FINAL

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ADDENDUM TO SAMPLING AND ANALYSIS PLAN

for
Corrective Action Plan-Part A and B Investigations at Former Underground Storage Tank Sites Hunter Army Airfield, Georgia

Prepared for

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

Contract No. DACA21-95-D-0022
Delivery Order 0038

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TO
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AT
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Prepared for

U.S. Army Corps of Engineers
Savannah District
Under Contract Number DACA21-95-D-0022
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Prepared by

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March 1999

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

APPROVALS

ADDENDUM
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SAMPLING AND ANALYSIS PLAN
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AT
FORMER UNDERGROUND STORAGE TANK SITES
HUNTER ARMY AIRFIELD, GEORGIA

for 3/31/99

Bruce King, Deputy Program Manager Date

C. Allison Bailey 3/31/99

Allison Bailey, Project Manager Date

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LIST OF ABBREVIATIONS AND ACRONYMS

BGS	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
DQO	data quality objective
DRO	diesel-range organic
EPA	U.S. Environmental Protection Agency
GA DNR	Georgia Department of Natural Resources
GEPD	Georgia Environmental Protection Division
GRO	gasoline-range organic
HAAF	Hunter Army Airfield
IDW	investigation-derived waste
IWQS	In-stream Water Quality Standards
MCL	maximum contaminant level
NTP	Notice to Proceed
PAH	polynuclear aromatic hydrocarbons
PDO	Old Property Disposal (Yard)
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
UST	Underground Storage Tank
USTMP	Underground Storage Tank Management Program

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1.0 INTRODUCTION

This addendum supplements the *Sampling and Analysis Plan (SAP) for the Corrective Action Plan-Part A Investigations for Former Underground Storage Tank Sites at Hunter Army Airfield, Georgia* (SAIC 1998). It presents changes to the SAP and the specific sampling requirements for the performance of Corrective Action Plan (CAP)-Part B investigations at the Underground Storage Tank (UST) 108, Building 1346 and USTs 21 & 22, Building 1327 Sites, Facility IDs: 9-025104 and 9-025053, respectively. In addition, specific requirements for supplemental sampling activities to be performed at the UST 129, Building 8658, Facility ID: 9-025318 Site and the Old Property Disposal (PDO) Yard are also presented in this document.

The CAP-Part B investigations are required at the UST 108 and USTs 21 & 22 Sites by the Georgia Department of Natural Resources (GA DNR), Underground Storage Tank Management Program (USTMP) Branch, based upon the results of the CAP-Part A investigation. The supplemental sampling activities at the UST 129 Site are required to complete the UST Closure activities and at the PDO Yard to assist with the preparation of the Resource Conservation and Recovery Act (RCRA) CAP. All field investigation and sampling activities will be conducted concurrently. Table 1-1 provides general site information and presents the proposed investigative activities for each site.

Table 1-1. Site Information and Investigative Activities

Site	Facility ID	Building Number	Type of Tank	Field Activities
USTs 21 & 22	9-025053	1327	Diesel/gasoline	• Install five soil borings. • Collect two soil samples from each boring. • Collect five geotechnical soil samples. • Install five permanent 2-inch-diameter groundwater monitoring wells. • Collect five groundwater samples. • Collect two surface water and sediment samples.
UST 108	9-025104	1346	Used oil	• Install three soil borings. • Collect two soil samples from each boring. • Collect three geotechnical soil samples. • Collect one Shelby tube sample. • Install three permanent 2-inch-diameter groundwater monitoring wells. • Collect three groundwater samples. • Collect two surface water and sediment samples.
UST 129	9-025318	8658	Used oil	• Install one soil boring. • Collect one soil sample. • Collect one groundwater sample. • Install one temporary piezometer.
PDO Yard	N/A	N/A	Used oil and JP-8 aboveground storage tanks	• Collect four groundwater samples from existing wells. • Collect three Shelby tube samples.

CAP = Corrective Action Plan.
N/A = Not applicable.
PDO = Old Property Disposal.
UST = Underground storage tank.

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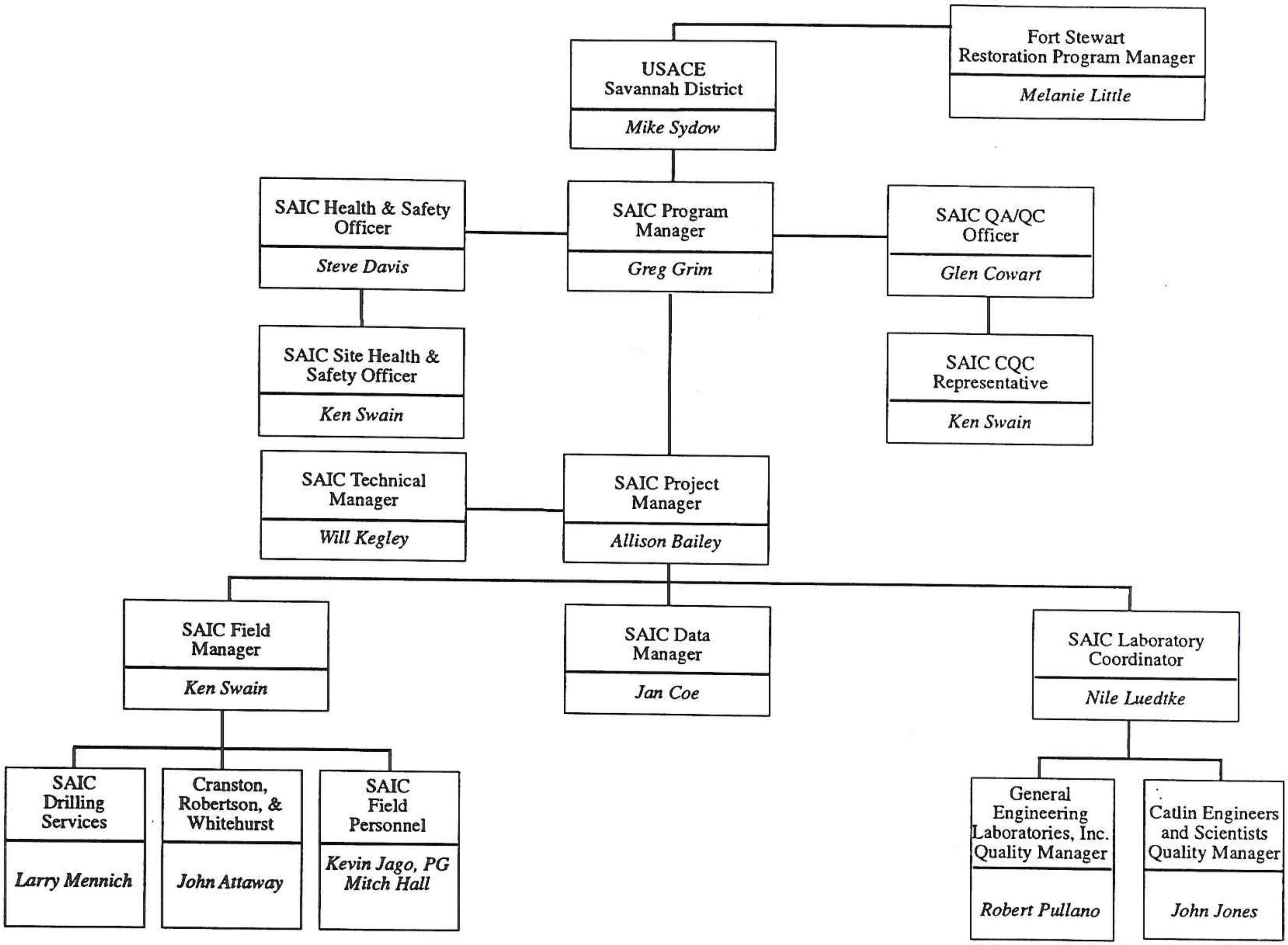
2.0 PROJECT ORGANIZATION

A revised organizational chart is presented in Figure 2-1. A revised list of key personnel is presented in Table 2-1.



Refer to Section 3 of the project QAPP for lab organization breakdown.

Figure 2-1. Organizational Chart for the CAP-Part B Investigations for Former UST Sites at HAAF, Georgia.

