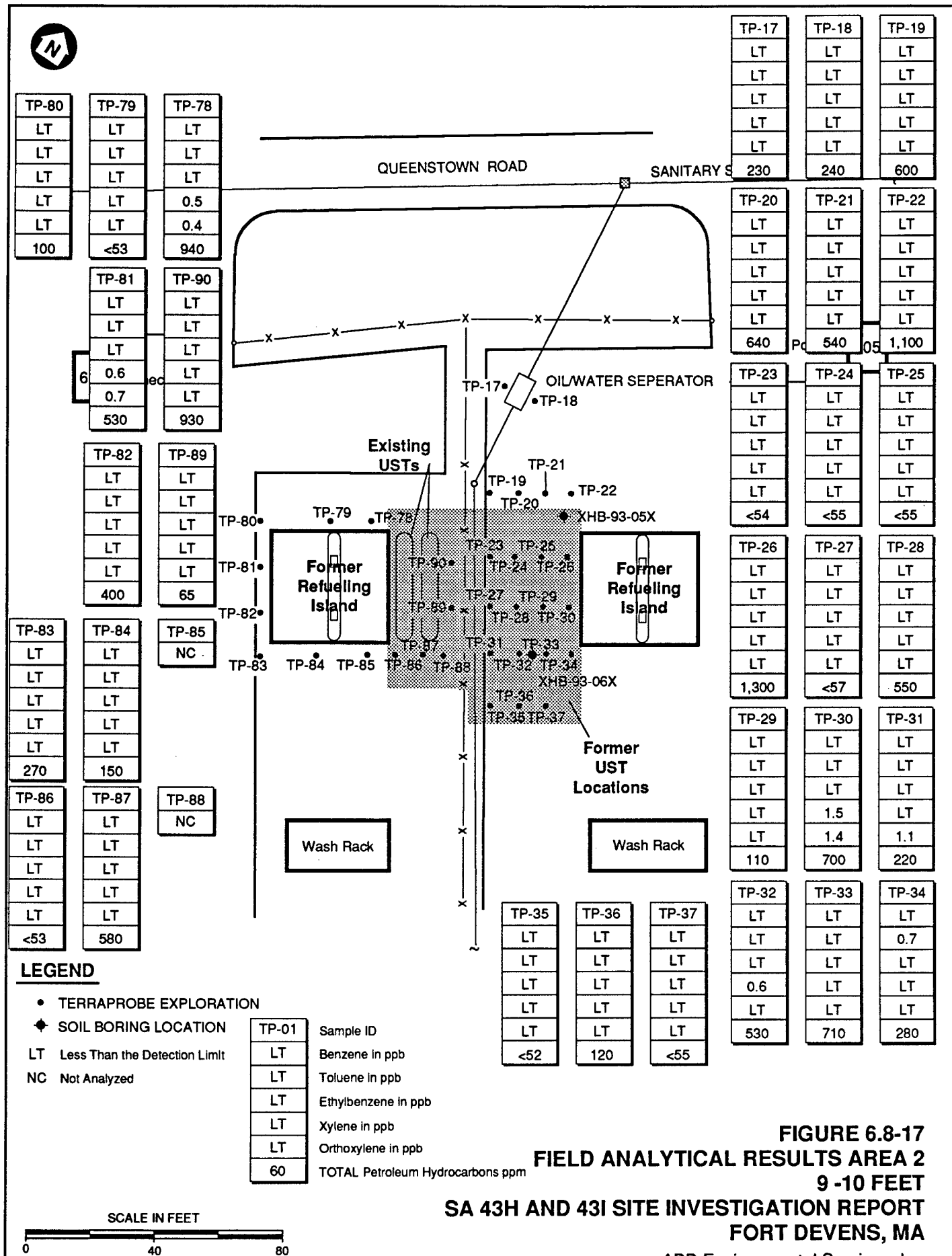
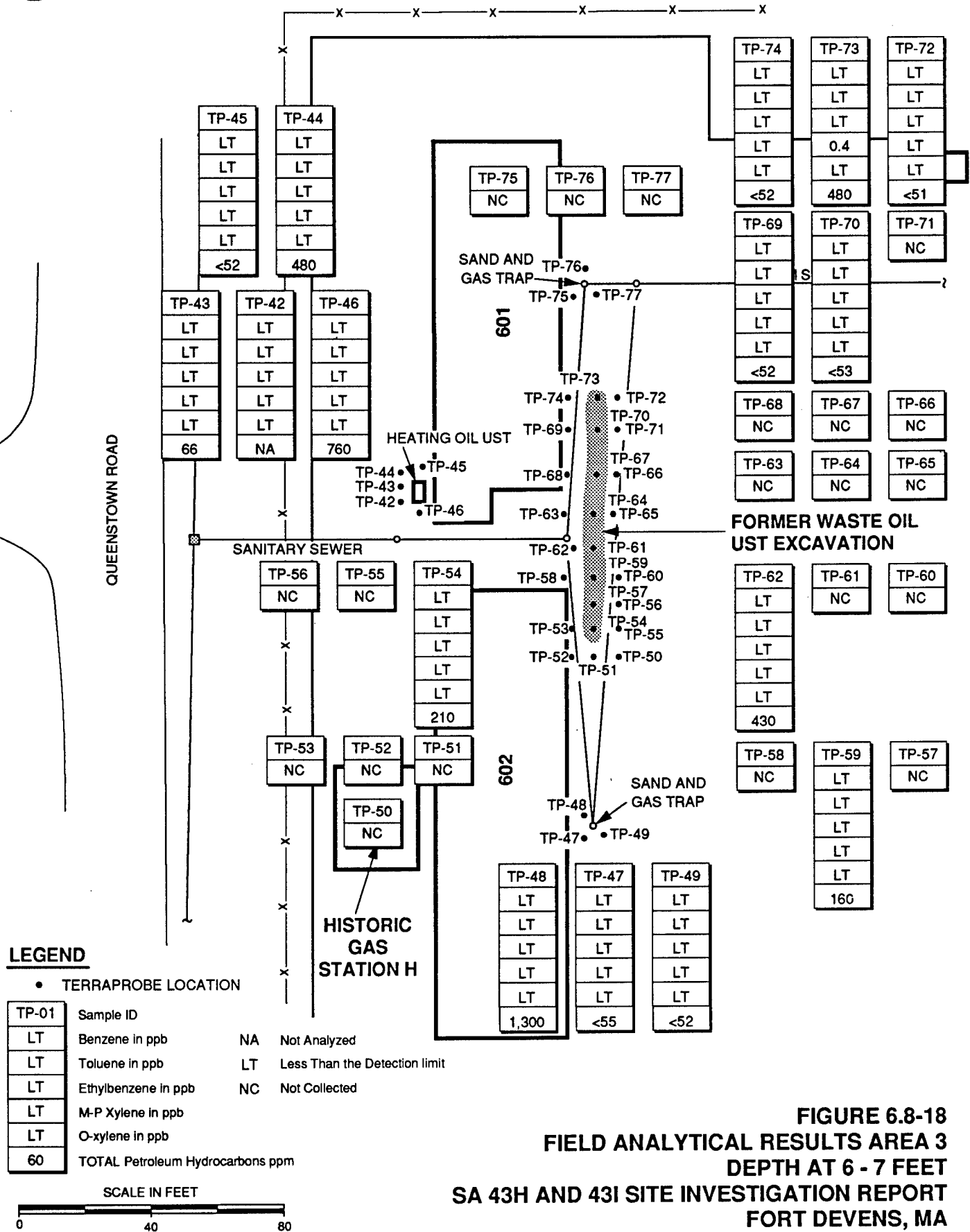


FIGURE 6.8-17
FIELD ANALYTICAL RESULTS AREA 2
9 -10 FEET
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA



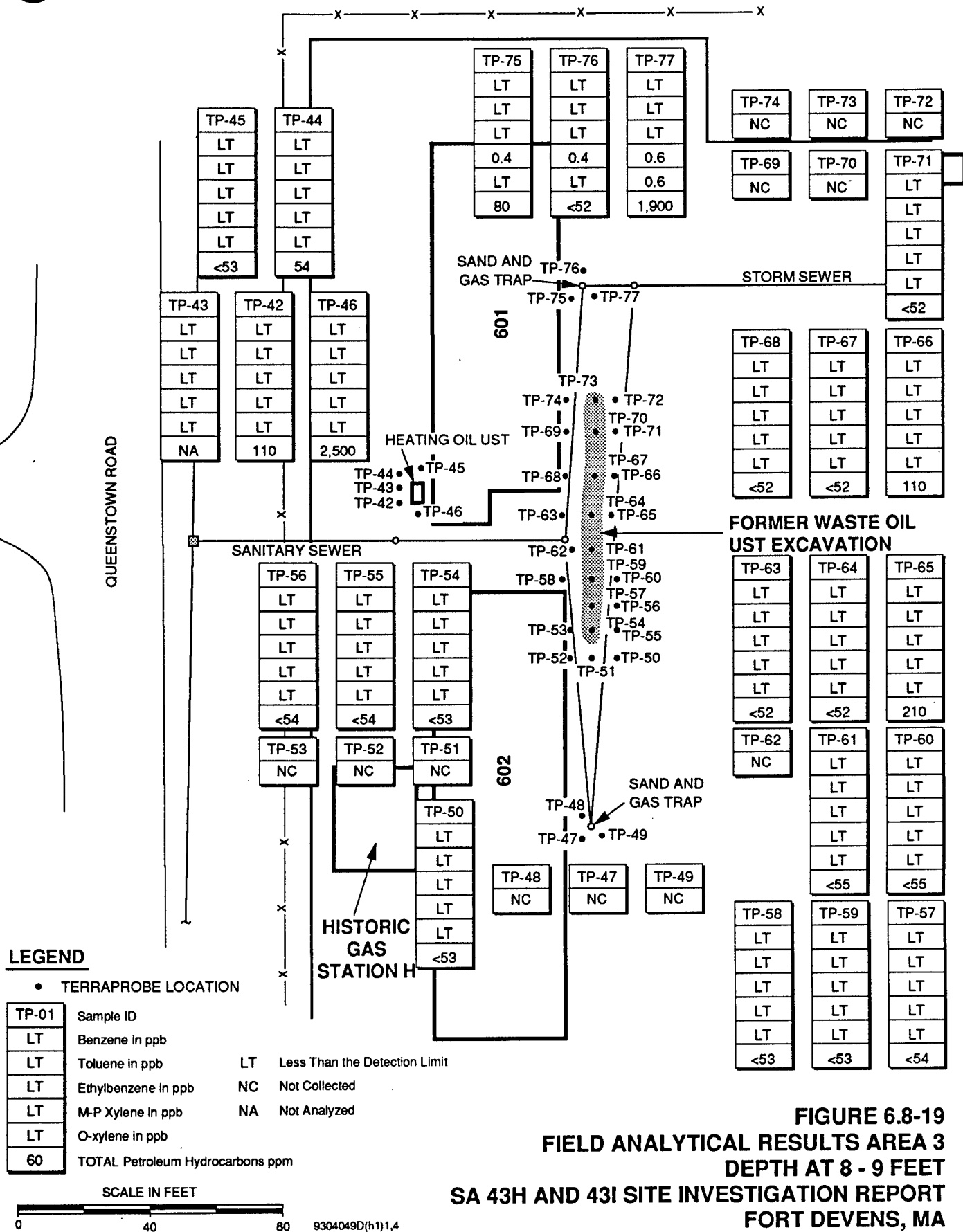
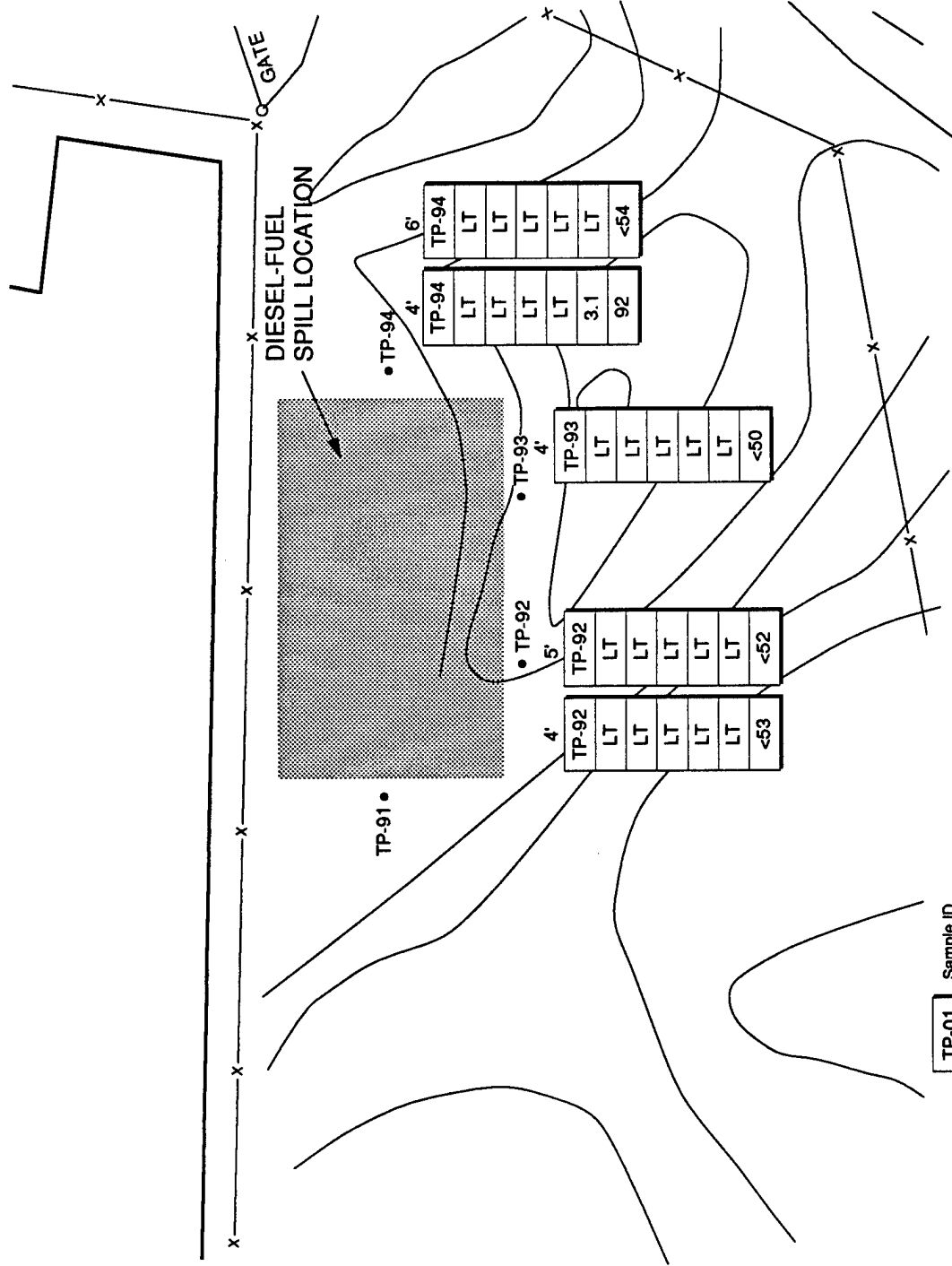


FIGURE 6.8-19
FIELD ANALYTICAL RESULTS AREA 3
DEPTH AT 8 - 9 FEET
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA



LEGEND

- TERRAPROBES LOCATIONS

APPROXIMATE
SCALE IN FEET



FIGURE 6.8-20
FIELD ANALYTICAL RESULTS AREA 4
DEPTH 4 TO 5 FEET
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA
ABB Environmental Services, Inc.



PARKING AREA

HISTORIC GAS STATION I

43I-92-01X

DUP

10-12	13-15	33-35	33-35
0.008	0.006	0.008	0.007
0.53	0.52	0.77	0.32
1110	242	49.2	126

Pb	3.6	Pb	7.0
9-11	34-36		
LT	LT		
NA	NA		
LT	LT		

DUP

	10-12	13-15	33-35	33-35
As	89.0	33.0	22.0	23.0
Be	1.79	1.9	1.02	LT
Ca	1980	LT	LT	LT
Cu	25.3	19.8	LT	LT
Fe	23,400	20,200	LT	LT
Mg	LT	5850	LT	LT
Mn	LT	511	LT	LT
Ni	53.5	44.2	16.4	LT
Na	332	278	392	268
Zn	57.4	39.9	LT	LT

P-03

TP-02

XHB-93-02X

AREA 1c

TP-04

SANITARY SEWER

TP-06

TP-05

TP-07

TP-09

TP-08

XHB-93-03X

TP-13

TP-12

TP-10

TP-11

TP-14

TP-15

XHB-93-04X

TP-16

AREA 1b

FORMER WASTE OIL UST EXCAVATION

SAND AND GAS TRAP

AREA 1c

	8-10
As	22.0
Be	1.76
Cu	19.0
Fe	18,900
Mn	322
Ni	38.8
Na	273
Zn	89.4

	6-8	8-10
Be	1.65	1.52
Cu	14.4	12.4
Fe	17,900	15,200
Mn	665	782
Ni	37.3	27.8
Na	323	329
Zn	35.6	LT

	6-8	8-10
	0.038	LT
	0.61	0.41
	LT	LT

LEGEND

- TERRAPROBE EXPLORATION
- ◆ SOIL BORING LOCATION

16'	Sample Depth in Feet
LT	TOTAL VOCs in µg/g
LT	TOTAL SVOCs in µg/g
LT	TPHC in µg/g

LT LESS THAN DETECTION LIMIT
(LESS THAN BACKGROUND FOR INORGANICS)

NA NOT ANALYZED

Al 3610

CONCENTRATION (µg/g)
ANALYTE

SAND AND GAS TRAP OVERFLOW OUTFALL

SCALE IN FEET

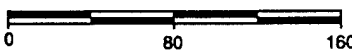
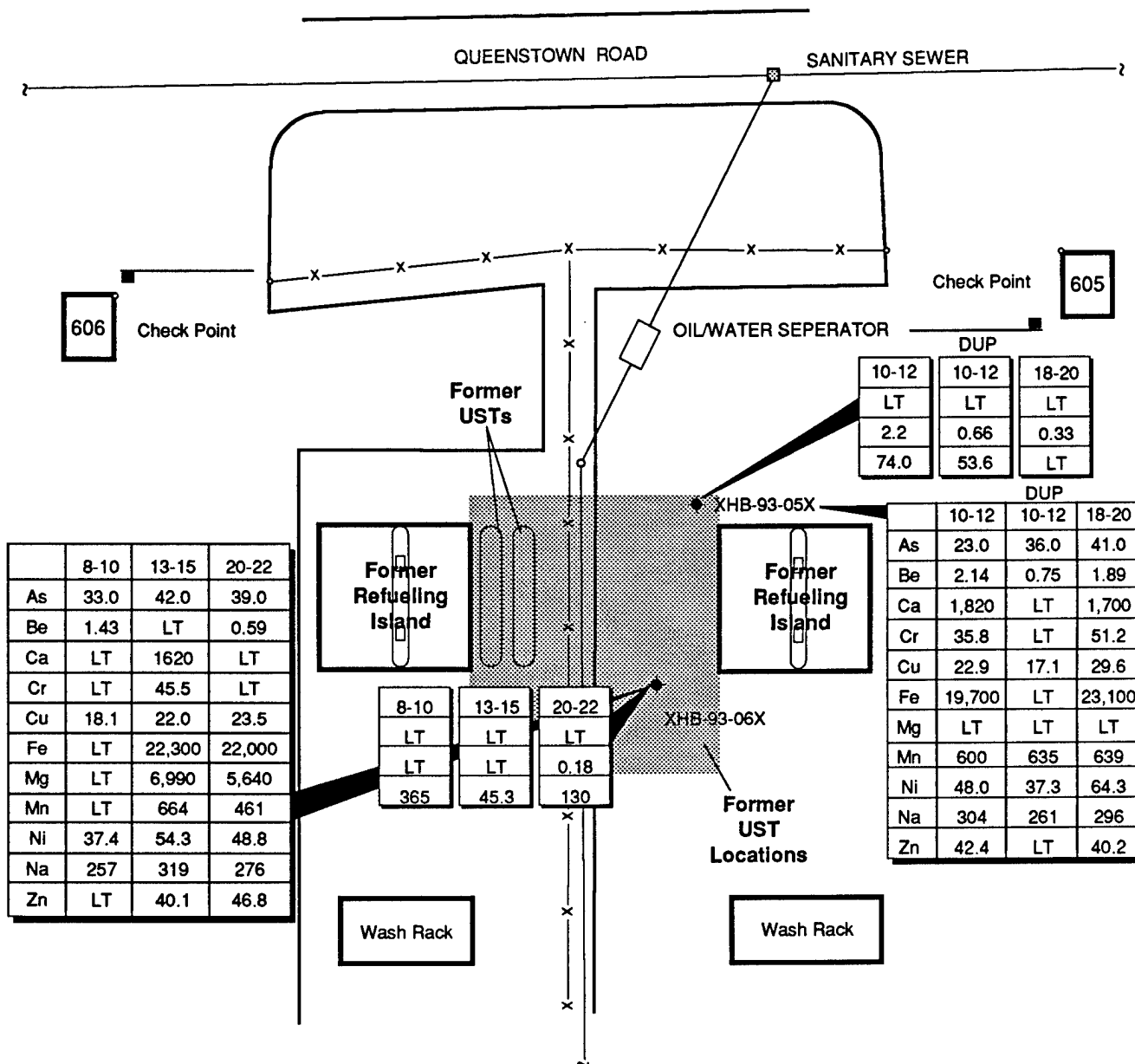


FIGURE 6.8-21

ANALYTES IN SOIL AREA 1
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



LEGEND

-
- SOIL BORING LOCATION
 EXISTING ROAD
 EXISTING RAILROAD

16'	Sample Depth in Feet
LT	TOTAL VOCs in µg/g
LT	TOTAL SVOCs in µg/g
LT	TPHC in µg/g
LT	LESS THAN DETECTION LIMIT

SCALE IN FEET

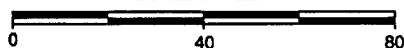
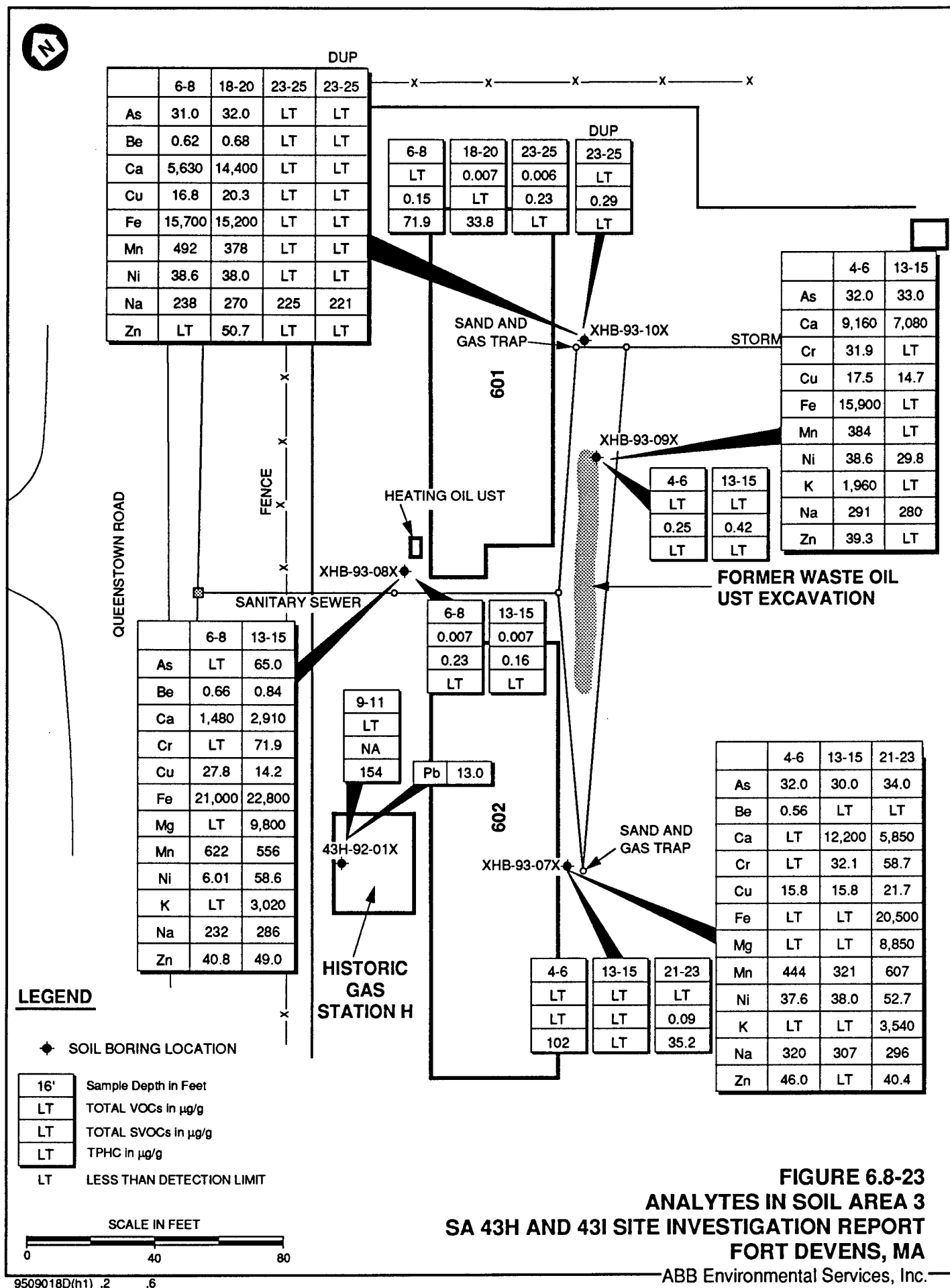


FIGURE 6.8-22
ANALYTES IN SOIL AREA 2
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

-ABB Environmental Services, Inc.



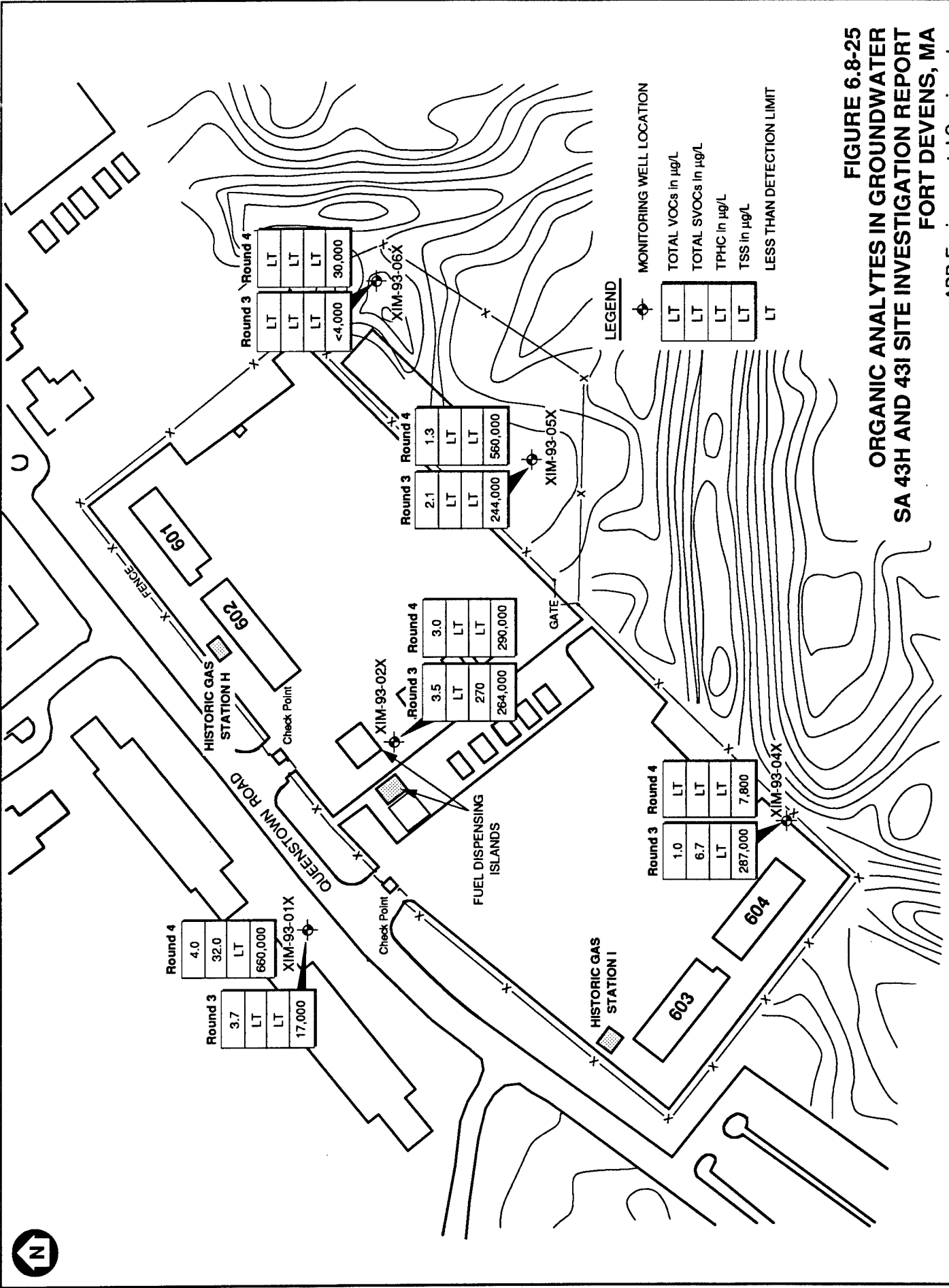


FIGURE 6.8-25
ORGANIC ANALYTES IN GROUNDWATER
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA
 ABB Environmental Services, Inc.

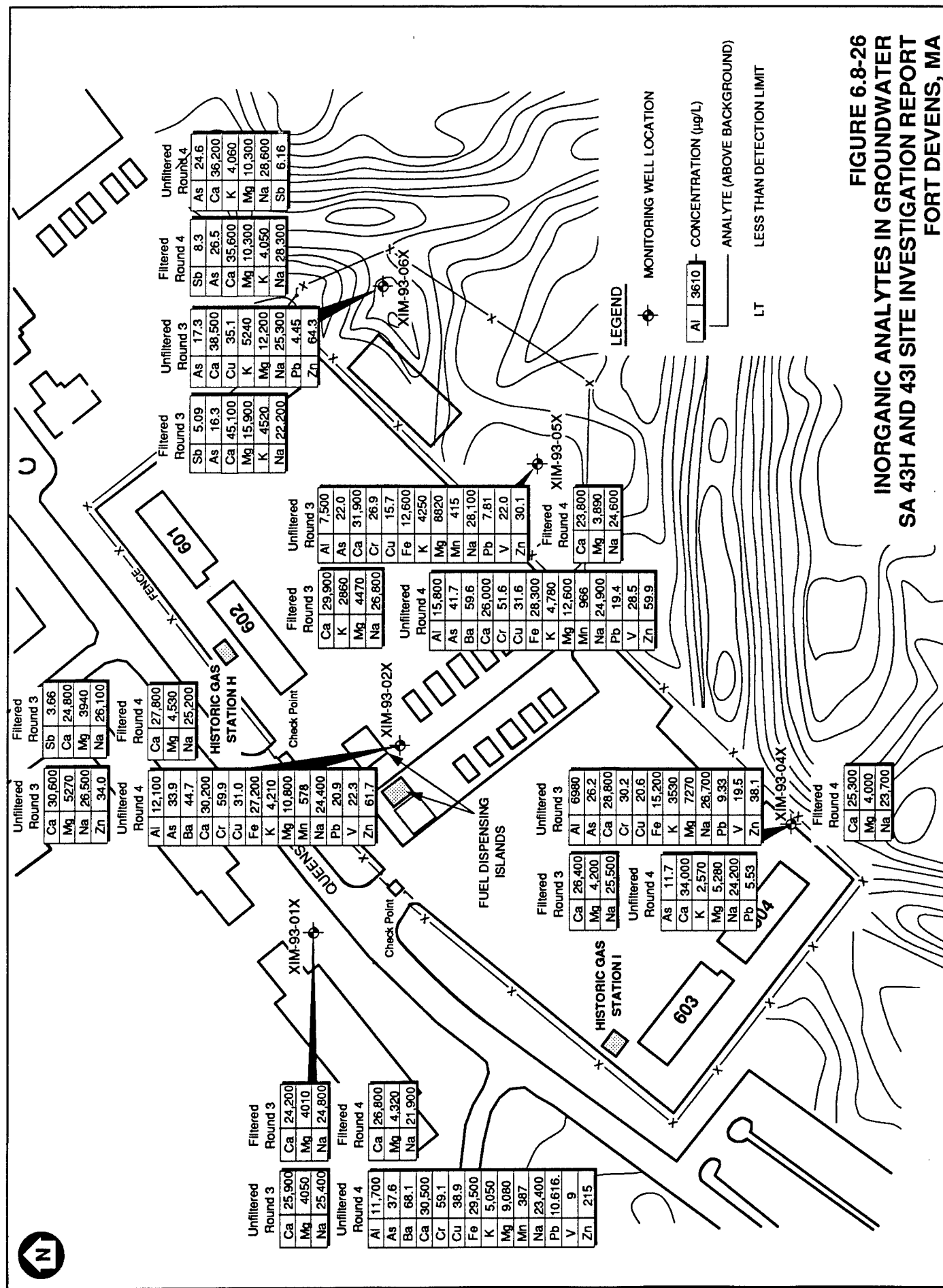


FIGURE 6.8-26
INORGANIC ANALYTES IN GROUNDWATER
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

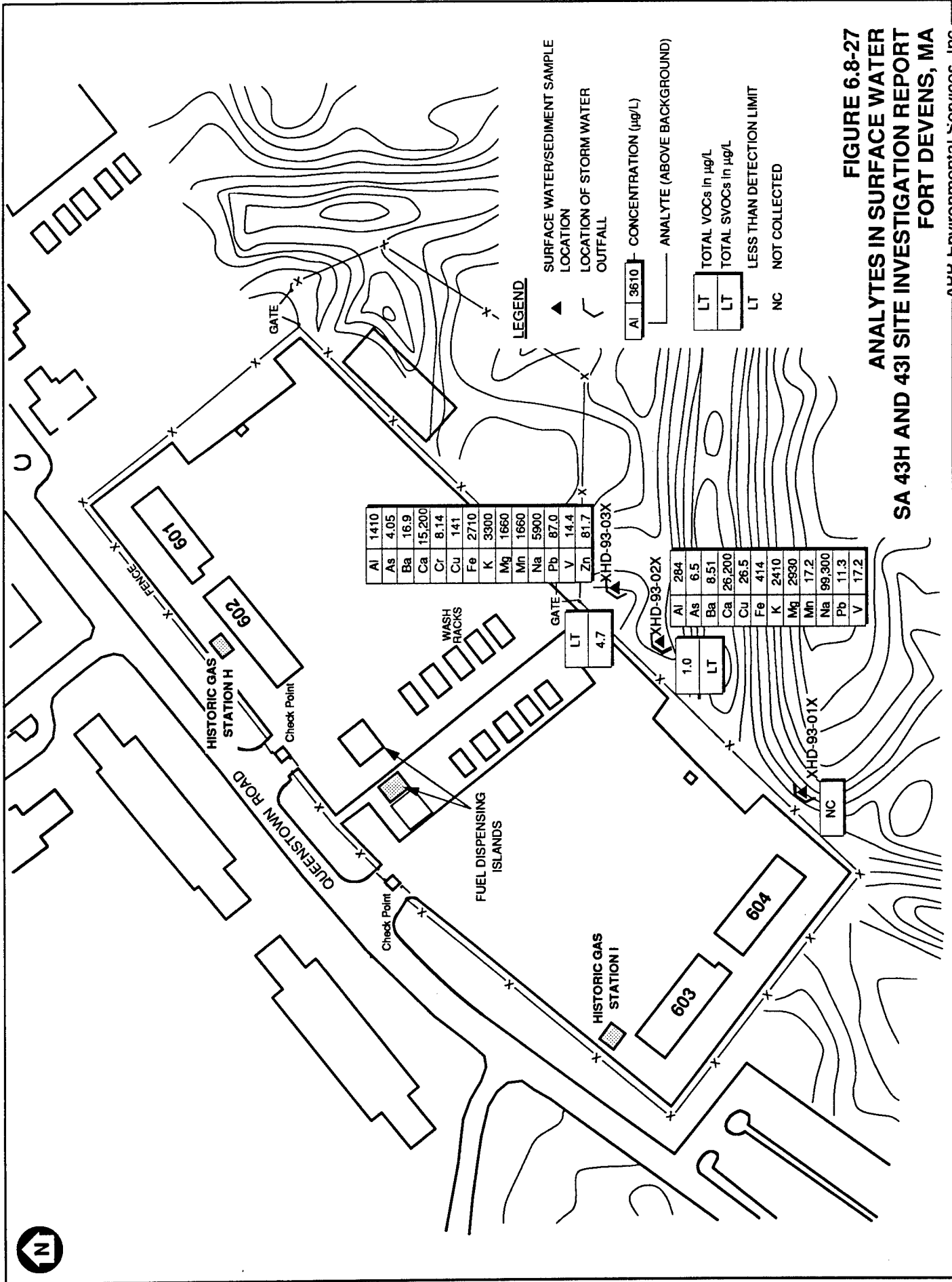


FIGURE 6.8-27
ANALYTES IN SURFACE WATER
SA 43H AND 43I SITE INVESTIGATION REPORT
FORT DEVENS, MA

6.9 STUDY AREA 43J

6.9.1 Study Area Background and Conditions

The structure of the historic gas station at SA 43J consisted of a pump island and a small gasoline pumphouse. This gas station was reported to be a Type A station which had one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. SA 43J is located on an access road in the central portion of the Main Post, that connects Patton Road and Queenstown Road. The area around the location of SA 43J, is presently a vehicle storage yard and maintenance facility (Building T-2446) for a Special Forces Unit of the U.S. Army. The yard and maintenance facility is paved and surrounded by a chain-linked fence with a locked gate located at the northern side of the yard (Figure 6.9-1).

6.9.2 Site Investigation Program Summary

The SI at SA 43J were performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). A field investigation was conducted at SA 43J to determine if any abandoned UST(s) were present at the site, and if any residual contamination was present in the subsurface soil around the historic gas station. The program consisted of a surficial geophysical survey, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring from which subsurface soil samples were collected for off-site laboratory analysis. Table 6.9-1 summarizes the activities completed during the SI.

The geophysical survey at SA 43J consisted of a metal detector and GPR survey.

Due to subsurface obstructions, only nine subsurface soil samples were collected from eight TerraProbe points. Five soil samples were collected from 4 feet to 5 feet bgs, and four soil samples were collected from 9 feet bgs (Figure 6.9-2). All of the soil samples were analyzed in the field for BTEX and TPHC.

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SECTION 6

One soil boring (43J-92-01X) was drilled to collect subsurface soil samples for off-site laboratory analysis. Due to subsurface obstructions, only one soil sample was collected from 5 feet in this boring. This soil samples was analyzed for VOCs, TPHC, and lead (see Figure 6.9-2).

6.9.3 Supplemental Site Investigation Program Summary

The SSI at SA 43J were performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The following sections describe the field activities completed at this historic gas station during the SSI. Table 6.9-1 summarizes the activities completed during the SSI.

The SSI at SA 43J was conducted during August, 1993. The investigation focuses in and around the former waste oil UST located south of Building 2446 (see Figure 6.9-2). The TerraProbe points were advanced northeast of the TerraProbe points completed at the historic gas station J during the SI. These points were located in and around the excavation of the former waste oil UST removed in 1992. The results of these samples were used to further define the horizontal distribution of contaminants detected during the SI. Up to two soil samples were collected from each TerraProbe point. The samples were analyzed in the field for BTEX and TPHC.

Four groundwater monitoring wells were installed to monitor upgradient and downgradient groundwater quality (see Figure 6.9-1). Soil samples were collected from the water table or the bedrock surface from three of the four monitoring well borings. No soil sample was collected from XJM-93-04X due to the fact that bedrock was encountered only 0.7 feet bgs. The soil samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs inorganics, TPHC, and TOC. The soil sample from XJM-93-01X was collected from the top of bedrock, while the soil samples from XJM-93-02X and XJM-93-03X were collected from the water table in the overburden soils. The screen of each monitoring well was placed so that it intersected the water table to monitor for free product and allow for seasonal groundwater fluctuations. The well screen in the monitoring wells installed at XJM-93-01X and XJM-93-04X was installed in the bedrock. The well screens in the monitoring wells at XJM-93-02X and XJM-93-03X were installed in overburden soils. Each of the existing monitoring

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wells (2446-01 through 2446-04) were installed in the bedrock. Table 6.9-2 summarizes the monitoring well construction at SA 43J.

Two rounds (Round Three and Four) of groundwater were collected from two of the ATEC monitoring well and the SS1 monitoring wells. Round Three groundwater samples were collected in October 1993 and Round Four was collected in January 1994. Groundwater samples were not collected from the existing upgradient monitoring well 2446-01 due the fact that its flush-mounted well protector had been damaged and the integrity of the well had been compromised. These samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, inorganics (both filtered and unfiltered), TPHC, and TSS.

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were preformed. Hydraulic conductivity tests were not performed at XJM-93-02X because only 2 feet of water was present in the monitoring well at the time of the testing. The tests consisted of a rising and falling head test.

6.9.4 Field Investigation Results and Observations

The results of the geophysical survey at SA 43J indicated that one abandoned UST was present at the site. The results of the geophysical surveys is presented in Appendix L.

The UST discovered at SA 43J was added to the installation's UST removal program and on August 26, 1992 ATEC removed a 5,000 gallon UST. At the time of the removal, tank content consisted of gasoline. Visually contaminated soil and strong fuel odor were present in the excavation (ATEC, 1992h). ATEC performed headspace screening for total VOCs and NDIR for TPHC, on eight soil samples collected from the sides and bottom of the UST excavation (Figure 6.9-3). VOC concentrations ranged from 100 to 400 ppm in the sample headspace, and TPHC concentrations ranged from 43.9 to 3,534.8 ppm (ATEC, 1992h) (Table 6.9-3).

Based on the results of the field screening, additional soil was removed from this excavation. Groundwater was encountered in the southeastern corner of the excavation and bedrock was reached at approximately 7 feet. Based on the

ABB Environmental Services, Inc.

SECTION 6

observations made in the UST excavation, it appeared that the water table was below the bedrock surface. The lateral distribution of the contamination was not determined during this cleanup process due to physical restriction (e.g., driveways, buildings, stockpiled soil). ATEC collected five soil and one water sample from the UST excavation, after the additional soil was removed, for off-site laboratory analysis. These samples were analyzed by a non-approved USAEC laboratory for VOCs and TPHC. VOC concentrations ranged from 0.13 ppm to 2.2 ppm (total VOCs). TPHC concentrations detected in these samples ranged from 38 ppm to 2,170 ppm (see Table 6.9-3). Because of these results, the installation's decided to stop the cleanup process, line the excavation with polyethylene sheeting, and backfill the excavation. An inspection of the UST was completed by the installation's on-site representative and a representative of the MADEP. This inspection did not find any obvious holes or breaks in the walls of the UST. An Underwriters Laboratory (UL) tag found on the UST appeared to indicate that this UST was of a younger age than the reported age of the historic gas station at SA 43J. The conclusion reached by Fort Devens and MADEP personnel was that the original UST had been replaced by the UST that was removed during this removal program, and that the contamination detected, in the excavation, appeared to be caused by the original UST, not the UST found at SA 43J.

Before the 5,000 gallon historic gas station UST was removed, ATEC (1992i) had excavated a 1,000 gallon waste oil UST approximately 50 feet east of the abandoned UST at SA 43J (see Figure 6.9-3). This UST was used by the existing Special Forces unit for the storage of waste oil generated from the maintenance operation at this vehicle maintenance facility. Not all of the contaminated soil was removed; confirmatory samples from the excavation had TPHC levels of 74 and 918 ppm. It is likely that some of the contamination from the two UST excavations may have mixed together and contaminated the soil around both of the former USTs. ATEC installed four monitoring wells (2446-01 through 2446-04) around the area of the former 1,000 gallon waste oil UST (see Figure 6.9-1). These monitoring wells were designed to determine the groundwater quality in this area.

One round of groundwater sampling was conducted by ATEC in November 1992. The samples were analyzed by a non-approved USAEC laboratory for TPHC, only. USEPA Method 418.1 was used to analyze the sample.

The soil encountered during the SI and SSI at SA 43J consisted of a poorly graded silty sand (which appeared to be fill material) underlain by a fine sandy silt with fine gravel (glacial till). Bedrock was encountered at SA 43J at a depth of 0.7 and 13.5 feet bgs. The bedrock at this site was classified as meta siltstone or phyllite (Table 6.9-4).

The calculated hydraulic conductivities in the bedrock monitoring wells ranged from $5.8E^{-06}$ cm/sec. at XJM-93-01X to $8.5E^{-06}$ cm/sec. at XJM-93-04X. The hydraulic conductivity of the overburden soils at XJM-93-03X was $2.2E^{-05}$ cm/sec. The hydraulic conductivity for each monitoring well is presented in Table 6.9-5.

The SSI and ATEC monitoring wells have been included in several installation-wide synoptic water-level rounds completed at Fort Devens. The water-levels from the November 8, 1993 round was chosen to represent the water table conditions at the site after the SSI. The inferred groundwater flow based on these elevations appears to be moving to the east-northeast (Figure 6.9-4). All SSI explorations were surveyed.

