

**SITE INVESTIGATION SAMPLING AND ANALYSIS
FOR
FORT McCLELLAN, ALABAMA**

FINAL

Administrative Copy

Submitted to:

**U.S. Army Corps of Engineers
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CETHA-IR
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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Hydrogen cyanide
ADEM	Alabama Department of Environmental Management
AMPS	U.S. Army Military Police School
ACMLS	U.S. Army Chemical School
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BEQ	Bachelor Enlisted Quarters
BG	Bacillus globigii
BOQ	Bachelor Officer Quarters
BZ	Chemical Agent (3-Quinuclidynl Benzilate)
CG	Phosgene (Carbonyl chloride)
CK	Cyanogen chloride
COD	Chemical Oxygen Demand
CE	U.S. Army Corps of Engineers
CW	Chemical Warfare
CX	Phosgene oxime
DES ₂	bis(2-diisopropylaminoethyl)
DESMP	S-(diisopropylaminoethyl) methylphosphonothioate
DQO	Data Quality Objective
DS-2	Decontamination Solution 2
DVS	Divinyl sulfide
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FFID	Federal Facility Identification
FFS	Focused Feasibility Study
GB	Sarin (Isopropyl methyl phosphonofluoridate)
H&SP	Health and Safety Plan
HC	Hexachloroethane (Smoke Agent)
HD	Distilled Mustard
HO	Mustard Sulfoxide
HRS	Hazard Ranking System
ID	Inside Diameter
IRDMIS	Installation Restoration Data Management Information System
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
mph	Miles Per Hour
MP	Military Police
MSL	Mean Sea Level
NBC	Nuclear, Biological, and Chemical
NGVD	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetlands Inventory
OD	Outside Diameter
OVA	Organic Vapor Analyzer

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
POW	Prisoner of War
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SAIC	Science Applications International Corporation
SAP	Sampling Analysis Plan
SI	Site Inspection
SM	Serratia mercesans
SOP	Standard Operating Procedure
STB	Supertropical Bleach
SPT	Standard Penetration Test
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TEU	U.S. Army Technical Escort Unit
TRADOC	U.S. Army Training and Doctrine Command
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
UST	Underground Storage Tank
UTES	Unit Training Equipment Site
UXO	Unexploded Ordnance
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VX	O-ethyl-S(diisopropylaminoethyl)-methylphosphonothiolate

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

Science Applications International Corporation (SAIC) is conducting a Site Investigation (SI) at Fort McClellan, Alabama to determine the presence and nature of potential environmental contamination at 17 sites identified by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The work to be conducted at Fort McClellan will be completed at the request of USATHAMA pursuant to Contract DAAA15 91-D 0017, Task Order 1.

This SI Sampling and Analysis Plan (SAP) will be implemented at the sites identified to SAIC by USATHAMA. The 17 sites were selected for initial investigation as a result of the findings of a 1989 SI Report submitted to the U.S. Environmental Protection Agency (EPA) Region IV by Fort McClellan. The sites were presented to U.S. EPA Region IV and the State of Alabama during a January 1991 meeting. The sites to be investigated are summarized in Table 1-1.

SI activities will follow site-specific plans that include field sampling and laboratory chemical analyses conducted using specific quality assurance/quality control (QA/QC) and health and safety requirements. QA/QC and Health and Safety requirements for the Fort McClellan SI are detailed in supplemental plans (SAIC 1991a,b) to this SAP. Specific objectives of the SI include identification of the presence and magnitude of environmental contamination at 17 identified sites at Fort McClellan. Delineation of the areal extent of detected contamination and geologic/hydrogeologic characterization of the sites are not objectives of the SI. Sampling and investigative activities at Fort McClellan will be conducted by SAIC in conjunction with the U.S. Army Technical Escort Unit operating out of the Aberdeen Proving Ground, Maryland. Contractors providing services in support of the Fort McClellan SI will be required to conform to the protocols identified in the project Sampling and Analysis, Quality Assurance, and Health and Safety Plans.

The information gathered during this investigation will enable the SI team to determine the presence or absence of contamination at the identified sites and evaluate the need for further

**Table 1-1. Sites to be Investigated Under SI Program
Fort McClellan, Alabama**

Site	Location
Detection and Identification Area	Main Post
Area T-4 Biological Stimulant Test Area	Main Post
Area T-5 Toxic Hazards Detection and Decontamination Training Area	Main Post
Area T-6 Agent Decontamination Training Area	Main Post
Area T-24A Chemical Munitions Disposal Training Area	Main Post
Area T-31 Technical Escort Reaction Area	Main Post
Area T-38 Technical Escort Reaction Area	Main Post
Old Toxic Training Area	Main Post
Range I Agent Shell Tapping Area	Pelham Range
Range J Agent Training Area	Pelham Range
Range K Agent Training Area	Pelham Range
Range L (Lima Pond) Chemical Munitions Disposal Area	Pelham Range
Old Water Hole	Pelham Range
HD Spill/Burial Sites	Main Post/Pelham Range
Former Landfill # 1	Main Post
Former Landfill # 2	Main Post
Former Landfill # 3	Main Post

investigation. Descriptions of all data quality objectives (DQOs) and procedures associated with sample collection, laboratory analysis, sample custody, initial and continuing instrument/equipment calibration, and internal quality assurance (QA) checks, applicable to this project are contained within this document. Additional information can be found in the project QAP (SAIC 1991a). This SI will be conducted according to the 1987 USATHAMA *Geotechnical Requirements for Drilling, Monitoring Wells, Data Acquisition, and Reports*, and using guidance from the 1986 Region IV U.S. Environmental Protection Agency (EPA) Engineering Support Branch document *Standard Operating Procedures (SOPs) and Quality Assurance Manual*, the 1990 USATHAMA *Quality Assurance Program* for environmental sample collection and analysis.

As the contractor for the SI at Fort McClellan, Science Applications International Corporation (SAIC) has the responsibility for establishing DQOs and the corresponding QA standards by which the sampling and analysis effort will be conducted, and ensuring that these standards are met by all participants.

2. PROJECT DESCRIPTION

2.1 POST DESCRIPTION

Fort McClellan is located in northeastern Alabama near the city of Anniston in Calhoun County, as shown in Figure 2-1. The Post is approximately 60 miles northeast of Birmingham and approximately 75 miles northwest of Auburn, Alabama. Two major municipalities are located in the immediate vicinity of Fort McClellan: Anniston adjoins the main post on the south and east, and the town of Gadsden lies 28 miles to the north. The Morrisville Maneuver Area, or Pelham Range, is located approximately 5 miles due west of the main post and adjoins the Anniston Army Depot. Pelham Range is bordered on the east by U.S. Highway 431. Fort McClellan is under the jurisdiction of the U.S. Army Training and Doctrine Command (TRADOC). The post houses three major organizations -- U.S. Army Military Police School (AMPS), U.S. Army Chemical School (AMCLS), and Training Center (under the direction of the Training Brigade) -- in addition to other major support units and tenants.

2.2 PROCESS AND WASTE DISPOSAL HISTORY

Historical information regarding the activities conducted at the sites to be investigated under the SI program is taken from Weston (1990) and Environmental Science and Engineering (1984). The available information is summarized in Table 2-1. The locations of the SI sites are shown in Figures 2-2 and 2-3.

The chemical and biological agent training sites under investigation during the SI were formerly used for the training of personnel in various facets of chemical and biological warfare decontamination, detection, and munitions/agent disposal. Training occurred at various times between the early 1950's and 1973. Operations occurring on the sites involved various agents, some of which may or may not have been used on the individual sites. The agents included Mustard (HD), the nerve agents VX and GB (Sarin), and the biological simulants BG and SM. The predominant agent thought to have been used at Fort McClellan was HD. One important property of HD is that it readily undergoes hydrolysis to form thiodiglycol, a fairly nontoxic compound. The HD may also polymerize on its surface in aqueous situations to form a protective insoluble coat, thus inhibiting further hydrolysis.

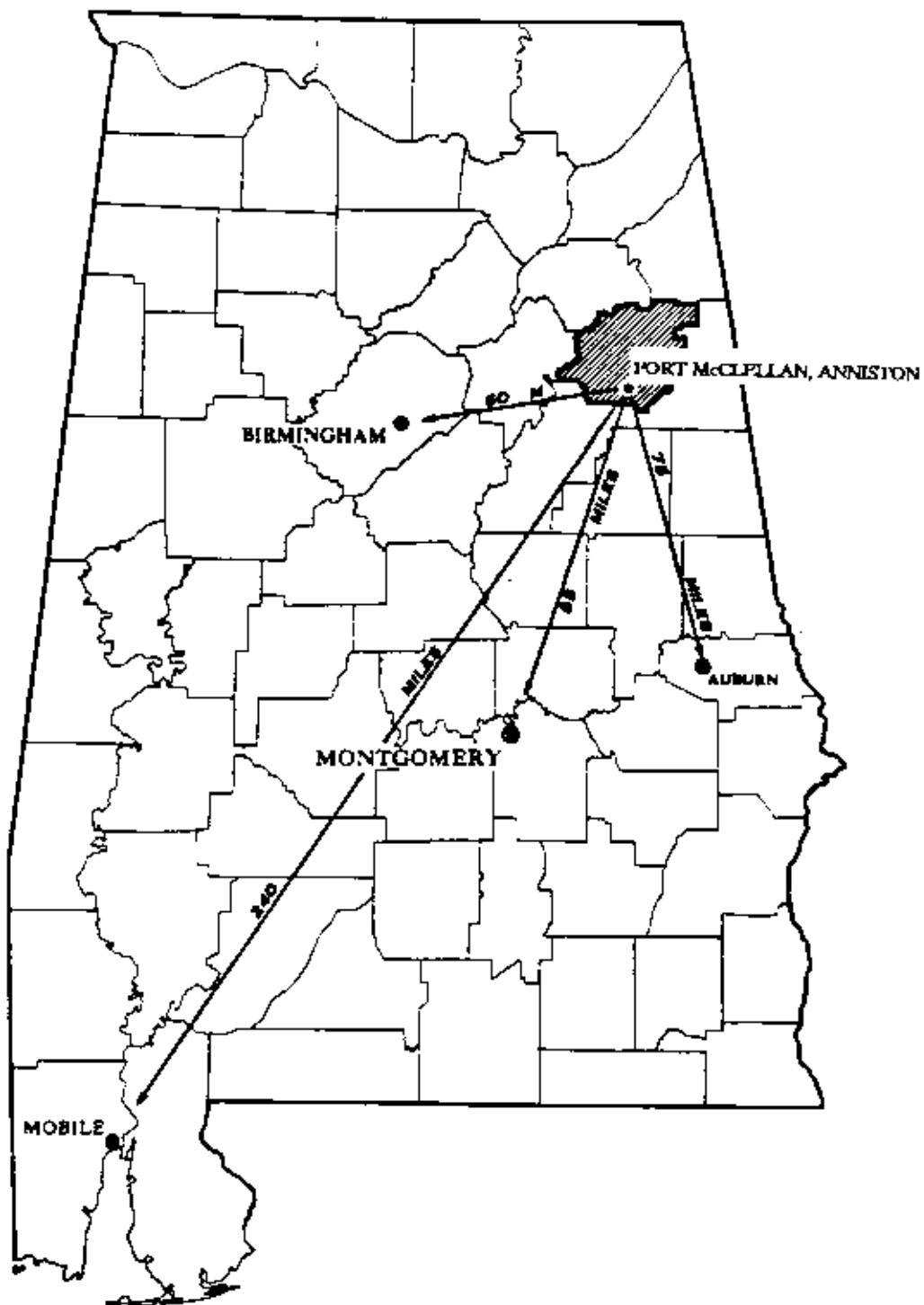


Figure 2-1 Location of Fort McClellan: Anniston, Alabama

Table 2-1. S1 Site Historical Use, Fort McClellan, Alabama

Site	Approximate Size	Process and Waste Disposal History
Detection and ID Area	1.1 acres	Testing and training with chemical/biological agents BG, HD, HD, CK, CC, CX, AC; Training aids burned in pit onsite.
T-4 Biological Stimulant Test Area	.25 acres	Testing biologic stimulants RG, SM.
T-5 Toxic Hazards Detection and Decontamination Training Area	11.4 acres	Training for detection and decontamination of HD, HX agents. Possible (unconfirmed) 110 gallon HD spill.
T-6 Agent Decontamination Training Area	7.5 acres	Training for decontamination of chemical agents, including HD.
T-24a Chemical Munitions Disposal Training Area	1.5 acres	Chemical munitions disposal training for CG, RZ, GB, HD agents. Two square (736 sq.ft.) burn pits, depth unknown, possibly 6 feet. Possible HD spill (unconfirmed).
T-31 Technical Escort Reaction Area	3.4 acres	Training with GB, HD agents. Onsite storage. Possible spills (unconfirmed).
T-38 Technical Escort Reaction Area	6 acres	Training in elimination of toxic hazards for chemical munitions storage of GB, VX, HD agents; STB, DS-2 decontaminants.
Old Toxic Training Area	.23 acres	Training exercises for identification and detection of HD agent. Other agents possible. Agent placed directly on ground surface.
Range I - Agent Shell Tapping Area	.5 - 1 acre	Chemical agent shell tapping - HD agent.
Range J - Agent Training Area	.2 acres	Training and chemical/biological agent disposal, possibly HD. Possible HD spill disposal area.
Range K - Agent Training Area	2 acres	Chemical/biological agent (unknown type) training.

Table 2-1. SI Site Historical Use, Fort McClellan, Alabama (Continued)

Site	Approximate Size	Process and Waste Disposal History
Range 1 - Chemical Munitions Disposal Area (Luna Pond)	.5 acres	Disposal of captured WW II munitions, including chemical munitions.
Old Water Hole	Location unknown	Disposal site (possible sinkhole), chemical agents, munitions.
HD Spill/Burial Sites	Varied	HD spill/burial sites.
Former Landfill #1	2 acres	No information available on operation or content of landfill.
Former Landfill #2	4 acres	Waste disposal during deactivation of installation.
Former Landfill #3	22 acres	Sanitary landfill disposal.

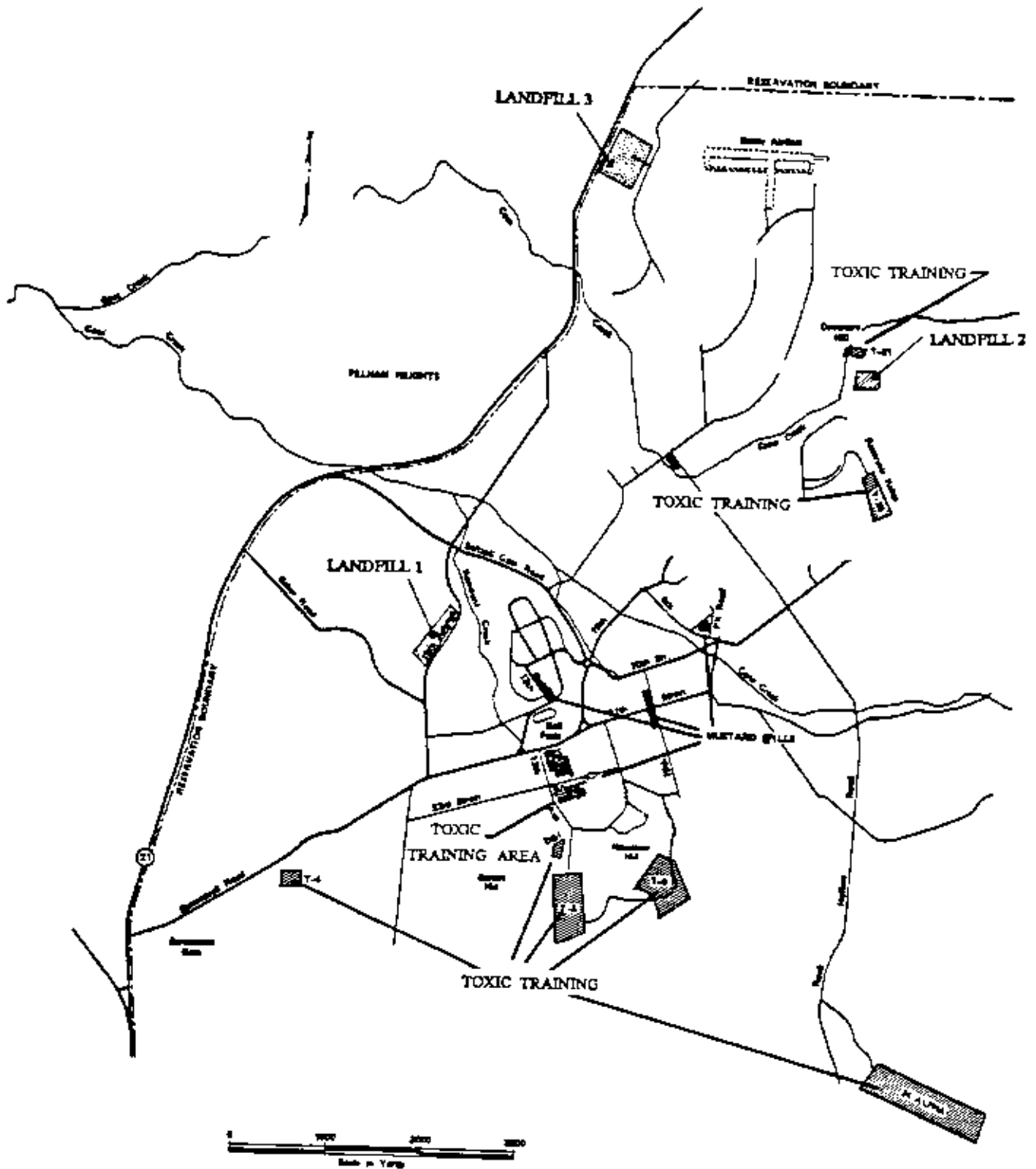


Figure 2-2. Site Locations: Main Post

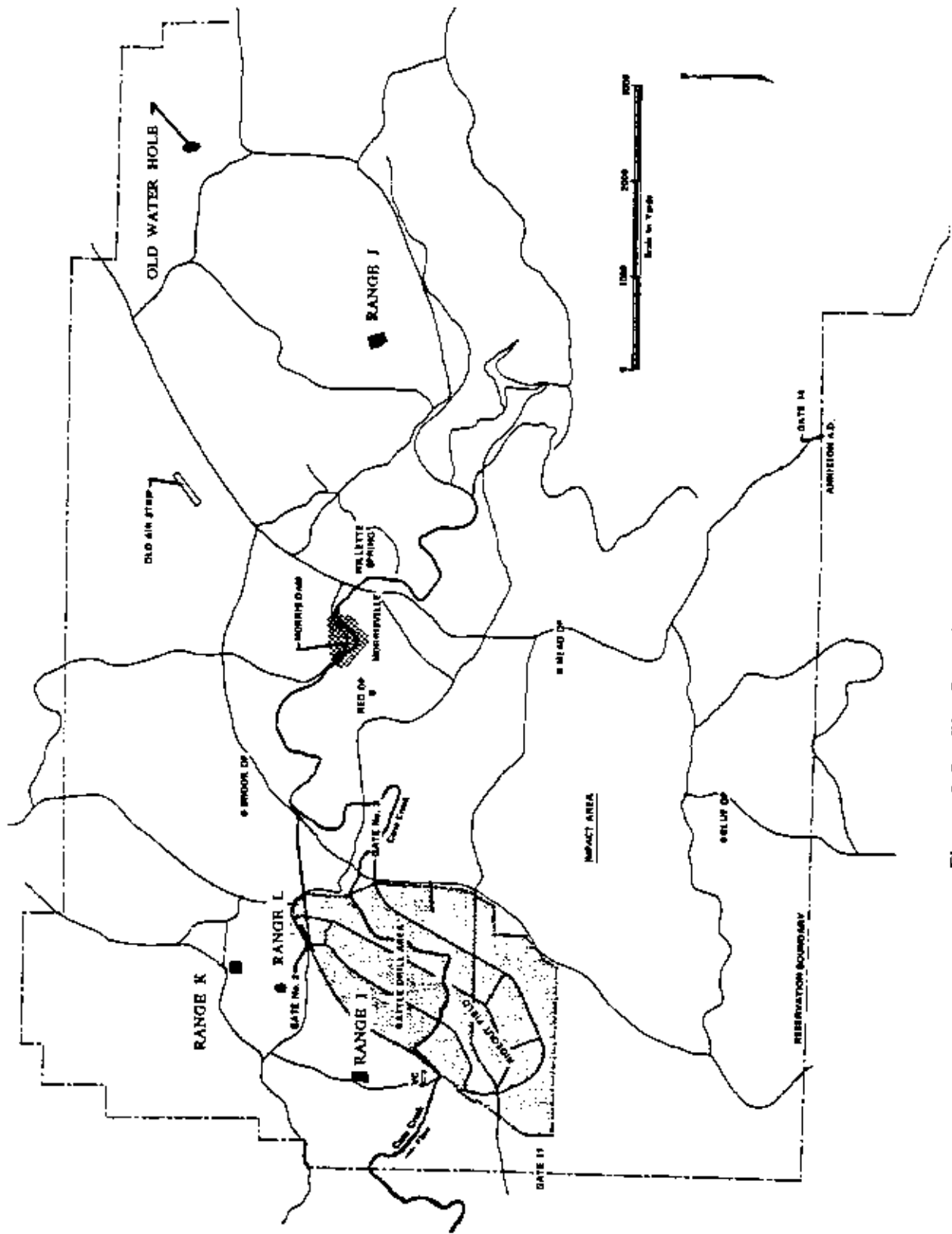


Figure 2-3. Site Locations: Pelham Range

Based on the hydrolysis characteristics of the compounds, Weston (1990) concluded that the only toxic compounds with potential to persist in groundwater are divinyl sulfide (DVS), mustard sulfoxide (HO), DES, (bis[2-diisopropylaminoethyl]), and S-(diisopropylaminoethyl) methylphosphonothioate (DI/SMP). Divinyl sulfide is formed from the alkaline hydrolysis of HD with DS-2, and HO is formed from the oxidation of HD with STB. DESMP is formed from the hydrolysis of VX. Although the potential exists for these compounds to be present in groundwater, it is unlikely that they will be detected due to the limited quantities of agents used and subsequently decontaminated during training exercises.

Waste disposal activities were conducted at Former Landfills #1 to #3 at various times between approximately 1945 to 1973. The landfills were reportedly utilized for the disposal of municipal wastes and construction-type debris.

2.3 PROJECT OBJECTIVES AND INTENDED DATA USAGES

The primary objective of the SI is to determine the presence, type, and concentration of contaminants potentially occurring at the sites under investigation. Based on the data obtained from each site, the site will either be eliminated from further study or will be recommended for inclusion in the Remedial Investigation/Feasibility Study (RI/FS) process. Sites in which contamination is identified will be recommended for further investigation (i.e., RI/FS) or for no further action, if justified.