Table 2-1. Key Field Personnel Assignments and Qualifications

Project Assignment	Minimum Degree Requirements	Minimum Qualifications
Project Manager C. Allison Bailey	B.S. Civil Engineering, Geology, or related field	10+ years of experience in HTRW projects, including site investigations and related environmental evaluations/studies.
Technical Manager William P. Kegley, P.G.	B.S. Civil Engineering, Geology, or related field	5+ years of experience in HTRW projects, including management of field projects for site investigations, remedial investigations, and related environmental evaluations/ studies.
Site Safety and Health Officer Ken Swain	B.S. in Safety, Engineering, or related field	5+ years of experience in HTRW projects, including providing health and safety oversight for site investigations, remedial investigations, and related environmental evaluations/studies.
CQC Representative Ken Swain	A.S. in Science or Engineering Technology, or related field or equivalent field work experience	3+ years of experience in HTRW projects, including site investigations, remedial investigations, and related environmental evaluations/studies.
Field Manager Ken Swain	B.S., Engineering, Geology, or related field	5+ years of experience in HTRW projects, including management of field projects for site investigations, remedial investigations, and related environmental evaluations/ studies.
Laboratory Coordinator Nile Luedtke	B.S. Chemistry	7+ years of experience in HTRW projects, including laboratory interface for site investigations, remedial investigations, and related environmental evaluations/studies.
Site Geologist Kevin Jago, P.G.	B.S. Civil Engineering, Geology, or related field	3+ years of experience in HTRW projects, including soil and rock logging, and monitoring well installation.
Sampling Technicians Mitch Hall Scott Lane	A.S. in Science or Engineering Technology, or related field or equivalent field work experience	3+ years of experience in HTRW projects, including soil and groundwater sampling, and monitoring well installation.

CAP = Corrective Action Plan.
HAAF = Hunter Army Airfield.
HTRW = Hazardous, Toxic, and Radioactive Waste.
UST = Underground Storage Tank.

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3.0 PROJECT SCOPE AND OBJECTIVES

3.1 SCOPE OF THE INVESTIGATION

The scope of this project includes four main components: (1) development of an addendum to the existing SAP describing the field investigations at the sites, (2) performance of the CAP-Part B field investigations, (3) collection of supplemental data for UST Site Closure and preparation of an RCRA CAP, and (4) completion of CAP-Part B Reports. All project reporting will be performed according to the requirements as defined in the U.S. Army Corps of Engineers (USACE) guidance EM-200-1-3 (September 1, 1994) and the SAP (SAIC 1998). The specific scope for the CAP-Part B UST Investigation and the supplemental sampling activities includes the following:

- describe the rationale for sampling and the data quality objectives (DQOs);
- list the samples that need to be taken, including media to be sampled, list of analytes, sample locations, and sampling procedures;
- list the monitoring wells and the respective locations that need to be installed, including procedures;
- specify how investigation-derived wastes (IDWs) will be handled and disposed of;
- ensure that the site-specific Health and Safety Plan covers all activities; and
- present a schedule for completing the field investigation.

3.2 PROJECT OBJECTIVES

The investigation objectives for each site are listed below:

UST 108, Building 1346

- Verify that all measurable free product has been removed.
- Evaluate and verify the absence of any groundwater contamination.
- Assess the potential impact of petroleum contaminants to the surface water body (unnamed drainage ditch) located downgradient from the site.

USTs 21 & 22, Building 1327

- Delineate the free product plume.
- Horizontally delineate the dissolved benzene contamination plume.
- Assess the potential impact of petroleum contaminants to the surface water body (unnamed drainage ditch) located downgradient from the site.

UST 129, Building 8658

- Complete Site Closure activities.
- Determine if petroleum contamination is present in the soil and/or groundwater.
- Determine if free product is present.

PDO Yard

- Assist with the preparation of the RCRA CAP.

In order to achieve these objectives, the data collected are to be of sufficient quality and quantity to be legally defensible under regulatory requirements.

3.3 DATA QUALITY OBJECTIVES

The DQO process is useful in identifying data gaps and developing a SAP that describes the procedures for collecting sufficient data of known and defensible quality. These data will assist the decision makers in arriving at appropriate and sound decisions concerning remedial action activities. The DQO process also assists in determining appropriate detection limits, analytical methods, and sampling and handling procedures/requirements. The seven-step process defined by the U.S. Environmental Protection Agency (EPA 1993), as it applies to the CAP-Part B investigation activities at the UST 108 and USTs 21 & 22 Sites, the UST 129 Site, and the PDO Yard, is presented in the following sections.

3.3.1 Step 1 – Investigation Objectives

1. Define the extent of benzene, toluene, ethylbenzene, and xylenes (BTEX), polynuclear aromatic hydrocarbons (PAHs), and/or total petroleum hydrocarbon (TPH) contamination in the groundwater and/or soil to a concentration not exceeding regulatory limits set forth in Rule 391-3-15-09 at the UST 108 and USTs 21 & 22 Sites. Determine if free product is still present at the sites and, if so, delineate the free product plume.

2. Determine if BTEX, PAH, and/or TPH contamination exists above the respective Soil Threshold Levels in the soil below former UST 129. Also, determine if BTEX and PAH constituents are present in the groundwater and if free product is present at the site.

3. Measure the geochemical parameters including nitrate, iron, sulfate, sulfide, methane, and carbon dioxide in the groundwater and geotechnical parameters including moisture content, grain size distribution, Atterburg limits, total organic carbon (TOC), permeability, specific gravity, porosity, and density in the soil at the PDO Yard. These measurements will assist in the evaluation of site-specific transport conditions and the effectiveness of potential corrective action alternatives that are part of the RCRA CAP.

3.3.2 Step 2 – Identification of Decision Types

The primary decisions to be made during the course of the project for the UST 108 and USTs 21 & 22 Sites include the following. All of these decisions are based on requirements defined by the Georgia Environmental Protection Division (GEPD)–USTMP for investigation.

1. Are BTEX, PAH, or TPH soil concentrations in excess of the applicable soil threshold limits?
2. Are BTEX or PAH groundwater concentrations in excess of the applicable groundwater maximum contaminant levels (MCLs) or In-stream Water Quality Standards (IWQSs), as appropriate? Is free product present?
3. Is the nature and extent of contamination completely defined according to CAP-Part B requirements?
4. Prepare a CAP-Part B Report.

The primary decisions to be made during the investigation for the UST 129 Site include the following:

1. Are BTEX, PAH, or TPH soil concentrations in excess of the applicable soil threshold limits?
2. Are BTEX or PAH groundwater concentrations in excess of the applicable groundwater MCLs or IWQSs, as appropriate? Is free product present?

The primary decisions to be made during the investigation for the PDO Yard include the following:

1. Are the sampling locations appropriately selected to sufficiently characterize the site geochemical and geotechnical conditions.

3.3.3 Step 3 – Key Environmental Variables

Key environmental variables for the project are presented in Section 3.3.3 of the SAP (SAIC 1998).

3.3.4 Step 4 – Temporal and Spatial Boundaries

According to guidance provided by the GEPD–USTMP regarding the assessment of contamination at USTs, investigations conducted in support of the assessment are conducted as "one-time" events. Therefore, temporal boundaries are not applicable to the investigations to be conducted at the project sites.

The spatial boundaries for this project are defined by the maximum number and locations of direct-push samples and monitoring wells (both primary and reserve) to be installed/sampled.

3.3.5 Step 5 – Data Evaluation

Based on the output from the previous DQO steps, CAP-Part B reports must be prepared for the UST 108 and USTs 21 & 22 Sites; the Site Closure Report must be completed for the UST 129 Site; and the site-specific transport conditions and the effectiveness of potential corrective action alternatives must be evaluated for the PDO Yard as part of the RCRA CAP.

3.3.6 Step 6 – Data Quality Requirements

DQOs are based on the concept that different uses may require different data quality. The primary objectives for the investigation activities are discussed in Sections 3.2 and 3.3.1. In support of the objectives, both screening and definitive data will be utilized.

3.3.7 Step 7 – Sampling Characterization Plan

The sampling characterization plan is discussed fully in Section 3.3.7 of the SAP.

4.0 GEOLOGIC AND HYDROGEOLOGIC DATA

The following information is presented to provide supplemental information to Sections 1.1.3 through 1.1.7 of the SAP (SAIC 1998). This information was compiled for the CAP-Part A reports prepared for the UST 108 and USTs 21 & 22 Sites, and provides detailed information relating to the geologic and hydrogeologic conditions at HAAF and for each of the respective UST sites.

4.1 REGIONAL GEOLOGY

Southeast Georgia is located within the Coastal Plain Physiographic Province of the Southeast United States (Clark and Zisa 1976). In this region, the thickness of southeastward dipping, subsurface strata ranges from 0 feet at the fall line, located approximately 350 miles inland from the Atlantic coast, to approximately 4,200 feet below land surface at the coast. Herrick (1961) provides detailed lithologic descriptions of the stratigraphic units encountered during the installation of water and petroleum exploration wells in Chatham County. The well log of GGS Well 125, located on White Bluff Road, 700 feet west and 0.3 miles north of Buckhalter Road, Savannah, provides one of the more complete lithologic descriptions of upper Eocene, Miocene, and Pliocene to Recent sedimentary strata in Chatham County.