6.9.5 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.9.5.1 Soil. Because contaminated soil was encountered in the historic gas station UST excavation, ABB-ES advanced 10 TerraProbe points at SA 43J during the SI (see Figure 6.9-2). BTEX and TPHC were detected in six of the nine soil samples collected. Total BTEX concentrations ranged from 3,600 ppb in the 9 foot sample collected from TP-01 to 81,000 ppb in the 9 foot sample collected from TP-03. TPHC concentrations ranged from 130 ppm in the 4 foot sample collected from TP-05 to 940 ppm in the 9 foot sample collected from TP-03. All of the TerraProbe points encountered refusal prior to reaching the water table (Table 6.9-6; Figures 6.9-5 and 6.9-6).

A total of 15 TerraProbe points were completed and soil samples were collected from 9 to 10 feet bgs (the top of the bedrock), and analyzed for BTEX and TPHC. The TerraProbe points were concentrated in and around the former waste oil UST grave in front of Building 2446. The results of the field analyses indicate the presence of concentrations of TEX in and around the former waste oil UST excavation. The total TEX concentrations range from below the detection limit (at apparent upgradient locations) to 12,100 ppb at the northeast

ABB Environmental Services, Inc.

SECTION 6

(TP-25) side of the excavation. TPHC was detected less frequently than TEX and ranged from below the detection limit to 3,100 ppm. The distribution of the contamination has been roughly defined on the northwest and west sides of the excavation, however the northeast, east and southern sides have not been fully defined (see Table 6.9-6; Figure 6.9-7).

Based on the field analysis results and the observation from the UST excavation, one soil boring (43J-92-01X) was drilled to the top of bedrock to confirm the field analytical results. One subsurface soil sample was collected at the bedrock surface at 6.2 feet bgs. Xylenes (0.02 $\mu\text{g/g}$) and TPHC (1770 $\mu\text{g/g}$) were detected in this soil sample (Table 6.9-7; Figure 6.9-8).

Subsurface soil samples were collected from three of the four SS1 monitoring well borings (XJM-93-01X through XJM-93-03X) completed at SA 43J. A subsurface soil sample was not collected from XJM-93-04X due to the very shallow depth to bedrock (0.7 feet bgs). The only organic compounds detected in the SSI subsurface soil samples were common laboratory contaminants (acetone, di-n-butylphthalate, and trichlorofluoromethane). TPHC was detected in the 5-foot sample collected from XJM-93-02X at 220 $\mu\text{g/g}$. TPHC was not detected in the other samples collected (see Table 6.9-7; Figure 6.9-8). The results of the off-site laboratory analyses did indicate the presence of several inorganic analytes above their Fort Devens background concentrations. A majority of these analytes were detected in the 5-foot sample from XJM-93-02X (see Table 6.9-8; Figure 6.9-8).

6.9.5.2 Groundwater. The results indicated in ATEC's 10-day report showed detectable concentrations of TPHC ranging from 3 mg/L in MW-4 to 140 mg/L in MW-3. No TPHC was detected in MW-1 (Figure 6.9-9). Neither the final reports nor the QA/QC documentation had been received by Fort Devens at the time of this report. The results of the Round Three and Four groundwater sampling indicated that several VOCs were present in three of the newly installed monitoring wells (XJM-93-02X through XJM-93-04X) and in each of the existing monitoring wells. Total VOCs ranged from 8.9 at XJM-93-02 to 18,200 $\mu\text{g/L}$ at 2446-02 in the Round Three samples. Total VOC concentrations for the Round Four sampling ranged from 240 $\mu\text{g/L}$ at XJM-93-02X to 21,200 $\mu\text{g/L}$ at 2446-02. Several SVOCs (2-methylnaphthalene, naphthalene and phenanthrene) and TPHC were also detected in these same monitoring wells during Rounds Three and Four.

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Total SVOCs for Round Three ranged from 26.6 $\mu\text{g/L}$ at XJM-93-04 to 502.2 $\mu\text{g/L}$ at 2446-03, while total SVOCs for Round Four ranged from 23.6 $\mu\text{g/L}$ at XJM-93-02X to 358.2 $\mu\text{g/L}$ at 2446-02. Round Three TPHC concentrations ranged from <180 $\mu\text{g/L}$ to 34,500 $\mu\text{g/L}$ at 2446-03, and Round Four concentrations ranged from <190 $\mu\text{g/L}$ to 9,000 $\mu\text{g/L}$ at 2446-02 (Table 6.9-9; Figure 6.9-9).

Several inorganics were detected above their Fort Devens background concentrations in the unfiltered and filtered samples (see Table 6.9-9; Figure 6.9-10).

6.9.6 Source Evaluation and Migration Potential

The results of the TerraProbe survey and field analytical program indicate that VOCs (toluene, ethylbenzene, and xylenes) and TPHC are present in the soil at the top of bedrock in and around the excavation of the former waste oil UST. The distribution of the contamination is consistent with the UST removal report which indicated that residual soil contamination was present in the excavation at the time that the excavation was backfilled. The contamination appears to be on the southern, western and eastern sides of the former excavation. The contaminants appear to merge with contamination detected in the soil around the UST located at historic gas station J (approximately 25 feet northwest of the former waste oil UST). The distribution of the soil contamination has not been fully defined.

Soil samples were collected from the monitoring well borings located upgradient and downgradient of both of the former USTs. These soil samples were collected to determine if contaminants detected at SA 43J, and the former waste oil UST, had migrated with the groundwater flow and contaminated the soil away from the site. The only VOCs and SVOCs detected were laboratory contaminants. Several inorganic analytes were detected above their Fort Devens background concentration. The soil samples from 5 feet and 10 feet at XJM-93-02X had the largest number of inorganic analytes above the Fort Devens background and the highest concentrations of those analytes. The 15-foot soil sample from XJM-93-03X also had similar analytes and concentrations as those detected in the 10-foot soil sample collected from XJM-93-02X. It appears that the contaminants detected at the SA 43J have not impacted downgradient soil quality.

VOCs (benzene, ethylbenzene, toluene, and xylenes), SVOCs (2-methylnaphthalene, naphthalene, and phenanthrene), and TPHC were detected in groundwater samples collected from the downgradient monitoring wells at SA 43J. It appears that fuel-related contaminants have migrated from the contaminated soil detected around both former USTs to the groundwater; and appear to be adversely impacting the groundwater quality at the site as well as downgradient of the site. The distribution of the groundwater contamination has not been fully delineated.

6.9.7 Preliminary Human Health Risk Evaluation

Nine TerraProbe soil samples and one confirmatory soil boring were collected and analyzed in the field during the SI. The locations and results for these samples are discussed in Subsection 6.9.4.1. During the SSI, sixteen additional TerraProbe samples from the area of the removed waste oil UST were collected and analyzed. Table 6.9-10 combines and summarizes the additional SSI field analytical data with the SI field analytical data and the SI confirmatory boring off-site laboratory data. The analytical results for all field and off-site analytical samples from both the Historic gas station and the former waste oil UST, are compared to Region III commercial and MCP Category S-2 soil guidelines. Concentrations of toluene, ethylbenzene, and xylenes detected in the SSI samples, collected around the former waste oil UST, were at least an order of magnitude greater than concentrations detected in the SI samples collected at the historic gas station, but no concentrations exceeded guidelines. TPHC was detected in twelve of 25 samples, but only the maximum detected concentration of TPHC exceeds the MCP Category S-2 soil guideline. The confirmatory boring drilled during the SI was analyzed for lead, which was detected at a concentration of 10.9 , which is below the Region III and MCP Category S-2 soil guidelines. In summary, concentrations of TPHC in subsurface soil at SA 43J may present a risk to human health.

Table 6.9-11 presents summary statistics for groundwater associated with SA 43J and drinking water standards/guidelines for comparison. Only data for unfiltered samples is reported.

Several organic compounds were detected in the groundwater associated with SA 43J: 1,2-dichlorobenzene, 2-methylnaphthalene, benzene, chloroform, ethylbenzene, naphthalene, phenanthrene, toluene, xylenes, and TPHC. Chloroform was detected in two of 18 samples. Although the concentration of

chloroform exceeded the federal MCL, this compound is a common laboratory contaminant and is not believed to be site-related. Xylene and 1,2-dichlorobenzene were detected at concentrations that did not exceed a standard or guideline. Benzene, ethylbenzene, and toluene were detected at concentrations exceeding their respective federal MCLs. Although the PAHs do not have federal or state standards or guidelines, naphthalene does have a Region III tap water concentration of 1,500 $\mu\text{g/L}$. The maximum concentration of naphthalene does not exceed this health-protective concentration. Finally, both the average and maximum concentrations of TPHC exceed the MCP GW-1 standard of 1,000 $\mu\text{g/L}$.

The maximum concentrations of all inorganic analytes detected in unfiltered groundwater were greater than established base-wide background concentrations for groundwater. Six analytes were detected at concentrations above their respective drinking water standard/guideline. The average concentrations of aluminum, iron, and manganese each exceeded their respective USEPA secondary MCL. (Secondary MCLs are set for aesthetic or economic reasons, not health reasons.) The average concentration of sodium exceeds its Massachusetts guideline. Four of the 18 detections of arsenic exceed its federal MCL, although the average concentration does not. Three of 18 detections of lead as well as the average concentration is above the USEPA action level. In the filtered groundwater samples, three detections of arsenic exceed its federal MCL. None of the detected concentrations of lead in filtered groundwater are above the USEPA action level.

Based on this screening-level analysis, the use of this groundwater as a source of drinking water would pose potential human health risks.

6.9.8 Conclusions and Recommendations

An RI/FS is recommended SA 43J to further assess the soil and groundwater contamination detected during the SI and SSI.

TABLE 6.9-1
SUMMARY OF TECHNICAL APPROACH
SA 43J - HISTORIC GAS STATION J

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATION
SI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-10	* IN AND AROUND FORMER HGS UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* CHARACTERIZE SOILS CONTAMINATION * COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	43J-92-01X	* ADJACENT TO TERRAPROBE "HOT SPOT"
SSI PROGRAM			
TERRA PROBE	* COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-11 THRU TP-27	* IN AND AROUND FORMER WASTE OIL UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	* INSTALL MONITORING WELLS * CHARACTERIZE SOILS CONTAMINATION * COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	XIM-93-01X XIM-93-02X XIM-93-03X XIM-93-04X	* UPGRADIENT * DOWNGRADIENT
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	* MONITOR GROUNDWATER LEVELS * MONITOR GROUNDWATER QUALITY * DETERMINE AQUIFER CONDUCTIVITIES	XIM-93-01X XIM-93-02X XIM-93-03X XIM-93-04X	* UPGRADIENT * DOWNGRADIENT

TABLE 6.9-2
MONITORING WELL COMPLETION DETAILS
SA 43J - HISTORIC GAS STATION J

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (FEET bgs)	WELL SCREEN ELEVATION (FEET NGVD)	COMPLETION DEPTH (FEET bgs)	CONSTRUCTION MATERIAL
XJM-93-01X	DRIVE AND WASH CASING	ROCK CORE	BEDROCK	6.5-16.5	362.7-352.7	16.5	4" ID PVC
XJM-93-02X	HOLLOW STEM AUGER	NA	SOIL	5.9-15.9	365.2-355.3	15.9	4" ID PVC
XJM-93-03X	HOLLOW STEM AUGER	NA	SOIL	6.6-16.6	361.9-351.7	16.6	4" ID PVC
XJM-93-04X	DRIVE AND WASH CASING	ROCK CORE	BEDROCK	4.2-14.2	364.5-354.6	15.2	4" ID PVC

NA= Not Applicable

TABLE 6.9-3
ATEC FIELD SCREENING/LABORATORY RESULTS
SA 43J - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY	
	PID (ppm)	NDIR (ppm)	VOC (ppm)	TPH (ppm)
SS-1	350	759.9	N/A	N/A
SS-2	400	315.6	N/A	N/A
SS-3	200	43.9	N/A	N/A
SS-4	150	189.5	N/A	N/A
SS-5	100	3122	N/A	N/A
SS-6	100	3534.8	N/A	N/A
SS-7	300	469.2	N/A	N/A
SS-8	290	659.8	N/A	N/A
LRS-1	6.0	N/A	N/A	38
LRS-2	7.0	N/A	N/A	ND
LRS-3	170.0	N/A	2.2*	N/A
LRS-4	180.0	N/A	N/A	2170
LSS-1	N/A	N/A	0.572	1660
LWS-1	N/A	N/A	0.132	114

NOTES:

* = total VOCs detected

SS = ATEC Field Screening Sample

LRS = ATEC Laboratory Remedial Soil Sample

LSS = ATEC Laboratory Soil Sample

LWS = ATEC Laboratory Water Sample (Water Sample from the Excavation)

Stock = Soil Stock Pile Sample

ND = Non-detect

N/A = Not applicable

**TABLE 6.9-4
SUMMARY OF SOIL BORINGS
SA 43J - HISTORIC GAS STATION J
SITE INVESTIGATION REPORT
FORT DEVENS, MA**

EXPLORATION ID	COMPLETION DEPTH (FEET bgs)	REFERENCE SAMPLE INTERVALS (FEET bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43J-92-01X	6	5-6	5-6	SM	BKG	
XJM-93-01X	17	0-2 10-12 13-13.1	10-12	SP-SM SM-ML SM-SP	BKG BKG BKG	Rollerbit bedrock from 13.1 to 17-feet
XJM-93-02X	17.5	0-2 5-7 10-12 14-16	10-12	SP SM SM SM	BKG BKG BKG BKG	
XJM-93-03X	18	1-3 5-7 10-12 15-16.4	15-16.4	SW SM SM SM	BKG BKG BKG BKG	
XJM-93-04X	15.2					No spoons collected Phyllite cored from 3.5 to 15.2-feet

NOTES:

bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site.

TABLE 6.9-5
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 43J - HISTORIC GAS STATION J

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (FEET bgs)	ELEVATION OF WATER (FEET NGVD)	CONDUCTIVITY
				HVORSLEV ² (cm/sec)
XJM-93-01X	371.20	7.26	363.94	5.8E-06
XJM-93-02X	370.44	11.76	358.68	NA
XJM-93-03X	367.88	8.18	359.70	2.2E-05
XJM-93-04X	370.97	7.49	363.48	8.5E-06

Notes:

bgs = below ground surface

cm/sec = centimeters per second

NGVD = National Geodetic Vertical Datum

1 = elevation of top of pvc

2 = averaged value of two tests

Groundwater elevations from November 8, 1993.

synoptic water level round

TABLE 6.9-6
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43J - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

	TP-01	TP-01	TP-03	TP-05	TP-06	TP-07	TP-08	TP-09	TP-10	TP-11	TP-12	TP-13	TP-14
ANALYTE	TSI0105F	TSI0109F	TSI0309F	TSI0504F	TSI0609F	TSI0704F	TSI0809F	TSI0904F	TSI1004F	TSI1109F	TSI1209F	TSI1309F	TSI1409F
	5 FT	9 FT	9 FT	4 FT	9 FT	4 FT	9 FT	4 FT	4 FT	9 FT	9 FT	9 FT	9 FT
ORGANICS													
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 50
TOLUENE	710	770	17000	< 0.1	3400	< 0.1	< 0.1	< 0.1	< 0.1	4.1	< 0.1	< 0.1	1900
ETHYLBENZENE	3300	570	16000	< 0.1	15000	< 0.1	5400	< 0.1	< 0.1	8.7	< 0.1	< 0.1	1800
m/p-XYLENE	20000	2000	30000	< 0.1	29000	5300	13000	< 0.1	< 0.1	15	< 0.1	< 0.1	3200
o-XYLENE	10000	260	18000	< 0.1	11000	< 0.1	11000	< 0.1	< 0.1	5.6	< 0.1	< 0.1	520
OTHER													
TOTAL PETROLEUM HYDROCARBONS	NA	270	940	130	690	370	540	< 55	< 55	290	< 56	< 54	610

Notes:

< = Less than detection limit.

NA = Not analyzed

TABLE 6.9-6
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43J - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-16	TP-17	TP-17	TP-17	TP-18	TP-18	TP-19	TP-20	TP-22	TP-23	TP-24	TP-25	TP-26	TP-27
	TSJ1609F	TSJ1709F	9 FT	10 FT	TSJ1809F	9 FT	TSJ1909F	TSJ2009F	TSJ2209F	TSJ2309F	TSJ2409F	TSJ2509F	TSJ2609F	TSJ2709F
ORGANICS														
BENZENE	< 0.5	< 0.1	< 0.1	< 0.2	< 0.1	< 0.1	< 0.1	< 0.3	< 68	< 14	< 0.1	< 130	< 55	< 0.6
TOLUENE	< 0.5	< 0.1	< 0.1	31	< 0.1	< 0.1	< 0.1	77	< 68	< 14	< 0.1	< 130	< 55	7.2
ETHYLBENZENE	< 0.5	< 0.1	< 0.1	83	< 0.1	< 0.1	< 0.1	490	< 68	360	< 0.1	2400	450	< 0.6
m/p-XYLENE	10	1.0	< 0.1	110	0.9	< 0.1	< 0.1	970	1700	310	< 0.1	6400	820	7.3
o-XYLENE	13	0.8	< 0.1	43	< 0.1	< 0.1	< 0.1	190	650	460	< 0.1	3300	< 55	7.1
OTHER														
TOTAL PETROLEUM HYDROCARBONS	< 55	< 53	< 54	< 54	< 55	< 54	< 54	< 55	110	280	< 54	3100	< 54	< 55

Notes:

< = Less than detection limit.
NA = Not analyzed

TABLE 6.9-7
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43J - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI						SI	
	XJM-93-01X 10 FT	XJM-93-02X DUP 10 FT	XJM-93-02X 5 FT	XJM-93-02X 10 FT	XJM-93-03X 15 FT	XJM-93-01X 5 FT		
ORGANICS (ug/g)								
ACETONE	< 0.017	< 0.017	0.062	< 0.017	< 0.017	< 0.017		
DI-N-BUTYL PHTHALATE	0.14	0.13	< 0.1	0.12	< 0.061	< 0.1		
TRICHLOROFLUOROMETHANE	< 0.006	< 0.006	0.008	< 0.006	< 0.006	< 0.006		
XYLENES	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002		
OTHER (ug/g)								
TOTAL ORGANIC CARBON	495	649	1050	< 360	3370	NA		
TOTAL PETROLEUM HYDROCARBONS	< 28.5	< 28.8	220	< 28.5	< 28.5	1770		

Notes:

< = Less than detection limit.

TABLE 6.9-8
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43J - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI					SI
		XJM-93-01X 10 FT	XJM-93-02X DUP 10 FT	XJM-93-02X 5 FT	XJM-93-02X 10 FT	XJM-93-03X 15 FT	
INORGANICS (ug/g)							43J-92-01X 5 FT
ALUMINUM	15000.0	9680	6060	13900	5180	9220	NA
ARSENIC	21.0	15	15	28	13	17	NA
BARIUM	42.5	34	15.3	49	16.3	32.4	NA
CADMIUM	2.0	< 0.7	1.1	< 0.7	< 0.7	< 0.7	NA
CALCIUM	1400.0	1330	1350	1120	948	8940	NA
CHROMIUM	31.0	18.3	21.6	55.4	19.6	19.8	NA
COBALT	NA	6.67	7.73	12	8.08	8.68	NA
COPPER	8.39	12.3	16.8	20.6	14.2	13.3	NA
IRON	15000.0	15300	18300	25700	16700	17400	NA
LEAD	36.9	6.9	12	11	9.8	6.5	10.9
MAGNESIUM	5600.0	3400	3480	8220	2750	4590	NA
MANGANESE	300.0	276	494	425	532	322	NA
NICKEL	14.0	22.5	30	43	27.7	29.7	NA
POTASSIUM	1700.0	1460	481	2940	506	1410	NA
SODIUM	131.0	362	354	422	311	431	NA
VANADIUM	28.7	13.6	8.36	31.4	7.96	13.7	NA
ZINC	35.3	37	38.9	52.3	36	42	NA

Notes:

< = Less than detection limit.

Shaded values exceed background limit.

TABLE 6.9-9

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TABLE 6.9-9
ANALYTES IN GROUNDWATER
SA 43 J - HISTORIC GAS STATION J
REMEDIAL INVESTIGATION REPORT
FORT DEVENS, MA

Site ID: Sample Date: Depth: Field Sample Number:	ROUND 4		ROUND 3		ROUND 4		ROUND 3		ROUND 4		ROUND 3	
	2446-43 8/12/794 15 MX-460332	2446-43 8/12/794 15 MX-460332	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433	2446-44 8/12/794 15 MX-460433
PAL CATIONS/ANIONS (µg/L)												
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL METALS (µg/L)												
Aluminum	6870	8480	141	17300	141	17300	141	17300	141	17300	141	17300
Antimony	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03
Arsenic	10.5	61.7	65.1	42.1	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Barium	39.6	63	23.9	119	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9
Calcium	14700	34000	33500	64300	58100	58100	58100	58100	58100	58100	58100	58100
Chromium	14.7	15.2	6.02	35.4	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02
Cobalt	25	25	25	25	25	25	25	25	25	25	25	25
Copper	8.09	20.8	8.09	29.1	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09
Iron	9100	31600	18100	33900	1820	1820	1820	1820	1820	1820	1820	1820
Lead	4.25	23.5	2.28	13.9	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
Magnesium	3480	13100	11000	20600	14600	14600	14600	14600	14600	14600	14600	14600
Manganese	291	900	8580	4780	3480	3480	3480	3480	3480	3480	3480	3480
Nickel	34.3	34.3	34.3	49.4	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3
Potassium	2370	3630	2380	7780	3250	3250	3250	3250	3250	3250	3250	3250
Sodium	10800	45000	48700	69600	60000	60000	60000	60000	60000	60000	60000	60000
Vanadium	11	11	11	30.9	11	11	11	11	11	11	11	11
Zinc	21.1	117	21.1	65.3	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
PAL SEMIVOLATILE ORGANICS (µg/L)												
1,2-dichlorobenzene	<	1.7	NA	2.8	NA	NA	2.5	3.6 D	NA	NA	1.7	1.7
1,4-dichlorobenzene	<	5.8	NA	5.8	NA	NA	5.8	5.8 D	NA	NA	5.8	5.8
2,4-dimethylphenol	<	44	NA	13	NA	NA	13	22 D	NA	NA	1.7	1.7
2-methylnaphthalene	<	3.9	NA	3.9	NA	NA	3.9	3.9 D	NA	NA	3.9	3.9
2-methylphenol / 2-creosol	<	1.2	NA	0.52	NA	NA	0.52	0.52 D	NA	NA	0.52	0.52
4-methylphenol / 4-creosol	<	6.9	NA	100	NA	NA	4.8	4.8 D	NA	NA	4.8	4.8
Bis (2-ethylhexyl) Phthalate	<	100	NA	60	NA	NA	70	100 D	NA	NA	0.5	0.5
Naphthalene	<	0.5	NA	0.5	NA	NA	0.5	0.5 D	NA	NA	0.5	0.5
Phenanthrene	<	10	NA	2	NA	NA	10	1000	NA	NA	0.5	0.5
PAL VOLATILE ORGANICS (µg/L)												
1,2-dichloroethylenes (cis And Trans Isomers)	<	2000	NA	2	NA	NA	10	20 D	NA	NA	0.5	0.5
Xylenes	<	300	NA	2	NA	NA	1000	900 D	NA	NA	0.84	0.84
Acetone	<	10	NA	60	NA	NA	300	100 D	NA	NA	0.5	0.5
Benzene	<	50	NA	50	NA	NA	70	80 D	NA	NA	0.5	0.5
Carbon Tetrachloride	<	10	NA	3	NA	NA	10	6 D	NA	NA	0.58	0.58
Chloroform	<	10	NA	2	NA	NA	10	8 D	NA	NA	0.5	0.5
Ethylbenzene	<	2000	NA	300	NA	NA	1000	1000 D	NA	NA	0.5	0.5
Methylene Chloride	<	60	NA	10	NA	NA	20	20 D	NA	NA	2.3	2.3
Toluene	<	1000	NA	200	NA	NA	500	400 D	NA	NA	0.5	0.5
PAL WATER QUALITY PARAMETERS (µg/L)												
Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite, Nitrate-nitrogen Specific	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen By Kjeldahl Method	NA	NA	NA	NA	NA	NA	450000	440000 D	NA	NA	NA	NA
Total Dissolved Solids	340000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Hardness	700000	NA	NA	1080000	NA	NA	1400000	1200000 D	NA	NA	638000	411000 D
Total Suspended Solids	1100	NA	NA	781	NA	NA	670	200 D	NA	NA	180	192 D
OTHER (µg/L)												
Total Petroleum Hydrocarbons												

TABLE 6.9-9
ANALYTES IN GROUNDWATER
SA 43 J - HISTORIC GAS STATION J
REMEDIAL INVESTIGATION REPORT
FORT DEVENS, MA

Site ID: Sample Date: Depth: Field Sample Number:	ROUND 3			ROUND 4			ROUND 3			ROUND 4			ROUND 3			ROUND 4		
	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1	XJM-93-01X 10/04/93 11.5 MXXJ01X1
PAL CATIONS/ANIONS (µg/L)																		
Chloride	6870	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141	141
Phosphate	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03	3.03
Sulfate	10.5	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54
Aluminum	39.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Antimony	14700	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500	53500
Arsenic	14.7	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.02
Barium	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Bismuth	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09
Calcium	9100	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Chromium	4.25	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
Cobalt	291	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5
Copper	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3
Iron	2370	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120
Lead	10800	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400
Magnesium	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Manganese	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Nickel	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3
Potassium	2370	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120
Sodium	10800	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400	22400
Vanadium	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Zinc	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
PAL SEMI-VOLATILE ORGANICS (µg/L)																		
1,2-dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylphenol / 2-cresol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-methylphenol / 4-cresol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis (2-ethylhexyl) Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL VOLATILE ORGANICS (µg/L)																		
1,2-dichloroethylenes (cis And Trans Isomers)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
xylenes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL WATER QUALITY PARAMETERS (µg/L)																		
Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite, Nitrate-non Specific	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen By Kjeldahl Method	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Hardness	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Suspended Solids	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OTHER (µg/L)																		
Total Petroleum Hydrocarbons	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 6.9-9
ANALYTES IN GROUNDWATER
SA 43 J - HISTORIC GAS STATION J
REMEDIAL INVESTIGATION REPORT
FORT DEVENS, MA

Site ID: Sample Date: Depth: Field Sample Number:	ROUND 3			ROUND 4			ROUND 3			ROUND 4			AVERAGE UNFILTERED SAMPLES	DIVIDED BY # OF SAMPLES
	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X	XJM-93-43X			
	10/07/93 11.5 MXCJ03X1	10/07/93 11.5 MXCJ03X1	10/07/93 11.5 MXCJ03X1	8/12/794 11.5 MXCJ03X2	8/12/794 11.5 MXCJ03X2	8/12/794 11.5 MXCJ03X2	10/07/93 11.5 MXCJ03X1	10/07/93 11.5 MXCJ03X1	10/07/93 11.5 MXCJ03X1	8/12/794 11.5 MXCJ03X2	8/12/794 11.5 MXCJ03X2			
PAL CATIONS/ANIONS (µg/L)														
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAL METALS (µg/L)														
Aluminum	6870	764	141	F	5260	141	F	41	141	F	150	F	20464.17	1136.90
Antimony	3.03	3.03	3.04	F	3.03	3.03	F	3.03	3.03	F	3.03	F	3.41	0.19
Arsenic	10.5	9.81	8.21	F	20	7.89	F	36.4	36.2	F	11.1	F	35.71	1.98
Barium	39.6	45.6	32.2	F	58	39.2	F	46.9	40.8	F	541	F	146.59	8.14
Calcium	14700	65300	66100	F	59900	62400	F	44800	42700	F	60900	F	59288.89	3293.83
Chromium	14.7	6.02	6.02	F	13.5	6.02	F	6.02	6.02	F	6.02	F	40.83	2.27
Cobalt	25	25	25	F	25	25	F	25	25	F	25	F	33.83	1.88
Copper	8.09	8.09	8.09	F	11.5	8.09	F	8.09	8.09	F	8.43	F	35.50	1.97
Iron	9100	1360	49.6	F	10000	414	F	4690	5370	F	4690	F	44217.22	2456.51
Lead	4.25	2.39	4.12	F	5.97	1.26	F	1.84	1.41	F	3.36	F	21.55	1.20
Magnesium	3480	18800	20100	F	16200	15100	F	16000	15400	F	25200	F	20443.89	1135.77
Manganese	291	60	2020	F	2750	2580	F	3090	3430	F	2490	F	6968.22	387.12
Nickel	34.3	4.3	34.3	F	34.3	34.3	F	34.3	34.3	F	42.4	F	76.19	4.23
Potassium	2370	3450	4060	F	4680	3570	F	10600	4350	F	4070	F	7094.44	394.14
Sodium	10800	78500	74700	F	64600	66900	F	31800	23500	F	179000	F	51572.22	2865.12
Vanadium	11	11	11	F	11	11	F	11	11	F	11	F	31.98	1.78
Zinc	21.1	24.3	21.1	F	33.7	21.1	F	21.1	21.1	F	114	F	112.22	6.23
PAL SEMIVOLATILE ORGANICS (µg/L)														
1,2-dichlorobenzene	<	1.7	NA	<	1.7	NA	<	1.7	NA	<	1.7	NA	4.78	0.27
1,4-dichlorobenzene	<	1.7	NA	<	1.7	NA	<	1.7	NA	<	1.7	NA	3.83	0.21
2,4-dimethylphenol	<	5.8	NA	<	5.8	NA	<	5.8	NA	<	5.8	NA	11.24	0.62
2-methylnaphthalene	<	1.7	NA	<	1.7	NA	<	1.7	NA	<	1.7	NA	22.11	1.23
2-methylphenol / 2-cresol	<	3.9	NA	<	3.9	NA	<	3.9	NA	<	3.9	NA	9.34	0.52
4-methylphenol / 4-cresol	<	0.52	NA	<	0.52	NA	<	0.52	NA	<	1.2	NA	1.82	0.10
Bis (2-ethylhexyl) Phthalate	<	4.8	NA	<	4.9	NA	<	4.8	NA	<	4.8	NA	31.01	1.72
Naphthalene	<	0.5	NA	<	30	NA	<	60	NA	<	20	NA	81.09	4.50
Phenanthrene	<	0.5	NA	<	0.5	NA	<	0.5	NA	<	0.5	NA	1.12	0.06
PAL VOLATILE ORGANICS (µg/L)														
1,2-dichloroethanes (cis And Trans Isomers)	<	5	NA	<	2	NA	<	10	NA	<	5	NA	14.92	0.83
Xylenes	<	800	NA	<	40	NA	<	1000	NA	<	400	NA	1763.41	97.97
1,2-dichloroethane	<	100	NA	<	4	NA	<	300	NA	<	5	NA	30.31	1.68
Acetone	<	200	NA	<	100	NA	<	70	NA	<	200	NA	241.39	13.41
Benzene	<	6	NA	<	3	NA	<	10	NA	<	6	NA	66.99	3.72
Carbon Tetrachloride	<	20	NA	<	2	NA	<	10	NA	<	5	NA	16.66	0.93
Chloroform	<	500	NA	<	100	NA	<	500	NA	<	100	NA	15.08	0.84
Ethylbenzene	<	20	NA	<	10	NA	<	60	NA	<	50	NA	1033.47	57.42
Methylene Chloride	<	20	NA	<	10	NA	<	60	NA	<	50	NA	61.75	3.43
Toluene	<	600	NA	<	100	NA	<	500	NA	<	100	NA	1068.74	59.37
PAL WATER QUALITY PARAMETERS (µg/L)														
Alkalinity	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11277.78	626.34
Nitrite, Nitrate-non Specific	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.00	1.94
Nitrogen By Kjeldahl Method	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.94	1.94
Total Dissolved Solids	NA	NA	NA	NA	430000	NA	NA	NA	NA	NA	NA	NA	123333.33	6851.85
Total Hardness	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10666.67	592.59
Total Suspended Solids	42000	340000	NA	NA	340000	NA	NA	9000	NA	NA	21000	NA	210688.89	117049.38
OTHER (µg/L)														
Total Petroleum Hydrocarbons	1030	NA	NA	NA	210	NA	NA	3350	NA	NA	1700	NA	6384.61	354.70

TABLE 6.9-10
HUMAN HEALTH PRE EVALUATION OF SUBSURFACE SOIL
SA 43J - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
ORGANICS (ug/kg)						
TOLUENE	9/26	2655.5	17000	200000000	90000	NO
ETHYLBENZENE	12/26	3821.8	16000	100000000	80000	NO
m/p-XYLENE*	18/25	6269.1	30000	1000000000	800000	NO
o-XYLENE*	15/25	3696.6	18000	1000000000	800000	NO
XYLENE (TOTAL)**	1/1	-	0.022	1000000000	800000	NO
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	12/25	758.3	3100	1680	2500	YES

Notes:

[a] Subsurface soil (3 to 15 feet) based on field analytical samples TP-01 through TP-10 from 1992, TP-11 through TP-18 from 1993, and soil boring 43J-92-01X.

ug/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

- = not applicable

MCP = Massachusetts Contingency Plan

Shaded compounds exceed standard or guideline.

* = analyte from field screening samples.

** = analyte from laboratory analytical samples.

TABLE 6.9-11
HUMAN HEALTH PRE EVALUATION OF GROUNDWATER
SA 43J - HISTORIC GAS STATIONS
SITE INVESTIGATION REPORT
FORT DEVENS, MA

Analyte	Frequency Of Detection	Detected Concentration [a]		Groundwater Background Concentration (µg/L)	Maximum Exceeds Background ?	Drinking Water Standard/ Guideline [b] (µg/L)	Maximum Exceeds Standard/ Guideline ?
		Concentration [a]					
		Average (µg/L)	Maximum (µg/L)				
ORGANICS							
1,2-DICHLOROBENZENE	6/18	4.55	8.1	NA	-	600	NO
2-METHYLNAPHTHALENE	12/18	32.31	100	NA	-	NA	-
BENZENE	14/18	85.66	200	NA	-	5	YES
CHLOROFORM	2/18	14	20	NA	-	5	YES
ETHYLBENZENE	13/18	1430.7	4000	NA	-	700	YES
NAPHTHALENE	13/18	112.1	400	NA	-	1500	NO
PHENANTHRENE	1/18	2.2	2.2	NA	-	NA	-
TOLUENE	14/18	1373.9	8000	NA	-	1000	YES
XYLENES	14/18	2267	9000	NA	-	10000	NO
INORGANICS							
ALUMINUM	15/18	23403	29200	6870	YES	50-200	YES
ANTIMONY	3/16	5.3	6.34	3.03	YES	6	YES
ARSENIC	18/18	36.4	90.8	10.5	YES	50	YES
BARIUM	18/18	143	541	39.6	YES	2000	NO
CALCIUM	18/18	59011	97300	14700	YES	NA	-
CHROMIUM	15/18	44.14	54.8	14.7	YES	100	NO
COBALT	5/18	59.48	89	25	YES	NA	-
COPPER	15/18	42.39	140	8.09	YES	1300	NO
IRON	18/18	44333.9	191000	9100	YES	300	YES
LEAD	18/18	22.33	44.6	4.25	YES	15	YES
MAGNESIUM	18/18	20352.7	25900	3480	YES	NA	-
MANGANESE	18/18	7542.6	17200	291	YES	50	YES
NICKEL	9/18	122.9	308	34.3	YES	100	NO
POTASSIUM	18/18	6913.3	69600	2370	YES	NA	-
SODIUM	18/18	50444.4	78500	10800	YES	28000	YES
VANADIUM	13/18	39.5	126	11	YES	260	NO
ZINC	17/18	117.2	375	21.1	YES	5000	NO
OTHER							
TOTAL PETROLEUM HYDROCARBONS	11/18	10326.4	55000	NA	-	1000	YES

Notes:

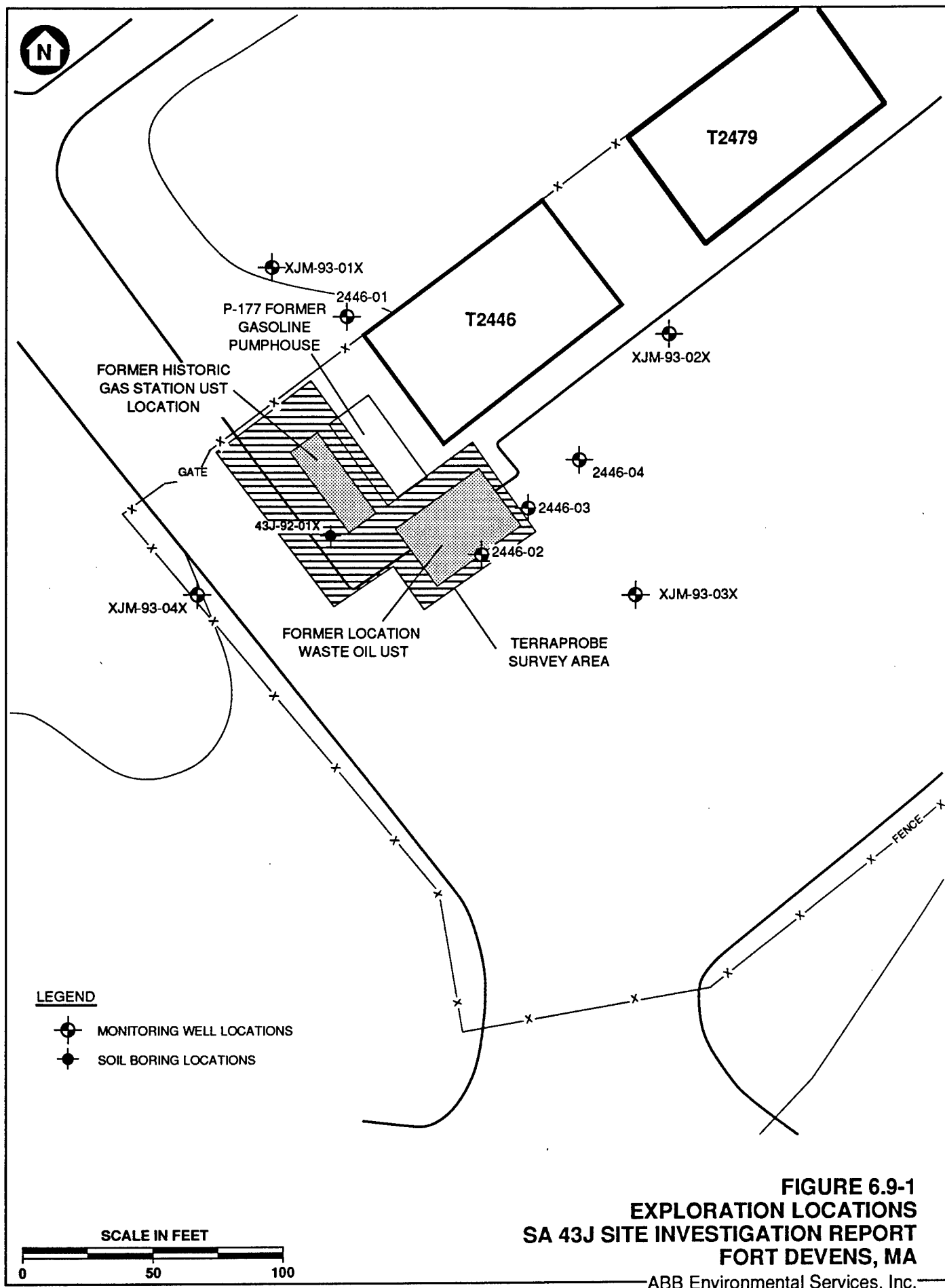
[a] Groundwater based on unfiltered samples from 2446-02 to 2446-04 and XJM-93-01X (1 duplicate) to XJM-93-04X.
[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

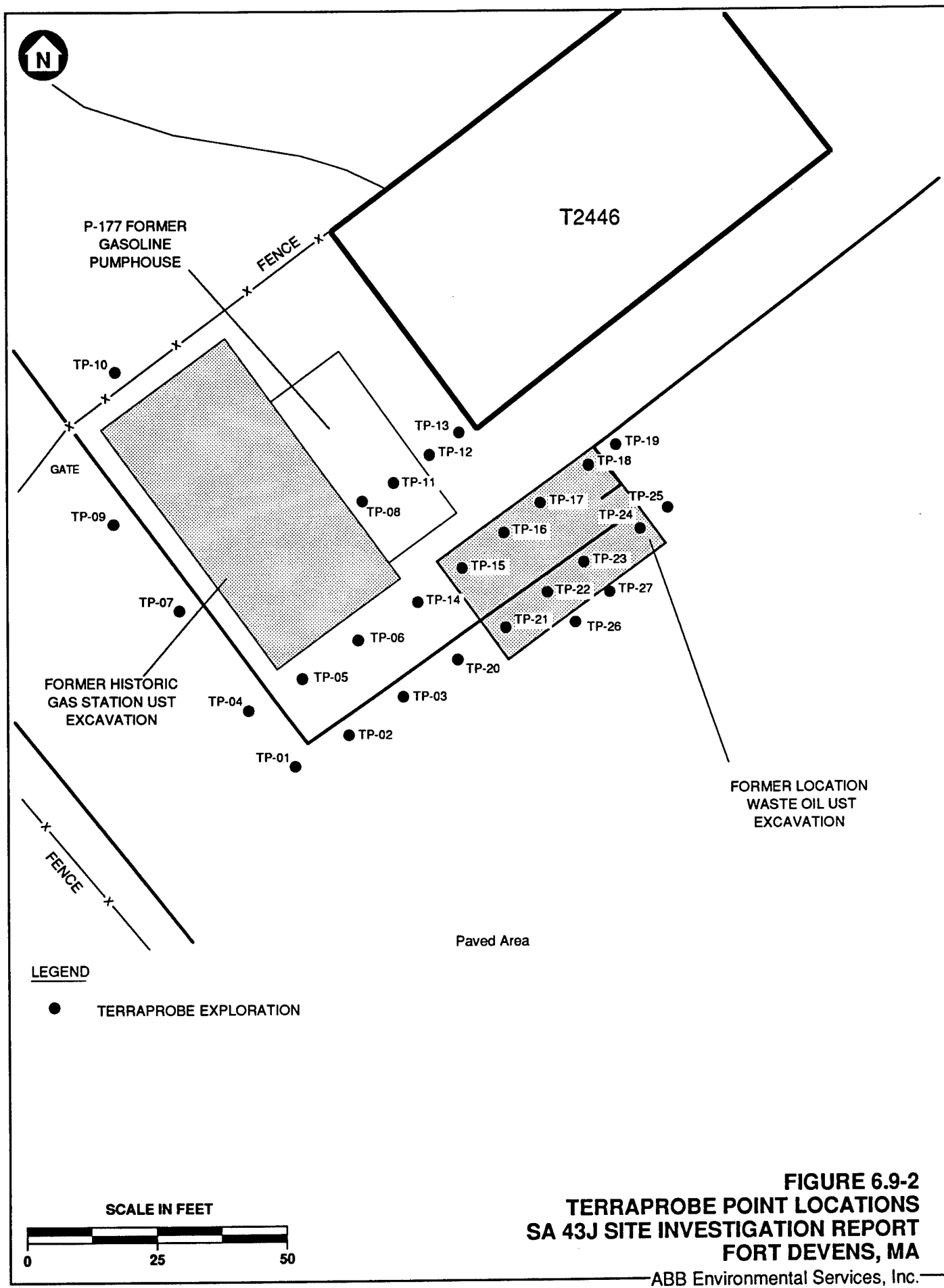
NA = not available

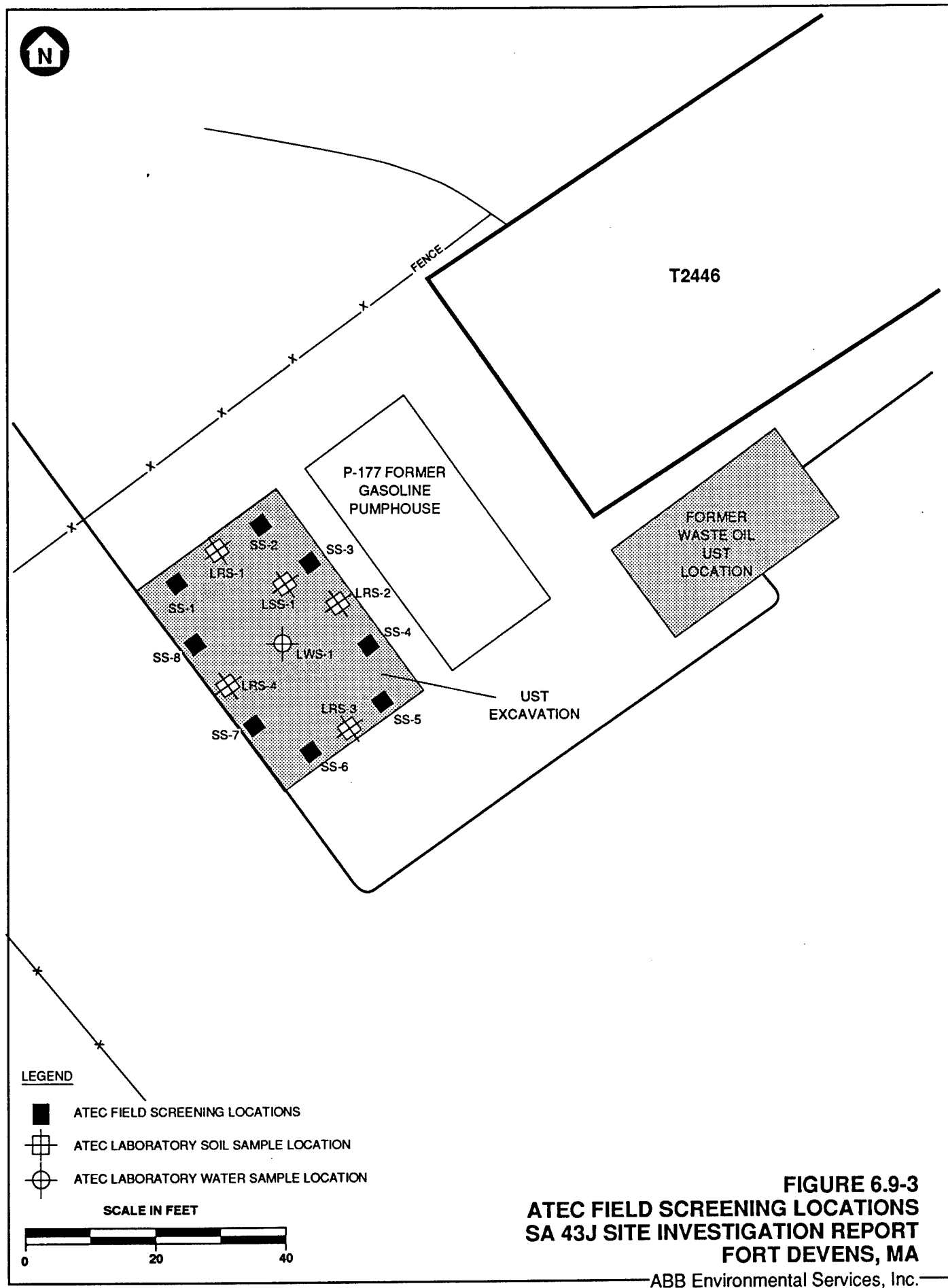
µg/L = micrograms per liter

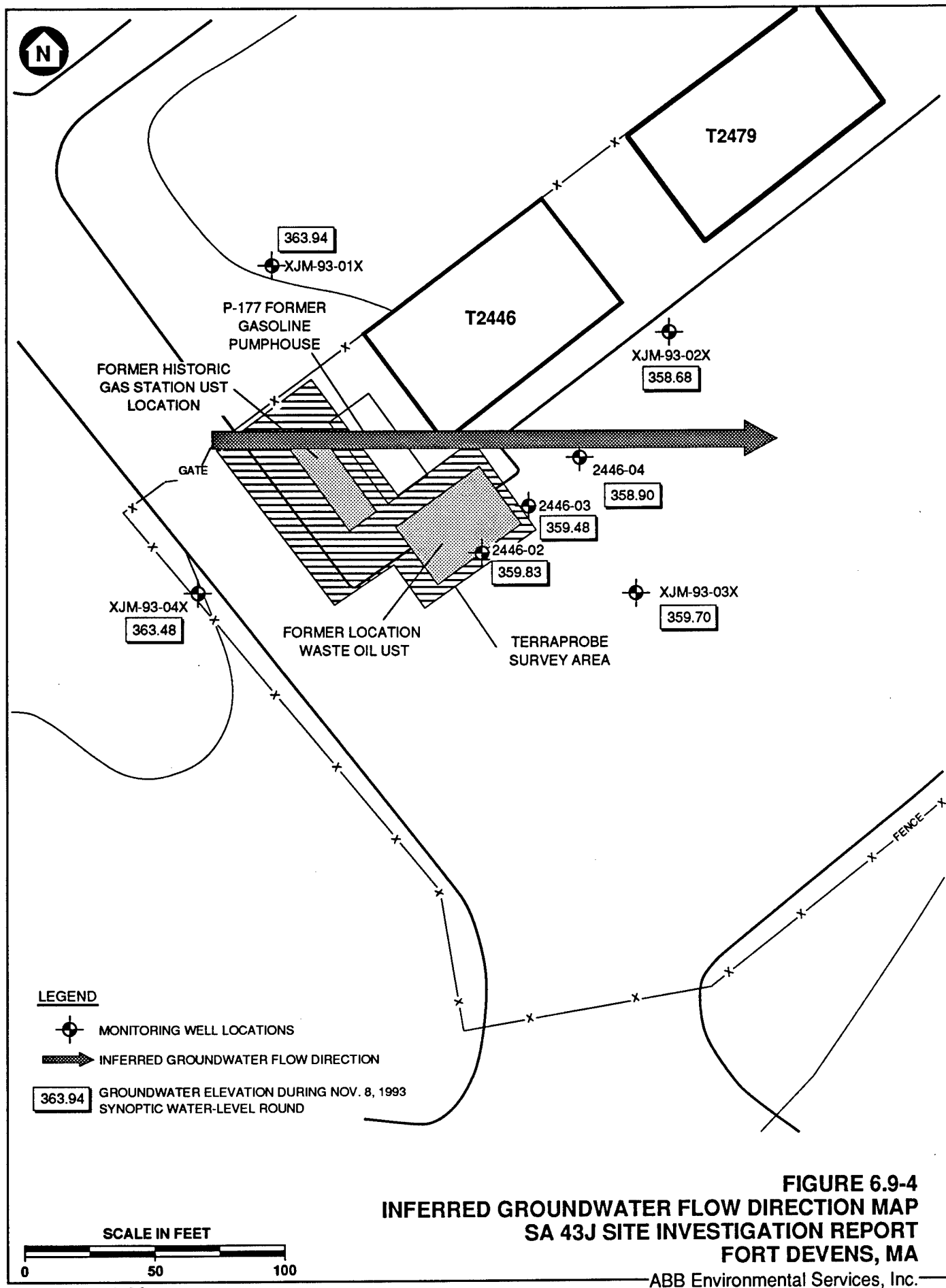
- = not applicable

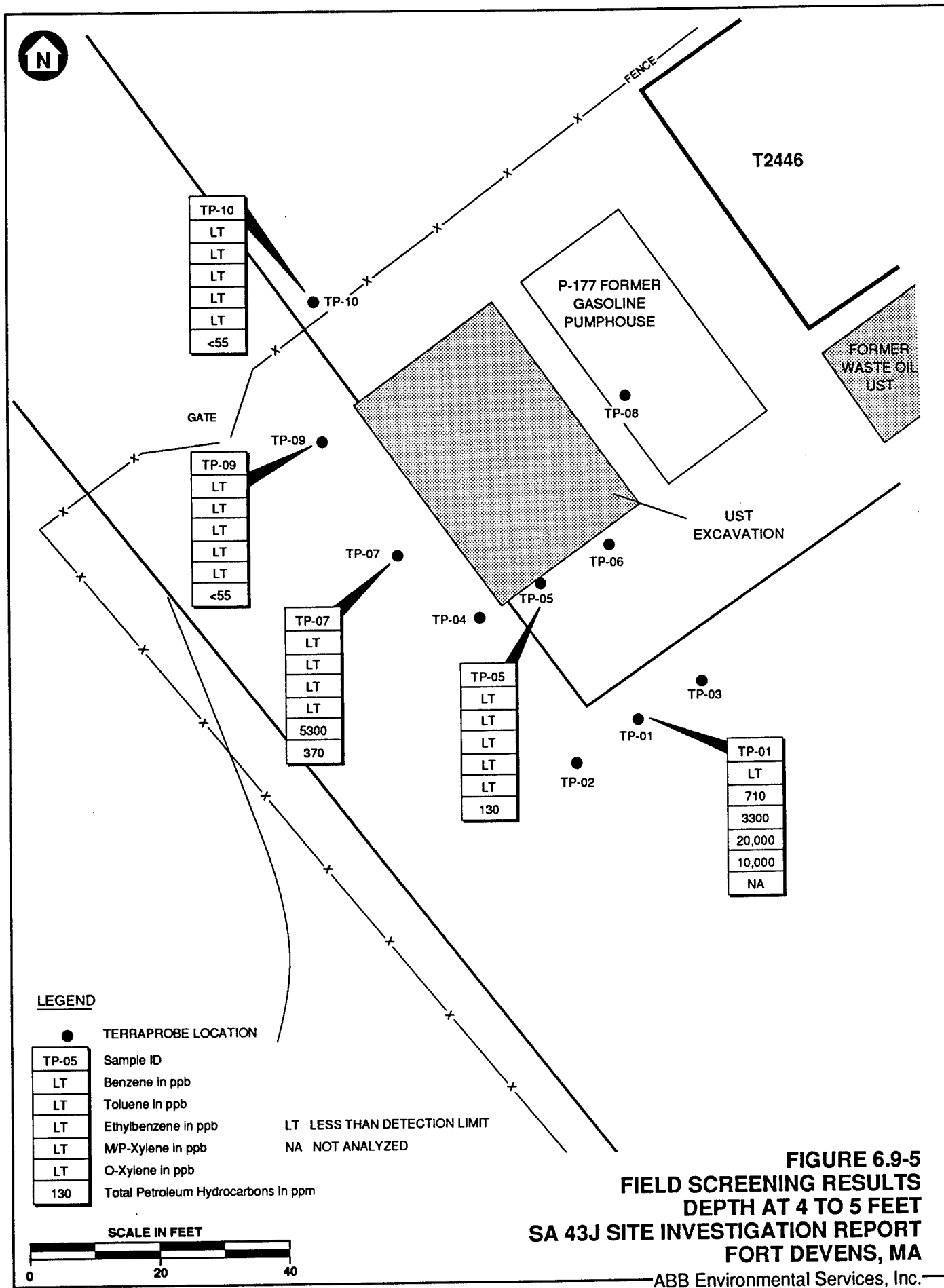
Shaded compounds exceed standard or guideline.

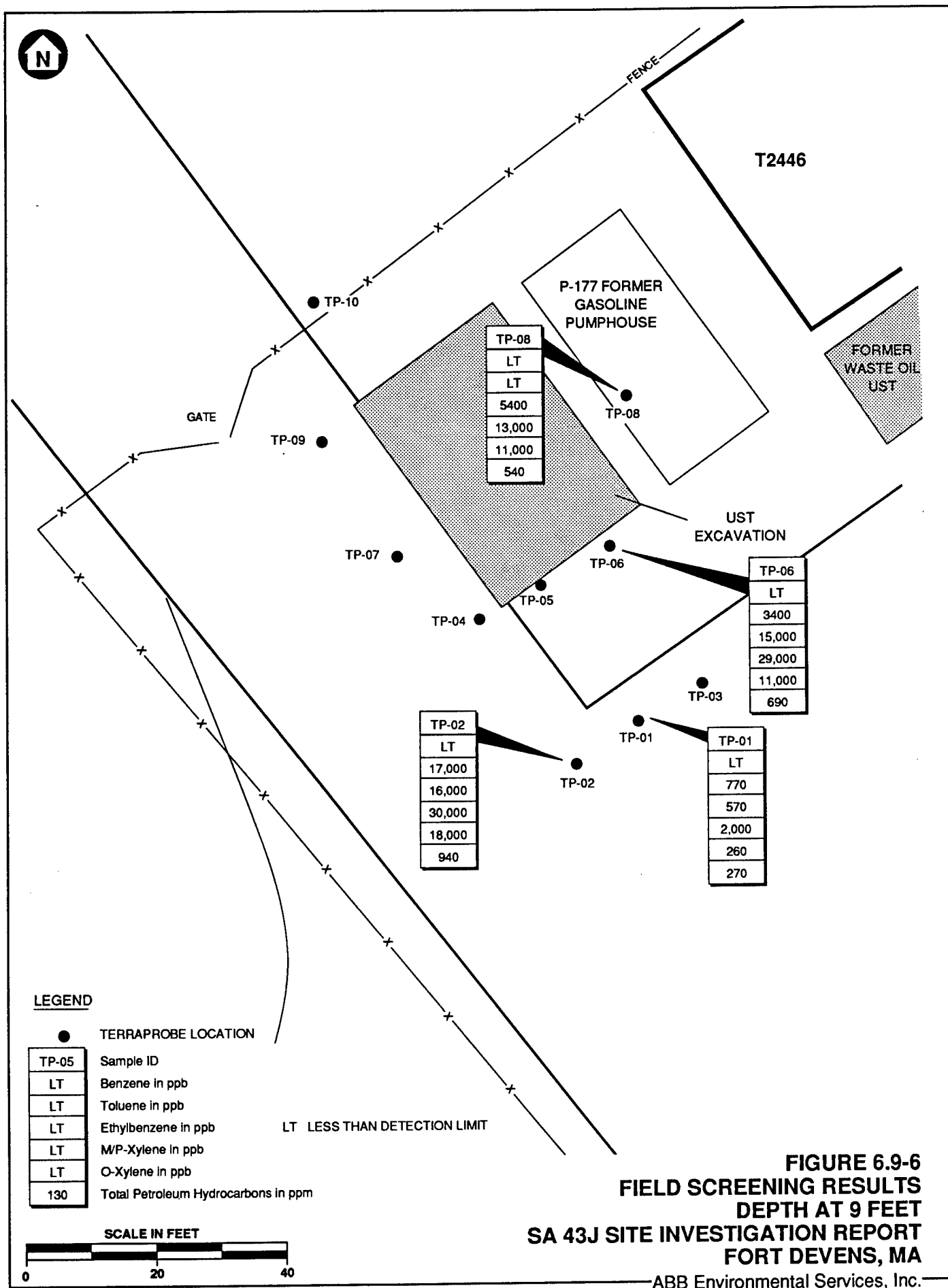


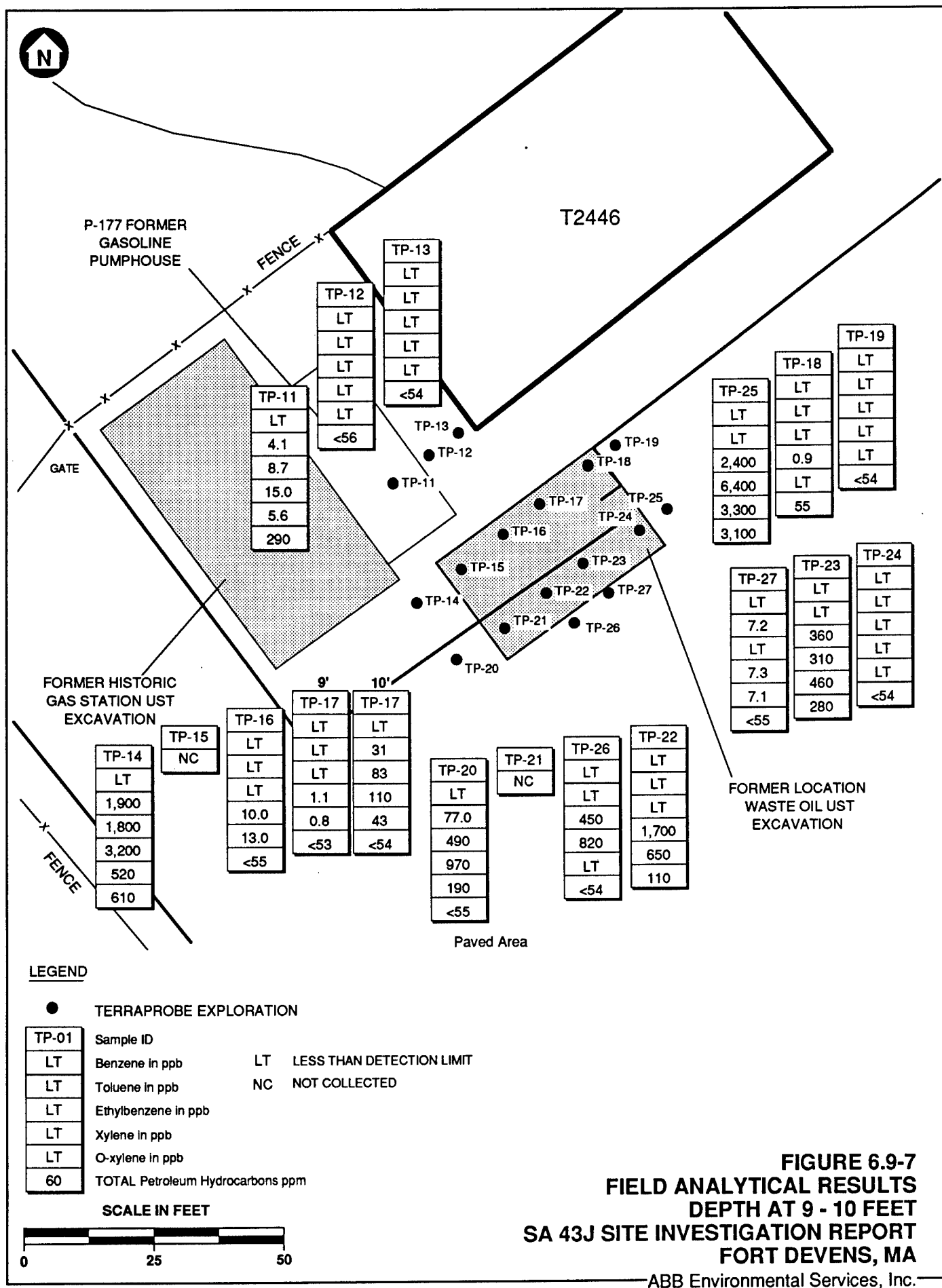


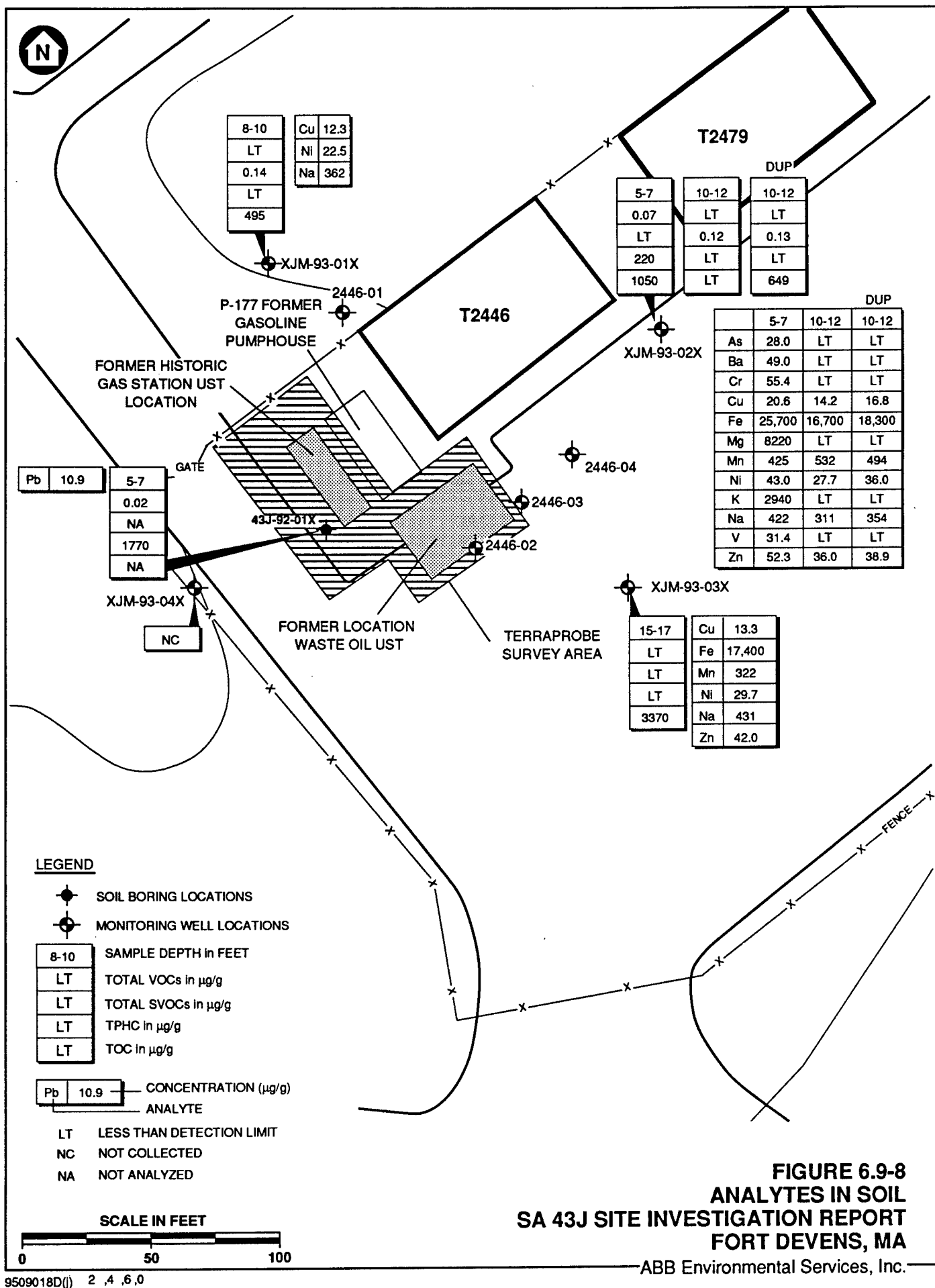


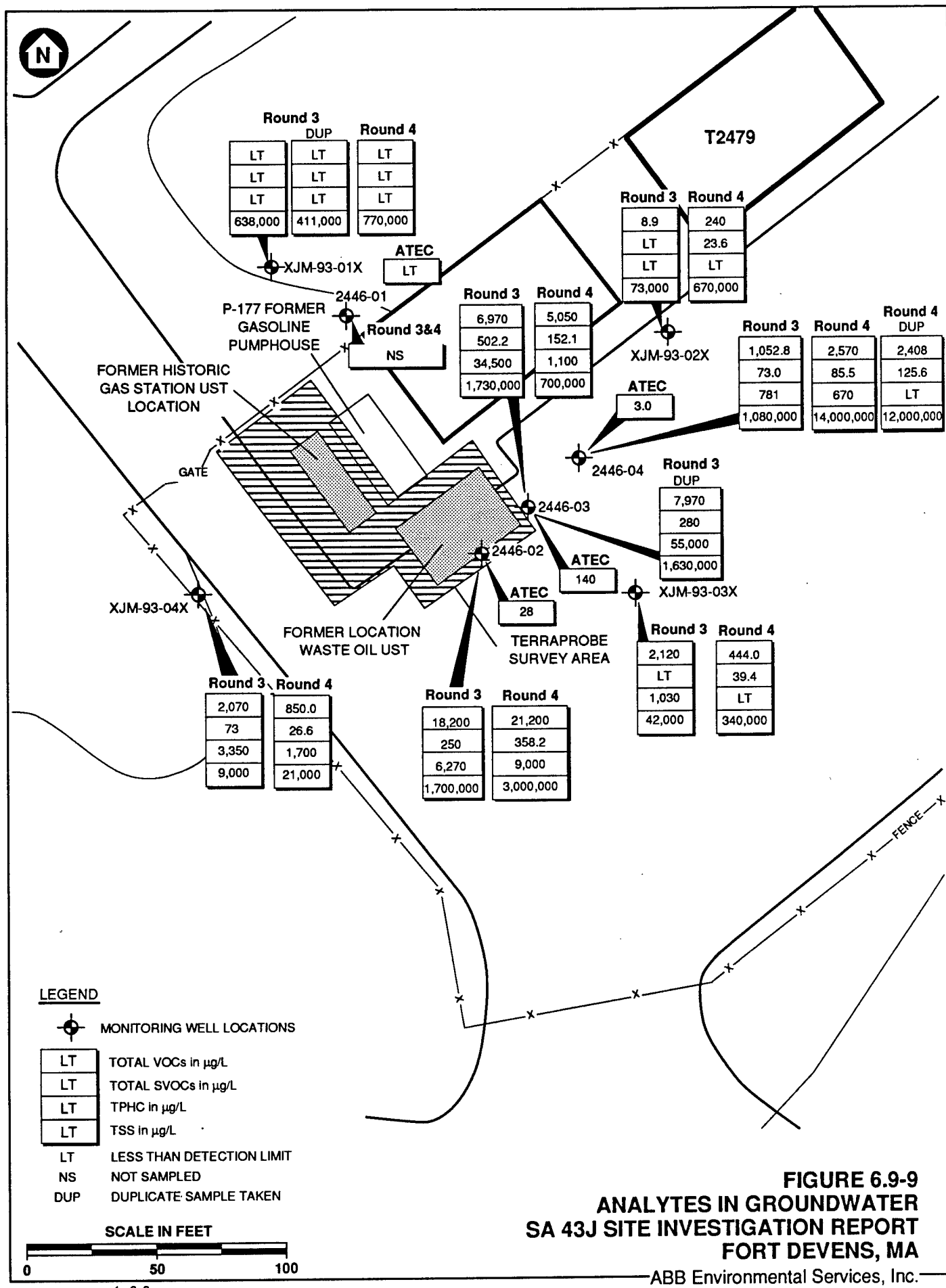












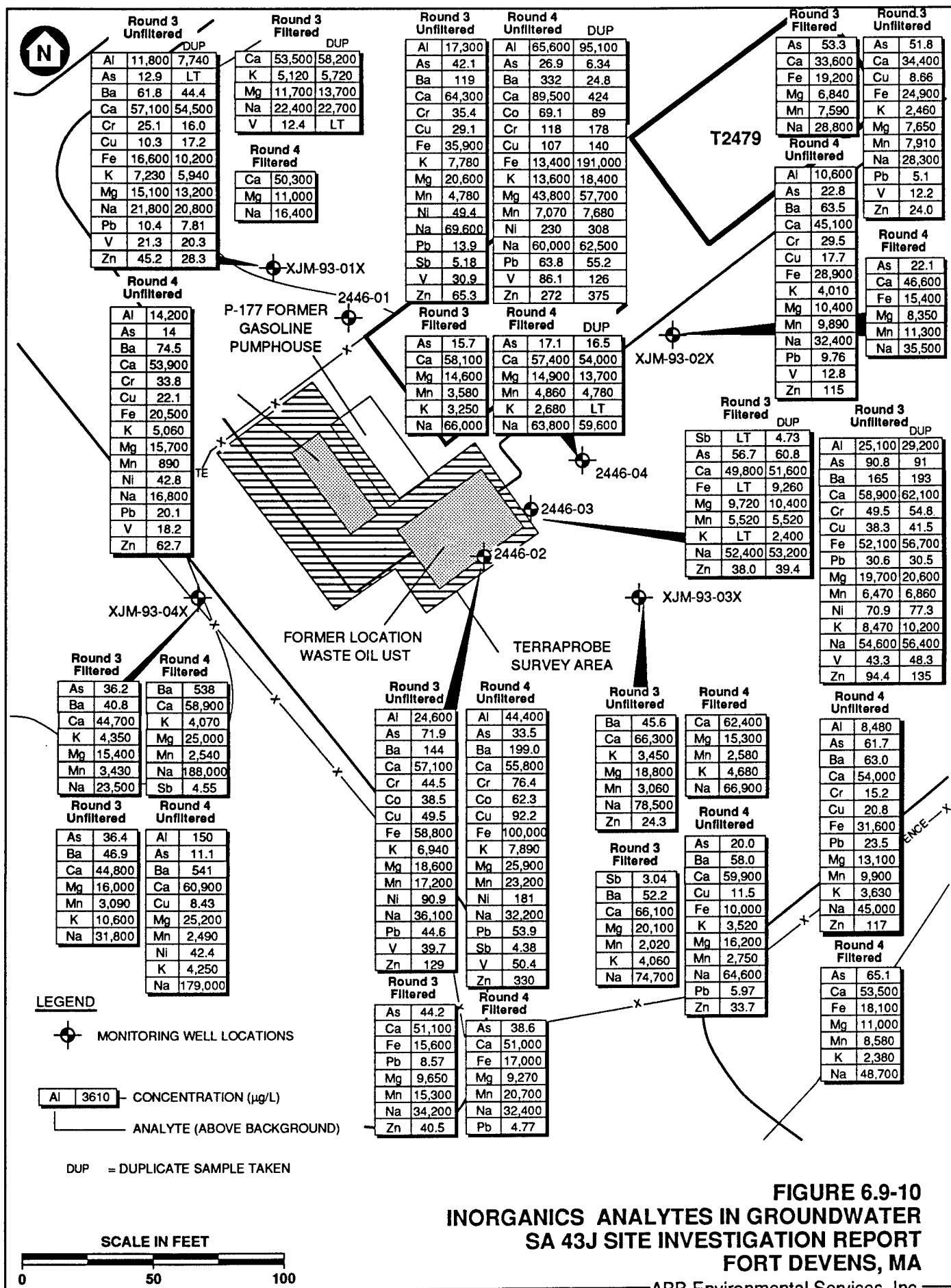


FIGURE 6.9-10
INORGANICS ANALYTES IN GROUNDWATER
SA 43J SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.10 STUDY AREA 43K

6.10.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43K consisted of a pump island and a small gasoline pumphouse. This gas station was a Type A station which had one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. SA 43K is located approximately 1,500 feet west of SA 43J on an access road off Patton Road. The area around the reported location of SA 43K is presently a recreational vehicle storage yard and maintenance facility for Fort Devens Directorate of Logistics. The pumphouse associated with the historic gas station (Building T-2514) appears to still be present at the site. The yard and maintenance facility is paved and surrounded by a chain-linked fence with a locked gate located on the northeast side of the yard (Figure 6.10-1).

6.10.2 Study Area Investigation Program Summary

A field investigation was conducted at SA 43K to determine if any abandoned UST(s) were present at the site, and if any residual contamination was present in the subsurface soil. The program consisted of a surficial geophysical survey, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring to collect subsurface soil samples for laboratory analysis.

The geophysical survey at SA 43K consisted of a metal detector and GPR survey (Figure 6.10-2).

Ten TerraProbe points were advanced to the water table and a single subsurface soil sample was collected from each point. All of the subsurface soil samples collected with the TerraProbe unit were analyzed in the field for BTEX compounds and TPHC (see Figure 6.10-2).

One soil boring (43K-92-01X) was drilled to the water table and a single soil sample was collected to confirm the field screening results. This soil sample was

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SECTION 6

collected from the water table (5 feet) and was analyzed in the laboratory for VOCs, TPHC, and lead (see Figure 6.10-2).

6.10.3 Field Investigation Results and Observations

The soil below SA 43K consists of a sandy silt with gravel. Groundwater was encountered at 5 feet bgs. Bedrock was not encountered in this boring.

The results of the geophysical survey at SA 43K indicated that one abandoned UST was present at the site (see Figure 6.10-2). The results of the geophysical surveys are presented in Appendix L.

The abandoned UST was added to the installation's UST removal program and on September 3, 1992 ATEC removed a 5,000 gallon UST from SA 43K. At the time of the removal, the tank was full of gasoline and water (ATEC, 1992j). The UST was half submerged in the groundwater, which was observed at approximately 5 feet in the excavation. Visually contaminated soil and groundwater were observed at and above the water in the excavation. ATEC performed field screening on eight soil samples (SS-1 through SS-8) collected from the excavation at 5 to 6 feet bgs (Figure 6.10-3). VOC concentrations (measured by PID in soil headspace) ranged from 0.5 to 190 ppm, and TPHC levels, measured on a NDIR, were from 22.1 to 88.7 ppm (ATEC, 1992j). Based on these results, ATEC removed more soil from the excavation and collected four additional soil samples (LRS-1 through LRS-4). VOCs ranged from 1 to 4 ppm in the soil headspace and TPHC concentrations (measured in the laboratory) ranged from 15 ppm to 58 ppm. The 58 ppm of TPHC was found in the southeast corner of the excavation. No VOCs were detected in the one soil sample (LRS-3) analyzed in the laboratory for VOCs. One groundwater sample (LWS-1) was collected from the excavation and analyzed in the laboratory for TPHC only (see Figure 6.10-3). A concentration of 22 mg/L of TPHC was detected in LWS-1 (Table 6.10-1). Due to these results, ATEC lined the southeast corner of the excavation with polyethylene sheeting and backfilled the entire excavation with clean fill. Based on the results of the ATEC field screening, this UST removal was classified as a successful UST removal and no further soil removal or remediation was conducted.

To determine whether contamination had migrated laterally along the water table, soil samples were collected at ten TerraProbe points around the excavation at

SA 43K (see Figure 6.10-2). The results of the field analyses indicated that no BTEX or TPHC was present in the subsurface soil samples around the excavation (Table 6.10-2; Figure 6.10-4).

One soil boring (43K-92-01X) was drilled to the water table to confirm the field screening results. No VOCs or TPHC were detected in the sample collected from the water table, and lead was present below established Fort Devens background concentrations (Table 6.10-3; Figure 6.10-5).

6.10.4 Preliminary Human Health Risk Evaluation

A 5,000-gallon UST was discovered by ABB-ES and removed by ATEC during the SI field program. It should be noted that groundwater was encountered at 6 feet bgs. Prior to backfilling, ATEC collected 8 soil samples from the excavation walls which were screened for TPHC by the NDIR method. TPHC levels ranged from 22 ppm to a maximum value of 89 ppm in the tank wall samples. Laboratory results of confirmatory soil samples showed concentrations of TPHC ranging from 15 ppm to 58 ppm. The excavation was backfilled by ATEC and ABB-ES conducted follow-up SI activity.

Field analysis of 11 TerraProbe soil samples immediately below the water table revealed no measurable concentrations of BTEX to a depth of 9-feet. TPHC was not detected above the method detection limit in any of 8 samples analyzed. A soil sample from a confirmatory boring 43K-92-01X showed no evidence of residual TPHC contamination at 5 feet bgs.

These results indicate that little residual contamination exists at SA 43K in the saturated zone from petroleum products. Comparing all the results against available risk-based commercial/industrial concentration values indicates that there should be no significant risk to public health from soil contamination at SA 43K.

6.10.5 Conclusions and Recommendations

Based on the results of the field and laboratory analysis conducted by ATEC and ABB-ES, it appears that the contamination detected during the UST removal at SA 43K was removed by ATEC during the remediation phase of the UST removal. No further action is recommended for this historic gas station.

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TABLE 6.10-1
ATEC/ABB-ES FIELD SCREENING RESULTS
SA 43K - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY	
	PID (ppm)	NDIR (ppm)	VOC (ppm)	TPHC (ppm)
SS-1	5.0	88.7	N/A	N/A
SS-2	30.0	36.2	N/A	N/A
SS-3	0.5	44.7	N/A	N/A
SS-4	5.0	22.1	N/A	N/A
SS-5	50.0	26.9	N/A	N/A
SS-6	190.0	32.5	N/A	N/A
SS-7	60.0	43.4	N/A	N/A
SS-8	50.0	22.2	N/A	N/A
LRS-1	1.0	N/A	N/A	ND
LRS-2	1.3	N/A	N/A	58
LRS-3	4.0	N/A	ND	15
LRS-4	1.1	N/A	N/A	18
LWS-1	N/A	N/A	N/A	22

NOTES:

SS = ATEC FIELD SCREENING SOIL SAMPLE

LRS = POST-REMEDIATION LABORATORY SOIL SAMPLE

LWS = ATEC LABORATORY WATER SAMPLE (FROM THE EXCAVATION)

ppm = PARTS PER MILLION

ND = Non-detect

N/A = Not applicable

TABLE 6.10-2
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE K
SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTEX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSK01XX601XF	43K	SOIL	TP-01	6	NR	0	ND	ND	ND	ND	ND	
43TSK02XX901XF	43K	SOIL	TP-02	9	< 55	0	ND	ND	ND	ND	ND	
43TSK03XX901XF	43K	SOIL	TP-03	9	< 55	0	ND	ND	ND	ND	ND	
43TSK04XX901XF	43K	SOIL	TP-04	9	< 55	0	ND	ND	ND	ND	ND	
43TSK05XX601XF	43K	SOIL	TP-05	6	NR	0	ND	ND	ND	ND	ND	
43TSK06XX901XF	43K	SOIL	TP-06	9	< 55	0	ND	ND	ND	ND	ND	
43TSK07XX901XF	43K	SOIL	TP-07	9	< 55	0	ND	ND	ND	ND	ND	
43TSK08XX601XF	43K	SOIL	TP-08	6	NR	0	ND	ND	ND	ND	ND	
43TSK08XX901XF	43K	SOIL	TP-08	9	< 55	0	ND	ND	ND	ND	ND	
43TSK09XX901XF	43K	SOIL	TP-09	9	< 55	0	ND	ND	ND	ND	ND	*** PHC's Detected
43TSK10XX901XF	43K	SOIL	TP-10	9	< 55	0	ND	ND	ND	ND	ND	

NOTES:

- * = ND denotes a non detect or concentration below 5 ppb
- ** = ND denotes a non detect or concentration below 10 ppb
- *** = Detection of Noncalibrated Petroleum Hydrocarbon Peaks
- # = Study Area
- NR = Not requested

TABLE 6.10-3
INORGANIC AND ORGANIC COMPOUNDS IN SOIL
SA 43K - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACK - GROUND	BORING DEPTH	43K-92-01X 5
ORGANICS (ug/g)			
ACETONE			0.031
INORGANICS (ug/g)			
LEAD	48.4		11.4
OTHER (ug/g)			
TOTAL ORGANIC CARBON			NA
TOTAL PETROLEUM HYDROCARBONS			< 27.9

NOTES:

TABLE LISTS DETECTED ANALYTES ONLY -
SEE PROJECT ANALYTE LIST FOR SUMMARY
< = LESS THAN DETECTION LIMIT SHOWN
NA = NOT ANALYZED

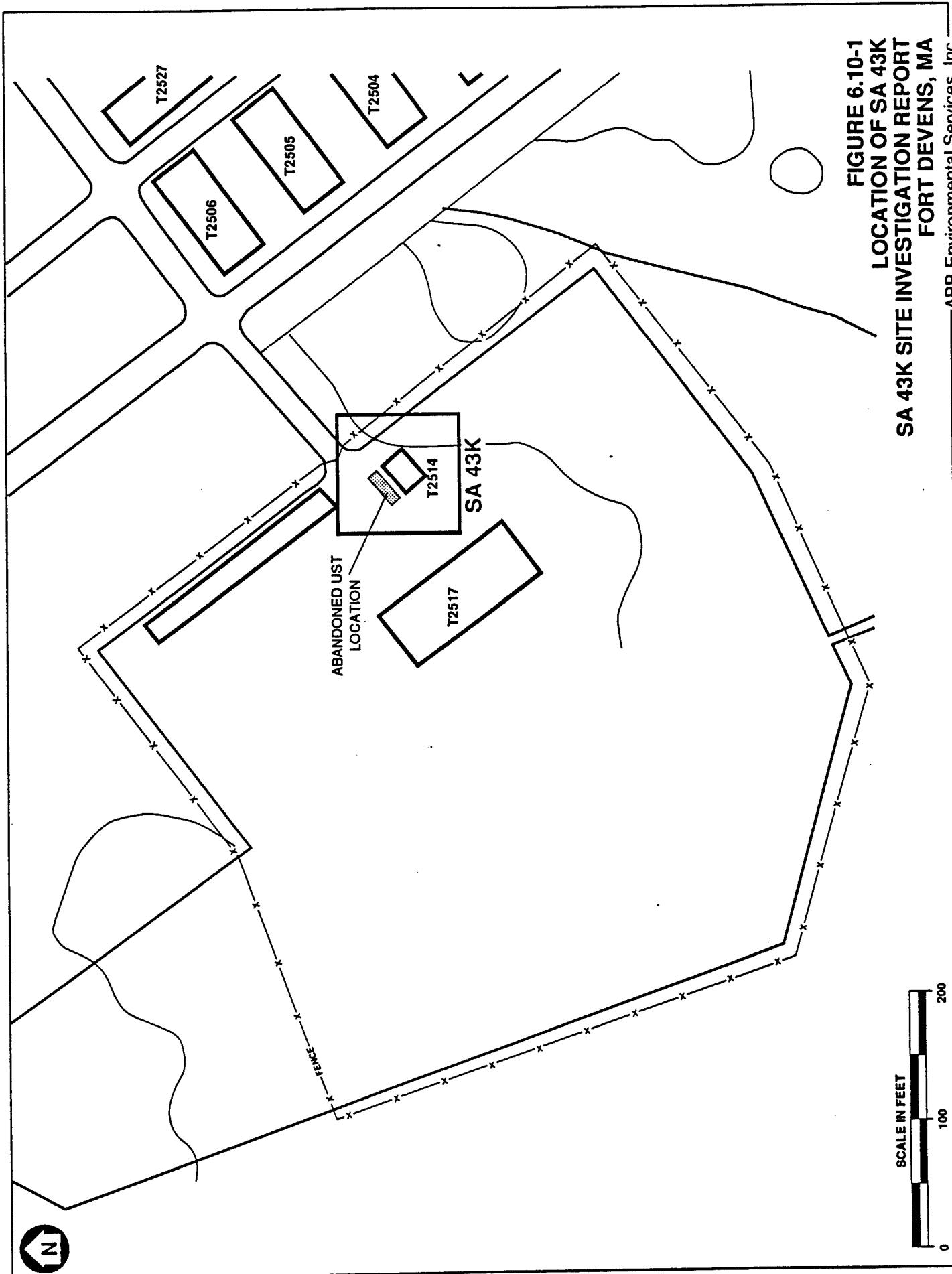
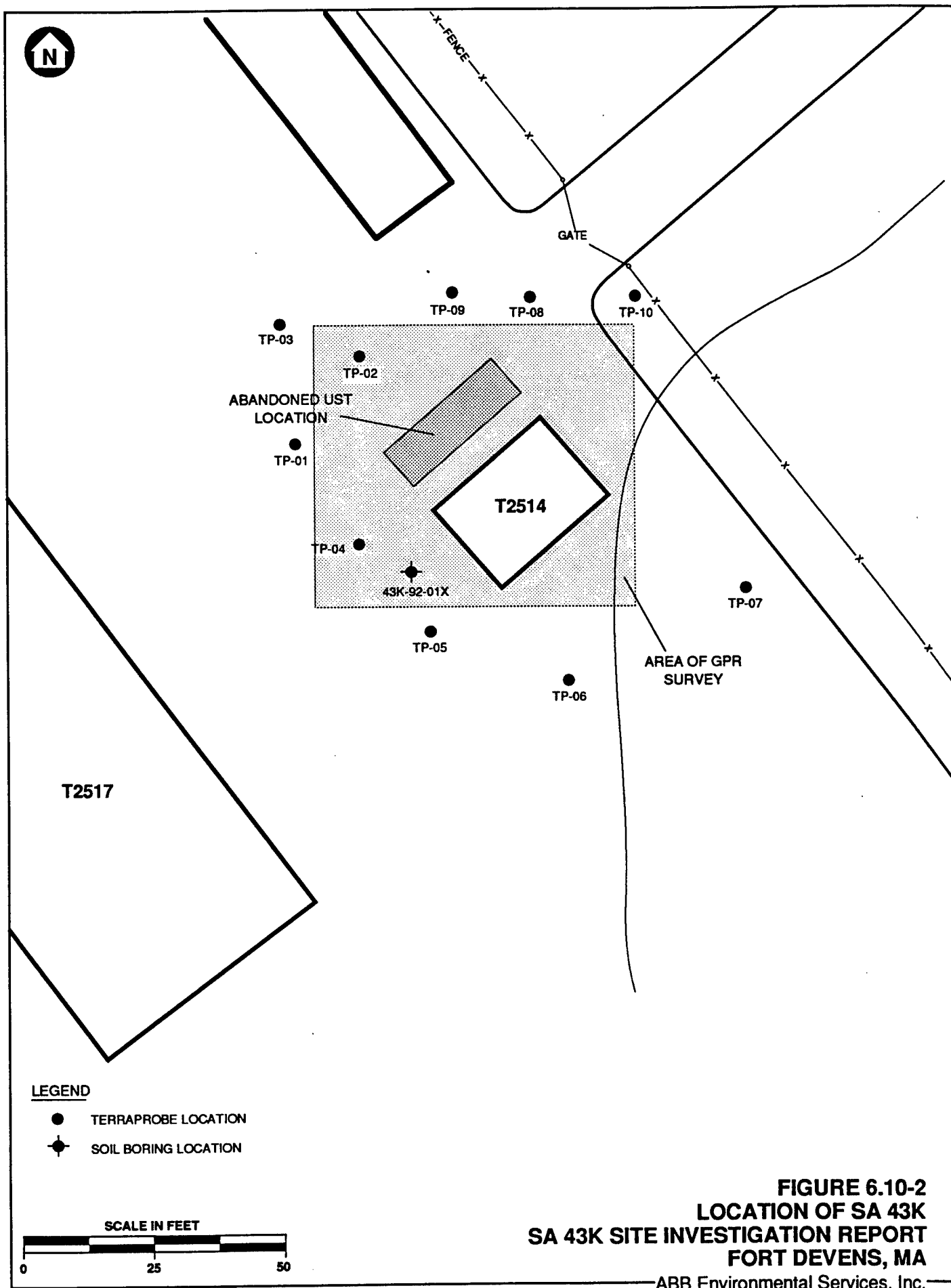
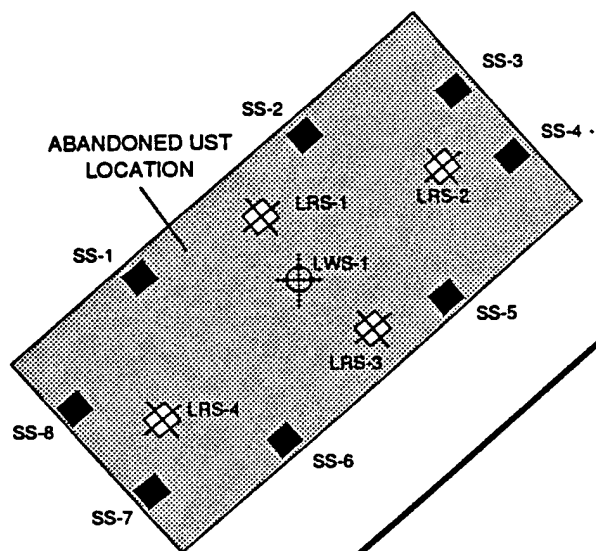