To accomplish this goal, data will be collected during the following activities:

- Monitoring well installation
- Subsurface soil sampling and analysis
- Sediment and surface water sampling and analysis
- Groundwater sampling and analysis.

Data obtained from soil samples, surface water, and sediment samples collected by the U.S. Army Technical Escort Unit (TEU) will be used to confirm the presence of chemical agents or their breakdown products. Data obtained from groundwater samples collected at former

Landfills # 1, 2, and 3 will quantitatively determine the presence of contaminants associated with the landfill contents.

2.4 TARGET COMPOUNDS

Target compound and element lists have been prepared based on the type of activities conducted or the contaminants suspected at each site. Table 2-2 summarizes the target compounds for each site.

2.5 DATA QUALITY OBJECTIVES

DQOs are qualitative (i.e., comparability and completeness) and quantitative (i.e., accuracy, precision, and completeness) and define the quality of data required to support all decisions made during the SI activities at each site. The DQOs determined for each SI site were developed following the guidelines presented in the 1987 EPA document *Data Quality Objectives for Remedial Response Activities*, Office of Solid Waste and Emergency Response (OSWER) Directive 933550.7B, in addition to the USATHAMA document *Quality Assurance Program*, USATHAMA PAM 11-41, January 1990. All environmental samples and associated QC samples will be collected and analyzed using methods and QC procedures commensurate with the 1990 USATHAMA QA Program. During the course of this SI, all activities and analyses will be conducted using standard procedures so that known and acceptable levels of precision, accuracy, representativeness, completeness, and comparability (PARCC) are documented. All results will be produced using established methodology and SOPs, and will be reproducible at all levels. DQOs for the SI are identified in Section 3.1.1.

Table 2-2. Target Analyses for Fort McClellan SJ

Location	Site Number	Number of Samples	Media	Analytical Parameters
Area T-4	1	0	Soil	Agent ¹ and Agent breakdown products ²
Area T-5	2	10	Soil/Sediment	Agent ¹ and Agent breakdown products ²
Area T-6	3	8	Soil	Agent ¹ and Agent breakdown products ²
Area T-24A	4	5	Soil/Sediment	Agent ¹ and Agent breakdown products ²
Area T-31	5	10	Soil/Sediment Surface Water	Agent ¹ and Agent breakdown products ²
Area T-38	6	6	Soil	Agent ¹ and Agent breakdown products ²
Old Toxic Training Area	7	4	Soil	Agent ¹ and Agent breakdown products ²
Range K	8	1	Sediment	Agent ¹ and Agent breakdown products ²
Range I	9	4	Soil	Agent ¹ and Agent breakdown products ²
Range J	10	8	Soil	Agent ¹ and Agent breakdown products ²
Detection and Identification Area	11	4	Soil	Agent ¹ and Agent breakdown products ² and metals
HD Spill/Disposal Sites	12	0	
Range L (Lama Pond)	13	1/1	Sediment/ Surface Water	Metals, volatiles, semi-volatiles, pesticides/PCBs, agent agent breakdown products ² , and explosives ³
Former Landfill #1	14	0	Magnetometer survey

Table 2-2. Target Analyses for Fort McClellan SI (Continued)

Location	Site Number	Number of Samples	Media	Analytical Parameters
Former Landfill #2	15	3	Groundwater	Metals, volatiles, semivolatiles, pesticides/PCBs, agent breakdown products ¹ , and explosives ²
Former Landfill #3	16	10/1	Groundwater/ Surface Water	Metals, volatiles, semivolatiles, pesticides/PCBs, agent breakdown products ¹ , and explosives ²
Old Water Hole	17	0	----	Magnetometer survey
Potable Water	----	2	Potable Water	Metals, volatiles, semivolatiles, pesticides/PCBs, agent breakdown products ¹ , and explosives ²
Background		4	Surface Water Sediment/Soil	Metals, volatiles, semivolatiles, pesticides/PCBs, agent breakdown products ¹ , and explosives ²

¹ Agent analyses to be conducted onsite.

² HD (i.e., bis(2-chloroethyl)sulfide) breakdown products include thiodiglycol (USATHAMA certification number UW22 p-chlorophenylmethyl sulfone, p-chlorophenylmethyl sulfoxide, 1,4 oxathiane, and 1,4 dithiane (USATHAMA certification number UL04).

GB (i.e., methylphosphorofluoridic acid, 1-methylethyl ester) breakdown products include isopropyl methylphosphonic acid (IMPA) and methylphosphonic acid (USATHAMA certification number UT02), and dimethyl methylphosphonate and diisopropyl methylphosphonate (USATHAMA certification number T8).

VX (i.e., methylphosphonothioic acid, S-[2-[bis(1-methylethylamino)ethyl]o-ethyl ester) breakdown products include ethyl methylphosphonate (or its sodium salt NaSC₂H₃N-(CH₂)₂) and isopropyl amine (no USATHAMA-certified method required).

³ Explosives, excluding PETN, TETR, or picric acid.

3. FIELD INVESTIGATION APPROACH AND PROCEDURES

This section presents the approach and procedures that will be followed during the SI at Fort McClellan, Alabama. The planned investigation and the purpose and logic of each specific activity are outlined below. SAIC's Standard Operating Procedures (SOP's) for field activities are provided in Appendix A. These procedures are non-program specific and have not been reviewed for compliance with USATHAMA guidelines. USATHAMA or U.S. EPA Region IV protocols will take precedence over SAIC's procedures where conflicts occur.

3.1 SITE INVESTIGATION OBJECTIVES

Data requirements for the SI phase of an Installation Restoration Program (IRP) project are less extensive than those necessary for a Remedial Investigation/Feasibility Study (RI/FS) phase. The objectives of the SI at Fort McClellan require that sufficient data be obtained to:

- Determine the presence and chemical nature of identified constituents
- Evaluate the potential for contaminant release and migration
- Conduct a preliminary hazard ranking system (HRS) scoring for remediating confirmed contamination at the site determined to have the highest level of contamination
- Prepare recommendations for broader investigation activities to determine the full extent of contamination (e.g., RI/FS phase), if necessary
- Evaluate the necessity for immediate response actions.

3.1.1 Data Quality Objectives

Analytical data are required from the Fort McClellan SI to support site characterization, hazardous constituent characterization, risk assessment, and evaluation of immediate response alternatives. These data use requirements indicate that the minimum appropriate analytical level is equivalent to EPA data quality objective (DQO) Level III. Recognized standards, such as American Society for Testing and Materials (ASTM) methods, will be used procedurally where appropriate. Specific DQOs for accuracy, precision, comparability, representativeness, and completeness, and specific analytical methods are detailed in the project QAP.

3.2 FIELD SAMPLE LOCATIONS

Approximately one week prior to the beginning of sampling activities at Fort McClellan, representatives of USATHAMA, EPA Region IV and SAIC will convene onsite to formally stake sample locations in the field.

3.3 GEOPHYSICAL SURVEYS

Magnetometer surveys will be conducted by the U.S. Army TEU at the Old Water Hole and Range L. The geophysical surveys at these sites will be planned and conducted by the TEU to assist in detecting quantities of disposed metallic munitions and identifying the areal extent of the site. The identification of subsurface anomalies during these geophysical surveys will aid in the selection of locations for future soil sampling or investigative work that may be performed at the sites. The nature and extent of the geophysical surveys to be conducted at these sites will be fully incorporated into the SAP by addendum. Survey planning, data collection, analysis, and reporting for these sites will be conducted by the TEU. Data and interpretation from the TEU surveys will be incorporated into the SI Report. SAIC will plan and conduct a magnetometer survey over the inferred area of Former Landfill #1. The results and analysis of the survey will be incorporated into the SI report.

3.3.1 Former Landfill #1 - Magnetometer Survey

Seven transects (Figure 3-1) will be made across the site using a portable proton precession magnetometer system. Magnetometer readings will be obtained at approximately 20 foot intervals along each transect. The magnetometer will be an EG&G Model G-856AX or EDA Instruments OMNI IV "Tie-line" instrument or equivalent. Either of these instruments will provide accuracy on the order of ± 1 gamma unit.

Prior to initiating the survey, the transect lines will be established in the field and the operator will remove magnetic objects from his person. Readings will be recorded in the instruments memory and will be simultaneously recorded in a field notebook. Measurements of the total magnetic field will be obtained at each transect interval. Several measurements will be obtained at each location to provide information on measurement repeatability.

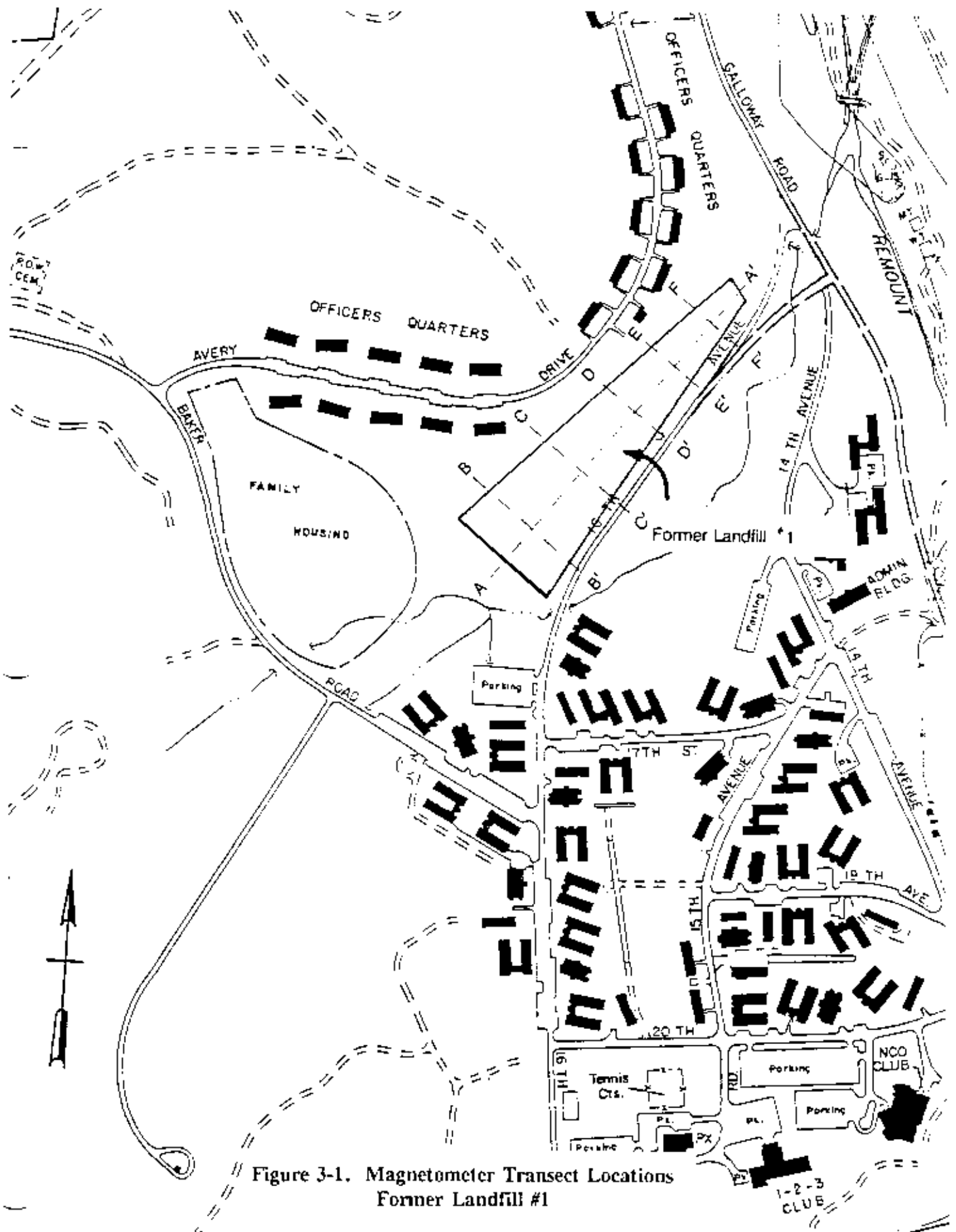


Figure 3-1. Magnetometer Transect Locations
Former Landfill #1

The survey data will be plotted for each transect and a plan view contour map of the data will be prepared with the survey data posted at each measurement location. The interpretation of the resulting data will focus on steep magnetic gradients and anomalously elevated total field readings.

3.3.2 *Old Water Hole*

The Old Water Hole is reportedly a disposal site located between New Mt. Sellers Cemetery and the prisoner of war (POW) camp on Pelham Range (see Figure 2-3). Post personnel reported that a variety of munitions, including chemical agents, may have been disposed of at a possible sinkhole. A rectangular, shallow, topographic depression approximately 85 by 35 feet was located by Fort McClellan Department of Environmental Health personnel in the approximate area between the cemetery and the POW camp. An additional circular depression was located near the main depression in this area. Fort McClellan personnel indicate that the depression periodically fills with water, although it was dry during an October 1991 site visit. Several small-caliber bullet shells were found at the site. The U.S. Army TEC will plan and conduct a magnetometer survey of the area. Additional sampling is not planned for the site area.

3.3.3 *HD Spill/Burial Sites*

A number of HD spills and burial sites (see Figure 2-2) have been reported on both the Main Post and Pelham Range, although the reports are unsubstantiated. Areas cited as possible spill locations include:

- Near 6th Street and PX Road
- Along the western side of 10th Avenue on either side of 21st Street
- Along the eastern side of 13th Avenue
- Southeast of the intersection of 13th Avenue and 23rd Street
- Toxic gas area near the western property line of Pelham Range, north of Cane Creek.

These areas have been paved or otherwise developed and in the absence of documented evidence of the reported sites, sampling is not presently warranted. These areas will be re-examined when additional documentation of spills or burials at these sites is located.

3.4 SHALLOW SOIL AND SEDIMENT SAMPLING

Shallow soil and sediment sampling will be conducted to provide data on the presence or absence of contamination in the surface and shallow subsurface soil. Shallow subsurface soil sampling will be conducted by the U.S. Army TEU at the following sites:

- Area T-4 (Site area reworked; unable to locate)
- Area T-5
- Area T-6
- Area T-24A
- Area T-31
- Area T-38
- Old Toxic Training Area
- Range K
- Range I
- Range J
- Detection and Identification Area
- Range L.

These sites are associated with the previous use of chemical or biological agents for training and research purposes or for munitions disposal. A decontaminated stainless steel hand auger (3" or 4" diameter) will be used by the TEU to drill boreholes to 5 feet below land surface. Duplicate soil samples will be collected from a homogenized bulk sample at the 1-foot and 5-foot depth intervals. SAIC will assist the TEU with sample packaging, shipping, and chain-of-custody protocols. A sample from each interval will be analyzed onsite to determine if chemical agent is present. Once clearance of the samples has been obtained from the TEU and the samples are declared free of chemical surety material, the remaining samples will be shipped from the site to SAIC's designated laboratory with all chain-of-custody intact. The sampled

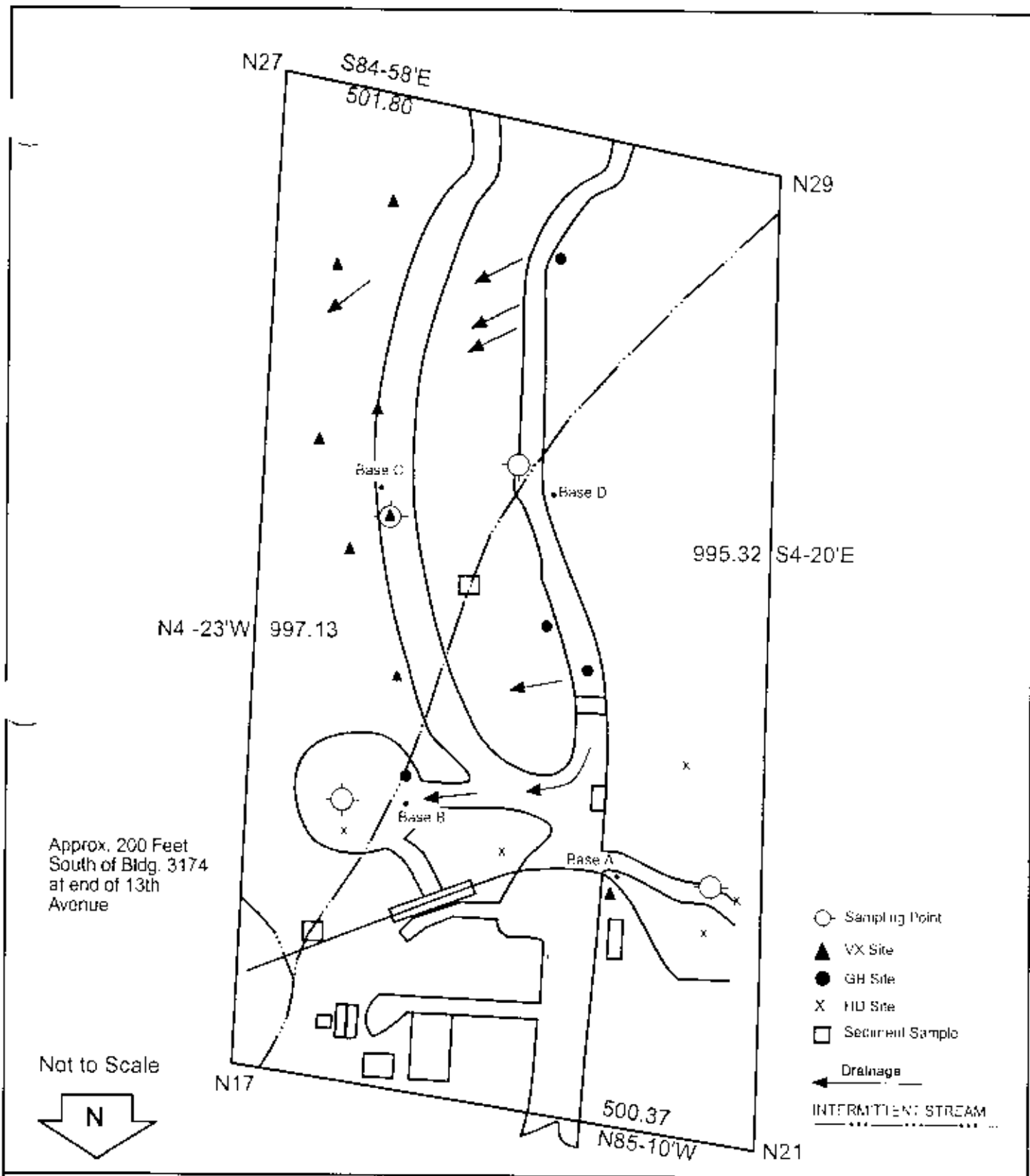
locations will be marked with a wooden stake painted fluorescent orange and labeled with the sample point identification number. Sampling to be conducted at these sites is described below.

3.4.1 Area T-4

Area T-4 was a Biological Simulant Test Area located on the Main Post (see Figure 2-2). Records indicate that the 0.25-acre site was used between 1965 and 1971 for biological simulants (BG and SM) training. Decontamination of the agents on the surface soils was performed by adding STB and DS-2. Contamination from HD was not detected in surface soil samples collected in April and July 1973. The area of the former site has been extensively re-worked and no evidence of a former site was observed during an October 1991 site visit by USATHAMA and SAIC. Additional sampling will not be conducted at this site because the biological simulants are not persistent and the site has been extensively rearranged such that the original site cannot be located.

3.4.2 Area T-5

Area T-5 was the Toxic Hazards Detection and Decontamination Training Area located between Sunset Hill and Howitzer Hill (see Figure 2-2). The 11.4-acre site was used between 1961 and 1973 to train students in the methods of detecting and decontaminating toxic agents (HD, VX, and GB). The quantities of agent used in training exercises ranged from 20 to 40 milliliters per exercise. The training sites were decontaminated by adding STB and/or DS-2 and were checked at the end of each exercise. In addition to HD, VX, and GB used during training, the site may have been the location of a 110-gallon HD spill. Available evidence indicates that the contaminated soil was chemically decontaminated, removed, and ultimately disposed of at Range J (Pelham Range). Surficial soil samples were taken at the unit in December 1972, April 1973, and July 1973 and analyzed for chemical agents HD, GB, and VX, with all results being below detection limits. Survey monuments "C" and "D" were located in the field during an October 1991 site visit. Additional building foundations and an asphalt pad were also found at this time. Four locations will be sampled in the vicinity of former training exercises at the site. The selected locations will provide a cross-section of the various agents used at the site. Additionally, two sediment samples will be taken from the intermittent streambed that crosses Area T-5. The sample locations are shown in Figure 3-2.



T5 CHEMICAL AREA - FORT McCLELLAN
EOD REACTION AREA

Figure 3-2

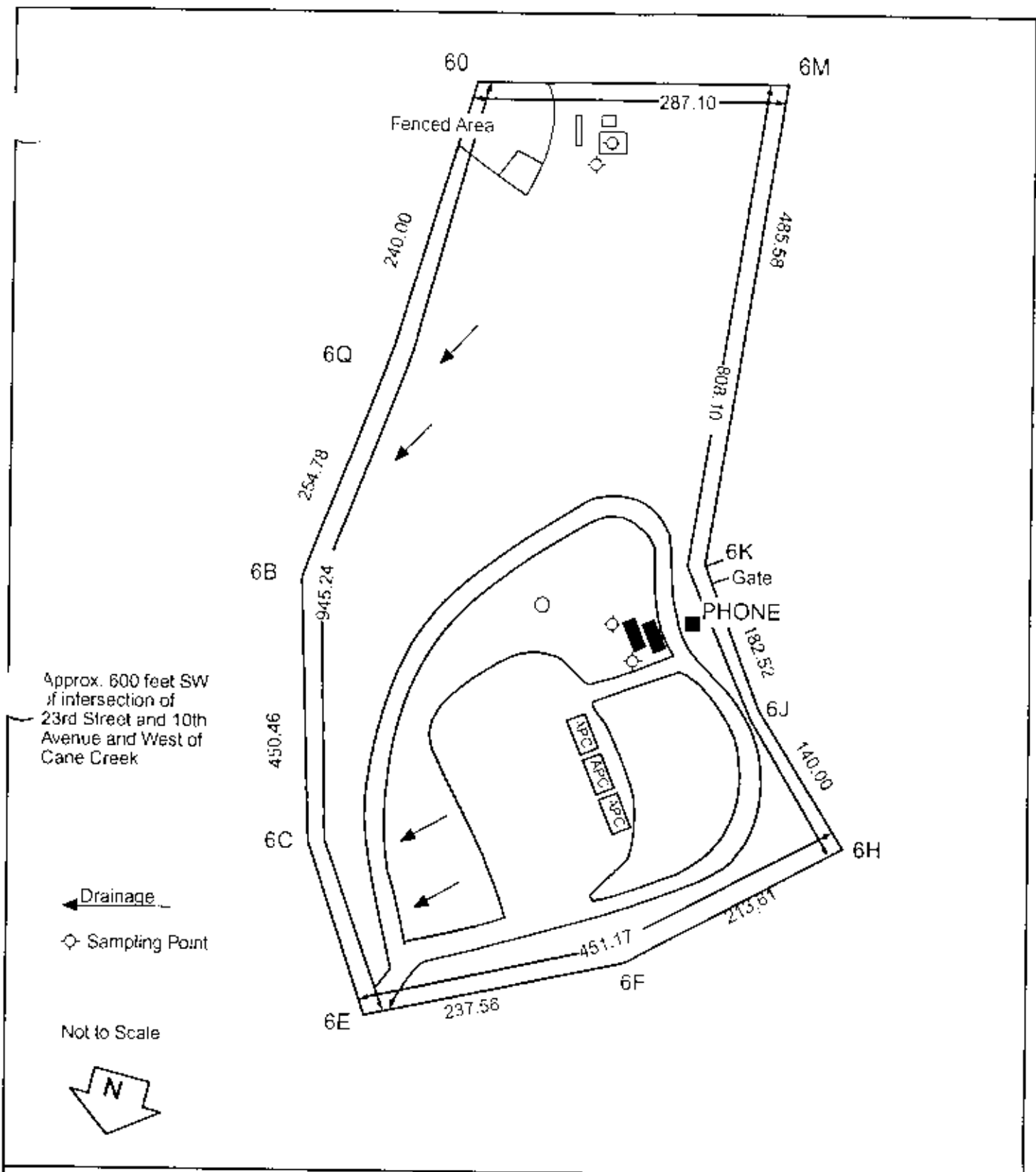
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3.4.3 Area T-6

Area T-6 was an Agent Decontamination Training Area (also referred to as Naylor Field) located near the base of the eastern slope of Howitzer Hill (see Figure 2-2). The 7.5-acre site was used until 1973 for training in techniques of decontaminating chemical agents, including HD. The area reportedly contained eight training sites that consisted of concrete pads on which equipment was parked. The equipment was contaminated with not more than 40 milliliters of HD during each exercise. Decontaminants STB and DS-2 were used during the exercises. Random surface soil samples taken at the site in March 1973 revealed no agent contamination, and the area was cleared for surface activity. Several concrete pad structures and a small metal hut were located on the heavily wooded site during an October 1991 site visit. Subsurface samples will be collected on the downslope side of the concrete pads located in October 1991. Additional samples will be collected in and downslope of the metal hut. The sample locations are shown in Figure 3-3.

