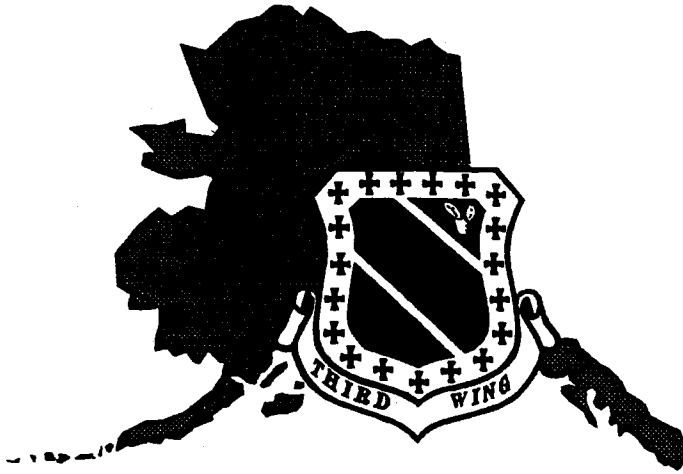


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**UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE, ALASKA**

ENVIRONMENTAL QUALITY PROGRAM

SERA PHASE VIII RELEASE INVESTIGATION REPORT
ST423/6/7/8, 381ST IS, UST AFID 755
DRAFT

FEBRUARY 2000

DP98000188

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LIST OF ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFID	Air Force Identification Number
ASTM	American Society for Testing and Materials
ATH	Ambient temperature headspace
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSRP	Contaminated Sites Remediation Program
cy	Cubic yard
DCE	Cis- or trans-1,2-dichloroethene
DRO	Diesel range organic
EAFB	Elmendorf Air Force Base
EPA	U.S. Environmental Protection Agency
ESF	Environmental Staging Facility
GRO	Gasoline range organic
HDPE	High-density polyethylene
IDW	Investigation-derived waste
LNAPL	Light nonaqueous-phase liquid
MRL	Method reporting limit
MS/MSD	Matrix spike/matrix spike duplicate
OU	Operable Unit
PAH	Polycyclic aromatic hydrocarbon
PCE	Tetrachloroethene
PID	Photoionization detector
POL	Petroleum, oil, and lubricants
ppm	Parts per million
QC	Quality control

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LIST OF ACRONYMS (Cont'd)

RRO	Residual range organics
SERA	State-Elmendorf Environmental Restoration Agreement
SVOC	Semivolatile organic compounds
TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TOC	Total organic carbon
TSDF	Treatment, Storage, and Disposal Facility
USAF	U.S. Air Force
USCS	Unified Soil Classification System
UST	Underground storage tank
VOC	Volatile organic compounds

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EXECUTIVE SUMMARY

ST423/6/7/8 (ST423) is the location of a former underground storage tank (UST) adjacent to Building 18224 at the 381st Intelligence Squadron. The 3,000-gallon tank, Air Force Identification Number (AFID) 755, held diesel fuel for the Squadron's backup generator. The UST was removed and replaced with a new tank in August 1995. Analytical results of soil samples collected from the excavation at the time of tank removal showed the site to be impacted by petroleum, oil, and lubricant (POL) products.

A release investigation was conducted at ST423 under the State-Elementendorf Environmental Restoration Agreement (SERA) Phase IV in 1996 and 1997 (15 borings drilled, 11 completed as groundwater monitoring wells), further indicating that the site was contaminated with petroleum hydrocarbons. The site was further investigated under SERA Phases VI, VII, and VIII to better characterize the nature and extent of contamination. During SERA VI, chlorinated solvent contamination was identified on site.

Soil sample results from investigations conducted between 1996 and 1999 indicate that petroleum hydrocarbons are present above the Alaska Department of Environmental Conservation (ADEC) Method Two soil cleanup level for diesel range organics (DRO; 250 mg/Kg) and benzene (0.02 mg/Kg). Toluene, ethylbenzene, xylenes, gasoline range organics (GRO), residual range organics (RRO), and polycyclic aromatic hydrocarbon (PAHs) have not been detected in soil in excess of their respective Method Two cleanup levels. Soil in the vicinity of the former UST was shown to contain DRO as high as 6,800 mg/Kg and benzene as high as 0.3 mg/Kg in 1996. The highest concentrations of DRO measured on site (up to 37,100 mg/Kg DRO) are present in a sand layer encountered approximately 150 feet downgradient of the former UST site and below the water table at approximately 25 to 30 feet below ground surface (bgs; the water table is at approximately 10 feet bgs in that area). High levels of DRO have also been detected in borings outside the facility fence line (up to 4,200 mg/Kg). With the exception of the sand unit, the extent of petroleum contamination has been delineated to the north-northwest, east, and south of the former UST site. The extent of the sand unit, the degree to which it is impacted, and the transport mechanisms by which petroleum hydrocarbons have reached the sand unit have not been fully investigated.

Groundwater level measurements collected between 1996 and 1999 show that free-phase petroleum hydrocarbons are consistently present on the water table in wells WL01 and WL03. All 12 on-site wells were sampled in 1999. Both petroleum hydrocarbons and chlorinated solvents were detected in the groundwater. Because ST423/6/7/8 is not within the Operable Unit 5 (OU5) Model Area, free-phase product and dissolved-phase contaminants must be addressed as part of the SERA investigation.

Possible sources of site contamination at ST423/6/7/8 have been identified. High concentrations of petroleum hydrocarbons remaining in the soil will likely continue to serve as a source of ongoing groundwater contamination.

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1.0 INTRODUCTION

This report presents the findings of the State-Elmendorf Environmental Restoration Agreement (SERA) Phase VIII release investigation at ST423/6/7/8 (ST423), Building 18224 (formerly Building 41-755) 381st IS Elephant Cage, on Elmendorf Air Force Base (EAFB). Figure 1-1 shows the location of ST423.

1.1 Report Outline

This report is divided into the following sections:

Section 1.0 provides an introduction to the report and describes the SERA program, applicable Alaska Department of Environmental Conservation (ADEC) regulatory requirements, the regional setting, site background, previous investigations, and site objectives.

Section 2.0 summarizes field methods employed in the release investigation. This section also discusses methods and standards used in data interpretation.

Section 3.0 describes the 1999 fieldwork and discusses all findings to date for the site.

Section 4.0 provides conclusions of the release investigation, identifies any remaining data gaps, and provides disposition recommendations for the site.

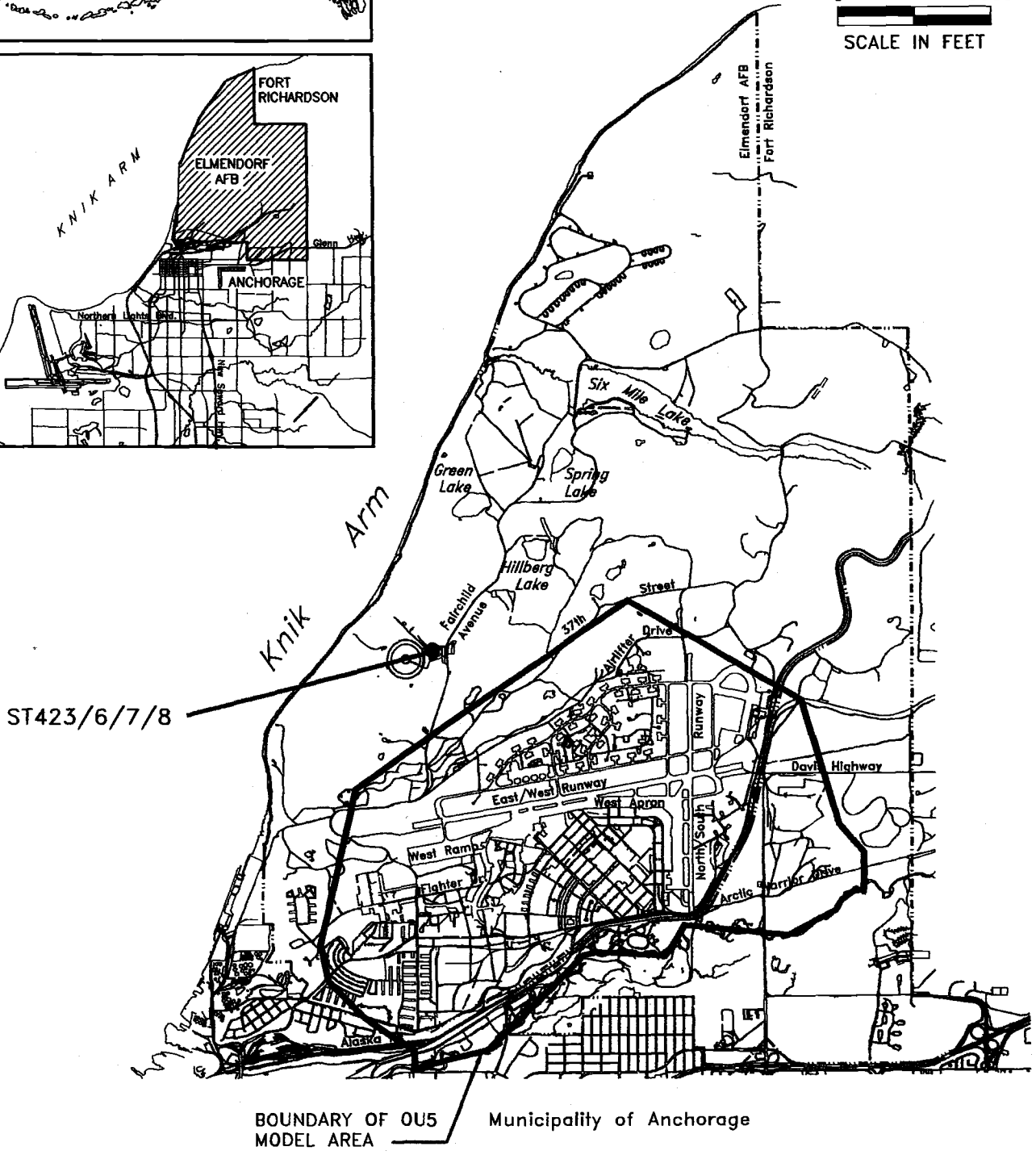
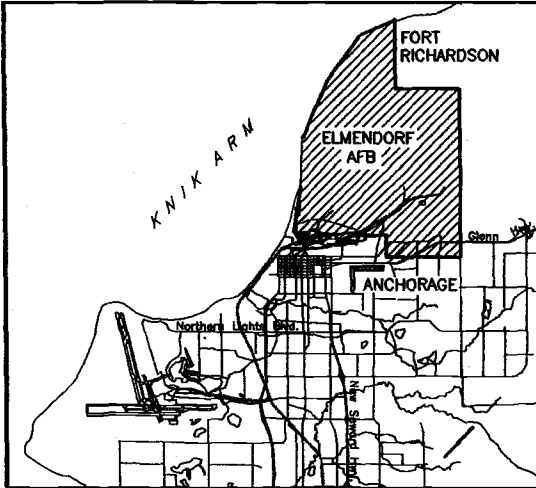
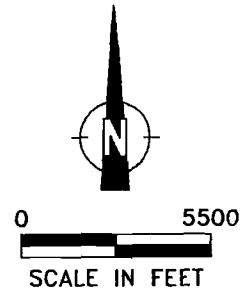
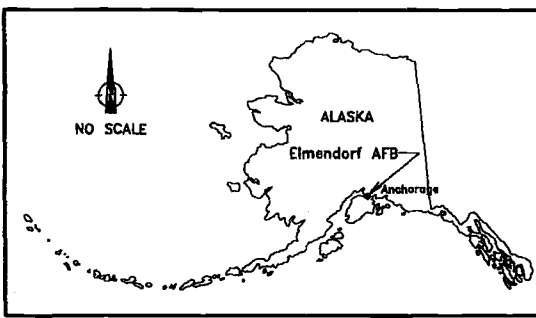
Section 5.0 presents a list of documents cited in this report.

The Data Assessment Report, which includes a discussion of data quality and chromatogram interpretations, is provided in Appendix A. Boring logs and analytical data for SERA VIII and previous phases are provided in Appendices B and C, respectively. Appendix D contains completed ADEC forms for the UST investigation. Photographs of the site are provided in Appendix E.

1.2 SERA

SERA is a cooperative agreement between the U.S. Air Force (USAF) and ADEC, signed in October 1992. SERA addresses EAFB's solid waste, underground storage tank (UST), and petroleum, oil and lubricant (POL) spill program areas, and does not include sites already addressed in EAFB's Federal Facility Agreement (sites subject to the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]). SERA requires EAFB to perform any necessary assessment, monitoring, remediation, and closure of solid waste, UST, and POL spill sites identified in SERA, as well as new sites identified subsequent to the issuance of SERA.

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FIGURE 1-1
ST423/6/7/8
SITE LOCATION MAP

3 CES/CEVQ
SERA VIII
ELMENDORF AFB, ALASKA
ENSR PROJECT #9010-049

The approach to SERA fieldwork is based on whether or not a site is located within the groundwater model area (Operable Unit 5 [OU5] Model Area) of the EAFB outwash plain (Figure 1-2). Because groundwater quality in the model area is already being monitored, SERA sites located within the model area typically do not address dissolved phase contamination. ST423/6/7/8 is not within the model area, and therefore the investigation must focus on both the presence of free product and understanding the nature and extent of dissolved phase and soil contamination.

1.3 ADEC Underground Storage Tank Regulations

For UST sites with a confirmed release of petroleum product, a release investigation must be performed in accordance with 18 AAC 78.235. ST423 is subject to the release investigation requirements of 18 AAC 78, including the soil and groundwater cleanup levels published in 18 AAC 75 commonly known as the Contaminated Sites Remediation Program (CSR).