The upper Eocene (Ocala Limestone) section of GGS Well 125 is approximately 225 feet thick and dominated by light-gray-to-white, fossiliferous limestone. The Miocene section is approximately 250 feet thick and consists of limestone with a 160-feet-thick cap of dark green phosphatic clay. This clay is regionally extensive and is known to occupy the Coosawatchie Formation of the Hawthorn Group (Furlow 1969; Arora 1984; Huddlestun 1988). The interval from approximately 80 feet to the surface is Pliocene to Recent in age and composed primarily of sand interbedded with clay and silt. This section is occupied by the Satilla and Cypresshead Formations (Huddlestun 1988).

4.2 LOCAL GEOLOGY

HAAF is located within the Barrier Island Sequence District of the Coastal Plain Physiographic Province of the Southeast United States (Clark and Zisa 1976). The Barrier Island Sequence District in Chatham and Bryan Counties is characterized by the existence of several marine terraces (step-like topographic surfaces that decrease in elevation toward the coast). These marine terraces, and their associated deposits, are the result of sea level fluctuations that occurred during the Pleistocene Epoch. The surficial (Quaternary) deposits in Chatham and Bryan Counties, in decreasing elevation and age, are part of the Okefenokee, Wicomico, Penholoway, Pamlico, and Silver Bluff terrace complexes (Wilkes et al. 1974; GA DNR 1976; Huddlestun 1988).

HAAF, as well as most of Chatham County, is underlain by the Pleistocene Pamlico Terrace. The Pleistocene Satilla Formation (formerly known as the Pamlico Formation) consists of deposits of the Pamlico Terrace complex and other terrace complexes in the region (Huddlestun 1988). The Satilla Formation is a lithologically heterogeneous unit that consists of variably bedded to non-bedded sand and variably bedded silty to sandy clay. During the Pleistocene, these sand and clay deposits were formed in offshore and inner continental shelf, barrier island, and marsh/lagoonal-type environments (Huddlestun 1988). According to the Geologic Map of

Georgia (GA DNR 1976), clay beds of marsh origin, which were deposited on the northwest side of the former Pamlico Barrier Island complex, exist in the western quarter of HAAF. Very fine- to coarse-grained sand deposits of barrier island origin are more common throughout the remaining areas of HAAF.

Based on the coring and sampling of unconsolidated strata at HAAF during the CAP-Part A investigations, it is concluded that all former USTs were buried within the Satilla Formation, which is overlain by various soil types. Soil groups at HAAF include the Chipley, Leon, Ellabelle, Kershaw, Pelham, Albany, Wahee, and Ogeechee (Wilkes et al. 1974).

4.3 REGIONAL AND LOCAL HYDROGEOLOGY

The hydrogeology in the vicinity of HAAF is mostly influenced by two aquifer systems. These are referred to as the Principal (Floridan) Aquifer and the Surficial Aquifer (Miller 1990). The Principal Aquifer is the lowermost hydrologic unit and is regionally extensive from South Carolina through Georgia, Alabama, and most of Florida. Known elsewhere as the Floridan, this aquifer, approximately 800 feet in total thickness, is composed primarily of Tertiary-age limestone including the Bug Island Formation, the Ocala Group, and the Suwannee Limestone. Groundwater from the Floridan is used primarily for drinking water (Arora 1984). According to Miller (1990), one of the largest cones of depression produced in the Upper Floridan Aquifer exists directly beneath Savannah, Georgia. Net water-level decline in the Floridan system, between the predevelopment period and 1980, exceeded 80 feet beneath Savannah. In addition, according to 1980 estimates, more than 500 million gallons of water per day were withdrawn from the Floridan for public and industrial use in southeast Georgia, more than any other region.

The confining layer for the Principal (Floridan) Aquifer is the phosphatic clay of the Hawthorn Group. There are minor occurrences of aquifer material within the Hawthorn Group; however, they have limited utilization (Miller 1990). The Surficial Aquifer overlies the Hawthorn confining unit.

The Surficial Aquifer consists of widely varying amounts of sand and clay, ranging from 55 to 150 feet in thickness, and is composed primarily of the Satilla and Cypresshead Formations in the Savannah vicinity (Arora 1984). This aquifer is primarily used for domestic lawn and agricultural irrigation. The top of the water table ranges from approximately 2 to 10 feet below ground level (Miller 1990). Groundwater in the Surficial Aquifer system is under unconfined, or water table, conditions. However, locally, thin clay beds create confined or semiconfined conditions, as is the case at HAAF where thin, surficial clay beds are present in the west quadrant (GA DNR 1976).

Groundwater encountered at the investigation sites is part of the Surficial Aquifer system. Based on the fact that all public and non-public water supply wells draw water from the Principal (Floridan) Aquifer, and that the Hawthorn confining unit separates the Principal Aquifer from the Surficial Aquifer, it is concluded that there is no hydraulic interconnection between the UST 108 and USTs 21 & 22 Sites (and associated plumes, if applicable) and water supply withdrawal points.

4.4 SITE GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

According to Wilkes et al. (1974), the soil common in the area occupied by the UST 108 and USTs 21 & 22 Sites consists of the Chipley-Urban land complex (Cuc). This complex contains 40 to 70 percent Chipley soils and 20 to 40 percent Urban Land soils. The surface layer of this complex is very dark grayish brown to gray, with the underlying layer being olive brown to light yellowish brown mottled with gray. A seasonal high water table is 15 to 36 inches below the surface. In places, the soil profile has been altered due to the cutting, filing, and grading activities resulting from urban development (Wilkes et al. 1974).

During direct-push sampling events conducted during the CAP-Part A investigation at the UST 108 and USTs 21 & 22 Sites, four major unconsolidated sediment types were encountered. These include: (1) non-native sandy fill in the former tank pit; (2) poorly graded sand with silt (SP-SM); (3) pale brown silty clay (CL); and (4) moderately to well sorted, clean quartz sand (SW).

At the UST 108 Site, the top of the saturated zone was encountered at the silty clay (CL) and sand (SW) boundary. Following the installation of piezometers at the site, water levels were typically discovered to exist above the CL-SW boundary at depths ranging from 1.6 to 3.84 feet below ground surface (BGS). This indicates that the CL unit acts as a confining layer to the water-bearing SW unit. At the USTs 21 & 22 Site, the groundwater was measured at depths ranging from 4.21 to 5.15 feet BGS.

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5.0 FIELD ACTIVITIES

Field activities for the CAP-Part B investigations will consist of installing soil borings, collecting soil samples, installing monitoring wells, collecting groundwater samples, and collecting surface water and sediment samples at the UST 108 and USTs 21 & 22 Sites. The site-specific investigative activities are presented in Tables 5-1, 5-2, and 5-3, and the proposed sampling locations are presented in Appendix A, Figures A-1 and A-2.

Field activities for the supplemental sampling performed at the UST 129 Site will consist of installing one soil boring. Two soil samples will be collected from the boring using direct-push technology. An in situ groundwater sample will also be collected from the boring using direct-push techniques. A temporary piezometer will be installed to bracket the water table to determine the presence of free product. The site-specific investigative activities are presented in Tables 5-1 and 5-2, and the proposed sampling location is presented in Appendix A, Figure A-3.

Field activities for the supplemental sampling activities performed at the PDO Yard will consist of purging and sampling four existing monitoring wells and collecting three undisturbed (Shelby tube) soil samples for geotechnical analysis. The site-specific investigative activities are presented in Tables 5-1 and 5-2, and the proposed groundwater and Shelby-tube sampling locations are presented in Appendix A, Figure A-4.

5.1 MONITORING WELL INSTALLATION

As recommended in the CAP-Part A Reports (SAIC 1999a and b), a total of 10 monitoring wells will be installed during the CAP-Part B investigations. Five monitoring wells will be installed at the USTs 21 & 22 Site; three will be installed at the UST 108 Site; and two monitoring wells will be held in reserve with locations determined during the field activities by Fort Stewart, USACE, and SAIC personnel. The monitoring wells will be installed using the hollow-stem auger method described in Section 4.1.2 of the SAP (SAIC 1998). During all borehole drilling, soil will be sampled continuously from ground surface to the water table with two soil samples selected from each borehole for submittal to an off-site laboratory for analysis. Subsurface soil sampling is described in Section 5.3. All down hole equipment will be certified clean from the manufacturer or decontaminated according to Section 4.1.10 of the SAP (SAIC 1998).

The augers used for well installation will have an inside diameter adequate for the installation of 2-inch-diameter wells through the augers and an outside diameter that results in a borehole large enough for a 2-inch minimum annular space around all sides of the well screen. All of the 10 monitoring wells to be installed will require flush-mount surface completions as described in Section 4.1.2.3.3 of the SAP (SAIC 1998).

5.2 GROUNDWATER SAMPLING

Groundwater samples will be collected from each of the 10 wells installed as part of the CAP-Part B investigation activities. Groundwater samples will also be collected from four existing monitoring wells at the PDO Yard and from one direct-push boring at the UST 129 Site. An investigation groundwater sampling summary is presented in Table 5-2.

Table 5-1. Investigation Soil-Sampling Summary

Site	Soil Borings	Analytical Soil Samples per Boring	Headspace Analysis	Soil Analysis[1]					
				BTEX	TPH	TPH-DRO	TPH-GRO	PAHs	Geotechnical
UST 108	3	2	Each sample	6	6	6	6	6	3
USTs 21 & 22	5	2	Each sample	10	0	10	10	10	5
CAP-Part B Reserve	2	2	Each sample	2	2	2	0	2	2
UST 129	1	1	Each sample	1	1	1	0	1	0
PDO Yard	3	1	N/A	0	0	0	0	0	3

Table 5-2. Investigation Groundwater-Sampling Summary

Site	Monitoring Wells	Groundwater Samples per Well	Direct-Push Samples	Groundwater Analysis[1]		
				BTEX	PAHs	Geochemical Parameters
UST 108	3	1	0	3	3	0
USTs 21 & 22	5	1	0	5	5	0
CAP-Part B Reserve	2	1	0	2	2	0
UST 129	0	0	1	1	1	0
PDO Yard	4	1	0	0	0	4

[1] Rinsate blanks and field duplicates will be collected at a rate of 5 and 10 percent, respectively, for soil and water samples designated for chemical analysis. Trip blanks will be sent with each sample shipment containing water samples for BTEX analysis.

BTEX = Benzene, toluene, ethylbenzene, and xylenes.
CAP = Corrective Action Plan.
PAHs = Polynuclear aromatic hydrocarbons.
PDO = Old Property Disposal.
TPH-DRO = Total petroleum hydrocarbon–diesel-range organics.
TPH-GRO = Total petroleum hydrocarbon–gasoline-range organics.
UST = Underground Storage Tank.

Table 5-3. Investigation Sediment and Surface Water-Sampling Summary

Site	Sample Locations	Samples per Location	Surface Water Analysis		Sediment Analysis				
			BTEX	PAHs	BTEX	TPH	TPH-DRO	TPH-GRO	PAHs
UST 108	2	1	2	2	2	2	2	2	2
USTs 21 & 22	2	1	2	2	2	0	2	2	2

BTEX = Benzene, toluene, ethylbenzene, and xylenes.
CAP = Corrective Action Plan.
PAHs = Polynuclear aromatic hydrocarbons.
PDO = Old Property Disposal.
TPH-DRO = Total petroleum hydrocarbon–diesel-range organics.
TPH-GRO = Total petroleum hydrocarbon–gasoline-range organics.
UST = Underground Storage Tank.

Groundwater field measurements performed during sampling activities at each of the four sites will include pH, specific conductance, temperature, turbidity, and ORP. Procedures and equipment for measurement of these parameters are presented in Section 4.1.5 of the SAP (SAIC 1998).

Groundwater samples from the CAP-Part B wells will be collected after the wells have been developed and purged according to Section 4.1.6 of the SAP (1998). The samples will be analyzed for BTEX and PAHs.

A single groundwater sample will be collected from the direct-push boring installed at the UST 129 Site using direct-push sample techniques presented in Section 4.1.6 of the SAP (SAIC 1998). The sample will be analyzed for BTEX and PAHs.

Groundwater samples will be collected from four existing wells at the PDO Yard (MW-05, MW-06, MW-07, and MW1-19). The wells will be purged and sampled according to Section 4.1.6 of the SAP (SAIC 1998) and analyzed for geochemical parameters including nitrate, iron, sulfate, sulfide, methane, and carbon dioxide at an off-site laboratory. Well installation diagrams from the RCRA Facility Investigation (Metcalf and Eddy 1998) are included in Appendix B.

5.3 SOIL BORINGS

Soil borings will be installed using direct-push techniques at the CAP-Part B investigation sites and the UST 129 Site. Soil samples will be collected according to Section 4.2 of the SAP; however, samples collected for volatile organic compound (VOC) analysis will be collected with Encore samplers. The VOC samples will be analyzed following EPA standard operating procedure (SOP) SW-846-8260B (5035) as published by the EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*, Third Edition (November 1986; Revision 1, July 1992; Revision 2, November 1992; through Update 3, June 1997). Three locations will be sampled at the UST 108 Site, and five locations at the USTs 21 & 22 Site will be sampled. Two borings will be held in reserve and positioned using all lines of evidence to ensure the project DQOs are met. Locations will be approved by the USACE Savannah and Fort Stewart/HAAF DPW. A summary of the soil sampling activities is presented in Table 5-1. All direct-push soil borings installed at the CAP-Part B sites will be converted to 2-inch-diameter monitoring wells by overdrilling the direct-push soil boring using hollow-stem auger drilling techniques as described in Section 5.1.

Two soil samples from each boring at the UST 108 Site will be selected and submitted to an off-site laboratory for analysis of TPH, TPH–gasoline-range organics (GRO), TPH–diesel-range organics (DRO), BTEX, and PAHs. Soil collected from the USTs 21 & 22 Site will be submitted for TPH-GRO, TPH-DRO, BTEX, and PAHs.

At the UST 129 Site, one soil sample shall be collected from a boring installed adjacent to the former tank pit near the former UST piping. The sample will be submitted to an off-site laboratory for BTEX, PAH, TPH, and TPH-DRO analysis.

All soil sample collection equipment will be decontaminated according to Section 4.1.10 of the SAP (SAIC 1998).

5.4 SURFACE WATER AND SEDIMENT SAMPLING

Surface water and sediment samples will be collected from the UST 108 and USTs 21 & 22 Sites in surface water drainage ditches that are located downgradient from each site. Surface water samples will be collected using a dipper. The dipper will consist of a stainless-steel, glass, or Teflon container attached to the end of an appropriate-length extension rod. The dipper will be lowered into the water, filled, and the water transferred to laboratory-supplied sample containers. Care will be taken to not overfill sample containers that have been prepreserved. The dipper will be decontaminated after use at each sampling location according to Section 4.1.10 of the SAP (SAIC 1998). Sampling of surface water will commence at the sample location farthest downstream and progress upstream to prevent cross-contamination of surface water from an upstream disturbance. Field measurements performed during the surface water sampling will include pH, specific conductance, and temperature. Procedures and equipment for measurement of these parameters are presented in Section 4.1.5 of the SAP (SAIC 1998).

Sediment samples will be collected using a trowel in accordance with EM 200-1-3. This method will be used in situations where the water depth is less than 15.2 cm (6.0 inches) deep. Samples will be collected from the top 6 inches of sediment. Sediment samples collected for VOC analysis will be collected directly from the trowel into Encore samplers. The VOC samples will be analyzed following EPA SOP SW-846-8260B (5035) (EPA 1997). The remaining samples will be collected directly from the sediment and homogenized in a stainless-steel bowl or in the laboratory-provided sample containers when applicable. Sampling of sediment will commence at the sample location furthest downstream and progress upstream to prevent cross-contamination of samples from an upstream disturbance.

In the event a sample must be collected from a location with greater than 6 inches of water but less than 10 feet, the sediment will be collected using a hand core sampler. The core sampler will consist of a stainless-steel barrel with either an auger bit or core tip mounted on the leading edge of the device. Extension rods will be attached to the core sampler and used to lower the device through the water to the sample point. The core sampler will be pushed or augered 6 inches into the sediment and pulled out to collect the sample. The core sampler will be decontaminated after completion of coring at each sampling location according to Section 4.1.10 of the SAP (SAIC 1998).

Surface water samples will be sent to an off-site analytical laboratory and analyzed for BTEX and PAHs. Sediment samples collected at the UST 108 Site will be analyzed for BTEX, PAHs, TPH, TPH-DRO, and TPH-GRO, while sediment samples collected at the USTs 21 & 22 Site will be analyzed for BTEX, TPH-DRO, TPH-GRO, and PAHs. A summary of the sediment and surface water sampling activities is presented in Table 5-3.

5.5 GEOTECHNICAL SAMPLING

One soil sample from each of the well installation borings installed at the UST 108 and USTs 21 & 22 Sites will be selected for geotechnical analysis. Selection of the 2-feet interval to be analyzed will be based on the visual description of the lithology and will be representative of the site soil. The samples will be collected as disturbed samples and sent to an off-site laboratory to be analyzed for grain-size distribution (ASTM C 117 and 136), Atterburg limits (ASTM D 4318), and moisture content (ASTM D 2216). In addition, one undisturbed (Shelby-tube) soil sample will be collected at the UST 108 Site and analyzed for TOC, permeability, specific gravity, porosity, and density.