FIGURE 6.10-1
LOCATION OF SA 43K
SA 43K SITE INVESTIGATION REPORT
FORT DEVENS, MA







LEGEND

-  ATEC FIELD SCREENING LOCATIONS
-  ATEC LABORATORY SOIL SAMPLE LOCATION
-  ATEC LABORATORY WATER SAMPLE LOCATION



FIGURE 6.10-3
ATEC FIELD SCREENING LOCATIONS
SA 43K SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

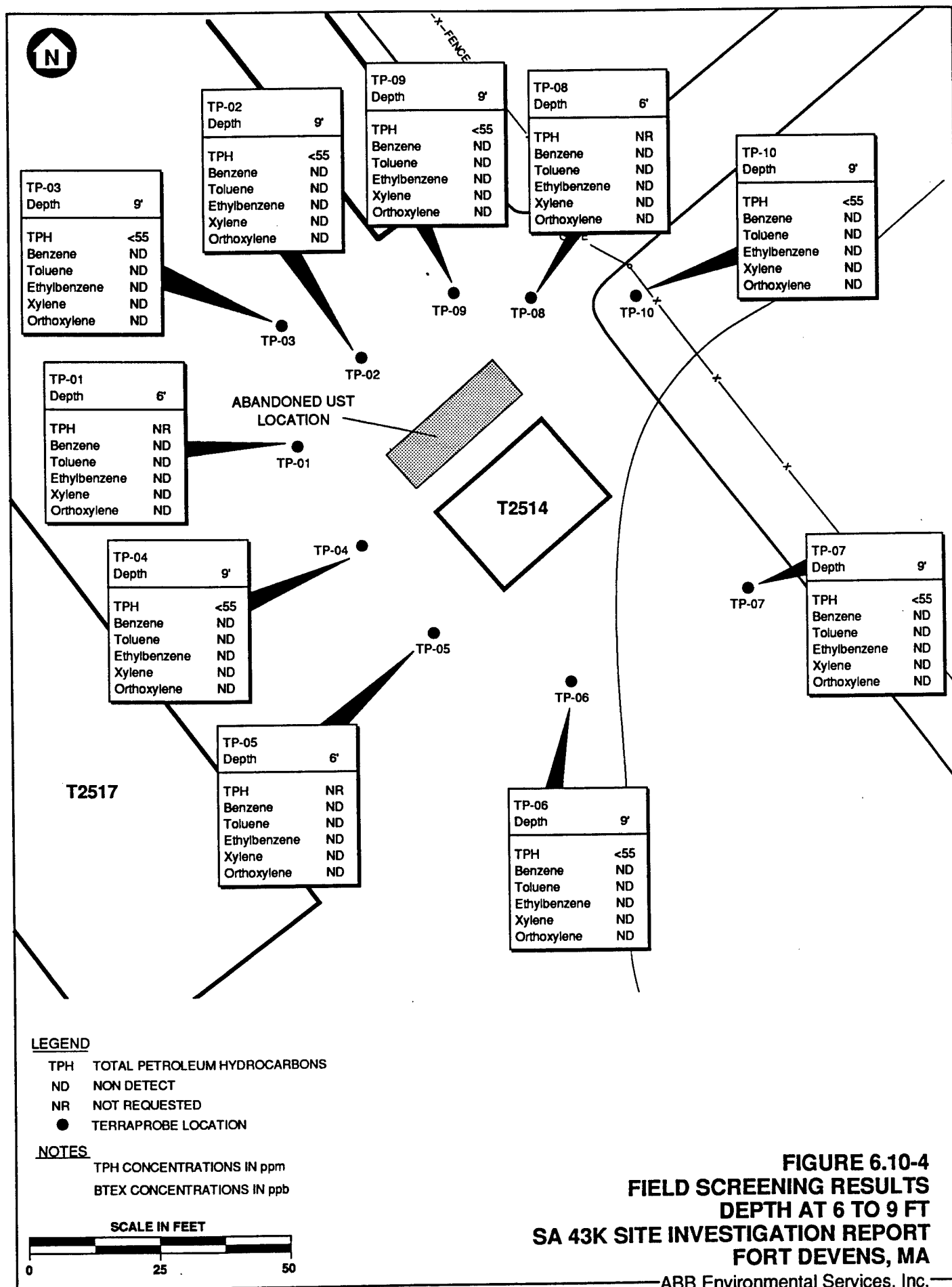


FIGURE 6.10-4
FIELD SCREENING RESULTS
DEPTH AT 6 TO 9 FT
SA 43K SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

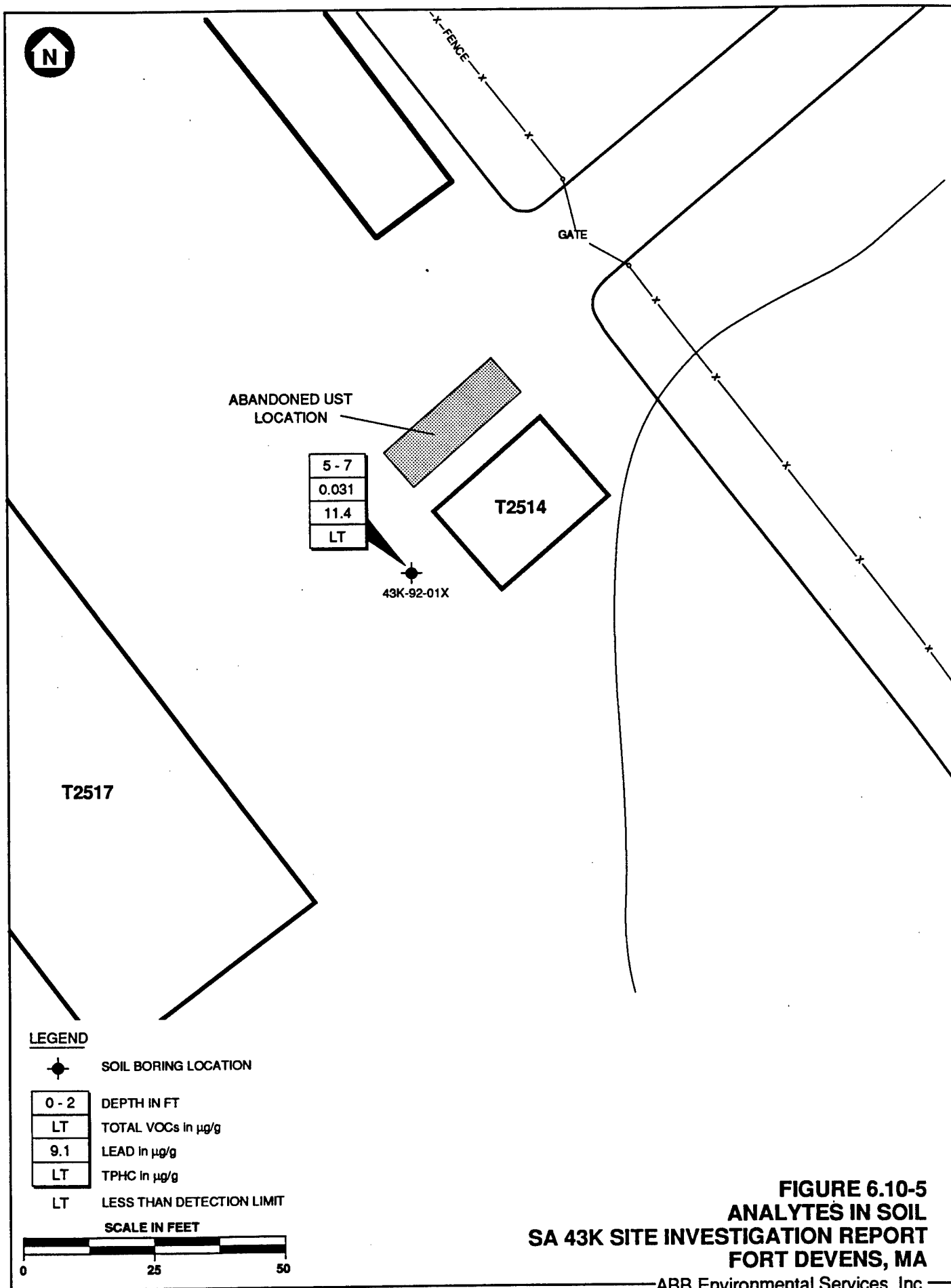


**FIGURE 6.10-5
ANALYTES IN SOIL
SA 43K SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.

6.11 STUDY AREA 43L

6.11.1 Study Area Background and Conditions

SA 43L was located on the corner of Lake George Street and Hattonsville Road adjacent to Building T-2601, in the southwestern portion of the Main Post (Figure 6.11-1).

The structures of the historic gas station at SA 43L consisted of a pump island and a small gasoline pumphouse. The station was a Type B stations which had two USTs (5,000 gallon or 5,140 gallon), located on each side of the pump island and oriented parallel to it. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool, however, it did appear that the USTs were not removed. The area around the former location of SA 43L is presently used as a storage yard for military vehicles and Building T-2601 appears to be a maintenance facility for the vehicles stored in the yard. The pumphouse associated with the historic gas station (Building P-179) is still present at the site. The yard and maintenance facility is paved and surrounded by a chain-linked fence with a locked gate located on the northern side of the yard (see Figure 6.11-1).

Kurz Associates (Kurz) conducted an investigation of the subsurface soil at SA 43L as part of a UST removal program at Fort Devens in November and December 1989 (Kurz Associates, 1991). Kurz found that both of the USTs were present at the site during the 1989 field program.

The two historic gas station USTs were removed. These USTs (referred to as tanks #5 and #6 [Kurz Associates, 1991]) were inspected after removal, and observed to be in good condition with no evidence of holes or pitting. The headspace of nine soil samples, from each excavation, were screened for total VOC with a PID. Total VOCs ranged from 0.4 ppm to 6.8 ppm. Four composite soil samples from the excavations were analyzed for TPHC, and concentrations ranged from 57 to 108 ppm.

The USTs at SA 43L were originally used for gasoline storage. During excavation, tanks #5 contained a mixture of water and what appeared to be fuel

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SECTION 6

oil, and tanks #6 contained a mixture of what appeared to be water and mogas (gasoline) (Kurz Associates, 1991).

After assessing the distribution and migration potential of the contaminants at this site, it was concluded by Fort Devens personnel that groundwater was not being impacted and that site conditions, at the time, posed no significant risk to potential receptors.

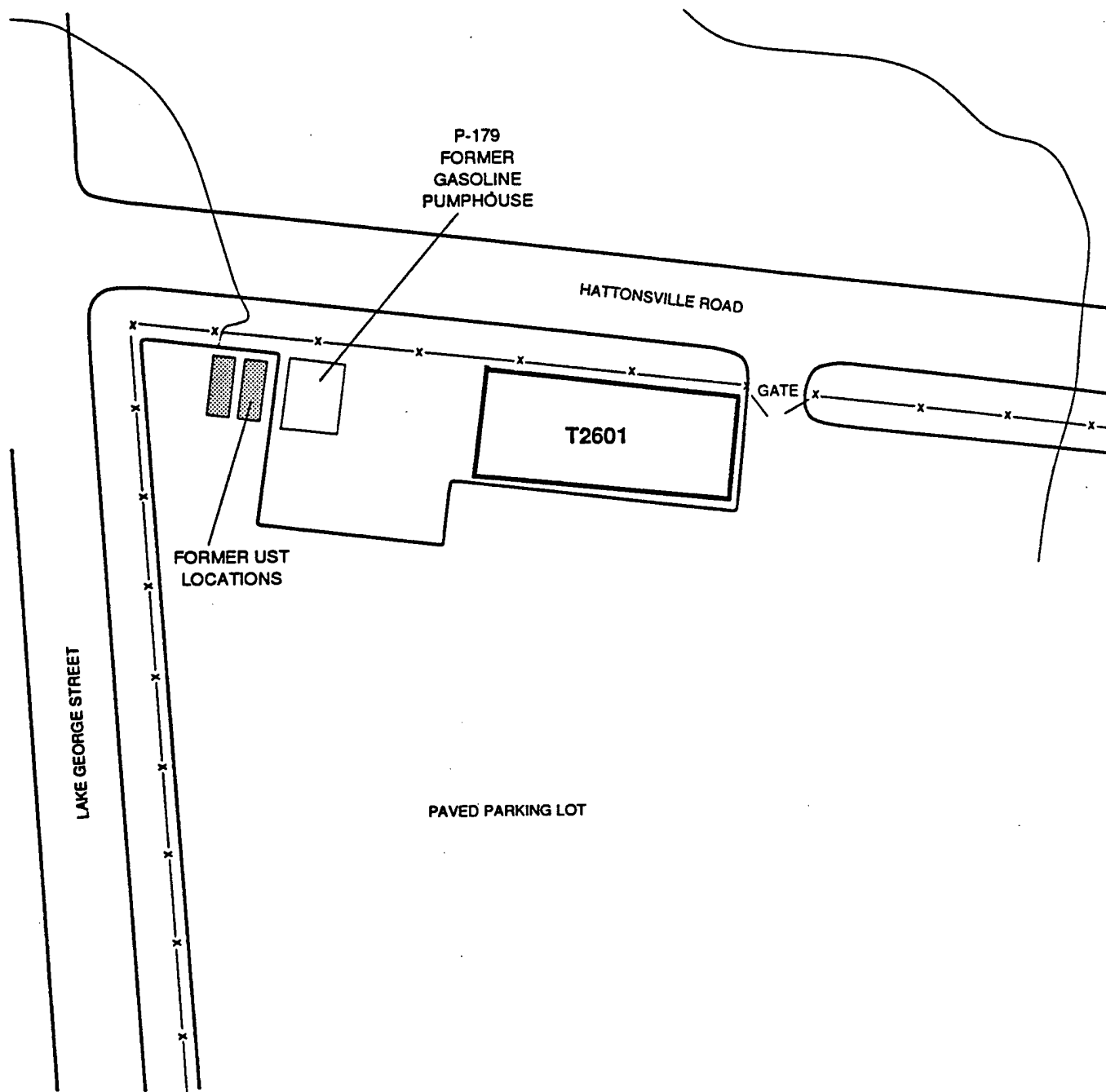
Based on this assessment, the excavations were backfilled and no additional investigation was conducted.

6.11.2 Study Area Investigation Program Summary

Based on the recommendations from the Kurz report, ABB-ES did not conduct a site investigation at SA 43L during the 1992 SI field program.

6.11.3 Conclusions and Recommendations

ABB-ES used the results of previous field investigations at SA 43L to determine if the former historic gas station activities had adversely impacted the soil or groundwater quality in the area around the study area. Based on the results of the work by Kurz Associates, it does not appear that the past activities at SA 43L have impacted the soil quality in the vicinity of the former UST location. Therefore, no further action is recommended at this historic gas station.



SCALE IN FEET

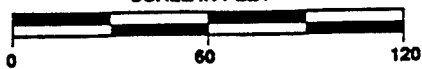


FIGURE 6.11-1
LOCATION OF SITE SA 43L
SA 43L SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.12 STUDY AREA 43M

6.12.1 Study Area Background and Conditions

SA 43M is located on the west side of Lake George Street adjacent to Building 2613 (Figure 6.12-1).

The structures of the historic gas station at SA 43M consisted of a pump island and a small gasoline pumphouse. The station was a Type B station which had two USTs (5,000 gallon or 5,140 gallon), located on each side of the pump island and oriented parallel to it. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool, however, it did appear that the USTs were not removed. The area around the reported location of SA 43M is presently used as a storage yard for installation contractors. The pumphouse associated with the historic gas station (Building P-180) is still present at the site. The yard is paved and surrounded by a chain-linked fence with a locked gate located on the eastern side of the yard (see Figure 6.12-1).

Kurz conducted an investigation of the subsurface soil at SA 43M, as part of a UST removal program at Fort Devens in November and December 1989 (Kurz Associates, 1991). Kurz found that both of the USTs were present at the site during the 1989 field program.

The two USTs were removed. These USTs (referred to as tanks #7 and #8 [Kurz Associates, 1991]) were inspected after removal, and were observed to be in good condition with no evidence of holes or pitting. The headspace of nine soil samples from each excavation were screened for total VOCs with a PID, and the total VOC concentrations ranged from 1.0 to 7.4 ppm. Four composite soil samples were collected from the excavations for TPHC analysis. The concentrations ranged from 73 ppm to 101 ppm.

The USTs at SA 43M were originally used for gasoline storage. During excavation, tank #8 contained a mixture of water and what appeared to be fuel oil, and tank #7 contained a mixture of what appeared to be water and mogas (gasoline) (Kurz Associates, 1991).

SECTION 6

After assessing the distribution and migration potential of the contaminants at both stations, it was concluded by Fort Devens personnel that groundwater was not being impacted by the concentration detected and that current site conditions pose no significant risk to potential receptors.

Based on this assessment, the excavations were backfilled and no additional investigation was conducted.

6.12.2 Study Area Investigation Program Summary

Based on the recommendations from the Kurz report, ABB-ES did not conduct a site investigation at SA 43M during the 1992 SI field program.

6.12.3 Conclusions and Recommendations

ABB-ES used the results of previous field investigations at SA 43M to determine if the former historic gas station activities had adversely impacted the soil or groundwater quality in the area around the study area. Based on the results of the work by Kurz Associates, it does not appear that the past activities at SA 43M have impacted the soil quality in the vicinity of the former UST location. Therefore, no further action is recommended at this historic gas station.

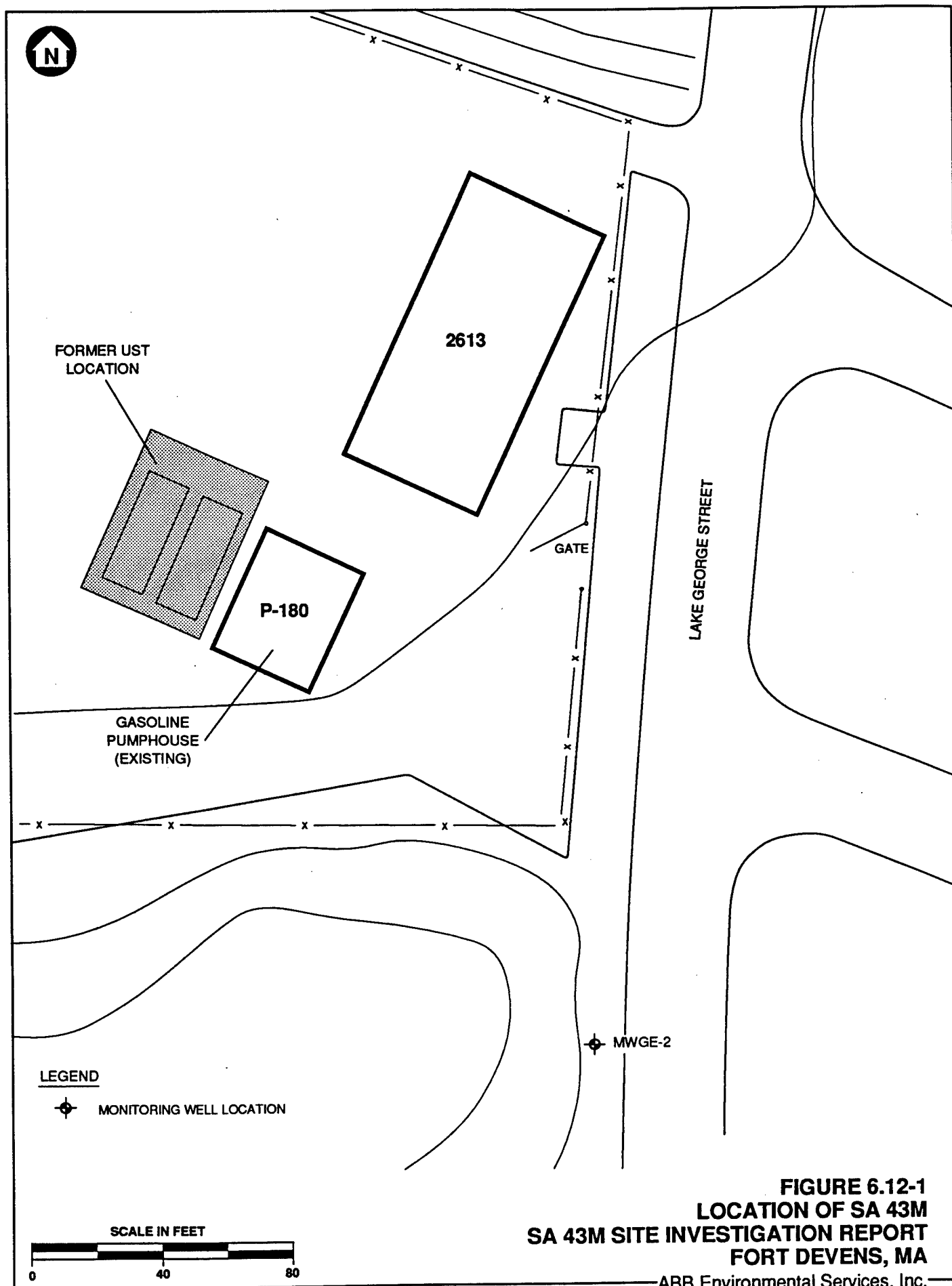


FIGURE 6.12-1
LOCATION OF SA 43M
SA 43M SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.13 STUDY AREA 43N

6.13.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43N consisted of a pump island and a small gasoline pumphouse. The gas station was a Type A station which had one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. This historic gas station was reportedly located on the eastern side of SA 45 which is located on Lake George Street on the western side of the Main Post (Figure 6.13-1). The wash rack associated with SA 45 was built approximately 30 years after this historic gas station was decommissioned. The two sites appear unrelated.

6.13.2 Site Investigation Program Summary

The SI at SA 43N was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). A field investigation was conducted at SA 43N to determine if any abandoned UST(s) were present at the site, and if residual contamination was present in the subsurface soil. The program consisted of a surficial geophysical survey, subsurface soil sampling using ABB-ES' TerraProbe unit, field analysis of the subsurface soil samples, and one soil boring to collect subsurface soil samples for off-site laboratory analysis. Table 6.13-1 summarizes the activities completed during the SI.

A geophysical investigation, consisting of a metal detector and GPR surveys, was conducted at SA 43N to determine the presence or absence of an abandoned UST (Figure 6.13-2).

A total of 10 TerraProbe points were advanced to 9 feet to 12 feet bgs to determine if residual soil contamination was present at this site (see Figure 6.13-2). The subsurface soil samples collected from these TerraProbe points were analyzed in the field for BTEX and TPHC.

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SECTION 6

One soil boring (43N-92-01X) was drilled to the water table to collect subsurface soil samples for laboratory analysis (see Figure 6.13-2). One soil sample was collected from the water table and submitted for off-site laboratory analysis for PAL VOCs, TPHC, and lead.

6.13.2 Supplemental Site Investigation Program Summary

The SSI at SA 43N was performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The following sections describe the field activities completed at this historic gas station during the SSI. Table 6.13-1 summarizes the activities completed during the SS1.

The SSI at SA 43N focuses on determining if the TPHC contamination detected during the SI had impacted the groundwater quality at the site.

Four groundwater monitoring wells were installed to monitor upgradient and downgradient groundwater quality (Figure 6.9-3). Soil samples were collected from the top of bedrock in each of the monitoring well borings because the water table was encountered in the bedrock at this site. The soil samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, lead, TPHC, and TOC. The screen of each monitoring well was placed so that it intercepted the water table to monitor for free product and allow for seasonal groundwater fluctuations. The water table was encountered approximately 2 feet below the top of bedrock in each of the monitoring well borings. The well screen in each of the monitoring wells was placed in the bedrock, and three of the well screens (XNM-93-02X through XNM-93-04X) were placed across the bedrock/soil interface. Table 6.9-2 summarizes the monitoring well construction at SA 43N and monitoring well construction details are presented in Appendix C.

Two rounds (Round Three and Four) of groundwater samples were collected during the SS1. Round Three groundwater samples were collected in October 1993 and Round Four was collected in January 1994. These samples were submitted for laboratory analysis consisting of PAL VOCs, SVOCs, lead (both filtered and unfiltered), TPHC, and TSS.

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were performed. The tests consisted of a rising and falling head test.

6.13.3 Field Investigation Results and Observations

The geophysical surveys conducted at this site during the SI determined that one abandoned UST was present. This UST was added to the installation's UST removal program and on June 23 and 24, 1992 one 5,000 gallon UST was removed by ATEC. At the time of removal the tank contained fuel and sludge (ATEC, 1992k). No obviously contaminated soil was observed after the UST was removed, and no groundwater was noted in the excavation. ATEC performed field screening on eight soil samples (SS-1 through SS-8) collected from the excavation at 4 to 6 feet (Table 6.13-3; Figure 6.13-4). VOC concentrations (measured by PID in soil headspace) ranged from 0.8 to 56 ppm, and TPHC concentrations measured in the field on an NDIR unit, ranged from 28.8 to 99.9 ppm (ATEC, 1992k). TPHC concentrations in two confirmatory soil samples collected by ATEC for laboratory analysis (LSS-1 and LSS-2) were 11 ppm and 13 ppm, respectively. ABB-ES collected one composite soil sample (XNE-92-01X) from the bottom of the excavation and submitted it for laboratory analysis. This sample was analyzed at ABB-ES' Wakefield, Massachusetts laboratory for TPHC using USEPA Method 418.1. The TPHC concentration was detected at 136 ppm in this soil sample (see Table 6.13-3). Based on the results of ATEC's sampling and screening, ATEC backfilled the excavation (ATEC, 1992k). However, the results of the sample collected by ABB-ES indicated that TPHC concentrations were above 100 ppm. Because of this, additional explorations were conducted to confirm the nature and distribution of the fuel-related contamination detected.

The soil encountered at SA 43N consisted of a gravelly sand/sandy gravel (fill) underlain by a sandy silt with fine gravel (glacial till). The depth to bedrock was approximately 11 to 13 feet bgs. The bedrock encountered at this site was classified as a metasilstone or phyllite (Table 6.13-4). Soil boring logs for SI and SS1 borings are presented in Appendix B.

The calculated hydraulic conductivities in the bedrock monitoring wells ranged from 1.0E^{-03} cm/sec. at XNM-93-03X to 3.3E^{-07} at XNM-93-04X. The results of

SECTION 6

the hydraulic conductivity test are presented in Table 6.13-5. Hydraulic conductivity results are presented in Appendix A.

The monitoring wells at SA 43N were included in the November 8, 1993 synoptic water-level round at Fort Devens. The results of that round are presented in Table 6.13-5. The inferred groundwater flow appears to be moving to the north-northwest (Figure 6.13-5). A summation of the synoptic water level rounds for SA 43N are presented in Appendix I. All SSI exploration locations were surveyed.

6.13.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.13.4.1 Soil. After the historic gas station UST excavation was backfilled, ABB-ES advanced 10 TerraProbe borings at SA 43N (see Figure 6.13-2), and ten soil samples were collected from 9 feet to 12 feet bgs (below the bottom of the fill). No BTEX compounds were detected in any of the samples collected, but TPHC was detected in TP-01 at 210 ppm, TP-02 at 380 ppm, and TP-03 at 91 ppm (Table 6.13-6; Figure 6.13-6).

Based on these results, soil boring 43N-92-01X was drilled to the water table during the SI, through the backfilled UST excavation to confirm the results of the field analysis and collect subsurface soil samples. One soil sample from 12 feet to 14 feet was collected. No VOCs were detected, but TPHC was present in this sample at 258 ppm. Lead was detected below the Fort Devens background concentration in each sample (Table 6.13-7; Figure 6.13-7).

One subsurface soil sample was collected during the SSI for off-site laboratory analysis from the top of bedrock at three of the four monitoring well boring locations (XNM-93-01X, XNM-93-03X and XNM-93-04X). A subsurface soil was not collected from the top of bedrock at XNM-93-02X because of insufficient soil sample volumes in the split-spoon sampler at the time of drilling. The soil samples were collected from the top of bedrock because the water table was encountered below the bedrock surface. No VOCs were detected and the only SVOC detected was di-n-butyl phthalate (a common laboratory contaminant). Lead concentrations were below the Fort Devens background but highest in XNM-93-04X. TPHC was detected in the soil sample from XNM-93-04X, only, at 215 $\mu\text{g/g}$ (see Table 6.13-7; Figure 6.13-7).

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6.13.4.2 Groundwater. Round Three and Four groundwater samples were collected from the four monitoring wells (XNM-93-01X through XNM-93-04X) installed during the SSI. Toluene was detected at 0.84 $\mu\text{g/L}$ in XNM-93-04X in the Round Three sample but not in the Round Four sample. Phenanthrene was detected at 0.59 $\mu\text{g/L}$ in the Round Three sample and at 1.2 $\mu\text{g/L}$ in the Round Four sample at XNM-93-03X. No other VOCs or SVOCs were detected in the samples collected. TPHC was not detected in any of the Round Three samples but was detected in the Round Four sample collected from XNM-93-04X at 580 $\mu\text{g/L}$. Lead was detected above the Fort Devens background concentration in the unfiltered sample collected from one of the four samples collected during Round Three, however, lead was not detected above the detection limit in any of the Round Three filtered samples. Lead was not detected above the Fort Devens background concentration in the filtered samples collected during Round Four. However, lead was detected above the Fort Devens background concentration in the unfiltered groundwater sample collected from XNM-93-01X (Table 6.13-8; Figure 6.13-8).

6.13.5 Source Evaluation and Migration Potential

TPHC was detected in the soil samples collected from the top of bedrock in several field analytical samples collected during the SI and one of the four monitoring well borings (XNM-93-04X) completed during the SSI. Toluene, phenanthrene, and TPHC were also detected in groundwater samples collected during the SSI. Based on the results of the SSI, it appears that the past activities at historic gas station N have impacted the groundwater quality at the site but the concentrations detected are below applicable human health risk guidelines.

6.13.6 Preliminary Human Health Risk Evaluation

During the SI, both TerraProbe samples and a confirmatory soil boring were analyzed. The results are displayed and discussed in the SI Report. Based on a comparison of the results with available risk-based commercial/industrial concentration values, it was concluded that there should be no significant risk to public health from soil contamination at SA 43N. Soil samples collected during the SSI were from the monitoring well borings and are not appropriate to use to characterize the soil at the site because the monitoring wells are not located within the source area.

SECTION 6

Table 6.13-8 presents summary data based on unfiltered groundwater samples collected during the SSI from SA 43N along with drinking water standards/guidelines for comparison. The organics detected were phenanthrene and toluene as well as TPHC. The single detection of toluene did not exceed the federal MCL. No federal standard or guideline is available for phenanthrene. The maximum concentration of TPHC did not exceed the MCP GW-1 standard of 1,000 $\mu\text{g/L}$ (Table 6.13-9).

Lead was the only inorganic analyzed for and was detected in four of eight samples. The maximum concentration of lead did not exceed the USEPA action level.

Based on this screening, it does not appear that groundwater poses a potential risk to human health.

6.13.7 Conclusions and Recommendations

Based on the results of the SI and SSI and the findings of the human health PRE, NFA is recommended for SA 43N.

TABLE 6.13-1
SUMMARY OF TECHNICAL APPROACH
SA 43N - HISTORIC GAS STATION N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRAPROBE	- CHARACTERIZE SOILS CONTAMINATION - COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-01 THRU TP-10	IN AND AROUND FORMER HGS UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	- CHARACTERIZE SOILS CONTAMINATION - COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	43N-92-01X	ADJACENT TO TERRAPROBE 'HOT SPOT'
SI PROGRAM			
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	- INSTALL MONITORING WELLS - CHARACTERIZE SOILS CONTAMINATION - COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	XNM-93-01X XNM-93-02X XNM-93-03X XNM-93-04X	- UPGRADIENT - DOWNGRADIENT
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	- MONITOR GROUNDWATER LEVELS - MONITOR GROUNDWATER QUALITY - DETERMINE AQUIFER CONDUCTIVITIES	XNM-93-01X XNM-93-02X XNM-93-03X XNM-93-04X	- UPGRADIENT - DOWNGRADIENT

TABLE 6.13-2
MONITORING WELL COMPLETION DETAILS
SA 43N - HISTORIC GAS STATION N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (Feet bgs)	WELL SCREEN ELEVATION (Feet NGVD)	COMPLETION DEPTH (Feet bgs)	CONSTRUCTION MATERIAL
XNM-93-01X	NA	ROCK CORE	BEDROCK	13.2 - 23.2	324.1 - 314.1	23.5	4" ID PVC
XNM-93-02X	NA	ROCK CORE	BEDROCK	14.5 - 24.5	319.4 - 309.4	24.5	4" ID PVC
XNM-93-03X	NA	ROCK CORE	BEDROCK	10.0 - 20.0	3324.4 - 314.4	22.5	4" ID PVC
XNM-93-04X	NA	ROCK CORE	BEDROCK	10.5 - 20.5	322.4 - 312.4	20.5	4" ID PVC

NA=Not Applicable

TABLE 6.13-3
ATEC FIELD SCREENING/LABORATORY RESULTS
SA 43N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY
	PID (ppm)	NDIR (ppm)	TPHC (ppm)
SS-1	56.0	37.5	N/A
SS-2	7.2	49.7	N/A
SS-3	39.0	61.1	N/A
SS-4	0.8	99.9	N/A
SS-5	2.5	83.2	N/A
SS-6	15.4	55.6	N/A
SS-7	7.8	46.7	N/A
SS-8	27	30	N/A
SS-9	3.6	28.8	N/A
SS-10	28.0	29.3	N/A
LSS-1	N/A	N/A	11
LSS-2	N/A	N/A	13
XNE-92-01X	N/A	N/A	136

NOTES:

SS = ATEC Field Screening Soil Sample

LSS = ATEC Laboratory Soil Sample

XNE-92-01X = ABB-ES Laboratory Composite Soil Sample

N/A = Not applicable

**TABLE 6.13-4
SUMMARY OF SOIL BORINGS
SA 43N - HISTORIC GAS STATION N
SITE INVESTIGATION REPORT
FORT DEVENS, MA**

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
43N-92-01X	23.5	10-12 12-14	12-14	SP SW	BKG BKG	Apparent bedrock encountered at 13.6' bgs
XNM-93-01X	23.5	0-2 2-4 4-6 6-8 8-10 10-12	8-10	SP GP-SP SP-GP GP-SP GP-SP GP-SM	BKG BKG BKG BKG BKG BKG	
XNM-93-02X	24	0-2 5-7 10-11.2		SW SW SW	BKG BKG BKG	Bedrock cored from 12.5 to 23.5 - feet
XNM-93-03X	22.5	0-2 2.5-4.5 4.5-6.5 6.5-8.5 8.5-10.5 10.5-12.5 12.5-13.5	10-11.2	SW SW SW SW SW GW GW	BKG BKG BKG BKG BKG BKG BKG	Rollerbit bedrock from 11.2 to 24 - feet
XNM-93-04X	20.5	0-2 2.5-4.5 4.5-6.5 6.5-8.5 8.5-10.5 10.5-12.4	12.5-13.5	SW SW SW SW GM SM	BKG BKG BKG BKG BKG 0.5	Rollerbit phyllite from 13.5 to 22.5 - feet
			10.5-12.4			Rollerbit phyllite from 12.4 to 20.5 - feet

NOTES:

bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site

TABLE 6.13-5
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 43N - HISTORIC GAS STATION N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (Feet bgs)	ELEVATION OF WATER (Feet NGVD)	CONDUCTIVITY
				HVORSLEV ² (cm/sec)
XNM-93-01X	339.20	13.74	325.46	2.3E-05
XNM-93-02X	336.49	16.67	319.82	8.0E-04
XNM-93-03X	336.60	16.61	319.99	1.0E-03
XNM-93-04X	332.25	10.38	321.87	3.3E-07

Notes:

bgs = below ground surface

cm/sec = centimeters per second

NGVD = National Geodetic Vertical Datum

1 = elevation of top of pvc

2 = averaged value of two tests

Groundwater elevations from November 8, 1993

synoptic water level round

TABLE 6.13-6
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 43N - HISTORIC GAS STATION N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-01	TP-02	TP-03	TP-04	TP-05	TP-06	TP-07	TP-08	TP-09	TP-10
	TSN0109F	TSN0212F	TSN0309F	TSN0409F	TSN0509F	TSN0609F	TSN0709F	TSN0809F	TSN0909F	TSN0109F
ORGANICS (ppb)	9 FT	12 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER (ppm)										
TOTAL PETROLEUM HYDROCARBONS	210	380	91	<52	<52	<52	<53	<53	<54	<53

Notes:

< = Less than detection limit.

NA = Not analyzed

TABLE 6.13-7
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 43N - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI			SI
	XNM-93-01X 10 FT	XNM-93-03X 13 FT	XNM-93-04X 12 FT	
ORGANICS (ug/g)				
DI-N-BUTYL PHTHALATE	0.12	0.083	0.13	< 0.1
TRICHLOROFLUOROMETHANE	0.007	< 0.006	< 0.006	< 0.006
INORGANICS (ug/g)				
LEAD	5.22	9.0	9.0	9.92
OTHER (ug/g)				
TOTAL ORGANIC CARBON	588	2750	1240	2080
TOTAL PETROLEUM HYDROCARBONS	< 28.5	< 28.5	215	258

Notes:

< = Less than detection limit.

TABLE 6.13-8
ANALYTES IN GROUNDWATER
SA 43N - HISTORIC GAS STATION N

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XNM-93-01X				XNM-93-02X			
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4
ORGANICS (ug/L)									
TOLUENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5
PHENANTHRENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5
INORGANICS (ug/L)									
LEAD	4.25	< 1.26	4.01	< 1.26	8.03	< 1.26	< 1.26	< 1.26	< 1.26
OTHER (ug/L)									
TOTAL PETROLEUM HYDROCARBONS		NA	< 180	NA	< 180	NA	< 180	NA	< 180
TOTAL SUSPENDED SOLIDS		NA	102000	NA	250000	NA	13000	NA	15000

TABLE 6.13-8
ANALYTES IN GROUNDWATER
SA 43N - HISTORIC GAS STATION N
SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XNM-93-03X				XNM-93-04X			
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4
ORGANICS (ug/L)									
TOLUENE		NA	< 0.5	NA	< 0.5	NA	0.84	NA	0.5
PHENANTHRENE		NA	0.59	NA	1.2	NA	< 0.5	NA	< 0.5
INORGANICS (ug/L)									
LEAD	4.25	< 1.26	3.15	< 1.26	< 1.26	< 1.26	< 1.26	< 1.26	4.23
OTHER (ug/L)									
TOTAL PETROLEUM HYDROCARBONS		NA	< 180	NA	< 180	NA	< 180	NA	580
TOTAL SUSPENDED SOLIDS		NA	31000	NA	NA	NA	17000	NA	17000

TABLE 6.13--9
HUMAN HEALTH PRELIMINARY RISK EVALUATION OF GROUNDWATER
SA 43N - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		GROUNDWATER BACKGROUND CONCENTRATION (ug/L)	MAXIMUM EXCEEDS BACKGROUND?	DRINKING WATER STANDARD/ GUIDELINE [b] (ug/L)	MAXIMUM EXCEEDS STANDARD/ GUIDELINE ?
		AVERAGE (ug/L)	MAXIMUM (ug/L)				
ORGANICS							
PHENANTHRENE	2/8	0.89	1.2	NA	-	NA	-
TOLUENE	1/8	0.84	0.84	NA	-	1000	NO
TOTAL PETROLEUM HYDROCARBON	1/8	580	58	NA	-	1000	NO
INORGANICS							
LEAD	4/8	4.85	8.03	4.25	YES	15	NO

Notes:

[a] Groundwater based on unfiltered samples from XNM-93-01X to XNM-93-04X.

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

NA = not available

ug/L = micrograms per liter

- = not applicable

Shaded compounds exceed standard or guideline.