The release investigation regulations require that after initial release abatement is complete, a release investigation is conducted to characterize the release and the actual or potential threat to human health and safety, and to the environment. If applicable to the site, the release investigation must include the following (with the applicability to the SERA program also noted):

- *Soil samples must be taken to adequately characterize the horizontal and vertical distribution of the release in the soil and to identify soil properties that are likely to influence the type and rate of migration.* Multiple investigations have been conducted at the site to satisfy this requirement.
- *Investigation of the site geology and hydrogeology must be conducted to adequately characterize the horizontal and vertical distribution of the release in groundwater and to identify the features that affect the fate and transport of the release.* Multiple investigations have been conducted at the site to satisfy this requirement.
- *Investigation of any surface waters must be conducted to adequately characterize significant hydrologic features such as surface drainage patterns and quantities, surface waters, floodplains, and actual or potential contaminant migration routes toward or within these features.* The site is located approximately ½ mile upgradient from Knik Arm (of Cook Inlet). During SERA VI a surface water pathway was observed in the area between sample locations HB-E and HB-F. Samples collected from the surface water were submitted for volatile organic compound (VOC) and semivolatile organic compound (SVOC) analyses. cis-1,2-Dichloroethene (cis-1,2-DCE) was the only analyte detected that was not also detected in an associated method blank; the reported concentration was 9.1 µg/L.
- *A hazard ranking evaluation must be conducted to measure the potential risk to human health and safety and to the environment.* The ADEC form "Underground Storage Tank Program Preliminary Risk Evaluation Form" is provided in Appendix D.

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SOURCE: Boundaries of Elmendorf End Moraine, and Regional Groundwater Flow Patterns South of Elmendorf Moraine Interpreted From:

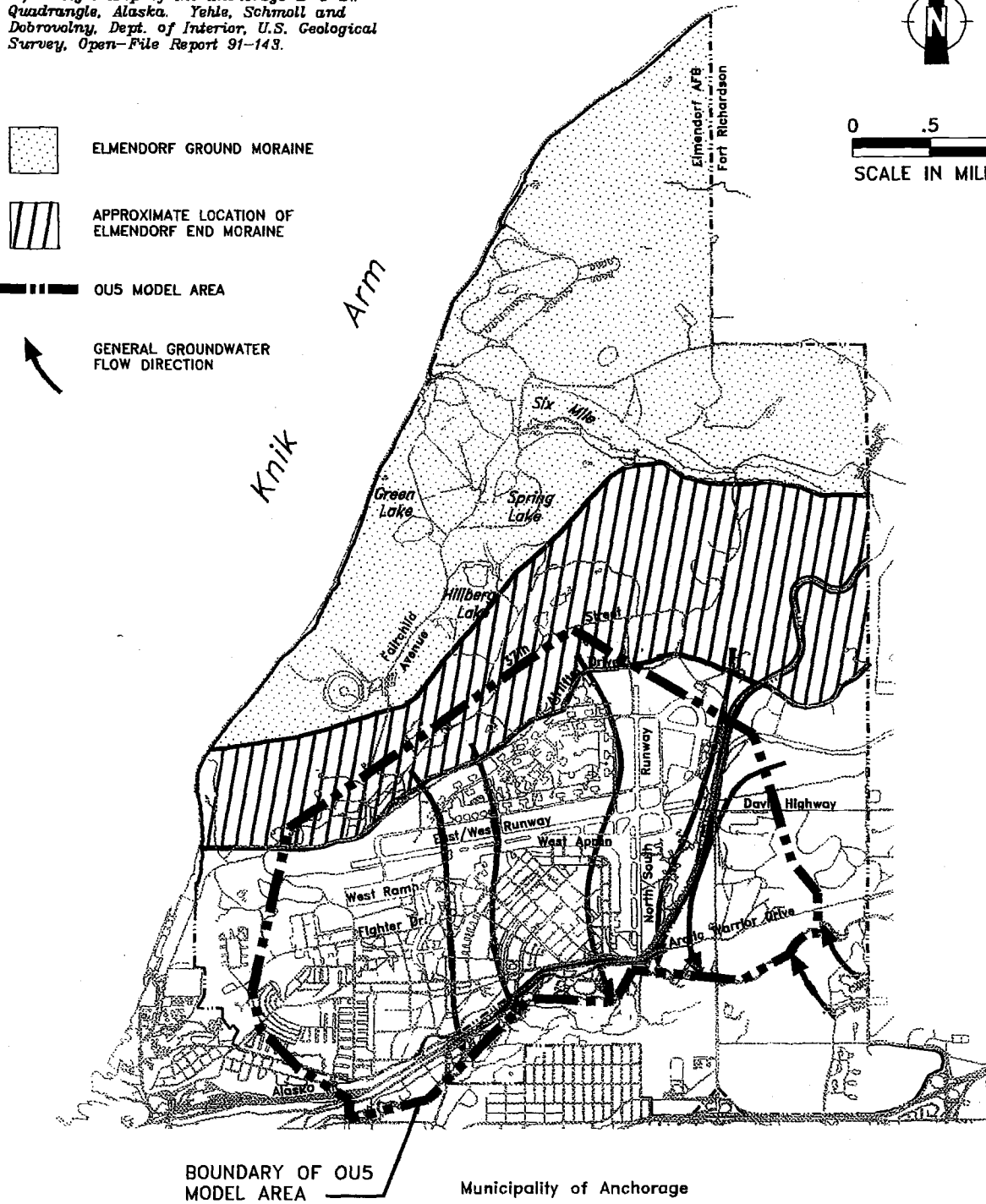
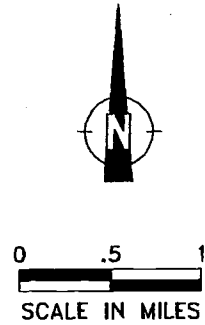
- 1.) CRREL 1997 Interim Draft, *The Glacial Geology and Stratigraphy of Fort Richardson: A Synthesis of The Hydrogeologic Framework.*
- 2.) Operable Unit 5, *Groundwater Modelling Report, December, 1994.*
- 3.) *Geologic Map of the Anchorage B-8 SW Quadrangle, Alaska.* Yehle, Schmoll and Dobrovolsky, Dept. of Interior, U.S. Geological Survey, *Open-File Report 91-143.*

 ELMENDORF GROUND MORAINE

 APPROXIMATE LOCATION OF ELMENDORF END MORAINE

 OUS MODEL AREA

 GENERAL GROUNDWATER FLOW DIRECTION



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FIGURE 1-2
REGIONAL GROUNDWATER
FLOW PATTERNS

3 CES/CEVQ
SERA VIII
ELMENDORF AFB, ALASKA
ENSR PROJECT #9010-049

1.4 Regional Setting

EAFB is located in Southcentral Alaska, along the head of Cook Inlet and adjacent to the City of Anchorage (Figure 1-1). EAFB comprises 13,130 acres, bordered to the north and west by Cook Inlet, to the east by Fort Richardson, and to the south by the City of Anchorage. Land use at EAFB is varied. Nearly half (6,053 acres) of the Base has been developed for airfield operations (runways, taxiways, and maintenance areas) and support operations, including housing and recreational facilities. The remaining acreage (7,077 acres) is mostly undeveloped and includes 1,416 acres of wetlands, lakes, and ponds.

EAFB lies within the Cook Inlet-Susitna Lowlands, which is bordered on the west by the Alaska Range and on the east by the Kenai, Chugach, and Talkeetna mountain ranges. The Elmendorf terminal moraine traverses the Base northeast to southwest. The southern boundary of the Elmendorf Moraine is a ridge line running along the north side of the east-west runway.

Groundwater flow is divided by the Elmendorf Moraine. Regional groundwater flow north of the moraine is to the northwest towards Knik Arm of Cook Inlet. Regional groundwater flow south of the moraine is south and west toward Ship Creek. ST423 is located on the north side of the Elmendorf Moraine and is not in the OU5 Model Area. The general groundwater flow direction from this site is northwest, towards Knik Arm. Information on localized groundwater flow is included in Section 3.2.2. Figure 1-1 shows the location of ST423 on EAFB, and Figure 1-2 shows the regional groundwater flow on EAFB.

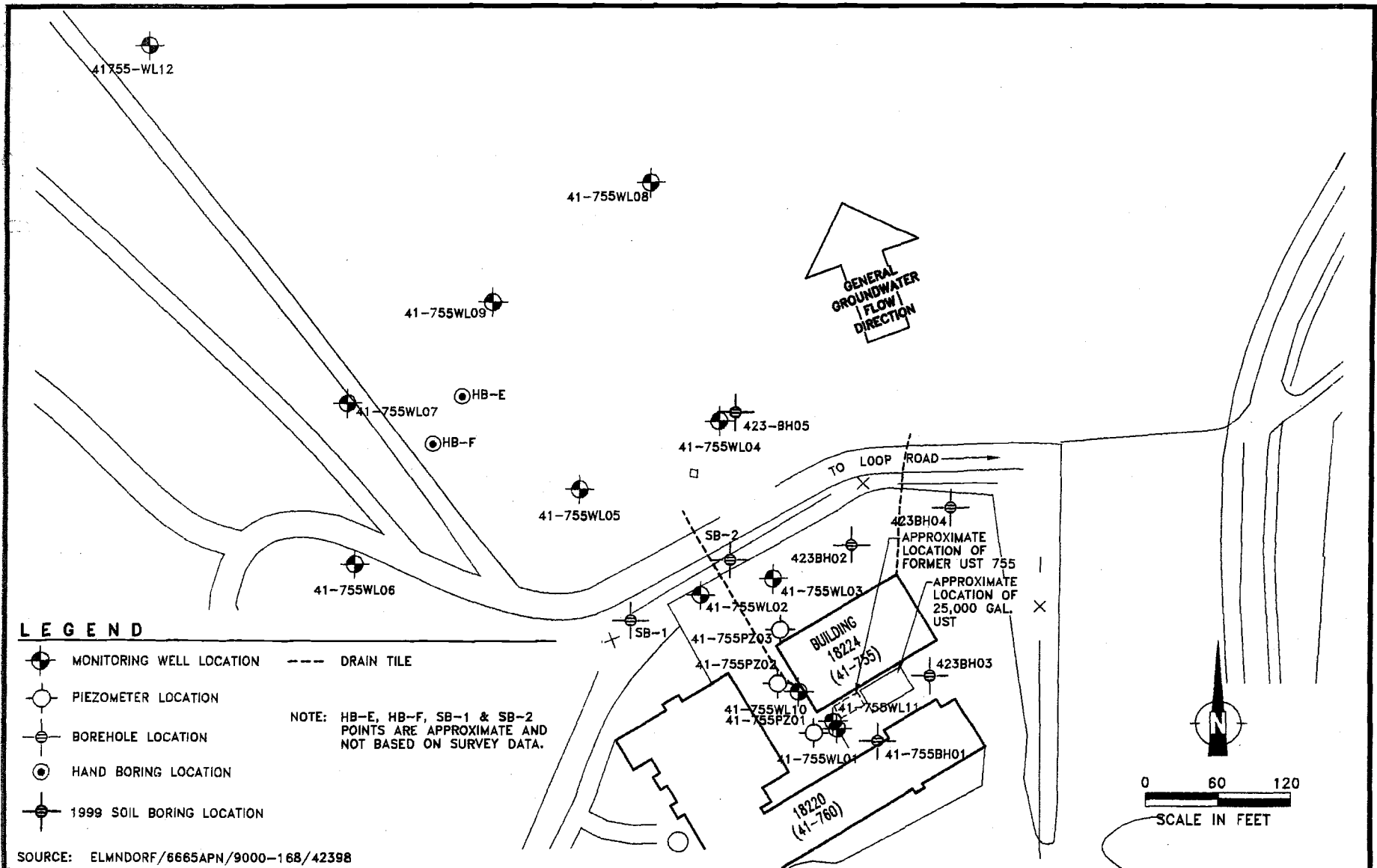
1.5 Site History

ST423 is the location of a former 3,000-gallon steel UST immediately south of Building 18224 (formerly Building 41-775, the 381st Information Squadron [IS] boiler facility plant/garage). Figure 1-3 shows the site layout. The tank was identified as AFID 755. The 3,000-gallon UST had been used to store diesel fuel for the emergency generator at Building 18224. The UST was removed and replaced with a new 4,000-gallon UST in August 1995. Piping between the UST and Building 18224 was abandoned in place by crimping and taping the ends (USAF 1995).

Soil samples were collected from the excavation at the time of UST removal. An ADEC matrix score cleanup Level B was determined for the site at the time of tank removal. Three of the four soil samples collected from the excavation exceeded the ADEC Level B cleanup level for diesel range organics (DRO), with the highest concentration of DRO reported at 9,700 mg/Kg. A 25,000-gallon diesel fuel UST (referred to as AFID 756 and/or STMP458) is located immediately to the northeast of the former 3,000-gallon UST site and is still in place (due to a large transformer located above the UST), but all fuel has been removed from this tank.

A review of as-built drawings of Building 18224 shows that a drainage tile ("french drain") system is in place around the perimeter of the building and discharges via two drain pipes (shown in Figure 1-3). Drain tiles are set approximately 3 feet below ground surface (bgs) in

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FIGURE 1-3
 ST423, 381st IS
 SITE LAYOUT

3 CES/CEVQ
 SERA VIII
 ELMENDORF AFB, ALASKA
 ENSR PROJECT #9010-049

gravel backfill around the entire building. A second, deeper drain tile (11 feet bgs) is located at the southwest corner of the building, corresponding to the portion of the building that has a basement. This drainage tile/pipe system and its gravel backfill may have acted as a contaminant migration pathway (USAF 1999a).

As-built drawings reveal that the floor drainage network inside the former garage area of Building 18224 connects to the drainage tile/pipe system. As-built drawings show catch basins in four floor drains, a wash rack, and a "grease pit" leading to a grease and oil interceptor (a weir-type oil/water separator). Drawings further show that underflow from the interceptor discharges to the building's drainage tile/pipe system. POL and other contaminants could have exited the interceptor if it was not operating properly or if waste streams not suitable for the interceptor (e.g., streams denser than water) entered the interceptor. Based upon this review of as-built drawings and knowledge of past vehicle maintenance activities inside Building 18224, it is possible that contaminants from these activities have impacted the subsurface at ST423 (USAF 1999a).

During SERA Phase VI fieldwork in 1997, a suspected disposal area was discovered northwest of Building 18224, where an empty 55-gallon drum, 5-gallon pail, and other debris were observed (USAF 1998a).