Three undisturbed soil samples will be collected at the PDO Yard using stainless-steel Shelby tubes. Each Shelby tube will be analyzed for moisture content, grain-size distribution, Atterburg limits, TOC, permeability, specific gravity, porosity, and density. Soil will be collected from the bottom of each Shelby tube and submitted to the chemical laboratory for total organic content analysis.

6.0 INVESTIGATION-DERIVED WASTE

IDW will be collected, stored, sampled and characterized, and disposed of according to Section 7.0 of the SAP (SAIC 1998). Composite samples will not be used to characterize waste unless directed by Fort Stewart/HAAF and the USACE.

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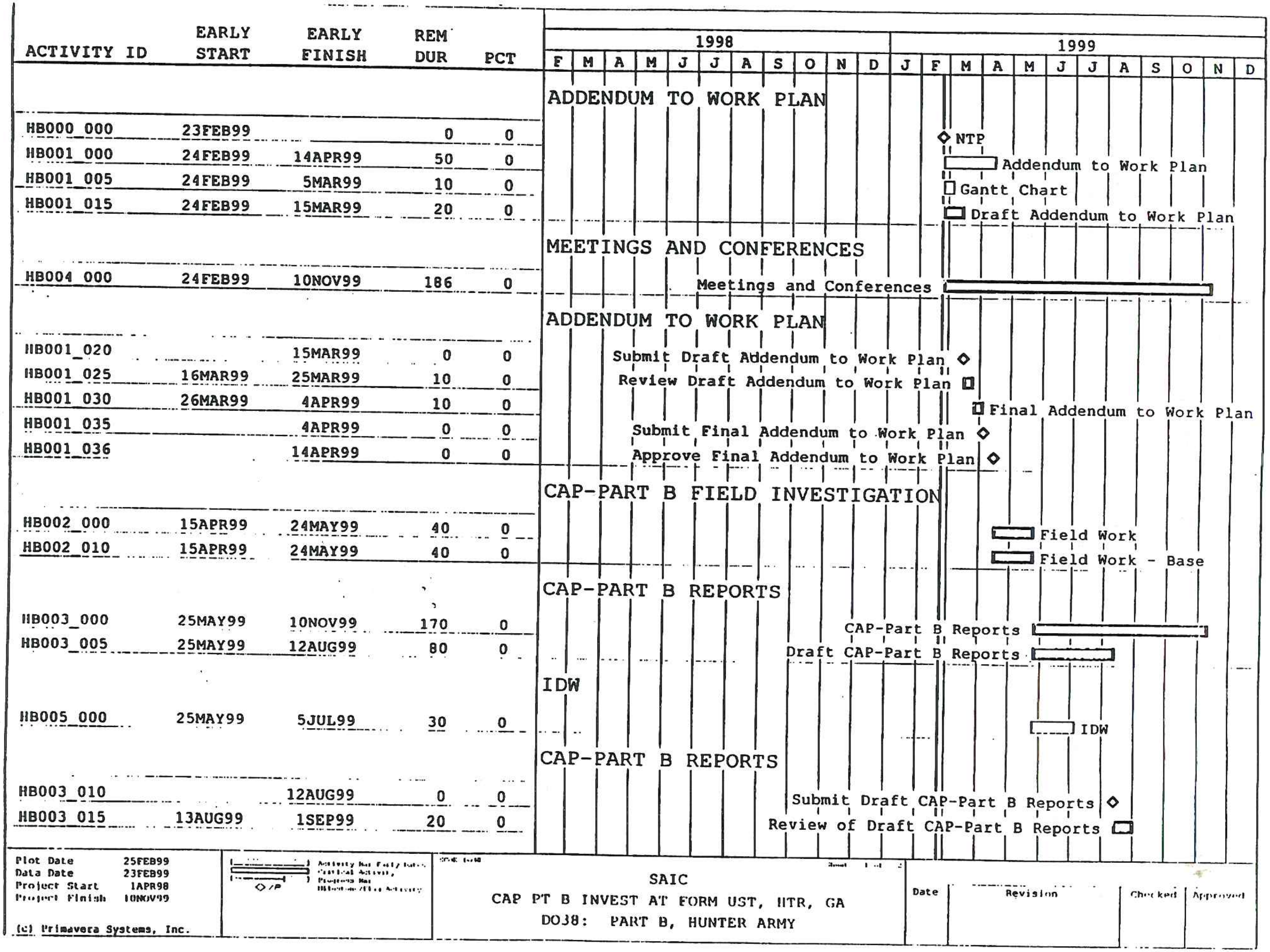
7.0 PROJECT SCHEDULE

The schedule for implementing the SAP addendum and completing the CAP-Part B Reports is outlined in Figure 7-1. The project schedule presented in Figure 7-1 is based on receiving approval of the final SAP addendum in early April 1999. The time scale on this figure is in months after the Notice to Proceed (NTP).



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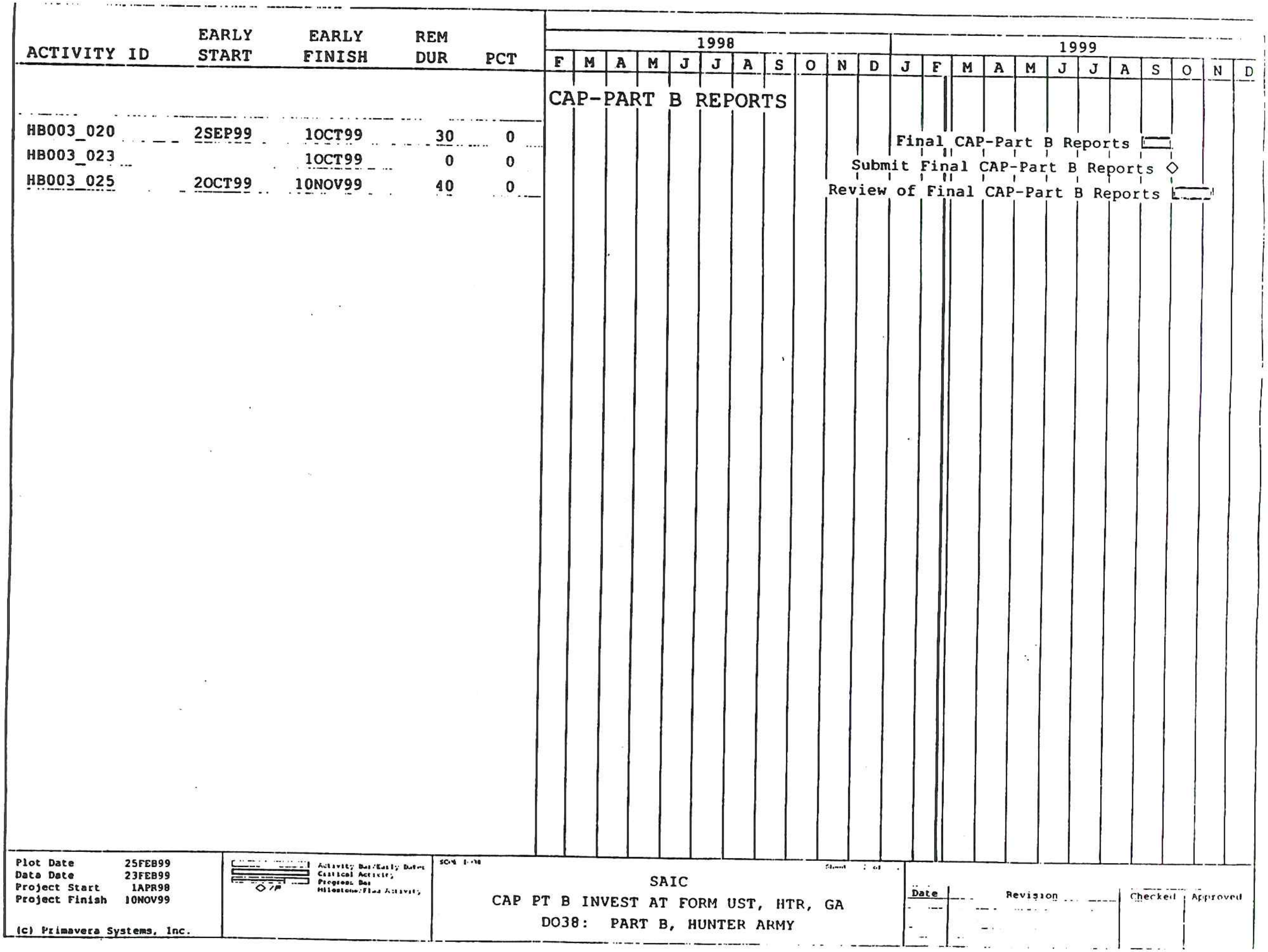
HB000_000	23FEB99		0	0
HB001_000	24FEB99	14APR99	50	0
HB001_005	24FEB99	5MAR99	10	0
HB001_015	24FEB99	15MAR99	20	0
HB004_000	24FEB99	10NOV99	186	0
HB001_020		15MAR99	0	0
HB001_025	16MAR99	25MAR99	10	0
HB001_030	26MAR99	4APR99	10	0
HB001_035		4APR99	0	0
HB001_036		14APR99	0	0
HB002_000	15APR99	24MAY99	40	0
HB002_010	15APR99	24MAY99	40	0
HB003_000	25MAY99	10NOV99	170	0
HB003_005	25MAY99	12AUG99	80	0
HB005_000	25MAY99	5JUL99	30	0
HB003_010		12AUG99	0	0
HB003_015	13AUG99	1SEP99	20	0

Plot Date 25FEB99
Data Date 23FEB99
Project Start 1APR98
Project Finish 10NOV99

(c) Primavera Systems, Inc.

SAIC
CAP PT B INVEST AT FORM UST, HTR, GA
DO38: PART B, HUNTER ARMY

Figure 7-1. Project Schedule for the CAP-Part B Investigations for Former UST Sites at HAAF, Georgia.



ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	PCT
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HB003_023		1OCT99	0	0
HB003_025	2OCT99	10NOV99	40	0

Plot Date	25FEB99
Data Date	23FEB99
Project Start	1APR98
Project Finish	10NOV99

(c) Primavera Systems, Inc.

SAIC
CAP PT B INVEST AT FORM UST, HTR, GA
DO38: PART B, HUNTER ARMY

Date	Revision	Checked	Approved

Figure 7-1. (Continued)

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8.0 REFERENCES

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APPENDIX A

PROPOSED SITE SAMPLING LOCATIONS

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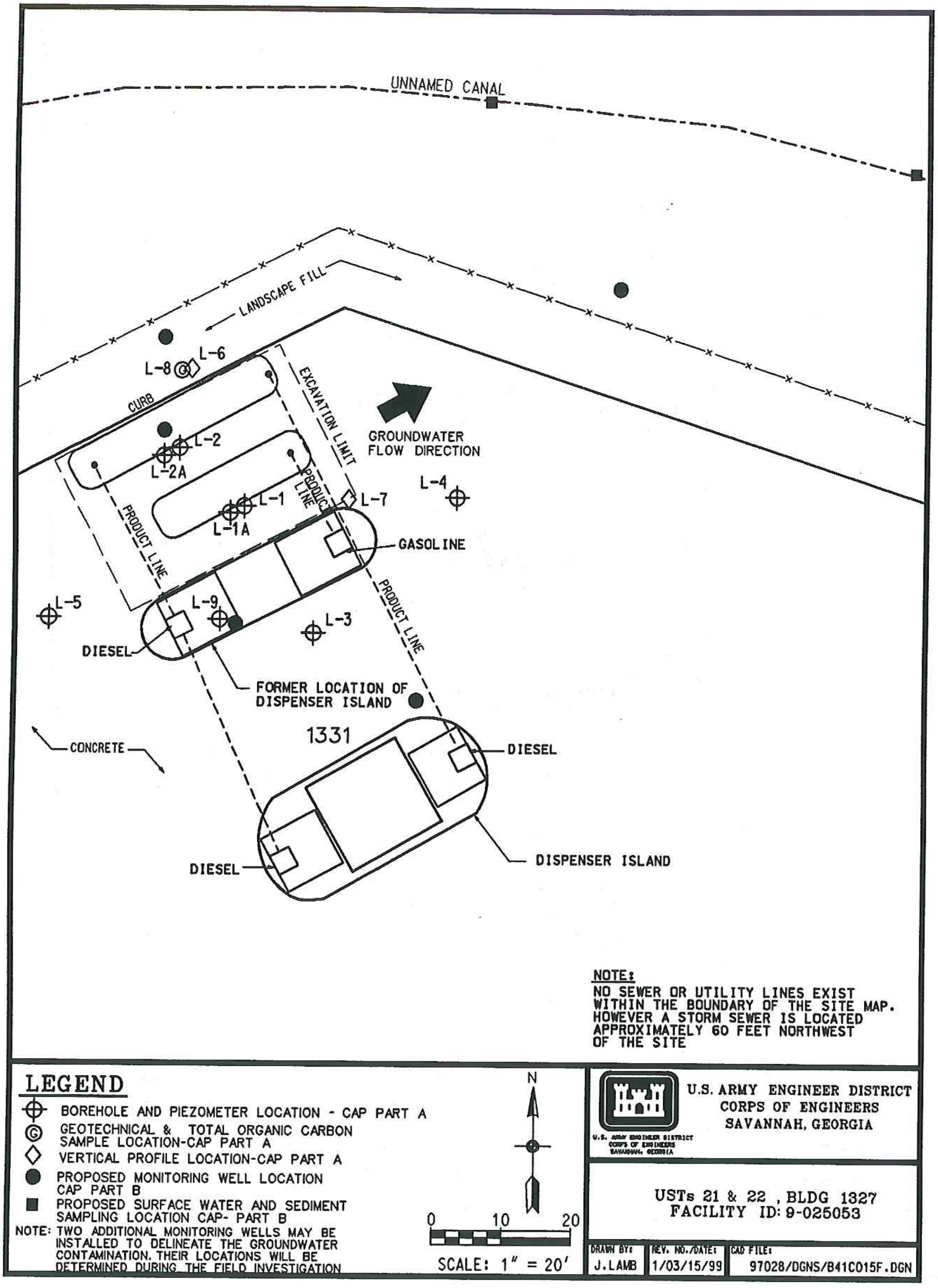

Figure A-1. Proposed Soil Borings/Monitoring Well Locations for the USTs 21 & 22, Building 1327 Site.

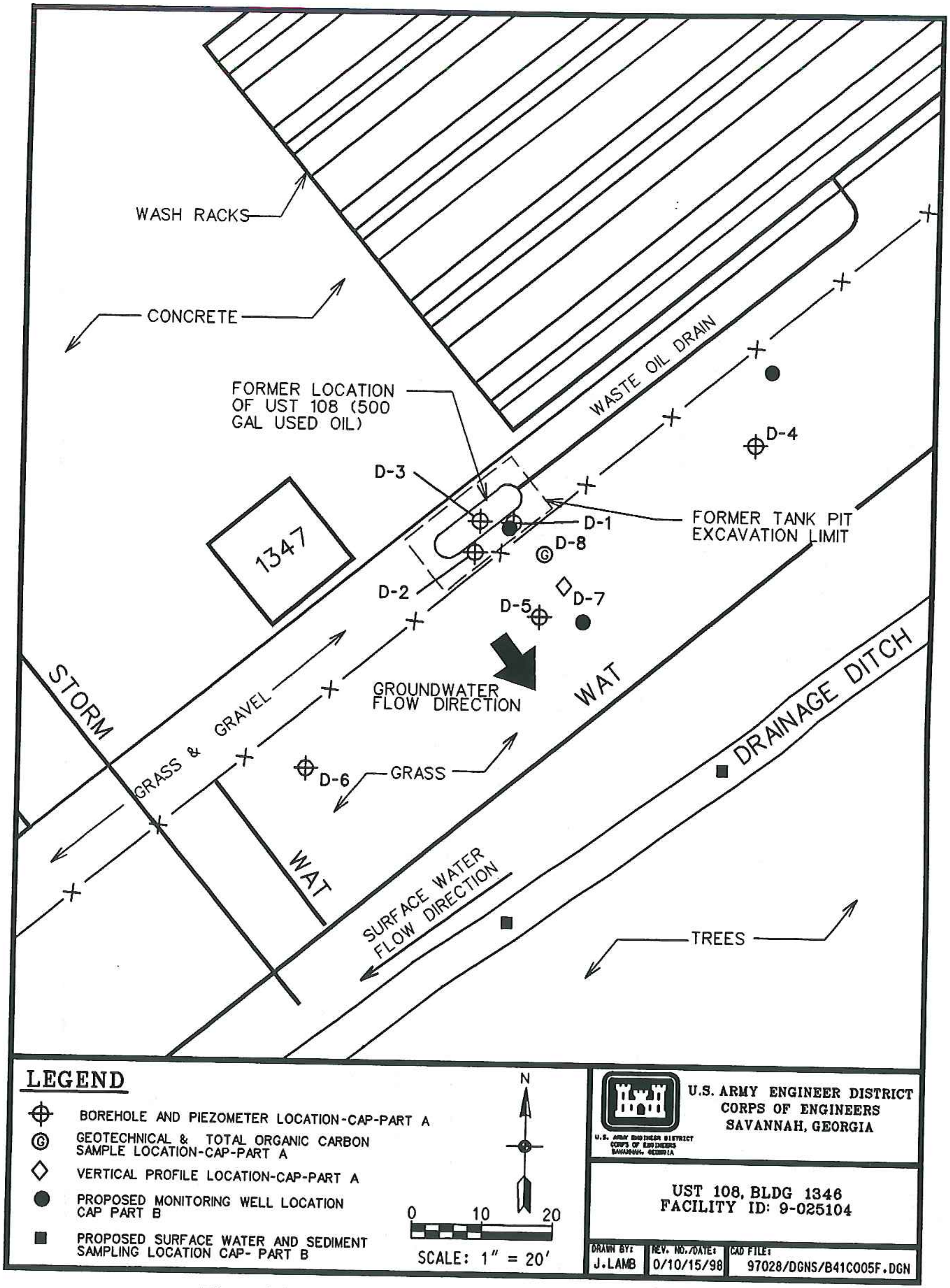

Figure A-2. Proposed Soil Borings/Monitoring Well Locations for the UST 108, Building 1346 Site.