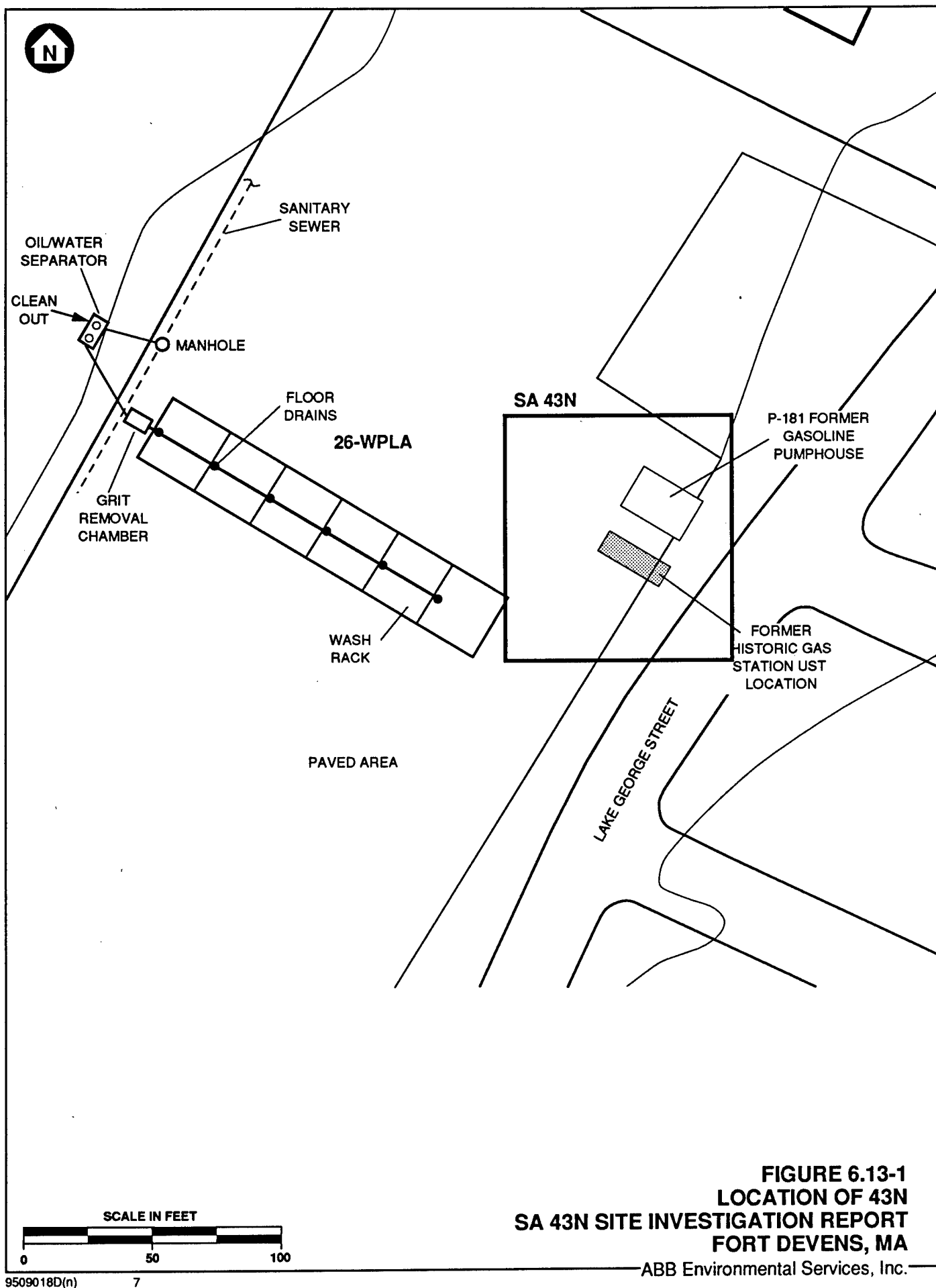
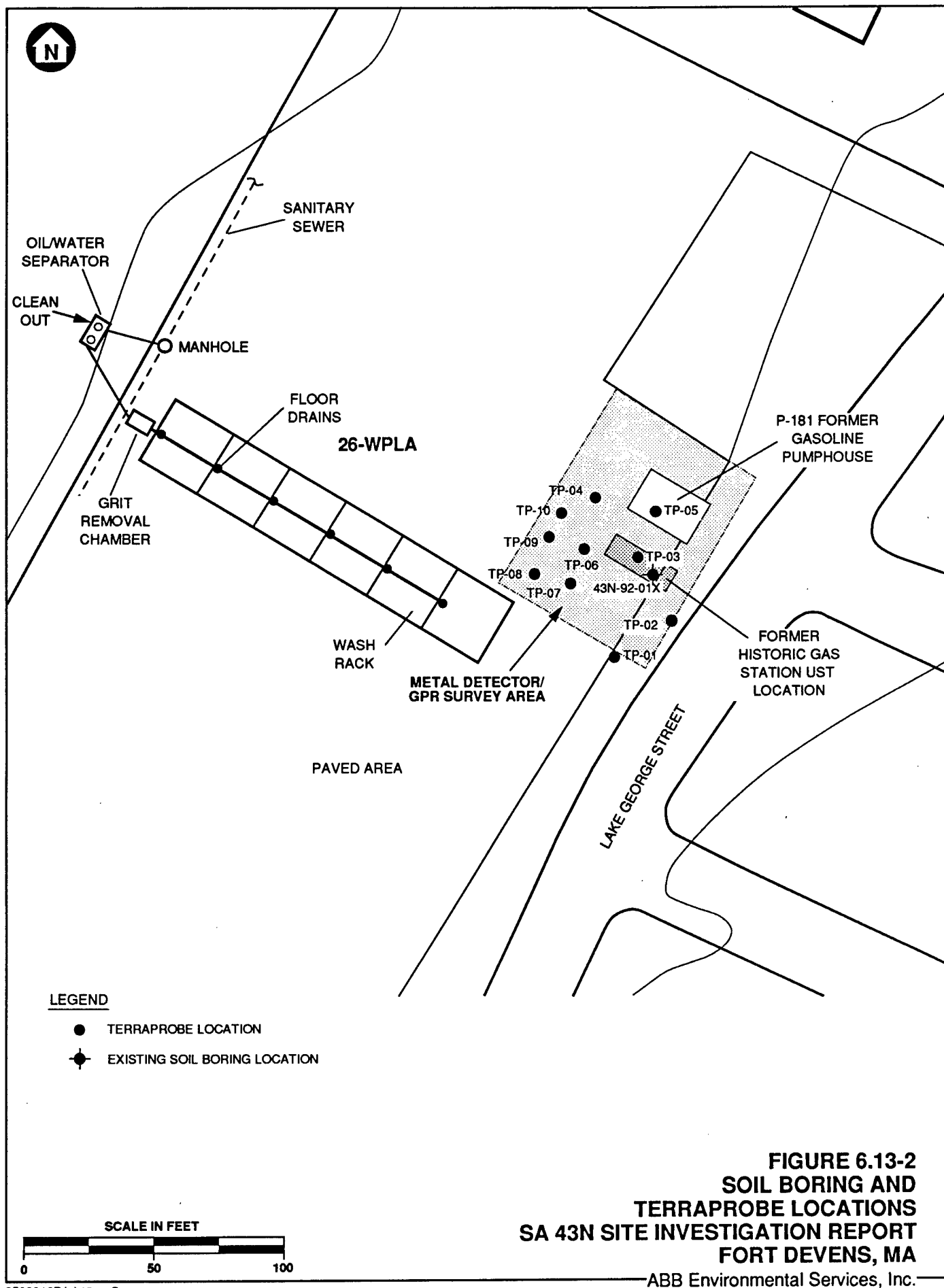


**FIGURE 6.13-1
LOCATION OF 43N
SA 43N SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.



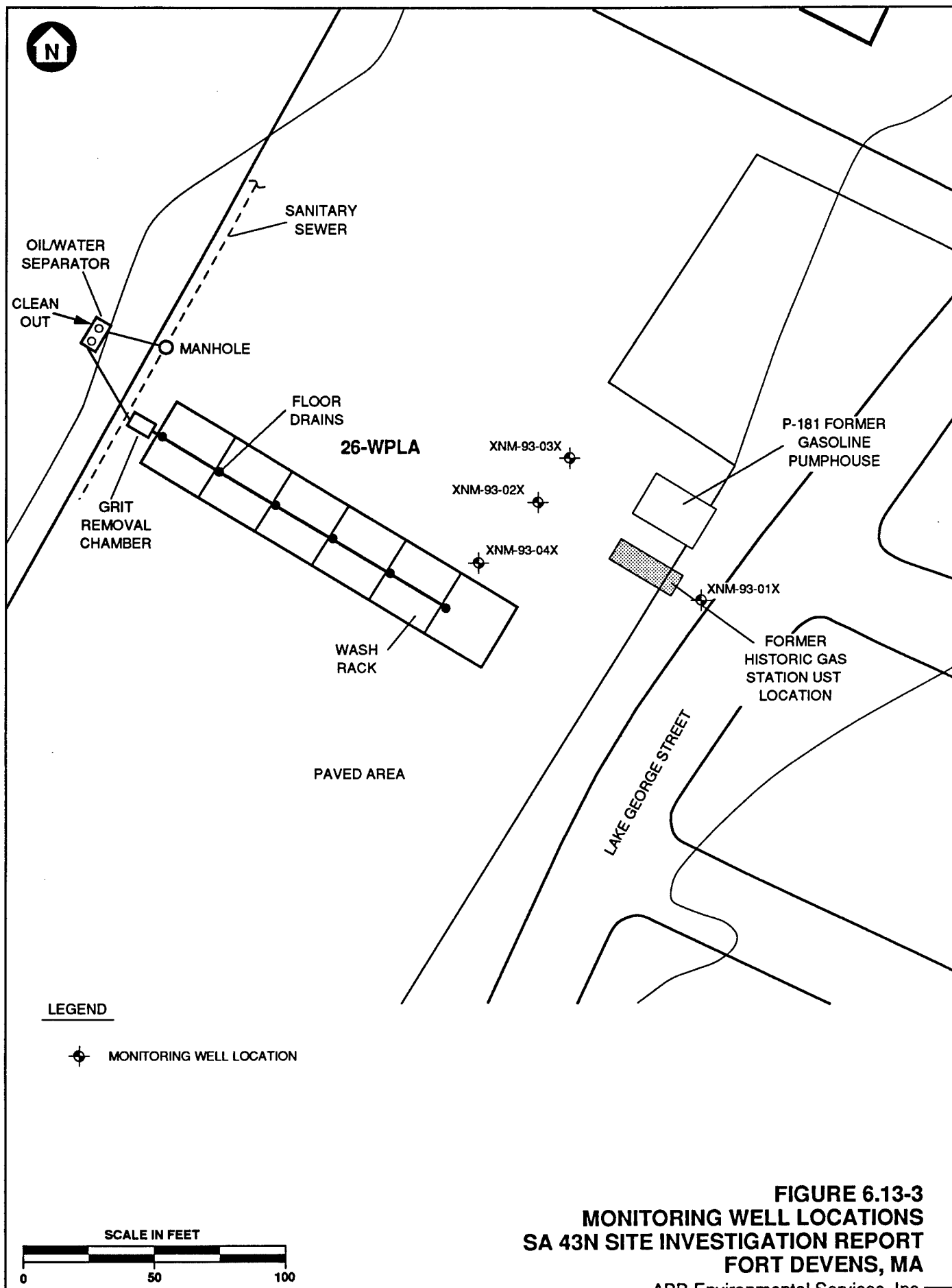


FIGURE 6.13-3
MONITORING WELL LOCATIONS
SA 43N SITE INVESTIGATION REPORT
FORT DEVENS, MA

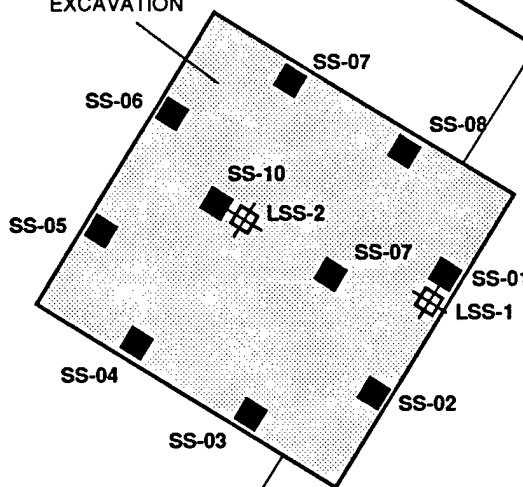
ABB Environmental Services, Inc.



26-WPLA

P-181 FORMER
GASOLINE
PUMPHOUSE

UST
EXCAVATION



LEGEND



ATEC FIELD SCREENING LOCATIONS



ATEC LABORATORY SOIL SAMPLE LOCATION

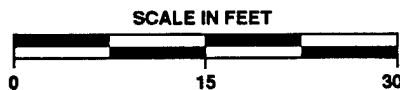
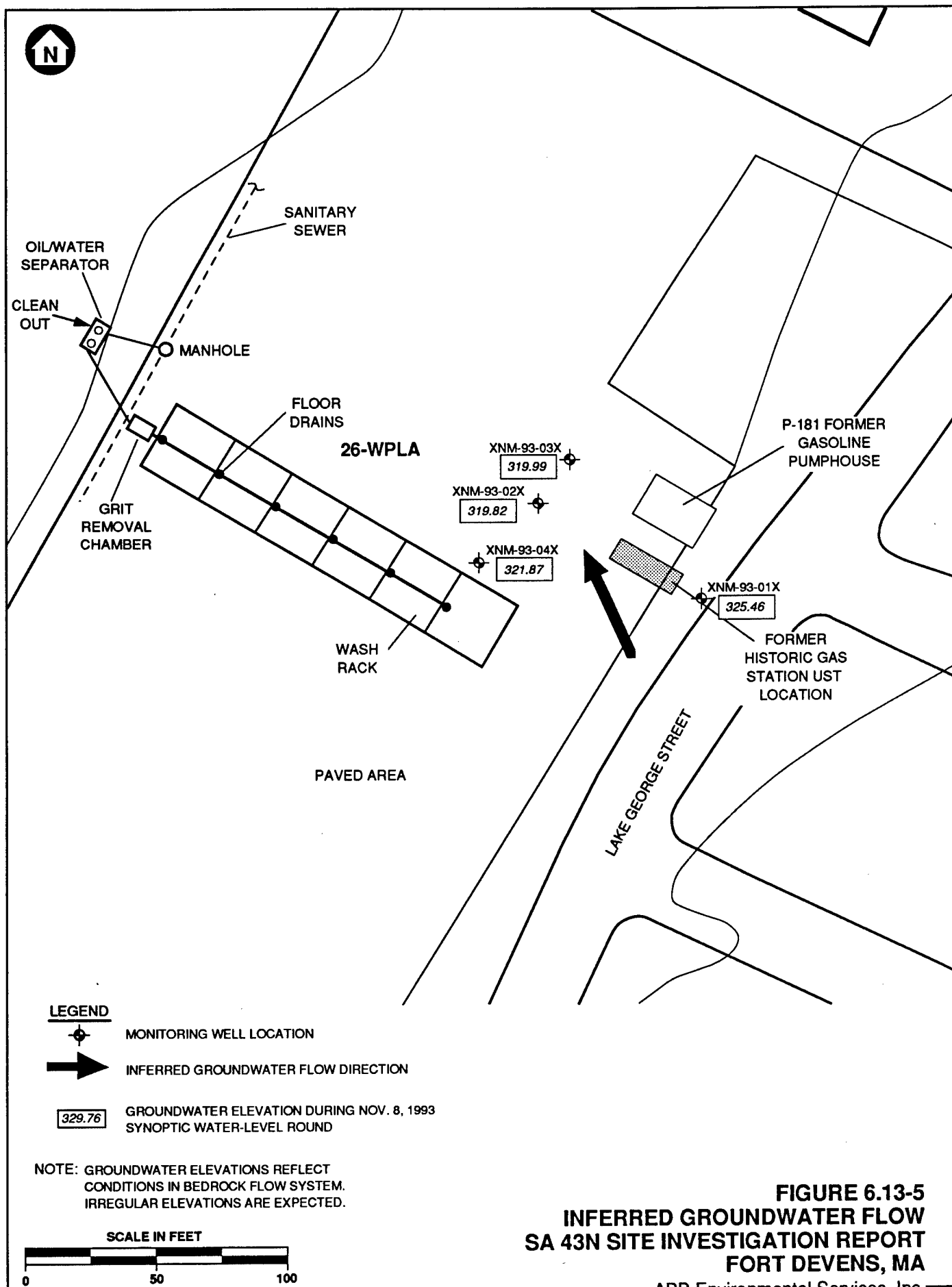
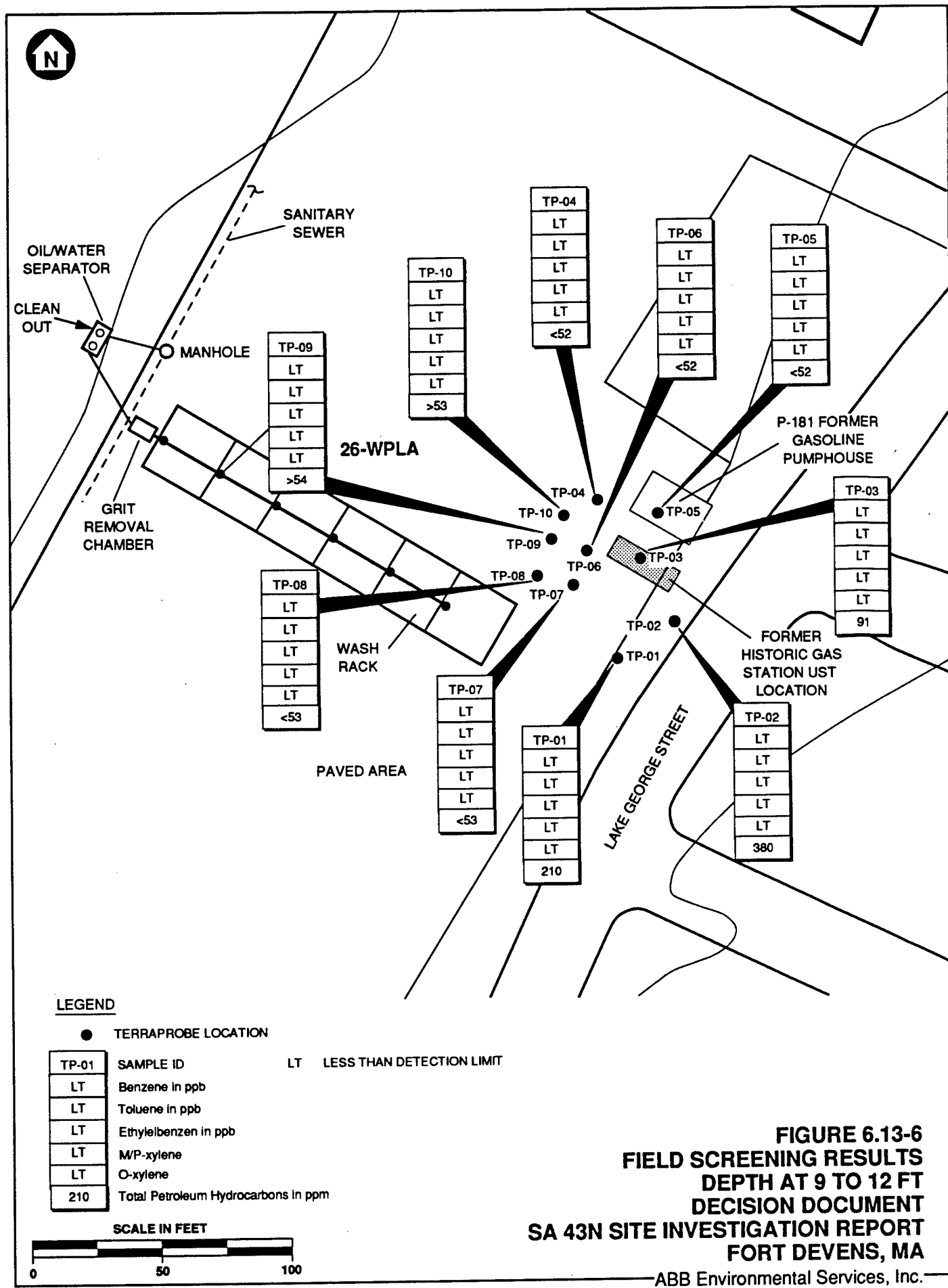
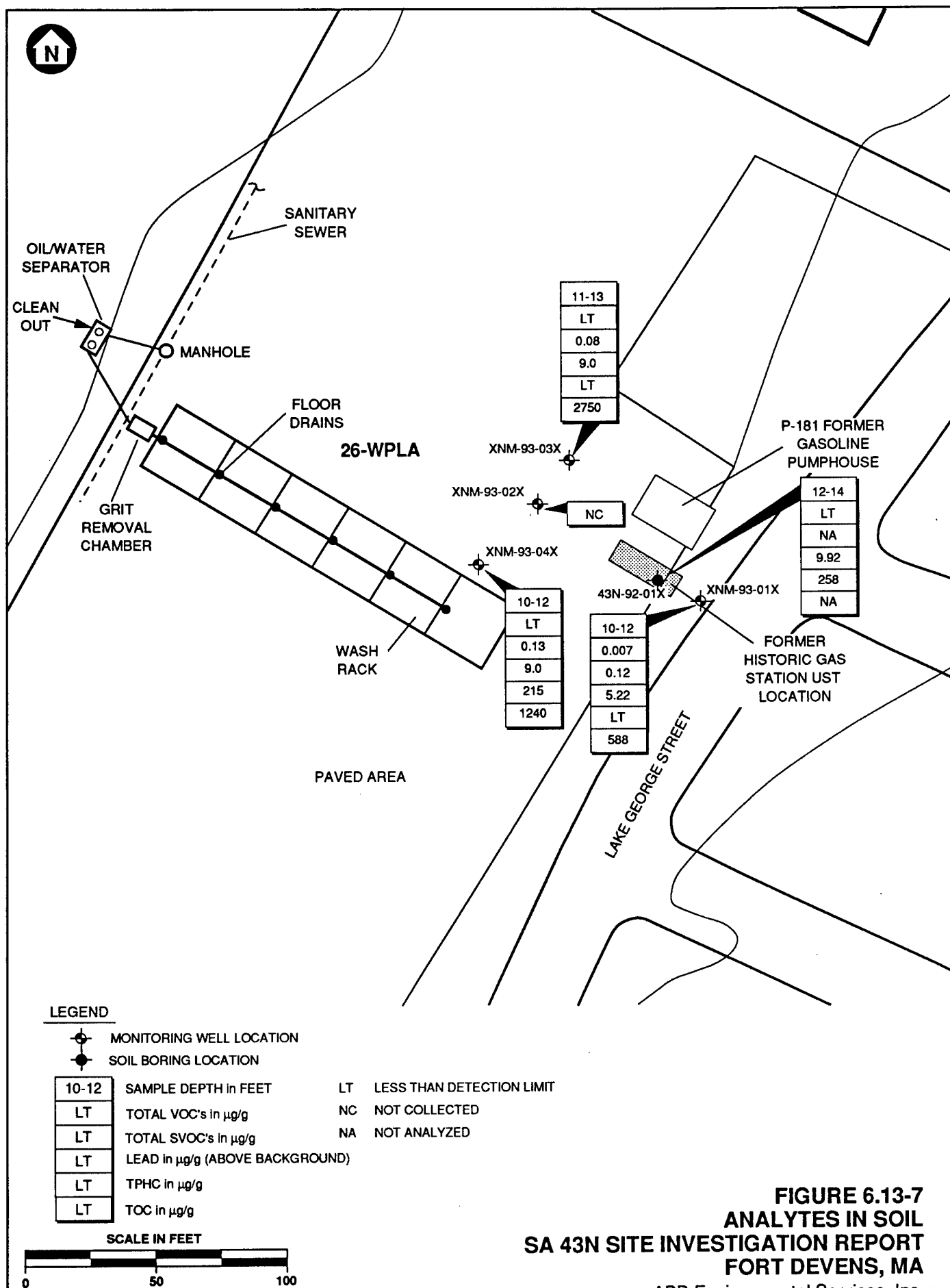


FIGURE 6.13-4
ATEC FIELD SCREENING LOCATIONS
SA 43N SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.







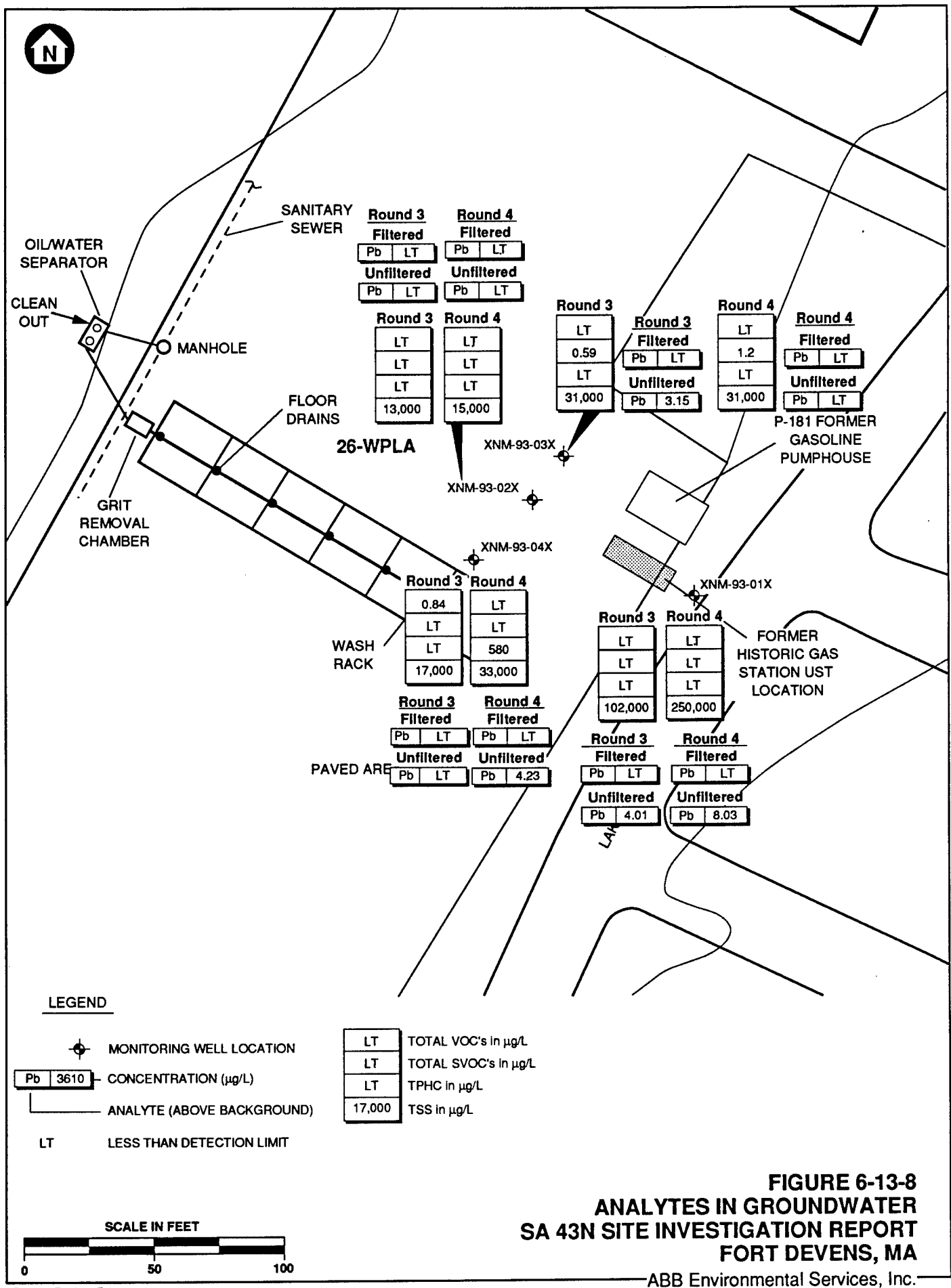


FIGURE 6-13-8
ANALYTES IN GROUNDWATER
SA 43N SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.14 STUDY AREA 43O

6.14.1 Study Area Background and Conditions

The structure of the historic gas station located at SA 43O consisted of a pump island and a small gasoline pumphouse. The gas station was a Type B station which had two 5,000 gallon (or possibly 5,140 gallon) USTs located on either side of the gasoline pumphouse and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST. The area around where SA 43O was located is presently used by the Nuclear, Biological, and Chemical (NBC) School for classroom facilities (Building 2680) and parking (Figure 6.14-1).

The two USTs associated with historic gas station N were removed by Kurz in 1989 as part of an installation-wide UST removal program. Residual contamination was observed at the time of removal. Both USTs contained a mixture of water and what appeared to be mogas. Approximately 150 cubic yards of contaminated soil was removed from the excavations. PID measurements indicated that residual soil contamination was still present in the soil around the former USTs. Due to the presumed soil contamination, the excavation was backfilled and additional investigation was conducted. As part of the removal program, three monitoring wells (2680W-01 through 2860W-03) were installed to monitor for free product. The groundwater table was measured by Kurz at 9 feet bgs, and no product was detected (Kurz Associates, 1991).

6.14.2 Site Investigation Program Summary

The SI at SA 43O was performed in accordance with the Final SI Historic Gas Station Task Order Work Plan (ABB-ES, 1992a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The field investigation program at SA 43O consisted of 10 TerraProbe points, one soil boring, and groundwater sampling from the existing monitoring wells. Table 6.14-1 summarized the activities completed during the SI.

SECTION 6

The TerraProbe points were advanced to the water table (9 feet bgs) and one subsurface soil sample was collected from each point and analyzed in the field for BTEX and TPHC (see Figure 6.14-1).

One soil boring (43O-92-01X) was advanced to the water table and two subsurface soil samples were collected for laboratory analysis. The samples were analyzed for PAL VOCs, TPHC, and lead (see Figure 6.14-1).

Two of the three existing monitoring wells (2680W-01 and 2680W-02) were developed and sampled. Development and sampling was not conducted on 2680W-03 due to an obstruction in the well which prevented access to the groundwater at this location. These samples were collected during the Round Two of groundwater sampling for the SI. These samples were submitted for off-site laboratory analysis for PAL VOCs and lead. The monitoring well construction details are presented in Appendix C.

6.14.3 Supplemental Site Investigation Program Summary

The SSI at SA 43O was performed in accordance with the Final SSI Task Order Work Plan (ABB-ES, 1993a) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1992b). The following sections describe the field activities completed at each historic gas station during the SSI. Table 6.14-1 summarizes the activities completed during the SS1.

The SSI at SA 43O was conducted around the excavation of the former UST at Historic Gas Station O south of Building 2680.

The 10 TerraProbe points were advanced on all sides of the TerraProbe points completed at this site during the SI. These points were located in and around the excavation of the former UST removed in 1991 (see Figure 6.14-1). The results of these samples collected during the SSI were used to further define the horizontal distribution of contaminants detected during the SI. Up to two soil samples were collected from each TerraProbe point. The samples were analyzed in the field for BTEX and TPHC.

Three groundwater monitoring wells (XOM-93-01X through XOM-93-03X) were installed to monitor downgradient groundwater quality (see Figure 6.14-1). One soil sample was collected from the water table in each of the monitoring well

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borings. The soil samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, lead, TPHC, and TOC. The well screen of each monitoring well was placed so that it intersected the water table to monitor for free product and allow for seasonal groundwater fluctuation. Table 6.14-2 summarizes the monitoring well construction at SA 43O.

Round Three groundwater samples were collected from the SA 43N monitoring wells in October 1993 and Round Four samples were collected in January 1994. An additional round of groundwater sampling (Round Five) was collected in April 1994 to assess groundwater contaminant concentrations at high water table conditions. All three rounds of samples were submitted for off-site laboratory analysis consisting of PAL VOCs, SVOCs, lead (both filtered and unfiltered), TPHC, and TSS.

After the newly installed monitoring wells were developed and sampled, hydraulic conductivity tests were preformed. The tests consisted of a rising and falling head test.

6.14.4 Field Investigation Results and Observations

The soil at SA 43O consists of silty fine sand with gravel. Groundwater was encountered at 12 feet in the soil boring and refusal (apparently bedrock) was reached at 12.5 feet bgs (Table 6.14-3).

The calculated hydraulic conductivities in the bedrock monitoring wells ranged from $2.9E^{-04}$ cm/sec. at XNM-93-01X to $5.8E^{-05}$ cm/sec. at XNM-93-03X. The results of the hydraulic conductivity tests are presented in Table 6.14-4. The water levels measured in the existing monitoring wells were measured at an average of 9 feet bgs.

The new monitoring wells were included in the November 8, 1993 synoptic water-level round at Fort Devens. The results of that round are presented in Table 6.14-4. The inferred groundwater flow appears to be moving to the west-northwest (Figure 6.14-2). All SSI exploration locations were surveyed.

SECTION 6

6.14.5 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

6.14.5.1 Soil. The results of the TerraProbe soil samples indicated that residual soil contamination was present in the soils around the former UST. VOCs were detected in three of the 10 samples (TP-02, TP-03, and TP-08) ranging from 37 ppb in TP-08 to 840 ppb in TP-03. TPHC was detected six of the 10 soil samples collected from SA 43O. Concentrations of TPHC ranged from 620 ppm in TP-03 to 92 ppm in TP-04 (Table 6.14-5; see Figure 6.14-3).

A total of eight TerraProbe points were completed during the SSI to further define the distribution of contaminants detected during the SI. Soil samples were collected from 10 to 13 feet and analyzed for BTEX and TPHC. Toluene was detected in the 10 and 12-foot samples collected from TP-11 at 0.5 and 0.4 ppb. Xylenes were detected the four samples collected from TP-11, the 10 and 11-foot samples collected from TP-12, the 11-foot sample collected from TP-14, the 12-foot sample from TP-18, and the 11-foot sample from TP-19. TPHC was detected in upgradient and downgradient of the former UST location ranging from 71 ppm to 420 ppm (see Table 6.14-5; Figure 6.14-4 and 6.14-5).

Based on the results obtained from the SI field analytical program, soil boring 43O-92-01X was drilled adjacent to TP-03, which had the highest concentrations of BTEX and TPHC. Two subsurface soil samples were collected from 5 feet to 7 feet and 11 feet to 13 feet bgs. Acetone was detected in the 5 foot to 7 foot sample at a concentration of 0.032 $\mu\text{g/g}$. This VOC is a common laboratory contaminant and is not believed to be a site contaminant. Section 3.2.2 of this report discusses this and other common laboratory contaminant detected. No other VOCs were detected in the 5 foot to 7 foot sample nor the 11 foot to 13 foot sample. TPHC was not detected in either of soil samples collected, and lead was present at a concentration below established Fort Devens background in both soil samples (Table 6.14-6; see Figure 6.14-6).

One subsurface soil sample was collected from the water table at each of the three SSI monitoring well borings completed at this site and submitted for off-site laboratory analysis. The only SVOCs detected were found to be a laboratory contaminant (bis(2-hexylmethyl)phthalate) (see Table 6.14-6). One soil sample (10-foot sample from XOM-93-02X) was analyzed for inorganic. Several inorganic analytes (copper, iron, manganese, nickel, sodium, and zinc) were

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detected slightly above their Fort Devens background. TPHC was detected at 35.1 $\mu\text{g/g}$ in XOM-93-02X and at 44.2 $\mu\text{g/g}$ in XOM-93-03X. TPHC was not detected in the sample collected from XOM-93-01X (see Table 6.14-7; Figure 6.14-6).

6.14.5.2 Groundwater. Only two (2680W-02 and 2680W-03) of the three existing monitoring wells were sampled during Round Two of the SI due to an obstruction in 2680W-03. Chloroform was detected in both groundwater samples at concentrations of 0.62 $\mu\text{g/L}$ and 1.2 $\mu\text{g/L}$, respectively. No other VOCs were detected in either samples. Lead was detected at 106 $\mu\text{g/L}$ in 2680W-01 and 56.2 $\mu\text{g/L}$ in 2680-03. These concentrations are above the established Fort Devens background concentration, however, TSS concentrations were detected at 4,190 mg/L and 1,320 mg/L , respectively. The lead concentrations may be attributed to high TSS concentrations (Table 6.14-8; see Figure 6.14-7). Filtered samples were not collected during Round Two to confirm this hypothesis.

Rounds Three, Four, and Five groundwater samples were collected from the three newly installed monitoring wells (XOM-93-01X through XOM-93-03X) and two of the three existing monitoring wells (2680W-01 and 2680W-02). A groundwater sample was not collected from 2680W-03 because of an obstruction in the monitoring well. Several VOCs (TEX) and TCE, one SVOC (naphthalene), and TPHC were detected in the new and existing downgradient monitoring wells and the monitoring well installed within the former UST excavation. Lead was detected above the Fort Devens background concentration in the unfiltered sample from each monitoring well, however, lead was not detected above the detection limit in the filtered samples (see Table 6.14-8; Figure 6.14-7).

The results of the Round Four groundwater sampling indicated the presence of several VOCs (TCE, chloroform, ethylbenzene, and xylenes) in the downgradient monitoring wells (2680W-02, XOM-93-01X, XOM-93-02X, and XOM-93-03X). TCE was detected at 9.3 $\mu\text{g/L}$ at XOM-93-03X. This was the only VOC detected above its drinking water standard/guideline (5.0 $\mu\text{g/L}$). Naphthalene (0.85 $\mu\text{g/L}$ at XOM-93-01X) was the only SVOC detected in the Round Four samples. TPHC was not detected in any of the Round Four samples. Lead was detected above the Fort Devens background concentration in several of the unfiltered groundwater samples. Concentrations of lead in the unfiltered samples ranged from 9.5 $\mu\text{g/L}$ at XOM-93-03X to 200 $\mu\text{g/L}$ at 2680W-02. Lead was not detected above the analytical detection limit (1.26 $\mu\text{g/L}$) in any of the filtered groundwater

SECTION 6

samples collected during Round Four. TSS concentrations ranged from 850,000 $\mu\text{g/L}$ at 2680W-01 to 65,000 $\mu\text{g/L}$ at XOM-93-01X (see Table 6.14-8).

The results of the Round Five groundwater sampling indicated the presence of several VOCs (TCE, ethylbenzene and xylenes) in the downgradient monitoring wells (XOM-93-01X, XOM-93-02X, and XOM-93-03X). TCE was the only VOC detected above its drinking water standard/guideline of 5.0 $\mu\text{g/L}$. TCE was detected at 6.2 $\mu\text{g/L}$ in the groundwater samples collected from XOM-93-03X. No SVOCs nor TPHC were detected in the Round Five samples. Lead was detected above the Fort Devens background concentration in several of the unfiltered groundwater samples. Concentrations of lead in the unfiltered samples ranged from below the detection limit (1.26 $\mu\text{g/L}$) at 2680W-01 to 17.9 $\mu\text{g/L}$ at 2680W-02. Lead was not detected above the analytical detection limit of 1.26 $\mu\text{g/L}$ in any of the filtered groundwater samples collected during Round Five. TSS concentrations ranged from 500,000 $\mu\text{g/L}$ at 2680W-01 and 2680W-02 to 11,000 $\mu\text{g/L}$ at XOM-93-01X (see Table 6.14-8).

6.14.6 Source Evaluation and Migration Potential

The results of the field and off-site laboratory analytical programs indicated that residual TPHC was present in the soil at the water table in and around the excavation of the former USTs. TPHC was detected in soil upgradient and downgradient of the former UST excavation. The distribution of the contamination is consistent with the UST removal report which indicated that residual soil contamination was present in the excavation at the time that the excavation was backfilled. The contamination appears to be in the center and western side of the former excavation.

Several VOCs (ethylbenzene, toluene, xylenes, and TCE) were detected in the groundwater samples collected downgradient of the former UST excavation and from the monitoring well installed in the former excavation. The detection of these contaminants in groundwater appears to indicate that residual contamination associated with the historic use of this site, has impacted the groundwater quality at the site, as well as downgradient of the site.

However, the groundwater result from the monitoring well with the highest concentrations of TCE showed a noticeable reduction from Round Three to Round Five (see Table 6.14-8).

6.14.7 Preliminary Human Health Risk Evaluation

During the SI, 10 TerraProbe subsurface soil samples and one confirmatory soil samples were collected and analyzed and are discussed in the SI Report. An additional 22 TerraProbe samples and one confirmatory boring sample were taken during the SSI. Tables 6.14-5, 6.14-6, and 6.14-7 give the individual analytical results for the soil samples collected from SA 430. Table 6.14-9 summarizes the combined SI and SSI TerraProbe and confirmatory boring results and compares them to Region III commercial and MCP Category S-2 soil guidelines. Low concentrations of TEX which did not exceed guidelines were detected in both SI and SSI TerraProbe samples. TPHC was detected in 14 of 36 samples at concentrations not exceeding guidelines. The acetone and di-n-butyl phthalate which were detected in the laboratory analytical results for the soil borings are common laboratory contaminants and are not considered site-related. Concentrations of inorganics detected in the soil did not exceed guidelines. In conclusion, it appears that contact with subsurface soil at SA 430 does not pose a potential risk to human health.

Table 6.14-10 presents summary data based on unfiltered groundwater samples from SA 430 along with drinking water standards/guidelines for comparison. The organics detected were chloroform, ethylbenzene, naphthalene, TCE, xylenes, and TPHC. The concentrations of chloroform, ethylbenzene, and xylenes did not exceed their respective federal MCLs. In addition, chloroform is a common laboratory contaminant and is not considered site-related. No standard is available for naphthalene, but the detected concentration does not exceed the Region III tap water concentration. TCE exceeded its federal MCL. TPHC was detected in three of 17 samples and the average concentration which exceeded the MCP GW-1 standard.

Lead was the only inorganic analyzed for and was detected in 13 of the 17 samples. Both the maximum and average concentrations of lead exceeded the USEPA action level. However, the results of the filtered inorganic sample results showed lead below the detection limit. Based on these results and the TSS result,

SECTION 6

it is unlikely that the lead concentration detected, is a result of petroleum releases at this site.

Based on this screening, it appears that TCE and TPHC in groundwater may pose a potential risk to human health. However, the reduction in TCE from Round Three to Round Five (in XOM-93-03X) indicates that TCE concentrations may continue to decline and eventually be below the MCL reducing the potential risk to human health. In addition, TPHC was not detected in the two rounds of groundwater samples collected from XOM-93-03X, after the maximum concentration of 2,810 $\mu\text{g/L}$ which was detected in Round Three (see Table 6.14-8).

6.14.8 Conclusions and Recommendations

Based on the results of the human health PRE, an NFA is recommended for SA 430.

TABLE 6.14-1
SUMMARY OF TECHNICAL APPROACH
SA 430 - HISTORIC GAS STATION O

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ACTIVITY	PURPOSE	SITE IDENTIFICATION	RATIONALE FOR SELECTED LOCATIONS
SI PROGRAM			
TERRA PROBE			
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	• COLLECT SOIL SAMPLES FOR FIELD ANALYSIS • CHARACTERIZE SOILS CONTAMINATION • COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	TP-01 THRU TP-10 430-92-01X	• IN AND AROUND FORMER HGS GASOLINE UST • ADJACENT TO TERRAPROBE 'HOT SPOT'
SSI PROGRAM			
TERRA PROBE	• COLLECT SOIL SAMPLES FOR FIELD ANALYSIS	TP-11 THRU TP-20	• IN AND AROUND FORMER WASTE OIL UST
SOIL BORINGS AND SUBSURFACE SOIL SAMPLING	• INSTALL MONITORING WELLS • CHARACTERIZE SOILS CONTAMINATION • COLLECT SOIL SAMPLES FOR LABORATORY ANALYSIS	XOM-93-01X XOM-93-02X XOM-93-03X	• UPGRADIENT • IN FORMER UST GRAVE • DOWNGRADIENT
MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING	• MONITOR GROUNDWATER LEVELS • MONITOR GROUNDWATER QUALITY • DETERMINE AQUIFER CONDUCTIVITIES	XOM-93-01X XOM-93-02X XOM-93-03X	• UPGRADIENT • IN FORMER UST GRAVE • DOWNGRADIENT

TABLE 6.14-2
MONITORING WELL COMPLETION DETAILS
SA 430 - HISTORIC GAS STATION O

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL IDENTIFICATION	SOIL DRILLING METHOD	BEDROCK DRILLING METHOD	MEDIA SCREENED	WELL SCREEN DEPTH (Feet bgs)	WELL SCREEN ELEVATION (Feet NGVD)	COMPLETION DEPTH (Feet bgs)	CONSTRUCTION MATERIAL
XOM-93-01X	HOLLOW STEM AUGER	NA	SOIL	10-20	322.9 - 312.9	20.5	4" ID PVC
XOM-93-02X	HOLLOW STEM AUGER	NA	SOIL	7.5 - 17.5	325.9 - 315.9	18.5	4" ID PVC
XOM-93-03X	HOLLOW STEM AUGER	NA	SOIL	9.0 - 19.0	323.3 - 313.3	19.8	4" ID PVC

NA= Not Applicable

TABLE 6.14-3
SUMMARY OF SOIL BORINGS
SA 430 - HISTORIC GAS STATION O
SITE INVESTIGATION REPORT
FORT DEVENS, MA

EXPLORATION ID	COMPLETION DEPTH (Feet bgs)	REFERENCE SAMPLE INTERVALS (Feet bgs)	ANALYTICAL SAMPLES COLLECTED	SOIL TYPE (USCS)	TOTAL VOCs BY PID (PPM)	COMMENTS
430-92-01X	12.5	5-7	5-7	SM	22.0	
		7-9		SM	5.0	
		9-11		SM	BKG	
		11-12.5	11-12.5	SM	BKG	
XOM-93-01X	20.3	0-2		GP-SP	BKG	
		5-7		GP-SP	BKG	
		10-12	10-12	SM-SP	BKG	
		14-14.2		SP-GP	BKG	Rollerbit phyllite from 14.2 to 20.3 - feet
XOM-93-02X	18.5	0-2		SW-SM	BKG	
		2-4		SM-GP	BKG	
		4-6		SM-GP	BKG	
		6-8		SM-GP	BKG	
		8-10		SM-GP	BKG	
		10-12	10-12	SP	BKG	
		12-14		SP	BKG	
		14-16		SP-GP	BKG	
		0-2		GP-SP	BKG	
		5-7		SM-SP	BKG	
XOM-93-03X	19.8	10-12	10-12	SM-SP	BKG	
		14.5-14.7		SM-SP	BKG	
						Rollerbit phyllite from 14.5 to 19.8 - feet

NOTES:
bgs = below ground surface
VOCs = Volatile organic compounds
USCS = Unified soil classification system
ppm = parts per million
phyl = phyllite
BKG = background levels of Total VOCs were measured with a PID at the work site

TABLE 6.14-4
SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
SA 430 - HISTORIC GAS STATION O

SITE INVESTIGATION REPORT
FORT DEVENS, MA

WELL ID	ELEVATION ¹	DEPTH TO WATER (Feet bgs)	ELEVATION OF WATER (Feet NGVD)	CONDUCTIVITY
				HVORSLEV ² (cm/sec)
XOM-93-01X	331.29	10.86	320.43	2.9E-04
XOM-93-02X	332.87	7.11	325.77	7.4E-05
XOM-93-03X	331.87	11.12	320.77	5.8E-05

Notes: bgs = below ground surface

cm/sec = centimeters per second

NGVD = National Geodetic Vertical Datum

1 = elevation of top of pvc

2 = averaged value of two tests

Groundwater elevations from November 8, 1993

synoptic water level round

TABLE 6.14-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-01	TP-02	TP-03	TP-04	TP-05	TP-06	TP-07	TP-08
	TSO0109F	TSO0209F	TSO0309F	TSO0409F	TSO0509F	TSO0609F	TSO0709F	TSO0809F
ORGANICS (ppb)	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT	9 FT
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	100	290	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	63	130	< 0.1	< 0.1	< 0.1	< 0.1	14
m/p-XYLENE	< 0.1	290	320	< 0.1	< 0.1	< 0.1	< 0.1	15
o-XYLENE	< 0.1	86	100	< 0.1	< 0.1	< 0.1	< 0.1	7.5
OTHER (ppm)								
TOTAL PETROLEUM HYDROCARBONS	< 56	150	620	92	140	< 54	< 53	110

Notes:

< = Less than detection limit.

TABLE 6.14-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-09		TP-10		TP-11		TP-11		TP-11		TP-12		TP-12			
	TSO0909F	9 FT	TSO1009F	9 FT	TSO1110F	10 FT	TSO1111F	11 FT	TSO1112F	12 FT	TSO1113F	13 FT	TSO1209F	9 FT	TSO1210F	10 FT
ORGANICS (ppb)																
BENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE		< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE		< 0.1	< 0.1	< 0.1	0.6	< 0.1	0.5	< 0.1	0.5	< 0.1	< 0.1	< 0.1	0.4	< 0.1	0.4	< 0.1
o-XYLENE		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS	93		<55		420		< 57		< 54		86		< 56		< 55	

Notes:

< = Less than detection limit.

TABLE 6.14-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-12		TP-14		TP-14		TP-14		TP-15		TP-15		TP-16		TP-16	
	TSO1211F	11 FT	TSO1409F	9 FT	TSO1410F	10 FT	TSO1411F	11 FT	TSO1509F	9 FT	TSO1510F	10 FT	TSO1609F	9 FT	TSO1610F	10 FT
ORGANICS (ppb)																
BENZENE		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1
TOLUENE		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1
ETHYLBENZENE		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1
m/p-XYLENE		< 0.1		< 0.1		< 0.1		0.4		< 0.1		< 0.1		< 0.1		< 0.1
o-XYLENE		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1
O'OTHER (ppm)																
TOTAL PETROLEUM HYDROCARBONS		< 54		< 55		55		90		55		< 54		< 57		< 55

Notes:

< = Less than detection limit.

TABLE 6.14-5
FIELD ANALYTICAL SUBSURFACE SOIL SAMPLES
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	TP-17		TP-17		TP-17		TP-18		TP-18		TP-19	
	TSO1709F	10 FT	TSO1710F	11 FT	TSO1711F	10 FT	TSO1810F	11 FT	TSO1811F	12 FT	TSO1911F	12 FT
ORGANICS (ppb)	9 FT											
BENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOLUENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
ETHYLBENZENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
m/p-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.2	0.4	< 0.1
o-XYLENE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OTHER (ppm)												
TOTAL PETROLEUM HYDROCARBONS	< 59	< 57		< 60	< 54	< 54	< 54	< 54	< 54	71	< 56	92

Notes:

< = Less than detection limit.

TABLE 6.14-6
ORGANIC ANALYTES IN SUBSURFACE SOIL
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	SSI				SI		
	XOM-93-01X DUP 10 FT	XOM-93-01X 10 FT	XOM-93-02X 10 FT	XOM-93-03X 10 FT	430-92-01X DUP 5 FT	430-92-01X 5 FT	430-92-01X 11 FT
ORGANICS (ug/g)							
ACETONE	< 0.017	< 0.017	< 0.017	< 0.017	0.032	< 0.017	< 0.017
DI-N-BUTYL PHTHALATE	0.22	0.54	0.41	0.16	<0.62	<0.62	<0.62
OTHER (ug/g)							
TOTAL ORGANIC CARBON	936	18600	2720	657	495	NA	517
TOTAL PETROLEUM HYDROCARBONS	55.3	< 28.5	35.1	44.2	< 27.9	< 27.9	< 27.7

Notes:

< = Less than detection limit.

NA = not analyzed.

