7.

RI/FS PROJECT WORK PLAN

FORT McCLELLAN, ALABAMA
TASK ORDER 005
Contract Number DAAA15-91-D-0017

FINAL

Prepared for:

U.S. Army Environmental Center
Installation Restoration Division
Aberdeen Proving Ground, Maryland 21010-5401

April 6, 1994

WORK PLAN FOR
FORT McCLELLAN RI/FS
ANNISTON, ALABAMA

FINAL

Submitted to:

U.S. Army Environmental Center
Installation Restoration Division
SFIM-AEC-IRB
Aberdeen Proving Ground, Maryland 21010-5401

Submitted by:

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USATHAMA Contract DAAA15-91-D0017
Task Order 5

SAIC Project No. 01-827-03-6520-004

April 6, 1994

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LIST OF ACRONYMS AND ABBREVIATIONS (continued)

HRS	Hazard Ranking System
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IC	Initial Calibration
ID	Inside Diameter
IDW	Investigation Derived Waste
IRDMIS	Installation Restoration Data Management Information System
IRP	Installation Restoration Program
lb	Pound
LEL	Lower Explosive Limit
LF	Landfill
LPM	Liter per Minute
MCL	Maximum Contaminant Level
MPH	Miles Per Hour
MP	Military Police
MSA	Mine Safety Appliances, Inc.
MSL	Mean Sea Level
NIST	National Institute of Standards and Technology
NOAEL	No observed Adverse Effect Level
OD	Outside Diameter
OLF	Old Landfill
OP	Observation Post
OSDMP	O,5-Diethyl Methylphosphonate
OVA	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PID	Photoionization Detector
ppm	Parts per Million
ppt	Parts per Thousand
PRI	Potomac Research, Inc.
POW	Prisoner of War
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RF	Response Factor
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAIC	Science Applications International Corporation
SAP	Sampling Analysis Plan
SD	Standard Deviation
SI	Site Investigation
SM	Serratia mercesans

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SOP	Standard Operating Procedure
SPT	Standard Penetration Test
STB	Supertropical Bleach
STS	Sample Tracking System
SVOC	Semivolatile Organic Compound
SW	Surface Water
1,1,2,2-TCA	1,1,2,2-Tetrachloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Properties
TETRYL	N-Methyl-N,2,4,6-tetranitrobenzenamine
TRADOC	U.S. Army Training and Doctrine Command
TWA	Time Weighted Average
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USATEU	U.S. Army Technical Escort Unit
UXO	Unexploded Ordnance
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VX	O-ethyl-S(diisopropylaminoethyl)-methylphosphonothiolate
YSI	Yellow Springs Instrument

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AC	Hydrogen Cyanide
ADEM	Alabama Department of Environmental Management
AMPS	U.S. Army Military Police School
AMCLS	U.S. Army Chemical School
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BG	Bacillus globigii
BLS	Below Land Surface
CBR	Chemical, Biological, and Radiological
CCV	Continuing Calibration Verification
CE	U.S. Army Corps of Engineers
CG	Phosgene (Carbonyl chloride)
CK	Cyanogen chloride
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CRF	Central Record Facility
CWA	Chemical Warfare Agent
CX	Phosgene oxime
DCL	DataChem Laboratories
DCN	Document Control Number
DES_2	bis(2-diisopropylaminoethyl)
DFP	Diisopropyl Phosphorofluoridate
DIMP	Diisopropyl Methylphosphonate
DMMP	Dimethyl Methylphosphonate
DS2	Decontamination Solution #2
DQO	Data Quality Objective
ecoCOC	Ecological Contaminant of Concern
EM	Electromagnetic
EOD	Explosive Ordnance Disposal
ERA	Ecological Risk Assessment
ES&E	Environmental Science & Engineering
FFID	Federal Facility Identification
FS	Feasibility Study
FID	Flame Ionization Detector
FP	Field Procedure
FPD	Flame Photometric Detector
GB	Sarin or (Isopropyl methyl phosphonofluoridate)
GC	Gas Chromatography
GPR	Ground Penetrating Radar
GPS	Global Positioning System
GW	Groundwater
H&SP	Health and Safety Plan
HC	Hexachloroethane (Smoke Agent)
HD	Distilled Mustard
HO	Mustard Sulfoxide

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

Science Applications International Corporation (SAIC) is conducting a remedial investigation/feasibility study (RI/FS) at 12 sites located on Fort McClellan, Alabama. The purpose of the investigation is to determine the nature, extent, and potential ecological and human health impacts of environmental contamination resulting from controlled U.S. Army chemical warfare agent training activities and uncontrolled munitions and municipal waste disposal historically conducted at the sites. Assessment of the sources of potential contamination, delineation of the areal extent of detected contamination, detailed geologic/hydrogeologic characterization of several of the sites, and site remediation are additional objectives of the RI/FS. The sites to be investigated are summarized in Table 1-1 and include seven former training areas (T-4, T-5, T-24A, T-38, Range J, Range K, and Detection and Identification (D&I) Area), two former munitions disposal sites (Old Water Hole, Range L [Lima Pond]), and three former municipal or demolition debris landfills (Landfills #1, #2, and #3). The work to be conducted at Fort McClellan will be completed at the request of the U.S. Army Environmental Center (USAEC) pursuant to Contract DAAA15-91-D-0017, