FINAL
REMEDIAL ACTION REPORT
AREAS OF CONTAMINATION 44 & 52

DEVENS, MASSACHUSETTS

CONTRACT DACA87-02-D-0007
DELIVERY ORDER NO. DB01

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

SEPTEMBER 2005

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Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

Prepared by:

MACTEC Engineering and Consulting, Inc.
Portland, Maine

SEPTEMBER 2005

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Final Remedial Action Report
Record of Preparation, Review, and Approval

Areas of Contamination 44 & 52
Devens, Massachusetts

This Remedial Action Report was prepared according to EPA OSWER Directive 9320.2-09A-P, dated January 2000. This AOCs 44 & 52 Final Remedial Action Report will be used, along with previous and future remedial action reports for other relevant sites at Devens and the other Five Year Review Reports, as the basis for the development of the Preliminary and Final Close Out Report.

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September 2005

FINAL
REMEDIAL ACTION REPORT
AREAS OF CONTAMINATION 44 & 52

DEVENS, MASSACHUSETTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This Remedial Action Report was prepared for Areas of Contamination (AOCs) 44 & 52 at the former Fort Devens, Devens, Massachusetts by MACTEC Engineering and Consulting, Inc. (MACTEC) under the direction of the U.S. Army Corps of Engineers (USACE). The USACE was and remains the contracting party responsible for remedial/removal action design and implementation at AOCs 44 & 52 and is the party most familiar with the site. MACTEC completed the Site Investigation, Feasibility Study, and Record of Decision for AOCs 44 & 52 and is also familiar with the site.

Fort Devens was placed on the National Priorities List on December 21, 1989, under the Comprehensive Environmental Response Compensation and Liability Act. This report will be used, along with previous and future remedial action reports for other relevant sites at Devens and Five-Year Review Reports, as the basis for the development of the Preliminary and Final Close Out Report. The Army is the lead federal agency responsible for environmental cleanup at the former Fort Devens. The CERCLIS ID for Fort Devens is MA7210025154.

AOCs 44 & 52 comprise the Barnum Road Maintenance Yards at the former Fort Devens. The AOCs are situated along Barnum Road near the former Barnum Gate, approximately one mile southwest of the Town of Ayer Route 2A/110 intersection. AOC 44 was known as the Cannibalization Yard. Vehicles were stored at AOC 44 before being dismantled for usable parts. AOC 52 was a maintenance yard where vehicles were stored while awaiting repairs. It was also known as the TDA (Table of Distribution and Allowances) Maintenance Yard. Northwest of the Cannibalization Yard was a separately fenced vehicle storage yard known as the RTS (Regional Training Site) Yard. A fenced-off area southeast of the main portion of the TDA Maintenance Yard was known as the K-Yard. All four yards had a long and continuing history of vehicle storage and were combined as one operable unit. Contamination at the AOCs consisted primarily of petroleum hydrocarbons in unsaturated soil resulting from spills of gasoline, a leaking waste oil storage tank, and spills and leaks from vehicle maintenance and storage.

In accordance with the Record of Decision, the excavation of over 30,000 cubic yards of surface (upper two feet) and hot-spot soil, and cold-mix asphalt batching of 11,800 cubic yards of soil exceeding risk-based cleanup levels for carcinogenic polynuclear aromatic compounds and Massachusetts Contingency Plan (MCP) S-1 standards for total petroleum hydrocarbons was completed in 1995. Required upgrades to the storm water collection system were completed in 1996. Groundwater monitoring was discontinued in 2000, after analytical results for 1998 and 1999 samples showed that concentrations of contaminants of potential concern were well below MCP GW-1 standards. Analytical results for a follow-up round of groundwater samples collected in December 2003 were consistent with 1998 and 1999 results. AOCs 44 & 52 are designated as Army Retained land, and the Army has no plans to transfer the property as part of base closure activities.

The Installation Master Plan provides institutional controls to manage the long-term use of AOCs 44 & 52.

The remedial action at AOCs 44 & 52 is considered complete.

1.0 INTRODUCTION

This Remedial Action Report was prepared by MACTEC Engineering and Consulting, Inc. (MACTEC) for the U. S. Army Corps of Engineers (USACE) New England District in partial fulfillment of Contract DACA87-02-D-0007 Delivery Order DB01. The USACE was and remains the contracting party responsible for remedial/removal action design and implementation at Areas of Contamination (AOCs) 44 & 52 at the former Fort Devens, Devens, Massachusetts and is the party most familiar with the site. MACTEC (d/b/a ABB Environmental Services, Inc., [ABB-ES]), under contract to the Army, completed the Site Investigation (SI), Feasibility Study (FS), and Record of Decision for AOCs 44 & 52 and is also familiar with the site.

Fort Devens was placed on the National Priorities List on December 21, 1989, under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act. The Army is the lead federal agency responsible for the cleanup and funding is from the Department of Defense. The CERCLIS ID for Fort Devens is MA7210025154.

1.1 INSTALLATION HISTORY

The former Fort Devens is located approximately 35 miles west of Boston in the towns of Ayer and Shirley (Middlesex County) and Harvard and Lancaster (Worcester County) (Figures 1 and 2). It was created as a temporary cantonment in 1917 for training soldiers. From 1922 to 1931, it was a training camp for various troops. In 1929, Dr. Robert Goddard tested his early rockets there. The installation was formally dedicated as Fort Devens in 1932. In 1940, Fort Devens became a reception center and encompassed more than 10,000 acres. A hospital and airfield were built. Inductees were processed there throughout WWII, and it had a peak population of 65,000. At the end of the war, Fort Devens became a demobilization center and reverted to caretaker status in 1946.

Fort Devens was reactivated in 1948 because of the Korean War. It maintained its function as a training and induction center and as a mobilization and demobilization site during the Korean and Vietnam conflicts, and Operations Desert Shield and Desert Storm. Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Closure and Realignment Act (BRAC Act) of 1990, and was officially closed in September 1996. The Army retained portions of the property formerly occupied by Fort Devens for reserve forces training and renamed the property Devens reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment.

The installation developed on what were primarily open farmlands and forested areas. It was divided into North, Main, and South Posts (see Figure 2). Over 6,000 acres at Fort Devens were used for training and military maneuvers, and over 3,000 acres were developed for housing, buildings, and other facilities; the installation has been reported as the largest undeveloped land holding under a single owner in north-central Massachusetts (United States Fish and Wildlife Service [USFWS], 1992).

No major industrial operations occurred at Fort Devens, although several small-scale industrial operations were performed under the Directorate of Plans, Training, and Security; the Directorate of Logistics; and the Directorate of Engineering and Housing. The major waste-producing operations performed by these groups were photographic processing and maintenance of vehicles, aircraft, and small engines.

1.1.1 Location

AOCs 44 & 52 comprise the Barnum Road Maintenance Yards at the former Fort Devens. The AOCs are situated along Barnum Road near the former Barnum Gate and approximately one mile southwest of the Town of Ayer Route 2A/110 intersection. The Maintenance Yards were fenced and used for military vehicle storage. AOC 44 was known as the Cannibalization Yard. It was an area where vehicles were stored before being dismantled for usable parts. AOC 52 was a maintenance yard where vehicles were stored while awaiting repairs. It was also known as the TDA (Table of Distribution and Allowances) Maintenance Yard. Northwest of the Cannibalization Yard was a separately fenced vehicle storage yard known as the RTS (Regional Training Site) Yard. A fenced-off area southeast of the main portion of the TDA Maintenance Yard was known as the K-Yard. All four yards had a long and continuing history of vehicle storage and were combined as one operable unit.

Figure 2 shows the location of the site relative to the Main Post. Site features including soil removal/remediation areas and monitoring wells are shown on Figure 3.

1.1.2 Setting

The total area of the site is approximately 7.8 acres. The Maintenance Yards were bordered to the north by Massachusetts Army National Guard property, which was used for similar vehicle storage activities as the Barnum Road Maintenance Yards. Boston and Maine Railroad property and Barnum Road border the site to the west and east, respectively. Building 3713, located south of the site, is a 6-acre building used by the Army for vehicle maintenance activities. Prior to remedial activities, all yards show evidence of being at least partly paved at one time.

Groundwater in the aquifer underlying the yards has been assigned to Class I under Commonwealth of Massachusetts regulations. Class I consists of groundwater that is designated as a source of potable water supply. Based on water level data, inferred

groundwater flow from the Maintenance Yards is northeast toward Grove Pond. The Town of Ayer currently owns and operates two water supply wells within 150 feet of the south side of Grove Pond and approximately one-half mile from the yards. The town engaged a consultant to establish a Zone II area of influence around the wells to define the conceptual zone of contribution to the wells under the most severe pumping and limited recharge conditions that can be anticipated realistically. The report shows the Zone II area as including the Maintenance Yards. The Maintenance Yards are also located approximately 1,600 to 1,700 feet from the Fort Devens Grove Pond well field and are, therefore, within the default Zone II (one-half mile radius) of this Army wellfield.

The Maintenance Yards are located approximately 1,200 feet west of Cold Spring Brook. Surface water from the Maintenance Yards drains into part of the Fort Devens stormwater collection system which discharges to Cold Spring Brook (see Figure 3). Cold Spring Brook merges with Bowers Brook and flows northeast into Grove Pond and then to Plow Shop Pond. Ultimately these ponds drain into Nonacoicus Brook, which flows about 1 mile northwest before its confluence with the Nashua River.

1.1.3 General Site History

The Maintenance Yards on Barnum Road have a long history of Army vehicle storage and maintenance. As a consequence, the soils of the site were exposed to possible crankcase releases over a long duration. Gasoline, motor oil, and other automotive fluids have also likely been released during vehicle dismantling operations in the Cannibalization Yard. Individual releases are not likely to have been of significant volume, but numerous releases over the period in which the yards were used lead to soil contamination. The only recorded vehicle release was an estimated 20 gallons of "MOGAS" (motor vehicle gasoline) and hydraulic fluid released near the center of the Cannibalization Yard in 1985 during the cannibalization process. Approximately 4 cubic yards of visibly contaminated soils were excavated immediately and containerized by Army personnel.

The bulleted items below summarize the chronology of events that are specific to the site.

- **April 1985** MOGAS release at Cannibalization Yard; visibly contaminated soils were excavated immediately.
- **July 1991** Exploratory test pits were excavated for construction of a concrete spill-containment basin in the TDA Maintenance Yard; petroleum contaminated soils detected.
- **December 1991** Proposed spill-containment basin area excavated for construction. Contaminated soils had been removed.
- **May 1992** Waste oil underground storage tank (UST) removed at the Cannibalization Yard.

- **June 1992** SI initiated at Study Areas (SAs) 44 & 52.
- **April 1993** SI Report issued and recommends a FS.
- **June 1993** Supplemental SI (SSI) initiated at SAs 44 & 52; upon completion, SAs designated AOCs.
- **January 1994** FS issued.
- **July 1994** To accelerate cleanup schedule, predesign field work performed in advance of Record of Decision.
- **August 1994** Conceptual remedial design issued.
- **December 1994** 65% design issued.
- **March 1995** Record of Decision signature.
- **March 1995** Final design issued.
- **August 1995** Remedial action work commences.
- **April 1996** Remedial action work completed.
- **June 1996** Remedial action Completion Report issued.
- **April 1998** Groundwater Monitoring Plan issued.
- **May 1998** Round 1 groundwater sampling complete.
- **October 1998** Annual Groundwater Sampling Report issued.
- **June 1999** Round 2 groundwater sampling complete.
- **October 1999** Annual Groundwater Sampling Report issued with Recommendations to Discontinue Annual Groundwater Sampling.
- **September 2000** First five-year review recommended remedial action be considered complete.
- **December 2003** Round 3 groundwater sampling complete.
- **2004** Round 3 Groundwater Sampling Report issued.

1.1.4 AOC 44 & 52 Contamination and Cleanup

A summary of the details of the site contamination, and cleanup is as follows:

- In 1985, the only recorded vehicle fluid release occurred and was an estimated 20 gallons of MOGAS and hydraulic fluid released near the center of the Cannibalization Yard. Approximately 4 cubic yards of visibly contaminated soils were excavated immediately and containerized by Army personnel.

- In July 1991, exploratory test pits were excavated for construction of a concrete spill-containment basin in the southeast corner of the TDA Maintenance Yard. Test pitting revealed zones of contaminated soil below the surface. Toxicity Characteristic Leaching Procedure (TCLP) analyses detected 3 to 7 micrograms per liter (µg/L) of benzene in leachate from the soil samples. Total petroleum hydrocarbons (TPH) were found at 420 to 700 parts per million (ppm) concentrations in surface soil samples and at 80 ppm in one sample from a 4-foot depth. TPH were not detected in the 8-foot-deep soil samples. In November and December 1991, the approximate 100- by 160-foot proposed spill-containment basin area was excavated to begin construction.

  Excavation continued until field screening (non-dispersive infrared detection [NDIR]) and visual observation indicated that contaminated soils had been removed.

  The contaminated layer was between 8 and 12 inches thick. The uncontaminated layer extended below the upper layer to the construction subgrade limit throughout the spill-containment basin's extent. Approximately 1,200 tons of soil were excavated and stockpiled. Laboratory analysis was performed on samples from stockpiled soil. TPH concentrations ranged from 130 to 800 ppm. In addition, a petroleum identification analysis (ASTM D 3328) was performed on six of the 10 stockpile samples. These samples showed a presence of a hydrocarbon pattern in the C24-C36 range, but the pattern did not match any of the fuel standards for gasoline, No. 2, 4, and 6 fuel oils, kerosene, or motor oil/transmission fluid. The soil was suspected to be an asphalt-treated, gravel road base.

- In May 1992, a 1,000-gallon UST, formerly used to store waste oil was removed from the Cannibalization Yard. Visibly contaminated soil was stockpiled, and laboratory analysis of soil samples from the bottom and one side of the tank excavation showed TPH concentrations of 17,600 and 9,780 ppm, respectively. Reportedly, the tank was observed to be in good condition; however, inspection revealed that the fill pipe was improperly connected to the tank, allowing the pipe contents to leak. In July 1992, contaminated soils surrounding the removed tank were excavated. Laboratory tests on samples from two excavation sidewalls and stockpiled soil following tank excavation revealed residual TPH concentrations ranging from 1,110 to 2,740 ppm thereby indicating that the TPH concentration in unexcavated soil remained above cleanup levels. This area was subsequently addressed as a hot-spot during 1995 remedial activities. In May and July, a total of 91 tons (an estimated 120 cubic yards) of contaminated soils were removed from the waste oil UST area and shipped off-site for treatment and reuse.

A more detailed description of the site history can be found in the SI and SSI reports (ABB-ES, 1993a, 1993b), and Section 1.2 of the FS Report (ABB-ES, 1994a).

1.1.5 AOCs 44 & 52 Investigation and Enforcement

In conjunction with the Army's Installation Restoration Program, Fort Devens and the U.S. Army Environmental Center (USAEC) initiated a Master Environmental Plan (MEP) in 1988 (Biang, 1992). The MEP consists of assessments of the environmental status of SAs, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. AOCs (SAs) 44 & 52 were identified as potential sources of contamination. The MEP recommended that a record search be conducted to better define past and current activities. It also recommended that the extent of contamination be determined by drilling soil borings and sampling for the U. S. Environmental Protection Agency (USEPA) hazardous substance list compounds and TPH. The MEP suggested installing monitoring wells if the deeper soils were found contaminated.

On December 21, 1989, Fort Devens was placed on the National Priorities List under CERCLA as a result of contamination at two other Devens sites (Shepley's Hill Landfill and Cold Spring Brook Landfill). A Federal Facility Agreement (FFA) was developed and signed by the Army and USEPA Region I on May 13, 1991 and finalized on November 15, 1991. The FFA provides the framework for the implementation of the CERCLA/SARA process at Devens.

Under the BRAC Act of 1990, Fort Devens was selected for closure. As a result, an Enhanced Preliminary Assessment (PA) was performed to address areas not normally included in the CERCLA process, but requiring review prior to closure. Although the Enhanced PA covers MEP activities, its main focus was to determine if additional areas required detailed records review and SI and to provide information and procedures to investigate installation wide areas requiring environmental evaluation. A final version of the Enhanced PA report was completed in April 1992 (Biang, 1992). No additional findings or recommendations for AOCs 44 & 52 were provided in the PA.

In 1992, the Army initiated a SI for AOCs 44 & 52. The purpose of the SI was to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted. The Final SI Report was issued April 1993. In June 1993, a SSI was performed to fill specific data gaps. The SI and SSI met the requirements of a remedial investigation (RI) in defining the nature and extent of contamination at the Maintenance Yards. As a result of the SI and SSI, the Maintenance Yards SAs were designated as AOCs because of contamination detected in the unsaturated soils. A FS was issued in 1994 to evaluate remedial action alternatives for cleanup of the Maintenance Yards soils. The Final FS was issued January 1994. The Proposed Plan detailing the Army's preferred remedial alternative was issued in May 1994 for public comment.

2.0 OPERABLE UNIT AOC 44 & 52 BACKGROUND

2.1 AOC 44 & 52 RECORD OF DECISION BACKGROUND

A Record of Decision was signed in March 1995 documenting asphalt batching as the selected remedial remedy for cleanup of contaminated surface soils and soils associated with two known releases at AOCs 44 & 52 (ABB-ES, 1995b).

2.1.1 Remedy Components

The selected remedy at AOCs 44 & 52 addressed long-term worker exposure to contaminated surface soil, the principal known threat at the Maintenance Yards and two known release areas (a reported release of MOGAS and leakage from a former waste oil UST, also referred to as the hot-spot areas). The selected remedial alternative relied on cold mix asphalt batching of soils to control site risks. The following are the major components of the selected remedy.

- Excavate surface soil (top two feet across the site),
- Excavate the two hot-spot areas,
- Stockpile soils for sampling and analysis,
- Cold-mix asphalt batch soils exceeding site cleanup levels of 7 ppm (average) total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and 500 ppm TPH,
- Backfill excavations with uncontaminated stockpiled soil and then place the asphalt batched material as a pavement subbase,
- Apply a pavement wearing course,
- Expand the existing stormwater collection system,
- Perform groundwater monitoring,
- Institute deed restrictions to:
    - prohibit residential development/use of the Maintenance Yards;
    - minimize the possibility of long-term (working lifetime) exposure to subsurface soils; and
    - require management of soils resulting from construction related activities.

2.1.2 Remedial Action Objectives

Remedial action objectives for the selected cleanup remedy at AOCs 44 & 52 are discussed below.

- Minimize direct contact/ingestion and inhalation with surface soils at the Maintenance Yards, which are estimated to exceed the USEPA Superfund target range of one in 10,000 to one in 1,000,000 excess cancer risk for carcinogens.
- Reduce off-site run-off of contaminants that might result in concentrations in excess of ambient surface water quality standards and background concentrations in sediments.
- Reduce or contain the source of contamination to minimize potential migration of contaminants of concern that might result in groundwater concentrations in excess of the federal drinking water Maximum Contaminant Levels.

2.1.3 Cleanup Goals

A cleanup level of 7 ppm average total cPAHs was identified for the site during the FS Report. This value was arrived at assuming all cPAHs are as potent as benzo(a)pyrene (the B[a]P approach), which was USEPA's Region I standard approach for computing risk estimates for cPAHs at the time the quantitative risk evaluation was performed for the Maintenance Yards. This cleanup level for known and suspect carcinogens (Classes A, B, and C compounds) achieves a 10^{-4} excess cancer risk level considering exposures via dermal contact and incidental ingestion. (Although inhalation is a potential exposure route, risk estimates indicated that it was an insignificant contributor to the overall risk at the Maintenance Yards).

Although not required to do so under CERCLA, the Army agreed, with Massachusetts Department of Environmental Protection (MADEP) approval, to establish TPH cleanup levels for soils at the Maintenance Yards based on guidance from the Massachusetts Contingency Plan (MCP). The MCP established 500 ppm as the cleanup criteria for TPH based on MCP S-1/GW-1 criteria. The S-1 soil standard for TPH does not apply to benzene, toluene, ethylbenzene, and xylene or specific polynuclear aromatic hydrocarbon (PAH) compounds. Therefore, the S-1 soil standard for TPH was used for AOCs 44 & 52 soils in conjunction with the site-specific cleanup level for cPAHs identified above. Benzene was not detected in AOCs 44 & 52 soil. As reported in Appendix A of the FS, the risks associated with toluene, ethylbenzene, and xylenes in AOCs 44 & 52 soils fell well outside the target hazard index of one.

Based on the Baseline Risk Evaluation in the FS Report, exposure to non-carcinogenic Classes D and E compounds are at an acceptable level to which the human population

including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime. Consequently no cleanup levels were derived for these compounds.

The cleanup level for cPAHs attains USEPA's risk management goal for remedial actions and has been determined by USEPA to be protective of human health and the environment. The cleanup level for TPH meets the requirement of the MADEP for this contaminant.

2.2 DESIGN

The remedial design was performed by ABB Environmental Services, Inc. (ABB-ES, presently MACTEC, Inc.) under contract with the USACE. Predesign field activities commenced in July 1994. Predesign field activities consisted of excavating test pits, evaluating the existing stormwater system and performing a site topographic survey. Details of these investigation results were submitted in the Predesign Investigation Report (ABB-ES, 1994c) that was followed by the Conceptual Design (ABB-ES, 1994d). Following approval of the Conceptual Design, ABB-ES submitted an In-Progress Review Design Submission (65 percent) (ABB-ES, 1994e) in December 1994 followed by the Final Design (ABB-ES, 1995b) in March 1995 for regulatory review. Portions of the specifications and drawings were revised and issued final in August 1995. Details of the design consisted of the construction components listed in the Record of Decision.

3.0 CONSTRUCTION ACTIVITIES

Remedy implementation consisted of completion of a remedial design and the remedial action, performing groundwater monitoring, and enforcing institutional controls in general accordance with the criteria specified in the Record of Decision. A summary of remedial construction and groundwater sampling activities are presented in this section. Additional details are presented in Section 4 of the Remedial Action Operable Unit Completion Report for the remediation of Barnum Road Maintenance Yards AOCs 44 & 52 (Weston, 1996).

3.1 REMEDIAL CONSTRUCTION

Construction began in August 1995 and entailed excavating and sampling of over 30,000 cubic yards of surface soils from the top 2 feet of the site to segregate and treat soils exceeding the cleanup level of 7 ppm for cPAH and 500 ppm for TPH. Treatment was performed by cold mix asphalt batching 11,800 cubic yards of contaminated soils and then backfilling/compacting both the uncontaminated excavated soils and the asphalt batched material as a sub-base material in the excavation. The top 9 inches of backfilled material consisted of batched material, while the bottom 15 inches consisted of uncontaminated backfilled soil. Four inches of bituminous pavement was placed over this sub-base material to complete a pavement wearing course for Army vehicle parking.

During the excavation, a total of three hot spot areas were excavated below the 2-foot surface soil depth to delineate and batch contaminated soil. These were the UST area near the southern corner of the Cannibalization Yard, the MOGAS spill area in the center of the Cannibalization Yard, and at soil boring location 44B-92-06X near the northern corner of the Cannibalization Yard. At the UST area a 25.5 x 19 foot excavation was opened to reach a 14 foot depth. On-site field screening of samples from the excavation sidewalls and bottom yielded results of less than 500 ppm TPH. The UST excavation was not backfilled until confirmation laboratory analysis confirmed that in-situ soil was below the 500 ppm criteria. Similarly, excavations at the other two hot-spots were not backfilled until confirmation that in-situ soil was below the 500 ppm criteria. Sampling of soils from in-situ and stockpiles from these areas revealed TPH concentrations were below the site cleanup concentration of 500 ppm.

In addition to the excavation and soil treatment, a drainage system was installed throughout the Maintenance Yards to collect surface stormwater from the newly paved surface. A detention pond was constructed to store accumulated rainfall and minimize flow at the outfall at Cold Spring Brook during heavy storm events. Also an oil/water separator was installed within the stormdrain system. Remedial construction was completed by April 1996. The Remedial Action Completion Report was issued in June 1996 (Weston, 1996).

3.2 GROUNDWATER SAMPLING

The objective of the groundwater monitoring required by the Record of Decision was to provide assurance to the public and regulatory agencies that the groundwater in the aquifer underlying the facility remains unaffected by past Maintenance Yard activities and that it has not been adversely affected by remedial activities.

The need to investigate groundwater directly downgradient of the former waste oil tank and MOGAS spill was discussed during a draft FS review meeting held at Fort Devens on May 5, 1993 (*Record of Decision, Barnum Road Maintenance Yards,* ABB-ES, March, 1995a). During the meeting it was suggested that the existing monitoring wells located in and around AOCs 44 and 52 might not be positioned to readily detect the full impact of the UST and spill contamination sources on groundwater. In response, the Army installed two monitoring wells positioned to readily detect the full impact of the tank and spill contamination sources on the groundwater. The two monitoring wells, G3M-93-10X and G3M-93-11X, were installed at the edge of the Cannibalization Yard, approximately 50 feet downgradient of the removed underground waste oil storage tank and the MOGAS spill, respectively (Figure 4).

Two rounds of samples were collected from wells G3M-93-10X and G3M-93-11X and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), TPH, and inorganics. Results from Round 1 (June 1993) showed no detectable concentrations of TPH (quantitation limit of 178 µg/L) or VOCs. In Round 2 (September 1993), trace concentrations of toluene (2.6 µg/L and 1.25 µg/L in G3M-93-10X and -11X, respectively) and tetrachloroethene (2.6 µg/L in G3M-93-10X) were detected in the groundwater. Concentrations for these analytes were below state and federal drinking water MCLs and below MCP GW1 standards. The only detected SVOC was bis(2-ethylhexyl)phthalate, a suspected laboratory contaminant, at 22 µg/L in the Round 1 sample from G3M-93-10X. The fact that no significant contamination was detected supported the conclusion that surface soil contaminants at the Cannibalization Yard did not impact the aquifer and indicated that the waste oil UST and the MOGAS spill were not significant contributors to groundwater contamination. Based on these results, the Record of Decision did not require installation of additional monitoring wells.

The Sampling and Analysis Plan for long-term groundwater monitoring required by the Record of Decision was issued in April 1998 (Weston, 1998a) and specified that annual sampling would be performed at three existing monitoring wells G3M-92-04X, G3M-92-05X, and MNG-1, for two years. Monitoring well G3M-92-04X is located within the maintenance yard fence at the downgradient edge of the maintenance yards, and G3M-92-05X is located cross-gradient of the maintenance yards. Monitoring well MNG-1, located north and downgradient of the maintenance yards on Massachusetts Army National Guard property outside the maintenance yard fence, could not be located during the sampling rounds and was believed to have been destroyed or buried during new construction in the

vicinity of the well location. The plan also specified that the groundwater samples would be analyzed off-site for MADEP extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH), and lead, which are pertinent analytes for the historic releases of petroleum at the site.

The first annual round of samples was collected at monitoring wells G3M-92-04X and G3M-92-05X in May 1998, and no concentrations of EPH, VPH, or lead were detected above MCP Method 1 GW-1 Standards. The analytical results were presented in the 1998 Annual Groundwater Sampling Report along with a recommendation to discontinue monitoring if the 1999 sampling showed similar results (Weston, 1998b). The second annual round of sampling was completed in June 1999 with no reported exceedances of MCP Method 1 GW-1 Standards. Because two years of monitoring had been completed as planned and there were no exceedances of the standards, the 1999 Annual Groundwater Sampling Report recommended that groundwater monitoring be discontinued (Weston, 1999).

In response to the recommendations of the sampling reports, USEPA provided a letter of concurrence to the Army agreeing that groundwater monitoring was no longer needed at the site, but stated that one more round of sampling should be considered to satisfy the Record of Decision requirement that sampling be performed "...for a period of five years upon commencement of remedial activities" (USEPA, 1999). MADEP questioned the recommendation to discontinue sampling (MADEP, 1999), and the matter was discussed at the April 13, 2000 BCT meeting. Meeting minutes indicate brief discussion with the outcome that discontinuance of sampling was left to the discretion of the Army. The decision for termination of sampling was documented in the First Five Year Review (HLA, 2000).

Subsequently, a third round of groundwater monitoring was performed in December 2003 to verify that the aquifer remained unaffected. Results of the 2003 round yielded limited PAH detections; however, all detections were below Method 1 GW-1 Standards. This final round was completed more than five years after issuance of the Groundwater Sampling and Analysis Plan and more than eight years after the commencement of remedial activities and thereby satisfies both the Sampling and Analysis Plan and the Record of Decision requirements for the duration of groundwater monitoring.

Further details of the groundwater monitoring are presented in Subsection 5.1, and analytical summary tables are provided in Appendix C of this report.

4.0 CHRONOLOGY OF EVENTS

Site-related Activities starting with the signing of the Record of Decision are summarized in Table 1.

TABLE 1 - CHRONOLOGY OF EVENTS FOR AOCs 44 & 52

Date	Action
March 1995	Record of Decision signed.
March 1995	Final Remedial Action design issued.
August 1995	Remedial action work commenced.
April 1996	Remedial action work completed.
June 1996	Remedial Action Completion Report issued.
April 1998	Groundwater Monitoring Plan issued.
May 1998	Round 1 groundwater sampling completed.
October 1998	Annual Groundwater Sampling Report issued.
June 1999	Round 2 groundwater sampling completed.
October 1999	Annual Groundwater Sampling Report issued.
September 2000	First Five-year Review Report issued.
December 2003	Round 3 groundwater sampling completed.

Prepared by: PL 05/26/04
Checked by: SR 05/26/04

5.0 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

The objective of the remedial activities conducted at this site was to remediate on-site soil contaminants to the acceptable cleanup levels of 7 ppm for cPAHs and 500 ppm for TPH. To achieve this goal, excavation and sampling of surface soils and hot-spot soils were necessary to identify, segregate, and treat soils exceeding the TPH and cPAH cleanup goals. Soils exceeding the cleanup goal were treated using cold mix asphalt batching and the application of the batched products to the surface of the site. Uncontaminated soils were used for backfilling the excavation.

5.1 PERFORMANCE STANDARDS

Surface soils were excavated to a depth of two feet in 6-inch increments. Prior to excavation activities the site was gridded into 105 by 52 foot areas so that each 6-inch layer was approximately 100 cubic yards. Soil was sampled at the frequency of one composite sample (consisting of 5 sub-samples) per 100 cubic yards of stockpiled soils. All stockpiled soils were analyzed on-site for TPH and cPAHs using NDIR and gas chromatograph mass spectrophotometer (GC/MS) to determine when site cleanup goals for TPH and cPAHs were exceeded. A total of 102 samples of the 263 samples analyzed for cPAHs were at or above the cleanup level of 7 ppm, with the balance of 161 samples below the cPAH cleanup criteria. A total of 33 of the 263 samples for TPH were above the cleanup criteria of 500 ppm with the balance of 230 samples below the TPH cleanup criteria. The top 6-inch layer was contaminated with cPAHs, TPH or both. The second layer showed reduced concentrations of TPH and cPAH. Only one of the cells was excavated deeper than 24 inches because of elevated concentrations of cPAHs at the 24-inch level. Analytical data from the 24 to 30-inch depth showed reduced concentrations of cPAHs and TPH, both below site cleanup standards. Sampling results are presented in an analytical summary table in Appendix H, Remedial Action Operable Unit Completion Report (Weston, 1996). The analyses support the predesign sampling results that showed that contaminants occur primarily within the top 6 to 12 inches of soil and that contaminants appear not to have migrated deeper than 2 feet.

Groundwater sampling was performed in May 1998, June 1999, and December 2003. Monitoring Well MNG-1, located on Massachusetts Army National Guard property north of the Maintenance Yards, could not be located and was believed to have been destroyed or buried during new construction in the vicinity of the well location. Analytical results for G3M-92-04X and G3M-92-05X revealed that concentrations of hydrocarbon fractions and target analytes of VPH and EPH, and the concentrations of lead did not exceed the MCP Method GW-1 Standards in 1998, 1999, or 2003. In 1998, all concentrations were below reporting limits except that C19-C36 aliphatic fraction was detected at 150 µg/L in one duplicate sample at G3M-92-05X and less than 62 µg/L in the primary sample. In

1999, all results were below laboratory reporting limits. In the 2003 round, there were limited PAH detections in samples from G3M092-04X; however, the detections were near or below the reporting limit of 0.02 µg/L. It is noteworthy that the detection limits achieved for EPH aliphatics/aromatics and PAHs in 2003 were significantly lower than those achieved in 1998 and 1999; thereby emphasizing the lack of groundwater contamination. Details of the sampling at G3M-92-04X and G3M-92-05X are provided in the Annual Groundwater Sampling Reports (Weston, 1998b, 1999; USACE, 2004). Analytical summary tables are provided in Appendix C of this report.

The excavation and asphalt batching of contaminated soils has been effective at immobilizing the petroleum related contaminants and has met the objectives of the remedial action (minimizing contact/ingestion and inhalation of contaminated surface soils by human receptors; reducing the probability of surface run-off of contaminants; and minimizing the potential migration of contaminants to groundwater). Sampling data provide no indication that the aquifer underlying AOCs 44 & 52 has been adversely affected by past maintenance yard activities or remediation. It should be noted that data from only one existing downgradient monitoring well are available for this assessment; however, the well is well positioned at the midpoint of the downgradient edge of maintenance yards to detect contamination from the most heavily contaminated areas of the site. In addition, data from former monitoring wells G3M-93-10X and G3M-93-11X (discussed in Subsection 3.2) support the conclusion that releases at AOCs 44 & 52 have not adversely affected the underlying aquifer.

5.2 CONSTRUCTION QUALITY CONTROL

The Quality Assurance/Quality Control (QA/QC) program used throughout the operation of the site remediation activities was outlined in the Project Work Plan, Contractor Quality Control Plan and the Chemical Data Acquisition Plan prepared prior to commencement of remediation. Inspection reports were completed daily, and preliminary, follow-up, and completion QC reports were completed for the definable features of the work.

As specified in the Work Plan, surface soils and hot-spot soils throughout AOCs 44 & 52 were sampled at a frequency of one composite sample per 100 cubic yards of stockpiled soil. All stockpiled soils were analyzed for TPH and cPAH. Soils exceeding the 7 ppm total cPAH and/or the 500 ppm TPH level were cold-mix asphalt batched on-site. All field soil samples were analyzed at the on-site facility. Duplicate and confirmation samples were sent off-site for confirmatory analyses, and triplicate samples were sent to the USACE for QA compliance and data validation. Data obtained from the duplicate and triplicate sampling and analysis confirmed the on-site data conclusion that all surface soils within the top 24-inches and hot-spot areas which contained cPAH or TPH above the cleanup level of 7 ppm and 500 ppm, respectively, were asphalt batched and used as a subgrade for the paved parking area. Details of DQO evaluation are presented in

Appendix R (Chemical Quality Assurance Report) of the Remedial Action Operable Unit Completion Report for the remediation of Barnum Road Maintenance Yards AOCs 44 & 52 (Weston, 1996).

QA/QC of the backfilling, asphalt batching, and asphalt placement process was conducted to ensure that adequate compaction and thickness requirements were meet. The details of this process are presented in the AOC 44 & 52 Remedial Action Operable Unit Completion Report text, and Appendices K and M of that report (Weston, 1966).

6.0 FINAL INSPECTION AND CERTIFICATIONS

6.1 INSPECTIONS AND NOTED DEFICIENCIES

No deficiencies were noted during the site inspections. Groundwater monitoring results were consistent with expectations. No violations of the institutional control requirements were noted during the site inspections.

6.2 ADHERENCE TO HEALTH & SAFETY REQUIREMENTS DURING RA IMPLEMENTATION

No health and safety problems were encountered during the remedial construction process. However, the discovery of unexploded ordnance (UXO) during the excavation activities lead to specific UXO awareness and safety training for site personnel. These UXO turned out to be practice rounds and the encounters did not result in accidents, incidents, or near misses.

Health and safety procedures implemented during the remediation are presented in Appendix E - Summary of Exposure Monitoring and Air Monitoring, Remedial Action Operable Unit Completion Report for the remediation of Barnum Road Maintenance Yards AOCs 44 & 52 (Weston, 1996), and are reprinted in Appendix D of this report.

Remedial action and groundwater monitoring at AOCs 44 & 52 are complete and no longer being implemented at this site. Therefore health and safety procedures are no longer required. As required by the institutional controls, a Health and Safety Plan (HASP) would be needed for any excavation below 2 feet at the Maintenance Yards, unless the institutional controls are modified or rescinded.

6.3 DETAILS OF INSTITUTIONAL CONTROLS

The Record of Decision requires institution of institutional controls in the form of deed restrictions prevent potential circumstances which may result in risk of harm to health, safety, public welfare or the environment. These restrictions include the following:

1) No residential development/use of the Maintenance Yards will be permitted. The quantitative risk evaluation and established cleanup level assume the property will remain zoned for commercial/industrial use.

2) Removal of the 2-foot cover or an asphaltic barrier from the Maintenance Yards will be prohibited to prevent surface soil exposure to existing subsurface soils (2-foot to 5-foot level). This deed restriction will be implemented as a precautionary

measure to minimize the possibility of long-term (working lifetime) exposure to subsurface soils. This restriction will not apply to excavations undertaken in connection with construction of buildings or other structures, utilities, infrastructures or any other construction related purpose where the cover is penetrated and/or temporarily removed and protection from long-term exposure to subsurface soil is not jeopardized. To comply with this deed restriction, the 2-foot layer of cover material (which may consist of one or combination of "clean" site soil used as backfill, asphalt batched material, off-site soils/aggregate and bituminous pavement) will remain over the subsurface soil (existing 2- to 5-foot soil level) to minimize direct contact/ingestion to the present subsurface soils. The continuity of the paved surface need not be maintained providing the cover thickness of 2 feet is provided. As an alternative, a continuous and maintained paved surface which would prevent exposure to subsurface soils could be substituted for the 2-foot thick cover.

This restriction also would not apply to excavation and use that is within the scope of any authorized response action. The deed restriction may be nullified, as approved by the regulatory agencies, should there be future evidence showing that contaminant concentrations within the 2- to 5-foot soil zone are below site surface soil cleanup levels.

3) Excavation below 2 feet at the Maintenance Yards, subsequent to completion of the remedial action established in the Record of Decision, will require:

a) Development and implementation of a Health and Safety Plan for the work area; and

b) Development and implementation of a Sampling and Analysis Plan for management of the excavated soils in accordance with the following:

Where reuse of soil within the Maintenance Yards is intended, sampling and analysis of stockpiled soils excavated below 2 feet will follow criteria detailed in the Record of Decision for hot-spot area soils. Soils with contaminants exceeding the 500 ppm cleanup level for TPH will be treated in a manner consistent with the Record of Decision. Soils with contaminants below the established cleanup level may be returned to the excavation. Soil excavated below 2 feet but returned to the top 2 feet (as surface soil) must also be sampled, analyzed and, if required, treated for cPAH contaminants as detailed in the Record of Decision.

Where reuse of soil outside the Maintenance Yards is intended, sampling/analysis and action levels for stockpiled soils excavated below 2 feet will follow criteria governed by the regulations or policies in effect for the final disposal area.

There are no current or future plans for transfer of property from the RFTA at this time. The Installation Management Plan currently provides institutional controls. If property transfer occurs in the future, institutional controls, if still required by the Record of Decision, will be incorporated into the property deed or other instrument of property transfer.

7.0 OPERATION AND MAINTENANCE ACTIVITIES.

The asphalt batching of contaminated soils was completed in 1996, has been effective at immobilizing the petroleum related contaminants, and has met the objectives of the remedial action (minimizing contact/ingestion and inhalation of contaminated surface soils by human receptors, reducing the probability of surface run-off of contaminants, and minimizing the potential migration of contaminants to groundwater). Human health is no longer at risk at AOCs 44 & 52. The remedy completed at AOCs 44 & 52 is protective, and is expected to remain protective, of human health and the environment.

The first Five-year Review for AOCs 44 & 52 was completed in 2000. The Five-year Review recommended that remedial actions including groundwater monitoring be considered complete. However, at the request of USEPA, one additional groundwater-sampling round was conducted in December 2003. Groundwater monitoring to date has confirmed that migration of surface soil contaminants to the aquifer following the historic releases at the site or as a result of remedial activities has not occurred. It should be noted that data from only one existing downgradient monitoring well are available for this assessment; however, the well is well positioned at the midpoint of the downgradient edge of maintenance yards to detect contamination from the most heavily contaminated areas of the site. In addition, data from former monitoring wells G3M-93-10X and G3M-93-11X (discussed in Subsection 3.2) support the conclusion that releases at AOCs 44 & 52 have not adversely affected the underlying aquifer.

At this time, other than standard operation and maintenance requirements of the drainage system and oil/water separator as detailed in Appendix Q of the Remedial Action Completion Report (Weston, 1996) and reprinted in Appendix E of this report, there are no long term operation and maintenance needs to maintain the integrity of the remedial action.

8.0 SUMMARY OF PROJECT COSTS.

As described in the May 1994 Final FS Addendum, a pavement wearing course placed over the batched material was not included in the FS cost as it reportedly would not be required by the regulatory agencies. However, as detailed in the Record of Decision, the Army chose to add a pavement-wearing course for a vehicle-parking surface over the asphalt-batched material as part of the selected remedial approach. Addition of the wearing course helps ensure the integrity of the asphalt-batched material as a parking lot base for current and future property use.

Remedial Cost information as presented in the Record of Decision is as follows.

Estimated Time for Restoration:	Approximately four months for treatment; restoration completed prior to closing of the Maintenance Yards.
Estimated Capital Costs w/ wearing course:	$1,865,000
Estimated Operation and Maintenance Costs:	$72,000 (net present worth)
Estimated Total Costs:	$1,937,000 (net present worth, assuming 10 percent discount rate and operation and maintenance for five years)

Information on the total capital expenditures for AOCs 44 & 52 was not available for this report; however, no information was identified to suggest that they were out of line with cost estimates. Because only three groundwater sampling rounds were performed, rather than the planned five, operation and maintenance costs have been less than estimated in the Record of Decision ($19,000/yr) and are estimated at approximately $24,000 ($15,000 for 1998 and 1999 plus $7,500/yr x 1.03/yr x 4 yr).

9.0 OBSERVATIONS AND LESSONS LEARNED

The remedial components required by the Record of Decision have been implemented and are operating properly and successfully. All cleanup goals have been achieved. Observations and lessons learned through this process are as follows.

- Remedial action consisting of soil excavation, asphalt-batching of contaminated soil, repaving, and installation of a stormwater collection system was completed in April of 1996.

- The asphalt batching of contaminated soils has been effective at immobilizing the petroleum related contaminants and has met the objectives of the remedial action (minimizing contact/ingestion and inhalation of contaminated surface soils by human receptors, reducing the probability of surface run-off of contaminants, and minimizing the potential migration of contaminants to groundwater).

- Groundwater monitoring data provide no indication that the aquifer underlying AOCs 44 & 52 has been adversely affected by past maintenance yard activities or remediation. It should be noted that data from only one existing downgradient monitoring well are available for this assessment; however, the well is well positioned at the midpoint of the downgradient edge of maintenance yards to detect contamination from the most heavily contaminated areas of the site. In addition, data from former monitoring wells G3M-93-10X and G3M-93-11X (discussed in Subsection 3.2) support this assessment.

- Zero- to two-feet deep soils (the only ones found to contain contaminants exceeding cleanup levels) at AOCs 44 & 52 were asphalt batched and no longer present a human-health risk at the site. The remedy effectively prevents direct human contact with these contaminants and minimizes the probability of contaminant migration.

- The selected remedy at AOCs 44 & 52 is protective, and is expected to remain protective, of human health and the environment. No areas of non-compliance or deficiencies have been noted that would make the remedial action at AOCs 44 & 52 non-compliant with the Record of Decision, or sufficient to warrant a finding of not protective.

- Use of the maintenance yards remains consistent with the restrictions outlined in the Record of Decision. No signs of disturbed pavement or excavation within or near the maintenance yards have been noted. There was no evidence that the stormwater collection system was not performing adequately. Protective casings and monitoring wells were intact and secure.

- The Record of Decision currently requires institutional controls that 1) prohibit residential development/use of the Maintenance Yards; 2) prohibit removal of the 2-foot cover or an asphaltic barrier from the Maintenance Yards to prevent surface soil exposure to existing subsurface soils (2-foot to 5-foot level); and 3) require soil management practices for excavation below 2 feet at the Maintenance Yards (including a HASP and Sampling and Analysis Plan).

10 CONTACT INFORMATION

The remedial design contractor was:

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The remedial action contractor for AOCs 44 & 52 was:

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(603) 656-5400

Annual groundwater sample collection in 1998 and 1999 was performed by:

Roy F. Weston, Inc.
One Wall Street
Manchester, NH 03103
(603) 656-5400

Annual groundwater sample collection in 2003 was performed by:

U.S. Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751

The following laboratories have performed chemical analyses on groundwater samples:

1998 groundwater

Katahdin Analytical Services, Inc.
340 County Road No. 5
P.O. Box 720
Westbrook, ME

1999 groundwater

AMRO Environmental Laboratories, Inc.
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Merrimack, NH 03054

2003 groundwater

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APPENDIX A

References

APPENDIX A

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APPENDIX B

Glossary of Acronyms and Abbreviations

APPENDIX B

Glossary of Acronyms and Abbreviations

AOC	Area of Contamination
ABB-ES	ABB Environmental Services
BRAC	Base Realignment and Closure
CERCLA Act	Comprehensive Environmental Response, Compensation, and Liability
cPAH	carcinogenic polynuclear aromatic hydrocarbons
EPH	extractable petroleum hydrocarbons
FFA	Federal Facility Agreement
FS	feasibility study
GC	gas chromatograph
HASP	health and safety plan
MADEP	Massachusetts Department of Environmental Protection
MEP	Master Environmental Plan
MOGAS	motor vehicle gasoline
MS	mass spectrophotometer
MCP	Massachusetts Contingency Plan
µg/L	micrograms per liter
NDIR	non-dispersive infrared detection
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
ppm	parts per million
QA	Quality assurance
QC	Quality control
RI	Remedial Investigation
RFTA	Reserved Forces Training Area
RTS	Regional Training Site
SA	Study Area
SI	Site Investigation

SSI	Supplemental Site Investigation
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TDA	Table of Distribution and Allowances
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons

APPENDIX C

Historical Groundwater Analytical Data Summary (1998, 1999, 2003)

Table C-1
Ground Water Analytical Results 1998
Relative to Massachusetts Contingency Plan Standards