A review of drawings for the 381st IS main building (18220, formerly Building 41-760) shows that the basement of the building contained a hobby shop, mechanical room, laundry, and kitchen facilities. Floor drains throughout the basement discharged to the building's sanitary sewer system, which discharged to a sewage lagoon located approximately 1,300 feet northwest of Building 18220. Treated effluent from the lagoon, as well as overflow, discharged to Knik Arm. A drainage tile system similar to that for Building 18224 is in place around and under the foundation of Building 18220. Drain pipes from Building 18220's drainage tile system are oriented in four directions: one pipe discharges to the ditch south of the building; one pipe discharges to the ditch east of the building; and two pipes discharge to the hillside immediately northwest of the building (refer to Table 1-1). Drawings for Building 18220 show that two fuel tanks may have been installed near the northwest side of the building. Neither of these tanks would be suspected of contributing to the contamination observed in the area, and downgradient, of ST423.

A review of drawings, discussions with EAFB personnel, and a search of the ADEC UST database indicates there are inconsistencies in the names of the tanks, the capacity of the tanks, and their current status. The ADEC database has only three tanks listed for the buildings, and discussions with EAFB personnel and review of drawings indicates five tanks. Table 1-1 summarizes the available information.

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Table 1-1. Summary of Underground Storage Tanks at ST423/6/7/8.

AFID No.	STMP No.	ADEC Tank ID No.	Tank Volume (gal)	Comments
755	457	none	3,000	Removed in 1995.
755A	none	97	4,000	Installed in 1995 to replace 3,000-gallon tank.
756	458	232?	25,000	Out of service but still in place under transformer on south side of Building 18224. This tank failed a tightness test conducted in July 1997. Tank has also been referred to as 12,000 gallons in capacity. In a SERA VI report (USAF 1998a), a figure shows a 12,000 gallon UST on the <u>north</u> side of Building 18224. However, in ENSR's subsequent review of as-built drawings for the facility, no drawings ever showed an UST on the north side of the building. The figure in USAF 1998a is likely in error. ADEC tank inventory shows the following: tank ID no. 232 as 12,000 gallons, with AFID of 755; tank installed in 1951, last used in 1994.
760	456	none	10,000	EAFB STMP shows tank as 10,000 gallons. Tank passed tightness test in July 1994. Tank scheduled for removal. As-built drawings (1959) show this tank as being near the northwest corner of Building 18220 and as being 5 feet 4 inches in diameter and 9 feet in length, which corresponds to approximately 1,500 gallons.
762	none	382	550	Design drawings (not "as-built") show tank located on northwest side of Building 18220, associated with a "document disintegration system," and having a capacity of 1,000 or 2,000 gallons. ADEC tank inventory shows tank capacity as 550 gallons; also states that tank was removed from ground, last used 12/15/98.

1.6 Previous Investigations

To date, ST423 has been investigated under several phases of SERA, with the various phases focused on separate source areas and contaminants. The following is a brief summary of the investigations and their focus. To improve readability, the prefixes used in the sample location identifiers, either "41-755" or "423" have been omitted in the text, although they are still included on figures and in tables. In general, the various phases of SERA investigation at this site have been focused as follows:

- SERA Phase IV focused on petroleum hydrocarbon contamination associated with one or more UST sources located in the vicinity of the boiler plant/garage, Building 18224. Investigative fieldwork was conducted both inside and outside of the fenced yard surrounding this building.
- SERA Phase VI better delineated the petroleum-impacted soil and groundwater downgradient of the source areas and outside the facility fence line, and identified chlorinated solvent contamination on site.
- SERA Phase VII concentrated on better defining the extent of petroleum-impacted soil within the facility fence line.

1.6.1 SERA Phase IV

In 1996, the SERA IV release investigation at ST423 consisted of drilling 13 borings, including installation of 9 groundwater monitoring/air injection wells and 3 soil gas monitoring arrays (one boring was grouted following sampling). Soil analytical results showed that petroleum hydrocarbons were present at high concentrations in the vicinity of the former UST and downgradient: notably, up to 37,100 mg/Kg DRO, 616 mg/Kg gasoline range organics (GRO), and 20.27 mg/Kg benzene. One boring drilled upgradient of the former UST did not exceed any pertinent cleanup levels and therefore provided partial delineation to the south-southeast.

During the 1996 investigation, groundwater samples were collected from 7 of the 9 new wells and analyzed for DRO, GRO and BTEX compounds (USAF 1997). Groundwater contamination at this location was found to be in excess of Category B cleanup levels and was not fully delineated. Free product was found to be present on the water table at this site at locations WL01 and WL03 (USAF 1998b). The extent of free product was defined to the south of the former UST site, but was not delineated to the north/northwest or east. A Petropore® passive product recovery system was installed in monitoring well WL01 as part of a product recovery evaluation. The evaluation concluded that product recovery was sustainable and a larger diameter, higher capacity recovery system would likely increase product recovery rates. Use of the passive product recovery system in place at WL01 was discontinued during spring break-up in 1997 to prevent incidental migration of surface runoff to the well.

Work continued at this site under SERA Phase IV in 1997, when two 4-inch diameter recovery wells (WL10 and WL11) were installed near the former UST location (AFID 755) primarily to

better evaluate the potential for free product recovery using an active skimmer system. A Petropore® passive recovery system was installed in one of the wells, and an active recovery system (Spillbuster® skimmer) was installed in another of the 4-inch wells. This system was operated until September 1997 but recovered little product. The active system was replaced with the Petropore® system in October 1997 due to snow removal/freezing concerns (USAF 1998b).

Based upon water level data collected during the 1997 SERA IV investigation, groundwater was estimated to be at 4 to 10 feet bgs in the immediate vicinity of the former UST location and at 6 to 16 feet bgs northwest of Building 18224 (USAF 1999a).

1.6.2 SERA Phase VI

Additional fieldwork was conducted in 1997 and 1998 under SERA Phase VI to further define the extent of downgradient petroleum hydrocarbon contamination.

In 1997, 62 Gore Sorber® passive sorbent collection devices (sorbers) were installed 3 feet bgs on a 50-foot grid and were analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX). Sorber results showed two discontinuous areas of elevated TPH and BTEX soil vapor concentrations, one area approximately 100 feet northwest of Building 18224 and the other approximately 430 feet northwest, near the downgradient monitoring wells. The sorbers were reanalyzed for chlorinated solvents following the discovery of a possible disposal area in the northwest portion of the site. Re-analysis of the sorbers revealed the presence of trichloroethene (TCE), tetrachloroethene (PCE), cis- and trans-1,2-dichloroethene (DCE), and 1,1,1-trichloroethane (TCA). The areas exhibiting elevated chlorinated solvent vapor concentrations were adjacent to and northwest of Buildings 18220 and 18224, as well as near the suspected disposal area farther northwest of the site. The source of chlorinated solvent contamination immediately north of Buildings 18220 and 18224 was not theorized.

After evaluating the sorber data, a sampling program was implemented to confirm the soil gas sampling results and better determine the extent of contamination. Two soil borings were drilled just outside the facility fenceline and were analyzed for petroleum hydrocarbons. Results showed elevated concentrations of DRO and residual range organics (RRO) at depths of up to 4.5 feet bgs; elevated DRO was found in the 10- to 12-foot-bgs interval and was interpreted as being associated with groundwater (USAF 1998a). Two shallow borings were hand augered to approximately 5 feet bgs in the suspected disposal area and sampled for petroleum hydrocarbons and VOCs. High concentrations of DRO (7,500 and 42,000 mg/Kg) were detected in these samples; of the chlorinated VOCs, only cis-1,2-DCE was detected at a low concentration (0.17 mg/Kg).

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Groundwater samples from four downgradient wells (WL06, WL07, WL08, and WL09) were collected in 1997 and analyzed for VOCs and SVOCs. Chlorinated solvents – including TCE, TCA, and DCE – were detected in only one of the wells sampled (WL08; USAF 1998a).

In 1998, one soil boring, completed as a groundwater monitoring well (WL12), was installed approximately 740 feet downgradient from Buildings 18224 and 18220 to assess if contaminant migration was occurring and to expand the network of downgradient wells. One soil sample from this boring (6 to 8 feet bgs) was submitted for analysis of petroleum hydrocarbons, VOCs, and SVOCs. Methylene chloride (0.027B mg/Kg) and 2-butanone (0.003J mg/Kg) were the only analytes detected in this sample, but methylene chloride was also found in the associated laboratory method blank, and 2-butanone was detected at an estimated concentration below the analytical reporting limit. Primary and duplicate groundwater samples were collected from this well and analyzed for DRO, RRO, polycyclic aromatic hydrocarbons (PAH), and VOCs. DRO and RRO were detected at concentrations below the ADEC groundwater cleanup levels. No VOCs, BTEX, or PAHs were detected in this sample (ADEC 1999b).

1.6.3 SERA Phase VII

ST423 was further investigated under SERA Phase VII in 1998, with the goal of filling data gaps identified under SERA Phase IV. Three borings were drilled to the east and northeast of the existing boreholes to better delineate the extent of contamination in these directions. In several borings, a sand layer was encountered below the water table at approximately 25 to 30 feet bgs (the water table is at approximately 10 feet bgs in that area). This sand unit was found to contain the highest levels of DRO and is overlain by soils that contain significantly lower concentrations (USAF 1999a).

With the exception of the sand unit, the extent of petroleum contamination appeared to be adequately defined to the north-northwest, east, and south of the former UST site, when considering data obtained during SERA Phases IV, VI, and VII. The extent of the sand unit, the degree to which it is impacted, and the transport mechanisms by which petroleum hydrocarbons have reached the sand unit are not fully understood.

Groundwater level measurements during SERA Phase VII indicated that free-phase product was present on the water table in wells WL01 and WL03. Local groundwater flow was calculated to be to the northwest at a gradient of 0.061 foot/foot. Groundwater samples were not collected during this investigation.

1.6.4 Exceedances of Cleanup Levels

Soil. Data from the SERA IV, VI, and VII investigations were compared to the ADEC Method Two levels (18 AAC 75.342, Tables B1 and B2, under 40 inch zone). The exposure pathway – inhalation, ingestion, or migration to groundwater – with the most stringent value was chosen for comparison with the analytical results.

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Soil sample results from investigations conducted between 1996 and 1998 indicated that petroleum hydrocarbons were present above the ADEC Method Two soil cleanup level for DRO (250 mg/Kg) and benzene (0.02 mg/Kg) in the vicinity of, and downgradient from, the former UST. Toluene, ethylbenzene, xylenes, GRO, RRO, and PAHs were not detected in soil in excess of their respective Method Two cleanup levels. The two soil samples collected from the suspected disposal area (under SERA Phase VI, 1997) showed that low concentrations of VOCs (including cis-1,2-DCE) were present in the soil, but below ADEC Method Two cleanup levels.

Soil in the vicinity of the former 3,000-gallon UST (AFID 755) was shown to contain DRO as high as 6,800 mg/Kg and benzene as high as 0.3 mg/Kg in 1996. Downgradient of the former UST, the highest concentrations of DRO were measured on site at up to 37,100 mg/Kg in the sand unit below the water table. High levels of DRO were also detected in borings outside the facility fenceline (up to 42,000 mg/Kg in the suspected disposal area).

Groundwater. Data from the SERA IV and VI investigations were compared to the ADEC Method Two groundwater cleanup levels (18 AAC 75.345, Table C). During sampling of wells in 1996, four wells downgradient of the former UST site contained DRO ranging from 1.7 to 30.6 milligrams per liter (mg/L; WL02, WL04, WL05, and WL07), exceeding the ADEC groundwater cleanup level of 1.5 mg/L. Well WL07 was one of the most downgradient wells at the time. The groundwater cleanup level for GRO (1.3 mg/L) was exceeded in one well (WL02).

In 1997, the wells downgradient of the site (WL06, WL07, WL08, and WL09) were sampled and analyzed for VOCs and SVOCs. Several VOCs, including chlorinated solvents, were detected only in WL08; however, only TCE (measured at 0.00996 mg/L) was found in excess of its groundwater cleanup level (0.005 mg/L).

In 1998, well WL12 was installed and sampled for GRO, DRO, RRO, BTEX, VOCs, and PAHs. Only DRO and RRO were detected, but below the corresponding groundwater cleanup levels.

1.7 Objectives of SERA VIII Investigation

Site characterization data gaps were identified based upon previous years' findings. The resulting objectives for SERA VIII investigation were to:

- Further investigate the extent of the sand unit and the degree to which it has been impacted by contaminants. Sampling conducted inside the facility fenceline during the SERA IV and VII investigations showed that the highest concentrations of petroleum hydrocarbons measured on site are in this sand unit, and the extent of contamination in this unit had not yet been defined.
- Evaluate current petroleum hydrocarbon and VOC concentrations in groundwater.
- Review existing reports and drawings to determine if any ongoing source of contamination remains at this site (e.g., additional USTs).

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- Fill data gaps as needed to develop a site disposition recommendation.

The SERA Phase VIII soil investigation focused only on filling data gaps associated with petroleum hydrocarbon contamination. Subsequent investigation of chlorinated solvents in soil at this site will be conducted under a different EAFB environmental program.

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2.0 FIELD METHODS

This section summarizes the field methods that were used in the 1999 SERA VIII Release Investigation. The Work Plan (USAF 1999b) was prepared following the guidelines of SERA, ADEC regulations in 18 AAC 75 and 18 AAC 78, and Basewide policies and procedures for fieldwork at EAFB as applicable to environmental compliance projects. Deviations from the Work Plan and rationale behind sample locations are included in Section 3.0.

2.1 Initial Activities

The field program was designed to address data gaps identified during previous investigations (e.g., SERA VII). One of the primary data gaps was the extent of a sand layer that had been identified as a possible transport mechanism for contamination. A review of available site geology and contaminant distribution was used to identify the optimal location for the soil boring to encounter the sand unit. Utility clearances were obtained for the site prior to drilling; personnel escorts or clearances were arranged for each sampling activity prior to entering the site.

2.2 Borings

One soil boring was advanced during the 1999 investigation. Sampling intervals and total depth of the boring were determined based on available knowledge of site geology (i.e., where the sand layer was most likely to be found).

Field screening measurements were made on each sample collected; the field screening procedure is further described in Section 2.3.1. The soil borings were advanced using a truck-mounted, hollow-stem auger drilling rig. The cuttings from the soil borings were placed in 55-gallon drums and disposed of as outlined in Section 2.6.