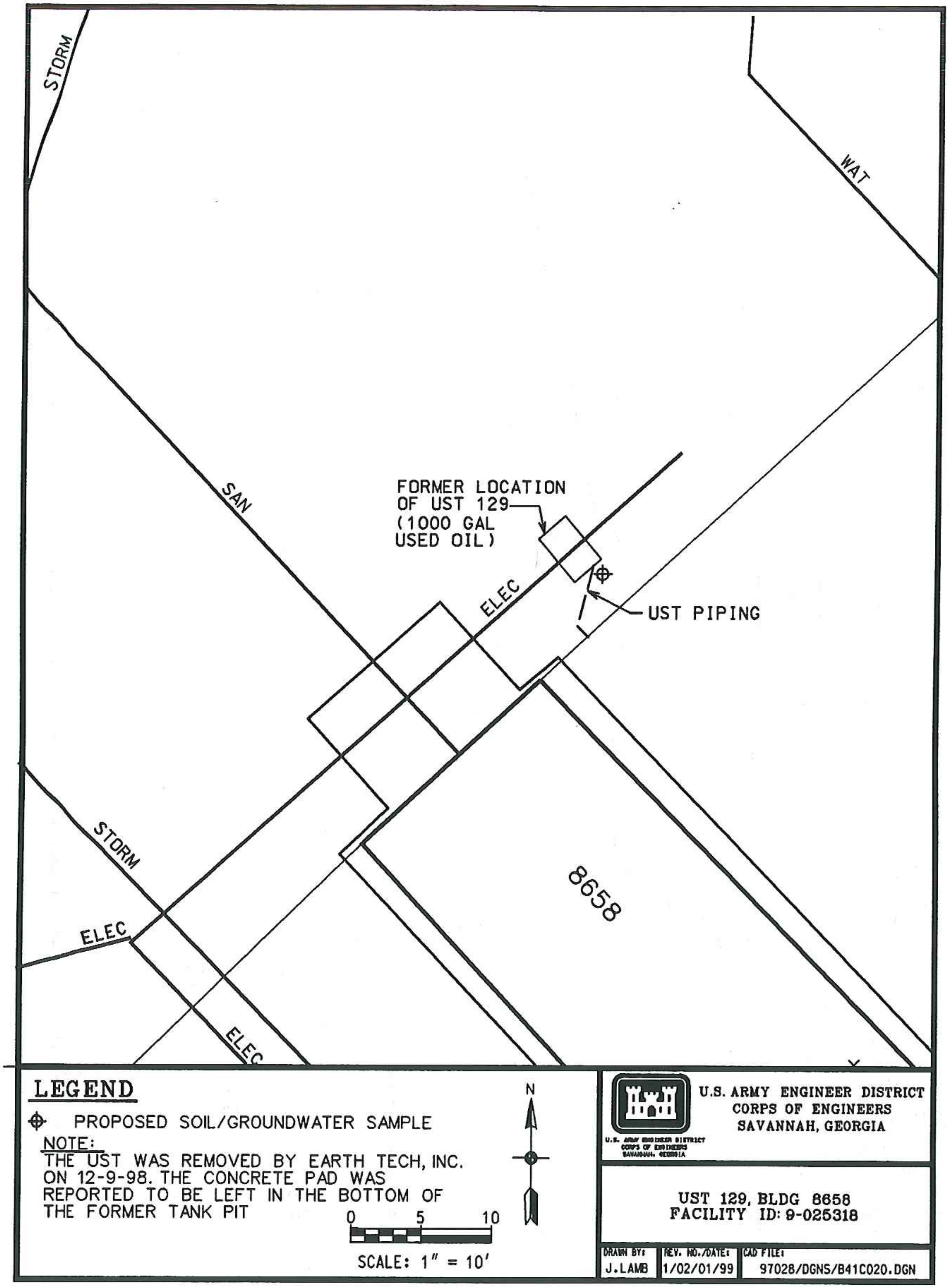

Figure A-3. Proposed Soil Boring/Temporary Piezometer Locations for the UST 129, Building 8658 Site.

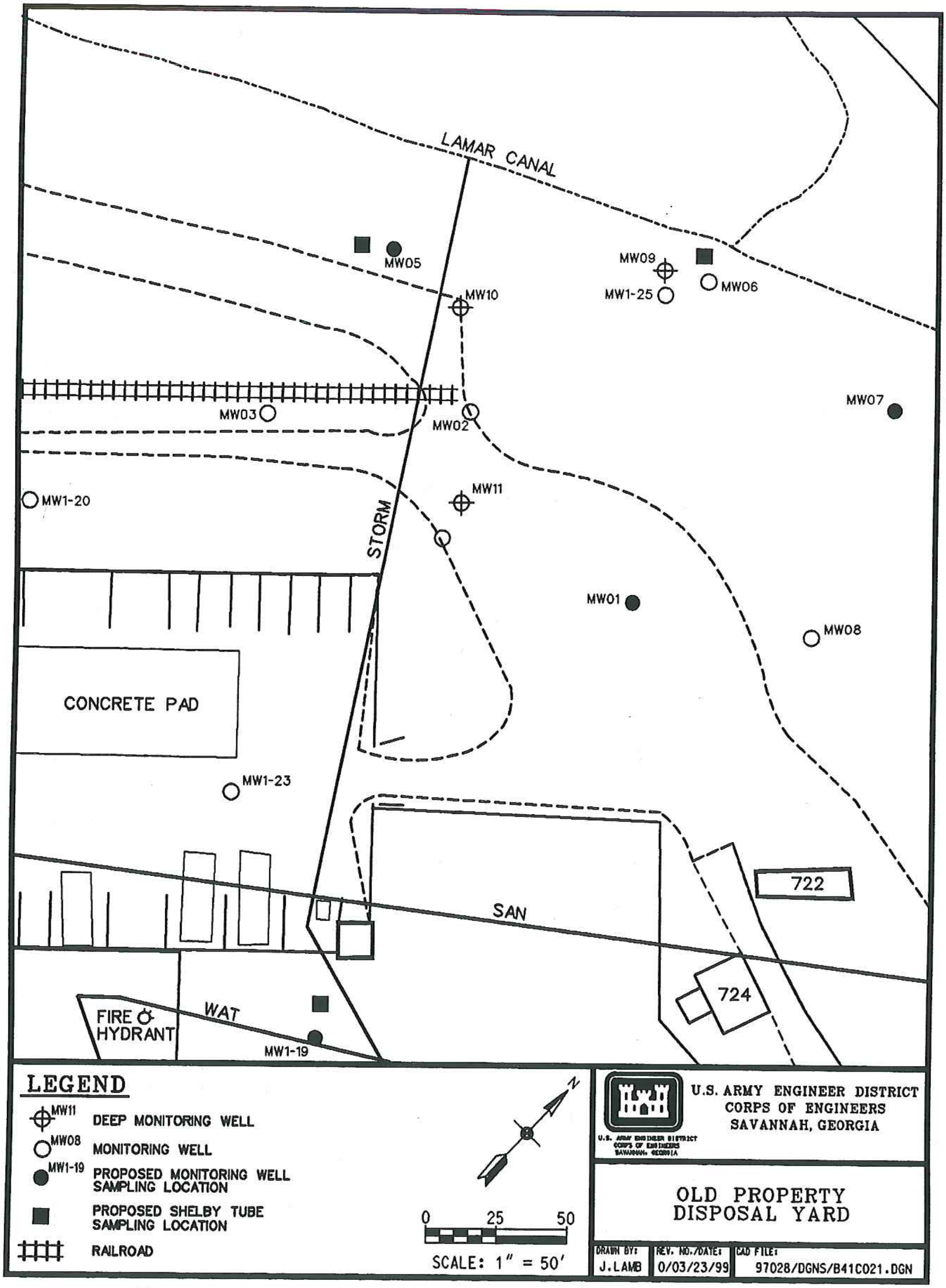

Figure A-4. Proposed Geotechnical Soil and Groundwater Monitoring Well Sampling Locations for the PDO Yard.

