INTERIM REMEDIAL ACTION REPORT

AREA OF CONTAMINATION (AOC) 69W
DEVENS, MASSACHUSETTS

SEPTEMBER 2002

U. S. Army Corps
of Engineers
New England District

PREPARED BY:

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Interim Remedial Action Report
Record of Preparation, Review and Approval

Devens, Massachusetts
Area of Contamination (AOC) 69W

This Interim Remedial Action Report was prepared according to EPA OSWER Directive 9320.2-09A-P, dated January 2000. It 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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This report was prepared by the U.S. Army Corps of Engineers New England District, the party most familiar with the activities at AOC 69W. The report summarizes information from various documents produced by Harding Lawson Associates (HLA) and the New England District. HLA is acknowledged as the source of many figures and data contained in this report. Appendix A is a full list of references.

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1.0 Introduction and Background

1.1 Installation History

The former Fort Devens is located approximately 35 miles west of Boston in the towns of Ayer, Shirley, Harvard, and Lancaster. 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.

It was reactivated in 1948 because of the Korean War and was an active Army facility until its closure in 1996. The mission was to command and train duty units, and provide various support functions. BRAC 91 designated the North and Main Posts for closure and the South Post for realignment. The installation ceased to be Fort Devens in 1996 and closure was completed in 1997. The remaining mission is in the Devens Reserve Forces Training Area.

The installation developed on was primarily farmed open areas and forested areas. It was divided into North, Main, and South Posts. The Nashua River flows through the North, Main, and South Posts. The topography is rolling except for wide flat areas on the east side of the Main Post and the west side of the Nashua River, which flows through the North, Main, and South Posts. Relief varies from 250 feet within the local flood plains to elevation 350 feet at Shepley's Hill, and 455 feet at Whitemore Hill.

1.2 Location, Setting, and History of AOC 69W.

1.2.1. AOC 69W is located at the northeast corner of MacArthur Avenue and Antietam Street. Figure 1 shows the location of the site relative to the Main Post. The site was formerly known as the Fort Devens Elementary School (Building 215) which included the associated parking lot and adjacent lawn extending approximately 300 feet northwest to Willow Brook. Site features and monitoring wells shown on Figure 2. A typical geologic cross section is on Figures 3 and soil removal areas portrayed by Harding Lawson Associates (HLA) are on Figure 4.

1.2.2 The topography at AOC 69W is, in general, relatively flat, sloping gently towards Willow Brook that abuts the west and northwest portions of the site. A small wooded, grassy wetland area is located to the northwest and north, northwest. The northern portion of the site is paved with asphalt for about 120 feet (parking lot) then grades into a grassy area. The eastern portion is a combination of asphalt pavement and grass. A small section of the southern portion is asphalt and then becomes a steep grassy embankment leading up to Antietam Road. The west side is a combination of asphalt pavement and grass leading to Willow Brook.

1.2.3 General events in the site history are in Table 1 below.

Table 1 - AOC 69W Operating History

Date	Event
1951	Ft. Devens Elementary School constructed. Heating oil provided by 10,000 gal UST in the present school courtyard.
1972	Addition added to school including a new boiler room to supplement the existing boiler. Original 10,000 gal UST removed and new 10,000 gal UST installed.
1972	Estimated that 7,000 to 8,000 gal release discovered.
Late 1972 or early 1973	"Skimmer system" installed connecting to a buried 250 gal UST. UST collected oily water and was pumped out every 3 months.
1978	Approximately 7,000 to 8,000 gal released into the soil and groundwater from failed pipe joint. About 2,600 gallons of oil were pumped from the 250 gal UST.
Post 1986	250-gal UST filled with crushed rock.
1989	Ft. Devens placed on National Priorities List under CERCLA.
1993	Ayer School Department closed school when determined excess to needs. Base Closure process evaluation of past spill sites designates school spill site as Area Requiring Environmental Evaluation (AREE) 69W.
1994	Army performed Site Investigation (SI) revealing presence of fuel related contaminants in both soil and groundwater. Remedial investigation (RI) is proposed.
1995 - 1997	RI field investigations performed to investigate distribution of contaminants previously detected and to determine whether remediation is warranted.
1997 -1998	Roy F. Weston, Inc. performed removal actions including: 3,500 cy of soil associated with the 1972 oil leak; the 10,000 gal UST; the 250 gal UST and associated piping.
1998	Final Remedial Investigation Report issued.
June 1999	Record of Decision (ROD) signed.
1999	Army's Proposed Plan for Limited Action at 69W issued for public comment.
2000	School reopened as Parker Charter School.
March 2000	Final Long Term Monitoring Plan, Area of Contamination 69W issued.
May 2000	Long term monitoring initiated.

1.3 **AOC 69W Contamination, Investigation, and Cleanup History.** Contamination at the site is attributed to heating oil, which leaked from underground piping in two separate incidences; once in 1972 and again in 1978. It is estimated that approximately 7,000 to 8,000 gallons of fuel oil were released into the soil from each incident. In 1998, a Removal Action was performed and approximately 3,500 cubic yards of petroleum-contaminated soil were excavated. In addition, the 10,000-gallon fuel oil UST and the oil recovery system's 250-gallon vault and associated piping were also removed. The school was closed for a period of time and was reopened in September 2000 as the Parker Charter School.

Table 2 - Major Investigation, Enforcement, and Cleanup Milestones at AOC 69W

Date	Event
1993	ADL performed a document review of the Elementary School designated

	AREE 69W, focussing on the 1978 on spill. Concluded there was a potential for contamination in soil and groundwater.
1994	Investigations were performed at AREE 69W that included sampling and testing of soil and groundwater, and a geophysical survey for utilities. Six monitoring wells installed.
1995 - 1997	RI field investigations performed. Four monitoring wells added in 1995. Three wells added 1996.
1997	Air sampling performed to determine if air quality in the school is impacted.
1997 -1998	Roy F. Weston, Inc. performed removal actions including: 3,500 cy of soil associated with the 1972 oil leak; the 10,000 gal UST; the 250 gal UST and associated piping.
May 2000	Initial LTM sampling round performed.
April 2001	2000 Annual Report for AOC 69W issued.
2001	Two new monitoring wells added to aid long term monitoring..
May 2002	2001 Annual Report for AOC 69W issued.

1.4 **Roy F. Weston Removal Action Details.** The scope of the removal actions performed at AOC 69W are provided in Table 3. The areas affected by excavations are located on Figure 4.

Table 3 - Removal Action/Site Details

December 1997	MADEP and EPA approve Weston's proposed removal of 10,000 gallon UST, 1,200 cy petroleum -contaminated soil from hot spot adjacent to UST location, underground piping from the "skimmer system", and the underground vault.
Time-critical removal action initiated in January 1998.	Removed 10,000-gal UST, 660 gal of tank sludge and oily water from UST, ~700-gal concrete vault, ~375 lf of clay pipe leading to the vault, and 3,500 cy of contaminated soil from parking lot and grassy area north of School Bldg. Exceeded estimated soil volume. Also, ~1,900 gal of oily water pumped from open excavation to remove oily sheen. Soils field screened using a Non-dispersive Infrared Spectrometer (NDIR) at rate one sample per 15 to 20 cy of excavated material. Field screen goal of 1,000 ppm used to segregate excavated soil for disposal.
Underground vault removal.	Top of concrete ~1.5 ft bgs. Vault circular ~5 ft x 5 ft. Filled with stone and soil. Heavy petroleum contamination in bottom 2 ft. Water table ~ 4 ft bgs. Excavation continued to 7 ft bgs. Sidewall towards Willow Brook showed some staining. Excavation removed 3-4 ft of sidewalls until field screens showed soils below 1,000 ppm TPH. Transite pipe found (6") at 2 ft bgs ~ 15 ft long, ending 5 ft from Willow Brook. At conclusion, slight oily sheen on ground water adsorbed with pads. Confirmatory soil samples collected from sidewalls and from floor.
Underground pipe and trench excavation	Digging traced pipe from UST area in the parking lot of the school from the concrete vault. Trench then excavated to a depth of 1 ft below pipe bottom extending 4 ft on either side. All pipe sections upstream of vault were clay. Some local contamination from leaks. Pipe was ~5 ft bgs at edge of parking