2.3 Sampling Procedures

2.3.1 Soil Sampling

Soil samples were collected from either a 2-inch or 3-inch outer-diameter split-spoon sampler advanced ahead of the auger flights. In general, samples were collected from 5 feet below grade to a depth of 20 feet at 5-foot intervals. Samples were then collected continuously (every 2 feet) to 32 feet bgs, and then again at 5-foot intervals. The last sample interval was 40 to 42 feet bgs. Samples collected for non-volatile organic analyses (i.e., DRO) were homogenized prior to placement in sample jars. Samples collected for volatile organic analysis were not homogenized and were transferred directly to the appropriate containers. Samples were immediately placed in a cooler with freeze packs and maintained at approximately 4°C while awaiting results of the ambient temperature headspace (ATH) analysis.

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All soil samples were field screened using the ATH method, as follows. A clean 250-mL or larger resealable plastic bag was partially filled (one-third to one-half) with soil immediately after opening the split-spoon. Headspace vapors were allowed to develop in the bag for at least 10 minutes but less than 1 hour. The container was agitated for 15 seconds at the beginning and end of the headspace development period to assist volatilization. The container was maintained at a minimum temperature of approximately 40°F. The probe of the field screening instrument, a photoionization detector (PID) with a minimum ionization potential of 10.2 eV, was then side-punched into the bag, to a point about one-half the headspace depth. Care was taken to avoid uptake of water or soil. The highest meter reading (2 to 5 seconds following insertion) was recorded on the soil boring logs at the appropriate depth. Erratic meter responses were noted on the boring logs.

Two samples from the boring were sent to the laboratory for chemical analysis; three samples were submitted for grain size analysis. The samples were chosen based on ATH screening results and field observations (e.g., staining, odor) to best delineate the vertical extent of contamination. Samples not chosen for laboratory analysis were placed with the soil cuttings awaiting final disposition. Table 2-1 summarizes sample analyses and laboratory methods.

Table 2-1. Sample Analytical Summary for ST423/7/8.

Analyte	Method	Number of Samples
Soil		
DRO	AK 102	2
GRO	AK 101	2
VOC	EPA 8260B	2
Grain Size	ASTM D422	3
Groundwater		
DRO	AK102	12
GRO	AK101	12
VOC	EPA 8260B	12
Note: Does not include Quality Assurance, Quality Control, or Blank Samples.		
Key: ASTM = American Society for Testing and Materials. EPA = U.S. Environmental Protection Agency.		

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Soil samples were placed in containers in the following order: 1) VOC, 2) GRO, 3) DRO, and 4) soil classification. Soil samples analyzed for GRO and VOCs were collected by transferring approximately 25 grams of soil into 4-ounce, wide-mouth jars preserved with methanol (one for each analysis). An additional 25 mL of methanol was added if the soil sample was not completely submerged in the methanol, and the extra methanol was noted on the sample log. No additional labels were added to the pre-tared GRO and VOC jars. Percent moisture determinations for DRO samples were used for the corresponding GRO/VOC samples.

2.3.2 Groundwater Sampling

Groundwater samples were collected using disposable polyethylene (PE) tubing fitted with a foot valve. The monitoring wells were purged prior to sampling to ensure that any stagnant water was removed. Prior to sampling, depth to groundwater was measured with an interface probe or a water level indicator to an accuracy of 0.01 feet. Once a minimum of three casing volumes of water was removed from the well and water temperature and conductivity were within 10 percent variability between measurements and pH was within +/- 0.1 units, the well was considered ready for sampling. Turbidity measurements were also collected and recorded during purging. Groundwater samples were collected after the well had been allowed to equilibrate and fines had settled. The water level was remeasured after purging had occurred and water level had returned to stasis. All sampling apparatus were handled by personnel wearing disposable gloves.

Water was transferred directly from the sampling device into appropriate containers in the order of the analyte volatility. Containers for analysis of VOCs and GRO were filled to a positive (convex) meniscus, capped, inverted, and lightly tapped after capping to ensure no bubbles were present.

2.3.3 Field Quality Control Samples

The following field quality control (QC) samples were collected:

- Field duplicates were collected at a rate of 10 percent for the entire SERA VIII field program. Field duplicates were submitted "blind" to the laboratory.
- Rinsate blanks (equipment blanks) were collected by rinsing the split spoon or foot valve with deionized/distilled water following decontamination and collecting the rinsate.
- One sample of deionized/distilled water was collected during the field mobilization by pouring directly from the original deionized/distilled water container.
- Laboratory-prepared trip (transfer) blanks of analyte-free media accompanied each batch of aqueous samples submitted for VOCs.

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- Two methanol trip blanks were submitted for GRO/BTEX analysis over the course of the fieldwork.
- Matrix spike/matrix spike duplicate (MS/MSD) samples were collected at an overall rate of 5 percent for the entire project.

2.3.4 Field Sample Identification

Samples collected during this field investigation were each assigned a unique field sample identification code and labeled accordingly. This system was developed to allow for sample control of the large number of samples that were collected during this and any following investigations. Each sample identification number consisted of a three-segment alphanumeric code that identifies the sampling location, the sample identifier, the type of sample, and the QC identifier. The sample numbers were defined as follows:

- 1) Site Designation. The first segment of the sample identification number is the SERA program site number (3 digits).
- 2) Location Designation. The next four characters represent the location within the sites where the samples were obtained, namely: AANN, where A = alpha code designating the type of sample, and N = the sequential number assigned. The following codes were used during this investigation:
BH = Borehole
WL = Well
- 3) Matrix Code. The next two characters indicate the sample matrix. The following are some of the codes that were used during this investigation:
SO = Soil
GW = Groundwater
WQ = Water Quality Control Matrix
- 4) Sample Depth. For soil samples only, the next set of numerals indicate the depth below the surface to the top of the soil sample collection interval in feet and tenths of feet (e.g., 2.5 or 17.5). Field duplicate samples were given a fictitious depth, typically 0.0, so that the laboratory was unaware of which primary sample it duplicated.
- 5) Sample Type. The next set of characters represents the field sample type. The following are some of the codes that were used during this investigation:
N# = Normal Environmental Sample
EB# = Equipment Blank
FD# = Field Duplicate

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The # symbol represents a numeral that was sequentially assigned by additional sample types collected from one location. Laboratory matrix spike and matrix spike duplicates on a single sample were identified together as an MS/MSD sample type. For example, a soil sample collected from borehole 5 at site ST423, from 13 to 15 feet bgs would be numbered:

423BH05SO13.0N1

Each sample container was labeled with the project number, site name, sample number (field sample identification code), date and time of sample collection, any preservatives used, analyses requested, and sampler name.

2.3.5 Sample Packaging and Shipping

Plastic bubble wrap was used to line the bottom of shipping coolers. The samples were placed in individual resealable plastic bags and wrapped in plastic bubble wrap prior to placement in the coolers. Samples were placed upright in coolers. Completed chain-of-custody forms were placed inside a resealable plastic bag and secured to the inside of coolers. Space between samples in the coolers was filled with packing material so that samples were protected and movement was limited. Cold packs were placed around and on top of the samples to maintain a temperature goal of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Coolers were sealed with chain-of-custody tape on the front right and back left corners. Prior to sealing the coolers, the chain-of-custody tape number was recorded on the chain-of-custody form. Packaging tape was placed around the cooler using a minimum of two full wraps.

When a transfer of samples occurred, the chain-of-custody form was completed with the name of the person relinquishing the samples; the person receiving the samples signed and dated the form. Copies of any shipping documentation were also retained for the project files.

Sample coolers were shipped by Federal Express delivery to Columbia Analytical Services, Inc., 1317 South Avenue, Kelso, WA.

2.4 Field and Sample Custody Documentation

Field documentation contains information pertinent to the field sampling program and the equipment preparation efforts. Field documentation was recorded in a bound logbook and entries were made in indelible ink. Corrections to any documentation were made by drawing a single line through the incorrect entry and initialing the correction. No documentation pages were removed from any field logbooks.

Field documentation was maintained by the field team data manager during field activities and transferred to the project files for a record of sampling.

Field and sample custody documentation consisted of the following:

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- *Field activity logbook.* This logbook was assigned to field team members to summarize daily field activities and to document required field briefings (such as health and safety briefings); to record the field team's activities and observations; to document any unusual occurrences affecting the overall project, weather conditions, etc.; to document equipment calibration; and to document subcontractor activities.
- *Boring log.* The boring log includes the following documentation: the name of the drilling subcontractor; drilling method; rig type and size; equipment diameter; boring number; blow counts; boring diameter; sampling depths; descriptions of lithology; headspace screening results; and any other observation relevant to the investigation. Soil samples were classified using the Unified Soil Classification System (USCS) and were described per American Society for Testing and Materials (ASTM) D-2488, including color, texture, moisture content, grain texture, sedimentary features, staining, and odors noted during field activities.
- *Groundwater sample collection records.* Records were completed during well sampling and include information on depth to water, total depth of well, purge volumes and water quality parameters.
- *Electronic sample log.* The sample log accounted for all samples collected and provided a basis for sample tracking.
- *Chain-of-custody records.* Chain-of-custody record forms were completed for each sample originating from a single site. The chain-of-custody forms summarized sample information (project, sample location, date and time of sampling, sample identifier, and analyses required) and provided a complete record of sample custody, from the point of sampling through receipt by the analytical laboratory. Samples not submitted to the analytical laboratory were not included on the chain-of-custody forms and remained under ENSR's custody until the samples could be deposited in associated drums of soil cuttings to be managed as described in Section 2.6.
- *Photography.* Photographs were taken of soil samples that showed contamination or sedimentary features. Photographs were also taken of any unusual conditions that were encountered. The location, time, film frame and roll number, and brief description of the photograph was recorded in the field logbook or the boring log.

2.5 Decontamination

All field equipment coming in contact with potentially contaminated soil or used for sampling was decontaminated before and after use. Clean, solvent-resistant gloves were worn by persons decontaminating tools and equipment. Soil sampling tools, including split spoons, were cleaned by the following process:

- 1) scrubbed with a brush in clean water
- 2) scrubbed with a brush in a solution of Alconox and water

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- 3) rinse twice in clean water
- 4) rinse with deionized and/or distilled water

Specific decontamination procedures for various types of field equipment are as follows:

- Auger flights, rods, and bits were decontaminated by cleaning with high pressure hot water at the beginning of the project, between boreholes, and before moving off site at the end of the field investigation.
- Well sounders, steel tapes, and water quality probes were washed with an Alconox solution, then rinsed with deionized water, and allowed to air dry.
- Personnel decontamination procedures followed the procedures presented in the Site-Specific Health and Safety Plan, Appendix B in the Work Plan (USAF 1999b).

2.6 Disposition of Investigation-Derived Waste

Because of the potential presence of chlorinated solvents at this site, soil cuttings generated during the investigation at ST423 were handled as potentially hazardous waste. Drums of investigation-derived waste (IDW) associated soil were labeled with permanent marker to show the date and time of sampling, soil boring location and depth, contents, a drum identification number, and the EAFB point of contact. The containers of soil were transported to the Environmental Staging Facility (ESF) for storage pending hazardous waste characterization. Staging and waste characterization were conducted according to the SERA VIII Work Plan (USAF 1999b). Final disposition was based on analytical data from boring- and well-specific soil and/or water samples.

One drum containing soil cuttings from borehole BH05 was identified as F-listed hazardous waste and was turned in to the EAFB Treatment, Storage, and Disposal Facility (TSDF) for subsequent management and disposal.

Decontamination water and water produced during sampling of monitoring wells was drummed in 55-gallon bung-top drums and handled as potentially hazardous waste. Drums of IDW water were labeled with permanent marker to show the date and time of sampling, monitoring well location(s), contents, a drum identification number, and the EAFB point of contact. IDW water drums were transported to the ESF for storage pending hazardous waste characterization. Staging and waste characterization were conducted according to the SERA VIII Work Plan (USAF 1999b). Based on a review of the analytical data, EAFB concluded that the five drums of IDW water generated at ST423 could be appropriately processed and disposed of through the IDW water conditioning system at the EAFB ESF. Free-phase product was separated from the water prior to processing. The product remains at the ESF pending a disposition recommendation from EAFB. Details on how the conditioning system works are presented in the *Basewide Environmental Staging Facility Operation and Maintenance Plan* (USAF 1994). IDW water was conditioned in January 2000. After conditioning, the system discharges the water to the sanitary sewer system for treatment in the Anchorage wastewater treatment system.

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Disposable protective clothing, disposable bailers, and other similar supplies were presumed to be nonhazardous; this waste was disposed of in dumpsters at EAFB.

2.7 Field Equipment Calibration

A PID with a minimum 10.2 eV lamp (e.g., Microtip 2000, OVM 580B, or Minirae) was used to field screen soil for volatile compounds. The PID was calibrated each day prior to use and recalibrated during the day, as needed (e.g., if PID drift was noted). The PID was calibrated in accordance with the owner's manual using a 100 parts per million (ppm) isobutylene reference gas and clean ambient air as the zero reference gas. The time, date, and result of each PID calibration reading were recorded in the field logbook. Other field instruments (e.g., Horiba U-10 water quality checker) were maintained according to the manufacturer's recommended procedures. The date, time, and results of all calibrations were recorded in the field logbook.

2.8 Survey

All 1999 sample locations were surveyed by an Alaska-registered surveyor. All survey data was established relative to the Municipality of Anchorage datum and the USAF identified benchmark (TTAN7) located on EAFB. The vertical datum for this survey was based on the Alaska State Plane coordinates. This control was the same datum used for the 1986 Elmendorf Master Plan and for other SERA investigations. Survey data is provided on the boring logs in Appendix B.

2.9 Data Interpretation

2.9.1 Field Screening Data

ATH/PID results are considered qualitative data and were used in the selection of samples for laboratory analysis and evaluating whether contamination was present. ATH/PID values in combination with odor and elevated analytical results from associated samples were generally interpreted as positive indicators of petroleum hydrocarbons. Elevated ATH/PID values not accompanied by odor or positive results from laboratory analyses were considered potentially suspect and possibly due to interference from moisture or equipment malfunction.

2.9.2 Comparison to ADEC Groundwater Cleanup Levels

Groundwater concentrations were compared to Method Two groundwater cleanup levels under ADEC's CSRP 18 AAC 75.345 (ADEC 1999). Groundwater at this site is not within the EAFB outwash plain and OU5 Model Area. However, if groundwater at this site is not a current or reasonably expected future source of drinking water, analytical groundwater results could be compared to 10 times the groundwater cleanup levels. Analytical results and associated groundwater cleanup levels pertinent to this site are provided in Table 3-2 presented in Section 3.2.2.

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2.9.3 Comparison to ADEC Soil Cleanup Levels – Method One

Soil petroleum hydrocarbon concentrations were initially compared to cleanup levels provided in 18 AAC 75.340, Table A1, Method One (ADEC 1999). Method One allows for soil cleanup levels based on a site-specific matrix score.

The matrix score sheet was used to estimate the cleanup level for soil at ST423/7. The completed matrix score sheet, provided in Appendix D, indicates a total matrix score of 39 (Level B cleanup levels). However, per 18 AAC 78.610(c), because groundwater at this site has been impacted by petroleum leachate, the site defaults to Level A cleanup levels. The assumptions used to develop the matrix score are discussed below:

- Depth to Subsurface Water: The depth to subsurface water is measured from the lowest point of the zone of soil contamination to the seasonal high groundwater table. In samples collected in 1997 and 1998, elevated concentrations of petroleum hydrocarbons were detected as deep as 28 feet bgs. Water levels measured in 1998 in the vicinity of the impacted soil show the water table to be at approximately 5 to 10 feet bgs. Therefore the depth to subsurface water from the zone of contamination is estimated at less than 5 feet.
- Mean Annual Precipitation: Mean annual precipitation for Anchorage, Alaska, is 15.57 inches (Western Regional Climate Center data for 4/1/52 through 4/30/98).
- Soil Type: Based upon boring logs associated with the site, the soil type encountered at ST423 would be categorized (according to the Matrix scoresheet) as coarse-grained soils with fines and fine-grained soil.
- Potential Receptors: The nearest public/private water system is approximately 2,800 feet southeast (and presumed upgradient) of ST423: Well 29 at Building 42-500 (EAFB Master Plan G-Tab drawing, Water Supply System). The number of people served by this well is not known, but is conservatively estimated to be over 25. The 381st IS facility receives potable water from the EAFB water supply system.
- Volume of Contaminated Soil: The extent of contaminated soil is not fully known. However, using the known areas of contamination, the volume of contaminated soil would fall into the highest possible scoring category of more than 500 cubic yards.

2.9.4 Comparison to ADEC Soil Cleanup Levels – Method Two

Soil analytical results were also compared to chemical-specific soil cleanup levels under 18 AAC 75.340 (ADEC 1999). Using Method Two of these regulations, bulk petroleum hydrocarbon (GRO and DRO) and chemical-specific (e.g., VOCs) cleanup levels are specified for various potential contaminant exposure pathways and as a function of the amount of precipitation the site receives. However, if it is determined that groundwater is not a current or reasonably potential future source of drinking water, a modified migration to groundwater cleanup level may be calculated to incorporate 10 times Table C groundwater cleanup levels.

The applicable Method Two cleanup levels for this site (less than 40 inches of precipitation per year) are the most stringent of the Table B1 or Table B2 ingestion-based levels and the migration to groundwater cleanup levels. The applicable cleanup levels are provided in the sample results tables presented in Section 3.2.

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3.0 RESULTS

3.1 1999 SERA VIII Field Program

3.1.1 Drilling and Soil Sampling

On October 21, 1999, one soil boring (423BH05) was advanced north of Building 41-755, outside the perimeter fence line (Figure 3-1). Boring 423BH05 was located approximately 15 feet northeast of WL04. This boring was advanced in order to determine if the sand unit observed elsewhere on site was present at this location. Although no sand unit was encountered during the installation of WL04 during 1996, samples were only collected at 5-foot intervals. During the drilling of BH05, samples were collected continuously (every 2 feet) from 20 to 30 feet below grade to aid in detecting the sand layer. Interpretation of existing geologic information indicated this would be the most likely interval in which to encounter the sand unit. No soil samples were recovered in the 20- to 22- and 26- to 28-foot intervals. It is possible that if there were a sand unit present, it may have been in one of these two intervals.

Wet to saturated soils were encountered from 5 to 26 feet bgs, although a water level measurement was not made. The water level measured in WL04 during groundwater sampling was approximately 12 feet below grade. Samples were collected to a total depth of 42 feet bgs; soils were identified as silty sands and gravels. Field observations, including ATH screening, indicated potentially contaminated soils were present from 22 to 26 feet bgs.

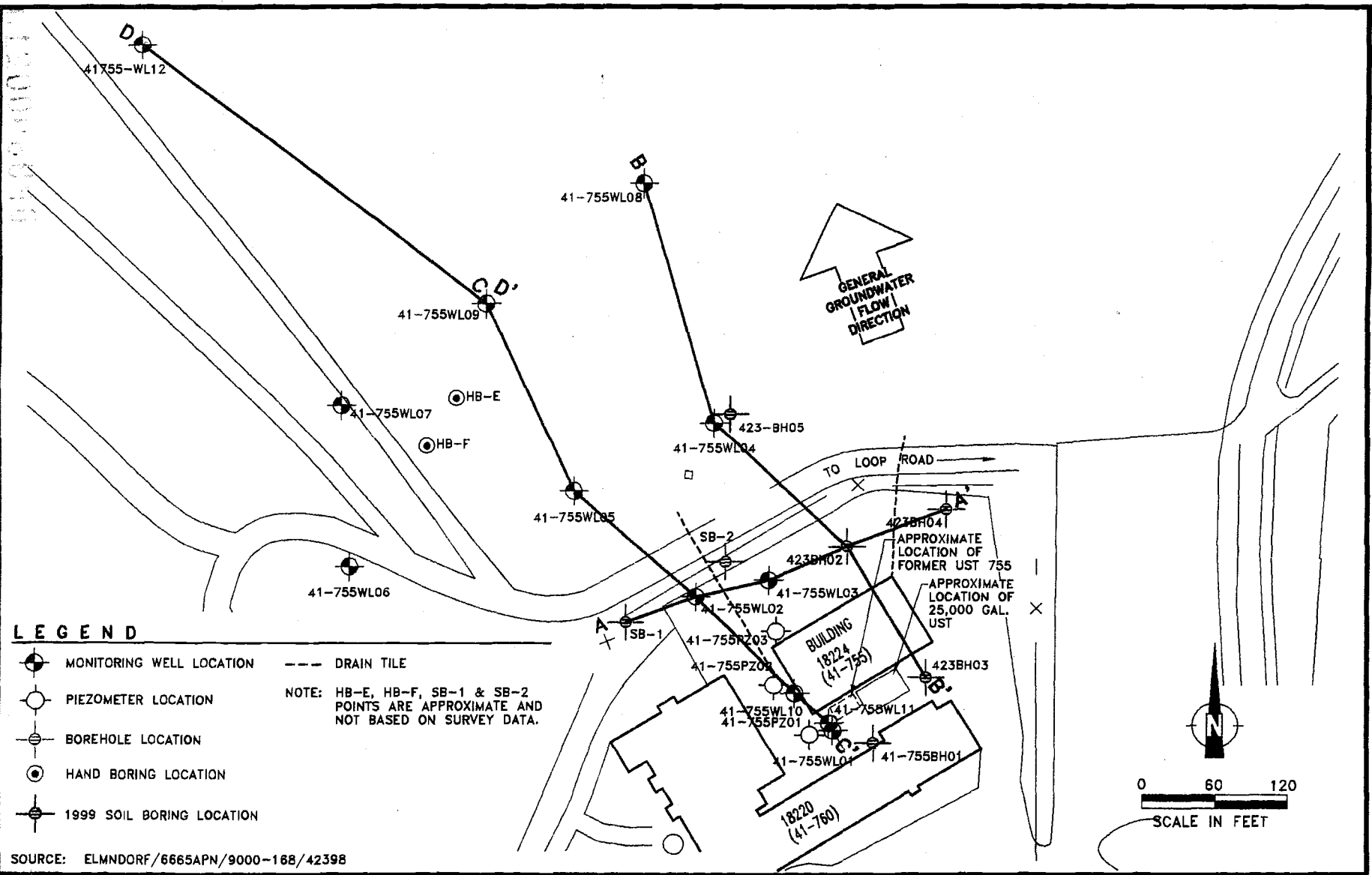
Soil samples were submitted to the laboratory for DRO, GRO, and VOC analysis.

3.1.2 Ground water Sampling

All 12 on-site wells were sampled between November 10 and 17, 1999. Wells WL08 and WL09 were initially plugged with ice; the ice plugs were thawed by circulating approximately one-half gallon of warm, distilled water in the well casing. Approximately one and one-half gallons (a volume equal to three times that of the injected volume) was purged in addition to the amount necessary for casing volumes and parameter stabilization. The protective casing (flush mount) for WL01 was full of ice and had to be cleared prior to accessing PVC casing.

Light nonaqueous-phase liquid (LNAPL) was detected in wells WL03 (0.01 feet) and WL01. The interface probe was not working at the time WL01 was sampled; approximately 1 gallon of product was purged from the well. A slight sheen was observed in the purge water from WL11. The product was purged from the well prior to beginning the groundwater purging.

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LEGEND

- MONITORING WELL LOCATION
 - PIEZOMETER LOCATION
 - BOREHOLE LOCATION
 - HAND BORING LOCATION
 - 1999 SOIL BORING LOCATION
 - DRAIN TILE
- NOTE: HB-E, HB-F, SB-1 & SB-2 POINTS ARE APPROXIMATE AND NOT BASED ON SURVEY DATA.

SOURCE: ELMENDORF/6665APN/9000-168/42398

DRAWING: 42399RP DRAWN: SSR
 C/SC: 1:1PS DISK: 35/99
 DATE: 02/28/00 CHECK: J.S.

FIGURE 3-1
 ST423/6/7/8, 381st IS
 SITE LAYOUT AND
 CROSS SECTION LOCATIONS

3 CES/CEVQ
 SERA VIII
 ELMENDORF AFB, ALASKA
 ENSR PROJECT #9010-049

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3.2 Discussion of Findings

3.2.1 Soil Findings

Only a limited number of soil samples were collected in 1999. However, they do provide for additional insight into the extent of petroleum hydrocarbons and the presence of chlorinated solvents at the site. The sample collected from 22 feet bgs had TCE present at 1.1 mg/Kg and cis-1,2-DCE present at 0.75 mg/Kg. DRO was reported at 250 mg/Kg (the cleanup level) in the duplicate sample collected at this interval; it was reported at 240 mg/Kg in the primary sample. No VOCs were reported present in the sample collected at 28 feet bgs in this borehole, and DRO was reported at the estimated concentration of 6 J mg/Kg.

The Method Two Cleanup levels for inhalation and ingestion do not apply to samples collected deeper than 15 feet bgs (ADEC 1999). Therefore, migration to groundwater cleanup levels were used for comparison with analytical results. Table 3-1 presents analytical results and associated cleanup levels for samples collected from BH05.

No soil sample results exceeded the migration to groundwater cleanup levels for benzene, ethylbenzene, toluene or xylene(s). Although the analytical results presented in Table 3-1 indicate that the method reporting limit (MRL) for benzene (0.05 mg/Kg) exceeds the cleanup level (0.02 mg/Kg), the laboratory was actually able to detect concentrations down to a method detection limit (MDL) of 0.02 mg/Kg. If benzene had been detected between 0.02 and 0.05 mg/Kg, the value would have been reported as an estimated concentration. Therefore, the benzene results are valid for determining whether the Method Two benzene soil cleanup level was met.

MRLs for a number of VOCs were greater than the compounds' associated cleanup levels. In all cases except for 1,2 -dichloropropane, dichloromethane and vinyl chloride, the MDLs are lower than the cleanup levels and the results are, as in the case of benzene, valid for determining whether the cleanup levels were met. For the three chemicals whose MDLs exceed the cleanup level, the results are considered indeterminate in deciding if cleanup levels have been met.

In reviewing all soil data collected to date (1996, 1997, 1998, and 1999), the extent of impacted soil appears to have been delineated on the south and east sides of the former 3,000-gallon UST. Soil samples collected in 1996 from downgradient borings WL06, WL07, WL08, and WL09 were within the Method Two cleanup levels, indicating that the extent of petroleum hydrocarbon contamination in soil downgradient of the source (former UST) has also been delineated. Samples have not been routinely submitted for VOC analysis, so the extent of chlorinated solvent contamination is not known. Soil boring 41-755WL01, sampled in 1996, provides some information on the vertical extent of impacted soil in the vicinity of the USTs, showing that DRO concentrations dropped from 1,700 mg/Kg at 11 feet bgs to 23 mg/Kg at 16.5 feet bgs.

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Table 3-1. ST423/6/7/8 1999 Subsurface Soil Sample Analytical Results

Sample Location: Sample Depth (feet): Sample Date: Laboratory ID:	Soil Cleanup Level*	423BH05		
		22'		28'
		10/21/99 K99769304	10/21/99 K99769302 Duplicate	10/21/99 K99769303
Bulk Petroleum Hydrocarbons [AK101/AK102] (mg/Kg)				
Gasoline Range Organics	300	15	31	5 U
Diesel Range Organics	250	240	250	6 J
BTEX [SW8260B] (mg/Kg)				
Benzene	0.02	0.05 U [†]	0.05 U [†]	0.05 U [†]
Ethylbenzene	5.5	0.05 U	0.05 U	0.05 U
Toluene	5.4	0.05 U	0.05 U	0.05 U
Total Xylenes ‡	78	0.05 U	0.05 U	0.05 U
Volatile Organic Compounds [SW8260B] (mg/Kg) §				
1,2-Dichloropropane	0.017	0.05 U[#]	0.05 U[#]	0.05 U[#]
cis-1,2-Dichloroethene	0.2	0.75	0.87	0.05 U
Dichloromethane	0.015	0.1 U[#]	0.1 U[#]	0.1 U[#]
Naphthalene	43	0.2 U	0.2	0.2 U
n-Butylbenzene	na	0.2 J	0.2	0.2 U
sec-Butylbenzene	na	0.1 J	0.1 J	0.2 U
Trichloroethene	0.027	1.1	1.4	0.05 U [†]
Vinyl chloride	0.009	0.05 U[#]	0.05 U[#]	0.05 U[#]

Notes:

- * The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (under 40 inch zone; ADEC 1999a).
 - † A method detection limit (MDL) lower than the cleanup level was achieved; result is valid when determining whether the soil cleanup level was met.
 - ‡ Value reported is the sum of detected m,p- and o-xylene isomers.
 - § Only those analytes detected or those not detected for which the MDL and method reporting limit (MRL) exceed the cleanup level are reported here. See Appendix C for a complete summary of results.
 - # While not detected, result is indeterminate when evaluating whether benzene soil cleanup level was met.
- BOLD** results indicate analyte exceeds soil cleanup level.

EPA Qualifier Codes:

- J = Estimated concentration; analyte detected between the MDL and MRL.
- U = Analyte not detected above the MRL; value reported is the MRL.

Key:

- BTEX = Benzene, toluene, ethylbenzene and xylenes.
- mg/Kg = Milligrams per kilogram.
- na = Not available.
- SIM = Selected ion monitoring.

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Figures 3-2, 3-3, and 3-4 provide cross-section diagrams for ST423. The dominant soil type at this site is silty sands and gravels. There is a sand unit that may underlie part or all of this site, and which is apparent at a depth of 20 feet bgs in 41-755WL02, 28 feet bgs in 41-755WL03, 26.5 feet bgs in 423BH02, and 30 feet bgs in 423BH04. The extent of this sand unit is not known. The upper limit of the water table begins within the silty soil or, in areas with sand and gravel overlying the silty soil (e.g., fill), within the sand and gravel unit. The underlying sand unit may exist under semi-confined or confined conditions. This unit is likely to have a higher hydraulic conductivity than the overlying silty unit. Soil samples from the sand unit had DRO concentrations reported at 37,100 mg/Kg (WL03 at 28 feet bgs – sampled in 1996) and 12,700 mg/Kg (BH02 at 26.5 feet bgs – sampled in 1998).

In review of all soil data, it is evident that high concentrations of petroleum hydrocarbons are present in the sand unit. Soil samples may indicate that contamination at this depth is vertically segregated from contamination at higher elevations (i.e., there appears to be a thin zone of less contaminated soil between the sand unit and the overlying soils). This suggests migration of contaminants to this deeper sand unit may not have occurred simply through vertical migration from above. There is currently not enough information to determine the extent of the sand unit or the transport mechanism for the petroleum contamination to reach it.

During 1997, a soil gas survey and additional soil sampling were conducted under SERA VI within the area of contaminated soils to the northwest of Building 18224. Data from the SERA VI soil gas survey suggests that a plume of petroleum hydrocarbons and chlorinated solvents is present in two separate areas: 1) in the field to the northwest of the building and outside the facility fenceline, in the area encompassed by WL04, WL05, WL06, WL07, WL08, and WL09; and 2) to the immediate north of Building 18224 (USAF 1998a). A review of as-built drawings for Building 18224 shows that the floor drainage system for the building may discharge in this area outside the facility fenceline. This drainage system is a potential source of contamination in the field northwest of the facility fenceline. The other area of contamination indicated by the soil gas survey is more immediate to Building 18224, and the petroleum hydrocarbons detected in this area are likely partially due to migration of diesel fuel from the former 3,000-gallon UST on the water table. SERA VI soil samples collected in Fall 1997 show that DRO concentrations in the area outside the fenceline were 7,500 and 42,000 mg/Kg DRO in two samples. Within the fenceline, SERA VI soil samples indicated DRO concentrations of 710 to 4,500 mg/Kg at depths of up to 10 to 12 feet bgs (USAF 1998a).

3.2.2 Groundwater Findings

Petroleum hydrocarbon concentrations in groundwater samples collected in November 1999 were similar to the results reported in 1996 for wells WL02, WL04, WL05, WL06, WL07, WL08, and WL09. Samples were not collected from the other five on-site wells during the sampling event in 1996, nor were chlorinated VOCs included in the target analyte list. The following is a summary of results from the 1999 investigation:

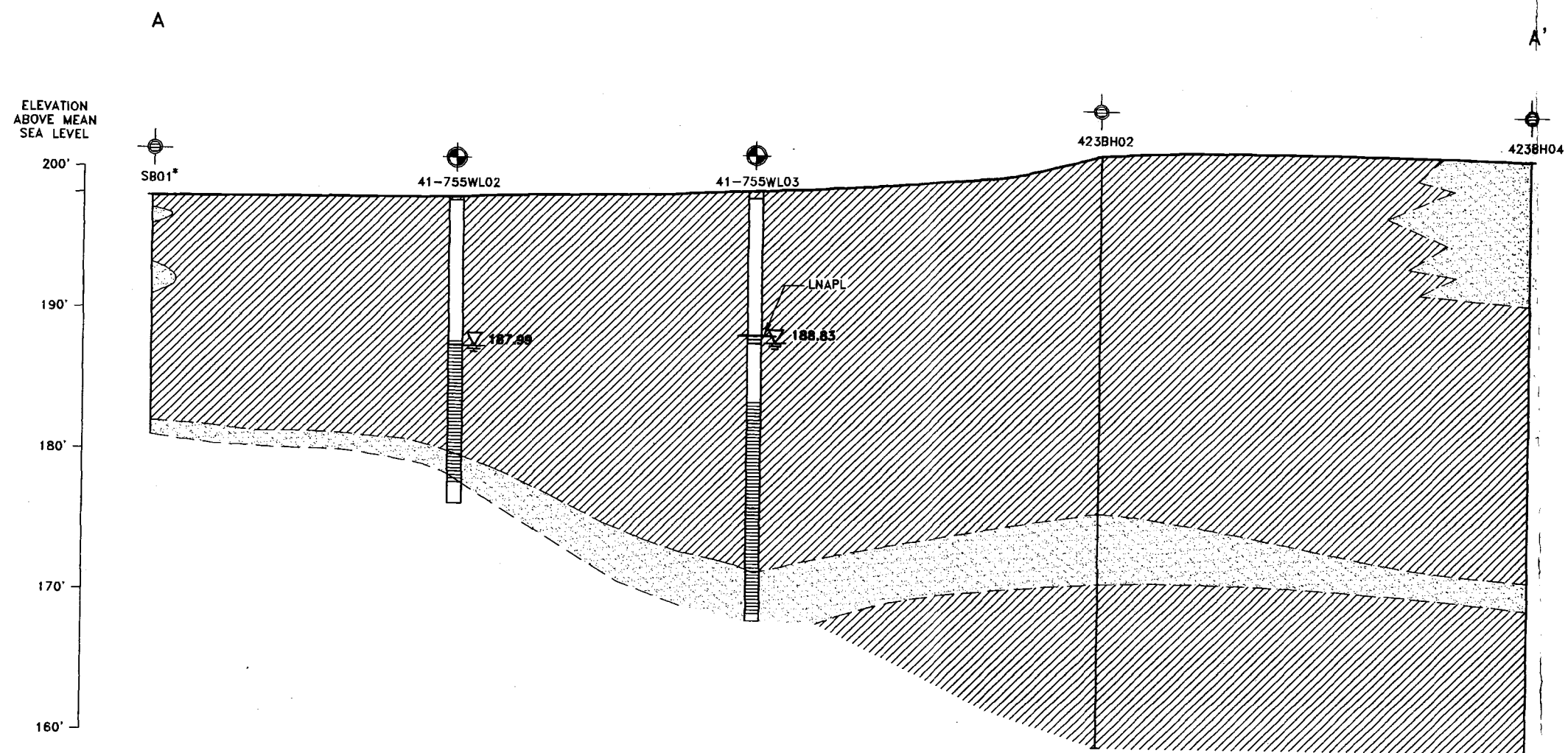
DP98000223

- DRO results for groundwater samples from wells WL01, WL02, WL03, WL05, and WL11 exceeded the groundwater cleanup level of 1.5 mg/L.
- The groundwater cleanup level for GRO of 1.3 mg/L was exceeded in wells WL01, WL02, and WL03.
- Of the BTEX compounds, only benzene was detected above its cleanup level (5 $\mu\text{g/L}$) and only in wells WL01 and WL03.
- PCE was detected at 2.8 mg/L in well WL02, well in excess of the Method Two Cleanup Level of 5 $\mu\text{g/L}$.
- TCE was detected in wells WL02, WL03, WL04, WL05 and WL08 at concentrations ranging from 5.7 $\mu\text{g/L}$ to 5 mg/L, well in excess of the cleanup level of 5 $\mu\text{g/L}$; it was detected in well WL01, but below the cleanup level.
- Cis-1,2-DCE was detected above the cleanup level in wells WL02, WL03, WL04 and WL05 at concentrations ranging from 2.1 mg/L to 5.7 mg/L.
- 1,1-DCE was detected above the cleanup level of 7 $\mu\text{g/L}$ in wells WL02 and WL04; it was detected in other wells, but not above cleanup levels.
- Vinyl chloride was detected in four wells, although it only exceeded the cleanup level of 2 $\mu\text{g/L}$ in well WL05 (9.6 $\mu\text{g/L}$).
- A number of other VOCs, including those associated with chlorinated solvents, were detected in the groundwater on site. However, none of these exceeded available cleanup levels.

The 1999 groundwater sample analytical results are presented in Table 3-2. The 1996 groundwater results are provided in Appendix C, for comparison purposes.




Water level measurements taken during the groundwater sampling in November 1999 indicate that local groundwater flow is to the northwest with a gradient of approximately 0.043 foot/foot within the fenceline area and approximately 0.095 foot/foot in the area north of the fenceline. In previous investigations, the gradient has been reported at approximately 0.06 foot/foot; this is approximately the average of the gradients within and outside of the fenceline area. Figure 3-5 shows groundwater contours for ST423, and Table 3-3 contains water level data. Two wells contained measurable product in the well casing: WL01 near the former UST location and WL03 downslope from Building 18224. Monitoring well WL01 contained an estimated 2 feet of product (estimated from amount observed in bailer) and WL03 contained 0.01 foot of product.

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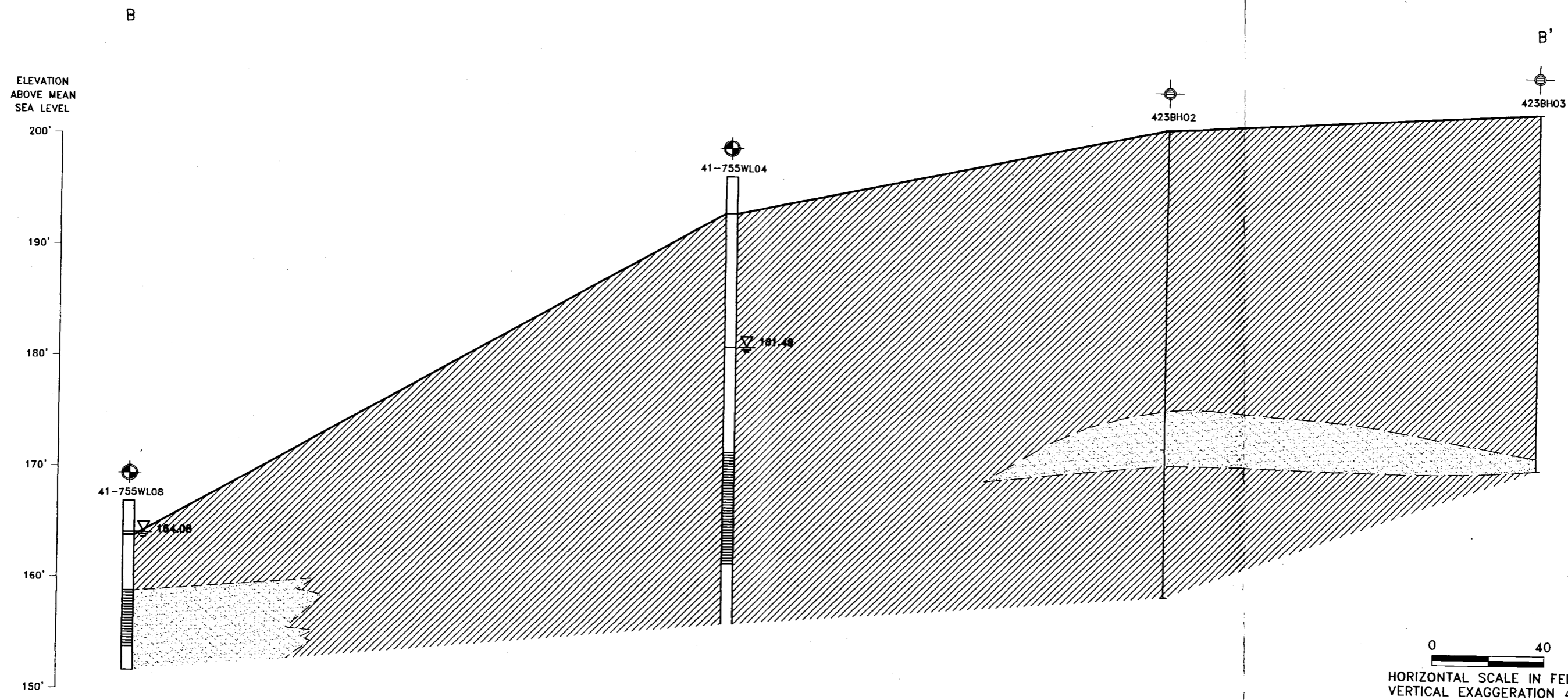
0 30
 HORIZONTAL SCALE IN FEET
 VERTICAL EXAGGERATION 3X

LEGEND




-  SANDS AND GRAVELS, LITTLE TO NO FINES
-  SILT/CLAY, SAND AND GRAVELS WITH SIGNIFICANT FINES
-  181.49 GROUNDWATER ELEVATION, NOVEMBER 1999

* GROUND ELEVATION ESTIMATED FROM AS-BUILT DRAWINGS; ELEVATION DATA FOR BORING IS NOT AVAILABLE.