3.4.4 Area T-24A

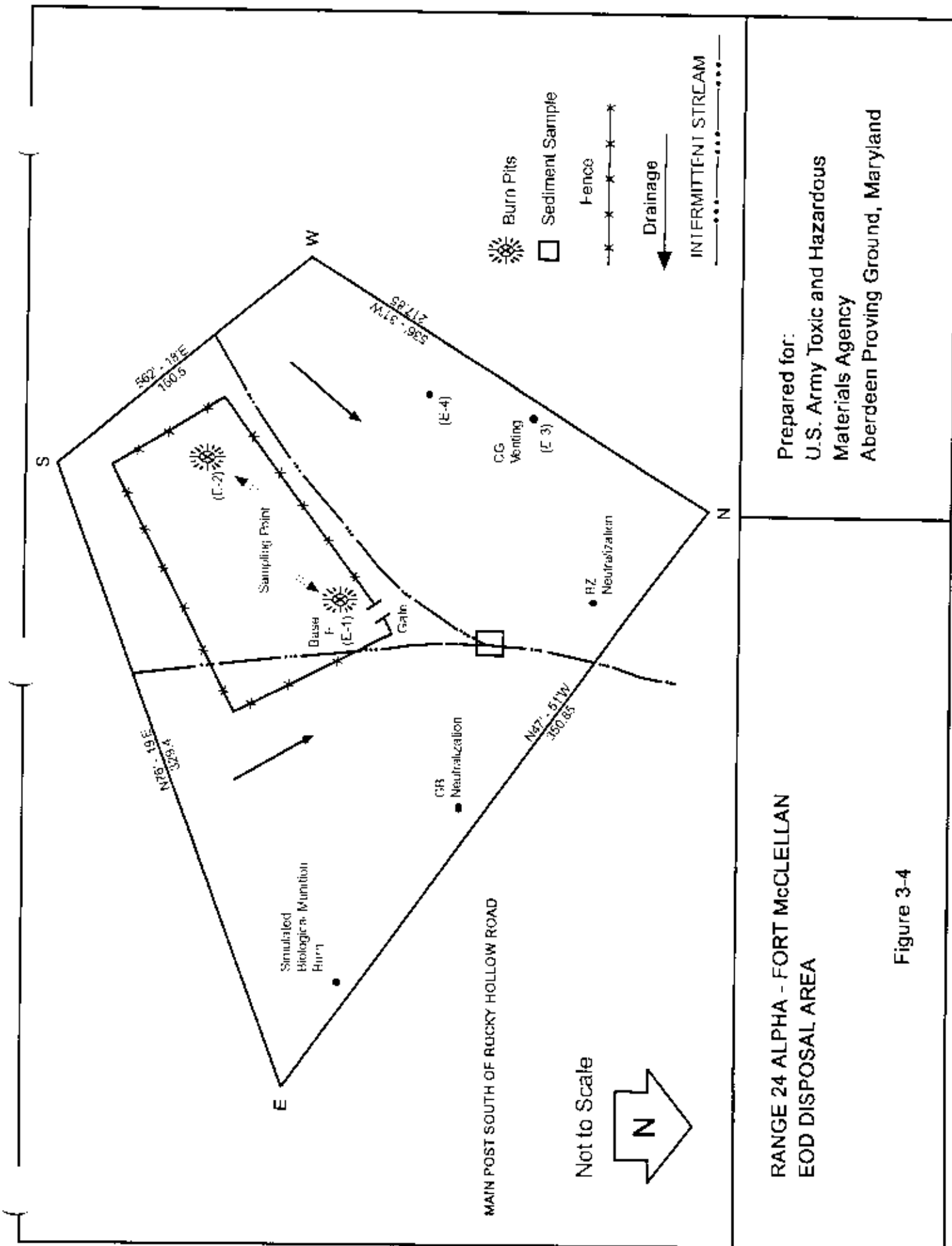
Area T-24A was a Chemical Munitions Disposal Training Area located on the Main Post south of Holloway Hill (see Figure 2-2). The 1.5-acre site was used until 1973 for chemical munitions disposal training with CG, BZ, GB, and HD. Quantities of HD used during each training exercise were approximately 4.46 kilograms. Quantities of CG, BZ, and GB were 40 milliliters, one M-6 canister, and 740 grams, respectively, per exercise. Two square burning pits, each 16 feet on a side, were used for training exercises and were enclosed by a fenced area measuring 40 by 80 meters. Decontamination of agents on residual soils was conducted with STB and DS-2. Surface sampling conducted in April and July 1973 in the proximity of the pits was negative for the agents. The enclosed site area was heavily overgrown during an October 1991 site visit. A survey marker was located within the enclosure showing the location of a former burn pit. Two 81-mm mortar shells were also discovered at the site in October 1991. Subsurface samples will be collected at this site in the vicinity of the burn pits. A sediment sample will be collected from the intersection of the two intermittent creekbeds northeast of the site. The locations of the sample points are shown in Figure 3-4.



T6 CHEMICAL AREA (HOWITZER HILL)
 AGENT DECONTAMINATION AREA -
 FORT McCLELLAN

Figure 3-3

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RANGE 24 ALPHA - FORT McCLELLAN
 EOD DISPOSAL AREA

Figure 3-4

3.4.5 Area T-31

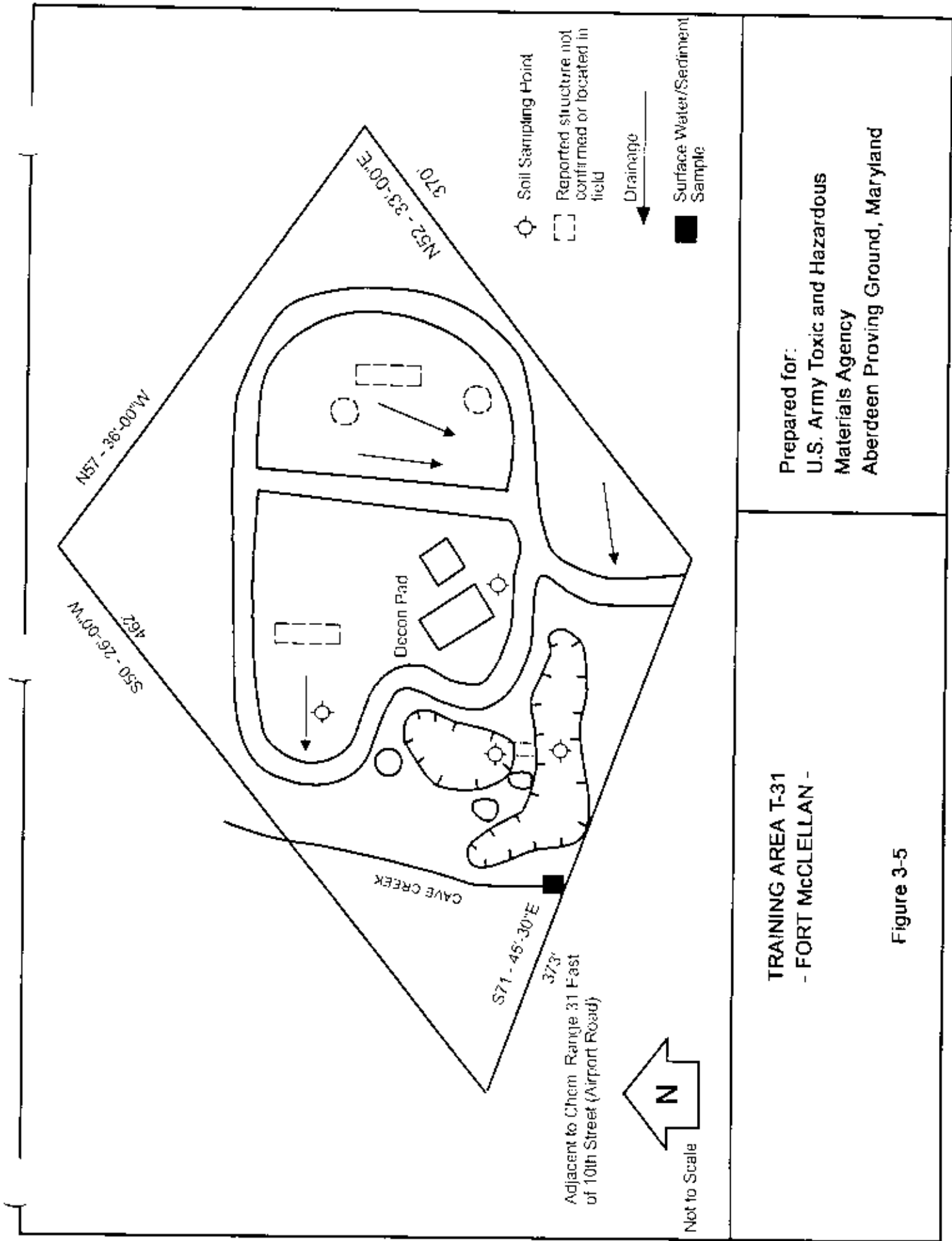
Area T-31 (Technical Escort Reaction Area) was a toxic hazard training area located on the Main Post (see Figure 2-2) near Range 31. The 3.4-acre site was used between 1957 and 1969 for training with GB and HD in quantities of 20 to 40 milliliters. Area T-31 also was used to store undetermined types of chemical agents and several spills were reported to have occurred onsite from these stored materials. Several concrete pads and structures were located during an October 1991 site visit. Sampling at the site will be conducted in the vicinity of a concrete decontamination pad and in a drainage culvert. A surface water and sediment sample will be collected from Cave Creek near its point of egress from the site area. The sample locations are shown in Figure 3-5.

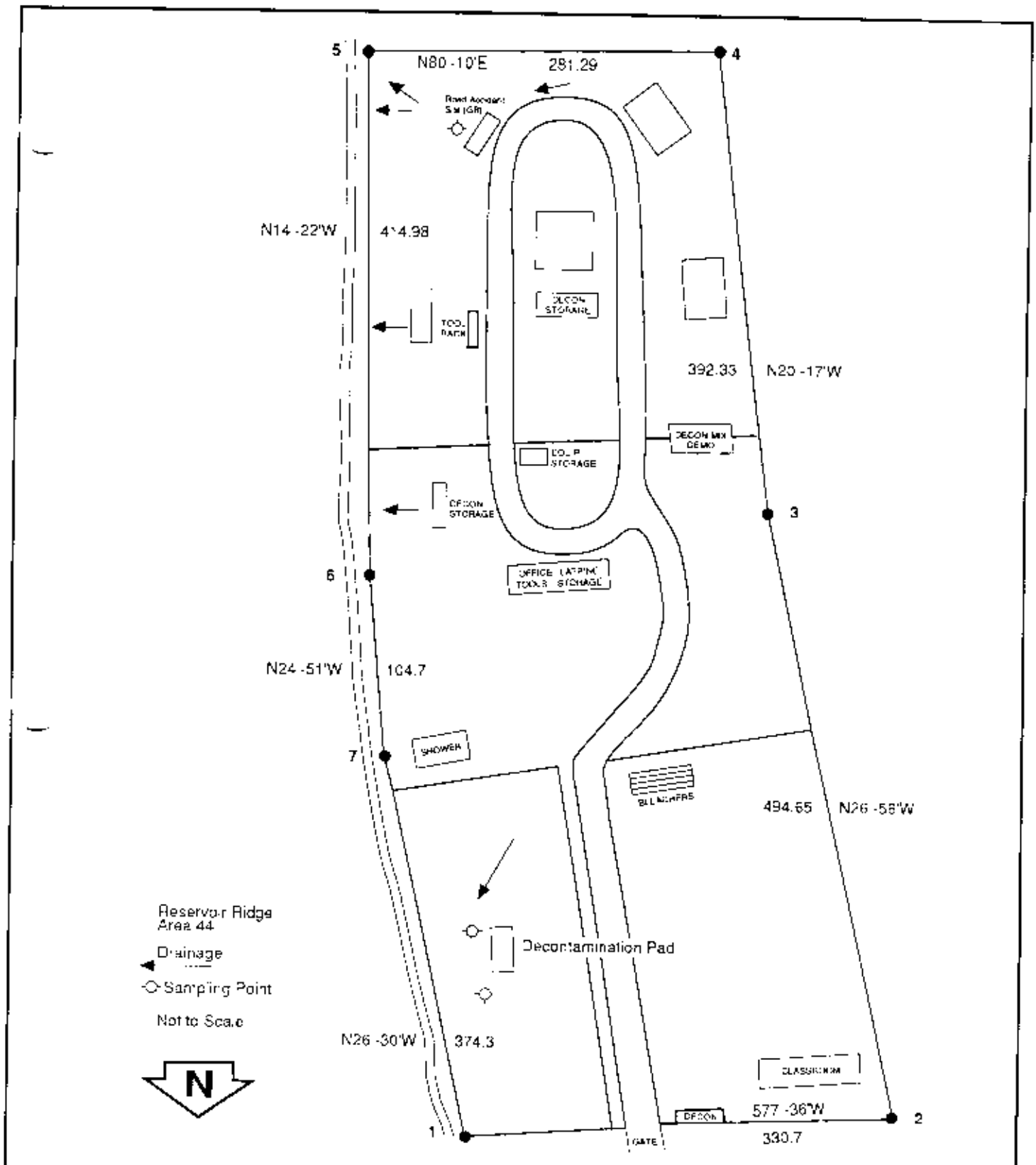
3.4.6 Area T-38

Area T-38 (Technical Escort Reaction Area) is located on the Main Post west of Reservoir Hill (shown in Figure 2-2). The 6-acre site was used between 1961 and 1972 for training escort personnel in techniques of eliminating toxic hazards caused by mishaps to chemical munitions during transport. The area was also used for storage of toxic agents and munitions, including GB, VX, and HD. In addition, unspecified decontaminants (likely STB and DS-2) were stored on at least two sites and were used for demonstration purposes. Extensive decontamination was conducted on this site for reported spills and contaminated training aids. Residual surface contamination with HD was reported in January 1973. Subsequent sampling in March 1973 indicated that Area T-38 was free from surface contamination. A concrete decontamination pad was located in the field during an October 1991 site visit. In addition, there is an unconfirmed report of the burial of a drum of agent in the southern portion of the site (location not specified). Sampling at site T-38 will be conducted downslope of a concrete decontamination pad at the site. Additional samples will be collected in the area of the former drum burial once the location is determined. The sample locations at site T-38 are shown in Figure 3-6.

3.4.7 Old Toxic Training Area

The Old Toxic Training Area is located within a fenced area on the Main Post behind Building 3183 (see Figure 2-2). The 484-square-foot ditch area was used during the 1950's for training exercises in the identification and detection of HD. The quantities of agent used during





T38 TRAINING AREA — FORT McCLELLAN
 TECHNICAL ESCORT REACTION AREA

Figure 3-6

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training are not documented. According to facility personnel, the chemicals were placed on the ground surface. Subsurface soil samples will be obtained from two locations in the fenced ditch area. The sample locations are shown in Figure 3-7.

3.4.8 Range K

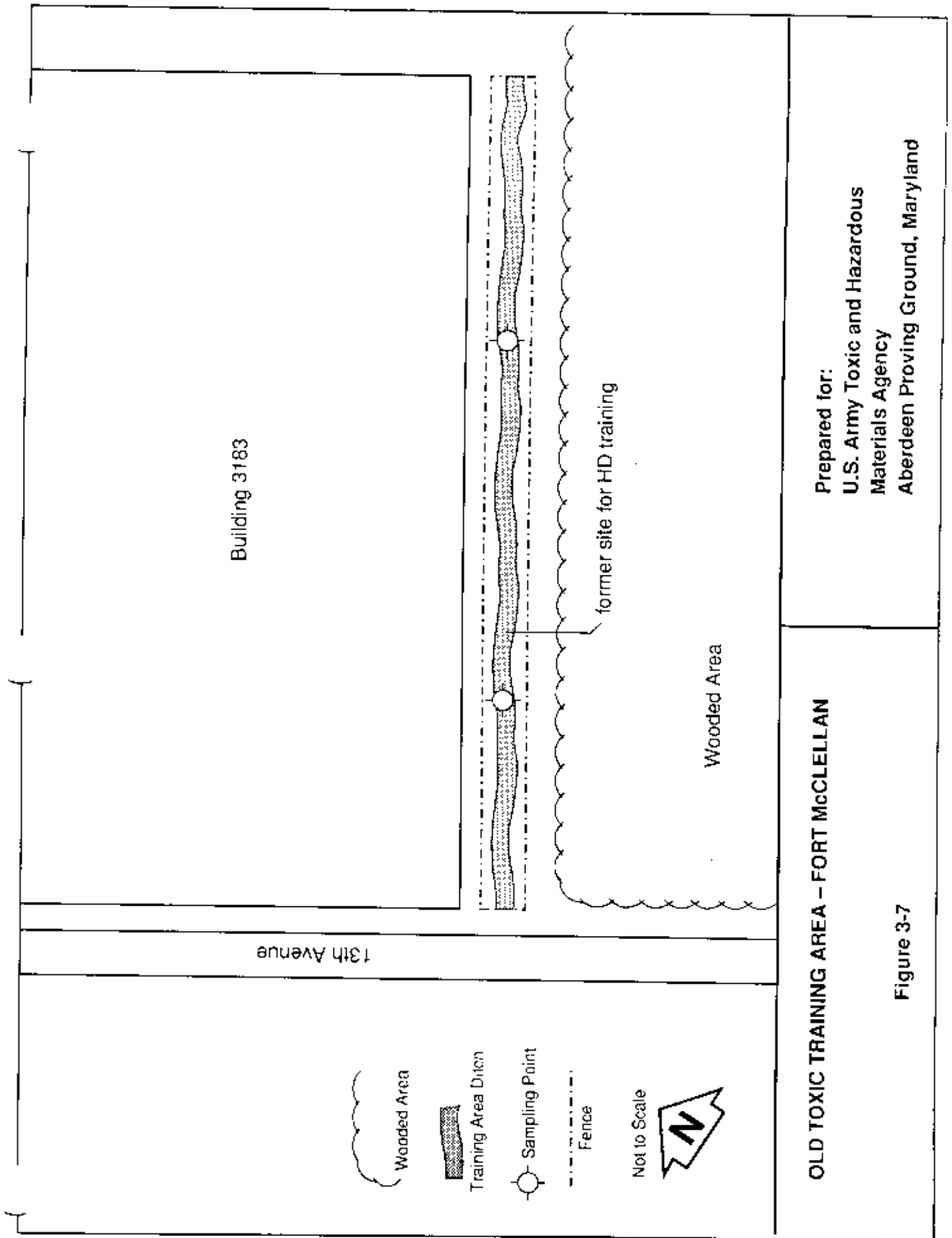
Range K was an Agent Training Area located on Pelham Range (see Figure 2-3). The 2-acre area was used for agent training. Limited information on the site is available, including time of operation and agents used. The site has been physically rearranged (bulldozed) and records indicate that the area was cleared in 1967. Surface monitoring was conducted in 1980 and no surface contamination was detected. Evidence of a former training area at this site was not observed at the site during an October 1991 site tour. An approximately 5-foot diameter area of ponded drainage was noted in the site area. In addition, evidences of site usage as a bivouac area were observed. A soil sample will be obtained from the area of ponded drainage.

3.4.9 Range I

Range I was an Agent Shell Tapping Area located on Pelham Range (see Figure 2-3). The 0.5- to 1-acre site was used between 1963 and 1964 for chemical agent shell tapping purposes. The agent used onsite is assumed to have been HD. The area has been physically rearranged, with the top 2 feet of soil having been moved to an unknown location. Field tests have shown no evidence of surface contamination. A concrete marker was located at the site during an October 1991 site visit. Subsurface soil samples will be obtained from two locations on site (Figure 3-8).