APPENDIX B

MONITORING WELL INSTALLATION DIAGRAMS FOR THE OLD PROPERTY DISPOSAL YARD

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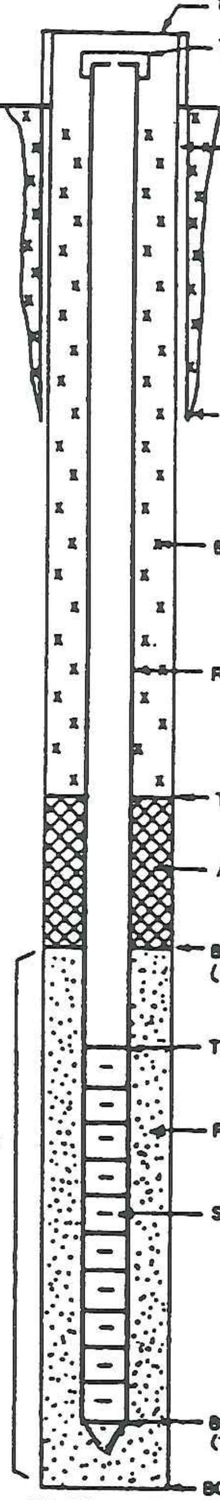
GROUND WATER INSTALLATION

PROJECT:
JOB NO. 017830
WELL NO. PDO - MW01
DRILLING CONTRACTOR: PSI
COORDINATES:
BEGUN: 8/26/96
FINISHED: 8/26/96
SUPERVISOR: D. Humphries
DRILLER: K. Durham
WELL SITE:
WATER LEVEL. DEPTH/ELEV 5.3' bgs

REFERENCE POINT & ELEVATION:



TOP OF SURFACE CASING:
TOP OF RISER CASING:
GROUND SURFACE
SURFACE CASING: DIA.: TYPE:
BOTTOM OF SURFACE CASING
BACKFILL: Grout TYPE: Portland type I
RISER CASING: DIA.: 2" TYPE: PVC sch 40
TOP OF SEAL
ANNULAR SEAL: TYPE: Bentonite
BOTTOM OF SEAL (SEDEPTH)
TOP OF SCREEN
FILTER MATERIAL: Silica Sand TYPE: 30/45
SCREEN: DIA.: 2" 10 SCRLENGTH
OPENING WIDTH: 0.010 in TYPE:
BOTTOM OF SCREEN (TOTDEPTH)
BOTTOM OF HOLE

	DEPTH IN FT.	ELEV. IN
TOP OF SURFACE CASING		
TOP OF RISER CASING		
GROUND SURFACE	0	17.7
BOTTOM OF SURFACE CASING	NA	
TOP OF SEAL	1.0	16.7
BOTTOM OF SEAL	1. 5	16.2
TOP OF SCREEN	2.0	15.7
SCRLENGTH	NA	
BOTTOM OF SCREEN	12.0	5.7
BOTTOM OF HOLE	13.0	4.7

METHOD DRILLED:
6¼" ID HSA

METHOD DEVELOPED:
See Develop Sheet

TIME DEVELOPED:

COMMENTS:

Metcalf & Eddy

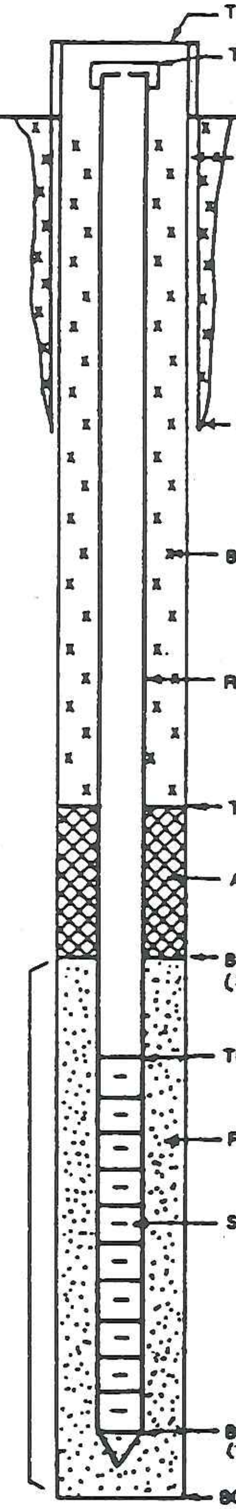
GROUND WATER INSTALLATION

PROJECT: HAAF PDO
JOB NO. 021974
WELL NO. MW05

DRILLING CONTRACTOR: Piedmont
COORDINATES:

BEGUN: 7/21/98
FINISHED: 7/21/98
SUPERVISOR: D. Humphris
DRILLER: Don Young
WELL SITE:
WATER LEVEL. DEPTH/ELEV

REFERENCE POINT & ELEVATION:



GENERALIZED GEOLOGIC LOG

	DEPTH IN	ELEV. IN
TOP OF SURFACE CASING:		
TOP OF RISER CASING:		
GROUND SURFACE		
SURFACE CASING: DIA.: TYPE:		
BOTTOM OF SURFACE CASING	NA	
BACKFILL: grout TYPE: Portland Type I		
RISER CASING: DIA.: 2" TYPE: Sch 40 PVC		
TOP OF SEAL	1.5	
ANNULAR SEAL: TYPE: bentonite pellets		
BOTTOM OF SEAL (SE DEPTH)	3.5	
	6.0	
TOP OF SCREEN		
FILTER MATERIAL: Silica Sand TYPE: Movie Sand OON		
SCREEN: DIA.: 2" OPENING WIDTH: TYPE: 10 slotted		
10 / SCRLENGTH	NA	
BOTTOM OF SCREEN (TOT DEPTH)	16.0	
BOTTOM OF HOLE	16.5	

METHOD DRILLED: 6 1/4" HSA

METHOD DEVELOPED:

HOLE DIAMETER 11"

COMMENTS:

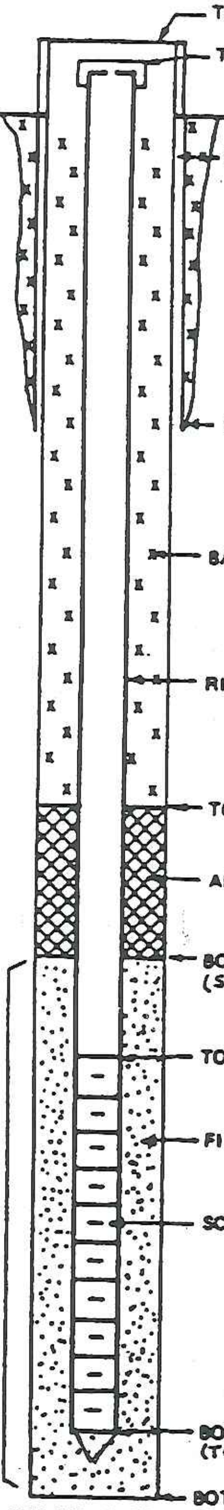
TIME DEVELOPED:

M&E Metcalf & Eddy

GROUND WATER INSTALLATION

PROJECT: HAAF PDO LTM
JOB NO. 021974
WELL NO. MW07
DRILLING CONTRACTOR: Piedmont
COORDINATES:
BEGUN: 7/23/98
FINISHED: 7/23/98
SUPERVISOR: D. Humphri's
DRILLER: D. Young
WELL SITE:
WATER LEVEL. DEPTH/ELEV

REFERENCE POINT & ELEVATION:



GENERALIZED GEOLOGIC LOG

	DEPTH IN	ELEV. IN
TOP OF SURFACE CASING:		
TOP OF RISER CASING:		
GROUND SURFACE		
SURFACE CASING: DIA.: NA TYPE:		
BOTTOM OF SURFACE CASING	NA	
BACKFILL: grout TYPE: Portland Type I		
RISER CASING: DIA.: 2" TYPE: PVC sch 40		
TOP OF SEAL	1.0	
ANNULAR SEAL: TYPE: bentonite pellets		
BOTTOM OF SEAL (SEDEPTH)	2.0	
TOP OF SCREEN	4.0	
FILTER MATERIAL: Silica Sand TYPE: Morie Sand 00 N		
SCREEN: DIA.: 2" OPENING WIDTH: 10 TYPE: slotted 10 / SCRLENGTH	—	
BOTTOM OF SCREEN (TOTDEPTH)	14.0	
BOTTOM OF HOLE	14.0	

METHOD DRILLED :
6 1/4" ID HSA

METHOD DEVELOPED :

HOLE DIAMETER
11"

COMMENTS:

TIME DEVELOPED :

Metcalf & Eddy

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