SOURCE:			
3 CES/CEVQ SERA VIII ELMENDORF AFB, ALASKA			
FIGURE 3-2 ST423/6/7/8, 381st IS CROSS SECTION A-A'			
DATE: 2/28/00	DRAWN BY: SSR	SCALE: AS SHOWN	DRAWING: 423CSA99
C/SC: 1:30	ZIP: 35/99	ENGINEER: J. SHAPIRO	CHECKED: J. SHAPIRO
		ENSR PROJECT: #9010-049	

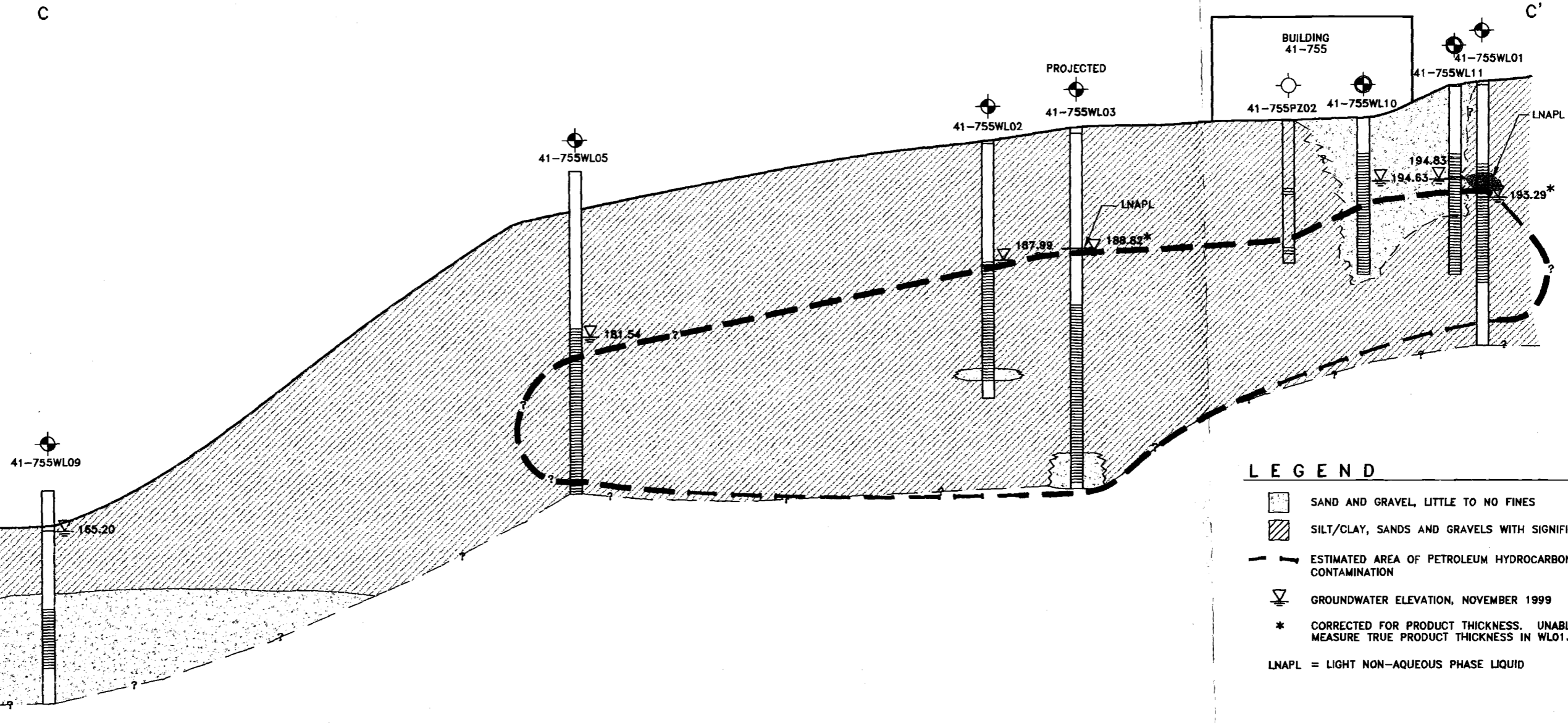
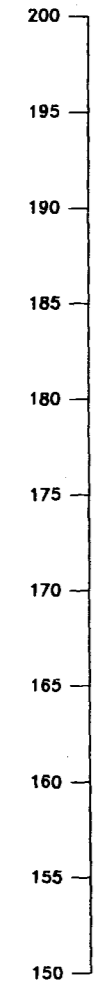


LEGEND

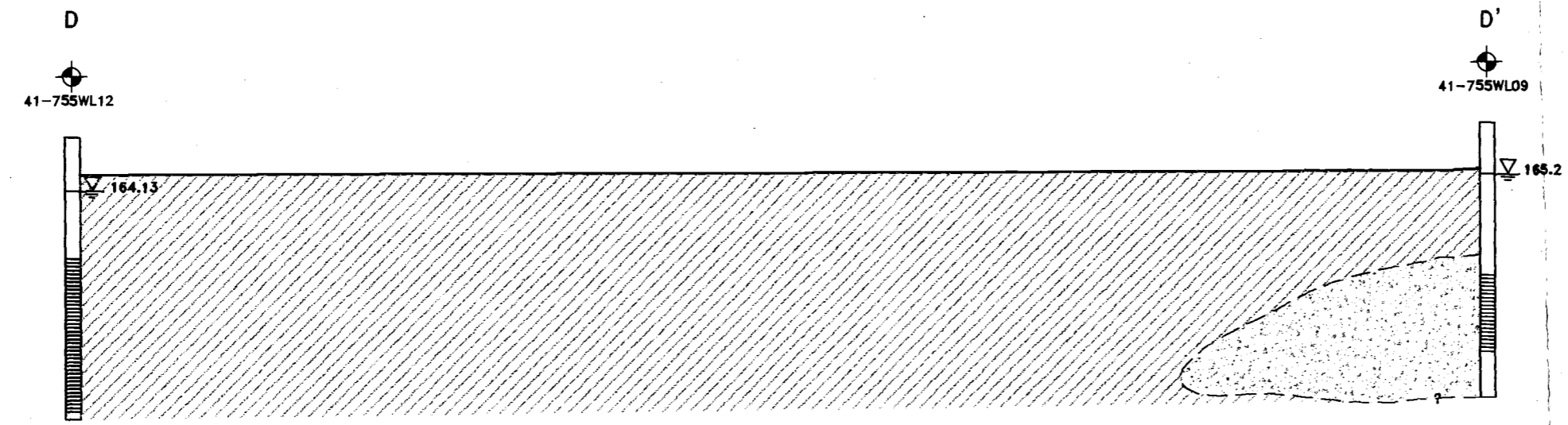
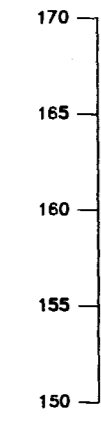
-  SANDS AND GRAVELS, LITTLE TO NO FINES
-  SILT/CLAY, SAND AND GRAVELS WITH SIGNIFICANT FINES
-  181.49 GROUNDWATER ELEVATION, NOVEMBER 1999

SOURCE:			
3 CES/CEVQ SERA VIII ELMENDORF AFB, ALASKA			
FIGURE 3-3 ST423/6/7/8, 381st IS CROSS SECTION B-B'			
DATE: 2/28/00	DRAWN BY: SSR	SCALE: AS SHOWN	DRAWING: 423CS899
C/SC: 1:40	ZIP: 35/99	ENGINEER: J. SHAPIRO	CHECKED: J. SHAPIRO
		ENSR PROJECT: #9010-049	

ELEVATION ABOVE MEAN SEA LEVEL

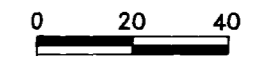


ELEVATION ABOVE MEAN SEA LEVEL



LEGEND

- SAND AND GRAVEL, LITTLE TO NO FINES
- SILT/CLAY, SANDS AND GRAVELS WITH SIGNIFICANT FINES
- ESTIMATED AREA OF PETROLEUM HYDROCARBON CONTAMINATION
- GROUNDWATER ELEVATION, NOVEMBER 1999
- * CORRECTED FOR PRODUCT THICKNESS. UNABLE TO MEASURE TRUE PRODUCT THICKNESS IN WL01.
- LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID



HORIZONTAL SCALE IN FEET
4 X VERTICAL EXAGGERATION

SOURCE:			
3 CES/CEVQ SERA VII ELMENDORF AFB, ALASKA			
FIGURE 3-4 ST423/6/7/8, 381st IS CONCEPTUAL SITE MODEL CROSS SECTION C-C' AND D-D'			
DATE: 2/27/00	DRAWN BY: SSR	SCALE: AS SHOWN	DRAWING: 423CSR
C/SC: 1:40	ZIP: 99505	ENGINEER: J. SHAPIRO	CHECKED: J. SHAPIRO
		ENSR PROJECT: #9010-049	

Table 3-2. ST423/6/7/8 1999 Groundwater Sample Analytical Results

Sample Location:	Groundwater	423WL01	423WL02	423WL03	423WL04	423WL05
Sample Date:	Cleanup	11/12/99	11/12/99	11/12/99	11/11/99	11/11/99
Laboratory ID:	Level*	K99823401	K99823403	K99823402	K99819706 K99819715 †	K99819707 K99819716 †
Bulk Petroleum Hydrocarbons [AK101/AK102] (µg/L)						
Gasoline Range Organics	1,300	4,400	3,000	1,300	400	560
Diesel Range Organics	1,500	1,300,000	2,000	160,000	1,000	18,000
BTEX [SW8260B] (µg/L)						
Benzene	5	160	4.4	7	2	2.6
Ethylbenzene	700	230	0.5 J	22	0.5 U	36
Toluene	1,000	6.4	0.5 U	0.4 J	0.4 J	7.5
Total Xylenes ‡	10,000	1,450	0.7	27	0.5 U	34.7
Volatile Organic Compounds [SW8260B] (µg/L) §						
1,1,1-Trichloroethane	200	0.5 U	3.3	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	4	0.5 U	0.5 U	0.5 U	0.5 U	0.9
1,1,2-Trichloroethane	5	0.5 U	0.5 U	0.5 U	0.4 J	0.5 U
1,1-Dichloroethane	3,650	0.5 U	2.4	0.4 J	0.6	0.6
1,1-Dichloroethene	7	0.5 U	9.1	4.1	9.4	5.3
1,2,3-Trichlorobenzene	na	2 U	2 U	2 U	2 U	3
1,2,4-Trichlorobenzene	70	2 U	2 U	2 U	2 U	2 J
1,2,4-Trimethylbenzene	na	1,000	2	54	2 U	80
1,2-Dichlorobenzene	600	0.5 U	0.5 U	0.2 J	0.5 U	0.3 J
1,3,5-Trimethylbenzene	na	320	0.4 J	8	2 U	23
4-Isopropyltoluene	na	16	2 U	6	0.2 J	20
Acetone	3,650	20 U	20 U	20 U	20 U	20 U
Bromodichloromethane	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	50.00	0.5 U	0.8	0.4 J	0.5 U	0.5 U
Carbon disulfide	3,650	0.3 J	0.5 U	0.3 J	0.5 U	0.5 U
Chloroethane	na	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J
Chloroform	100	0.5 U	0.4 J, B	0.5 U	1.7 B	0.5 U
Chloromethane	na	0.5 U	10 B	6.4 B	4.5 B	0.5 U
cis-1,2-Dichloroethene	70	3.8	4,200 J	2,100 J	2,200	5,700
Hexachlorobutadiene	10	2 U	2 U	2 U	2 U	2 J, B
Isopropylbenzene	na	28	0.7 J	9	0.7 J	24
Naphthalene	1,460	1,200	22 J	520	0.4 J, B	260
n-Butylbenzene	na	39	1 J	9	1 J	24
n-Propylbenzene	na	40	0.8 J	11	0.5 J	25
sec-Butylbenzene	na	14	0.8 J	4	3	11
tert-Butylbenzene	na	2 U	2 U	2 U	2 U	0.5 J
Tetrachloroethene	5	0.5 U	2,800	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	100	0.5 U	24	2.4	2	37
Trichloroethene	5	0.8	2,300	47	5,000	5.7
Vinyl chloride	2	0.5 U	1.3	0.9	0.4 J	9.6

Notes:

* Table C Groundwater Cleanup Levels (18 AAC 75; ADEC 1999a).

† Laboratory ID for Diesel Range Organics sample.

‡ Values reported are the sum of detected m,p- and o-xylene isomers

§ Only those analytes detected or those not detected for which the method detection limit (MDL) and method reporting limit (MRL) exceed the cleanup level are reported here. See Appendix C for a complete summary of results.

BOLD results indicate analyte exceeds groundwater cleanup level.

EPA Qualifier Codes:

B = Analyte was additionally found present in the associated method blank.

B (BOLD) = Analyte was additionally found present in the associated equipment and/or source water blank.

J = Estimated concentration; analyte detected between the MRL and MDL.

U = Analyte not detected above the MRL; value reported is the MRL.

Key:

-- = Not analyzed or sample not collected.

na = Not available.

BTEX = Benzene, toluene, ethylbenzene and xylenes.

µg/L = Micrograms per liter.

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Table 3-2. ST423/6/7/8 1999 Groundwater Sample Analytical Results (cont'd.)

Sample Location: Sample Date: Laboratory ID:	Groundwater Cleanup Level*	423WL06		423WL07	423WL08	
		11/1/99 K99819708 K99819717 †	11/1/99 K99819705 Duplicate	11/10/99 K99819702	11/17/99 K99838602	11/17/99 K99838604 Duplicate
Bulk Petroleum Hydrocarbons [AK101/AK102] (µg/L)						
Gasoline Range Organics	1,300	50 U	50 U	50 U	34 J	--
Diesel Range Organics	1,500	120 B	100 B	700	60 J	--
BTEX [SW8260B] (µg/L)						
Benzene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	700	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	1,000	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U
Total Xylenes ‡	10,000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Volatile Organic Compounds [SW8260B] (µg/L) §						
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.3 J	0.3 J
1,1,2,2-Tetrachloroethane	4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	3,650	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-Trichlorobenzene	na	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	70	2 U	2 U	2 U	2 U	2 U
1,2,4-Trimethylbenzene	na	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	600	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3,5-Trimethylbenzene	na	2 U	2 U	2 U	2 U	2 U
4-Isopropyltoluene	na	2 U	2 U	2 U	2 U	2 U
Acetone	3,650	20 U	20 U	8 J	20 U	20 U
Bromodichloromethane	100	0.2 J, B	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	50.00	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	3,650	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	na	0.5 U	0.5 U	0.5 U	0.2 J	0.3 J
Chloroform	100	3.8 B	0.5 U	0.5 U	0.6 B	0.6 B
Chloromethane	na	2.3 B	0.5 U	0.5 U	0.4 J, B	9.6 B
cis-1,2-Dichloroethene	70	0.5 U	0.5 U	0.5 U	8.4	8.5
Hexachlorobutadiene	10	2 U	2 U	2 U	2 U	2 U
Isopropylbenzene	na	2 U	2 U	2 U	2 U	2 U
Naphthalene	1,460	0.2 J, B	2 U	2 U	2 U	2 U
n-Butylbenzene	na	2 U	2 U	2 U	2 U	2 U
n-Propylbenzene	na	2 U	2 U	2 U	2 U	2 U
sec-Butylbenzene	na	2 U	2 U	2 U	2 U	2 U
tert-Butylbenzene	na	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.5 U	22	22
Vinyl chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

- * Table C Groundwater Cleanup Levels (18 AAC 75; ADEC 1999a).
- † Laboratory ID for Diesel Range Organics sample.
- ‡ Values reported are the sum of detected m,p- and o-xylene isomers
- § Only those analytes detected or those not detected for which the method detection limit (MDL) and method reporting limit (MRL) exceed the cleanup level are reported here. See Appendix C for a complete summary of results.
- BOLD** results indicate analyte exceeds groundwater cleanup level.