Sample ID	G3M-92-04X	G3M-92-05X	G3M-92-05XD	*MCP GW-1 Standards*
Date Sampled	5/21/98	5/21/98	5/21/98	
Units	ppb	ppb	ppb	*ppb*
EPH Aliphatics/Aromatics				
C9-C18 Aliphatics	<61	<62	<61	*4,000*
C19-C36 Aliphatics	<61	<62	150	*5,000*
C10-C22 Aromatics	<160	<160	<160	*200*
PAH				
Acenaphthene	<0.2	<0.2	<0.2	*20*
Acenaphthylene	<0.2	<0.2	<0.2	*300*
Anthracene	<0.2	<0.2	<0.2	*2,000*
Benzo (a) anthracene	<0.2	<0.2	<0.2	*1*
Benzo (b) fluoranthene	<0.2	<0.2	<0.2	*1*
Benzo (k) fluoranthene	<0.2	<0.2	<0.2	*1*
Benzo (a) pyrene	<0.2	<0.2	<0.2	*0.2*
Benzo (g,h,i) perylene	<0.2	<0.2	<0.2	*0.5*
Chrysene	<0.2	<0.2	<0.2	*2*
Dibenzo (a,h) anthracene	<0.2	<0.2	<0.2	*0.5*
Fluoranthene	<0.2	<0.2	<0.2	*300*
Flourene	<0.2	<0.2	<0.2	*300*
Indeno (1,2,3-cd) pyrene	<0.2	<0.2	<0.2	*0.5*
2-Methylnaphthalene	<0.2	<0.2	<0.2	*10*
Naphthalene	<0.2	<0.2	<0.2	*20*
Phenanthrene	<0.2	<0.2	<0.2	*300*
Pyrene	<0.2	<0.2	<0.2	*200*
VPH Aliphatics/Aromatics				
C5-C8 Aliphatics	<40	<40	<40	*400*
C9-C12 Aliphatics	<10	<10	<10	*4,000*
C9-C10 Aromatics	<10	<10	<10	*200*
VPH Analytes				
Benzene	<5	<5	<5	*5*
Toluene	<15	<15	<15	*500*
Ethylbenzene	<5	<5	<5	*700*
p/m-Xylenes	<20	<20	<20	*500*
o-Xylene	<10	<10	<10	*500*
Naphthalene	<10	<10	<10	*20*
Methyl-tert-Butyl Ether	<15	<15	<15	*70*
Metals				
Lead	<5	<5	<5	*15*

Table C-2
Ground Water Analytical Results 1999
Relative to Massachusetts Contingency Plan Standards

Sample ID	G3M-92-04X	G3M-92-05X	G3M-92-05XD	*MCP GW-1 Standards*
Date Sampled	6/8/99	6/8/99	6/8/99	
Units	ppb	ppb	ppb	*ppb*
EPH Aliphatics/Aromatics				
C9-C18 Aliphatics	<100	<110	<100	*4,000*
C19-C36 Aliphatics	<100	<110	<100	*5,000*
C10-C22 Aromatics	<100	<110	<100	*200*
PAH				
Acenaphthene	<0.1	<0.11	<0.1	*20*
Acenaphthylene	<0.1	<0.11	<0.1	*300*
Anthracene	<0.1	<0.11	<0.1	*2,000*
Benzo (a) anthracene	<0.1	<0.11	<0.1	*1*
Benzo (b) fluoranthene	<0.1	<0.11	<0.1	*1*
Benzo (k) fluoranthene	<0.1	<0.11	<0.1	*1*
Benzo (a) pyrene	<0.1	<0.11	<0.1	*0.2*
Benzo (g,h,i) perylene	<0.1	<0.11	<0.1	*0.5*
Chrysene	<0.1	<0.11	<0.1	*2*
Dibenzo (a,h) anthracene	<0.1	<0.11	<0.1	*0.5*
Fluoranthene	<0.1	<0.11	<0.1	*300*
Flourene	<0.1	<0.11	<0.1	*300*
Indeno (1,2,3-cd) pyrene	<0.1	<0.11	<0.1	*0.5*
2-Methylnaphthalene	<0.1	<0.11	<0.1	*10*
Naphthalene	<0.1	<0.11	<0.1	*20*
Phenanthrene	<0.1	<0.11	<0.1	*300*
Pyrene	<0.1	<0.11	<0.1	*200*
VPH Aliphatics/Aromatics				
C5-C8 Aliphatics	<100	<100	<100	*400*
C9-C12 Aliphatics	<25	<25	<25	*4,000*
C9-C10 Aromatics	<25	<25	<25	*200*
VPH Analytes				
Benzene	<0.2	<0.2	<0.2	*5*
Toluene	<0.2	<0.2	<0.2	*500*
Ethylbenzene	<0.2	<0.2	<0.2	*700*
p/m-Xylenes	<0.2	<0.2	<0.2	*500*
o-Xylene	<0.2	<0.2	<0.2	*500*
Naphthalene	<0.2	<0.2	<0.2	*20*
Methyl-tert-Butyl Ether	<0.2	<0.2	<0.2	*70*
Metals				
Lead	<5	<5	<5	*15*

Table C-3
Ground Water Analytical Results 2003
Relative to Massachusetts Contingency Plan Standards

Sample ID	G3M-92-04X	G3M-92-05X	G3M-92-05X Duplicate	*MCP GW-1 Standards*
Date Sampled	12/23/03	12/23/03	12/23/03	
Units	µg/L	µg/L	µg/L	*µg/L*
EPH Aliphatics/Aromatics				
C9-C18 Aliphatics	0.062 U	0.061 U	0.062 U	*4,000*
C19-C36 Aliphatics	0.083 U	0.082 U	0.082 U	*5,000*
C11-C22 Aromatics	0.18 U	0.17 U	0.17 U	*200*
PAH				
Acenaphthene	0.020 U	0.020 U	0.020 U	*20*
Acenaphthylene	0.020 U	0.020 U	0.020 U	*300*
Anthracene	0.016 J	0.020 U	0.020 U	*2,000*
Benzo (a) anthracene	0.020 U	0.020 U	0.020 U	*1*
Benzo (b) fluoranthene	0.018 J	0.020 U	0.020 U	*1*
Benzo (k) fluoranthene	0.015 J	0.020 U	0.020 U	*1*
Benzo (a) pyrene	0.020 U	0.020 U	0.020 U	*0.2*
Benzo (g,h,i) perylene	0.014 J	0.020 U	0.020 U	*0.5*
Chrysene	0.016 J	0.020 U	0.020 U	*2*
Dibenzo (a,h) anthracene	0.020 U	0.020 U	0.020 U	*0.5*
Fluoranthene	0.024	0.020 U	0.020 U	*300*
Flourene	0.020 U	0.020 U	0.020 U	*300*
Indeno (1,2,3-cd) pyrene	0.013 J	0.020 U	0.020 U	*0.5*
2-Methylnaphthalene	0.020 U	0.020 U	0.020 U	*10*
Naphthalene	0.020 U	0.020 U	0.020 U	*20*
Phenanthrene	0.020 U	0.020 U	0.020 U	*300*
Pyrene	0.021	0.020 U	0.020 U	*200*
VPH Aliphatics/Aromatics				
C5-C8 Aliphatics	40 U	40 U	40 U	*400*
C9-C12 Aliphatics	10 U	10 U	10 U	*4,000*
C9-C10 Aromatics	10 U	10 U	10 U	*200*
VPH Analytes				
Benzene	5.0 U	5.0 U	5.0 U	*5*
Toluene	15 U	15 U	15 U	*500*
Ethylbenzene	5.0 U	5.0 U	5.0 U	*700*
p/m-Xylenes	20 U	20 U	20 U	*500*
o-Xylene	10 U	10 U	10 U	*500*
Naphthalene	10 U	10 U	10 U	*20*
Methyl-tert-Butyl Ether	15 U	15 U	15 U	*70*
Metals				
Lead	1.6 U	1.6 U	1.6 U	*15*

Notes:
U: not detected above method detection limit
J: estimated value

APPENDIX D

Summary of Exposure Monitoring and Air Monitoring

Reprint of
Appendix E: Remedial Action Operable Unit Completion Report
for the remediation of Barnum Road Maintenance Yards AOCs 44 & 52 (Weston, 1996)

Summary of Exposure Monitoring and Air Monitoring

Personnel Zone Monitoring was conducted in accordance with the Site Safety and Health Plan. Monitoring was conducted down wind of all activities being performed. The areas monitored included the exclusion zone, contamination reduction zone and the support zone. Parameters of concern within the Maintenance Yards were cPAHs and TPHs.

Confined Space Entry (i.e., trench-box excavations) Air monitoring was conducted in accordance with the SSHP which included monitoring for oxygen, Lower Explosive Limit (LEL), and organics (TPHs and benzene). The monitoring was done at various levels of the excavation prior to entry by personnel.

Perimeter monitoring was conducted in accordance with the SSHP. Real time air monitoring for dust, TPHs and dust surrogates for cPAHs around the perimeter of the exclusion zone for the purpose of controlling on-site operations with respect to off-site receptors. Parameters of concern were TPHs and cPAHs.

Personnel/zone and Perimeter monitoring were conducted three times a day, while Confined Space Entry monitoring was conducted as needed. All monitoring events are recorded in a daily log book.

Instruments used during monitoring are shown in Table 1. The PID used was an OVM 58B with a response factor set for benzene detection. The Combustible Gas Indicator was a CG1 Mode 260, capable of oxygen detection. Action levels used for the site are also presented in Table 1.

Monitoring was also conducted when drums were discovered in grid B6. Debris was discovered in a number of other grids. Each time debris was found air monitoring was performed to ensure that workers were not being exposed to harmful contaminants. All instrument readings were observed to be non-detect.

No accidents/incidents or near misses occurred on the project. Drums were discovered in grid B6 on the fourth and final cut. The drums were left in place and air monitoring was performed to ensure the safety of the personnel working around this area. The drums were later removed by a subcontractor without incident. The drums were placed in overpack containers at the location where found. The work was performed in level B PPE. Test pits were excavated in the area surrounding the drums. No additional drums were found. Overpacked drums were then moved to a staging area on the decon pad.

Unexploded Ordnances (UXO) were also discovered during the performance of work. The first occurrence took place on 16 October 1995. An employee of AmRec brought the object to the attention of the SSHO and the QC personnel of Roy F. Weston (WESTON). The site was then evacuated. The Army Corps of Engineers were informed of the finding. WESTON contacted Human Factor Applications, Inc. (HFA). The safety officer for HFA came out and identified the UXO to be a WWI 3" Stokes mortar round. Military

Police evacuated an 800 foot radius around the UXO. Once all was secure, HFA personnel safely cleared the mortar which turned out to be a practice round.