3.4.10 Range J

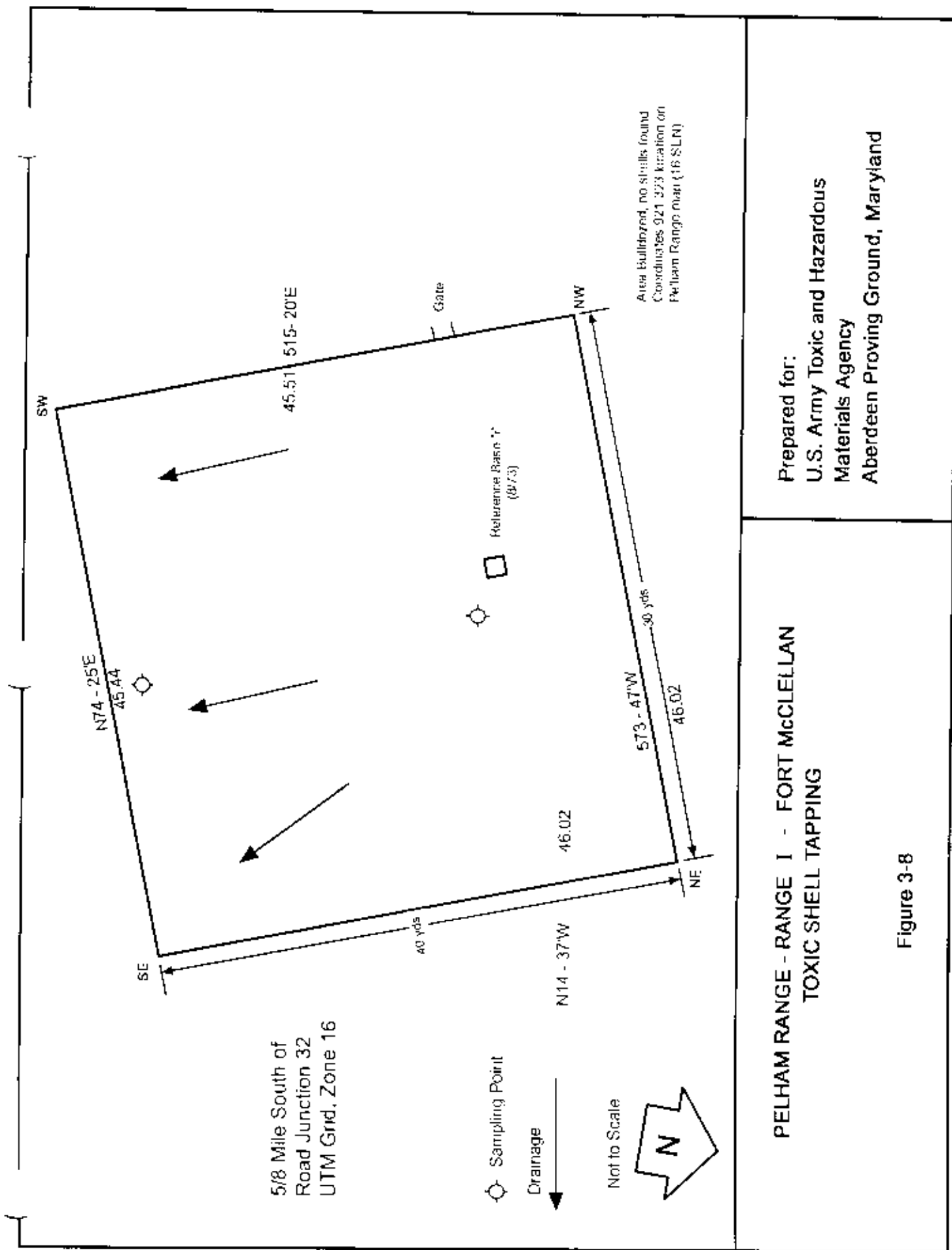
Range J was an Agent Training Area located on Pelham Range (see Figure 2-3). The 139- by 50-foot fenced area was used until 1963 for training and agent disposal. The agents used at the site are unknown, but believed to be HD. The site was also reportedly used for disposal of contaminated soil resulting from a 110 gallon HD spill that occurred on the Main Post in 1955. Evidence of drummed soil disposed of at the site was observed during an October 1991 walkover of the site. The depth at which this material was buried is unknown. A pit area



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OLD TOXIC TRAINING AREA – FORT McCLELLAN

Figure 3-7



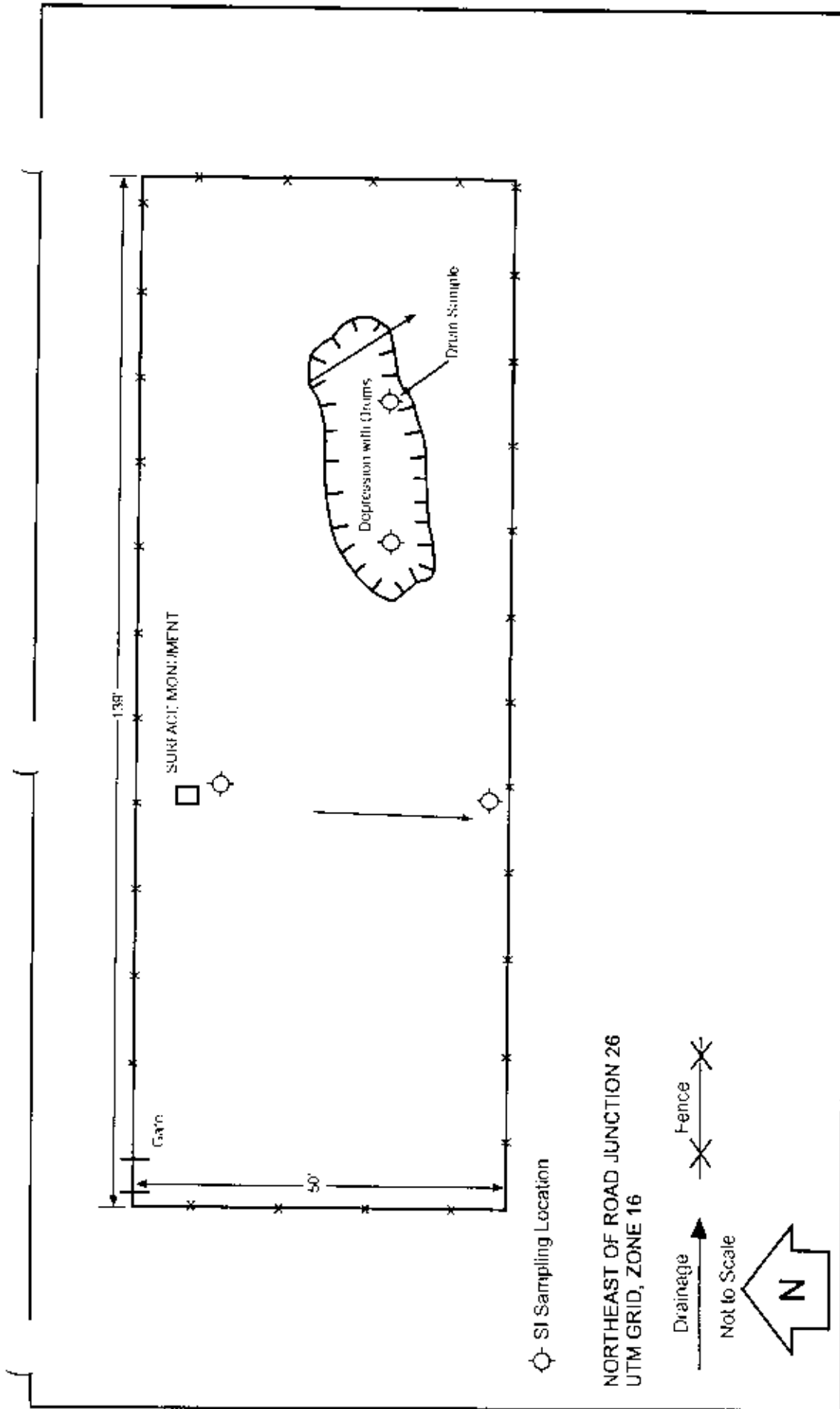
containing drums and a survey monument dated August 1973 were located within the fenced area during the October 1991 walkover. Subsurface soil samples will be obtained near the survey monument, downgradient of the survey monument near the site boundary and in the pit area. Additionally, a soil sample will be obtained from one of the drums disposed in the pit. The locations are shown in Figure 3-9.

3.4.11 Detection and Identification Area

The Detection and Identification (D and I) Area is located on the Main Post (see Figure 2-2). The 1.1-acre site was used from the 1950's to 1972 for GB training. The Navy may have used mustard (HD) at the site in the late 1950's for training purposes. Training routinely consisted of application of test kits to detection and identification of agents contained in 40 milliliter vials. Agents often were mixed as a 10 percent solution with water. It has been reported that agent simulants, CK, CG, CX, and AC were also used in the training area. All training aids from this site and a building from Area T-4 were burned twice in a dug pit and buried. The pit containing the burned materials is identified by Stake F. Decontaminants STB and DS-2 were used on surface soils and the area was cleared for surface use. Subsurface soil samples will be obtained near stake "F" and in a circular clearing near stake "F" (see Figure 3-10).

3.4.12 Range L (Lima Pond)

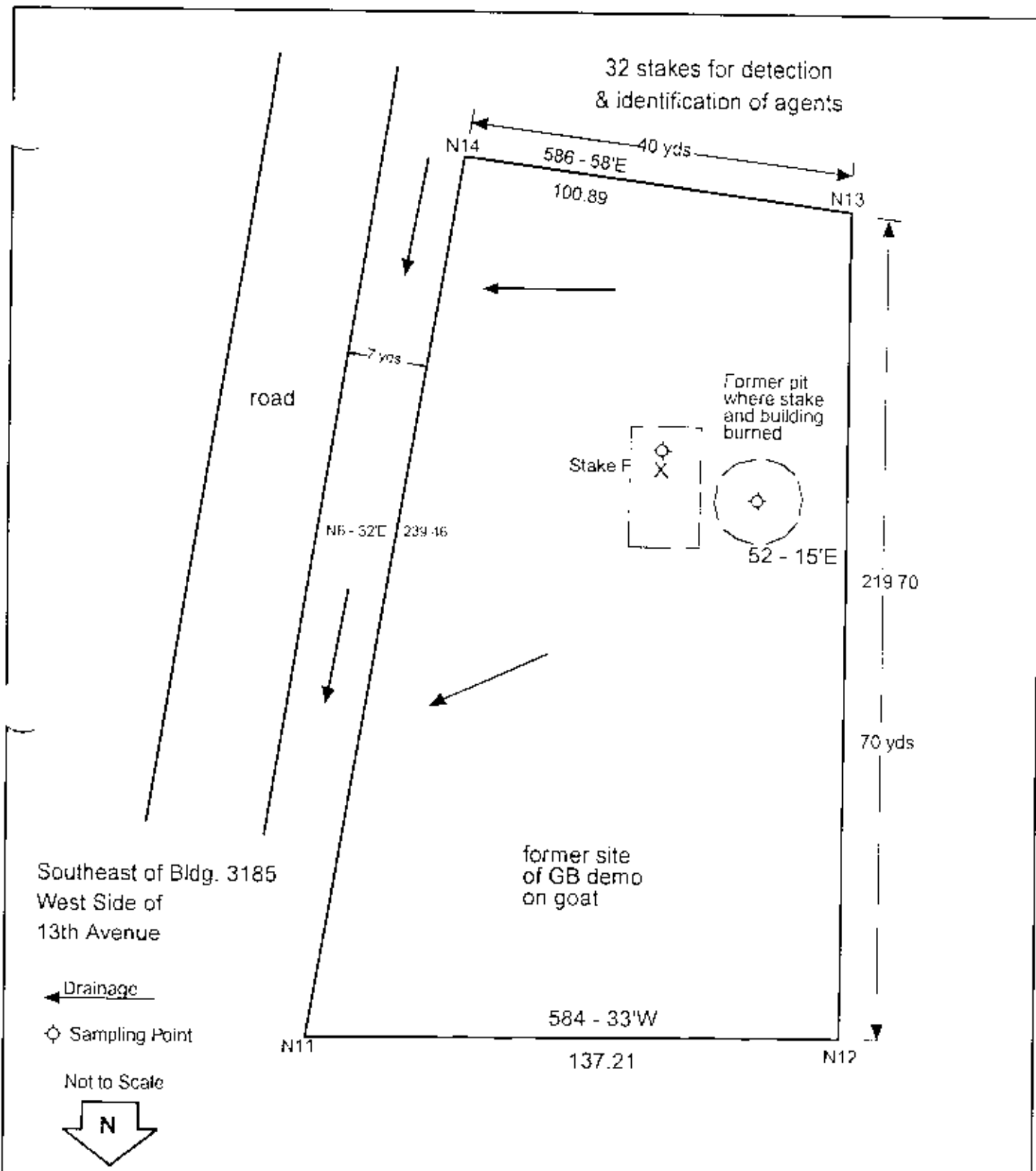
Range L was a Chemical Munitions Disposal Area located on Pelham Range (see Figure 2-3). The 0.5-acre site reportedly was used for the disposal of captured World War II munitions, including chemical munitions. According to Post personnel, a shallow man-made pond (Lima Pond) was the dump site for these munitions. The pond is a bermed area topographically higher than the surrounding wooded terrain. The pond is estimated to be approximately 30 feet deep from the top of slope to the existing pond bed, although the actual depth of the pit below the pond bed is unknown. Surface soil sampling at Range L indicated no detectable surface soil contamination. The depth of water in the pond was low (<2 feet) during an October 1991 site visit. Few indicators of munitions dumping were evident at the site, although empty ammunition crates were observed along the pond walls. A surface water and sediment sample will be collected from Lima Pond during the S1.



PELHAM RANGE - RANGE J - FORT MCCLELLAN
 REPORT HD BURIAL SITE

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Figure 3-9



**DETECTION AND IDENTIFICATION AREA
- FORT McCLELLAN -**

Figure 3-10

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3.5 SHALLOW SOIL SAMPLING PROCEDURES

The following lists the procedures that will be followed for transferring shallow soil samples during the SI at Fort McClellan:

- Hand augers and tools will be thoroughly cleaned and decontaminated before initial use and after each borehole completion. Specific instructions for auger decontamination are presented in Section 3-12.
- Two soil samples (i.e., at 1-foot and 5-foot depths) will be collected at each test pit or hand auger boring location.
- Soil samples at chemical training sites will be field screened: one sample will be sent to a local laboratory for surety materials using portable GC equipment. Samples will be heated to between 70°-100°F and the results will be noted on the chain-of-custody form. Detection levels for the screening are approximately .003 ppm.
- Decontaminated equipment will be allowed to air-dry, then wrapped in a nonplastic material (e.g., aluminum foil or Teflon®) and stored in a manner that reduces the potential for accidental contamination.
- Containers necessary for soil samples are described in Table 3-1.
- Each sample cooler will contain sufficient ice or blue ice® to maintain sample temperature at or below 4°C, but above 0°C. Each cooler will contain one coolant blank. Coolant blanks are sample bottles filled with water and capped. Before shipment, or at occasions when the ice has inadvertently been allowed to melt, the coolant blank will be opened and the temperature of its contents will be recorded. Laboratory personnel will repeat this procedure when the samples arrive at the laboratory.

Chemical Agents -- Soil and sediment samples will be collected and analyzed for chemical (i.e., mustard, sarin, and VX) agents using one 4-ounce, wide-mouth, amber glass container. A Teflon®-lined plastic cap will be used to seal the container. The sample label will be placed directly into the outside of the container and secured with waterproof tape. All samples will be kept at 4°C.

Chemical Agent Breakdown Products -- Soil and sediment samples will be collected and analyzed for chemical (i.e., mustard, sarin, and VX) agent breakdown products in one 4-ounce, wide-mouth, amber glass containers. A Teflon®-lined plastic cap will be used to seal each container. The sample label will be placed directly onto the outside of this container and

Table 3-1. Summary of Sample Containment and Sample Preservation Methods for Soil and Sediment Samples

Parameter	Analytical Method ^a	Sample Container		Preservation Methods	Holding Times ^c
		Quantity ^b	Type		
<i>Organics</i>					
VOCs	LM23	2	40 mL, amber glass vials, Teflon [®] -lined lid	Cool, 4°C	14 days
SVOCS	LM25	1	4-ounce, wide-mouth, amber glass, Teflon [®] -lined lid	Cool, 4°C	Extraction: 7 days Analysis: 40 days
Pesticides/PCBs	KK9B & LH17	1	4-ounce, wide-mouth, amber glass, Teflon [®] -lined lid	Cool, 4°C	Extraction: 7 days Analysis: 40 days
Chemical Agents Mustard (HD) Sarin (GB) VX		1	4-ounce, wide-mouth, amber glass, Teflon [®] -lined cap	Cool, 4°C	NA
Explosive-related compounds ^d plus RDX HMX TETRYL	LW23	1	4-ounce, wide-mouth, amber glass, Teflon [®] -lined cap	Cool, 4°C	Extraction: 56 days Analysis: 40 days
HD Breakdown Products ^e GB Breakdown Products ^f VX Breakdown Products ^g	LW18 and LL03 AAA9 and TT9 AAA9	1	4-ounce, wide mouth, amber glass, Teflon [®] -lined cap	Cool, 4°C	Extraction: 14 days Analysis: 40 days

Table 3-1. Summary of Sample Containment and Sample Preservation Methods for Soil and Sediment Samples (Continued)

Parameter	Analytical Method ^a	Sample Container		Preservation Methods	Holding Times ^b
		Quantity ^c	Type		
<i>Inorganics, Metals</i>					
Trace Metals (total), including silver, aluminum, boron, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, molybdenum, sodium, nickel, lead, antimony, tin, tellurium, vanadium, and zinc	ISPS	1	4-liter, wide mouth, amber glass, "fellow"-laced cap	None	6 months; mercury - 28 days
Arsenic	B9				
Selenium	JD20				
Mercury	Y9				

Footnotes to Table 3-1

- ^a The methods cited are USATHAMA-certified methods specific to DATACHEM Laboratories, Inc., and Environmental Science and Engineering, Inc., except where noted.
- ^b Soil sample volumes may be combined in a single container for the following analyses: SVOCs and pesticide/PCBs and explosive compounds and agent breakdown products, except for those samples collected at Lima Pond. Soil samples collected for VOC and metals analyses will be collected in separate containers. The following sample volumes will be used when preparing field QC blanks: two 40-mL vials for VOC analyses; two 1-liter containers each for SVOC and pesticide/PCB analyses; two 1-liter containers for HD, GB, and VX breakdown products analyses; two 1-liter containers for explosives-related compound analyses, including RDX, HMX, and TETRYL; and one 1-liter container for trace metals analyses. All field QC blanks will be preserved as specified in Table 3-1. Specific instructions for preparing field QC blanks are described in Section 3-11.
- ^c For data validation and useability purposes, holding times are defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time of sample analysis (e.g., VOCs) or the date and time of sample extraction and analysis (e.g., SVOCs), including all second column confirmation analyses, if required. Extraction hold times are further defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time the sample is concentrated to the final injection volume (excluding any extract cleanup techniques). Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
- ^d Explosive-related compounds include 2,4,6-trinitrotoluene (246TNT), 2,4-dinitrotoluene (24DNT), 2,6-dinitrotoluene (26DNT), 1,3,5-trinitrobenzene (135TNB), 1,3-dinitrobenzene (13DNB), and nitrobenzene (NB).
- ^e HD (i.e., bis(2-chloroethyl)sulfide) breakdown products include chloroacetic acid (USATHAMA certification number LW18) thiodiglycol (USATHAMA certification number, p-chlorophenylmethyl sulfone, p-chlorophenylmethyl sulfoxide, 1,4-oxathiane, and 1,4-dithiane (USATHAMA certification number LL03).
- ^f GB (i.e., methylphosphonofluoridic acid, 1-methylethyl ester) breakdown products include isopropyl methylphosphonic acid (IMPA) and methylphosphonic acid (USATHAMA certification number AAA9), and dimethyl methylphosphonate and diisopropyl methylphosphonate (USATHAMA certification number TT9).
- ^g VX (i.e., methylphosphonothioic acid, S-[2-[bis(1-methylethyl)amino]ethyl]o-ethyl ester) breakdown products include ethyl methylphosphonate (or its sodium salt-NaSC₄H₇N-(CH(CH₃)₂)₂) and isopropyl amine (no USATHAMA-certified method required).

secured with waterproof tape. All containers will be placed in a cooler and kept at 4°C. These samples will be shipped to Environmental Science and Engineering, Inc., located in Gainesville, Florida, by Federal Express.

Volatile Organic Compounds -- Sediment samples will be collected for VOCs at Range L (Lima Pond) only. The sample portion to be analyzed for VOCs will be collected in two 40 mL glass vials. A Teflon®-lined septum cap will be used to seal each vial. The sample label will be placed directly onto the outside of the vial and secured with waterproof tape. All samples will be maintained at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

Extractable Organics -- Sediment will be collected for SVOCs and pesticides/PCBs at Range L (Lima Pond) only in one 4-ounce, wide-mouth, amber glass container. A Teflon®-lined plastic cap will be used to seal the container. The sample label will be placed directly onto the outside of the container and secured with waterproof tape. All samples will be kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

Trace Metals (total) -- Samples to be analyzed for trace metals will be collected in one 4-ounce, wide-mouth, amber glass container. A teflon®-lined plastic cap will be used to seal each container. The sample label will be placed directly onto the outside of this container and secured with waterproof tape. All samples will be kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

Explosives-Related Compounds -- Sediment samples will be collected for explosives-related compounds at Range L (Lima Pond) only in one 4-ounce, wide-mouth, amber glass container. A Teflon®-lined plastic cap will be used to seal each container. The sample label will be placed directly onto the outside of this container and secured with waterproof tape. The sample volume in this container will also be used for RDX, HMX, and TETRYL analyses. All sample containers will be placed in the cooler and kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.6 DUPLICATE SOIL SAMPLING PROCEDURES

Duplicate soil samples will be collected as a means of assessing the reproducibility of the surface soil sampling effort during the SI at Fort McClellan. One duplicate sample will be taken per 10 sampling locations. Field duplicates do not release the laboratory from its own QC requirements for duplicate analyses. All samples will be collected using a hand auger. Due to the limited volume of the sampler and the increased duplicate sample volume requirement, the VOC samples and duplicates and the nonvolatile samples and duplicates will be collected from different depths in the borehole or from immediately adjacent boreholes. Once the sampler is retrieved from the borehole, the VOC sample will be collected as quickly as possible (i.e., a maximum of 1 minute from the time the split-spoon sampler is retrieved and the plastic cap is placed on the sample bottle).

After the samples for VOC analysis have been collected and due to sample volume requirements, the auger will be driven again and these contents will be used to collect the nonvolatile sample portions (e.g., trace metals and SVOCs). After collection, all sample bottles will be properly labeled and stored onsite in an ice chest at 4°C until they are packed and shipped via overnight delivery to the laboratory for analysis.

3.7 SUBSURFACE EXPLORATION

This section presents the rationale for the drilling of soil borings and installation of monitoring wells.

3.7.1 Drilling and Soil Sampling

The purpose of the soil drilling program is to obtain subsurface soil samples for lithologic analysis and stratigraphic information, and to install groundwater monitoring wells. Subsurface soil samples will be field-described to determine the sample lithology. Soil samples will be collected using a 2" diameter split spoons sampler (ASTM D-1586) at 5-foot intervals and at distinct changes in lithology. These samples will be screened in the field using a photoionization detector (PID) to provide field information on potential contaminant distributions.