	lot. Trench excavation was widened and deepened until all soils showing contamination above 1,000 ppm per NDIR field screening.
UST removal and disposal	10,000 gallon UST in the parking lot north of the school contained oily water. Contents pumped out ~660 gal and UST cleaned and removed. 6-8" of pavement removed; no evidence of petroleum contamination except near fill pipe. No evidence of leaks or deterioration in walls. UST top 2 ft bgs; bottom ~9 ft bgs. Ground water ~8 ft bgs. Feed and return lines removed to edge of excavation adjacent to loading dock and remaining sections crimped. No product emanating. UST was strapped to concrete pad ~ 15 ft x 20 ft.
UST area excavation.	Sandy soils with no staining or petroleum odor. No headspace readings registered. East sidewall had some pockets of contamination at 7-9 ft that were removed. Excavation advanced an additional 3-4 ft into sidewall to depth of 10 ft bgs (2 ft below water table) until NDIR screening showed readings well below 1,000 ppm. North, west, and south sidewalls showed pockets with dark staining at 7-10 ft bgs; TPH field screens exceeding 5,000 ppm. Well 69W-94-11 destroyed. • Additional soils removed below the concrete pad. No field screening TPH concentration above 1,000 ppm. Samples from floor and one from east sidewall sent off site for EPH/VPH. • Two brass pipes found at 7 ft bgs on south side of the excavation. Found terminated on the west side of the UST location. No free product found.
Hot spot excavation	RI data showed soil contamination hot spot around well 69W-94-10. Planned to remove 1,200 cy soil at UST and hot spot. Excavated 3,500 cy following soils above 1,000 ppm by NDIR field screening. Pavement removed to the planned boundaries. Soils were field screened at one sample per 15-20 cy. Soils above 4 ft bgs did not exhibit staining, odor, or headspace above 10 ppm. Soils generally contaminated from 5-6 ft bgs to 10-11 ft bgs. Field screened by headspace and NDIR. • Excavation of the floor continued to 2-3 ft below water table. At ~11 ft bgs (2-3 ft below water table), silty soils did not show staining or odor. Confirmed by field screens. Excavation stopped at maximum safe depth of excavation. • South sidewall TPH exceeded 5,000 ppm. Excavation could not advance because of the building. Contamination appeared concentrated at 7-11 ft bgs, heaviest at 8-11ft bgs. • West side excavation continued beyond the pipe trench until TPH less than 1,000 ppm on the NDIR. Confirmatory sidewall samples taken at 5-8 ft bgs for offsite EPH /VPH analyses. In first round, one sample exceeded MCP S1/GW1 standard for C9-C19 Aliphatics at 2200 ppm, and for C11-C22 Aromatics at 520 ppm. Additional soils excavated; results were below standards for EPH/VPH. • East side excavation did not advance beyond the loading dock as determined by NDIR field screening. • Excavation on the north side removed visible petroleum contamination on the sidewall to approximately 50 ft northward of wells 69W-94-12

	and 69W-94-13. During excavation, oily sheen developed on groundwater. Sorbent pads and booms were used. Approximately 1,900 gals of oily water were pumped from the excavation.
Underground pipe investigation.	At the conclusion of excavation, the section of pipe remaining under the school building was ~6 inches above the WT (~8 ft bgs). Pipe not discharging anything. The length and direction of the pipe under the building was investigated. Smoke test showed no smoke entering the building. Other tests included introducing soapy water and foam, a video inspection during high water table (very poor visibility), and a high-pressure wash test (no evidence in drains and sumps). Pipe was filled with 5 CY of tremie concrete.
March 1998 Backfilling operations	Samples sent to offsite lab for VOCs, SVOCs, PCBs, Total RCRA Metals, and TPH. Passed standards. The concrete vault excavation and the underground pipe trench upstream of the vault were backfilled with imported gravel. The remaining excavation backfilled with onsite material.

2.0 AOC 69W Record of Decision Background

2.1 **Remedy Components.** Based on results from the RI, supplemental sampling, and the soil removal action, the RI report recommended long term monitoring of groundwater quality with no additional investigation or remedial action. No Feasibility Study was performed. The Record of Decision (ROD) for AOC 69W was signed on June 29, 1999. A Limited Action alternative was the selected remedy for ground water and subsurface soils, which specified the following key components:

- A Long Term Monitoring Plan is developed to monitor for any potential off-site migration of contaminants and to verify that elevated concentrations decrease over time. It is anticipated that arsenic and MADEP EPH/VPH will be the monitored analytes.
- Institutional controls, including deed and/or use restrictions, are established and enforced that restrict or prevent potential human exposure to site soil and ground water contaminants left in place.
- Five-year reviews are conducted to review the data collected and to assess the effectiveness of the remedy.

No remedy design or construction activities are required in the ROD.

2.2 **Remedial Action Objectives.** The remedial action objectives (RAOs) are:

- Restore the aquifer to drinking water standards within a reasonable time frame.
- Monitor potential future migration of ground water contamination.
- Eliminate risk from potential consumption of ground water.
- Reduce or eliminate the direct contact threat of contaminated soils.

The RAOs are based on potential health risks to individuals in current and future use scenarios (i.e., maintenance worker and elementary school children scenario) at the site. The risk is attributable to arsenic in ground water as a potable source. The rationale for the limited action alternative is:

- The ground water will not be used as a drinking water source. As the Town of Devens has a municipal water supply, ground water poses no threat to human health or the environment.
- The Army will monitor arsenic and EPH/VPH levels in ground water and will place Institutional Controls on the property to ensure current and future protectiveness.

3.0 Construction Activities, Chronology of Events and Construction Quality Control.

3.1 **The ROD** requires no remedy design and construction. The long term monitoring program that includes the evaluation of the institutional controls began in May 2000.

3.2 **The LTMP** for AOC 69W was approved in March 2000 (HLA, March 2000). The Plan specified sampling of eight groundwater monitoring wells (nine wells the first round) to monitor for off-site migration of COCs and to verify that COCs decrease over time. Three of the eight wells were to be newly installed. The wells originally proposed by HLA are in Appendix C. Wells were to be monitored twice annually for EPH, VPH, iron, manganese, arsenic, and bis(2-ethylhexyl)phthalate. Changes made to the program are described in subsequent paragraphs.

3.3 **Institutional Controls** ensure that the remaining contaminated soils beneath and adjacent to the building are controlled and the extraction of groundwater from the site for industrial and/or potable water supply is not permitted. They are to be incorporated either in full or by reference into all deeds, easements, mortgages, leases or any other instruments of transfer prior to the transfer of the property to MassDevelopment. In the five-year review process, existing land use is evaluated to ensure control requirements are being met.

The Town of Ayer Parker Charter School currently occupies the property. MassDevelopment supplies potable water to the school. There were no excavations observed within the Excavated Soil Management Area (ESMA) during any long-term sampling event. No penetrations through the pavement or re-paved pavement cut marks were observed within the ESMA during both sampling events. No groundwater extraction wells have been installed on the site.