WESTON Management set up an awareness training with HFA for all personnel involved with field activities. Training took place on 18 October 1995 and provided managers and field workers information on UXO recognition, evacuation, and response procedures.

Subsequently, three additional UXO events took place. A practice rifle grenade was found in grid E6 on 20 October 1995 after the final excavation cut had been made. All safety precautions were taken to ensure the safety of personnel. HFA removed the UXO and work resumed.

The remaining UXO events occurred at the detention pond. On 1 November 1995, while excavating for the detention pond overflow, another UXO was discovered. All safety procedures were followed and HFA identified it as a British type 3" mortar round. It was also a practice round and removed from the site. On 2 November 1995 a second practice British type mortar was discovered and cleared by HFA as done with the previous UXO's.

Demobilization of equipment:

10/26/95	Webster equipment demobed off site
10/30/95	Crusher Excel 1500 demobed
	Kamatsu 420 Loader demobed
	6000 gal. tanker demobed
	Pugmill T-3000 demobed
11/7/95	D4H Dozer demobed
	980 Loader demobed

Decontamination Procedures for Equipment:

1. Gross decon of equipment in the contaminated area before moving to decon pad.

2. Once on the decon pad, complete decon of the equipment took place.

   a. Tires or tracks were scrubbed and rinsed with alconox and water.
   b. The bucket or blade is was washed and rinsed.
   c. All sides of the equipment where in contact with excavated materials, were washed and rinsed.
   d. The equipment was then inspected visually and with monitoring instruments to verify that the decon job was successful.
   e. All decon water was stored in a holding tank, analyzed, and properly disposed.

3. Equipment was demobed from the site.

APPENDIX E

Operation and Maintenance of the Drainage System

Reprint of
Appendix Q: Remedial Action Operable Unit Completion Report
for the remediation of Barnum Road Maintenance Yards AOCs 44 & 52 (Weston, 1996)

OPERATION AND MAINTENANCE OF THE DRAINAGE SYSTEM

Suggested Maintenance Frequency:

1) Clean all drain manhole sumps and all catch basin sumps at least twice per year, preferable after spring rains and after the tree leaves have fallen in the autumn.

   A) Check inlet side of hood inside box conduit for branches, leaves, and debris which might catch between the opening.

2) Twice annually at six month intervals, inspect all catch basin frame and covers and all drain manhole frames and covers for cracks, replace as necessary.

3) Twice annually at six month intervals, inspect all brick and mortar joints, repair as necessary.

4) Twice annually at six month intervals, or immediately after severe heavy rainfall or significant snow melt, check the detention pond area as follows:

   A) Condition of the Rip Rap in the brook and the overflow area of the pond;
   B) Condition of the discharge piping and the head wall;
   C) Condition of the embankments;
   D) Condition of the concrete flare end of the collection system piping;
   E) Condition of the Detention pond security fencing.
   F) Maintain Detention pond slopes, area should be mowed at least twice a year to prevent shrubs and small trees from taking root.

Suggested operations and maintenance of the Oil/Water Separator:

1) Check after each storm in the inlet section of Oil/Water Separator tank for the presence of sheen on top of the water. If this condition exists, contact a hazardous waste removal contractor to pump the contamination out of the separator.

2) Twice annually at six month intervals, check the outlet portion of the separator for contamination and remove as required. Check the flapper gates for proper operation.

3) Twice annually at six month intervals, inspect the manhole frames and covers for cracks and replace as necessary.

4) Twice annually at six month intervals, inspect the risers, brick work, and mortar joints for condition and repair as necessary.

FIGURES

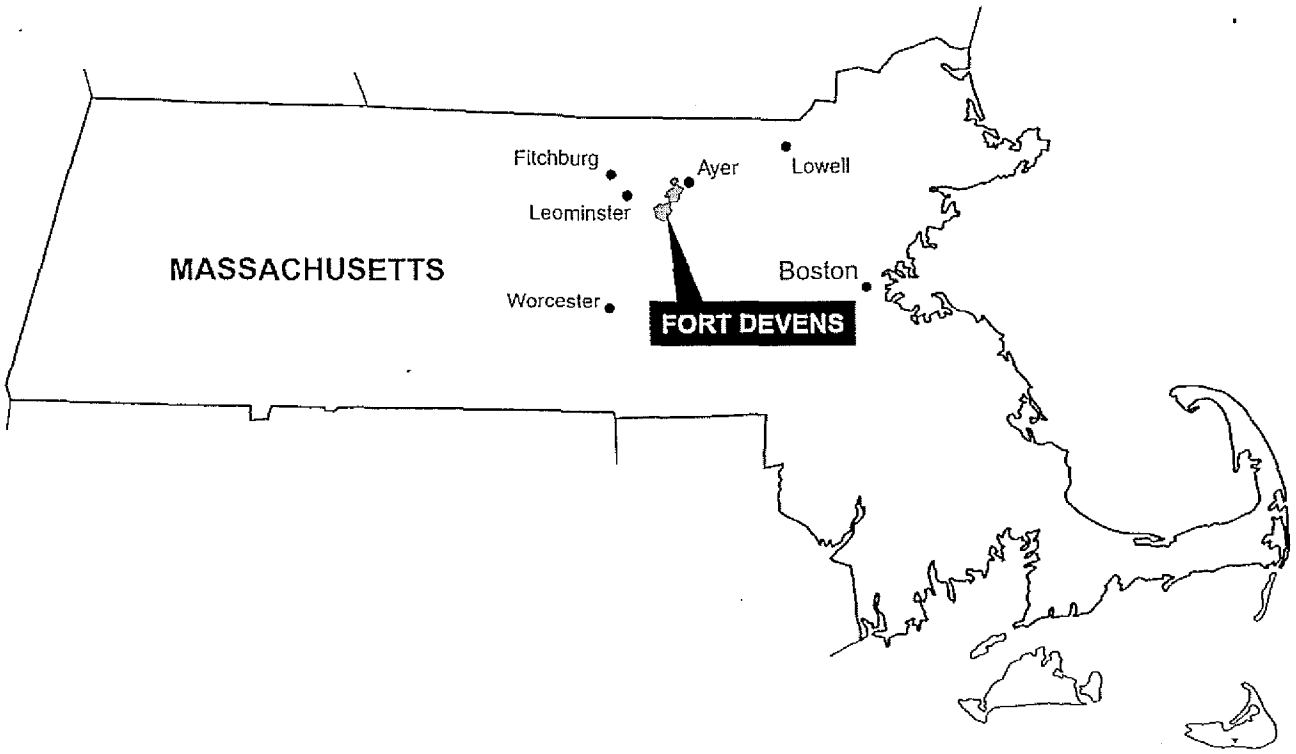

FIGURE 1
LOCATION OF FORMER FORT DEVENS
AOCs 44 & 52 FINAL REMEDIAL ACTION REPORT
BARNUM ROAD MAINTENANCE YARDS
DEVENS, MA