Additional information regarding the hydrochemistry of the sites under investigation will be obtained by completing the soil borings as monitoring wells after the soil samples have been collected and the total borehole depth is reached. The monitoring wells will provide necessary site-specific information on the groundwater quality and elevation. Subsequent to the completion and development, groundwater samples will be collected from the monitoring wells. This sampling will be a one-time event that will provide data to confirm or deny the presence of contamination in the groundwater at locations around the site. Eight schedule 40 polyvinyl chloride (PVC) monitoring wells will be installed during this SI in the vicinity of former landfill sites #2 and #3. The monitoring wells will also be used to obtain water level data for determining site-specific groundwater flow direction at the landfill sites.

3.7.1.1 Former Landfill # 2

Former Landfill # 2 was the Post sanitary landfill after the closure of Former Landfill # 1 and was active from 1947 to an unknown date. The landfill covers approximately 4 acres and is located west of the southern tip of Cemetery Hill, between 2nd Avenue and 10th Street. This landfill reportedly was used for disposal of waste during deactivation of the installation. Rusted drums, metal, smaller containers (5-gallon cans and bottles), assorted building materials, and machinery parts were observed at the site in October 1991. Drilling, monitoring well installation, and groundwater sampling will be conducted at the locations shown in Figure 3-11 around Landfill #2.

3.7.1.2 Former Landfill # 3

Former Landfill # 3 was the Post sanitary landfill in operation between 1946 and 1967. The landfill was operated using the trench and fill method, with trenches trending northwest to south-east. Traces of these trenches due to settling over the old landfill cells have been observed in the past, but were not observed during an October 1991 site visit. The landfill covers approximately 22 wooded acres and is located east of State Route 21 and north of Cane Creek. This location is northwest of and adjacent to Active Sanitary Landfill # 4. Five monitoring wells (OLF-1 to OLF-5) were installed within or adjacent to Former Landfill # 3 by the USAEHA in 1986. Water levels measured at that time indicate northwestwardly groundwater flow exiting Fort McClellan along State Route 21. Analysis of the initial (1986) groundwater sampling results indicated limited groundwater contamination. Access to the landfill area is obtained along unpaved perimeter roads. Five monitoring wells will be installed at the site at the locations shown in Figure 3-12.

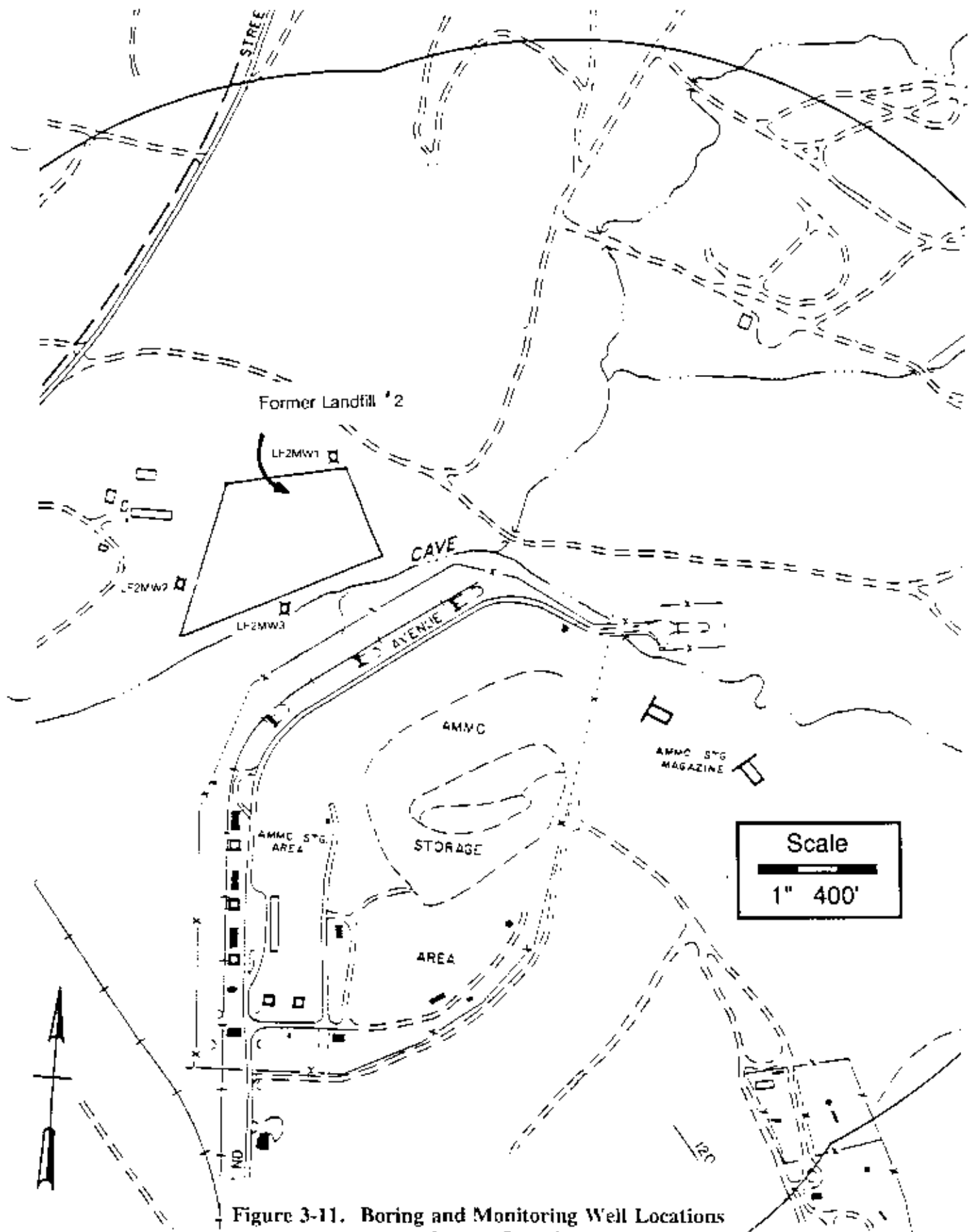


Figure 3-11. Boring and Monitoring Well Locations
Former Landfill #2

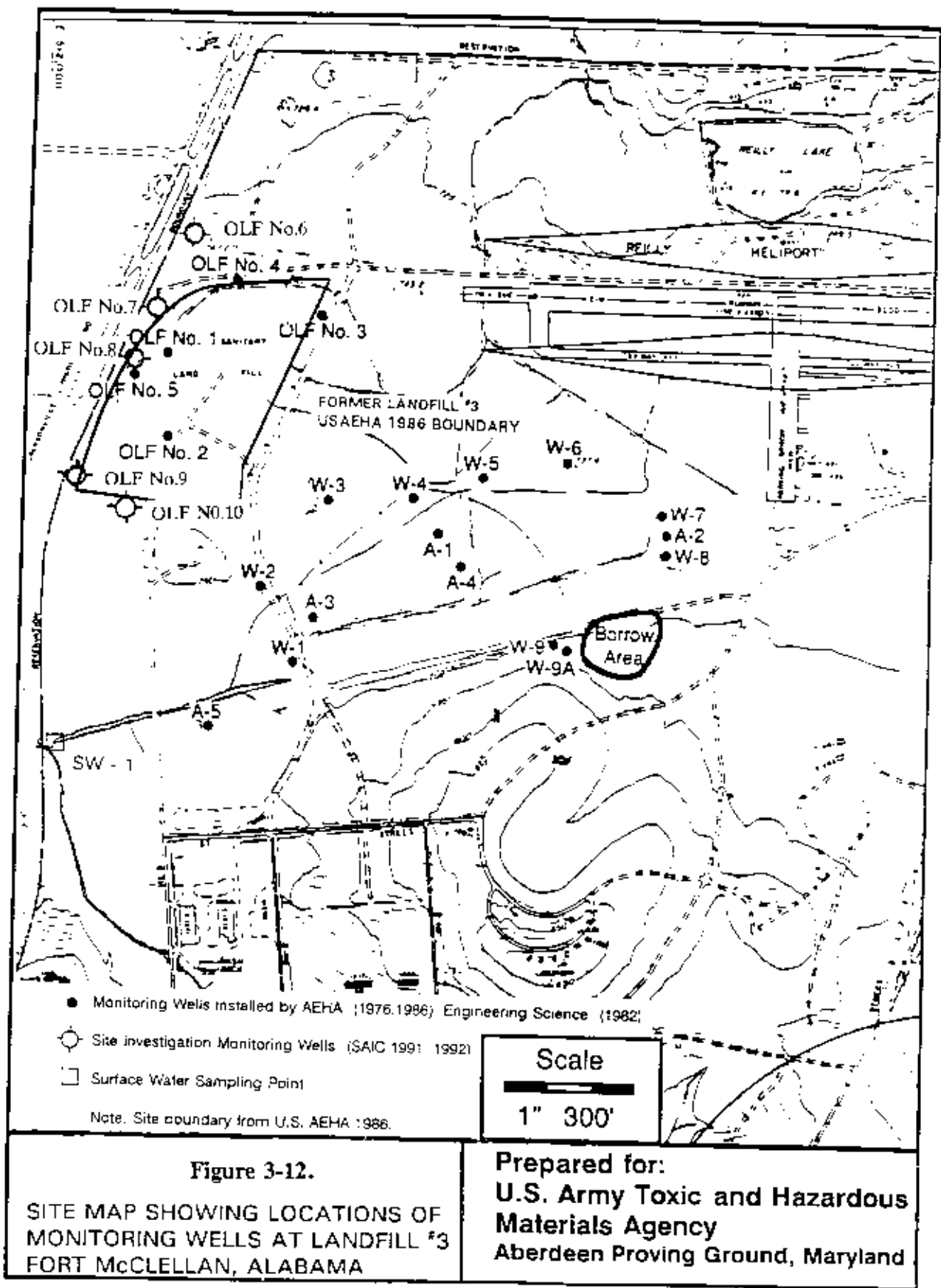
3.7.1.3 Predrilling Activities

Before any drilling activities occur at a site, all underground utility maps for the immediate vicinity of the drilling site will be reviewed. Proposed drilling locations will be staked in the field for inspection and clearance by Fort McClellan Post personnel. Digging permits will be obtained (if required) before any drilling activity is initiated. All drilling will comply with the applicable laws and regulations of the State of Alabama, ADEM, Fort McClellan, and USATHAMA guidelines.

3.7.1.4 Drilling Method

The boreholes for monitoring well installation will be drilled using nominal 6 and 1/4 inch inside diameter (ID), continuous flight hollow stem augers operated from a truck-mounted drilling rig. Hollow-stem augering combines rotational and downhole pressure to advance the auger flights. Samples will be collected by driving a conventional 2" diameter split-spoon sampling device inside the stem of the auger flights. Soil borings will be advanced to the depth at which the initial water contact is reached. The borehole will be advanced approximately 10 feet beyond this depth to accommodate the length of well screen.

Problems can arise using hollow stem augers if shallow bedrock, large rocks, or heaving sands are encountered. In the event that a boring is obstructed, it will be necessary to relocate the boring usually within 20 feet of the original location. To eliminate delays resulting from having to reapply for digging permits, an area sufficiently large to accommodate one or two relocations will be cleared through the Post at the time of initial digging permit application. In the event that heaving sand is encountered during the drilling of the monitoring wells, it may be necessary to add clean water to the augers to maintain a hydraulic head on the formation to allow completion of the well. Whenever possible, the introduction of water into the borehole will be avoided; however, when introduced, the volume of water will be recorded and at least five times this volume will be removed during the development process.



3.7.1.5 Confining Layer Integrity

The scope of this SI is to confirm or deny the presence of contamination at the sites under study. This effort is designed to investigate only the surficial aquifer and soils. No effort under this plan is designed to penetrate a confining layer between two aquifers.

3.7.1.6 Subsurface Soil Sampling

Subsurface soil sampling refers to samples collected during monitoring well drilling. A standard 2-inch split-spoon sampler (ASTM D-1586) will be used to collect samples necessary for lithologic descriptions. Sampling will be conducted every 5 feet and at distinct lithologic boundaries.

Each drilling rig will be equipped with a sufficient number of standard split-spoons to collect any other samples for lithologic descriptions or geotechnical analysis. The drilling equipment will be capable of performing standard penetration tests (SPT's) in accordance with ASTM D-1586. A representative portion of material from each split-spoon will be placed in a labeled sample jar for archive purposes. Approximately 5 percent of the samples will be subject to Unified Soil Classification System (USCS) testing, including grain size and Atterberg limits.

3.7.1.7 Borehole Logging

The SAIC onsite geologist will record the lithology and complete the drilling logs and an as-built diagram for all borings and wells. Each log will include a complete description of the characteristics of the material collected in each split-spoon sampler, as well as conditions encountered during drilling. The following sample characteristics will be included in each log:

- PID monitoring results
- Percent recovery
- Lithology
- Particle size (visual estimates)
- Color (Munsell)
- Consistency and texture

- Relative density (based on blow counts for noncohesive materials)
- Moisture (visual estimate)
- Fabric/bedding
- Standard penetration tests (ASTM D-1586)
- Other distinctive features.

3.7.1.8 Breathing Zone Monitoring

During all drilling operations, a PID will be used to monitor the breathing zone for organic vapor to determine the need for respiratory protection for the site workers.

In addition, a lower explosive limit and oxygen (LEL/O₂) meter will be used during drilling operations to monitor for explosive gases and reduced oxygen. Special precaution will be required if explosive vapors reach 10 percent of the LEL. If the LEL is reached, all site activities will be stopped, an assessment of the situation will be made, and precaution will be taken to protect site workers and surrounding areas before drilling is resumed.

3.7.1.9 Borehole Abandonment

All soil borings are planned to be completed as monitoring wells, but in the event a soil boring or monitoring well must be abandoned, the procedure will be according to the State of Alabama regulations. Each soil boring or monitoring well that will be abandoned will be filled with a cement/bentonite grout mixture and allowed to set overnight. The grout will be tremied into place as the augers are removed from the hole. This process will ensure the exposed formation will be sealed by the weight of the grout mixture in the hole. After the grout has dried, any settlement will be filled with additional grout and the boring will be inspected to ensure acceptable abandonment. All activities, including the reasons for abandonment, will be documented in the site geologist's logbook and on the boring or well completion forms.

3.7.2 Monitoring Well Construction, Completion, and Development

Eight monitoring wells will be installed in the vicinity of former landfills on Fort McClellan. The well locations are shown in Section 3.7.

3.7.2.1 Well Construction

Monitoring wells will be installed at the specified sites using an auger rig equipped with hollow-stem augers having a 6 ¼ inch ID. This minimum diameter will permit the installation of a 4-inch ID Schedule 40 PVC casing and PVC screen with a PVC end cap. Specific construction parameters, such as the exact screen settings, will be determined in the field based on information obtained during the well drilling process. The well screen lengths will be 10 feet with a 0.10-inch slot size. The well casings and screen will have flush-threaded joints. Monitoring wells will be protected by 8" diameter steel casings with four steel pickets radially located 4 feet from the well. The protective casing and pickets will be painted orange using a brush. Three wells will be installed at Former Landfill #2 and five wells will be installed at Former Landfill #3. A monitoring well construction schematic is shown in Figure 3-13.

3.7.2.2 Monitoring Well Development

Each monitoring well will be developed by surging and/or pumping using a hand pump, small-diameter submersible pump, or centrifugal pump until the water is turbidity free (visual) and specific conductivity, temperature, and pH are stable. These parameters will be measured following the removal of each well volume from the well. The total volume of water removed from the well will be recorded. The monitoring well will not be developed within 48 hours of the placement of grout seals. All equipment lowered into the well will be decontaminated prior to use. Water from well development will be collected and stored in tanks or drums at each well. The disposition of the development water will be determined based on the groundwater samples collected from the well. If the development water is determined to be non-hazardous, it will be discharged to the ground surface or the Post Sanitary Sewer System. Hazardous development water will be disposed in accordance with ADEM and Federal requirements. A well development form is provided in Figure 3-14.

The water level and well depth will be measured before any development activities. An electric water level indicator and weighted tape will be used to measure the well depth and water level from a permanently marked point on the well casing. The water level will be recorded to

the nearest 0.01 foot. A sample form to record water levels is provided in Figure 3-15. Groundwater levels will be measured in all wells before purging, using the following procedure:

- Decontaminate the water level meter and tape (i.e., sounding device) according to the procedures summarized in Section 3-12
- Lower the tip of the water level meter into the well until the tip comes into contact with the groundwater surface (sound begins)

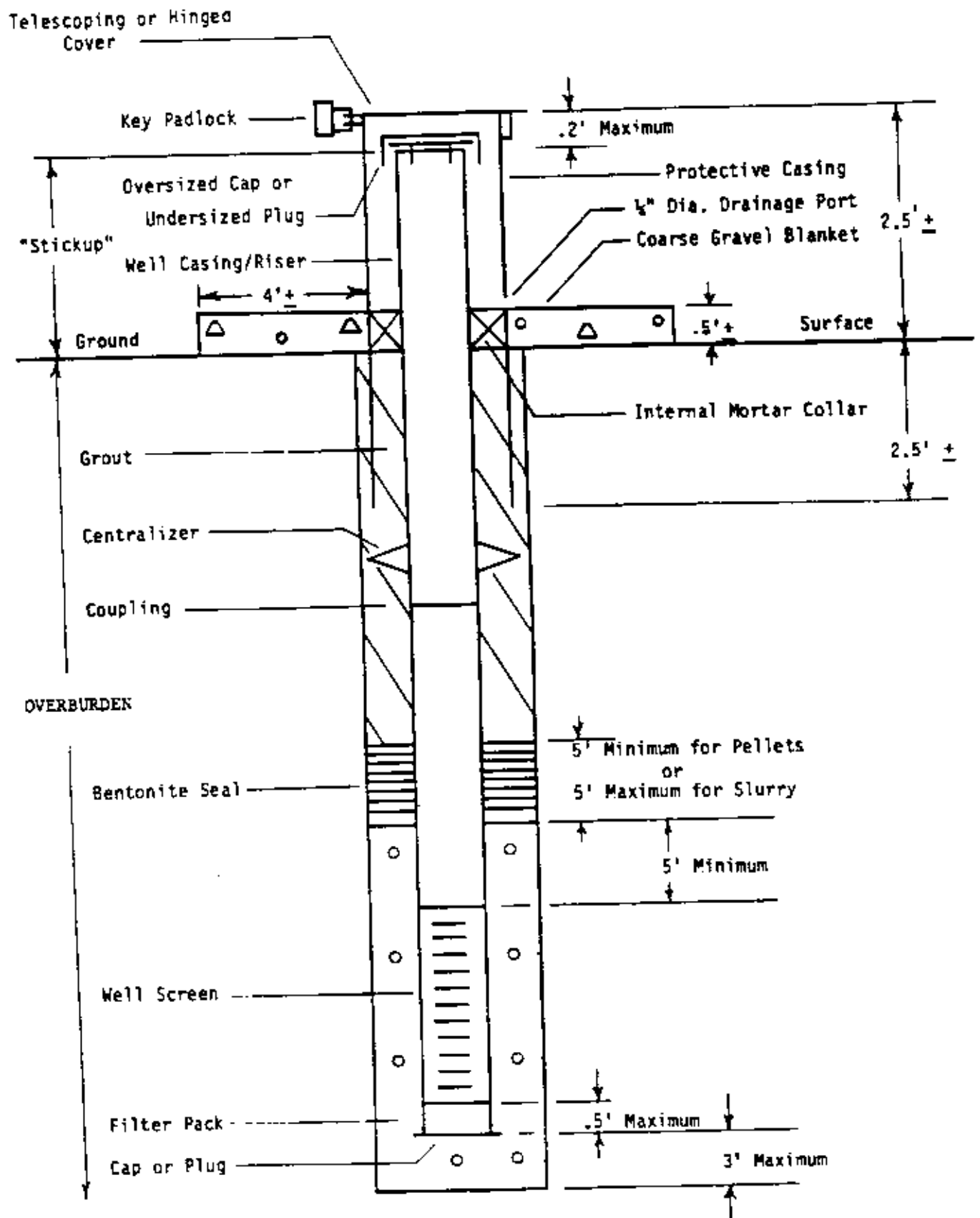


Figure 3-13. Well Construction Schematic

- Place the meter on the top of the casing and raise and lower the tip of the water level meter to adjust the length of the cable
- Mark the point on the cable with thumb nail and hold the cable in place
- Read the cable to nearest foot marker and use an engineer's ruler (tenths and hundredths of a foot) to measure increments of a foot to the nearest 0.01 foot
- Record the water level in the field notebook.

The addition of water to the wells will be avoided whenever possible; however, the addition of small quantities of potable water may be required to successfully complete the well installation. Examples of when it may be necessary to add water to the well are to control running sands or to hydrate bentonite pellets placed as a seal above the saturated interval. If water is introduced into the borehole during drilling or well installation, the volume will be recorded in the site logbook. In addition to meeting the stability and clarity requirements, at least five times the volume of water introduced during drilling will be removed before well development will be considered complete.

After all development activities are complete, a 3 7/8-inch outside diameter (OD) blank pump will be lowered into the well and will pass unobstructed through the entire well depth and be removed before the well will be considered acceptable by the Site Field Manager/Geologist. This will ensure that the well was not damaged during development and is sufficiently straight to allow for future sampling and other testing. Monitoring wells will be permanently marked with an identification number before demobilization from the site.

3.8 SAMPLING PROCEDURES FOR WATER SAMPLES

The sampling and analytical procedures for surface water and groundwater samples are described in this section. A sampling form is shown in Figure 3-16.

3.8.1 Groundwater Sampling

This section describes the procedures to be used for the collection of groundwater samples from the monitoring wells to be sampled during this SI.

Sampling Form

(Field Sheet)

Project Name and Number: _____

Sampling Crew: _____

Sampling Point Number: _____

Sampling Location: _____

Sample Type: GW SW Sol. SED Other _____

Date and Time Sample Collected: _____

Weather Conditions: _____

Purging Information (if applicable):

Method: _____

Quantity of Water Purged: _____

Disposition of Purge Water: _____

Date and Time of Purging: Start: _____ End: _____

Comments: _____

Groundwater:

Date and Time Collected: _____

Sampling Depth: _____

Water Level: _____

Sampling Method/Equipment: _____

Field Measurements: pH _____ Temp. _____ Cond: _____ Alkalinity: _____

Date and Time Filtered (if applicable): _____

Comments: _____

Surface Water:

Date and Time Collected: _____

Collection Method: _____

Date and Time Filtered (if applicable): _____

Field Measurements: pH _____ Temp: _____ Cond: _____ Turbidity: _____

Comments: _____

Soils/Sediment Sampling:

Date and Time Collected: _____

Sampling Depth: _____

Sampling Method: _____

Comments: _____

3.8.2 Well Purging

Prior to collection of samples, each well will be purged using the following procedures:

- Using measured water level, calculate purge volumes.
- Decontaminate all purging equipment according to the procedures summarized in Section 3-12.
- Lower purging devices to 1 foot below the water level.
- Begin to remove water at a rate that does not dewater the well, lowering the purging device as required to maintain a continuous flow. Obtain initial pH, specific conductance, and temperature measurements from purged water.
- Measure pH, specific conductance, and temperature at regular intervals (each well volume) proportional to the total volume of water removed.
- If the well recharges slowly, the well will be purged from the bottom of the screen at a rate that does not dewater the well.
- In all purging situations, the purging equipment discharge rate will be closely monitored so that water is not allowed to cascade down the well and increase the possibility of volatilizing the target compounds.
- Purging will continue until three to five volumes of water in the well have been removed, but the well is not dewatered. The water level should cover the bottom 5-feet of the well screen at all times.
- If the well cannot produce enough water to maintain a sufficient recharge rate, the well will be purged to dryness and allowed to recharge. When the well has recharged sufficiently to allow sampling, a sample will be collected to measure pH, temperature, and specific conductance. The well will be allowed to recharge further and the remaining samples to be shipped to the laboratory will be collected. After the samples have been collected, pH, temperature, and specific conductance will be remeasured for comparative purposes.