3.4 **Long Term Monitoring Events.** Activities performed to date for the Long Term Monitoring Program are summarized in Table 4.

Table 4 - Long Term Monitoring Events for AOC 69W

Date	Action
June 29, 1999	ROD for AOC 69W signed
March 2000	Long Term Monitoring Plan submitted
May 2000	First LTM sampling round performed
September 2000	First Five-Year Review Report submitted

November 2000	LTM sampling round performed
April 2001	2000 Annual Report for AOC 69W submitted
October 2001	Two new monitoring wells installed in the northern part of the site to serve as sentry wells
November 2001	LTM sampling round performed
April 2002	2001 Annual Report for AOC 69W submitted
May 2002	LTM sampling round performed

3.5 **Construction Quality Control.** No remedial construction was performed. The Army performed QA/QC for the Long Term Monitoring activities. The Army sampling teams followed protocols and quality control measures stated in the LTMP. The groundwater sampling and testing program includes split and duplicate samples that are analyzed by an independent laboratory. A chemist prepared reports on the QA comparisons that were included in each annual report.

4.0 Performance Standards, Remedy Objectives, Inspection and Certifications.

4.1 Performance Standards. There was no Feasibility Study and the ROD did not include time for groundwater restoration (e.g. MCLs). The components of the selected Limited Action remedy are institutional controls, long-term ground water monitoring, and five-year reviews. The stated expected outcome of this alternative is restoration of the aquifer to drinking water standards within a "reasonable time frame." The estimated total costs for the unspecified time frame are $23,300 in capital costs and $172,000 for operation and maintenance

The COCs for this site are volatile petroleum hydrocarbons (VPH) and extractable hydrocarbons (EPH), arsenic and manganese. Iron is no longer a COC as recommended in the first Five-Year Review Report (HLA, September 2000). Semi-volatile compound bis(2-ethylhexyl) phthalate was being analyzed for in wells ZWM-95-17X and ZWM-99-22X. Results suggested its presence was not site related and it was eventually dropped from future testing rounds. Eight monitoring wells, including a background well, four source area wells and two sentry wells, were sampled initially. In the May 2000 sampling round, results for well ZWM-96-19X (boiler room) continued to be below the MCLs and the well was dropped from further monitoring in accordance with the LTMP. Two new wells were installed in October 2001 after results from sentry well ZWM-99-23X showed exceedances that negated its function as a sentry well. After five semi-annual sampling events, the main results as shown in Table D-2 are:

- Four of ten wells (two source wells and two sentry wells) account for all exceedances of cleanup goals for VOCs (C11-C22 range only), arsenic, and manganese.
- VOCs in the two source wells exceeded the 200 ug/L in each round. Concentrations range from 690 to 2,500 ug/L. VOCs in sentry well ZWM-99-23X are at low concentrations, but increased above the goal in two consecutive sampling events and then decreased. Sentry well ZWM-95-15X showed no VOCs until the latest round in May 2002. Discrepancies between results from the primary and QA laboratories warranted an investigation into their analytical methods.
- Arsenic in the two source wells exceeded the 50-ug/L goal in each round. Concentrations range from 52 to 230 ug/L. Sentry well ZWM-99-23X concentrations fluctuated,

exceeding the goal in three consecutive events, and then decreasing below the goal. Concentrations range from 15 to 60 ug/L.

- Manganese in the two source wells and sentry well ZWM-99-23X exceeded the 375-ug/L goal in each round. Concentrations in the two source wells were consistent; concentrations in the sentry well appear to be decreasing.
  Manganese in sentry well ZWM-95-15X has fluctuated widely from 25 to 1,500 ug/L.

The ten monitoring wells are adequately distributed to detect changes in contaminant concentrations across this site. The laboratory results from this initial period of monitoring show that contamination exceeding cleanup goals is localized around four wells. Since it is difficult to predict an exact timeframe for aquifer restoration at this time, it is prudent to continue the periodic monitoring and reporting process through the initial five-year period. There are provisions for the review committee to adjust the program in accordance with the ROD

The monitoring program has been effective so far in meeting the objectives, monitoring potential offsite migration, detecting changes in the concentrations of the COCs, and protecting against exposures. The monitoring wells are adequately distributed, data acquisition and QA are performed competently, and periodic reviews occur as scheduled

The Army evaluated the quality of performance data for each sampling and testing event. The field crews followed prescribed field quality control procedures and checks. Quality assurance/quality control (QA/QC) samples were collected to monitor the sample collection, transportation, and analysis procedures. Staff chemists examined the primary laboratory's data for acceptability with respect to DQOs and prepared quality assurance reports from the results on QA samples. Findings are included in the annual reports.

All VPH and Metals comparisons were in good overall and quantitative agreement. In 2001, questions arose regarding EPH analyses. Comparisons of the QA split results showed that the primary laboratory's results in past rounds were consistently higher than the QA laboratory's for the C11-C22 aromatic hydrocarbons. The primary laboratory performs the MADEP-EPH analyses using a modified method based on a gas chromatography mass spectrometer (GC/MS) system. The QA laboratory performs the traditional GC/FID methodology. The GC/MS s method appears more sensitive than the GC/FID method in quantifying the hydrocarbon ranges, and therefore, results may be biased high. As the two laboratories performed the EPH analysis differently, a comparability study was performed that included comparisons of results from four laboratories as described in the Annual Report for 2001. It was subsequently determined that each method was valid and acceptable. The Army continues to utilize the primary laboratory's modified method to maintain consistency in this long-term monitoring program.

ICs are ensuring that exposures to contaminated subsurface soils are controlled and that extraction of groundwater from beneath the site is not permitted. MassDevelopment provides potable municipal water. The Army's sampling team reports results of IC inspections in the semi-annual and annual reports.

4.2 **Remedy objectives** for each remedial component were established and accomplished; please see table 5 below:

Table 5 - Remedy Objectives and Results

ROD Remedy Component Objectives	Results
Long term monitoring	- LTMP approved - Semiannual LTM continues; see results in Appendix D - Two monitoring wells added - LTMP to be revised as necessary by project team.
Institutional controls	Corps sampling team reports results in each semi-annual and annual report.
5 year reviews	First review performed in September 2000.

4.3 Inspection and Certification.

4.3.1 **Inspections.** The sampling team during each round inspects the monitoring wells and the physical features of the AOC and states any significant observations in each annual report. No discrepancies or concerns have been noted.

4.3.2 **Certification of Completion.** The Army has provided documentation verifying the IC and LTM remedy components are established in the annual reports and USEPA/MADEP have concurred

The Army evaluates the quality of performance data for each sampling event and provides data quality evaluations in the annual reports. There are checks on field quality control procedures, and chemists review the primary laboratory's data and evaluate QA sample results. All VPH and Metals comparisons have been in good overall quantitative agreement to date. A discrepancy was detected between the primary and QA laboratories' EPH results due to different methodologies. The primary laboratory's method appears to be more sensitive and the resulting concentrations may be biased high. The methods were investigated and both were considered valid.

The Army's sampling team leader observes site conditions around the school during each semiannual event ensuring that the ICs are being met. Observations were included in the annual reports. No excavations were observed within the Excavated Soil Management Area (ESMA) confirming continued protection against exposure to remaining contaminated soils. MassDevelopment supplies potable water to the school. Existing land use is to be evaluated in the five-year review process to ensure control requirements are being met. The current property owner is abiding by the institutional controls imposed on the property.