TABLE 6.14-7
INORGANIC ANALYTES IN SUBSURFACE SOIL
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	SSI				SI			
		XOM-93-01X DUP 10 FT	XOM-93-01X 10 FT	XOM-93-02X 10 FT	XOM-93-03X 10 FT	430-92-01X DUP 5 FT	430-92-01X 5 FT	430-92-01X 11 FT	430-92-01X 11 FT
INORGANICS (ug/g)									
ALUMINUM	15000.0	NA	NA	6420	NA	NA	NA	NA	NA
ARSENIC	21.0	NA	NA	5.79	NA	NA	NA	NA	NA
BARIUM	42.5	NA	NA	16.6	NA	NA	NA	NA	NA
CALCIUM	1400.0	NA	NA	1060	NA	NA	NA	NA	NA
CHROMIUM	31.0	NA	NA	16.1	NA	NA	NA	NA	NA
COBALT	NA	NA	NA	8.62	NA	NA	NA	NA	NA
COPPER	8.39	NA	NA	18.3	NA	NA	NA	NA	NA
IRON	15000.0	NA	NA	15900	NA	NA	NA	NA	NA
LEAD	36.9	15	13	10.1	12	9.13	9.85	9.75	9.75
MAGNESIUM	5600.0	NA	NA	3690	NA	NA	NA	NA	NA
MANGANESE	300.0	NA	NA	651	NA	NA	NA	NA	NA
NICKEL	14.0	NA	NA	31.3	NA	NA	NA	NA	NA
POTASSIUM	1700.0	NA	NA	408	NA	NA	NA	NA	NA
SODIUM	131.0	NA	NA	318	NA	NA	NA	NA	NA
VANADIUM	28.7	NA	NA	7.28	NA	NA	NA	NA	NA
ZINC	35.3	NA	NA	35.7	NA	NA	NA	NA	NA

Notes:

NA = not analyzed.

Shaded values exceed background limit.

TABLE 6.14-8
ANALYTES IN GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	2680W - 01				2680W - 01				2680W - 01			
		FILTERED ROUND 2	UNFILTERED ROUND 2	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 5	UNFILTERED ROUND 5	FILTERED ROUND 5	UNFILTERED ROUND 5		
ORGANICS (µg/L)													
XYLENES		NA	< 0.84	NA	< 0.84	NA	< 0.84	NA	< 0.84	NA	< 0.84		
TOLUENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5		
CHLOROFORM		NA	0.62	NA	0.62	NA	< 0.5	NA	< 0.5	NA	< 0.5		
ETHYLBENZENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5		
NAPHTHALENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5		
TRICHLOROETHYLENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5		
INORGANICS (µg/L)													
LEAD	4.25	NA	106	< 1.26	106	< 1.26	16.7	< 1.26	< 1.26	< 1.26	< 1.26		
OTHER (µg/L)													
TOTAL SUSPENDED SOLIDS		NA	4190000	NA	4010000	NA	850000	NA	850000	NA	500000		
TOTAL PETROLEUM HYDROCARBONS		NA	< 120	NA	< 190	NA	< 190	NA	< 190	NA	< 190		

Notes:
 < = Less than detection limit.
 NA = Not analyzed
 Shaded values exceed background limit

TABLE 6.14-8
ANALYTES IN GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	2680W -02					2680W -02					2680W -02				
		FILTERED ROUND 2	UNFILTERED ROUND 2	FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 5	UNFILTERED ROUND 5	FILTERED ROUND 5	UNFILTERED ROUND 5					
ORGANICS (µg/L)																
XYLENES		NA	< 0.84	NA	< 0.84	NA	< 0.84	NA	< 0.84	NA	< 0.84	NA	< 0.84			
TOLUENE		NA	< 0.5	NA	0.74	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5			
CHLOROFORM		NA	1.2	NA	< 0.5	NA	< 0.5	NA	1.2	NA	< 0.5	NA	< 0.5			
ETHYLBENZENE		NA	< 0.5	NA	0.89	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5			
NAPHTHALENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5			
TRICHLOROETHYLENE		NA	< 0.5	NA	< 0.5	NA	< 0.5	NA	0.76	NA	< 0.5	NA	< 0.5			
INORGANICS (µg/L)																
LEAD	4.25	NA	56.2	< 1.26	10.2	< 1.26	< 1.26	< 1.26	200	< 1.26	< 1.26	< 1.26	17.9			
OTHER (µg/L)																
TOTAL SUSPENDED SOLIDS		NA	1320000	NA	195	NA	620000	NA	620000	NA	620000	NA	500000			
TOTAL PETROLEUM HYDROCARBONS		NA	< 120	NA	959	NA	< 190	NA	< 190	NA	< 190	NA	< 180			

Notes:

< = Less than detection limit.

NA = Not analyzed

Shaded values exceed background limit

TABLE 6.14-8
ANALYTES IN GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XOM-93-01X			XOM-93-01X			XOM-93-01X		
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 5	UNFILTERED ROUND 5			
ORGANICS (µg/L)										
XYLENES		NA	0.9	NA	0.94	NA	< 0.84			
TOLUENE		NA	< 0.5	NA	< 0.5	NA	< 0.5			
CHLOROFORM		NA	0.81	NA	< 0.5	NA	< 0.5			
ETHYLBENZENE		NA	5.8	NA	6.4	NA	4			
NAPHTHALENE		NA	2.8	NA	0.85	NA	< 0.5			
TRICHLOROETHYLENE		NA	1.5	NA	< 0.5	NA	< 0.5			
INORGANICS (µg/L)										
LEAD	4.25	< 1.26	8.79	< 1.26	3.1	< 1.26	5.1			
OTHER (µg/L)										
TOTAL SUSPENDED SOLIDS		NA	311000	NA	65000	NA	11000			
TOTAL PETROLEUM HYDROCARBONS		NA	229	NA	< 180	NA	< 180			

Notes:
 < = Less than detection limit.
 NA = Not analyzed
 Shaded values exceed background limit

TABLE 6.14-8
ANALYTES IN GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	XOM-93-02X		XOM-93-02X		XOM-93-02X	
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 5	UNFILTERED ROUND 5
ORGANICS (µg/L)							
XYLENES		NA	1.9	NA	< 0.84	NA	1.1
TOLUENE		NA	< 0.5	NA	< 0.5	NA	< 0.5
CHLOROFORM		NA	< 0.5	NA	< 0.5	NA	< 0.5
ETHYLBENZENE		NA	0.49	NA	< 0.5	NA	0.51
NAPHTHALENE		NA	< 0.5	NA	< 0.5	NA	< 0.5
TRICHLOROETHYLENE		NA	1.2	NA	< 0.5	NA	0.53
INORGANICS (µg/L)							
LEAD	4.25	< 1.26	8.68	< 1.26	17	< 1.26	1.84
OTHER (µg/L)							
TOTAL SUSPENDED SOLIDS		NA	392000	NA	460000	NA	62000
TOTAL PETROLEUM HYDROCARBONS		NA	< 190	NA	< 190	NA	< 190

Notes:
< = Less than detection limit.
NA = Not analyzed
Shaded values exceed background limit

TABLE 6.14-8
ANALYTES IN GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACKGROUND	KOM-93-03X		KOM-93-03X		KOM-93-03X	
		FILTERED ROUND 3	UNFILTERED ROUND 3	FILTERED ROUND 4	UNFILTERED ROUND 4	FILTERED ROUND 5	UNFILTERED ROUND 5
ORGANICS (µg/L)							
XYLENES		NA	< 0.84	NA	< 0.84	NA	< 0.84
TOLUENE		NA	< 0.5	NA	< 0.5	NA	< 0.5
CHLOROFORM		NA	< 0.5	NA	1	NA	< 0.5
ETHYLBENZENE		NA	< 0.5	NA	< 0.5	NA	< 0.5
NAPHTHALENE		NA	< 0.5	NA	< 0.5	NA	< 0.5
TRICHLOROETHYLENE		NA	12	NA	9.3	NA	6.2
INORGANICS (µg/L)							
LEAD	4.25	< 1.26	13.1	< 1.26	9.5	< 1.26	11.5
OTHER (µg/L)							
TOTAL SUSPENDED SOLIDS		NA	271000	NA	170000	NA	221000
TOTAL PETROLEUM HYDROCARBONS		NA	2810	NA	< 190	NA	< 190

Notes:
< = Less than detection limit.
NA = Not analyzed
Shaded values exceed background limit

TABLE 6.14-9
HUMAN HEALTH PRE EVALUATION OF SUBSURFACE SOIL
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		REGION III COMMERCIAL/ INDUSTRIAL CONCENTRATION	MCP S-2 STANDARD	MAXIMUM EXCEEDS GUIDELINE CONCENTRATION ?
		AVERAGE	MAXIMUM			
ORGANICS (µg/kg)						
ACETONE	1/4	--	0.00032	10000000	3000	NO
DI-N-BUTYLE PHTHALATE	1/4	--	0.00041	100000000	N/A	NO
TOLUENE	4/36	97.7	290	200000000	90000	NO
ETHYLBENZENE	3/36	69	130	100000000	80000	NO
m/p-XYLENE*	11/32	57.2	320	1000000000	800000	NO
o-XYLENE*	4/32	48.7	100	1000000000	800000	NO
OTHER (mg/kg)						
TOTAL PETROLEUM HYDROCARBONS	14/36	151	620	1680	2500	NO

Notes:

[a] Subsurface soil (3 to 15 feet) based on field screening samples TP-01 through TP-10 from 1992, TP-11 through TP-19 from 1993, and soil borings XOM-93-02X and 430-92-01X.

* = analyte from field screening samples

$\mu\text{g/kg}$ = micrograms per kilogram

mg/kg = milligrams per kilogram

- = not applicable

MCP = Massachusetts Contingency Plan

NA = not available

TABLE 6.14-10
HUMAN HEALTH PRE EVALUATION OF GROUNDWATER
SA 430 - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	FREQUENCY OF DETECTION	DETECTED CONCENTRATION [a]		GROUNDWATER BACKGROUND CONCENTRATION (µg/L)	MAXIMUM EXCEEDS BACKGROUND ?	DRINKING WATER STANDARD/ GUIDELINE [b] (µg/L)	MAXIMUM EXCEEDS STANDARD/ GUIDELINE ?
		AVERAGE (µg/L)	MAXIMUM (µg/L)				
ORGANICS							
CHLOROFORM	5/17	0.89	1.2	NA	-	5	NO
ETHYLBENZENE	6/17	3.0	6.4	NA	-	700	NO
NAPHTHALENE	2/17	1.8	2.8	NA	-	1500	NO
TOLUENE	1/17	0.74	0.74	NA	-	1600	NO
TRICHLOROETHENE	6/17	5.16	12	NA	-	5	YES
XYLENES	4/17	1.21	1.9	NA	-	10000	NO
INORGANICS							
LEAD	13/17	44.1	200	4.25	YES	15	YES
OTHER							
TOTAL PETROLEUM HYDROCARBONS	3/17	1332.2	2810	NA	-	1000	YES

Notes:

[a] Groundwater based on unfiltered samples from 2680W-01 and 2680W-03 (2 rounds each) and XOM-93-01X to XOM-93-03X (one duplicate).

[b] Includes the lowest of either the EPA or MA drinking water standards, or if no federal standard or guideline is available, the Region III tap water concentration.

NA = not available

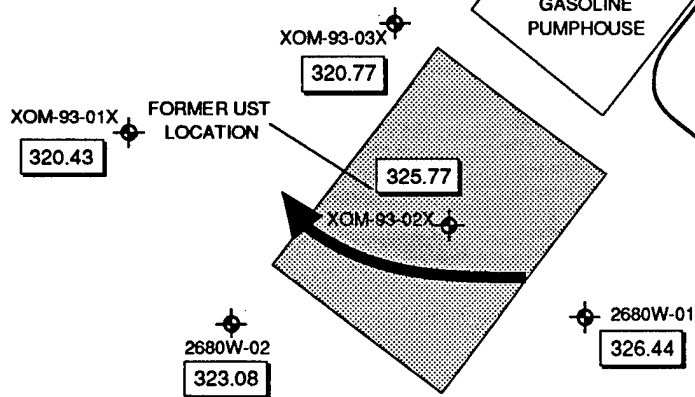
µg/L = micrograms per liter

- = not applicable

Shaded compounds exceed standard or guideline.



PAVED PARKING LOT



LEGEND



MONITORING WELL LOCATION



INFERRED GROUNDWATER FLOW DIRECTION

346.20

GROUNDWATER ELEVATION DURING NOV. 8, 1993
SYNOPTIC WATER-LEVEL ROUND

SCALE IN FEET

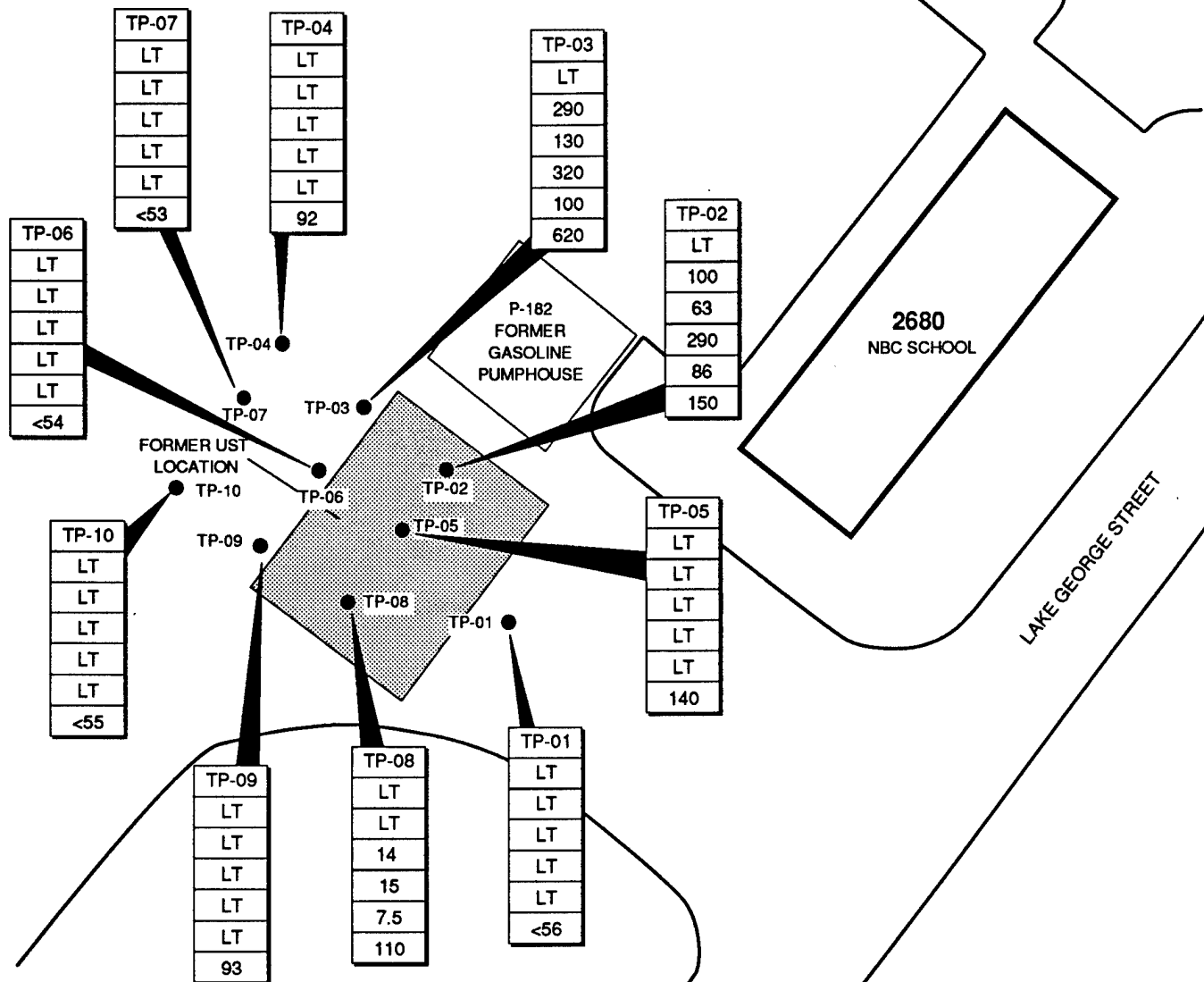


FIGURE 6.14-2
INFERRED GROUNDWATER FLOW DIRECTION
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



PAVED PARKING LOT



LEGEND

● TERRAPROBE LOCATION

TP-01	Sample ID
LT	Benzene in ppb
LT	Toluene in ppb
LT	Ethylbenzene in ppb
LT	M/P Xylene in ppb
LT	O-xylene in ppb
60	TOTAL Petroleum Hydrocarbons in ppm
LT	LESS THAN DETECTION LIMIT

SCALE IN FEET

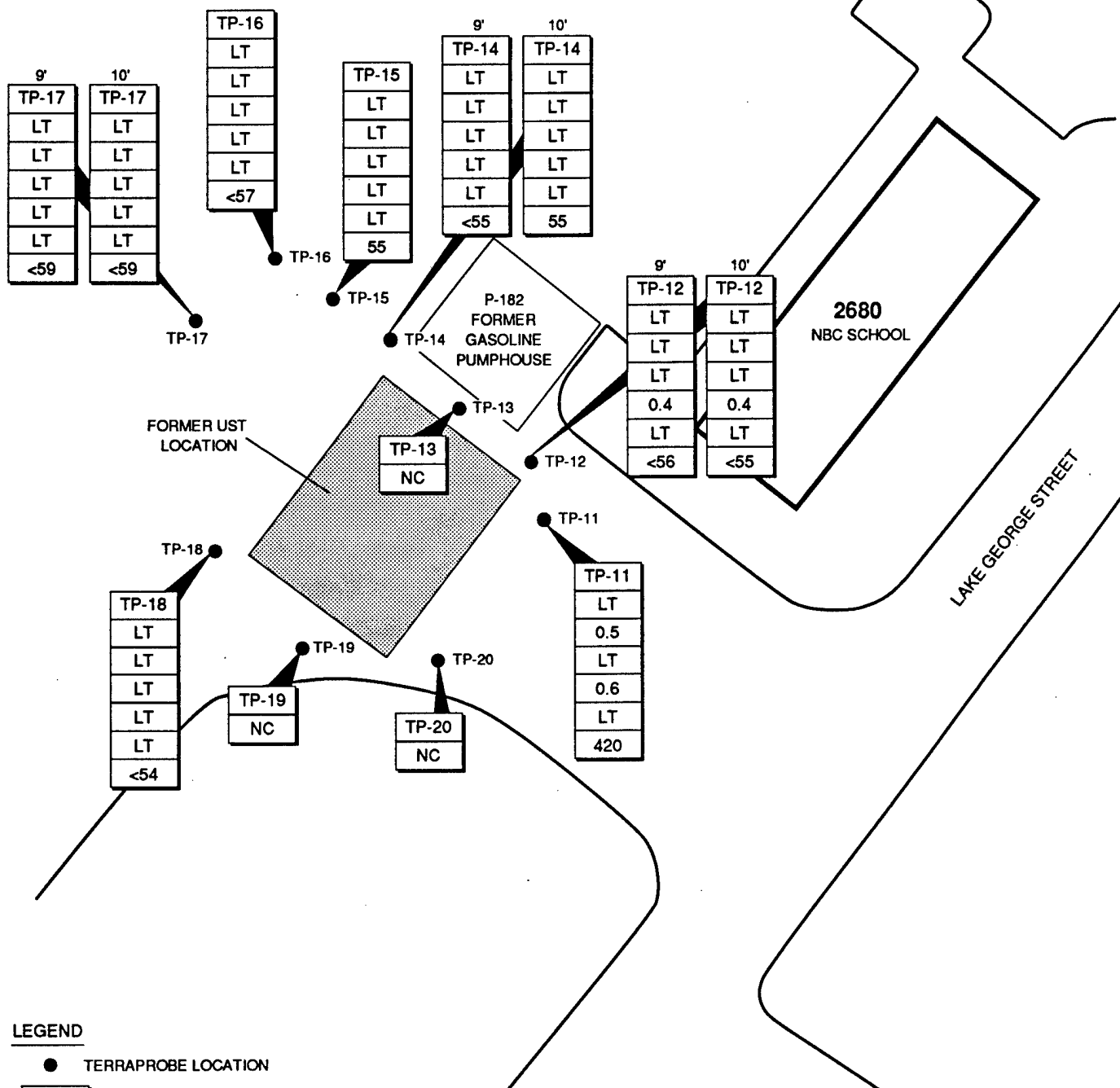


FIGURE 6.14-3
FIELD SCREENING RESULTS
DEPTH AT 9 FT
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



PAVED PARKING LOT



LEGEND

● TERRAPROBE LOCATION

TP-01	Sample ID		
LT	Benzene in ppb	LT	LESS THAN DETECTION LIMIT
LT	Toluene in ppb	NC	NOT COLLECTED
LT	Ethylbenzene in ppb		
LT	Xylene in ppb		
LT	Orthoxylene in ppb		
60	TOTAL Petroleum Hydrocarbons ppm		

SCALE IN FEET

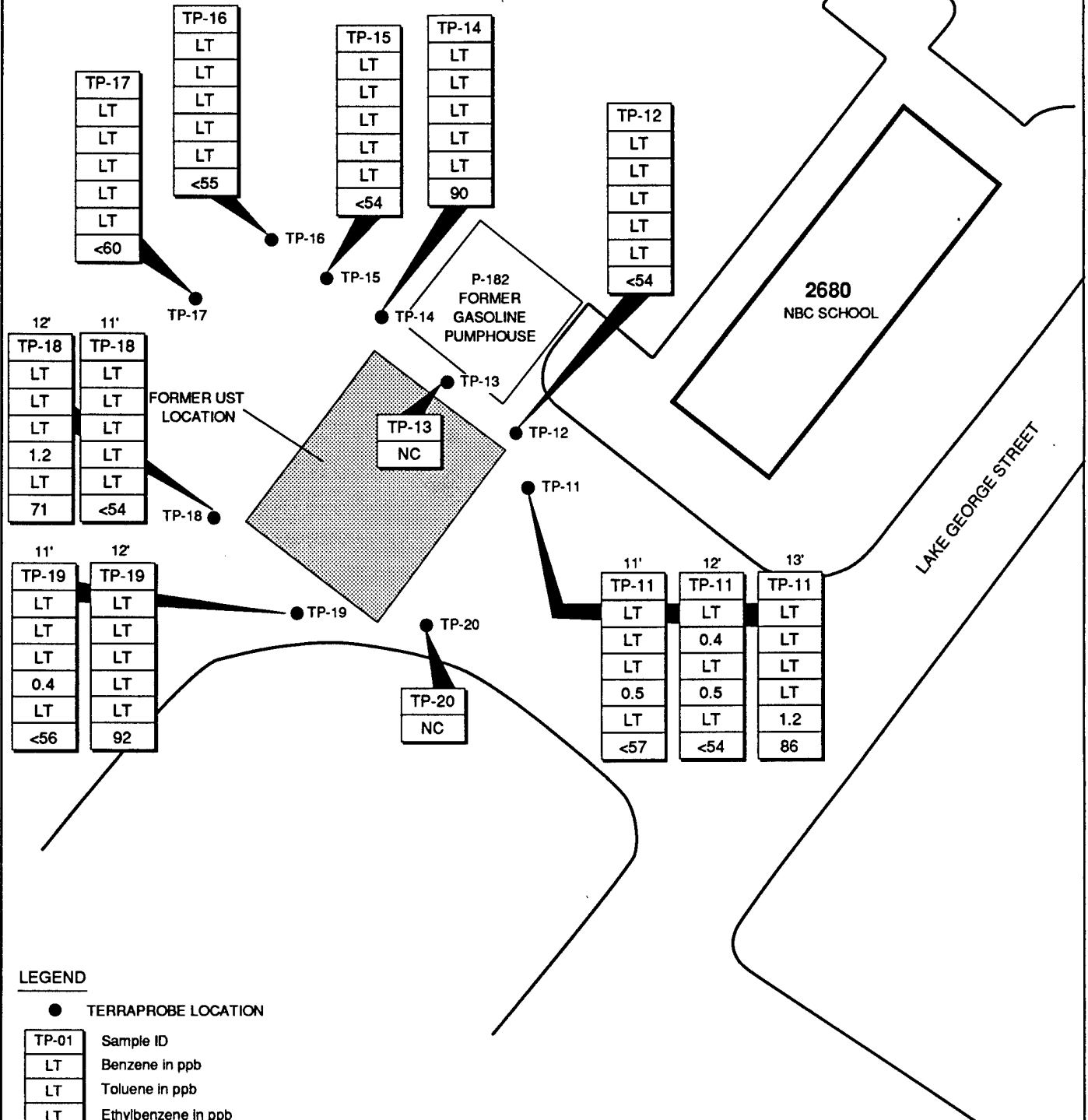


FIGURE 6.14-4
FIELD ANALYTICAL RESULTS
DEPTH AT 9 TO 10 FEET
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



PAVED PARKING LOT



LEGEND

● TERRAPROBE LOCATION

TP-01	Sample ID
LT	Benzene in ppb
LT	Toluene in ppb
LT	Ethylbenzene in ppb
LT	Xylene in ppb
LT	Orthoxylene in ppb
60	TOTAL Petroleum Hydrocarbons ppm
LT	LESS THAN DETECTION LIMIT
NC	NOT COLLECTED

SCALE IN FEET

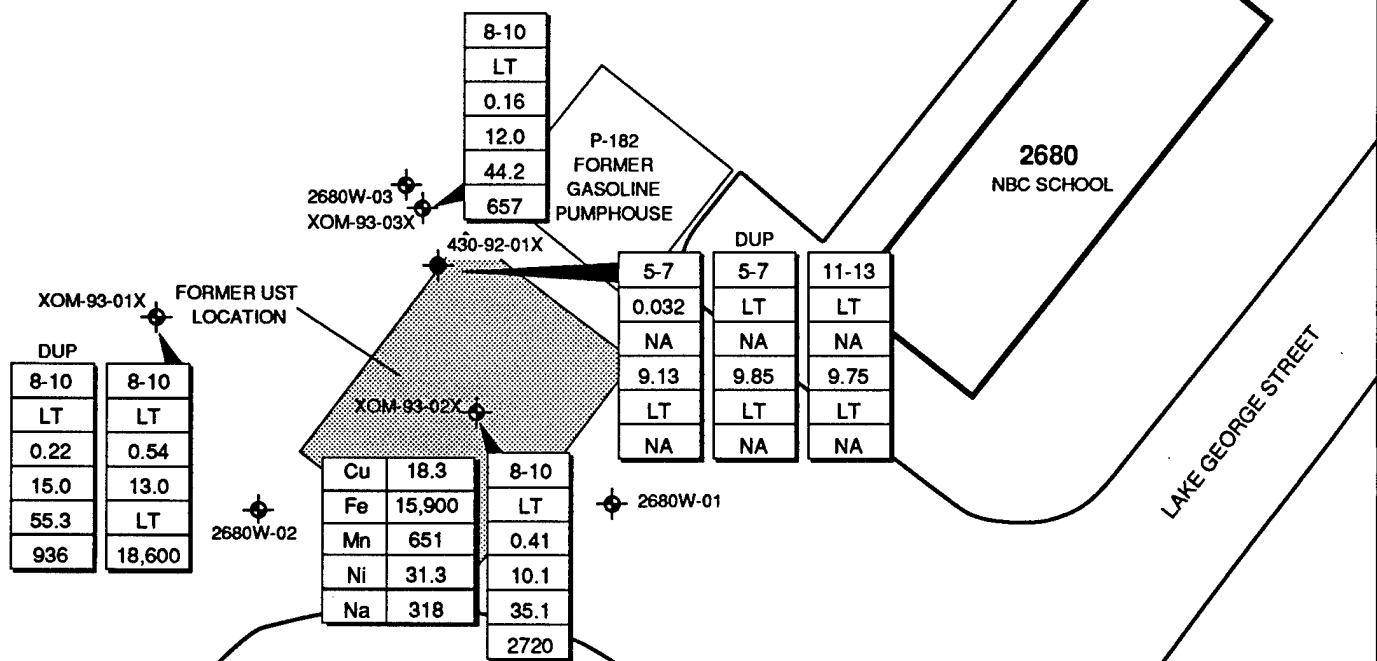


FIGURE 6.14-5
FIELD ANALYTICAL RESULTS
DEPTH AT 11 TO 13 FEET
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



PAVED PARKING LOT



LEGEND

- SOIL BORING LOCATION
- MONITORING WELL LOCATION

16'	SAMPLE DEPTH IN FEET
LT	TOTAL VOCs in µg/g
LT	TOTAL SVOCs in µg/g
LT	Lead in µg/g
LT	TPHC in µg/g
LT	TOC in µg/g

LT LESS THAN DETECTION LIMIT
NA NOT ANALYZED

SCALE IN FEET



FIGURE 6.14-6
ANALYTES DETECTED IN SOIL
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

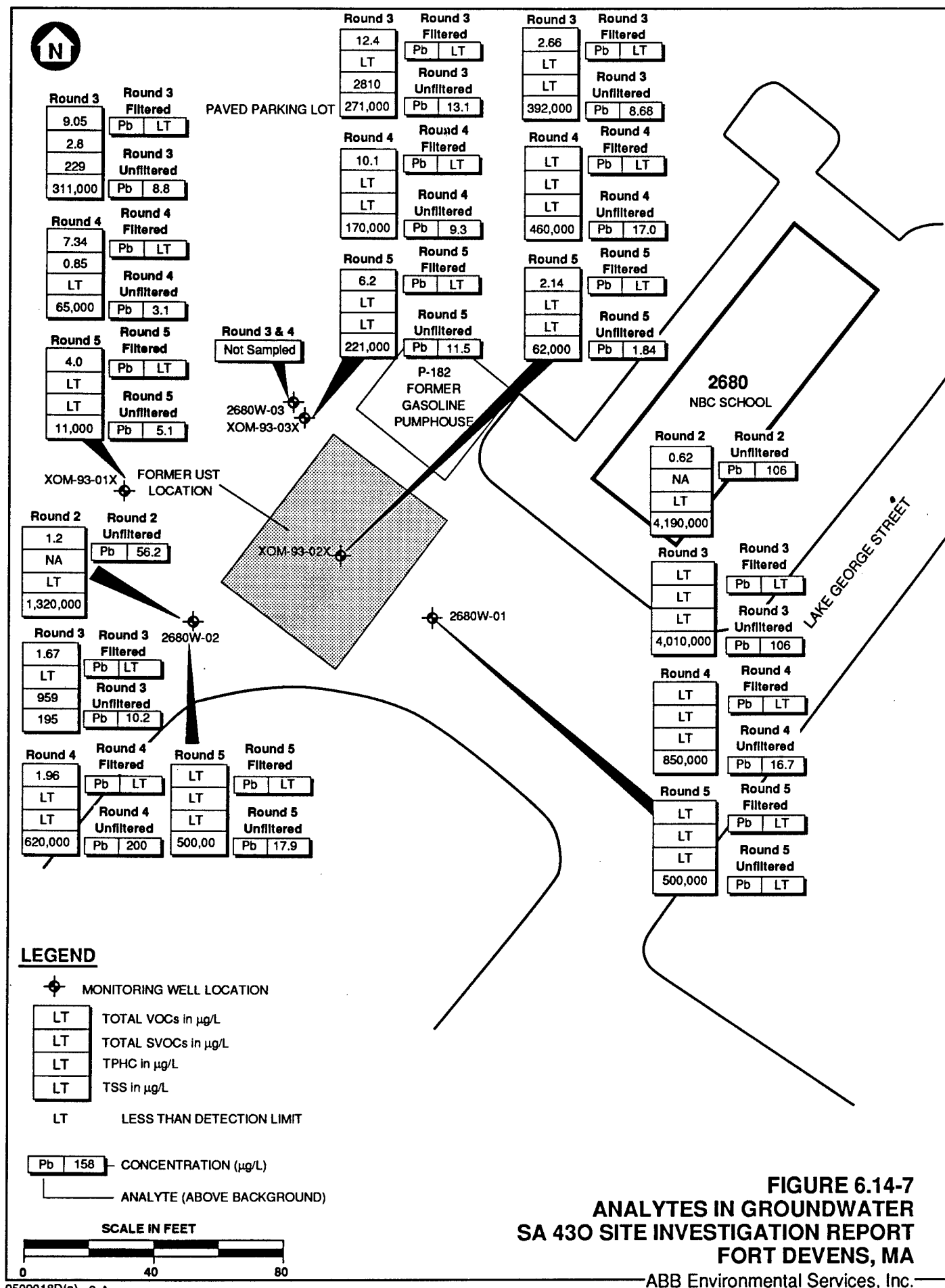


FIGURE 6.14-7
ANALYTES IN GROUNDWATER
SA 430 SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.15 STUDY AREA 43P

6.15.1 Study Area Background and Conditions

SA 43P is located on Sherman Avenue, approximately 150 feet northeast of the intersection of Givervy Street and Sherman Avenue (Figure 6.15-1). The structure of the historic gas station at SA 43P consisted of a pump island and a small gasoline pumphouse. The gas station at SA 43P was a Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. The gasoline UST at SA 43P was excavated and removed before 1952. Reportedly, this UST was moved to SA 43I and installed there as a second UST at that station. Records on the exact location of the station at SA 43P were not available prior to the commencement of the 1992 field investigation. Presently, the area around the reported location of SA 43P is an open grassy area with Building T-622 and a paved parking lot on the southern portion of the site and bedrock outcrop to the north (see Figure 6.15-1). Building T-622 is apparently an administrative office. A 1,000 gallon heating oil UST is located on the north side of Building T-622 and appears to still be in use (see Figure 6.15-1).

6.15.2 Study Area Investigation Program Summary

The field investigation program at SA 43P consisted of 11 TerraProbe points, collection of subsurface soil samples, field analysis of those soil samples, and one soil boring.

The TerraProbe points were advanced to refusal at each location and as many as three subsurface soil samples per point were collected for field analysis. The samples were analyzed in the field for BTEX and TPHC (Figure 6.15-2).

One soil boring (43P-92-01X) was advanced to refusal, apparently bedrock, and two subsurface soil samples were collected for laboratory analysis. The samples were analyzed for VOCs, TPHC, and lead (see Figure 6.15-2).

SECTION 6

6.15.3 Field Investigation Results and Observations

The soil encountered at SA 43P consisted of silty well graded sand with gravel. Refusal, apparently bedrock, was reached at 13 feet to 15 feet bgs in both the TerraProbe points and the soil boring. Groundwater was not encountered; however, the last soil sample collected from 43P-92-01X was moist to wet indicating that groundwater may be present in the bedrock. The boring log for 43P-92-01X is provided in Appendix B.

A total of 21 soil samples were collected and analyzed in the field. No BTEX compounds were detected in any of the samples, and TPHC was detected in only one soil samples (220 ppm at 5 feet in TP-02) (Table 6.15-1; Figures 6.15-2 through 6.15-4).

43P-92-01X was drilled adjacent to TP-02 to confirm the TPHC field analytical result. Two soil samples were collected from 5 feet to 7 feet bgs and 12 feet to 14 feet bgs for laboratory analysis. No VOCs or TPHC were detected in either sample, and lead was present below the established background concentration (Table 6.15-2; Figure 6.15-5). The water table was not encountered at this site.

6.15.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

The objective of the field sampling program at SA 43P was to determine if residual soil contamination was present at this historic gas station. Based on the results of the field screening, which detected TPHC at 220 ppm in one soil sample, it does not appear that an unacceptable amount of residual contamination exists at this historic gas station.

6.15.5 Preliminary Human Health Risk Evaluation

The groundwater table was not encountered at this SA. The tank at this location was removed before 1945. Field analysis of 13 shallow and intermediate depth TerraProbe soil samples revealed no measurable concentrations of BTEX to a depth of 9 feet. TPHC was detected above the method detection limit in only one of these 13 samples, at 220 ppm. Comparing this result against the calculated risk-based commercial/industrial concentration value of 1,700 $\mu\text{g/g}$ for gasoline

ABB Environmental Services, Inc.

indicates that there should be no significant risk to public health from soil contamination at SA 43P.

A confirmatory boring by ABB-ES supports the field-screening results. Soil samples at 5-feet and 12-feet in the boring through the suspected tank location (43P-92-01X) showed no residual TPHC contamination. Lead was detected at concentrations below the site-specific background.

6.15.6 Conclusions and Recommendations

The objective of the field sampling program at SA 43P was to determine if residual soil contamination was present at this historic gas station. Based on the results of the field screening, which detected TPHC at 220 ppm in only one soil sample and a human health PRE, it does not appear that an unacceptable level of residual contamination exists at this historic gas station. Since the investigation has focused on the subsurface, no ecological PRE was conducted. Therefore, NFA is recommended at this historic gas station.

TABLE 6.15-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION-SITE P

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA#	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTEX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSP01XX501XF	43P	SOIL	TP-01	5	< 55	0	ND	ND	ND	ND	ND	
43TSP01XX901XF	43P	SOIL	TP-01	9	< 60	0	ND	ND	ND	ND	ND	
43TSP02XX501XF	43P	SOIL	TP-02	5	220	0	ND	ND	ND	ND	ND	
43TSP02XX901XF	43P	SOIL	TP-02	9	< 52	0	ND	ND	ND	ND	ND	
43TSP02X1501XF	43P	SOIL	TP-02	15	< 55	0	ND	ND	ND	ND	ND	
43TSP03X1101XF	43P	SOIL	TP-03	11	< 55	0	ND	ND	ND	ND	ND	
43TSP03X1701XF	43P	SOIL	TP-03	17	< 60	0	ND	ND	ND	ND	ND	
43TSP04XX501XF	43P	SOIL	TP-04	5	< 55	0	ND	ND	ND	ND	ND	
43TSP04XX901XF	43P	SOIL	TP-04	9	< 60	0	ND	ND	ND	ND	ND	
43TSP04X1501XF	43P	SOIL	TP-04	15	< 55	0	ND	ND	ND	ND	ND	
43TSP05X1101XF	43P	SOIL	TP-05	11	< 55	0	ND	ND	ND	ND	ND	
43TSP05X1601XF	43P	SOIL	TP-05	16	< 55	0	ND	ND	ND	ND	ND	
43TSP06XX901XF	43P	SOIL	TP-06	9	< 55	0	ND	ND	ND	ND	ND	
43TSP07XX501XF	43P	SOIL	TP-07	5	< 55	0	ND	ND	ND	ND	ND	
43TSP07XX901XF	43P	SOIL	TP-07	9	< 60	0	ND	ND	ND	ND	ND	
43TSP07X1501XF	43P	SOIL	TP-07	15	< 57	0	ND	ND	ND	ND	ND	
43TSP08XX901XF	43P	SOIL	TP-08	9	< 55	0	ND	ND	ND	ND	ND	
43TSP08X1601XF	43P	SOIL	TP-08	16	< 55	0	ND	ND	ND	ND	ND	
43TSP09XX901XF	43P	SOIL	TP-09	9	< 55	0	ND	ND	ND	ND	ND	
43TSP10XX901XF	43P	SOIL	TP-10	9	< 55	0	ND	ND	ND	ND	ND	
43TSP11XX901XF	43P	SOIL	TP-11	9	< 55	0	ND	ND	ND	ND	ND	

NOTES:

* = ND denotes a non detect or concentrations below 5 ppm

** = ND denotes a non detect or concentrations below 10 ppm

= Study area

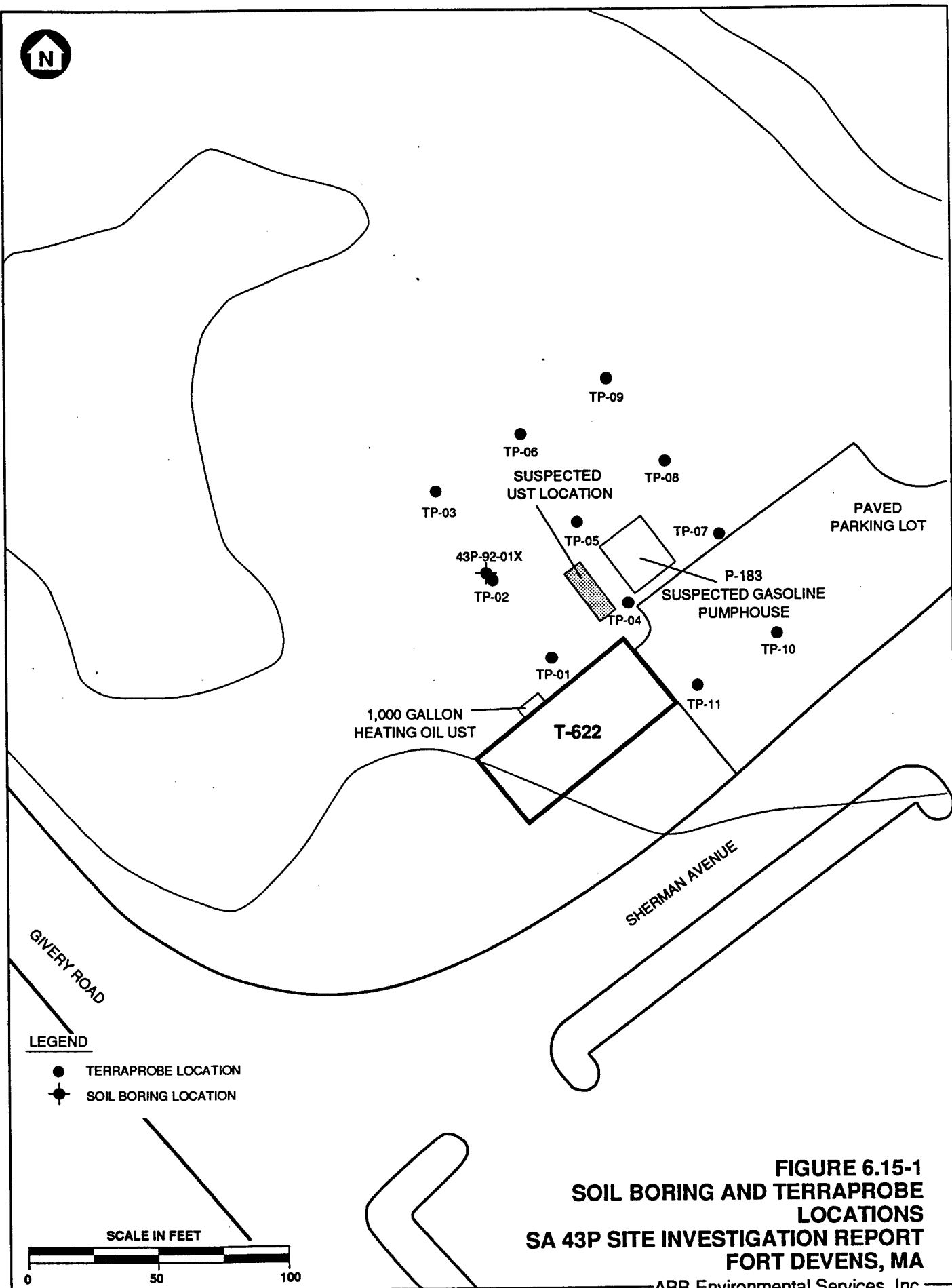
TABLE 6.15-2
INORGANIC AND ORGANIC COMPOUNDS IN SOIL
SA 43P - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACK - GROUND	BORING	
		DEPTH	
INORGANICS (ug/g)			
LEAD			
OTHER (ug/g)	48.4		
TOTAL ORGANIC CARBON			
TOTAL PETROLEUM HYDROCARBONS			
		9.67	6.82
		NA	854.0
		< 27.9	< 27.9

NOTES:

TABLE LISTS DETECTED ANALYTES ONLY -
SEE PROJECT ANALYTE LIST FOR SUMMARY
< = LESS THAN DETECTION LIMIT SHOWN
NA = NOT ANALYZED



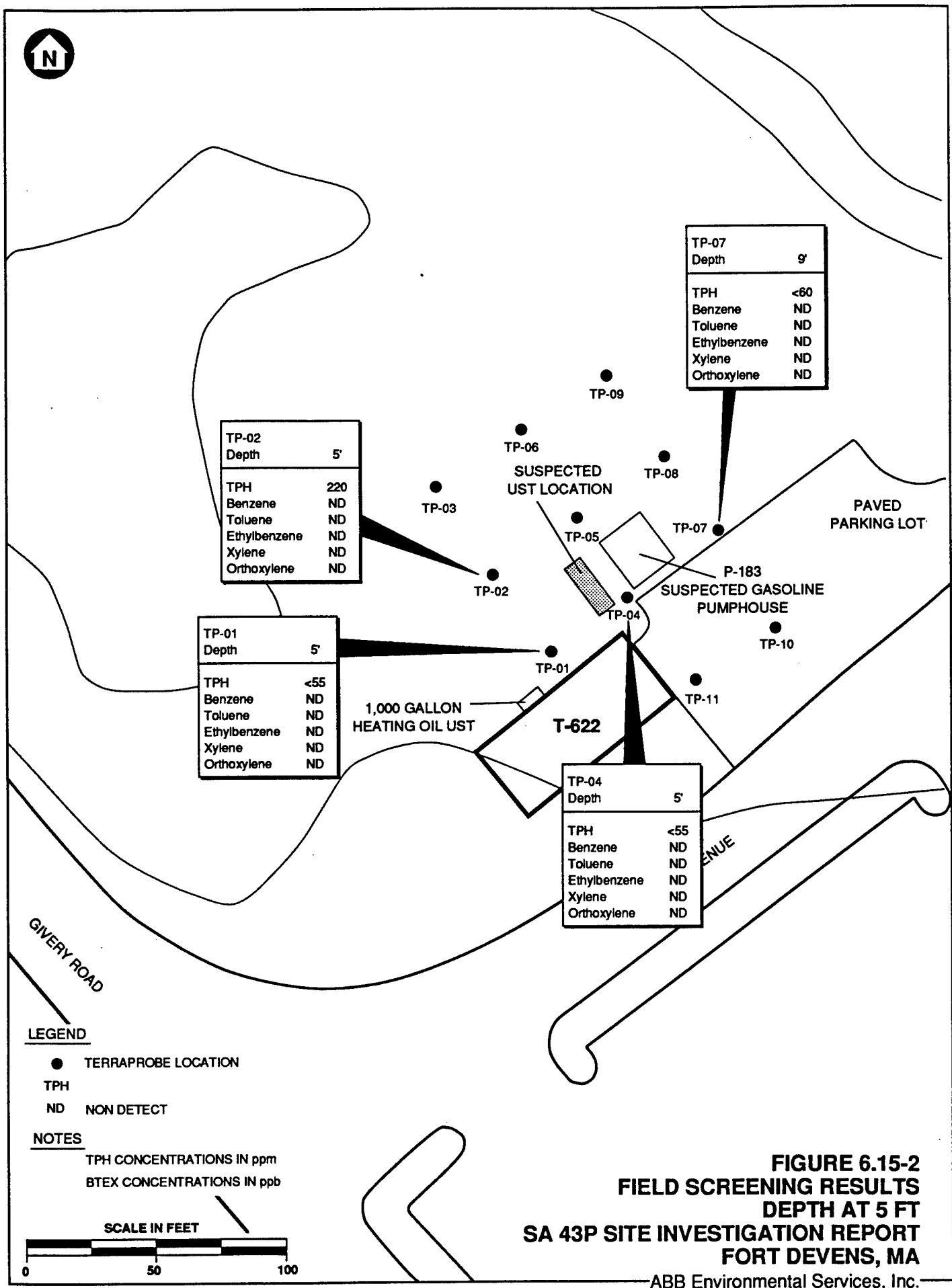
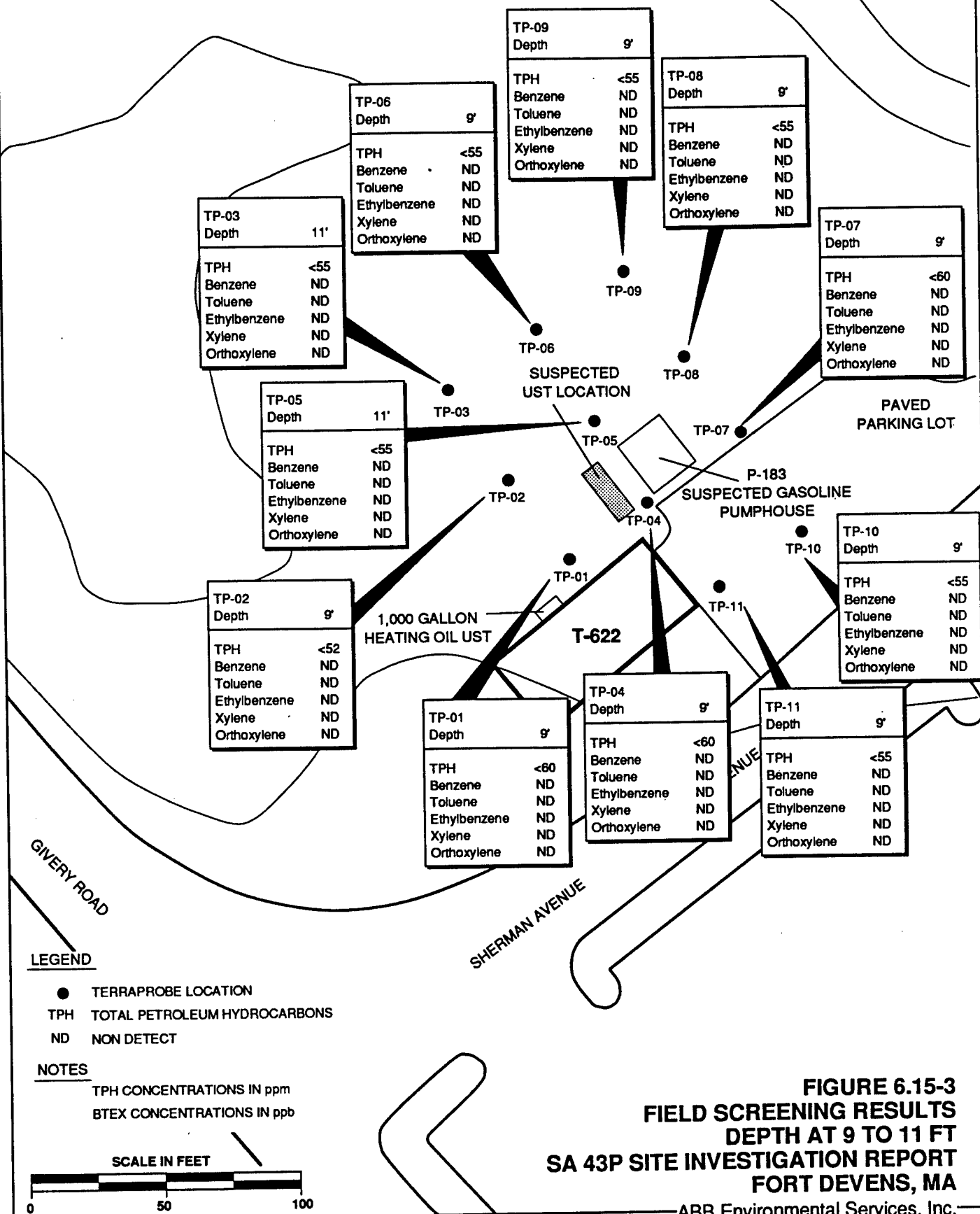


FIGURE 6.15-2
FIELD SCREENING RESULTS
DEPTH AT 5 FT
SA 43P SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



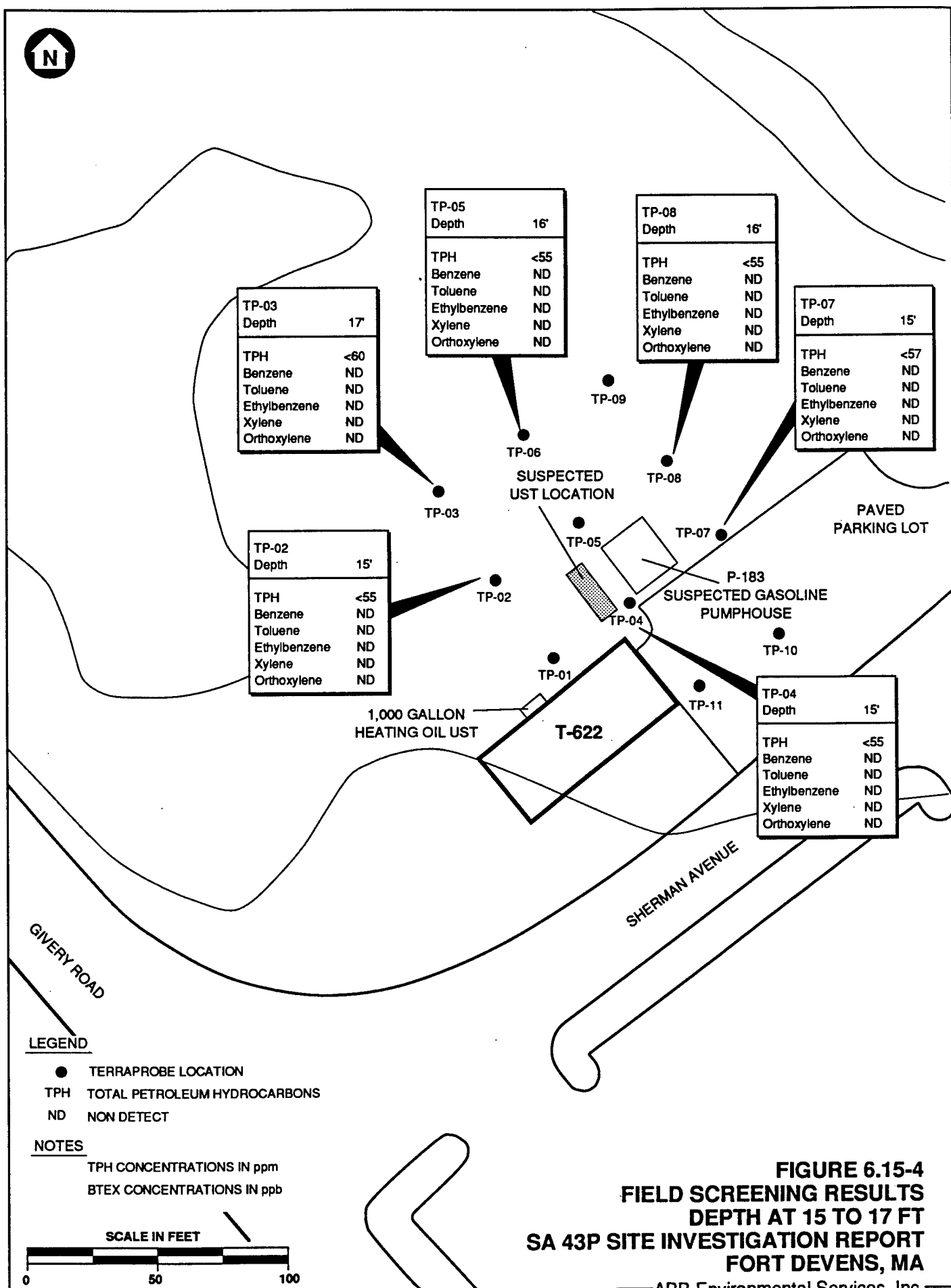
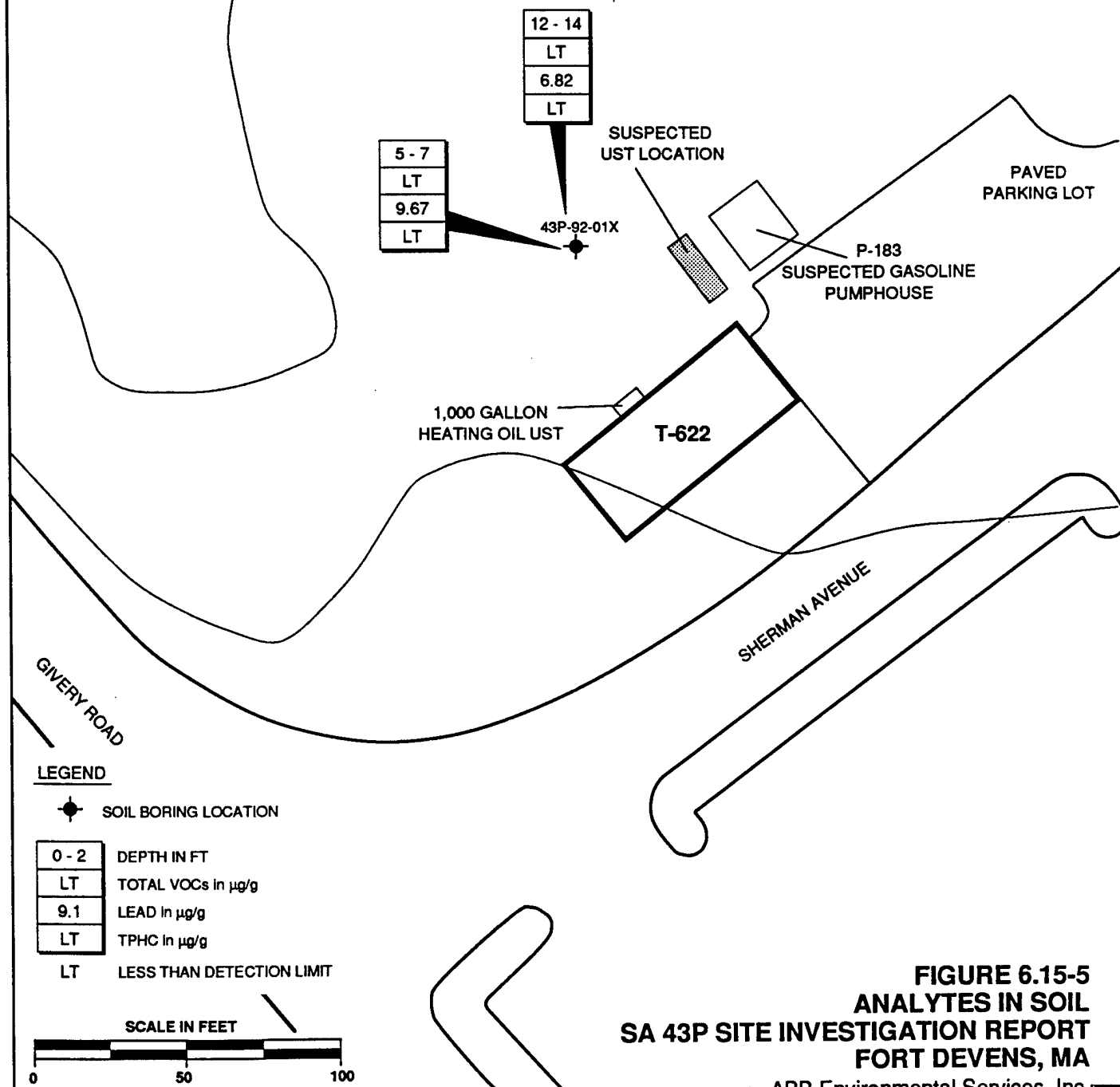


FIGURE 6.15-4
FIELD SCREENING RESULTS
DEPTH AT 15 TO 17 FT
SA 43P SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



6.16 STUDY AREA 43Q

6.16.1 Study Area Background and Conditions

The structure of the historic gas station at SA 43Q consisted of a pump island and a small gasoline pumphouse. Based on available documentation, the gas station at SA 43Q was a Type A station design. The Type A station had one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available of the decommissioning of the gas station or the removal of the associated UST. This historic gas station was located on the northern side of Sherman Avenue across from the existing Building 694 (Figure 6.16-1). Presently, the area around where SA 43Q was located is used by installation personnel as a soccer field.

6.16.2 Study Area Investigation Program Summary

The field investigation program at SA 43Q consisted of a surficial geophysical program, 10 TerraProbe points to collect subsurface soil and soil-gas samples and field analysis of those soil and soil-gas samples.

The surficial geophysical program consisted of a metal detector, magnetometer, and GPR survey. This program was designed to determine if any abandoned UST(s) were present at this site. The metal detector and magnetometer surveys covered a majority of the existing soccer field while the GPR survey was used to investigate magnetic anomalies detected in the other two surveys (see Figure 6.16-1).

A total of three soil samples were collected from two TerraProbe points, and 11 soil-gas samples were collected from 10 TerraProbe points. The soil samples were analyzed in the field for BTEX and TPHC, while the soil-gas samples were analyzed for BTEX, only (Figure 6.16-2).

6.16.3 Field Investigation Results and Observations

The results of the surficial geophysical surveys did not indicate the presence of an abandoned UST, but several small magnetic anomalies were detected in the

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SECTION 6

reported area of the historic gas station. These anomalies were believed to be construction debris from the former pumphouse and/or pump island. The results of the surveys are presented in Appendix L.

Only three soil samples were collected, from two locations, because refusal was reached at approximately 9 feet. Refusal was encountered at each TerraProbe point prior to reaching the water table. No BTEX or TPHC were detected in any of the soil samples collected (Table 6.16-1; see Figure 6.16-2). Because each of the TerraProbe points met refusal before encountering groundwater, soil-gas samples were collected between 8 and 9 feet from all 10 proposed points. Two soil-gas samples were collected from TP-04. These depths were estimated to be at or below the bottom of the former UST. All of the soil-gas samples were analyzed for BTEX, only. No BTEX was detected in the soil-gas sample collected from SA 43Q (see Table 6.16-1; Figure 6.16-3).

6.16.4 Preliminary Human Health Risk Assessment

No abandoned UST(s) was detected during the geophysical survey conducted at SA 43Q. Field analysis of three TerraProbe soil samples revealed no measurable concentrations of BTEX to a depth of 16 feet. TPHC was not detected above the method detection limit in any of these samples. Eleven TerraProbe soil-gas samples were collected, and no measurable concentrations of BTEX were encountered. There should be no significant risk to public health from soil contamination at SA 43Q.

6.16.5 Conclusions and Recommendations

The objective of the field sampling program at SA 43Q was to determine if residual soil contamination was present at this historic gas station. Based on the results of the field investigation program and a human health PRE, it does not appear that the past activities at SA 43Q have adversely impacted the soil or the groundwater quality. Since the investigation has focused on the subsurface, no ecological PRE was conducted. Therefore, NFA is recommended at this historic gas station.

TABLE 6.16-1
FIELD SCREENING RESULTS
HISTORIC GAS STATION - SITE Q

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTEX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSQ01XX901XF	43Q	SOIL	TP-01	9	<54	0	ND	ND	ND	ND	ND	
43TSQ01X1601XF	43Q	SOIL	TP-01	16	<53	0	ND	ND	ND	ND	ND	
43TSQ04XX901XF	43Q	SOIL	TP-04	9	<54	0	ND	ND	ND	ND	ND	
43TGO01XX801XF	43Q	GAS	TP-01	8	NA	0	ND	ND	ND	ND	ND	
43TGO02XX901XF	43Q	GAS	TP-02	9	NA	0	ND	ND	ND	ND	ND	
43TGO03XX801XF	43Q	GAS	TP-03	8	NA	0	ND	ND	ND	ND	ND	
43TGO04XX801XF	43Q	GAS	TP-04	8	NA	0	ND	ND	ND	ND	ND	
43TGO04XX901XF	43Q	GAS	TP-04	9	NA	0	ND	ND	ND	ND	ND	
43TGO05XX801XF	43Q	GAS	TP-05	8	NA	0	ND	ND	ND	ND	ND	
43TGO06XX801XF	43Q	GAS	TP-06	8	NA	0	ND	ND	ND	ND	ND	
43TGO07XX801XF	43Q	GAS	TP-07	8	NA	0	ND	ND	ND	ND	ND	
43TGO08XX801XF	43Q	GAS	TP-08	8	NA	0	ND	ND	ND	ND	ND	
43TGO09XX801XF	43Q	GAS	TP-09	8	NA	0	ND	ND	ND	ND	ND	
43TGO10XX801XF	43Q	GAS	TP-10	8	NA	0	ND	ND	ND	ND	ND	

NOTES:

* = ND denotes a non detect or concentrations below 5 ppb

** = ND denotes a non detect or concentrations below 10 ppb

= Study Area

NA = Not applicable

GAS = Soil gas



SOCGER FIELD

P-184
SUSPECTED
GASOLINE
PUMPHOUSE

SUSPECTED
UST
LOCATION

TP-06
TP-10
TP-07
TP-05
TP-08
TP-04
TP-01
TP-09
TP-02
TP-03

SHERMAN AVENUE

694

LEGEND

● TERRAPROBE LOCATION

SCALE IN FEET



**FIGURE 6.16-1
TERRAPROBE LOCATIONS
SA 43Q SITE INVESTIGATION REPORT
FORT DEVENS, MA**

ABB Environmental Services, Inc.



SOCCER FIELD

P-184
SUSPECTED
GASOLINE
PUMPHOUSE

SUSPECTED
UST
LOCATION

TP-10
TP-06
TP-07
TP-05
TP-08
TP-04
TP-09
TP-01
TP-02
TP-03

TP-01	
Depth	9'
TPH	<54
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Xylene	ND
Orthoxylene	ND

TP-01	
Depth	16'
TPH	<53
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Xylene	ND
Orthoxylene	ND

TP-04	
Depth	9'
TPH	<54
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Xylene	ND
Orthoxylene	ND

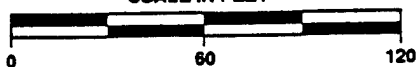
LEGEND

- TERRAPROBE LOCATION
- TPH TOTAL PETROLEUM HYDROCARBONS
- ND NON DETECT

NOTES

TPH CONCENTRATIONS IN ppm
BTEX CONCENTRATIONS IN ppb

SCALE IN FEET



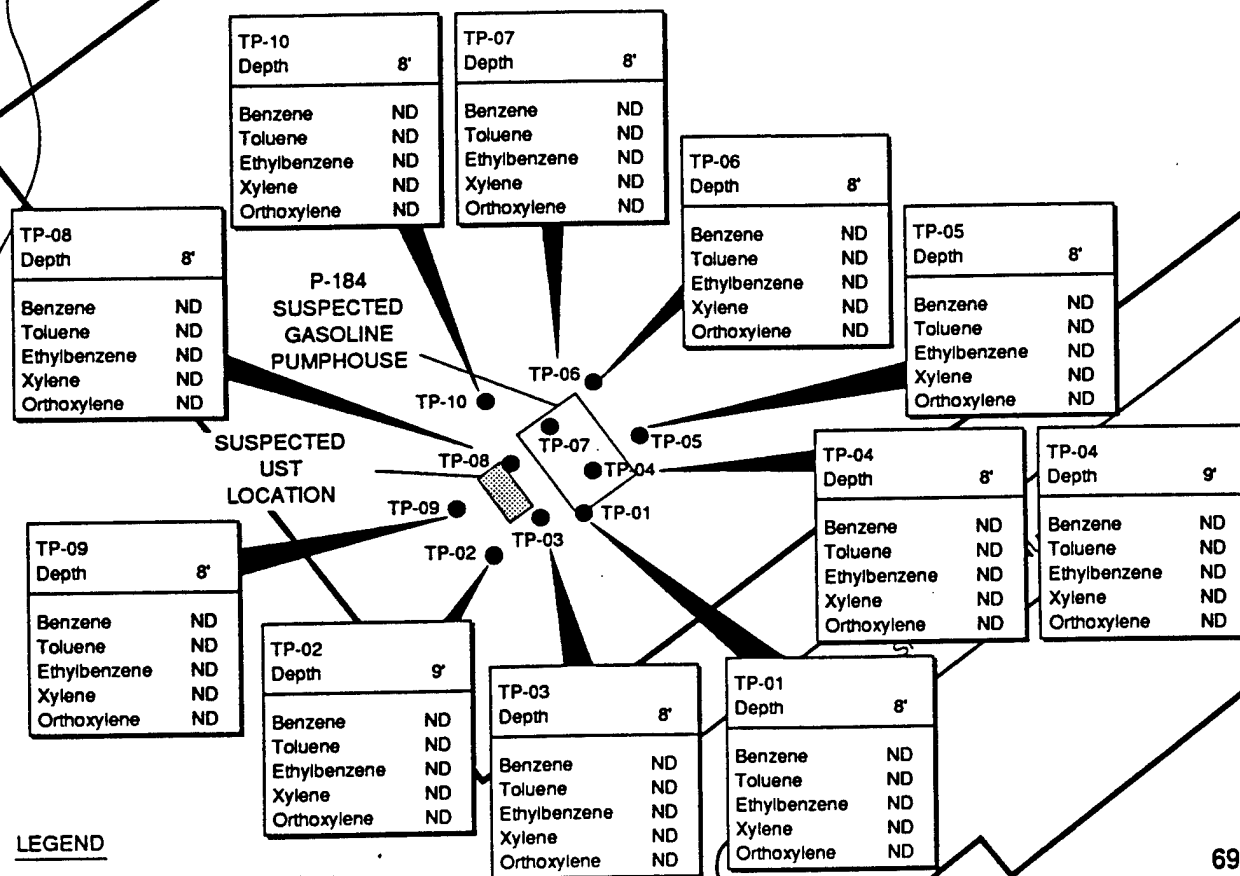
694

FIGURE 6.16-2
FIELD SCREENING RESULTS
SOIL; DEPTH AT 9 TO 16 FT
SA 43Q SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.



SOCCER FIELD



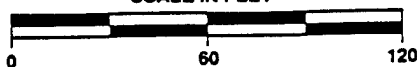
LEGEND

- TERRAPROBE LOCATION
- ND NON DETECT

NOTE

BTEX CONCENTRATIONS IN ppb

SCALE IN FEET



694

FIGURE 6.16-3
FIELD SCREENING RESULTS
SOIL GAS; DEPTH AT 8 TO 9 FT
SA 43Q SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

6.17 STUDY AREA 43R

6.17.1 Study Area Background and Conditions

The structure of the historic gas station at SA 43R consisted of a pump island and a small gasoline pumphouse. Based on available documentation, the gas station at SA 43R was a Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available of the decommissioning of the gas station or the removal of the associated UST. This historic gas station was located on the northern side of Sherman Avenue across from the existing Building 696 and approximately 600 feet northeast of SA 43Q (Figure 6.17-1). Presently, the area around where SA 43R was located is a grassy area bordered on the south-southwest by a parking lot and Sherman Avenue (see Figure 6.17-1).

6.17.2 Study Area Investigation Program Summary

The field investigation program consisted of surficial geophysical surveys, TerraProbe points to collect subsurface soil and soil-gas samples, field analysis of these soil and soil-gas samples, and one soil boring to collect soil samples for laboratory analysis.

The surficial geophysical program consisted of a metal detector, magnetometer, and GPR survey. This program was designed to determine if any abandoned UST(s) were present at this site. The metal detector and magnetometer surveys covered an area approximately 250 feet long and 150 feet wide, while the GPR survey was used to investigate magnetic anomalies detected in the other two surveys (see Figure 6.17-1).

A total of two soil samples were collected from two TerraProbe points, and one soil-gas sample was collected from each of the 10 TerraProbe points. The soil samples were analyzed in the field for BTEX and TPHC, while the soil-gas samples were analyzed for BTEX, only (see Figure 6.17-1).

SECTION 6

One soil boring (43R-92-01X) was drilled through the UST excavation, and two subsurface soil samples were collected for laboratory analysis. The samples were analyzed for VOCs, TPHC, and lead.

6.17.3 Field Investigation Results and Observations

Only three soil samples were collected from 43R-92-01X; the soil below the UST excavation consisted of poorly graded sand with gravel grading to a sandy silt. The groundwater was encountered at 12 feet bgs. Bedrock was not encountered in this soil boring. The major hydrologic feature on this side of the Main Post is the Nashua River which is located west of SA 43R. Based on this it appears that the groundwater flow in this area would also be to the west.

The geophysical surveys determined that one abandoned UST was present at the site. The UST was added to the installation's tank removal program, and on June 26, 1992 ATEC removed a 5,000 gallon UST. At the time of the removal, tank contents consisted of fuel and sludge (ATEC, 1992l). There was no visibly contaminated soil observed in the excavation, and groundwater was not encountered. ATEC performed field screening on 10 soil samples (SS-1 and SS-8) collected from the walls of the excavation at 5 feet to 6 feet, and two soil samples (SS-9 and SS-10) from the bottom of the excavation (Figure 6.17-2). VOC concentrations (measured by PID in soil headspace) ranged from 0.1 to 17.0 ppm, and TPHC levels (measured on an NDIR) ranged from 9.9 to 90.3 ppm (ATEC, 1992l) (Table 6.17-1). One composite soil sample was collected from the bottom of the excavation by ABB-ES and submitted for laboratory analysis at ABB-ES' Wakefield, Massachusetts laboratory. The results of this analysis indicated a TPHC concentration of 168 ppm (see Table 6.17-1). Based on the results of ATEC's sampling and screening, the soils in the excavation were deemed to be uncontaminated and the excavation was backfilled (ATEC, 1992l). However, based on the results of the sample collected and analyzed by ABB-ES, an additional investigation was conducted to confirm the nature and distribution of fuel-related contamination detected in the bottom of the abandoned UST excavation.

After the excavation was backfilled 10 TerraProbe points were advanced at SA 43R (see Figure 6.17-1). Only two soil samples were collected due to the dense soil, and subsurface obstructions. No BTEX or TPHC were detected in these soil samples (Figure 6.17-3). Groundwater was not encountered in the first

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two TerraProbe points so 10 soil-gas samples were collected from the 5 foot depth interval from 10 TerraProbe points. This depth was chosen due to the dense soil and subsurface obstruction encountered. BTEX was not detected in any of the soil-gas samples collected (Table 6.17-2; Figure 6.17-4).

Soil boring 43R-92-01X was drilled through the middle of the backfilled UST excavation in an attempt to reach the water table directly below the excavation. Groundwater was encountered at 12 feet, and soil samples were collected for laboratory analysis from depths 11 feet to 13 feet and 156 feet to 17 feet bgs. No VOCs or TPHC were detected in either sample and lead was present below the established Fort Devens background concentration (Table 6.17-3; Figure 6.17-5).

6.17.4 Preliminary Human Health Risk Evaluation

A 5,000 gallon UST at SA 43R was discovered by ABB-ES and removed by ATEC during the SI field investigation. The groundwater table was encountered at 12 feet. Prior to backfilling, ATEC collected 10 soil samples from the excavation walls which were screened in the field for TPHC by the NDIR method, and analyzed for TPHC in the laboratory. TPHC levels ranged from 10 ppm to a maximum value of 90 ppm on the NDIR, and from <10 ppm to 63 ppm in the laboratory. The TPHC level in a confirmatory soil sample collected by ABB-ES for TPHC analysis by USEPA Method 418.1 was 168 ppm. The excavation was backfilled by ATEC and ABB-ES conducted follow-up SI activity.

Field analysis of two TerraProbe soil samples in the unsaturated zone revealed no measurable concentrations of BTEX or TPHC to a depth of 15 feet. Ten TerraProbe soil-gas samples were collected, and no measurable concentrations of BTEX were encountered. A confirmatory boring by ABB-ES supports ABB-ES' field analysis results. Soil samples at 11 feet and 15 feet in the boring through the former UST location (43R-92-01X) showed no residual TPHC contamination. Lead was detected at concentrations below site-specific background. Comparing the TPHC results to the calculated risk-based commercial/industrial concentration value of 1,700 $\mu\text{g/g}$ for gasoline indicates that there should be no significant risk to public health from soil contamination at SA 43R.

SECTION 6

6.17.5 Conclusions and Recommendations

ATECs findings during removal of a UST at SA 43R and ABB-ES' field investigation and human health PRE indicate that little residual petroleum contamination exists in soils and that it poses no significant risk to public health. Since the investigation has focused on the subsurface, no ecological PRE was conducted. Therefore, no further action is recommended at this historic gas station.

TABLE 6.17-1
ATEC/ABB-ES FIELD SCREENING RESULTS
SA 43R - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE NO.	FIELD SCREENING		LABORATORY
	PID (ppm)	NDIR (ppm)	TPHC (ppm)
SS-1	0.1	18	N/A
SS-2	1.5	53	N/A
SS-3	0.2	28.3	N/A
SS-4	1.1	22.1	N/A
SS-5	17	41.7	N/A
SS-6	1	9.9	N/A
SS-7	1.8	13.9	N/A
SS-8	0.5	31.3	N/A
SS-9	5.2	90.3	N/A
SS-10	0.8	51.3	N/A
LSS-1	N/A	N/A	< 10
LSS-2	N/A	N/A	63
XRE-92-01X	N/A	N/A	168

NOTES:

SS = ATEC FIELD SCREEN SOIL SAMPLE

LSS = ATEC LABORATORY SOIL SAMPLE

XRE-92-01X = ABB-ES COMPOSITE LABORATORY SOIL SAMPLE

N/A = NOT APPLICABLE

TABLE 6.17-2
FIELD SCREENING RESULTS
HISTORIC GAS STATION-SITE R

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSR01X1501XF	43R	SOIL	TP-01	15	<54	0	ND	ND	ND	ND	ND	*** PHC's Detected
43TSR02X1501XF	43R	SOIL	TP-02	15	<55	0	ND	ND	ND	ND	ND	*** PHC's Detected
43TGR01XX501XF	43R	GAS	TP-01	5	NA	0	ND	ND	ND	ND	ND	
43TGR02XX501XF	43R	GAS	TP-02	5	NA	0	ND	ND	ND	ND	ND	
43TGR03XX501XF	43R	GAS	TP-03	5	NA	0	ND	ND	ND	ND	ND	
43TGR04XX501XF	43R	GAS	TP-04	5	NA	0	ND	ND	ND	ND	ND	
43TGR05XX501XF	43R	GAS	TP-05	5	NA	0	ND	ND	ND	ND	ND	
43TGR06XX501XF	43R	GAS	TP-06	5	NA	0	ND	ND	ND	ND	ND	
43TGR07XX501XF	43R	GAS	TP-07	5	NA	0	ND	ND	ND	ND	ND	
43TGR08XX501XF	43R	GAS	TP-08	5	NA	0	ND	ND	ND	ND	ND	
43TGR09XX501XF	43R	GAS	TP-09	5	NA	0	ND	ND	ND	ND	ND	
43TGR10XX501XF	43R	GAS	TP-10	5	NA	0	ND	ND	ND	ND	ND	

NOTES:

- * = ND denotes a non detect or concentrations below 10 ppb
- ** = ND denotes a non detect or concentrations below 5 ppb
- *** = Detection of Noncalibrated Petroleum Hydrocarbon Peaks
- # = Study area
- GAS = Soil gas
- NA = Not applicable

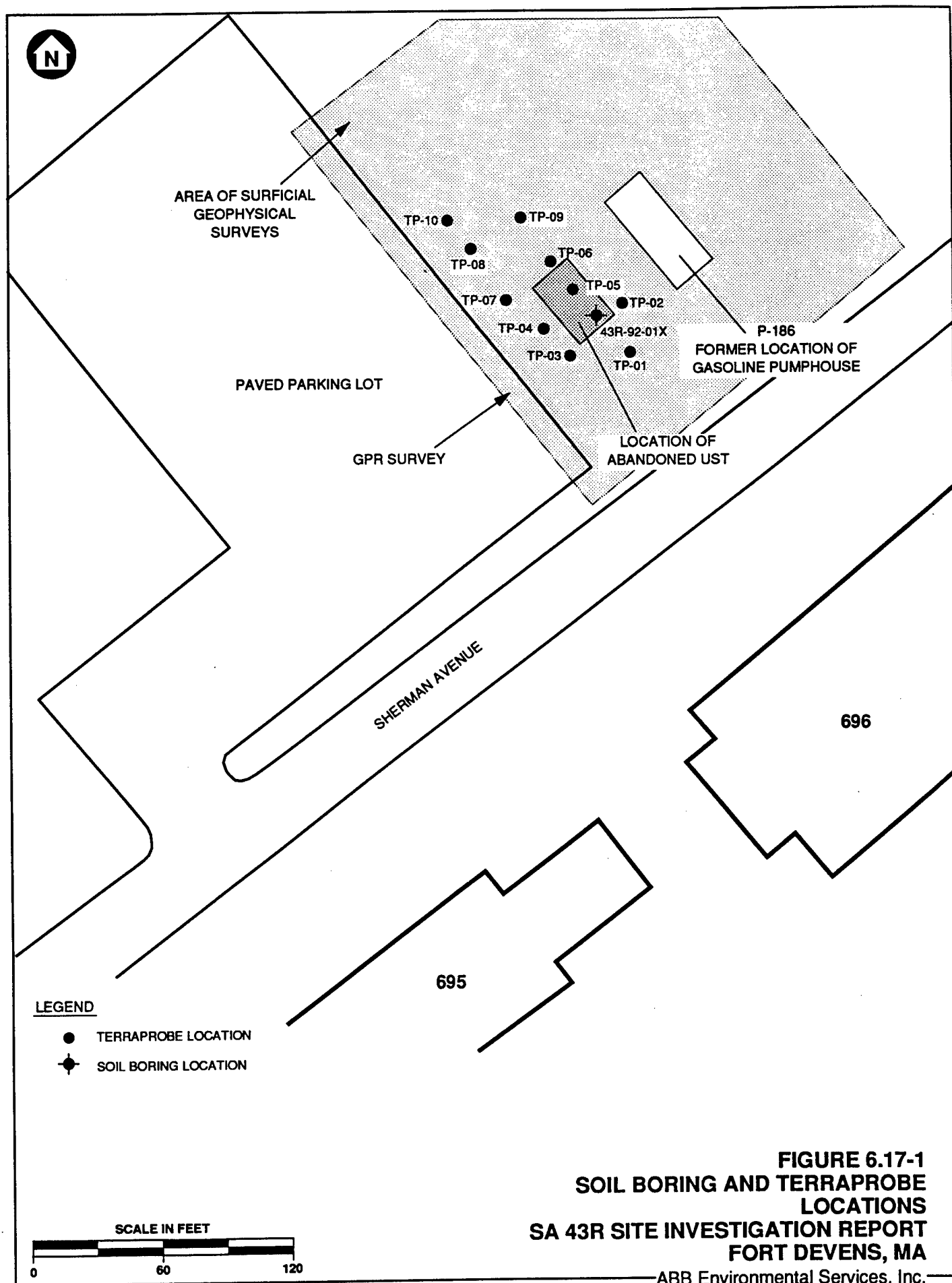
TABLE 6.17-3
INORGANIC AND ORGANIC COMPOUNDS IN SOIL
SA 43R - HISTORIC GAS STATIONS

SITE INVESTIGATION REPORT
FORT DEVENS, MA

ANALYTE	BACK - GROUND	BORING DEPTH	43R-92-01X 11	15
INORGANICS (ug/g)				
LEAD	48.4		12.0	9.57
OTHER (ug/g)				
TOTAL ORGANIC CARBON			NA	854.0
TOTAL PETROLEUM HYDROCARBONS			< 27.9	< 27.9

NOTES:

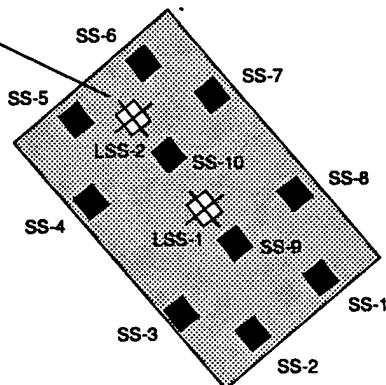
TABLE LISTS DETECTED ANALYTES ONLY -
SEE PROJECT ANALYTE LIST FOR SUMMARY
< = LESS THAN DETECTION LIMIT SHOWN
NA = NOT ANALYZED





P-186
FORMER LOCATION OF
GASOLINE PUMPHOUSE

LOCATION OF
ABANDONED UST



PAVED PARKING LOT

LEGEND



ATEC FIELD SCREENING LOCATIONS



ATEC LABORATORY SAMPLE LOCATION

SCALE IN FEET

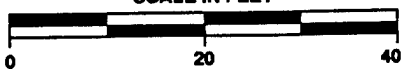


FIGURE 6.17-2
ATEC FIELD SCREEN LOCATIONS
SA 43R SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

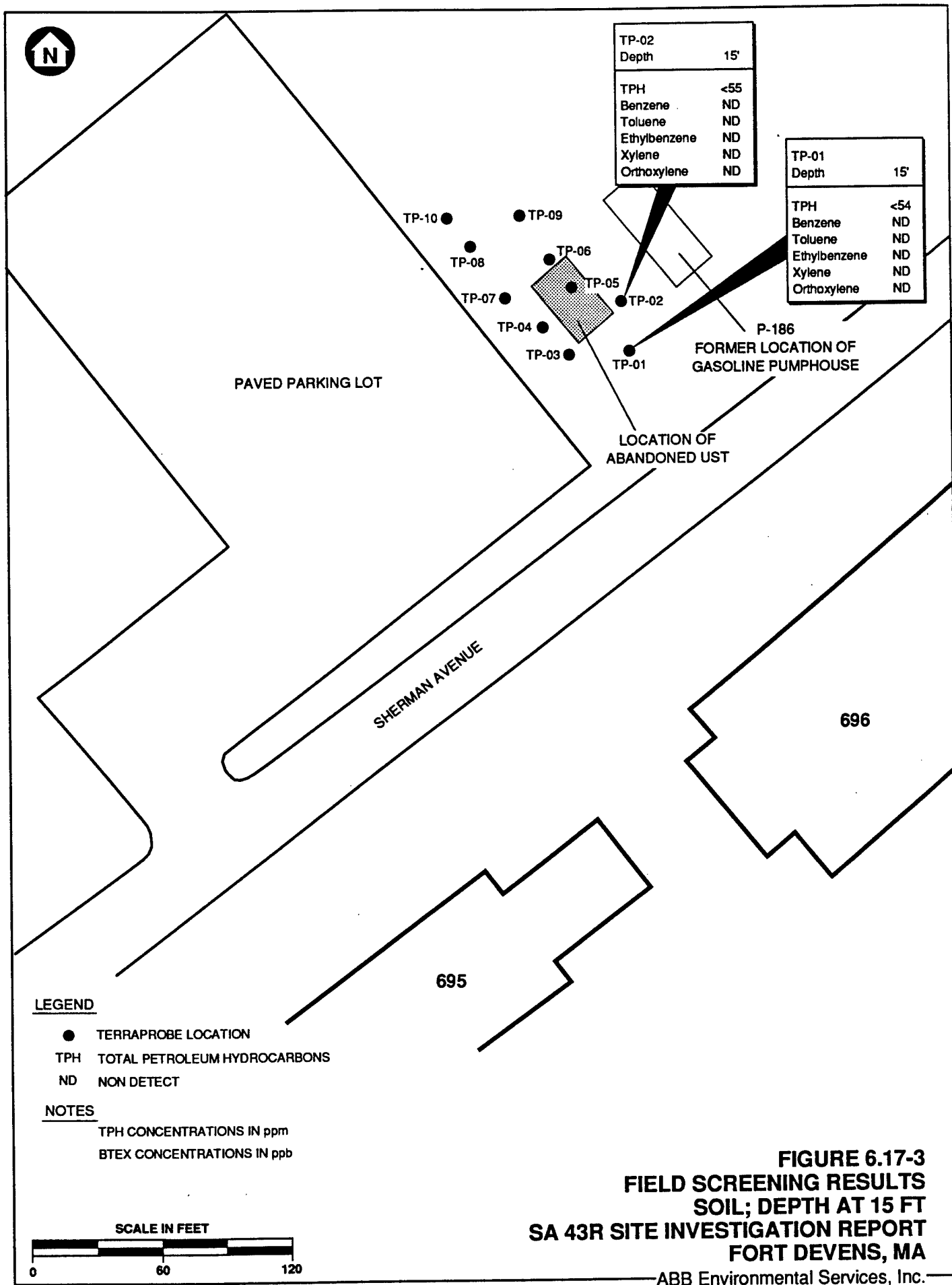
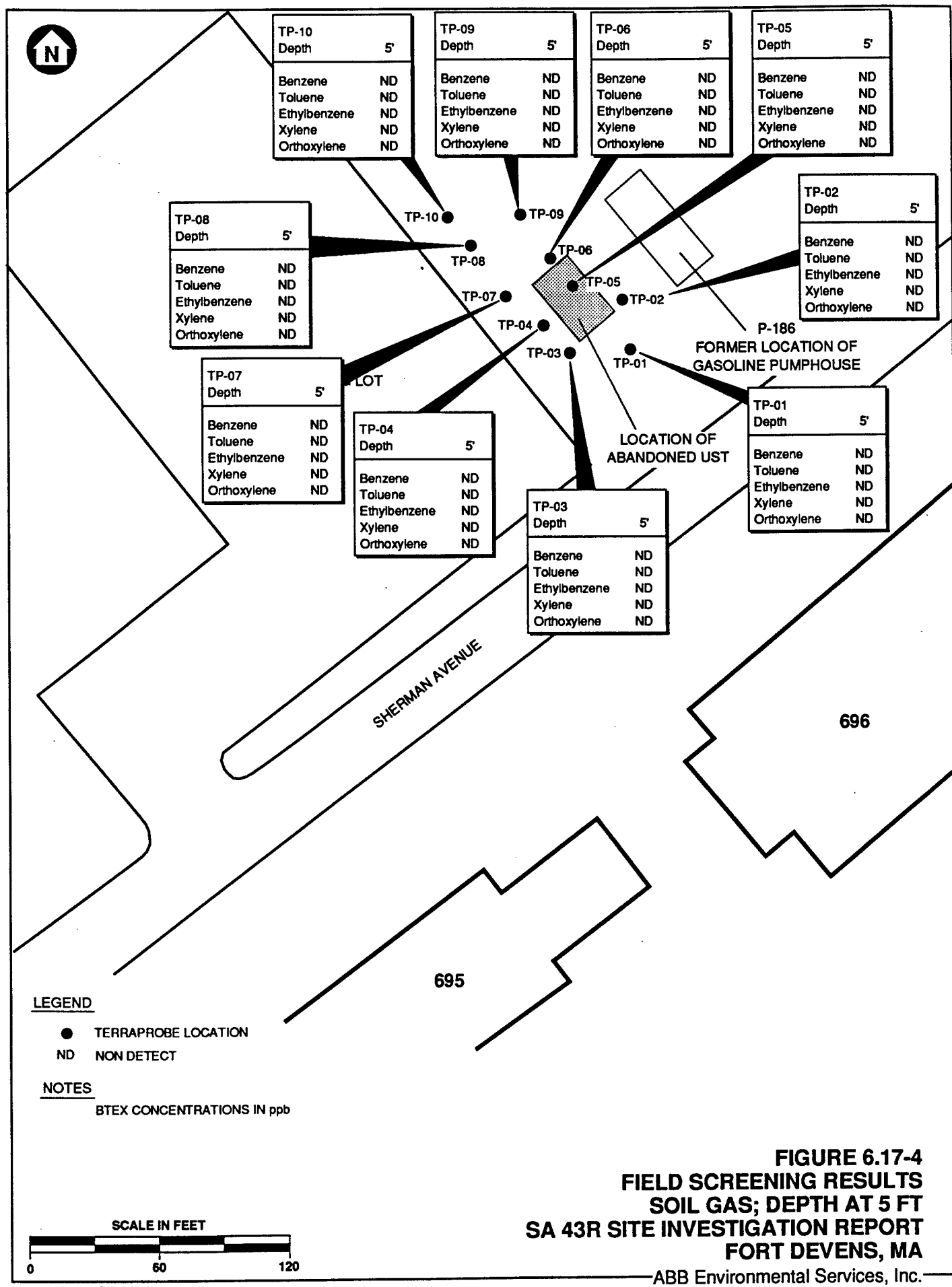
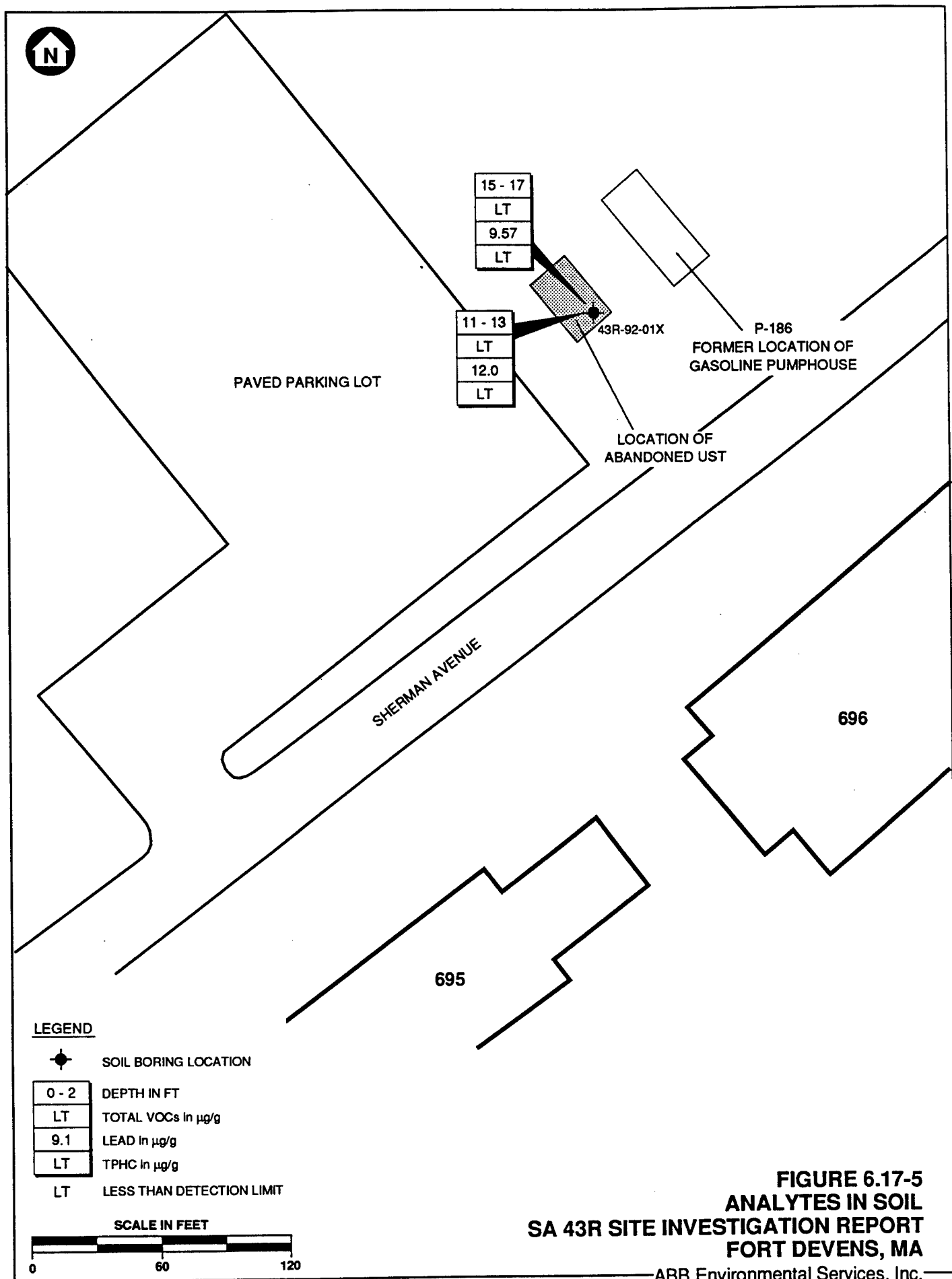


FIGURE 6.17-3
FIELD SCREENING RESULTS
SOIL; DEPTH AT 15 FT
SA 43R SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.