If the well is low-yielding and the Supervisory Geologist determines that purging five well volumes is impractical, a minimum of two volumes will be purged. Well purge water will be containerized at each well pending the results of chemical analysis of the well water. The disposition of the purge water will be as described in Section 3.7.2.2. Purging will be accomplished by using the most appropriate method for a particular well. Generally, the wells will be purged using a stainless steel submersible pump, Teflon[®] bailers, or centrifugal pump. A well volume is considered to be the standing column of water in the screened interval and riser pipe as well as the calculated volume of water in the sand pack. Measured depths to

groundwater will be used to calculate the height of standing water in the well, and therefore, the volume of standing water in each well and the purge volume.

3.8.3 *Groundwater Sampling Procedures*

Groundwater samples will be obtained from eight newly installed wells in the areas of former Landfills #2 and 3. Additional samples will be obtained from existing wells OL-1 to OL-5 at Landfill #3. Groundwater samples will be collected from the well as soon after purging as there is a sufficient volume of water in the well for the intended analyses. Groundwater samples will be retrieved using a point-source, bottom-filling Teflon® bailer, and dispensed directly into appropriate labeled sample bottles containing the necessary preservative for the intended analyses. Field measurements for temperature, pH, and specific conductance will be taken at each well immediately after sample collection. Sample clarity will be visually observed and noted.

The following procedures will be followed when collecting water samples or preparing field QC blanks during the SI at Fort McClellan:

- All sampling equipment, including internal components, will be decontaminated before use and between samples using potable water collected at a USATHAMA-approved source on-post.
- Decontaminated equipment will be allowed to air dry, wrapped in a nonplastic material (aluminum foil or Teflon®), and stored in a manner that reduces the potential for accidental contamination.
- Each sample cooler will contain sufficient ice or blue ice® to maintain sample temperature at or below 4°C, but above 0°C. Each cooler will contain one coolant blank. Coolant blanks are sample bottles filled with water and capped. Before shipment, or at occasions when the ice has inadvertently been allowed to melt, the coolant blank will be opened and the temperature of its contents will be recorded. Laboratory personnel will repeat this procedure when the samples arrive at the laboratory and report the arrival temperature on the chain-of-custody form.
- Containers and preservation techniques necessary for water samples are described in Table 3-2.

- Braided (i.e., polyfilament) nylon rope used for lowering sampling equipment into the well will be dedicated for each well and disposed of after sample collection is complete.
- Water-level probes will be decontaminated before use in each well with a laboratory-grade detergent wash and potable water rinse, as described in Section 3-12.

3.8.4 Surface Water Sampling

Surface water samples will be collected at Lima Pond and from Cane Creek south of Landfill #3 where the creek exits Fort McClellan. Surface water samples will be collected by holding the sample container beneath the surface of the water. Alternatively, a decontaminated, Teflon[®] or stainless steel ladle or sampling device may be used to fill the sample containers. Samples requiring chemical preservation except those collected for volatile analyses, will have the preservative added after the sample bottle is filled. Samples collected for volatile analyses will have preservative added to the sample bottle prior to sample collection. Field measurements for temperature, pH, and specific conductance will be taken in situ and from a container at the time of sampling. Procedures for sample collection and transport will substantially follow those detailed in Section 3.8.3.

3.9 SPECIFIC ANALYTE COLLECTION PROCEDURES

Water sample collection protocols for specific analyte groups are provided in the following sections.

3.9.1 Volatile Organic Compounds

The following describes the procedure that will be followed when collecting groundwater and surface water samples or preparing field QC blanks for VOC analyses.

Sample containers will be triple rinsed with the water to be sampled prior to obtaining the sample. For each environmental sample collected and each QC blank sample prepared for VOC analyses, four 40-mL VOA vials will be filled with groundwater, surface waters, or potable water until the meniscus rises above the rim of the vial. The cap liner will be carefully

Table 3-2. Summary of Sample Containment and Sample Preservation Methods for Water Samples

Parameter	Analytical Method ^a	Quantity ^b	Sample Container		Preservation Methods	Holding Times ^c
			Type	Type		
<i>Organics</i>						
VOCs	CM21	4	40 mL, glass, Teflon [®] -lined septum cap		HCl to pH < 2 Cool, 4°C	14 days 7 days
SVOCs	1, M25	2	1-liter, narrow-mouth amber glass, Teflon [®] -lined cap		Cool, 4°C	Extraction: 7 days Analysis: 40 days
Pesticides/PCBs	10P90	3	1-liter, narrow-mouth amber glass, Teflon [®] -lined cap		Cool, 4°C	Extraction: 7 days Analysis: 40 days
Explosive-related Compounds ^d plus RDX IMX TETRYL	1 W25	2	1 liter, narrow-mouth amber glass, Teflon [®] -lined cap		Cool, 4°C	Extraction: 7 days Analysis: 40 days
HD breakdown products ^e GB breakdown products ^f VX breakdown products ^g	A78 A18	2	1-liter, narrow-mouth amber glass, Teflon [®] -lined cap		Cool, 4°C	Extraction: 7 days Analysis: 40 days

Table 3-2. Summary of Sample Containment and Sample Preservation Methods for Water Samples (Continued)

Parameter	Analytical Method ^c	Quantity ^b	Sample Container Type	Preservation Methods	Holding Times ^d
<i>Inorganics, Metals</i>					
Trace Metals (total), including silver, aluminum, boron, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, molybdenum, sodium, nickel, lead, antimony, tellurium, vanadium, and zinc	SS12	2	1-liter, polyethylene bottle	Cool, 4°C nitric acid to pH < 2	6 months; mercury - 38 days
Arsenic	AX6				
Selenium	SD25				
Mercury	CV8				

Footnotes to Table 3-2.

- The methods cited are USATHAMA-certified methods specific to DATACHEM Laboratories, Inc., or Environmental Science and Engineering, Inc., except where noted.
- Groundwater and surface water sample volumes may be combined for all explosive compound analyses and all agent breakdown product analyses. The following sample volumes will be used when preparing field QC blanks: two 40-mL vials for VOC analyses; two 1-liter containers each for SVOC and pesticide/PCB analyses; two 1-liter containers each for HD, GB, and VX breakdown product analyses; two 1-liter containers for explosives-related compound analyses, including RDX, HMX, and TETRYL; and one 1-liter container for trace metals analyses. All field QC blanks will be preserved as specified in Table 4-1. Specific instructions for preparing field QC blanks are described in Section 4.5.2.
- For data validation and usability purposes, holding times are defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time of sample analysis (e.g., VOCs) or the date and time of sample extraction and analysis (e.g., SVOCs), including all second column confirmation analyses, if required. Extraction hold times are further defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time the sample is concentrated to the final injection volume (excluding any extract cleanup techniques). Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.
- Explosive-related compounds include 2,4,6-trinitrotoluene (246TNT), 2,4-dinitrotoluene (24DNT), 2,6-dinitrotoluene (26DNT), 1,3,5-trinitrobenzene (135TNB), 1,3-dinitrobenzene (13DNB), and nitrobenzene (NB).
- HD (i.e., bis(2-chloroethyl)sulfide) breakdown products include thiodiglycol (USATHAMA certification number UW22), p-chlorophenylmethyl sulfone, p-chlorophenylmethyl sulfoxide, 1,4-oxathiane, and 1,4-dithiane (USATHAMA certification number UL04).
- GB (i.e., methylphosphonofluoric acid, 1-methylethyl ester) breakdown products include isopropyl methylphosphonic acid (IMPA) and methylphosphonic acid (USATHAMA certification number UT02), and dimethyl methylphosphonate and diisopropyl methylphosphonate (USATHAMA certification number T8).
- VX (i.e., methylphosphonothioic acid, S-[2-[bis(1-methylethyl)amino]ethyl]o-ethyl ester) breakdown products include ethyl methylphosphonate (or its sodium salt- $\text{NaSC}_4\text{H}_9\text{N}(\text{CH}_2\text{CH}_3)_2$) and isopropyl amine (no USATHAMA-certified method required).

placed on the top of the vial, Teflon[®] side down, before the plastic cap is tightened securely. To ensure the vials contain no headspace, the vials will be inverted to check for bubbles. The vials will be placed in a cooler and kept at 4°C. VOC samples will be unpreserved because of the potential for HCl to react with thiodiglycol (a mustard breakdown product) in solution to potentially form chemical agent. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.9.2 Semivolatile Organic Compounds

The following describes the procedure that will be followed when collecting groundwater and surface water samples and preparing field QC blanks for SVOC analyses.

Sample containers will be triple-rinsed with the water to be sampled prior to collection of the final sample. For each discrete environmental sample collected or field QC blank prepared, two 1-liter amber glass containers will be filled, allowing for 10% head space, with groundwater, surface water, or potable water and the Teflon[®]-lined cap will be replaced. The containers will be placed in a cooler and kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.9.3 Pesticides/PCBs

The following describes the procedure that will be followed when collecting groundwater and surface water samples and preparing field QC blanks for pesticide/PCB analyses.

Sample containers will be rinsed three times with the water to be sampled prior to collection of the field sample. For each discrete environmental sample collected or field QC blank prepared, two 1-liter amber glass containers will be filled to the top with groundwater, surface water, or potable water and the Teflon[®]-lined cap will be replaced. The containers will be placed in a cooler and kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.9.4 Trace Metals

Total Metals -- The following describes the procedure that will be followed when collecting environmental samples and preparing field QC blanks for total metals analyses.

Sample containers will be rinsed three times with the water to be sampled prior to collection of the field sample. For each discrete environmental sample collected or field QC blank prepared, one 1-liter plastic bottle will be filled with sample or reagent-grade water before replacing the plastic cap. Sufficient 10 percent nitric acid will be added to each sample to lower the pH to 2 or lower. This preservation technique will be noted on the sample label and chain-of-custody form. The clarity of each environmental sample will be visually noted at this time. Although refrigeration is not required, the bottle will be placed in a cooler and kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.9.5 Explosives-related Compounds

The following describes the procedure that will be followed when collecting groundwater and surface water samples or preparing field QC blanks for explosives-related compounds analyses.

Sample containers will be rinsed three times with the water to be sampled prior to collection of the environmental sample. For each discrete sampling location, two 1-liter glass containers will be filled with sample or reagent-grade water before replacing the Teflon[®]-lined cap. The bottle will be placed in a cooler and kept at 4°C. The sample volume in this container will also be used for the RDX, HMX, and TETRYL analyses. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.9.6 Chemical Agent Breakdown Products

The following describes the procedure that will be followed when collecting groundwater and surface water samples or preparing field QC samples for chemical (i.e., mustard, sarin, and VX) agent breakdown product analyses.

Sample containers will be rinsed three times with the water to be sampled prior to collection of the environmental sample. For each discrete sampling location, three 1-gallon amber glass containers will be filled with sample or potable water before the Teflon®-lined cap is replaced. Two 1-liter containers will be used for breakdown product analysis. The containers will be placed in a cooler and kept at 4°C. These samples will be shipped to DATACHEM Laboratories, Inc., located in Salt Lake City, Utah, by Federal Express.

3.10 DUPLICATE WATER SAMPLING PROCEDURES

Duplicate water samples will be collected as a means of assessing sampling precision techniques during the SI at Fort McClellan. One duplicate will be collected for every 10 environmental samples collected. Duplicate samples will be coded in a manner to prevent laboratory personnel from recognizing them as QC samples. For the purposes of this project, water samples will be designated as duplicates even though several bailer volumes may be needed to fill the sample containers. Field duplicates do not release the laboratory from its own QC requirements for duplicate analyses. The procedures for collecting and containerizing field duplicate water samples are described below.

The volatile fraction will be collected first to minimize loss of volatile compounds. The first bailer volume will be used to fill the sample vials. The next bailer volume will be used to fill the duplicate sample vials.

After the volatile fractions have been collected, the sample volumes necessary for the remaining analyses will be collected in the manner described above. Sample collection, preservation, and containerization procedures will follow those described in Section 3.9 and Table 3-2 for the applicable analysis. After collection, all sample bottles will be labeled properly and stored onsite at 4°C until they are packed and shipped via overnight delivery to the laboratory for analyses.

3.11 INTERNAL FIELD QUALITY CONTROL

Collection and analysis of field blanks, equipment rinsate blanks, and field duplicates are provided as QC checks on the integrity of sample collection and handling procedures and equipment decontamination procedures. Field blank and equipment rinsates will be prepared using USATHAMA-approved potable water and sample bottles randomly selected from the bottles prepared for environmental samples. USATHAMA-approved potable water is used to prepare these field check samples, regardless of the environmental medium being sampled, because:

- It simulates the physical characteristics of groundwater and surface water
- It simulates a reproducible fraction (moisture) of soils and sediments

- No reproducible, affordable material is available that simulates the clay and organic portion of soils and sediments.

The following summarizes the field QC samples that will be collected during the SI at Fort McClellan:

- Two potable water sources will be identified by Fort McClellan DEH: 1 potable water source will be located on-post and other on Pelham Range. Water samples will be collected from these sources and submitted to DATACHEM Laboratories, Inc. for analysis using those certified methods proposed in the QAP. The results will be submitted to USATHAMA for approval.
- One set of equipment rinsate blanks for every 20 environmental (i.e., soil, sediment, surface water, or groundwater) samples will be collected. The blanks will be analyzed for the sample compounds and elements as those analyzed for the environmental samples collected.
- One field duplicate for every 10 environmental samples will be collected. Field duplicates will be collected at the same time and in the same manner as the other samples. Field duplicates are a separate sample, obtained from the same monitoring point. Results of the field duplicate analyses are used to assess the precision of the field sampling techniques, not that of the analytical techniques.

3.11.1 Equipment Rinsate Blanks

Equipment rinsate blanks will be prepared for manual and small automated sampling equipment used to collect environmental samples. One equipment rinsate blank will be collected during each sampling day. The blank will be collected by pouring USATHAMA-approved potable water into/through/over a clean piece of sampling equipment, such as Teflon® bailers, and then dispensing the water into prepared sample bottles. Each equipment rinsate blank will be analyzed in the laboratory using the same methods and procedures as those to be used for the environmental samples. These sample bottles will be randomly selected from the supply of prepared sample bottles, selecting a sample container appropriate for each type of analysis for which environmental samples are being collected. Analyses of equipment rinsate blanks are used to assess the efficiency of equipment decontamination procedures in preventing cross-contamination between samples.

3.11.2 Field Blanks

Field blanks will be prepared by pouring USATHAMA-approved potable water into prepared sample bottles. These sample bottles will be randomly selected from the supply of prepared sample bottles. Sample containers will be filled to yield an appropriate sample volume for the appropriate analysis. These field blanks will be prepared at Fort McClellan and then shipped for analysis prior to the field investigation. Results of the field blank analyses are used as the baseline concentration of compounds and elements that may be detected in the environmental samples collected.

3.11.3 Duplicate Samples

A field duplicate is two or more samples collected independently at a sampling location during a single act of sampling. The total number of field duplicates for each analysis will be equal to 10 percent of the samples collected, rounded to the next whole number.

Field duplicates will be labeled as to be indistinguishable by the laboratory from other samples. Therefore, one complete sample set will be identified with a coded or false identifier, which will be in the same format as other identifiers used with this sample matrix. Both the false and the true identifiers will be recorded in the field notebook. On the chain-of-custody forms, the coded identifier will be used. These coded field duplicates are used to assess the representativeness and precision of the sampling procedure.

3.11.4 Trip Blanks

Trip blanks will be prepared by the testing laboratory and delivered to Fort McClellan. Sample containers will be filled to yield an appropriate sample volume for VOC analysis. The trip blanks will be prepared at the laboratory, shipped to Fort McClellan, stored with the unused sample bottles, transported to the sampling site, and then shipped for analysis with the samples collected during the sampling event. The trip blank will remain unopened throughout the sampling event. Analysis of trip blanks is used to assess contamination of sample containers during storage at the site and contamination of samples during transport back to the laboratory.

One trip blank will be included in each shipping container containing soil and groundwater samples for VOC analysis.

3.12 EQUIPMENT DECONTAMINATION PROCEDURES

Decontamination rinsate from soil sampling activities will be collected and containerized pending the results of chemical analyses at the respective sites. Generated waste streams will be segregated by site to reduce potential disposal. Before groundwater sampling activities begin, and after sampling activities at a well have been completed, all sampling equipment (e.g., bailers) will be decontaminated. Two samples of the potable water (one from the Main Post, one from Pelham Range) will be collected as a background sample and submitted to the laboratory for complete chemical analysis before the start of drilling and groundwater sampling.

Well purging equipment will be decontaminated by washing with a solution of laboratory-grade detergent and rinsing with potable water. This equipment will be wrapped in aluminum foil, shiny side out, for transport to the site to prevent contamination of the purging equipment. Pumps will be circulated with a solution of detergent and potable water. Bailers will be scrubbed with a solution of laboratory-grade detergent and rinsed with potable water.

Between drilling locations, drilling equipment will be decontaminated onsite with a portable steam cleaner. SAIC will assist Fort McClellan in determining waste packaging, determination of waste characteristics, locating a licensed waste handler, and preparing manifests for waste transfer.

3.13 SAMPLE HANDLING AND SHIPPING

3.13.1 Bottle Preparation

All sample containers will be provided by a USATHAMA-approved vendor. The containers provided will be those described in 40 CFR 136 and cleaned in accordance with EPA protocols. Preparation certification and lot numbers will accompany all sample containers shipped to Fort McClellan from the vendor. The types of containers provided for the analytes of interest are listed in Table 3-2, along with the holding times and preservatives required for each analysis.

3.13.2 Sample Containment and Preservation

Sample containers will be selected to ensure compatibility with the waste and to minimize breakage during transportation. Aqueous phase samples for organic analyses will be contained in VOA vials with Teflon®-lined screw-type caps. Sample labels will be filled out at the time of sampling and will be attached to each container to identify the sample number, collector's name, date and time of collection, location of sampling point, and preservatives added.

3.13.3 Sample Packaging and Shipping

The following summarizes the procedures that will be followed when transporting environmental samples and field QC blanks from Fort McClellan to the surety materials laboratory and DATACHEM Laboratories:

- The outer surface of all sample containers will be cleaned with potable water and paper towels.
- Sample collection points, depth increments, and sampling devices documented in the field logbooks will be verified with the information written on the sample label and chain-of-custody form.
- Logbook entries, sample tags, chain-of-custody forms, and field record sheets with sample identification points, date, time, and names or initials of all persons handling the sample in the field will be completed.
- Custody seals will be wrapped around the cap and neck of each sample container.
- Environmental samples and field QC blanks to be submitted to the surety materials laboratory will be placed into a sample cooler along with ice packs and coolant blanks and the final cooler temperature will be recorded. After a cooler is filled, the appropriate chain-of-custody form will be placed inside a recloseable plastic bag and taped to the inside lid of the cooler, and the outer surface of the cooler will be cleaned.
- Custody tape will be attached in two separate locations on the outside of each cooler.
- Environmental samples and field QC blanks to be submitted to DATACHEM Laboratories, Inc. will be packed using the procedure described above. After the cooler is closed and the custody seals applied, the cooler will be placed in a secure area until the results of the surety materials analysis have been released. Upon direction from the USATHAMA Project Manager, these samples will be shipped to DATACHEM Laboratories. No sample shipment to DATACHEM will be made until

the samples have been cleared (i.e., all chemical agent have not been detected) by the USATHAMA Project Manager.

After the bottles for a given sample site have been filled, they will be placed in a shipping container. Those samples requiring preservation at 4°C will be covered with blue ice[®] packs or crushed ice in plastic bags and placed in a separate cooler. Field personnel will provide crushed ice or ice packs to add to the shipping cooler as the samples are collected. Each sample container will be cushioned and sealed in a cooler for shipment to the designated laboratory. Sample coolers shall be shipped to the laboratory by overnight delivery. Daily sample collection activities will terminate in time to ensure overnight delivery. A completed chain-of-custody record will accompany each sample shipment to provide documentation and to trace sample possession.

3.14 SAMPLE CUSTODY

A critical aspect of sound sample collection and analysis protocols is the maintenance of strict chain-of-custody procedures. Chain-of-custody procedures include tracking and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if it is: 1) in the physical possession or view of the responsible party, 2) secured to prevent tampering, or 3) placed in the restricted area by the responsible party. The Supervisory Geologist is responsible for the custody of the collected samples in the field until they have been properly transferred to the Field Manager, who is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the analytical laboratory. The laboratory is responsible for sample custody thereafter. Custody will be documented throughout all SI activities by the chain-of-custody record initiated for each day in which samples are collected. This record will accompany the samples from the site to the laboratory, and will be returned to key project personnel with the final analytical report. All personnel with sample custody responsibilities are required to sign, date, and note the time on the record when relinquishing and receiving samples from their immediate custody. Any discrepancies will be noted at this time. All samples will be shipped via overnight air courier. Bills of lading will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. All aspects of sample documentation and custody for field and laboratory activities are detailed below.

3.15 FIELD CHAIN-OF-CUSTODY

3.15.1 *Sample Labels*

A label will be attached to all sample containers at the time of sample collection. An example of the SAIC sample label is presented in Figure 3-17. The label will be completed in indelible ink and will contain the following information:

- Date and time collected
- Purpose of the sample (parameter and sample group)
- Sample number
- Source and location of the sample
- Project number and title of project
- Preservative used (if any)
- Name of collector.

3.15.2 *Field Sample Identification Procedures*

A sample identification system will be used to identify each environmental sample collected and field QC blank prepared during the field investigation. This identification system will provide a tracking procedure to allow information about a particular location to be retrieved easily and accurately. The system will also ensure that each sample is unique and will not be confused with any other sample. A complete list of sample numbers will be maintained by the Field Manager. Each sample number will assume the format described as follows:

Site Identification -- Each site will be assigned a unique number listed in Table 3-3.

Sampling Media and Sample Number -- A code will be used to identify the type of samples collected. The following are typical identifiers that will be used.