5.0 Operation and Maintenance Activities.

5.1 **Long term monitoring** of groundwater has been underway since May 2000. Five rounds have been completed. Adjustments have been made to the program. As recommended in the First Five-Year Review Report (HLA, 2000), iron was no longer considered a COC but it continues to be analyzed, as it is an indicator of remediation efficacy.

In the May 2000 round, results for well ZWM-96-19X (boiler room) continued to be below the MCLs and the well was dropped from further monitoring in accordance with the LTMP. Also, semi-volatile compound bis(2-ethylhexyl) phthalate was analyzed for in wells ZWM-95-17X and ZWM-99-22X to assess if its detection in 1966 samples were site related or a sampling/laboratory artifact. It was not detected in either well or in duplicate ZWM-DUP-001. Therefore, it was dropped from future testing rounds.

Analytical data from the first three semi-annual long-term monitoring rounds indicated that EPH aromatic hydrocarbons in the C11 - C22 range, VPH aromatic hydrocarbons in the C9 - C10 range, arsenic, and manganese were detected in sentry well ZWM-99-23X. Therefore, ZWM-99-23X no longer fits the definition of a sentry well; so two additional monitoring wells (ZWM-01-25X and ZWM-01-26X) were installed down and cross gradient of ZWM-99-23X in October 2001. See Figure 2. Ten monitoring wells are now sampled semi-annually.

As reported in the 2001 Annual Report, comparisons of the field sample results produced by AMRO Laboratory and QA data from STL showed discrepancies in EPH results. AMRO's results for the C11-C22 aromatic hydrocarbons were consistently higher than the QA lab's results in the last four QA sampling events. AMRO performs the MADEP-EPH analyses using a modified method based on a gas chromatography mass spectrometer (GC/MS) system. STL performs the traditional GC/FID methodology. The discrepancies were investigated. AMRO's method appears more sensitive in quantifying the hydrocarbon ranges than the GC/FID method, and therefore, results may be biased high. A comparability study against AMRO's method was performed using four laboratories. Additional replicate ground water samples were collected during the November 2001 sampling event and were analyzed by AMRO, STL, MADEP's Wall Experiment Station, and the Woods Hole Group. Although much was learned about the causes of the differences, there were complexities that make it difficult to ascertain which analytical method best represents true EPH concentrations. The Army will continue to utilize AMRO's analytical results to maintain consistency in this long-term monitoring program.

5.2 The results were presented in the 2001 Annual Report. Appendix D shows the summary of analytical results including those from the May 2002 round. Table D-2 in Appendix D compares the trends from the last two rounds. The same three monitoring wells, 69W-94-13, ZWM-99-22X and ZWM-99-23X continue to exceed the cleanup goals. Aromatic hydrocarbons in the C11 - C22 range (ug/L) and manganese appeared in sentry well ZWM-95-15X that showed no exceedances in the previously. Neither new well showed any results above the cleanup goals.

5.3 As specified in the ROD, the purpose of monitoring is to confirm that the site continues to have no impact upon human health and the environment. The LTMP will be changed over time depending upon results. Changes will be noted in the LTMP and 5-year reviews.

5.4 **Five-year Review Findings/Recommendations**. Five-year reviews are performed to review the data collected and assess the effectiveness of the remedy. AOC 69W was described in the Five-Year Review Report dated September 2000 (HLA, 2000). At that time, only the first

LTM sampling round had been completed and was not reviewed. The major points in the Report were:

- ARARs in the ROD were reviewed for changes that could affect protectiveness. None of the listed ARARs have been changed since the signing of the ROD.
- No areas of non-compliance were identified.

Addressing whether the remedy is functioning as intended, the assessment was:

- Health and safety procedures for the long-term groundwater monitoring in documents and plans are properly implemented.
- Implementation of institutional controls is satisfactory.
- Transfer of the property is pending the Land Use Plan Memorandum of Agreement and so institutional controls have not been officially implemented into the deed. No violations are known.
- Groundwater monitoring is conforming to the approved LTMP.
- Iron is no longer considered a COC and this report recommends removal of iron as a monitored contaminant. In addition, it is recommended that groundwater monitoring be discontinued if four consecutive representative samples are below action criteria.
- There are no early indicators of potential remedy failure evident during this review.

Addressing the question whether the assumptions used at the time of the remedy are still valid, the following points were made:

- With exception of arsenic, the review identified no changes to existing ARARs or newly promulgated standards or regulations affecting the remedy.
- There are no changes in exposure pathways.
- There are no changes in toxicity and other contaminant characteristics.
- Based on EPA's risk guidance, non-cancer health risks would not be calculated for iron and iron would not be identified as a COC.

The Report concluded that the selected remedy is protective and is expected to remain protective of human health and the environment. Current remedial action consists of groundwater monitoring, annual reporting, institutional controls, and five-year site reviews. Institutional controls will be placed in the deed at the time of property transfer. The components enable continued assessment of remedial progress. AOC 69W is a statutory site requiring ongoing five-year reviews.

6.0 **Project Costs**.

Cost estimates in the ROD for the Limited Action Alternative are:

- Estimated capital costs: $23,300
- Estimated operation and maintenance costs: $172,000
- Estimated Total Costs: $195,300

There is no specified period of performance or breakout for that total. Total project O&M costs to date are about $115,000, including the two new monitoring installed in October 2001.

7.0 Observations and Lessons Learned.

The LTM program was initiated in May 2000.

- Iron was dropped as a COC but it continues to be analyzed as an indicator of remediation efficacy.
- In the May 2000 round, results for well ZWM-96-19X (boiler room) continued to be below the MCLs and the well was dropped from further monitoring in accordance with the LTMP. Also, semi-volatile compound bis(2-ethylhexyl) phthalate was analyzed for in wells ZWM-95-17X and ZWM-99-22X to assess if its detection in 1966 samples were site related or a sampling/laboratory artifact. It was not detected in either well or in duplicate ZWM-DUP-001. Therefore, this compound was dropped from future testing rounds.
- Analytical data from ZWM-99-23X showed it no longer fits the definition of a sentry well, and so two new monitoring wells (ZWM-01-25X and ZWM-01-26X) were installed down and cross gradient of ZWM-99-23X in October 2001.
- Results from May 2000 through May 2002 show that the following six wells have not exceeded any of the COCs: background well ZWM-95-17X, source well 96W-94-14, sentry wells ZWM-95-18X and ZWM-99-24X, and new wells ZWM-01-25X and ZWM-01-26X.
- Results show certain wells exceed the cleanup goals for the following COCs: EPH in the C11 - C22 aromatic range (200 ug/L), arsenic (50 ug/L), and manganese (375 ug/L). Results from source monitoring wells 69W-94-13 and ZWM-99-22X exceeded cleanup goals for EPH, arsenic and manganese in all sampling events. Well ZWM-99-23X results for EPH and arsenic sometimes exceeded the goals; manganese results exceeded the goal in each event. In May 2002, EPH in sentry well ZWM-95-15X appeared above cleanup goal for the first time; the goal for manganese was sometimes exceeded.
- There were discrepancies in EPH results on field sample analyzed by AMRO and corresponding QA results from STL. AMRO's results for the C11-C22 aromatic hydrocarbons were consistently higher than the QA lab's results. AMRO performs the MADEP-EPH analyses using a modified method based on a gas chromatography mass spectrometer (GC/MS) system. STL performs the traditional GC/FID methodology. A comparability study against AMRO's method was performed using four laboratories. Method complexities make it difficult to ascertain which analytical method best represents true EPH concentrations. The Army will continue to utilize AMRO's analytical results to maintain consistency in this long-term monitoring program.

8.0 Contract Information.

8.1 No remedial construction is being performed. Corps of Engineers staff performs LTM sampling. Technical Drilling Services of Sterling, MA installed the two new monitoring wells in October 2001.

8.2 The following companies analyzed samples:

Primary laboratory:
AMRO Environmental Laboratories, Inc.
111 Herrick Street
Merrimack, NH 03054

QA laboratory:
Severn Trent Services
208 South Park Drive
Suite 1
Colchester, VT 05446

8.3 **The Project Managers** are:

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Appendix A - References

Harding Lawson Associates. 1998. Final Remedial Investigation Report, Area of Contamination (AOC) 69W, Devens, Massachusetts

Harding Lawson Associates. 1999. Record of Decision, Area of Contamination 69W, Devens, Massachusetts

Harding Lawson Associates. 2000. Final Long Term Monitoring Plan, Area of Contamination 69W, Devens, Massachusetts

Harding Lawson Associates. 2000. Final First Five-Year Review for Devens Reserve Forces Training Area, Devens, Massachusetts

U.S. Army Corps of Engineers, New England District. 2001. 2000 Annual Report for Area of Contamination (AOC) 69W, Long Term Monitoring, Devens, Massachusetts

U.S. Army Corps of Engineers, New England District. 2002. 2001 Annual Report for Area of Contamination (AOC) 69W, Long Term Monitoring, Devens, Massachusetts

USEPA, OSWER Directive 9320.2-09A. *"Close Out Procedures for National Priorities List Sites"*, January 3, 2000

Appendix B - Glossary of Acronyms and Abbreviations

AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
AREE	Area Requiring Environmental Evaluation
bgs	below ground surface
BRAC	Base Realignment and Closure
CAC	Citizen's Advisory Committee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
EPH	extractable petroleum hydrocarbons
ICs	institutional controls
LTM	long term monitoring
LTMP	Long Term Monitoring Plan
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
Ug/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	polyaromatic hydrocarbons
RAB	Restoration Advisory Board
RI	Remedial Investigation
RFTA	Reserved Forces Training Area
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SVOC	semivolatile organic compound
TRPH	total petroleum hydrocarbons
TRC	Technical Review Committee
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons

Appendix C

TABLE C-1
MONITORING WELLS USED FOR LONG TERM MONITORING

AOC 69W LONG TERM MONITORING
DEVENS, MASSACHUSETTS

MONITORING WELL[1]	SCREENED INTERVAL (FT BGS)	LOCATION	RATIONALE
69W-94-13 (2"I.D.)	4-14 ft.	North of paved area near source area	Source area well. Monitor for decrease in COC concentrations.
69W-94-14 (2"I.D.)	3-13 ft.	Approx. 30 feet upgradient of Willow Brook wetlands	Monitor for decrease in COC concentrations and decrease in the potential for off-site migration.
ZWM-95-15X (4" I.D.)	3-13 ft.	Near former underground concrete vault	Sentry well. Monitor for decrease in COC concentrations and decrease in the potential for off-site migration.
XWM-95-17X (4" I.D.)	12.2 – 22.2 ft.	Southeast of school	Background (upgradient) well.
ZWM-95-18X (4" I.D.)	3-13 ft.	Approximately 120 ft. downgradient of the concrete vault	Sentry well. Monitor for off-site migration.
ZWM-95-19X (2" I.D.)	6-16 ft.	Within "new" boiler room	Source area well. Dropped from further monitoring after May 2000 results showed analytes below MCLs.
ZWM-99-22X (2" I.D.)	5-15 ft. (est.)	In paved source area	Replacement well for former source area well 69W-94-10. Monitor for decrease in COC concentrations.
ZWM-95-23X (2" I.D.) [Dropped as sentry well after May 2002 results.]	3-13 ft. (est.)	Downgradient well northeast of 69W-94-14	Originally sentry well to monitor for decrease in COC concentrations and decrease in the potential for off-site migration.
ZWM-95-24X (2" I.D.)	3-13 ft. (est.)	Downgradient well east of Willow Brook and southwest of 69W-94-14	Sentry well. Monitor for decrease in COC concentrations and decrease in the potential for off-site migration.
ZWM-01-25X (2" I.D.)	5-15 ft. (est.)	Added in October 2001 downgradient of former sentry well ZWM-99-23X.	Monitor for decrease in COC concentrations and decrease in the potential for off-site migration.
ZWM-01-26X (2" I.D.)	5-15 ft. (est.)	Added in October 2001 cross gradient to former sentry well ZWM-99-23X.	Monitor for decrease in COC concentrations and decrease in the potential for off-site migration.

1 All monitoring wells are water table wells.
2 If all analytes are below MCLs, future sampling will be discontinued.

Notes:
ft – feet.
Bgs – below ground surface.
I.D. – inside diameter.
Est. – estimated.
COC – contaminant of concern.

Appendix D

TABLE D-1
AOC 69W HISTORICAL GROUNDWATER ANALYTICAL DATA (2000 - 2002)
LONG TERM MONITORING PROGRAM
DEVENS, MASSACHUSETTS

MONITORING WELL	ANALYTE AND CLEANUP GOAL (UG/L)	CONCENTRATION (ug/L) SAMPLING ROUND LTM 1 (5/00)	2 (11/00)	3 (5/01)	4 (11/01)	5 (5/02)
SOURCE WELLS						
69W-94-13						
EPH - Aliphatic Hydrocarbons						
	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	180
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	180
Aromatic Hydrocarbons						
	C11 - C22 (200 UG/L)	690	1400	720	790	1900
VPH - Aliphatic Hydrocarbons						
	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C9 - C10 (1,000 UG/L)	120	270	160	320	150
Metals	Arsenic (50 UG/L)	54	110	85	150	52
	Iron *	9800	9400	7700	12000	11000
	Manganese (291UG/L)	2300	1700	1500	1600	2100
69W-94-14						
EPH - Aliphatic Hydrocarbons						
	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	ND
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C11 - C22 (200 UG/L)	ND	ND	ND	ND	ND
VPH - Aliphatic Hydrocarbons						
	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C9 - C10 (1,000 UG/L)	ND	ND	ND	ND	ND
Metals	Arsenic (50 UG/L)	8.3	12	ND	5.9	4.5J
	Iron *	1300	2000	520	1400	1100
	Manganese (291UG/L)	300	340	5.1J	340	320
ZWM-99-22X						
EPH - Aliphatic Hydrocarbons						
	C9 - C18 (1,000 UG/L)	250	ND	210	ND	ND
	C19 - C36 (5,000 UG/L	180	150	130	ND	ND
Aromatic Hydrocarbons						
	C11 - C22 (200 UG/L)	2500	1400	2100	370	620
VPH - Aliphatic Hydrocarbons						
	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C9 - C10 (1,000 UG/L)	620	150	550.0	83	88
Metals	Arsenic (50 UG/L)	150	130	230	140	86
	Iron *	21000	14000	25000	16000	13000
	Manganese (291UG/L)	2000	1800	2300	2400	2000

Notes:
LTM = Long Term Monitoring
– = Well not installed at the time of the sampling round.
ND = Non detect above methos detection limit

25 = concentrations that exceed the cleanup goal for the respective contaminant

* As of the May 2001 sampling event, iron was no longer considered a Contaminant of Concern but will be compared to the background concentration of 9,100 ug/L.
Iron concentrations will be used as an indicator of remediation efficacy,

TABLE D-1 Continued
AOC 69W HISTORICAL GROUNDWATER ANALYTICAL DATA (2000 - 2002)
LONG TERM MONITORING PROGRAM
DEVENS, MASSACHUSETTS

MONITORING WELL	ANALYTE AND CLEANUP GOAL (UG/L)	CONCENTRATION (ug/L) SAMPLING ROUND LTM 1 (5/00)	2 (11/00)	3 (5/01)	4 (11/01)	5 (5/02)
SENTRY WELLS						
ZWM-95-15X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	430
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	280
Aromatic Hydrocarbons	C11 - C22 (200 UG/L)	ND	ND	ND	ND	1400
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	ND	ND	ND	ND	ND
Metals	Arsenic (50 UG/L)	ND	7.9	ND	22	36
	Iron *	ND	5100	ND	4300	11000
	Manganese (291UG/L)	28	1300	25	100	1500
ZWM-95-18X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	ND
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C11 - C22 (200 UG/L)	ND	ND	ND	ND	ND
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	ND	ND	ND	ND	ND
Metals	Arsenic (50 UG/L)	ND	ND	ND	ND	ND
	Iron *	49JB	ND	ND	ND	ND
	Manganese (291UG/L)	9.2J	ND	ND	4.4J	4.4J
ZWM-99-23X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	ND
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C11 - C22 (200 UG/L)	170	520	200	140	140
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	46	62	40	34	ND
Metals	Arsenic (50 UG/L)	23	70	67	55	15
	Iron *	8000	11000	13000	8000	2000
	Manganese (291UG/L)	4200	3600	5800	1500	550
ZWM-99-24X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	ND
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C11 - C22 (200 UG/L)	ND	ND	ND	ND	ND
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	ND	ND	ND	ND	ND
Metals	Arsenic (50 UG/L)	2.3J	ND	ND	ND	ND
	Iron *	340	ND	ND	ND	ND
	Manganese (291UG/L)	27	12J	ND	14J	ND
ZWM-01-25X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	--	--	--	ND	ND
	C19 - C36 (5,000 UG/L	--	--	--	ND	ND
R15	C11 - C22 (200 UG/L)	--	--	--	ND	ND
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	--	--	--	ND	ND
	C9 - C12 (400 UG/L)	--	--	--	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	--	--	--	ND	ND
Metals	Arsenic (50 UG/L)	--	--	--	4.1J	ND
	Iron *	--	--	--	170	ND
	Manganese (291UG/L)	--	--	--	280	61
ZWM-01-26X						
EPH - Aliphatic Hydrocarbons	C9 - C18 (1,000 UG/L)	--	--	--	ND	ND
	C19 - C36 (5,000 UG/L	--	--	--	ND	ND
Aromatic Hydrocarbons	C11 - C22 (200 UG/L)	--	--	--	ND	ND
VPH - Aliphatic Hydrocarbons	C5 - C8 (400 UG/L)	--	--	--	ND	ND
	C9 - C12 (400 UG/L)	--	--	--	ND	ND
Aromatic Hydrocarbons	C9 - C10 (1,000 UG/L)	--	--	--	ND	ND
Metals	Arsenic (50 UG/L)	--	--	--	ND	ND
	Iron *	--	--	--	ND	ND
	Manganese (291UG/L)	--	--	--	58	8.6J

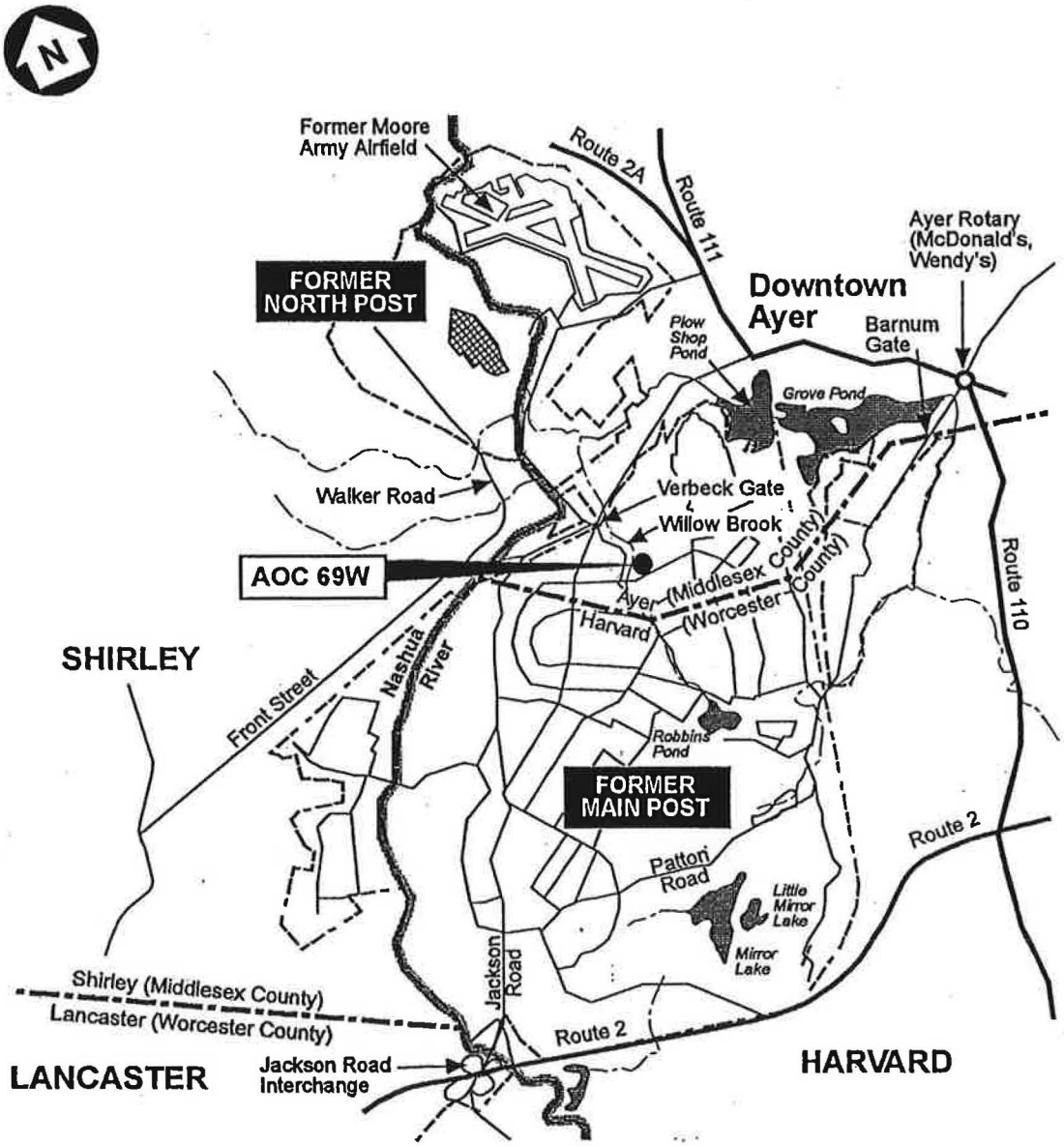
TABLE D-1 Continued
AOC 69W HISTORICAL GROUNDWATER ANALYTICAL DATA (2000 - 2002)
LONG TERM MONITORING PROGRAM
DEVENS, MASSACHUSETTS