EPA Qualifier Codes:

- B = Analyte was additionally found present in the associated method blank.
- B (BOLD)** = Analyte was additionally found present in the associated equipment and/or source water blank.
- J = Estimated concentration; analyte detected between the MRL and MDL.
- U = Analyte not detected above the MRL; value reported is the MRL.

Key:

- = Not analyzed or sample not collected.
- na = Not available.
- BTEX = Benzene, toluene, ethylbenzene and xylenes.
- µg/L = Micrograms per liter.

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Table 3-2. ST423/6/7/8 1999 Groundwater Sample Analytical Results (cont'd.)

Sample Location:	Groundwater	423WL09		423WL10	423WL11	423WL12	Source Water
Sample Date:	Cleanup	11/17/99	11/17/99	11/12/99	11/12/99	11/10/99	11/17/99
Laboratory ID:	Level*	K99838601	K99838603 Duplicate	K99823405	K99823404	K99819701	K99838606
Bulk Petroleum Hydrocarbons [AK101/AK102] (µg/L)							
Gasoline Range Organics	1,300	50 U	--	50 U	330	50 U	--
Diesel Range Organics	1,500	90 J	--	590	10,000	30 B,J	--
BTEX [SW8260B] (µg/L)							
Benzene	5	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U
Ethylbenzene	700	0.5 U	0.5 U	0.3 J	5.8	0.5 U	0.5 U
Toluene	1,000	0.5 U	1	0.5 U	0.2 J	0.5 U	0.5 J
Total Xylenes †	10,000	0.5 U	0.5 U	0.3 J	5.5	0.5 U	0.5 U
Volatile Organic Compounds [SW8260B] (µg/L) ‡							
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	3650	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-Trichlorobenzene	na	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	70	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trimethylbenzene	na	2 U	2 U	0.9 J	28	2 U	2 U
1,2-Dichlorobenzene	600	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3,5-Trimethylbenzene	na	2 U	2 U	2 U	9	2 U	2 U
4-Isopropyltoluene	na	2 U	2 U	2 U	4	2 U	2 U
Acetone	3,650	20 U	20 U	20 U	20 U	20 U	20 U
Bromodichloromethane	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J
Bromomethane	50.00	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	3,650	0.5 U	0.5 U	0.2 J	0.3 J	0.5 U	0.5 U
Chloroethane	na	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	4.6
Chloromethane	na	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5.6
cis-1,2-Dichloroethene	70	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U
Hexachlorobutadiene	10	2 U	2 U	2 U	2 U	2 U	2 U
Isopropylbenzene	na	2 U	2 U	2 U	5	2 U	2 U
Naphthalene	1,460	2 U	2 U	3 B	63	2 U	2 U
n-Butylbenzene	na	2 U	2 U	2 U	7	2 U	2 U
n-Propylbenzene	na	2 U	2 U	0.2 J	6	2 U	2 U
sec-Butylbenzene	na	2 U	2 U	0.4 J	4	2 U	2 U
tert-Butylbenzene	na	2 U	2 U	2 U	0.3	2 U	2 U
Tetrachloroethene	5	0.5 U	0.5 U	0.5 U	1.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.4 J	1 U	0.5 U	0.5 U
Vinyl chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:

- * Table C Groundwater Cleanup Levels (18 AAC 75; ADEC 1999a).
- † Laboratory ID for Diesel Range Organics sample.
- ‡ Values reported are the sum of detected m,p- and o-xylene isomers
- § Only those analytes detected or those not detected for which the method detection limit (MDL) and method reporting limit (MRL) exceed the cleanup level are reported here. See Appendix C for a complete summary of results.
- BOLD** results indicate analyte exceeds groundwater cleanup level.

EPA Qualifier Codes:

- B = Analyte was additionally found present in the associated method blank.
- B (BOLD)** = Analyte was additionally found present in the associated equipment and/or source water blank.
- J = Estimated concentration; analyte detected between the MRL and MDL.
- U = Analyte not detected above the MRL; value reported is the MRL.

Key:

- = Not analyzed or sample not collected.
- na = Not available.
- BTEX = Benzene, toluene, ethylbenzene and xylenes.
- µg/L = Micrograms per liter.

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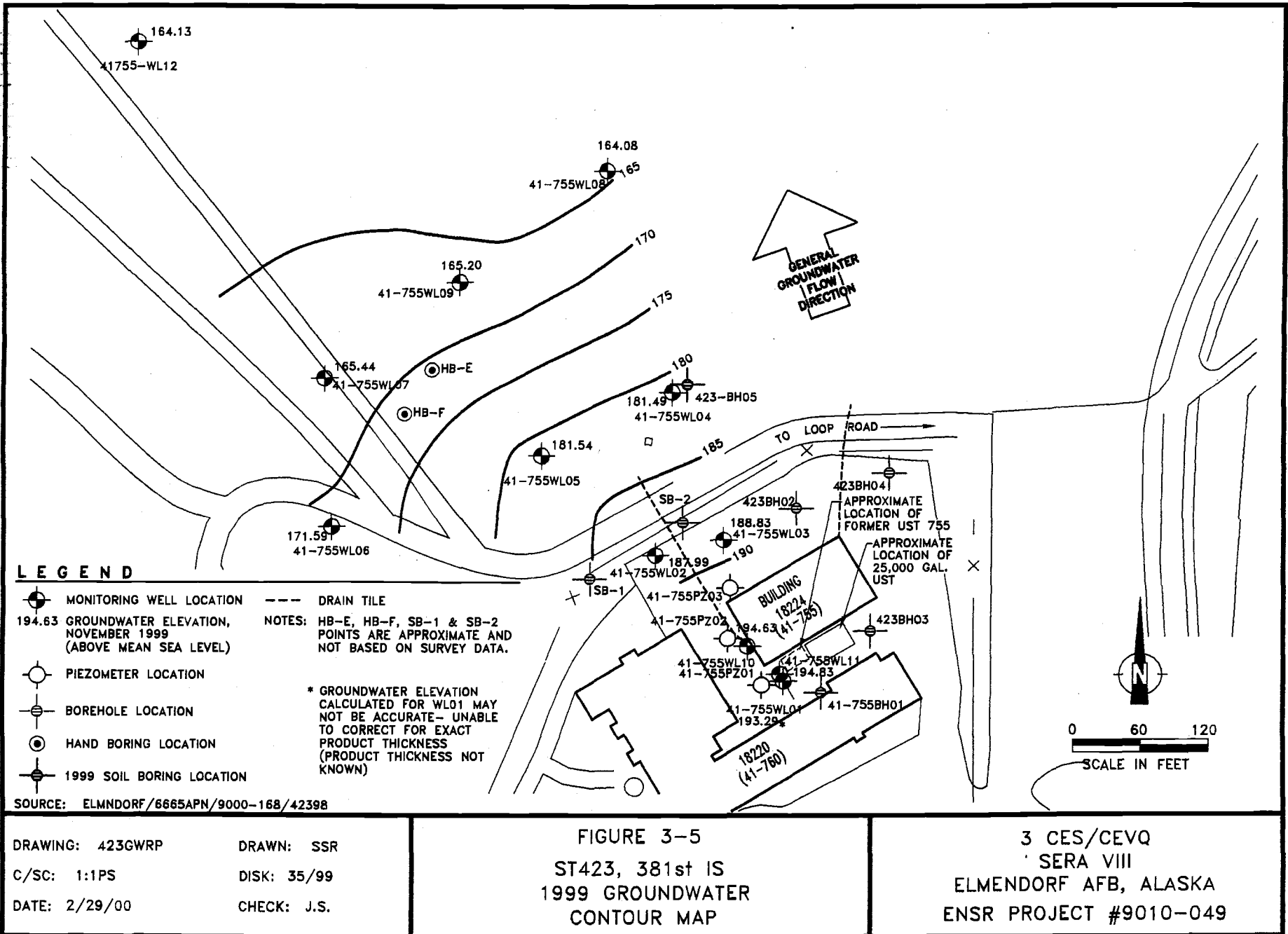


Table 3-3. Water Levels – November 1999.

Well No.	Top of PVC Elevation	Depth to Water	Depth to Product	Correction for Product Thickness*	Water Table Elevation	Notes
41-755WL01	202.78	11.00	unknown	0.84*1.8	193.29	Questionable elevation; product thickness based on amount measured in bailer.
41-755WL02	197.88	9.89			187.99	
41-755WL03	198.73	9.91	9.90	0.84*0.01	188.82	
41-755WL04	196.79	15.30			181.49	
41-755WL05	195.52	13.98			181.54	
41-755WL06	179.97	8.38			171.59	
41-755WL07	172.80	7.36			165.44	
41-755WL08	166.92	2.84			164.08	
41-755WL09	168.59	3.39			165.20	
41-755WL10	199.97	5.34			194.63	
41-755WL11	202.69	7.86			194.83	
41-755WL12	167.68	3.55			164.13	

Notes:

* Correction for product thickness: Water Table Elevation = Top of PVC Elev – Depth to Water + (Product Thickness x specific gravity of product [0.84 for diesel]).

Passive skimmers present in WL01, WL03, WL10 and WL11.

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4.0 CONCLUSIONS

4.1 Summary

Probable sources of petroleum hydrocarbon contamination at ST423 have been identified, and the extent of soil contamination due to the former UST has been well characterized to the north-northwest, east, and south of Building 18224. The extent of the underlying sand unit and the degree to which it is impacted by contaminants is not fully understood. High concentrations of petroleum hydrocarbons remaining in the soil will likely continue to serve as a source of ongoing groundwater contamination.

Soil sample results indicate that petroleum hydrocarbons are present above the ADEC Method Two soil cleanup levels for DRO (250 mg/Kg) and benzene (0.02 mg/Kg). Toluene, ethylbenzene, xylene, GRO, and RRO have not been measured in soil in excess of their respective Method Two cleanup levels. Soil in the vicinity of the former 3,000-gallon UST (AFID 755) was shown to contain DRO as high as 6,800 mg/Kg and benzene as high as 0.3 mg/Kg in 1996. The highest concentrations of DRO measured on site (up to 37,100 mg/Kg DRO) are present in the sand layer, encountered below the water table at approximately 25 to 30 feet bgs (the water table is at approximately 10 feet bgs). High levels of DRO have also been detected in borings outside the facility fenceline. The presence of chlorinated solvents both inside and outside the fenceline indicates that another contaminant source may have contributed to the contamination identified on site.

Groundwater level measurements collected in 1999 indicate that free-phase petroleum hydrocarbons are present on the water table. Local groundwater flow is to the northwest. Water samples collected in 1999 from on-site wells contain both petroleum hydrocarbons and chlorinated solvents in excess of groundwater cleanup levels. Because ST423 is not within the OU5 Model Area, free-phase product and dissolved-phase contaminants must be addressed.

Blueprints provided by EAFB have been reviewed and all USTs associated with Building 18224 have been identified.

4.2 Site Disposition

Free-phase product has consistently been observed in wells WL01 and WL03 on site. Passive recovery of product (i.e., emptying the Petropore[®] passiver skimmer of its contents on a regular schedule) has not been conducted since SERA IV. Previous water level and product thickness gauging as well as product recovery efficiency (from SERA IV) should be reviewed. Based on these findings, consideration should be given to resuming monthly water level and product thickness measurement to evaluate whether passive recovery of product should be reinstated. If undertaken, all on-site wells should be included in the monthly effort. Because the wells

within the fenceline are flushmounted and difficult to locate in the winters, their locations should be well documented in the fieldbook.

Groundwater results obtained during the investigation indicate the presence of chlorinated solvents in a number of locations. Soil samples collected from BH05 also had detectable levels of chlorinated solvents. Further investigation of the nature and extent of the chlorinated solvents needs to be conducted. WL08, currently considered a downgradient well, had detectable levels of chlorinated solvents that exceed the groundwater cleanup levels. Consideration should be given to installing a well that would be located farther downgradient than WL08. At a minimum, periodic groundwater sampling of downgradient wells should be conducted in order to evaluate any changes in groundwater quality.

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5.0 REFERENCES

- Alaska Department of Environmental Conservation (ADEC). 1999. 18 AAC 75, Oil and Other Hazardous Substances Pollution Control Regulations, Article 3. January 22.
- U.S. Air Force (USAF) 1999a. AFID 755 SERA Phase VII ST423/7 Release Investigation Report. Final Draft. February.
- _____. 1999b. SERA Phase VIII Release Investigation Work Plan. Final. September.
- _____. 1998a. Year One Summary Report for Site Evaluations and Bioventing Studies at SERA VI Sites, Elmendorf AFB, Alaska. Preliminary Draft. January.
- _____. 1998b. SERA Phase IV 1997 Release Investigation Findings. June.
- _____. 1997. ST402, ST403, and ST423, SERA Phase IV, Groundwater Analytical Results, Elmendorf AFB, Alaska. March.
- _____. 1995. *UST Decommissioning and Site Assessment – AFID 755, 381st IS Site*. Prepared for Air Force Center for Environmental Excellence/Elmendorf Air Force Base by ASRC Contracting Company, Inc. Draft. November.
- _____. 1994. Environmental Restoration Contractors Guide. [Attachment 1: *Basewide Environmental Staging Facility Operation and Maintenance Plan. March 1993.*] December.

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