<u>Code</u>	<u>Media Description</u>
T4 - S0102	Soil sample number 2 collected from boring 1 at Area T-4
24AW0201	Water sample number 1 collected from monitoring well 2 at Area T-24A

SAIC		1710 Goodridge Drive, McLean, Virginia 22102	
<i>Location:</i>		<i>Project No:</i>	
<i>Sample Date/Time:</i>			
<i>Sample No.:</i>		<i>Sample Location:</i>	
<i>Analysis:</i>			
<i>Collection Method:</i>		<i>Purge Volume:</i>	
<i>Preservative:</i>			
<i>Comments:</i>			
			<i>Collector's Initials:</i> _____

Figure 3-17. Example of SAIC Sample Label

- RJ-S0101 Soil sample number 1 collected from location 1 at Range J
- RJ-D0104 Sediment sample number 4 collected at Range J, location 1.

The number immediately following the sampling media code will designate the sequential number of the samples acquired at each sampling location. For soil samples collected from borings, the numbers following the code designates the depth of the sample.

Field QC Blanks -- The following codes will be used to identify duplicate environmental and field QC blank samples:

- "R" will be used to identify all rinsate blanks collected in the field
- "F" will be used to identify field blanks prepared in the field
- "T" will be used to identify all trip blanks prepared by DATACHEM Laboratories.

Rinsate blanks will be identified by the site acronyms described above, followed by the QC code (R, F, or T) and a sample number code so that an easy cross-reference of associated samples can be made. As an example, a rinsate blank from site T-38 would be designated as T38R001. The sample collection date will be entered independently into the IRDMIS database.

3.15.3 Chain-of-Custody Record

Chain-of-custody forms will be used to document the integrity of all samples. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody form will be filled out for each sample set at each sampling location.

The chain-of-custody form for each sample shipment will contain the following information:

- Sample number (for each sample in shipment)
- Collection date (for each sample in shipment)
- Time shipment was packed

Table 3-3. Site Identification Designator

Location	Site Number
Area T-4	T4
Area T-5	T5
Area T-6	T6
Area T-24A	T24A
Area T-31	T31
Area T-38	T38
Old Toxic Training Area	OTA
Range K	RK
Range I	RI
Range J	RJ
Detection and Identification Area	DIA
HD Spill/Disposal Sites	HD
Range L (Lima Pond)	RL
Former Landfill #1	LF1
Former Landfill #2	LF2
Former Landfill #3	OLF
Old Water Hole	OWH
Potable Water	----

- Number of containers of each sample (for each sample in shipment)
- Sample description (environmental medium)
- Analyses required for each sample
- Preservative added, if any (for each sample in shipment)
- Shipment number
- Shipping address of the laboratory
- Date, time, and method of shipment
- Container lot numbers, if applicable
- Spaces to be signed as custody is transferred between individuals
- Airbill number
- Temperature of the coolant blank upon arrival at the laboratory.

The Field Manager, who will ship the samples from the field to the laboratory, is also responsible for completing the chain-of-custody form immediately prior to shipment by signing the form and noting the date and time of shipment. This individual will also inspect the form for completeness and accuracy. Any corrections to the chain-of-custody form entries will be made by a single-line strike mark through the incorrect item, and entering the correct entry adjacent to the strikethrough item. Corrections will be initialed and dated by the person making the change. After the form has been inspected and determined to be satisfactorily complete, the Field Manager or his designee (e.g., Sample Manager) will sign, date, and note the time of transferral on the form. The chain-of-custody form will be placed in a recloseable plastic bag and taped to the inside of the cooler lid after the Field Manager has detached the appropriate copy of the form. This copy will be filed and kept onsite for the duration of the S1. An example of the four-part chain-of-custody form is presented in Figure 3-18.

3.16 CUSTODY TRANSFER AND SHIPMENT PROCEDURES

The following summarizes the procedures that will be used in transferring and shipping samples:

- Samples will be accompanied by a chain-of-custody form at all times. When transferring the possession of samples, the individuals relinquishing and receiving will

sign, date, and note the time on the form. This form documents transfer of sample custody from the sampler to another person or to the laboratory.

- Samples will be properly packaged for shipment and dispatched to the analytical laboratory for analysis with a separate signed chain-of-custody form enclosed in each sample cooler. Shipping containers will be sealed with custody tape.
- Whenever samples are split with a facility or government agency, a separate chain-of-custody form will be prepared for those samples and marked to indicate with whom the samples are being divided.
- All packages will be accompanied by the chain-of-custody form showing identification of the contents. The original form will accompany the shipment, and the goldenrod copy will be retained by the Field Manager.
- When sent by common carrier, a copy of the bill of lading will be retained as part of the permanent custody documentation.

Samples will be accompanied by a chain-of-custody form. When the possession of samples is transferred, the individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time of transferral on the chain-of-custody document. This record will represent the official documentation for all transferral of sample custody until the samples have arrived at the laboratory.

Samples will be wrapped with plastic packing material and packed with crushed ice or blue ice[®] in sturdy, thermally insulated coolers. Samples to be submitted for surety analyses will be overpacked in a second cooler containing dry ice. Surety samples will be delivered by the U.S. Army to the surety laboratory within 24 hours of sample collection and will be analyzed within 24 hours. After clearance of the surety samples, sealed coolers will be transported from the Post to an air shipping company for overnight delivery to the analytical laboratory. The air bill number, written on the top of the chain-of-custody form, will serve as custody documentation while the cooler is in the possession of the courier. The chain-of-custody record will be available for the courier when required by the courier organization to maintain chain-of-custody protocols within their own organization during their time of possession. In this situation, the chain-of-custody form will be attached to the outside of the shipping containers during transportation. In all other situations, the chain-of-custody form will be placed in a recloseable plastic bag and taped to the inside lid of the cooler.

If samples are to be divided with another laboratory facility or governmental agency, a separate chain-of-custody record will be prepared for those samples. This chain-of-custody record will indicate with whom the samples have been split, and will be appropriately signed and dated with the time of transfer of split samples.

3.16.1 Sample Packaging

Samples will be packed according to the following procedures:

- One custody seal will be placed over the neck and cap of each container
- Glass sample containers will be wrapped with plastic insulating material to prevent contact with other sample containers or the inner walls of the cooler
- Samples will be classified according to the U.S. Department of Transportation (DOT) regulations pursuant to Title 49 CFR.

3.16.2 Shipping Containers

Samples will be packaged in thermally insulated, rigid coolers, according to DOT specifications 173 Subparts A and B and 172 Subparts B, C, and D. Sample containers will be placed in the cooler, which will contain blue ice[®] and absorbent packing for liquids or styrofoam packing for solids. The completed chain-of-custody form will be placed inside the shipping container, unless otherwise noted. The cooler then will be sealed. Samples submitted for surety analysis will be overpacked in a second cooler containing dry ice.

3.16.3 Marking and Labeling

The cooler will be marked as follows:

- Proper shipping name: Hazardous Substance, Liquid, or Solid.
- Hazardous class: To be determined (label placed in upper left corner of the outer container).
- Labels: "This Side Up" or arrows placed on the opposite side of the outer container if a liquid is to be shipped.
- Two strips of custody tape placed on each cooler, with at least one strip at the front and one at the back. Custody seals will be located in a manner that will indicate tampering, should any occur.

A hazardous material shippers certification will be filled out and will accompany the shipment. The container will be secured with strapping tape to prevent leakage and accidental opening.

3.17 DOCUMENTATION

The following sections address the requirements for developing, recording, and documenting the conditions, progress, and data collected during the performance of the SI at Fort McClellan. The purpose of these documents is to account for and specify, in detail, all activities related to the Fort McClellan SI.

All information pertinent to sampling, including field instrument calibration data, will be recorded in field logbooks. These books will be bound and the pages will be consecutively numbered. Entries in the logbook will be made in waterproof ink and will include, as a minimum, a description of all activities, individuals involved in sampling and oversight, date and time of sampling, weather conditions, any problems encountered, all field measurements, and a brief description of the sampling area. A plan and summary of each day's activities will be entered in the logbook.

Sufficient information will be recorded during the sampling trip to permit reconstruction of the sampling solely from the particular logbook. Shelf life, lot numbers, manufacturers, and expiration dates of buffer and standard solutions used for field instrumentation will be recorded in the field logbooks.

Entries in each logbook will include the following information, as a minimum:

- Name and title of author, date and time of entry, and physical environmental conditions during field activity
- Purpose of sampling activity
- Name and address of field contact
- Names and titles of field crew
- Names and titles of any site visitors

- Types of media (e.g., soil, sediment, groundwater) collected
- Sample collection method
- Number and volume of sample(s) taken
- Volume of groundwater removed before sampling
- Preservatives used
- Description of sampling point(s)
- Date and time of collection
- Sample identification number(s)
- Sample distribution (c.g., laboratory, name, address, telephone number, and point-of-contact)
- Field observations
- Field measurements made for pH, temperature, water level, and conductivity (σ).

Errors will not be obliterated, but crossed out with a single line, dated, and initialed by the originator.

All handwritten forms and documents will be recorded in a completely legible manner. None of the accountable serialized documents listed will be destroyed or discarded, even if the contents of these documents are illegible or contain inaccuracies that will require replacement.

All voided entries will be maintained in a file that will be kept onsite and referenced in the site logbook. The following forms are required and will be maintained onsite during the SI at Fort McClellan:

- Field equipment calibration log
- Soil boring log with descriptive text
- Groundwater sampling form
- Monitoring well construction log with descriptive text
- Well development log
- Water/sediment sampling form
- Field change request form.

Each space provided for sampling information will be completed. If some information is not available or not applicable to the SI, the space will be marked as "N/A." Blank spaces are not acceptable. All entries will be made in permanent black ink. All forms used will be recorded in the site logbook and kept in the field office in the same location as the site logbook in a three-ring binder or equivalent for the duration of the SI.

3.17.1 Sample Identification

Most methods of analysis of environmental samples must be accomplished within a specific amount of time after the collection of the sample. Where required, these timeframes ("holding times") are given in the method. Careful tracking of the analytical status of samples is required to ensure that these holding times are met.

Sample tracking will be accomplished in the field by assigning each sample a unique identification number as it is collected, following the procedures described in Section 5.1.2. This number will be traceable back to the day, time, site, and depth (where appropriate) of collection. The identification number will be recorded on the sample label and chain-of-custody form, as well as in the field logbook. A master log of the identification numbers used will be maintained by the Field Manager. All containers will be labeled before actual sampling. A general identification number will be used to identify such items as monitoring well location and sample interval. Each number or letter provides vital information pertaining to site identification, sample location, and sampling interval.

3.17.2 Site Logbook

The site logbook is the master field investigation document and is required for the SI at Fort McClellan. It is a bound book with a hard cover and sequentially numbered pages. The primary purpose of this document is to contain, in one location, the actual field data or references to other field documents that contain a specific description of every activity that has occurred during the SI on any given day. The site logbook will contain any administrative occurrences, conditions, or activities that may have affected the field work or data quality of any environmental samples or field QC blanks on any given day or during a given field task. The front of the logbook will list the project number and project name; the names of the

subcontracting company performing the field investigation (e.g., drilling, soil gas surveys); the service client; the contract under which the investigation is being conducted; and the dates of duration of the SI. The site logbook will be kept up to date on a daily basis.

The site logbook will contain the following information, as a minimum:

- Day, date, time entered onsite, temperature, weather conditions, and names and titles of personnel present onsite
- Names of SAIC personnel participating in the SI and the specific field logbook assigned to each individual
- Names, titles, and organizations of any visitors who entered the site during the day
- Numbers of samples by matrix that were collected and any field tests that may have occurred during the day's events, or a reference to the field logbook or the field forms that contain more specific information on all sampling that has occurred
- Specific comments relative to any problem areas that occurred during the day's activities, the final resolution, and the anticipated impact on the outcome of the field investigation or on data quality
- Instruments calibrated during the day, the individual who performed the calibration, and reference to the calibration log that provides more specific information on calibration procedures and results.

The Field Manager will sign the bottom of each page of the site logbook.

3.17.3 Daily Logs

Daily logs will be kept during field activities by the Field Manager and the Supervisory Geologist at the site. These daily logs will be kept in a bound field notebook of water-resistant paper. The cover of each logbook will list the project name and number, the name of the subcontracting company performing the field investigation, the service client, contract number, and the dates of the duration of the SI. All entries will be made legibly in indelible ink, signed, and dated. Information that will be recorded in the field notebook includes:

- Date, time, and place of sampling
- Names, titles, and organizations of individuals conducting sample collection tasks

- A description of all site activities and references to all applicable forms and other supporting documentation
- A description of all environmental and field QC samples collected or prepared; a list of sample label or tag numbers, if applicable; sample identification numbers; sample containers and volume of sample collected, preservation methods, and shipment numbers; and the date, time, and name of person to whom sample custody was transferred
- Weather conditions at the time of sampling, including ambient temperature and approximate wind direction and speed
- Data from field analyses (i.e., temperature, specific conductance, and pH of water samples, if applicable)
- Turbidity of water samples
- Data from physical tests (e.g., slug tests)
- Observations about site and samples (e.g., odors, appearance)
- Information about any activities, extraneous to sampling activities, that may affect the integrity of the samples (such as low-flying aircraft nearby, fossil-fueled motors being used nearby, painting operations being carried out upwind of sampling sites)
- Analyses, required sample treatment techniques, and solution preparation
- Coolant blank temperature readings.

3.17.4 Field Equipment Logbook

The Field Equipment Logbook (FEL) will document the proper use, maintenance, and calibration of all field testing equipment used during the SI at Fort McClellan. Before using field equipment, the Field Manager will inspect and approve the use of the field testing equipment by initialing the appropriate form in this document. A calibration log sheet will be maintained for each instrument used during the SI and will be kept in the log. The following items will be tracked in the FEL, as a minimum, during the SI:

- Equipment calibration status
- Equipment decontamination status
- Equipment nonconformance
- Equipment inspection and repair records.

The person using, maintaining, or calibrating field equipment will document his/her actions in the FEL. Entries will contain the following information:

- Name and signature of person making entry
- Date of entry
- Name of equipment and its identifying number
- Decontamination status
- Nature of work conducted
- List of reference or procedures used for calibration or maintenance
- Manufacturer, lot number, and expiration date of calibration standards
- Names of all persons conducting work
- Measurement results (acceptable or unacceptable).

Entries in the logbook will be signed and dated by the person making the entry. Every page in the log will be signed and dated by the Field Manager.

3.17.5 Materials Certification

Documentation (or copies) concerning the quality of all materials used onsite will be retained onsite for the duration of the SI at Fort McClellan. The following is a list of the materials certification documentation that will be kept, as a minimum:

- Analysis of all decontamination rinse water (i.e., USATHAMA approved water)
- Sieve analysis of filter pack material
- Manufacturer and lot number for calibration standards
- Material certificates for all construction materials
- Certificates of analysis for materials used in decontamination
- Certificates of acceptable calibration for thermometers
- Certificates of cleaning or decontamination furnished by the container or equipment manufacturer (the certificate will detail the cleaning procedure).

Material blanks are samples of the construction materials used in sampling equipment, such as monitoring wells, that are archived for future analysis. Material blanks are required for all of the applicable construction materials used during the SI at Fort McClellan. The types of material that will be sampled are pipe, well screen, filter pack material, drilling additives, bentonite, and cement.

Dry measure materials (e.g., cement, bentonite, and silica sand) will be sampled and labeled in the same manner described for the environmental and field QC samples. Approximately 2 pounds of dry material are required per sample for analysis. Liquid materials, such as drilling additives, paint, and lubricants, will require at least 1 liter of sample for analysis. Rigid materials, such as riser pipe and well screen, will require at least 2 feet of material per sample. The archived samples will be stored in clean containers and protected from exposure for the duration of the SI. The USATHAMA Project Manager will determine the length of time material blanks are to be stored after completion of the SI.

3.17.6 Corrections to Documentation and Variances

A variance is a deviation from project requirements. All variances from procedural and planning/design documents and other project requirements will be documented on the Field Change Request Form. The USATHAMA Project Manager for the SI at Fort McClellan will approve field changes that have a major impact on cost, schedule, and/or technical performance before incorporation.

Field changes and deviations from project planning documents will be reviewed and approved by the Project Manager, Field Manager, or the Project QA Manager. All deviations from procedural and planning documents will be recorded in the site logbook. Project reports will detail all field changes and deviations.

When it becomes necessary to make corrections to any form of documentation (e.g., sample labels, chain-of-custody forms, daily logbooks), the obsolete information will be crossed out with a single line and the changes made and initialed by the person making the change.

3.17.7 Photographs

A photographic record may be made during the field program, documenting field activities (i.e., drilling, soil boring, well installation, and sample collection). This photographic record may be used to highlight and enhance appropriate sections in the report resulting from these activities.

3.17.8 Disposition of Documentation

Upon conclusion of the field effort at Fort McClellan, all field documentation (i.e., maps, well logs, logbooks, and photographs) will be clearly labeled and submitted to USATHAMA.

3.18 BACKGROUND SAMPLING

Background samples for soil, sediment, and surface water will be collected from the location where Cave Creek enters Fort McClellan. Surface water and sediment samples will be collected in addition to hand auger samples collected at 1- and 5-foot depths. The background samples will be analyzed for all of the parameters for which analysis are being conducted at the SI sites.

4. DATA MANAGEMENT

This section provides information on the management of information collected in the field and in the laboratory. The USATHAMA Data Management System (IRDMIS) will be used to:

- Store information for future use
- Sort information for specific needs
- Allow data evaluation and comparison
- Present information in useable forms.

The quantity of the analytical, geotechnical, and map data produced is so large that an elaborate data management system is required for tracking and storage. The USATHAMA IRDMIS and accompanying software will be used to enter, store, and retrieve data for later interpretation as part of the Fort McClellan SI. The data will be entered according to the requirements in the Installation Restoration Program Quality Assurance Program (IRPQAP) Manual, "IRDMIS User's Guide Volume I: PC Tools", "IRDMIS User's Guide Volume II: Data Dictionary", and "Installation Restoration Control Charts (IRCC) Manual". The data will be transmitted error-free to Potomac Research, Inc. (PRI) for additional error checking, reformatting, and final entry into the pyramid data repository. The following sections outline the steps necessary for the collection of analytical, geotechnical, and map data, and the requirements necessary to enter the data into the USATHAMA database.

4.1 FILE INFORMATION

The items selected for entry into IRDMIS will be entered in one or more of four geotechnical files:

- Map File (GMA)
- Field Drilling File (GFD)
- Well Construction File (GWC)
- Groundwater Stabilized File (GGS)
- Chemical Data File (SCC).

These files, and others, along with data entry procedures are fully described in Sections 3 and 4 of the Installation Restoration Data Management User's Guide.

The following information (arranged by file) will be verified and entered into the IRDMIS. The chemical data file will be prepared by the testing laboratory. Specific coding of this information can be found in the IRDMIS User's Guide.

Map File (GMA)

- installation
- site type
- site identification/site number
- coordinates and coordinate system
- ground surface elevation
- source and accuracy of mapping data
- aquifer
- pointer information (cross reference for each boring and associated well(s))
- source of data (company and individual).

Field Drilling File (GFD)

- installation
- site type
- site identification
- depth to first encountered water
- depth to bedrock
- depth to deepest part of boring
- unified soil classification system symbol (expanded for bedrock lithologies)
- lithologic intervals (by depth and thickness)
- source of data (company and individual)
- dates.

Well Construction File (GWC)

- installation
- site type
- site identification
- stickup
- bentonite seal interval
- blank well casing interval
- well casing diameter
- length of overburden casing
- overburden casing diameter
- total depth of boring
- filter pack interval
- grout interval
- screen interval
- dates
- source of data (company and individual).

Groundwater Stabilized File (GGS)

- installation
- site type
- site identification
- depth to water (from ground surface)
- date(s) measured
- source of data (company and individual).

Chemical Data File (SCC)

- installation
- functional area
- site type
- file type
- site identification

- field sample number
- sample date
- program
- depth
- sample technique
- preparation date
- laboratory
- lot
- sample number
- laboratory analysis number
- analysis date
- method number
- test name
- uncorrected boolean
- uncorrected measurement
- unit of measurement
- dilution factor
- moisture
- analysis accuracy
- initials
- flagging code
- depth unit
- class indicator
- corrected value
- analysis type
- prime contractor.

5. PROJECT SCHEDULE

The Fort McClellan SI is composed of three phases, including project planning, field investigation, and data reporting. A detailed project schedule for field investigation activities and reporting is provided in Table 5-1. This section outlines the subtasks incorporated into each phase of the project.

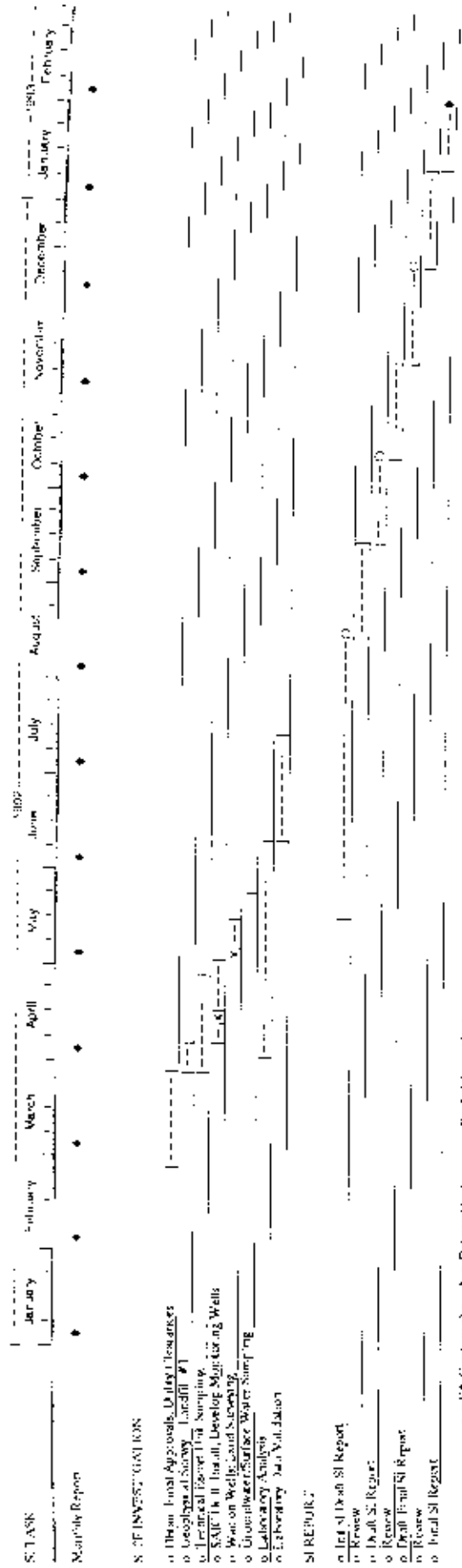
5.1 SITE INVESTIGATION

Upon acceptance and approval of project plans by USATHAMA and EPA Region IV, the U.S. Army TEU and SAIC will commence field activities at Fort McClellan.