MONITORING WELL	ANALYTE AND CLEANUP GOAL (UG/L)	CONCENTRATION (ug/L) SAMPLING ROUND LTM 1 (5/00)	2 (11/00)	3 (5/01)	4 (11/01)	5 (5/02)
BACKGROUND WELL						
ZWM-95-17X						
EPH - Aliphatic Hydrocarbons						
	C9 - C18 (1,000 UG/L)	ND	ND	ND	ND	ND
	C19 - C36 (5,000 UG/L	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C11 - C22 (200 UG/L)	ND	ND	ND	ND	ND
VPH - Aliphatic Hydrocarbons						
	C5 - C8 (400 UG/L)	ND	ND	ND	ND	ND
	C9 - C12 (400 UG/L)	ND	ND	ND	ND	ND
Aromatic Hydrocarbons						
	C9 - C10 (1,000 UG/L)	ND	ND	ND	ND	ND
Metals	Arsenic (50 UG/L)	ND	ND	ND	ND	ND
	Iron *	220	ND	ND	ND	ND
	Manganese (291UG/L)	ND	ND	ND	ND	ND

Table D-2
Trends of Parameters at Wells Exceeding Goals

VOCS [C11-C22 AROMATIC HYDROCARBONS] [CLEANUP GOAL 200 UG/L]					
WELL	MAY 2000 (UG/L)	NOV 2000 (UG/L)	MAY 2001 (UG/L)	NOV 2001 (UG/L)	MAY 2002 (UG/L)
69W-94-13 SOURCE	690	1,400	720	790	1,900
ZWM-99-22X SOURCE	2,500	1,400	2,100	370	620
ZWM-95-15X SENTRY	ND	ND	ND	ND	1,400
ZWM-99-23X SENTRY	(170)	520	200	(140)	(140)
ARSENIC [CLEANUP GOAL 50 UG/L]					
69W-94-13 SOURCE	54	110	85	150	52
ZWM-99-22X SOURCE	150	130	230	140	86
ZWM-95-15X SENTRY	ND	(7.9)	ND	(22)	(36)
ZWM-99-23X SENTRY	(23)	70	67	55	(15)
MANGANESE [CLEANUP GOAL 375 UG/L]					
69W-94-13 SOURCE	2,400	1,700	1,500	1,600	2,100
ZWM-99-22X SOURCE	2,000	1,800	2,300	2,400	2,000
ZWM-95-15X SENTRY	(28)	1,300	(25)	(100)	1,500
ZWM-99-23X SENTRY	4,200	3,600	5,800	1,500	550

Figures



Harding Lawson Associates
Engineering and
Environmental Services

Location of AOC 69W
Long-term Monitoring Plan
Devens, Massachusetts

FIGURE 1

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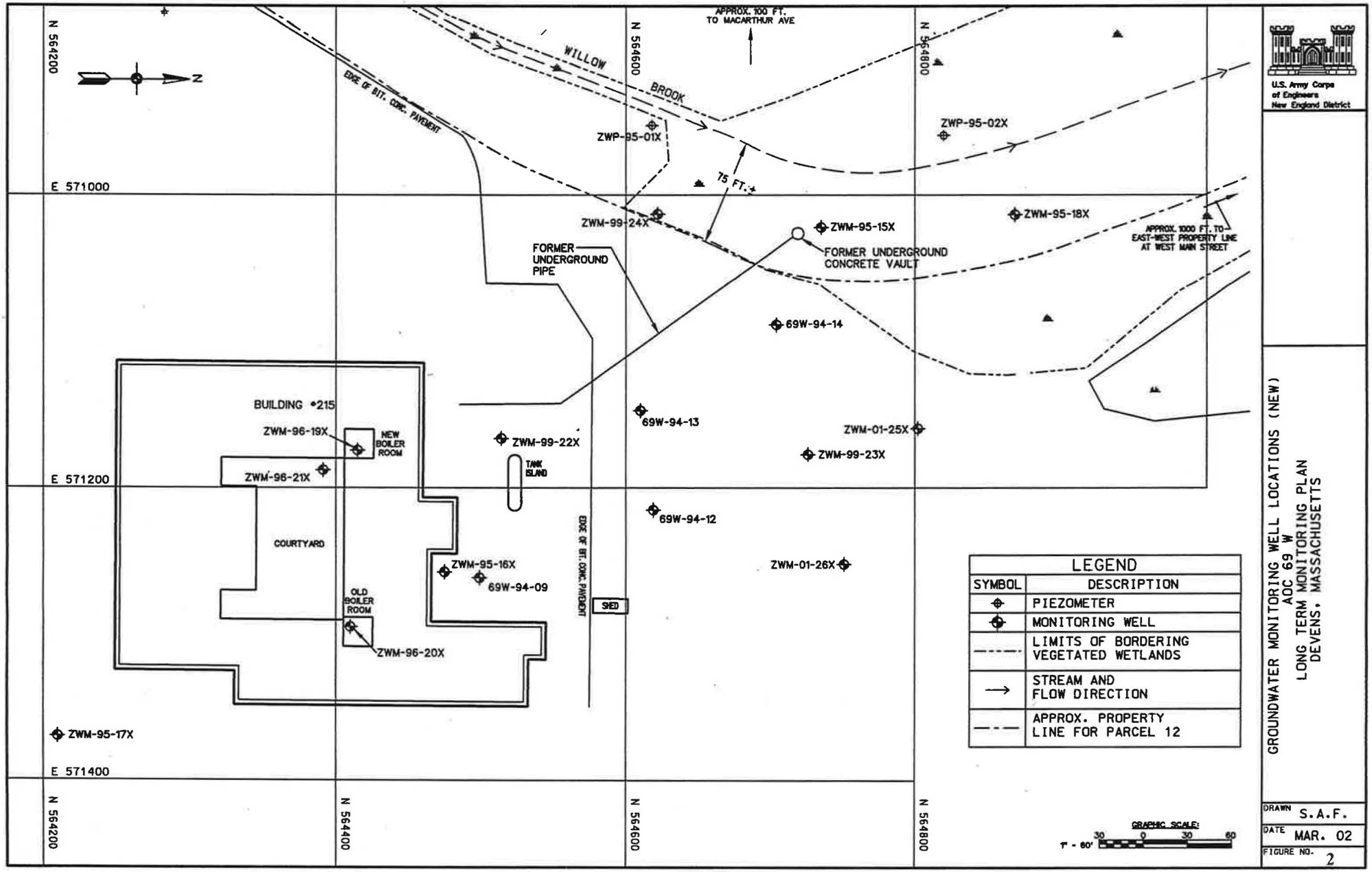
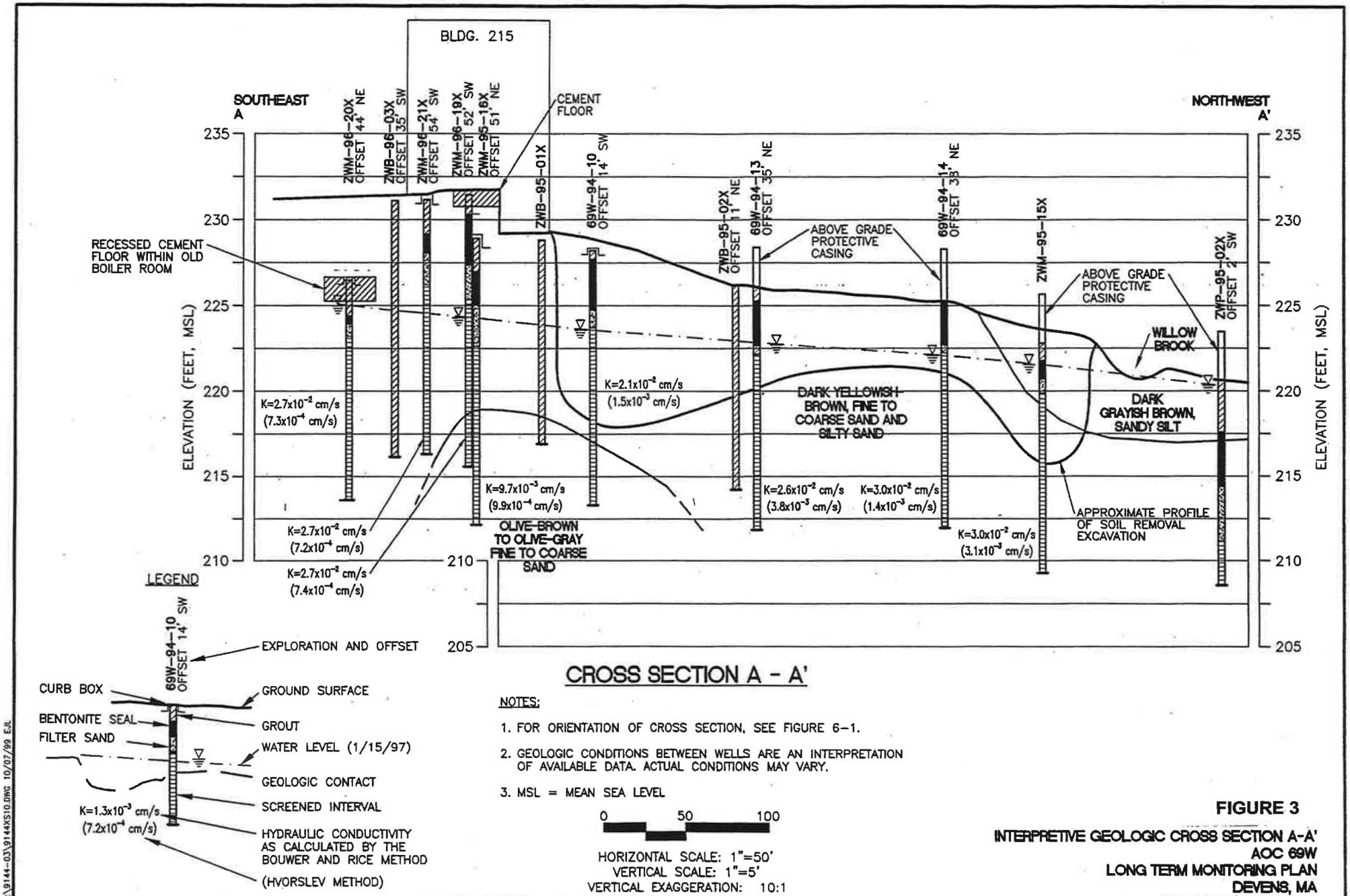