MACTEC

W2004018b.cdr

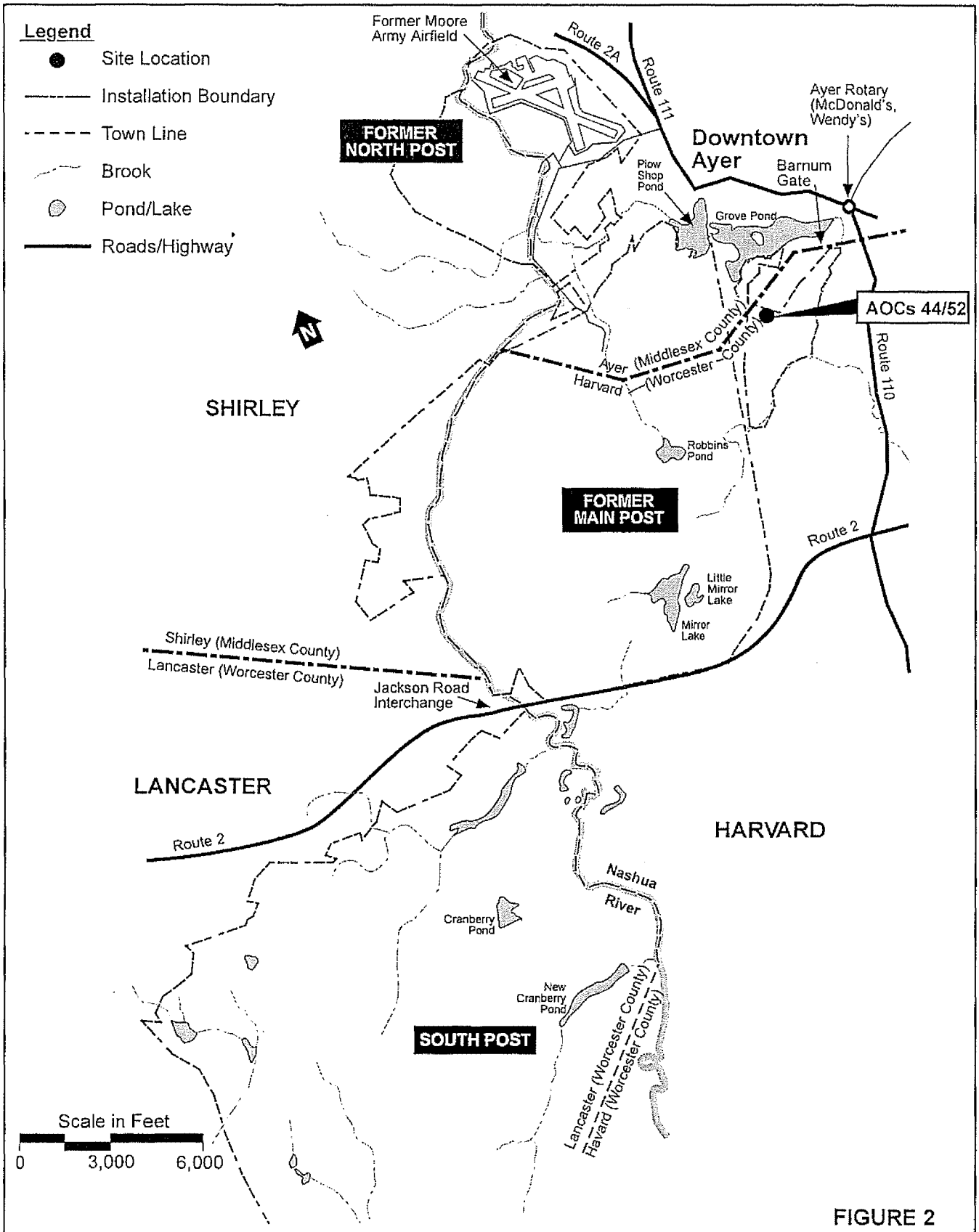

FIGURE 2
LOCATION OF AREAS OF CONTAMINATION 44 & 52
AOCs 44 & 52 FINAL REMEDIAL ACTION REPORT
DEVENS, MA

MACTEC

W2004018a.fh10 AOC 44/52

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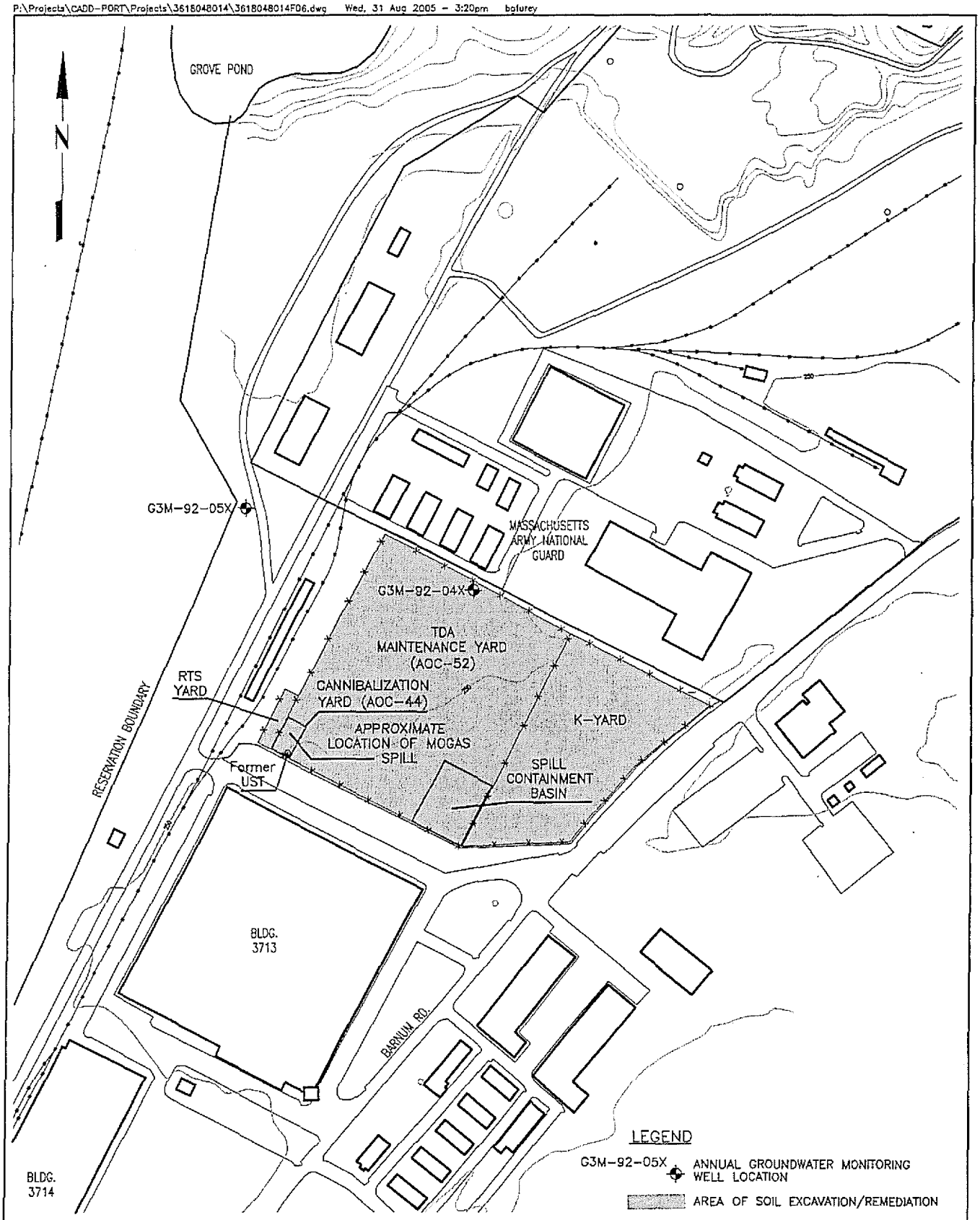

PREPARED/DATE:	BGF 8/30/05
CHECKED/DATE:	SWR 8/30/05

FIGURE 3
AREA OF SOIL EXCAVATION/REMEDIATION
AOCS 44 AND 52 FINAL REMEDIAL ACTION REPORT
BARNUM ROAD MAINTENANCE YARDS
DEVENS, MA

MACTEC

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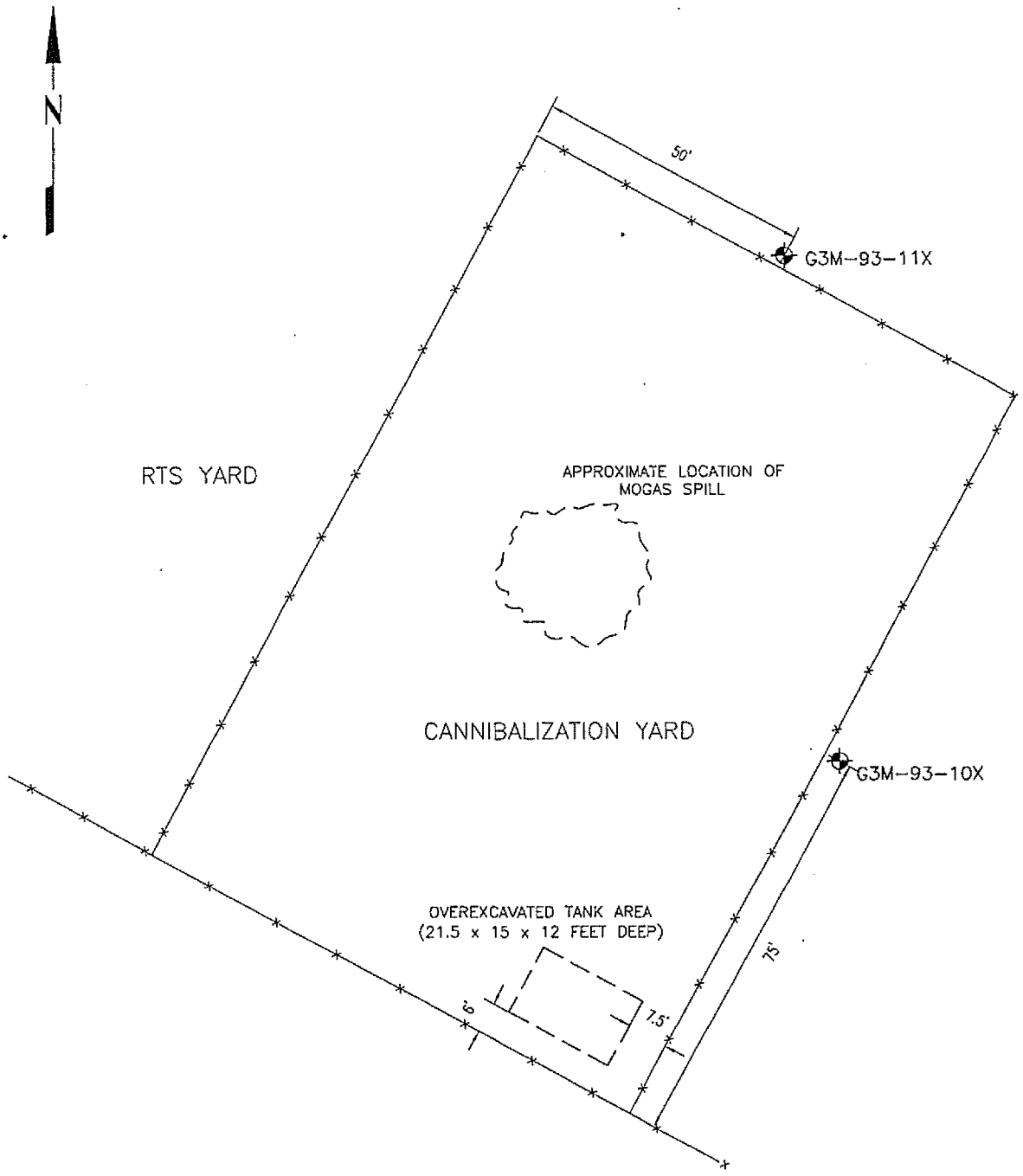

0 15 30
Scale in feet

PREPARED/DATE:	BGF 8/30/05
CHECKED/DATE:	SWR 8/30/05

FIGURE 4
MONITORING WELLS G3M-93-10X AND G3M-93-11X
AOCS 44 AND 52 FINAL REMEDIAL ACTION REPORT
BARNUM ROAD MAINTENANCE YARDS
DEVENS, MA

MACTEC