6.18 STUDY AREA 43S

6.18.1 Study Area Background and Conditions

The structures of the historic gas station at SA 43S consisted of a pump island and a small gasoline pumphouse. Based on available documentation, the gas station at SA 43S was a Type A station with one 5,000 gallon (or possibly 5,140 gallon) UST located between the gasoline pumphouse and the pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available of the decommissioning of the gas station or the removal of the associated UST. This historic gas station is located on the portion of the Main Post that is west of the Nashua River. Presently, the area around this historic gas station is used as a storage and training facility for a U.S. Army communication unit. This facility is approximately 15 acres in size. SA 43S was reportedly located on the western side of the training facility. During the field investigation, a concrete fuel spill containment pad was built approximately 50 feet east of the reported location of SA 43S. The area where the gas station was reportedly located is presently a grassy area bordered on the west by Gorgas Street and on the east by an access road (Figure 6.18-1). The entire communications training facility is surrounded by a chain-link fence with a locked gate on the eastern side of the area.

6.18.2 Study Area Investigation Program Summary

The field investigation program consisted of surficial geophysical surveys, 10 TerraProbe points for the collection of subsurface soil and soil-gas samples, and field analysis of the soil and soil-gas samples.

The surficial geophysical program consisted of a metal detector survey, magnetometer survey, and GPR survey. This program was designed to determine if any abandoned UST(s) were present at this site. The metal detector and magnetometer surveys covered a majority of the lawn area around SA 43S while the GPR survey was used to investigate magnetic anomalies detected in the other two surveys (see Figure 6.18-1).

A total of three soil samples were collected from TP-01, and one soil-gas sample was collected from each of 10 TerraProbe points. The soil samples were analyzed

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SECTION 6

in the field for BTEX and TPHC , while the soil-gas samples were analyzed for BTEX, only.

6.18.3 Field Investigation Results and Observations

The results of the surficial geophysical surveys did not indicate the presence of any abandoned USTs at this site. Results of the surveys are presented in Appendix L.

Three soil samples were collected from location TP-01 in an attempt to reach the water table. No other soil samples were collected from the other nine points, because groundwater was not reached in TP-01. BTEX was not detected in any of the soil samples, TPHC was detected at 140 ppm in the soil samples collected from 21 feet (Table 6.18-1; Figure 6.18-2). Because refusal was met without encountering groundwater, soil-gas samples were collected at eight feet from all 10 TerraProbe points. BTEX was not detected in any of the soil-gas samples collected from SA 43S (see Table 6.18-1; Figure 6.18-3).

6.18.4 Nature and Distribution of Contamination (Field Screening and Laboratory Results)

TPHC was detected in one soil sample; however, no other residual soil or soil-gas contaminants were detected at SA 43S.

6.18.5 Preliminary Human Health Risk Evaluation

No UST(s) was detected by ABB-ES at this location during the geophysical surveys. The groundwater table was not encountered during the SI. Field analysis of three TerraProbe soil samples revealed no measurable concentrations of BTEX to a depth of 21 feet. TPHC was detected above the method detection limit in one of these samples at 21 feet (140 ppm). Ten TerraProbe soil-gas samples were collected, and no measurable concentrations of BTEX were encountered. There should be no significant risk to public health from soil contamination at SA 43S.

6.18.6 Conclusions and Recommendations

The objective of the field sampling program at SA 43S was to determine if residual soil contamination was present at this historic gas station. Based on the

ABB Environmental Services, Inc.

results of the field investigation program and human health PRE, it does not appear that the past activities at this site have adversely impacted the soil or groundwater quality. Since the investigation has focused on the subsurface, no ecological PRE was conducted.

TPHC was detected in one soil sample; however, no other residual soil or soil-gas contaminants were detected at SA 43S. Therefore, NFA is recommended at this historic gas station.

TABLE 6.18--1
FIELD SCREENING RESULTS
HISTORIC GAS STATION--SITE S

SITE INVESTIGATION REPORT
FORT DEVENS, MA

SAMPLE ID	SA #	MEDIUM	SITE ID	DEPTH (feet)	TPH ppm	TOTAL BTX ppb	BEN* ppb	TOL* ppb	E-BEN* ppb	M/P XYL** ppb	O-XYL* ppb	COMMENTS
43TSS01XX901XF	43S	SOIL	TP-01	9	<53	0	ND	ND	ND	ND	ND	
43TSS01X1601XF	43S	SOIL	TP-01	16	<56	0	ND	ND	ND	ND	ND	
43TSS01X2101XF	43S	SOIL	TP-01	21	140	0	ND	ND	ND	ND	ND	
43TGS01XX801XF	43S	GAS	TP-01	8	NA	0	ND	ND	ND	ND	ND	
43TGS02XX801XF	43S	GAS	TP-02	8	NA	0	ND	ND	ND	ND	ND	
43TGS03XX801XF	43S	GAS	TP-03	8	NA	0	ND	ND	ND	ND	ND	
43TGS04XX801XF	43S	GAS	TP-04	8	NA	0	ND	ND	ND	ND	ND	
43TGS05XX801XF	43S	GAS	TP-05	8	NA	0	ND	ND	ND	ND	ND	
43TGS06XX801XF	43S	GAS	TP-06	8	NA	0	ND	ND	ND	ND	ND	
43TGS07XX801XF	43S	GAS	TP-07	8	NA	0	ND	ND	ND	ND	ND	
43TGS08XX801XF	43S	GAS	TP-08	8	NA	0	ND	ND	ND	ND	ND	
43TGS09XX801XF	43S	GAS	TP-09	8	NA	0	ND	ND	ND	ND	ND	
43TGS10XX801XF	43S	GAS	TP-10	8	NA	0	ND	ND	ND	ND	ND	

NOTES:

* = ND denotes a non detect or concentrations below 5 ppb

** = ND denotes a non detect or concentrations below 10 ppb

= Study area

NA = Not applicable

GAS = Soil gas

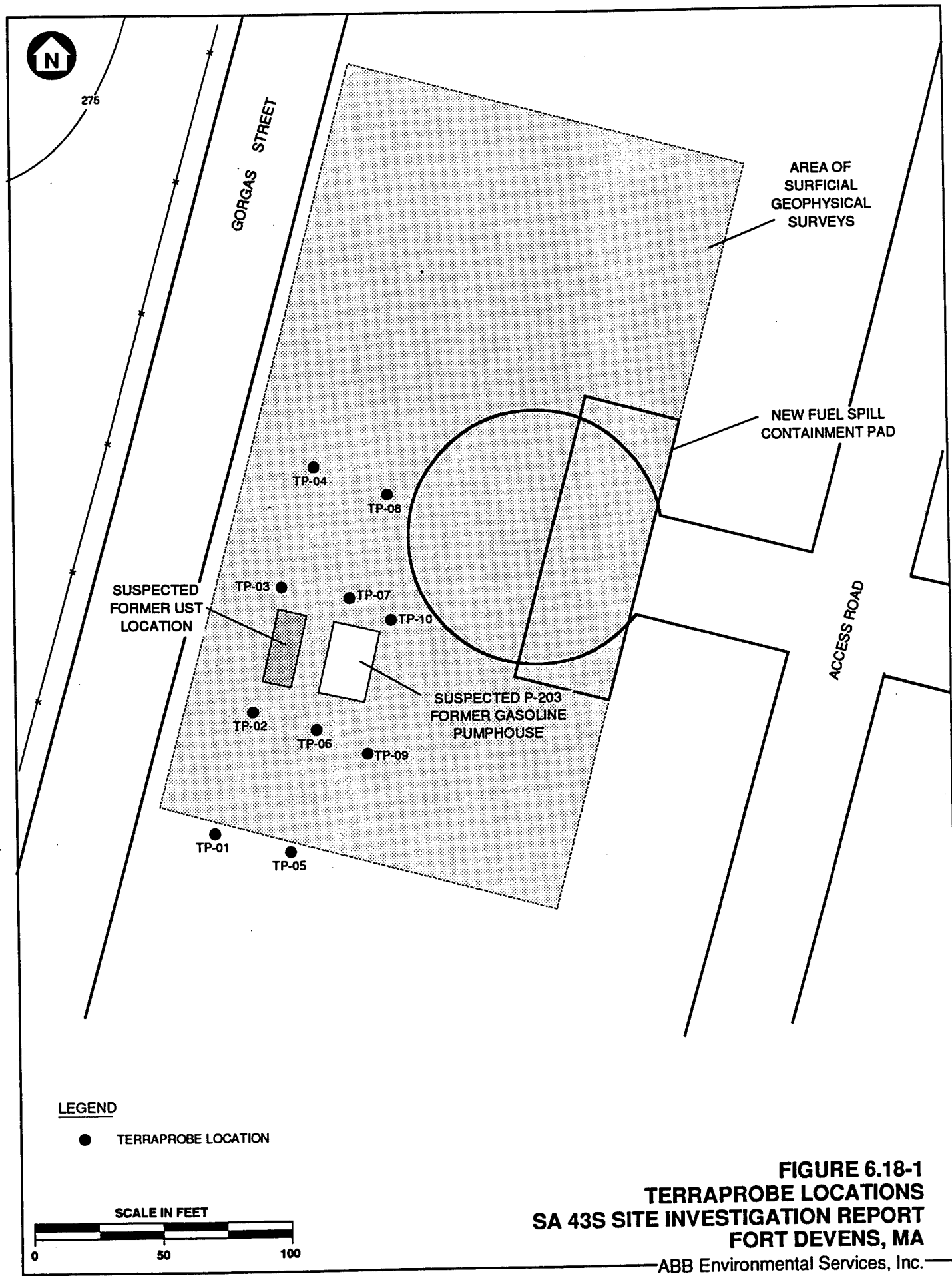


FIGURE 6.18-1
TERRAPROBE LOCATIONS
SA 43S SITE INVESTIGATION REPORT
FORT DEVENS, MA

ABB Environmental Services, Inc.

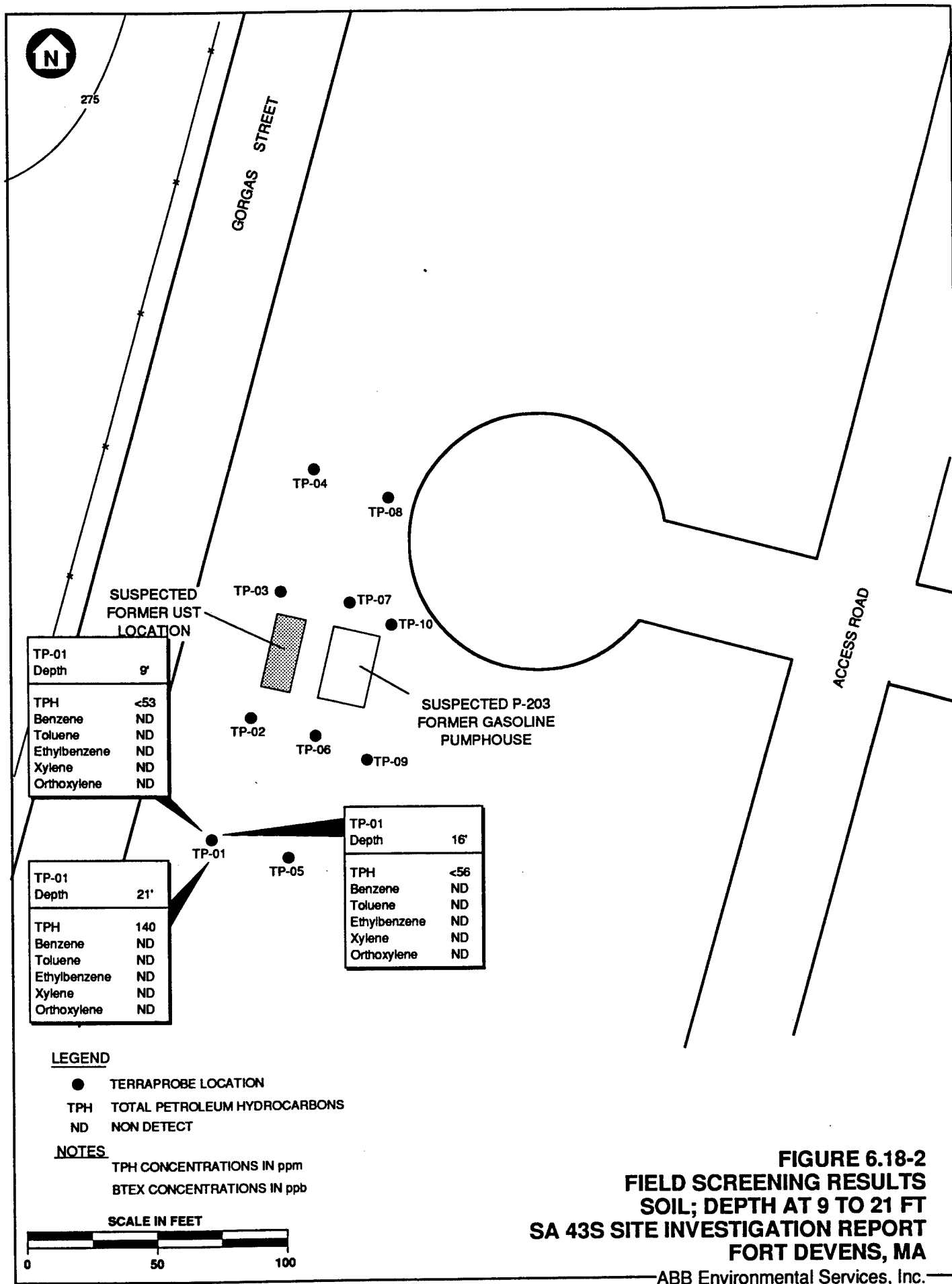
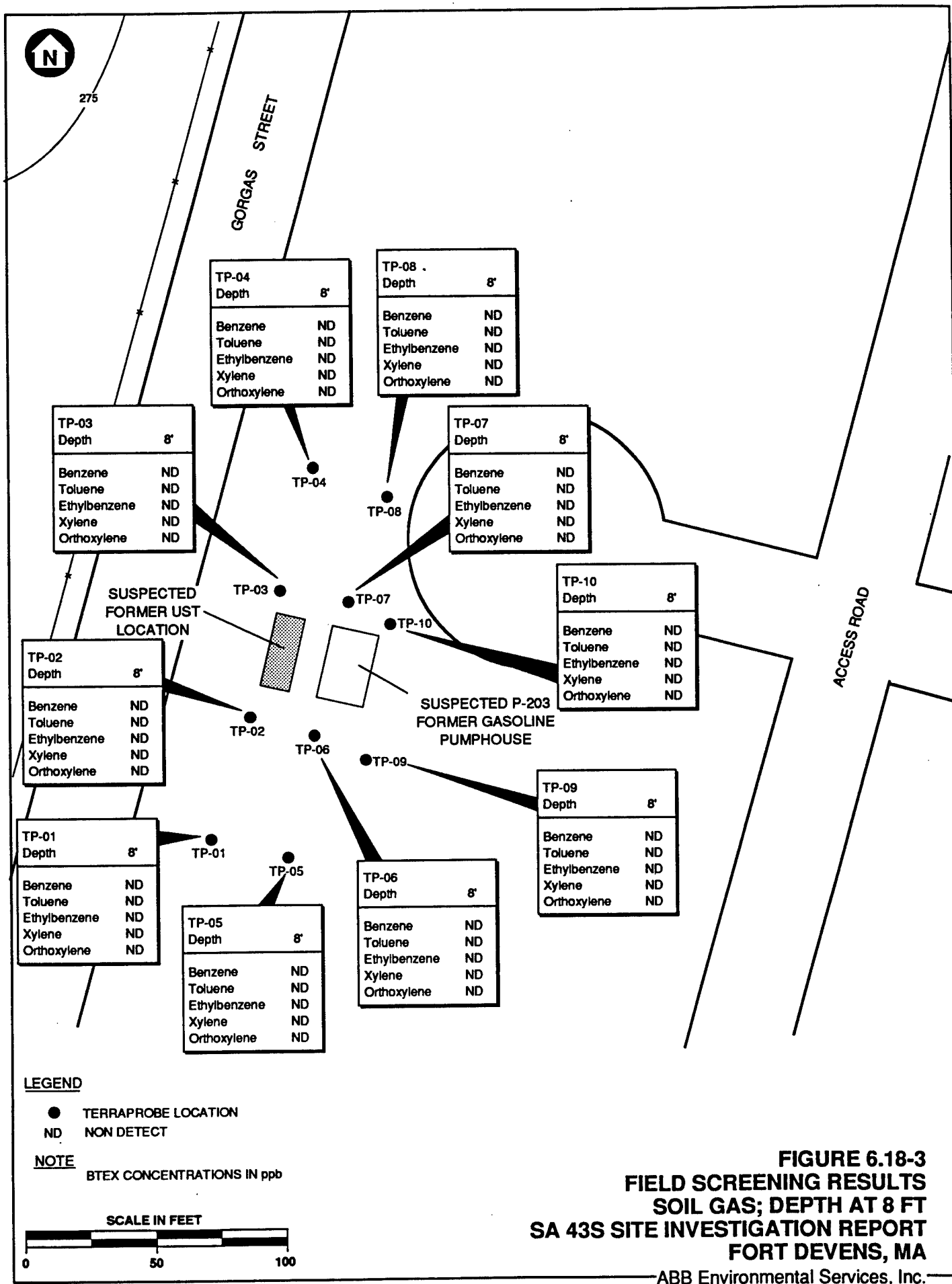


FIGURE 6.18-2
FIELD SCREENING RESULTS
SOIL; DEPTH AT 9 TO 21 FT
SA 43S SITE INVESTIGATION REPORT
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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AAFES	Army and Air Force Exchange Service
ABB-ES	ABB Environmental Services, Inc.
ACEC	Area of Critical Environmental Concern
AEC	U.S. Army Environmental Center
AEHA	U.S. Army Environmental Hygiene Agency
AMCCOM	Army Armament, Munitions, and Chemical Command
ANL	Argonne National Laboratory
ARAR	Applicable or Relevant and Appropriate Requirement
AREE	Area Requiring Environmental Evaluation
ARF	Analysis Request Form
Army	U.S. Army
AST	above ground storage tank
ATEC	ATEC Environmental Consultants
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BIS	bis (2-ethylhexyl) phthalate
BRAC	Base Closure and Realignment Act
BTEX	benzene, toluene, ethylbenzene, and xylenes
CaCO ₃	calcium carbonate
CCC	Civilian Conservation Corps
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
cm/sec	centimeters per second
CMR	Code of Massachusetts Regulations
CMTC	Civilian Military Training Corps
COC	chain-of-custody
COR	Contracting Officer's Representative
CPC	Chemicals of Potential Concern
CRL	Certified Reporting Limit
°C	degree Celcius
DCA	1,2-Dichloroethane
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethene
DDT	dichlorodiphenyl trichloroethene

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DF	dilution factor
°F	degree Fahrenheit
DQO	Data Quality Objectives
DRMO	Defense Reutilization Marketing Office
E&E	Ecology & Environment, Inc.
EA	Environmental Applications
EHSI	Environmental Hazards Specialists International
EMO	Environmental Management Office
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESE	Environmental Science and Engineering, Inc.
FESA	Federal Endangered Species Act
FORSCOM	United States Army Forces Command
FSP	Field Sampling Plan
ft/ft	feet per foot
ft ² /day	square feet per day
ft/yr	feet per year
GC	gas chromatograph
gpm	gallons per minute
GPR	ground-penetrating radar
GZAR	GZA Remediation, Inc.
HASP	Health and Safety Plan
HMX	cyclotetramethylenetetranitramine
HSA	hollow-stem augers
ID	inside diameter
IDW	investigation-derived waste
IR	infrared
IRDMIS	Installation Restoration Data Management Information System
ISA	Initial Site Assessment
Kurz	Kurz Associates

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

LOEL	Lowest Observed Effects Level
LUST	leaking underground storage tank
MAAF	Moore Army Airfield
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MCP	Massachusetts Contingency Plan
MEP	Master Environmental Plan
MESA	Massachusetts Endangered Species Act
mg/g	milligrams per gram
mg/day	milligrams per day
mg/kg/day	milligrams per kilogram per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ml	milliliter
MMCL	Massachusetts Maximum Contaminant Levels
MNHP	Massachusetts Natural Heritage Program
mph	miles per hour
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NBC	Nuclear, Biological, and Chemical
ND	non detect
NDIR	Non-Dispersive Infrared
NFA	no further action
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effects Level
NWR	National Wildlife Refuge
NYSDEC	New York State Department of Environmental Conservation
OD	outside diameter
ORSG	Office of Research and Standards Guidelines
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PAL	Project Analyte List

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

PARCC	precision, accuracy, representativeness, completeness, and comparability
PC	personal computer
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PCL	protective contaminant level
PCR	performance and cost report
PID	photoionization detector
POL	Petroleum, Oil, and Lubricant
POP	Project Operations Plan
ppb	parts per billion
ppm	parts per million
PQLs	Practical Quantitation Limits
PRC	Project Review Committee
PRE	Preliminary Risk Evaluation
PRI	Potomac Research, Inc.
psi	pound-per-square-inch
PVC	polyvinyl chloride
PX	Post Exchange
QA	quality assurance
QAC	Quality Assurance Coordinator
QAPP	Quality Assurance Project Plan
QC	quality control
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RDX	cyclonite
RI/FS	Remedial Investigation/Feasibility Study
ROTC	Reserve Officer Training Corps
RPD	relative percent difference
SA	Study Area
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SAS	Special Analytical Services
SCS	Soil Conservation Service
SI	Site Investigation

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

SQC	Sediment Quality Criteria
SSI	Supplemental Site Investigation
SVOC	semivolatile organic compound
SWMUs	Solid Waste Management Units
TBC	to be considered
TCE	Trichloroethene
TCLP	Toxic Compound Leaching Procedure
TEX	toluene, ethylbenzene, and xylenes
TKN	total Kjeldahl nitrogen
TNT	trinitrotoluene
TPHC	total petroleum hydrocarbons
TRC	Technical Review Committee
TSS	total suspended solids
TOC	total organic carbons
$\mu\text{g/kg}$	micrograms per kilogram
$\mu\text{g/g}$	micrograms per gram
$\mu\text{g/L}$	micrograms per liter
μl	microliter
USAEC	U.S. Army Environmental Center
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WPA	Works Progress Administration
2,4-DNT	2,4-dinitrotoluene

ABB Environmental Services, Inc.

REFERENCES

AAFES (See Army and Air Force Exchange Service)

ABB-ES (see ABB Environmental Services, Inc.)

ABB Environmental Services, Inc., 1992. "Biological and Endangered Species Baseline Study Fort Devens, Massachusetts - Preliminary Draft"; November.

ABB Environmental Services, Inc., 1992a. "Final Project Operations Plan for Site Investigations and Remedial Investigations, Fort Devens, Massachusetts"; Data Item A005/A008; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; July.

ABB Environmental Services, Inc., 1992b. "Site Investigation Work Plan - Groups 2 and 7, Fort Devens, Massachusetts, Final Task Order Work Plan", and "Site Investigation Work Plan - Historic Gas Stations, Fort Devens, Massachusetts, Final Task Order Work Plan"; Data Item A004; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; December.

ABB Environmental Services, Inc., 1992c. "Site Investigation Work Plan - Groups 2 and 7, Fort Devens, Massachusetts, Draft Final Task Order Work Plan"; Data Item A004; prepared for Commander, US Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; September.

ABB Environmental Services, Inc., 1993a. Site Investigation Data Package - Groups 2 and 7, Fort Devens, Massachusetts; Data Item A009; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; February.

ABB Environmental Services, Inc., 1993b. "Final Site Investigation Reports"; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; May.

ABB Environmental Services, Inc.

REFERENCES

- ABB Environmental Services, Inc., 1993c. "Final Site Investigation Work Plan"; Reports; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; August.
- ABB Environmental Services, Inc., 1993d. "Final Group 1A RI Addendum Report"; prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency; prepared by ABB Environmental Services, Inc., Portland, Maine; December.
- AEC see U.S. Army Environmental Center
- Alden, W.C., 1925. "Physical Features of Central Massachusetts"; in *Contributions to the Geography of the United States, 1923-1924*; U.S. Geological Survey Bulletin 760; pp. 13-106.
- Alpha Analytical Laboratories, 1991. "Certificate of Analysis"; Westborough, MA; April 12.
- ATEC-EC, 1992a. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Diesel, UST No. 0108, Building 3549, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; September 25. [SA 43C]
- ATEC-EC, 1992b. "Post-Removal Report, Underground Storage Tank Closure, (1) 5,000 Gallon, (1) 5,000 Gallon Diesel, UST Nos. 0109/0110, Lot P-171, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; October 15. [SA 43D]
- ATEC-EC, 1992c. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Gasoline, UST No. 0111, Building 2000, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; September 29. [SA 43E]

ABB Environmental Services, Inc.

REFERENCES

ATEC-EC, 1992d. "Post-Removal Report, Underground Storage Tank Closure, 10,000 Gallon Diesel Fuel, UST No. 0016, Building 605, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; May 19. [SA 43H]

ATEC-EC, 1992e. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Diesel Fuel, UST No. 0084, Building 605, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; May 19. [SA 43H]

ATEC-EC, 1992f. "Post-Removal Report, Underground Storage Tank Closure, 10,000 Gallon Diesel Fuel, UST No. 0089, Building 605, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; June 4. [SA 43H]

ATEC-EC, 1992g. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Diesel Fuel, UST No. 0017, Building 606, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; September 25. [SA 43I]

ATEC-EC, 1992h. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Gasoline, UST No. 0112, Building 2446, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; September 24. [SA 43J]

ATEC-EC, 1992i. "Post-Removal Report, Underground Storage Tank Closure, 1,000 Gallon Waste Oil, UST No. 0055, Building 2446, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; June 8. [SA 43J]

ABB Environmental Services, Inc.

REFERENCES

- ATEC-EC, 1992j. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Gasoline, UST No. 0113, Building 2514, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; October 8. [SA 43K]
- ATEC-EC, 1992k. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Diesel Fuel, UST No. 0114, P-181/Lake George Street, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; June 8. [SA 43N]
- ATEC-EC, 1992l. "Post-Removal Report, Underground Storage Tank Closure, 5,000 Gallon Diesel Fuel, UST No. 0115, P-185/Sherman Avenue, Fort Devens, Massachusetts"; ATEC File No. 37.07.91.07451; Norwell, MA; prepared for U.S. Army Directorate of Contracting; Fort Devens, Massachusetts; July 14. [SA 43R]
- Army and Air Force Exchange Service, 1973. "Community Center Main Store & Warehouse, Fort Devens, Mass., Demolition Plan (As-Built)"; Drawing No. 73-EN-C-03, Sheet C-3; November 11.
- Barbour, F.A., c. 1941. "Fort Devens, Mass. General layout Plan"; Plan 6101-710.1B; prepared for Construction Division, Office of Quartermaster General; Scale approximately 1:7,000.
- Biang, C.A., R.W. Peters, R.H. Pearl, and S.Y. Tsai, 1992. "Master Environmental Plan for Fort Devens, Massachusetts"; prepared for U.S. Army Corps of Engineers Toxic and Hazardous Materials Agency; prepared by Argonne National Laboratory, Environmental Assessment and Information Sciences Division, Argonne, Illinois; April.
- Biang, C.A., R.W. Peters, R.H. Pearl, and S.Y. Tsai, 1991. "Master Environmental Plan for Fort Devens, Massachusetts"; prepared for U.S. Army Corps of Engineers Toxic and Hazardous Materials Agency; prepared by Argonne National Laboratory, Environmental Assessment and Information Sciences Division, Argonne, Illinois; November.

ABB Environmental Services, Inc.

REFERENCES

- Biang, C.A., R.W. Peters, R.H. Pearl, and S.Y. Tsai, 1990. "Master Environmental Plan for Fort Devens, Massachusetts"; prepared for U.S. Army Corps of Engineers Toxic and Hazardous Materials Agency; prepared by Argonne National Laboratory, Environmental Assessment and Information Sciences Division, Argonne, Illinois; July 1.
- Bouwer, H., and R.C. Rice, 1976. "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifer with Completely or Penetrating Wells"; *Water Resources Research*: v. 12, pp. 423-428.
- Brackley, R.A. and B.P. Hansen, 1977. "Water Resources of the Nashua and Souhegan River Basins, Massachusetts"; U.S. Geological Survey Hydrologic Investigations Atlas HA-276.
- Butler, B.O., 1992. Report of Blanding's Turtle Study - Fort Devens, 1992. Submitted under Research Contract MA HP 925R-05.
- Coffin & Richardson, Inc., 1980. "Oil Pollution Control Facilities, Building 2516, Building 2446/2479, and Consolidated Wash Rack (2692), Fort Devens, Ayer, MA"; File No. 7701-3135; Boston, MA; prepared for U.S. Army Corps of Engineers, New York District, New York, NY; November 20.
- Construction Division, 1941. "Fort Devens Airport, Fort Devens, Massachusetts, A.C. Gasoline Fueling System, Location Plan, Layout Plan and Details"; Office of the Quartermaster General, Plan No. 6101-343; February 26.
- Cook, W. and S.L. Kurz, 1990. "Underground Storage Tank Removals, Fort Devens Military Reservation, Shirley Housing Area and Bldg T-2417, Fort Devens, MA"; prepared by Kurz Associates, Inc., Bridgewater, MA; prepared for Franklin Environmental Services, Inc., Wrentham, MA; December 6.
- Corps of Engineers (See U.S. Army Corps of Engineers)
- Degraaf, R. M. and D.D. Rudis, 1986. "New England Wildlife: Habitat, Natural History, and Distribution"; USDA Forest Service, Northeastern Forest Experiment Station, General Technical Report NE-108.

ABB Environmental Services, Inc.

REFERENCES

- Detrick, C.E., 1991. "Installation Assessment, Fort Devens, Ayer, Massachusetts"; prepared for U.S. Army Toxic and Hazardous Materials Agency; prepared by Environmental Photographic Interpretation Center, Environmental Monitoring Systems Laboratory, Warrenton, VA; September.
- Directorate of Facilities and Engineering, 1977. "Oil Spill Prevention, Control, and Countermeasure Plan"; Fort Devens, MA; June.
- Engineering Technologies Associates, Inc., 1992. "Ground Water Flow Model at Fort Devens, Massachusetts"; prepared for Commander, US Army Toxic and Hazardous Materials Agency; Ellicott City, MD; October 30.
- Environmental Applications, Inc., 1990. "Ft. Devens Tank Replacement Project Final Report, Contract No., DAKF-31-89-C-0761, Vol. I"; prepared for U.S. Army, Fort Devens, MA; Waltham, MA; September.
- Fort Devens Dispatch, 1992. *The Army in New England: 75 Years in the Making*; Special Edition; Vol. 52, No. 34; September 10.
- Fox, W.A., 1988. *Geohydric Study No. 38-26-0325-88*, Fort Devens, Massachusetts, 11-19 July, United States Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland.
- Gates, W.C.B., 1987. "Hydrogeologic Assessment Plan No. 38-26-0653-87, Fort Devens, Massachusetts"; U.S. Army Forces Command, Fort Gillem, Forest Park, Georgia; February 10.
- GZA Remediation, Inc., 1990. "Tank Replacement Project, Fort Devens, Massachusetts, Modification p00003, Hydrogeological Investigation, Contract No., DAKF-31-89-C00761"; prepared for U.S. Army, Fort Devens, MA; Waltham, MA; October.
- Hagstrom, G.W., 1977. "Consolidated Post Wash Platform, Fort Devens, Ayer, MA"; Department of the Army Directorate of Facilities Engineering; Fort Devens, MA; Drawing No. 655-2263; August 17.

ABB Environmental Services, Inc.

REFERENCES

- Hunt, D. and R. Zaremba, 1992. "Floristic Survey with Emphasis on Rare Species, of Fort Devens, Massachusetts, Massachusetts Division of Fish and Wildlife, Boston, MA.
- Hvorslev, M.J., 1951. "Time Lag and Soil Permeability in Groundwater Observations"; *U.S. Army Corps of Engineers Waterways Experiment Station Bulletin*; Vol. 36; Vicksburg, Mississippi.
- Jahns, R.H., 1953. "Surficial Geology of the Ayer Quadrangle, Massachusetts"; Scale 1:31,680; U.S. Geological Survey.
- Jones, B., 1991. "Soil Excavation at Bldg. 2650, 2417 and Shirley Housing"; Memorandum to the Record from Environmental Specialist, Environmental Management Office, Fort Devens, MA; May 15.
- Koteff, C., 1966. "Surficial Geologic Map of the Clinton Quadrangle, Worcester County, Massachusetts"; U.S. Geological Survey Map GQ-567.
- Kurz Associates, Inc., 1991. "Underground Storage Tank Removal and Related Environmental Investigations, Fort Devens Military Reservation, Harvard, Massachusetts"; prepared for Franklin Environmental Services, Inc., Wrentham, MA; Bridgewater, MA; January.
- Long, E.R. and L.G. Morgan, 1990. "The Potential for Biological Effects of Sediment-sorbed Contaminants Tested in the National Status and Trends Program"; NOAA Technical Memorandum NOS OMA 52.
- Longest, H.L., II, 1988. "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites"; U.S. Environmental Protection Agency; OSWER Directive 19355.4-02, September 7.
- MADEP (See Massachusetts Department of Environmental Protection)
- Marcoa Publishing Inc., 1990. *Welcome to Fort Devens, A Community of Excellence*; San Diego, CA.
- Massachusetts Department of Environmental Protection, 1988. "Massachusetts Contingency Plan"; 310 CMR 40.00 *et seq.*

ABB Environmental Services, Inc.

REFERENCES

- Massachusetts Department of Environmental Protection, 1988. "Massachusetts Ground Water Quality Standards"; 314 CMR 6.00 *et seq.*
- Massachusetts Department of Environmental Protection, 1990. "Massachusetts Surface Water Quality Standards"; 314 CMR 4.00 *et seq.*
- Massachusetts Natural Heritage Program, 1990. Massachusetts Division of Fisheries and Wildlife, Boston, MA.
- McHugh, K.E., R.F. Bukoski, and S.W. Butcher, 1990. "Estimation of Remaining Buildings 2648 and 2650 No. 2 Fuel Oil Contamination, Fort Devens"; prepared by Kurz Associates, Inc.; Bridgewater, MA; prepared for Franklin Environmental Services, Inc.; September 5.
- McMaster, B.N., J.D. Bonds, J.H. Wiese, K.L. Hatfield, J.B. Holly, L.C. Carter, E.A. Knauff, and K.A. Civitarese, 1982. "Installation Assessment of Headquarters Fort Devens, Report No. 326"; prepared for Commander, Headquarters Fort Devens and for U.S. Army Toxic and Hazardous Materials Agency; prepared by Environmental Science and Engineering, Inc.; Gainesville, FL; August.
- Miller, G., 1992. "Response and Clean Up of the 17 October 1992 Diesel Fuel Spill at the 756th Engineering Battalion Motor Pool"; Memorandum for Record; Environmental Management Office, Fort Devens, MA; November 19.
- New York State Department of Environmental Conservation (NYSDEC), 1989. "Sediment Criteria - December 1989"; Bureau of Environmental Protection, Division of Fish and Wildlife.
- Peck, J.H., 1975. "Preliminary Bedrock Geologic Map of the Clinton Quadrangle, Worcester County, Massachusetts"; U.S. Geological Survey Open-File Report 75-658; Scale 1:24,000; text and 3 maps.
- Peck, J.H., 1976. "Silurian and Devonian Stratigraphy in the Clinton Quadrangle, Central Massachusetts"; in *Contributions to the Stratigraphy of New England*; Geological Society of America Memoir 148; pp. 241-252.

ABB Environmental Services, Inc.

REFERENCES

- Pierce, J., 1991. Letter from Chief, Environmental Management Office, Fort Devens, MA; to David Salvador, Massachusetts Department of Environmental Quality Engineering, Worcester, MA; May 15.
- Poole, T., 1992. Personal Communication from Forester, DEH Technical Services Branch, to ABB Environmental Services, Inc., Fort Devens.
- Poole, T., 1993. Personal Communication from Forester, DEH Technical Services Branch, to ABB Environmental Services, Inc., Fort Devens.
- Potomac Research Inc. (PRI), 1993. "User's Manual, IRDMIS PC Data Entry and Validation Subsystem"; Version 5.0; prepared for U.S. Army Toxic and Hazardous Materials Agency; Aberdeen Proving Ground, MD; February.
- Robinson, G.R., Jr., 1978. "Bedrock Geologic Map of the Pepperell Shirley, Townsend Quadrangles, and Part of the Ayer Quadrangle, Massachusetts and New Hampshire"; U.S. Geological Survey; Miscellaneous Field Studies Map MF-957.
- Robinson, P., and R. Goldsmith, 1991. "Stratigraphy of the Merrimack Belt, Central Massachusetts"; in "The Bedrock Geology of Massachusetts; U.S. Geological Survey Professional Paper 1366-G; pp. 61-637.
- Russell, S.L., and R.W. Allmendinger, 1975. "Interim Geologic Map of the Shirley Quadrangle, Massachusetts"; U.S. Geological Survey Open File Report 76-267.
- Smith, R.L., 1992. "Risk-Based Concentration Table, Fourth Quarter 1992"; U.S. Environmental Protection Agency, Region III; Philadelphia, Pennsylvania; October 27.
- Soil Conservation Service, 1989. Untitled Middlesex County field sheet #19; U.S. Department of Agriculture; Middlesex Conservation District; January 5.
- Soil Conservation Service, 1991. "Middlesex County Massachusetts Interim Soil Survey Report"; U.S. Department of Agriculture; Middlesex Conservation District; Westford, MA (includes soil sheet #19).

ABB Environmental Services, Inc.

REFERENCES

- U.S. Army Environmental Center, 1990. "Quality Assurance Manual"; Aberdeen Proving Ground, MD; January.
- U.S. Army Environmental Center, 1993. "Fact Sheet: Fort Devens Installation Restoration Program (IRP) and BRAC 91 Environmental Restoration Impact"; March.
- U.S. Department of the Army, 1979. "Environmental Impact Statement, Fort Devens Mission Activities, Fort Devens, Massachusetts"; Headquarters, U.S. Army Forces Command; June 30; Revised May 1, 1980.
- U.S. Engineer Office, 1952. "Master Plan, Fort Devens, Ayer, Mass., Detail Site Plan, Building Use Map"; Sheets Nos. 6 through 21; Boston, MA; Files X100-109/705 through X100-109/720.
- USEPA (See U.S. Environmental Protection Agency)
- U.S. Environmental Protection Agency, 1983. "Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Life and Its Uses." Draft; July 5.
- U.S. Environmental Protection Agency, 1984. "Ambient Water Quality Criteria for Lead"; EPA 440/5-84-027.
- U.S. Environmental Protection Agency, 1986. "Test Methods for Evaluating Solid Waste"; Office of Solid Waste and Emergency Response, Washington, D.C., November.
- U.S. Environmental Protection Agency, 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA"; Interim Final; USEPA Office of Solid Waste and Emergency Response Directive OSWER 9335.3-01; Washington, D.C.; March.
- U.S. Environmental Protection Agency, 1988a. "Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants"; Office of Water Regulations and Standards; SCD No. 17; Washington, D.C.

ABB Environmental Services, Inc.

REFERENCES

- U.S. Environmental Protection Agency, 1988b. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA"; USEPA Office of Emergency and Remedial Response, EPA/540/G-89/004, OSWER Directive 9355.3-01; October.
- U.S. Environmental Protection Agency, 1988c. "Ambient Water Quality Criteria for Aluminum"; EPA 440/5-86-008; August.
- U.S. Environmental Protection Agency, 1989. Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants, USEPA, Office of Water Regulations and Standards, Washington, D.C.
- U.S. Environmental Protection Agency (USEPA), 1991. "Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C., December.
- U.S. Environmental Protection Agency and U.S. Department of the Army, 1991a. "In the Matter of: The U.S. Department of the Army, Fort Devens Army Installation, Fort Devens, Massachusetts; Federal Facility Agreement under CERCLA Section 120"; May 13.
- U.S. Environmental Protection Agency, 1992. Memorandum to Ann-Marie Burke, USEPA Region I from Joan S. Dollarhide, Superfund Health Risk Technical Support Center, titled "Master List Responses for 2QTR 1992"; June 12.
- U.S. Environmental Protection Agency, 1992a. "Drinking Water Regulations and Health Advisories." Office of Drinking Water, Washington, D.C.
- U.S. Environmental Protection Agency, 1992b. "Framework for Ecological Risk Assessment"; EPA/630/R-92/001; February.
- United States Fish and Wildlife Service, 1992c. "Survey and Evaluation of Wetlands and Wildlife Habitat, Fort Devens, Massachusetts"; House of Representatives Appropriations Committee; p. 1-10.

ABB Environmental Services, Inc.

REFERENCES

- West, C.R., 1992. "Massachusetts Drinking Water Standards and Guidelines"; Massachusetts Department of Environmental Protection; Office of Research and Standards; Boston, Massachusetts; Autumn.
- Wones, D.R. and R. Goldsmith, 1991. "Intrusive Rocks of Eastern Massachusetts"; U.S. Geological Survey Professional Paper 1366-I.
- Wright, Larry, ed., 1976. The Beer Can, a Complete Guide to Beer Can Collecting; Beer Can Collectors of America; Greatlakes Living Press, Matteson, IL.
- Zen, E-an, Ed., 1983. "Bedrock Geologic Map of New England"; U.S. Geological Survey; Scale 1:250,000; 3 sheets.

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