U.S. Army Corps of Engineers
New England District

GROUNDWATER MONITORING WELL LOCATIONS (NEW)
AOC 69 W
LONG TERM MONITORING PLAN
DEVENS, MASSACHUSETTS

DRAWN S.A.F.
DATE MAR. 02
FIGURE NO. 2



CROSS SECTION A - A'

NOTES:

1. FOR ORIENTATION OF CROSS SECTION, SEE FIGURE 6-1.
2. GEOLOGIC CONDITIONS BETWEEN WELLS ARE AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS MAY VARY.
3. MSL = MEAN SEA LEVEL

0 50 100

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=5'
VERTICAL EXAGGERATION: 10:1

FIGURE 3

INTERPRETIVE GEOLOGIC CROSS SECTION A-A'
AOC 69W
LONG TERM MONITORING PLAN
DEVENS, MA

Harding Lawson Associates

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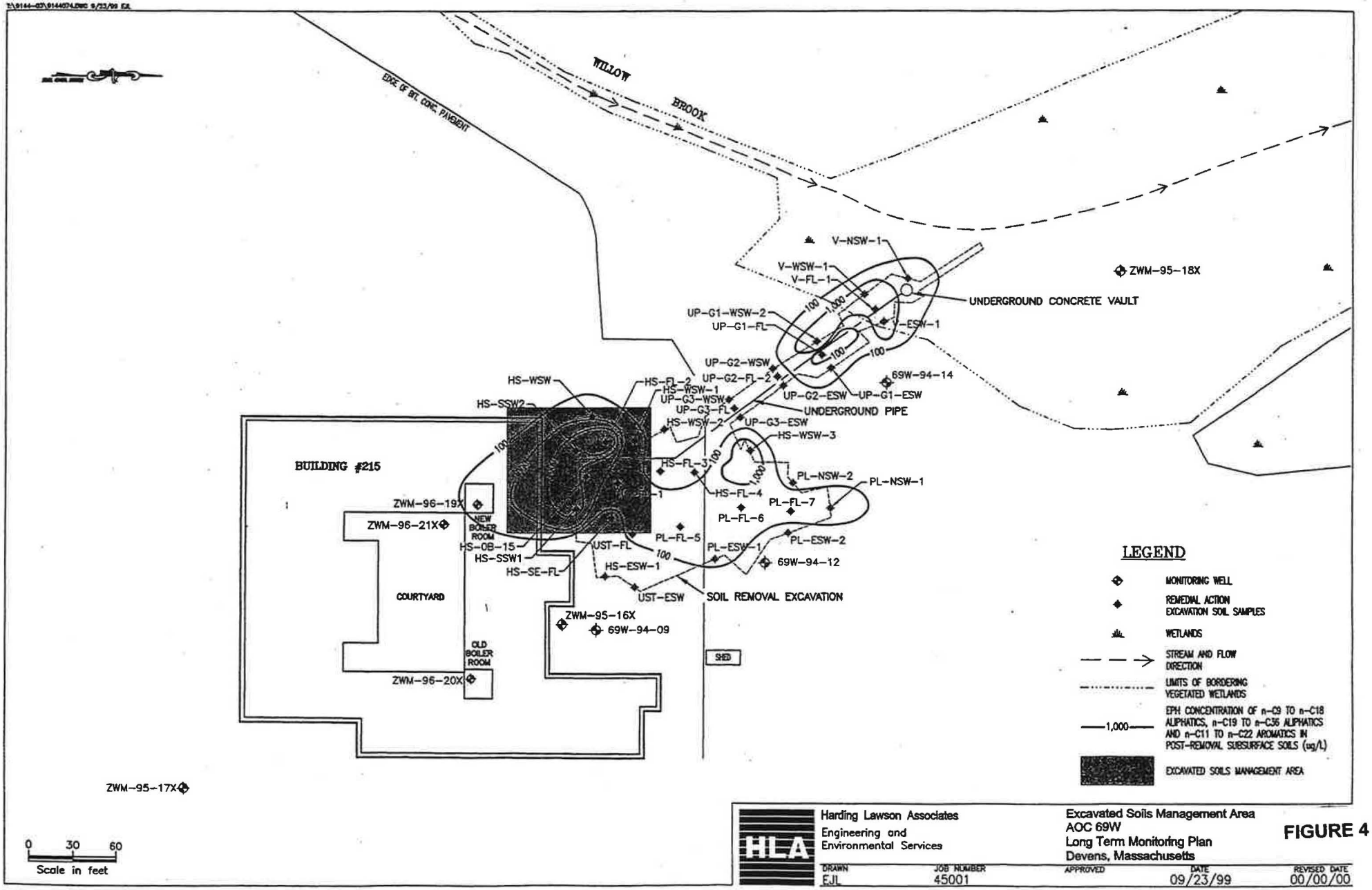

Harding Lawson Associates
Engineering and Environmental Services

Excavated Soils Management Area
AOC 69W
Long Term Monitoring Plan
Devens, Massachusetts

FIGURE 4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
EJL	45001		09/23/99	00/00/00