5.2 SI REPORT

SAIC will prepare a report to document the findings of the SI. The report will include tabulation of validated data and will incorporate aspects of the TEU sampling program. Identification of interim corrective measures will be addressed as warranted by the data.

Table 5-1. Schedule for Fort McClellan Site Investigation Sampling and Analysis



6. EQUIPMENT CALIBRATION PROCEDURES

6.1 FIELD EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Table 6-1 summarizes the calibration procedures required for the field equipment used during the SI at Fort McClellan.

The satisfactory operating condition of equipment and instrumentation used onsite will be verified before each piece of equipment is shipped to Fort McClellan. All equipment and instrumentation will be calibrated daily before field activities begin and immediately recalibrated if field personnel suspect that calibration may have been altered (i.e., change of batteries, equipment being dropped or knocked about, or significant changes in temperature or humidity).

6.1.1 Health and Safety Monitoring Instrumentation

Calibration of health and safety instruments will be performed daily, before use, at the intervals specified by the manufacturer, or more frequently if field personnel suspect that calibration may have been altered. Health and safety instruments will include a Mine Safety Appliances, Inc. (MSA) combustible gas indicator and an HNu photoionization detector (PID).

The MSA combustible gas indicator and HNu PID will be used for field personnel safety purposes and for screening potentially hazardous soil samples. Because the instrumentation and procedures are continually being updated, field personnel are required to consult the appropriate instruction manual for calibration instructions. Calibration procedures for these instruments will be in accordance with the manufacturers directions.

6.1.2 Water Quality Measurements

All instruments used to conduct water quality measurements will be calibrated daily before use and more frequently if field personnel suspect that calibration may have been affected by some external factor (e.g., temperature or humidity). Water quality measurement

**Table 6-1. Summary of Field Monitoring Equipment
Calibration Procedures and Frequencies**

Equipment	Use	Units of Measure	Calibration Procedures
HNu PID	Air monitoring during field operations for presence of organic vapors. Soil vapor monitoring at selected sites.	Parts per million	Calibrate daily using 100 ppm Iso - C ₂ H ₂ /Air nontoxic calibration gas manufactured by HNu Systems, Inc.; see Appendix A, SOP 630 FP 26.
MSA Combustible Gas Indicator	Air monitoring during field operations for presence of combustible gases.	Percent of lower explosive limit	Calibrate daily using an MSA manufactured calibration gas - a nonflammable pentane (0.75 percent v/v, in air, 50 percent lower explosive limit); see Appendix A, SOP 630 FP 25.
pH Meter	Measure groundwater pH during development purging and sampling of monitoring wells and sampling of surface waters.	Standard units	Calibrate in the field using Fisher Scientific solutions standardized at 25 °C against NIST standard reference material; see Appendix A, SOP FP 30.
Specific Conductance Meter	Measure groundwater specific conductance during development purging and sampling of monitoring wells and sampling of surface waters.	Micromhos per centimeter	Calibrate daily using YSI 3162 conductivity calibration solution (potassium chloride, water, and 0.002 percent iodine); see Appendix A, SOP 630 FP 31.
Mercury Thermometer	Groundwater temperature measurements during development purging and sampling of monitoring wells and surface water sampling locations.	Degree celsius	Calibrated by manufacturer.
Water Level Indicator	Groundwater level measurements in monitoring wells.	Feet	Calibrated by manufacturer. Calibration check will be made periodically using a surveyor's tape.

Note: NIST – National Institute of Standards and Technology.

instrumentation will include a hand-held pH, specific conductance, meter and a mercury or digital thermometer.

Specific Conductance Meter -- Details on the use of the specific conductance meter are discussed in SOP FP 7-5 located in Appendix A. The specific conductance meter will be calibrated daily, immediately prior to the day's first use. Calibration will be verified at each groundwater sample collection location and after 10 surface water sample locations. The following briefly describes the calibration procedure for the specific conductance meter:

- With the instrument turned off, check the meter's mechanical zero setting. Adjust the screwdriver adjustment control on the meter face, if necessary, to obtain a zero reading.
- Press the power switch to "on" and press the battery check switch. Verify that the meter needle deflects to the battery check area.
- Connect a clean, dry probe to the instrument. Remove the instrument from its carrying case and place it on a padded surface.
- Press the 0-2 range switch and verify that the meter reads zero. If it does not, adjust the null adjust potentiometer RB9 on the amplifier circuit board to obtain a reading as near to zero as possible.
- Press the 0-2,000 range switch.
- Immerse the probe in the 1,000 mg/L sodium chloride solution. The meter should read 1,990 $\mu\text{mhos/cm}$. If it does not, adjust the standardization potentiometer R32.

pH Meter -- Details on the use of the pH meter are discussed in SOP FP 7-4 located in Appendix A. This instrument will be calibrated daily, immediately prior to the day's first use. Calibration will be verified at each groundwater sample collection location and after 10 surface water sample collection locations. The following briefly describes the calibration procedure for the pH meter:

- Be sure the fill hole in the pH electrode is uncovered. The fill hole is to remain covered at all times, except for calibration and pH measurement. When the electrode is not in use, cover with the storage cap.
- Immerse the probes in the pH 7 buffer solution and select the pH mode. Allow approximately 30 seconds to reach equilibrium and adjust the CAL control to obtain a reading coinciding with the pH and temperature of the buffer.

- Remove the probes from the pH 7 solution and rinse thoroughly with ASTM Type II reagent water.
- Immerse the probes in a pH 4 or pH 10 buffer solution. Use the buffer solution within 3 units of expected sample values. Allow approximately 30 seconds for the probes to reach equilibrium. Adjust the SLOPE control for a reading determined by the temperature of the buffer solution. A table on the label of the buffer solution provides this information.
- Rinse the probes thoroughly with ASTM Type II reagent water.

Water Level Indicator -- This instrument arrives calibrated by the manufacturer for water level measurement. Before shipment to Fort McClellan, the length of each water level indicator will be calibrated against a surveyor's tape.

Digital Thermometer -- Before shipment to Fort McClellan, each thermometer used during the SI will be calibrated against a standard thermometer traceable to NIST. Certification of acceptable calibration will accompany each shipment of thermometers.

6.2 LABORATORY EQUIPMENT

Calibration is the process of determining and adjusting instrumental response, relative to physical or chemical standards traceable to USATHAMA, EPA, or NIST. Each calibration point is a reproducible reference to which all sample measurements can be correlated. To ensure that daily variances have not adversely affected the operation of the instrument, a series of calibration standards will be analyzed before any samples are analyzed. The calibration will be verified with another calibration standard each day. Calibration check standards will be analyzed according to the analysis method specifications. The laboratory will satisfy all calibration requirements as specified in the USATHAMA approved protocols. This is to include the running of all standards for initial and check calibrations.

Calibration of laboratory equipment will be based on written procedures approved and certified by USATHAMA. Records of calibration, repairs, or replacement will be filed and maintained by the analytical laboratory. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will

maintain service contracts with the applicable instrument vendor. Details of the laboratory equipment calibrations are provided in the project QAP (SAIC 1991a).

7. REFERENCES

- Environmental Science and Engineering, Inc., *Reassessment of Fort McClellan, Anniston, Alabama, Report No. 110A*, January 1984.
- Potomac Research, Inc. 1991. Users Guide: Installation Restoration Data Management Information System, Volume II, Data Dictionary, Version 1991.3, September 3, 1991.
- Science Applications International Corporation, *Draft Final, Quality Assurance Plan*, submitted to USATHAMA, November 1991a.
- Science Applications International Corporation, *Draft, Site Investigation Work Plan*, submitted to USATHAMA, November 1991c.
- Science Applications International Corporation, *Draft Final, Health and Safety Plan*, submitted to USATHAMA, November 1991b.
- Science Applications International Corporation, *Draft Final Data Management Plan*, submitted to USATHAMA, November 1991d.
- U.S. Army Environmental Hygiene Agency, *Draft Hazardous Waste Consultation No. 37-26-1649-87, Fort McClellan, Alabama*, December 1986.
- Roy F. Weston, Inc., *Enhanced Preliminary Assessment Fort McClellan, Alabama Vols I, II (Appendices)*, Report No. CETHA-BC-CR-90181, December 1990.
- U.S. Army Toxic and Hazardous Materials Agency, *Geotechnical Requirements for Drilling, Monitoring Wells, Data Acquisition, and Reports*, March 1987.
- U.S. Environmental Protection Agency, *Hazard Ranking System Data Collection Guide to Meet the Requirements of the Revised Hazard Ranking System (HRS2)*, U.S. EPA Region IV, 12 p., April 1991.
- U.S. Environmental Protection Agency, *Information and Data Requirements for Site Investigations - Federal Agencies*, U.S. EPA Region IV, 16p., October 1990.

APPENDIX A

SAIC Standard Operating Procedures

FIELD PROCEDURE FP 7-4

PH MEASUREMENTS

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7.2 Calibration solutions, as required.

8.0 PROCEDURE

The procedure for calibration, operation and maintenance of the OMEGA Model PHH 60/80 hand held pH meter is outlined below. If a different instrument is used, the owner's manual should be consulted for instructions.

8.1 Calibration

The OMEGA Model PHH-60/80 pH meter is laboratory calibrated prior to shipment from the manufacturer. Calibration should be performed daily or more frequently if field personnel suspect that calibration may have been altered. For best results, calibrate pH with a fresh buffer solution that is within three pH units of the test sample. The following procedure describe the steps for calibration of the OMEGA Model PHH 60/80 pH meter:

1. Rinse the pH probe with ASTM Type II reagent-grade water.
2. Insert the pH probe into 300 mL of a fresh pH 7 buffer solution (Fisher Scientific, monobasic potassium phosphate and sodium hydroxide, 0.05 Molar).
3. Slide back the battery compartment cover of the instrument exposing the adjustment pots.
4. Adjust the CAL pot until the display reads 7.00.
5. Remove the probe from the solution, rinse with ASTM Type II reagent-grade water and insert in 300 mL of either a pH 4 or a pH 10 buffer solution. Use the appropriate solution that is in the expected pH range of sampler. (Recommended buffer solutions: Fisher Scientific, pH 4: potassium biphthalate, 0.05 Molar; pH 10: potassium carbonate, potassium borate and potassium hydroxide, 0.05 Molar.)
6. Adjust the SLOPE pot until the display reads the correct value.

8.2 Operation

1. Slide back electrode compartment to release pH electrode. Remove storage cap.
2. Extend electrode in either the 90° or 180° measurement position.
3. Energize instrument by depressing the ON/OFF switch once.
4. Rinse the electrode thoroughly with distilled water to prevent cross-contamination.
5. Immerse electrode in solution to be measured. For proper operation, immerse electrode to half its length, approximately 300 ml. Do not immerse electrode caps.

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	Issue Date	Effective Date	
	05/25/90	07/02/90	
Acceptance - Program QA	Supersedes Procedure Number	Rev.	Date
	630 FP 30	0	
			Approval - Program Manager

1.0 PURPOSE

The purpose of this procedure is to define the necessary steps for conducting pH measurements during field activities.

2.0 SCOPE

2.1 This procedure applies to the calibration, operation and maintenance of the Omega Model PHH-60/80 hand-held pH meter and probe.

2.2 This procedure may also be used in conjunction with the manufacturer's instructions for other pH measuring devices.

3.0 REQUIREMENTS

pH is an important environmental parameter that is routinely measured during waste management investigations to provide information on the extent of contamination at a site. In addition, pH measurements are taken on purge waters from monitoring wells to aid in assessing when sufficient water has been removed from the well to ensure that formation water samples will be collected.

4.0 REFERENCES

OMEGA Engineering, Inc., Model PHH 60/80 Hand Held pH Meter Instruction Manual, 1986.

5.0 DEFINITIONS

None.

6.0 RESPONSIBILITIES

The Field Operations Leader is responsible to ensure that the necessary equipment is available for the calibration, use and maintenance of measuring equipment. The Field Operations Leader is also responsible to ensure that the calibration and use methodology is consistent and that workers have been instructed in the proper use of equipment.

7.0 EQUIPMENT

7.1 OMEGA Model PHH 60/80 hand held pH meter and probe, or equivalent.

6. Select the desired parameter by depressing pH/PPM switch.
7. Agitate electrode briefly and observe reading.
8. Rinse electrode thoroughly with ASTM Type II reagent-grade water and replace pH storage cap; fill the cap with a small amount of pH 4 buffer or potable water to keep the bulb from drying out.
9. Remove the battery when the instrument will be stored for a long period.

8.3 Preventive Maintenance

The pH meter should be cleaned and inspected daily before and after use. Batteries shall be replaced, as necessary and the pH electrode shall be replaced when required.

The pH electrode can be maintained by cleaning after use with ASTM Type II reagent-grade water and filling the electrode's protective cap with a small amount of pH 4 buffer or potable water to keep the bulb from drying out.

9.0 ATTACHMENTS

None.

FIELD PROCEDURE FP 7-5
SPECIFIC CONDUCTIVITY MEASUREMENTS

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3. Insert the probe into the sample solution. Immerse the tip to or beyond the vent holes and agitate the probe vertically to be sure air bubbles are not entrapped. Allow time for the reading to stabilize. If the reading falls within the lowest 10% of the range, select the next lower range and again allow the reading to stabilize before recording the measurement.

Taking the Temperature Measurement:

1. Press the POWER I key and °C key. Verify that the LO BAT indication does not appear.
2. Insert the probe into the sample solution. Immerse the tip to or beyond the vent holes and agitate the probe vertically if the sample is not flowing or being stirred to be sure air bubbles are not entrapped near the temperature sensor. Allow the reading to stabilize before recording the temperature measurement.
3. Rinse the probe thoroughly with demineralized water after each measurement.

8.3 Preventive Maintenance

Cleaning the Probe:

The probe should be rinsed thoroughly with deionized water between measurements during normal use. When this is done there will be little chance of interfering substances building up on the probe elements. Should the sample contain oils, greases or fats, however, the electrodes could become coated and affect accuracy of the readings. In this case, the probe should be cleaned with a strong detergent solution or dipped in a 1:1 hydrochloric acid solution and then rinsed thoroughly with deionized water.

Battery Replacement:

A low battery indication will appear in the upper left corner of the display when battery replacement is needed. Replace the complete set as described in the Battery Installation procedure in the Preparation for Use section.

Probe Replacement:

The replacement probe assembly listed in the replacement parts list comes with the cable and the 4-circuit connector installed and with the cable tie properly positioned four inches from the connector. Replace the probe assembly as follows:

1. Remove the batteries from the battery holder.
2. Remove the six screws securing the instrument in the case.
3. Carefully lift the instrument from the case.
4. Disconnect the probe cable connector from the circuit board jack.

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1. Be sure the probe is clean.
2. Soak the probe in demineralized water for at least 30 minutes.
3. Remove the probe from the water and fling out drops clinging inside.
4. Immerse the probe to or beyond the vent holes in a beaker containing Sodium Chloride Standard Solution, 1000 mg/L. Agitate vertically to remove entrapped air.
5. Repeat Steps 3 and 4 at least once more.
6. Press the POWER I key and CND key. Verify that the LO BAT indication does not appear.
7. Press the 2 mS/cm range key.
8. Check the reading on the display. It should be 1.990 mS/cm. If adjustment is needed, use a small screwdriver to adjust the CAL control next to the display. Counterclockwise adjustment increases the reading.

8.2 Operation

Taking the Conductivity Measurement:

If the probe has been in storage, soaking may be necessary prior to use to ensure the probe is thoroughly wetted.

1. Press the POWER I key and CND key. Verify that the LO BAT indication does not appear.
2. Select the appropriate range. If the range is unknown, begin with the highest range.
3. Insert the probe into the sample solution. Immerse the up to or beyond the vent holes and agitate the probe vertically to be sure air bubbles are not entrapped. Allow time for the reading to stabilize. If the reading falls within the lowest 10% of the range, select the next lower range and again allow the reading to stabilize before recording the measurement. An overrange condition cause a 1 display followed by blank digits.
4. Rinse the probe thoroughly with demineralized water after each measurement.

Taking the Total Dissolved Solids Measurement:

1. Press the POWER I key and CND key. Verify that the LO BAT indication does not appear.
2. Select the appropriate range. If the range is unknown, begin with the highest range.

Procedure No. SPECIFIC CONDUCTIVITY MEASUREMENTS	Rev. FP 7-5	0	Page 2 of 5
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7.0 EQUIPMENT

The following is a list of replacement parts, calibration standards and accessories associated with the operation of the Hach Model 44600 conductivity/TDS meter.

REPLACEMENT PARTS AND ACCESSORIES

Cat. No.	Description	Unit
19380-04	Battery, AA, alkaline.....	4/pkg
1080-42	Beaker, poly, 100 mL.....	each
620-14	Bottle, wash, 120 mL.....	each
14423-26	Gallic Acid Solution, 59-Ml dropping bottle.....	each
44600-88	Instruction Manual.....	each
162-36	Phenolphthalein Indicator Solution.....	15 mL
44606-00	Probe, conductivity.....	each
44606-10	Probe, conductivity, 10-ft cable (optional).....	each
2105-14	Sodium Chloride Standard Solution, 100 mg/L ($1990 \pm 20 \mu\text{S/cm}$, $995 \pm 10 \text{ TDS}$).....	118 mL
23075-14	Sodium Chloride Standard Solution, 85.47 mg/L ($180 \pm 00 \mu\text{S/cm}$, $90 \pm 10 \text{ TDS}$).....	118 mL
14400-14	Sodium Chloride Standard Solution, 491 mg/L ($1000 \pm 10 \mu\text{S/cm}$, $500 \pm 5 \text{ TDS}$).....	118 mL
23074-14	Sodium Chloride Standard Solution, 10246 mg/L ($18000 \pm 50 \mu\text{S/cm}$, $9000 \pm 25 \text{ TDS}$).....	118 mL

* Refer to specifications for differences in accuracy and zero error.

8.0 PROCEDURE

The procedure for calibration, operation, and maintenance of the Hach Model 44600 conductivity/TDS meter is outlined below. If using a different instrument, the owner's manual should be consulted for instructions.

8.1 Calibration

Calibration will be needed periodically due to aging of the probe electrical components or when a new probe is installed. Calibration with a standard solution of known conductivity value near the typical temperature of the sample solution will improve accuracy.

NOTE: Calibration on the 2 mS/cm range with the 100 mg/L NaCl (1.99 mS/cm) standard calibrates all three ranges accurately enough for most applications. However, slightly better accuracy will be gained by calibrating on the particular range to be used using the appropriate standard solution. Refer to *Replacement Parts and Accessories* for a list of available standards offered by Hach Company.

Calibrate as follows:

NOTE: Sodium Chloride standards are contaminated easily. Always clean the probe before calibration and use a clean, dry container for the standard solution.

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	Issue Date	Effective Date
SPECIFIC CONDUCTIVITY MEASUREMENTS	05/25/90	07/02/90
	Supersedes Procedure Number	Rev. Date
	630 FP 31	0
Acceptance - Program QA	Approval - Program Manager	

1.0 PURPOSE

The purpose of this procedure is to define the steps necessary for calibration, operation and maintenance of the Hach Model 44600 conductivity/TDS meter.

2.0 SCOPE

2.1 This procedure applies to the calibration, operation and maintenance of the Hach Model 44600 conductivity/TDS meter.

2.2 This procedure may also be used in conjunction with the manufacturer's instructions for other specific conductivity meters.

3.0 REQUIREMENTS

Electrical conductance of a substance is its ability to conduct an electrical current. Chemically pure water has a low electrical conductance; while water that contains dissolved inorganic solids (chloride, phosphate, etc.) has a high electrical conductance. Consequently, the greater the amount of dissolve solids in ground water the greater the water's electrical conductivity.

4.0 REFERENCES

4.1 Driscoll, F. G., 1986. *Groundwater and Wells*. Johnson Division, St. Paul, Minn. pp. 92-94.

4.2 Hach Model 44600 Conductivity/TDS Meter Instruction Manuals.

5.0 DEFINITIONS

None.

6.0 RESPONSIBILITIES

The Field Operations Leader is responsible to ensure that the necessary equipment is available for the calibration, use, and maintenance of the sampling equipment. The Field Operations Leader is also responsible to ensure that the calibration and the method of operation is consistent and that workers have been instructed in the proper use of equipment.

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5. Connect the replacement probe cable connector to the circuit board jack and install the instrument in its case. Be sure the cable tie installed on the probe cable is placed inside the compartment housing the circuit boards to provide a strain relief for the probe cable.
6. Secure the instrument in the case with the six screws removed in Step 2. Thread the screws until the heads contact the panel surface. Screws will not become tight with further rotation, but threads will not strip.
7. Replace the batteries. *Refer to Battery Installation.*
8. Perform calibration with the new probe. *Refer to the Calibration paragraph.*

9.0 ATTACHMENTS

- 9.1 Attachment 9.1 - Description and Location of Controls and Indicators.

DESCRIPTION AND LOCATION OF CONTROLS AND INDICATORS

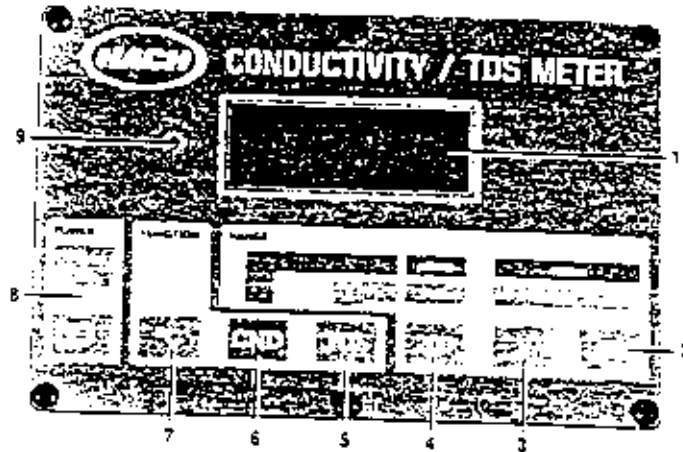


Table 1 Instrument Controls

Item	Name	Description
1	Liquid Crystal Display	A 3 1/2-digit display indicates value of measurement. Readout will be in millisiemens per centimeter, microsiemens per centimeter, grams per liter total dissolved solids, milligrams per liter total dissolved solids or degrees celsius, depending on the function and range switches selected. A low battery indication is incorporated, indicating LO BAT when battery replacement is required.
2	20 Range Key	Selects range 20 for mS/cm conductivity or g/L total dissolved solids.
3	200 Range Key	Selects range 2 for mS/cm conductivity or g/L total dissolved solids.
4	200 Range Key	Selects range 200 for μ S/cm conductivity or mg/L total dissolved solids.
5	TDS Key	Selects total dissolved solids measurement mode.
6	COND Key	Selects conductivity measurement mode.
7	°C Key	Selects temperature measurement mode.
8	Power Keys	Turns operating power on and off. Press I for on, O for off.
9	CAL Control	Used to calibrate the cell constant setting to compensate for variations in probe electrical characteristics.



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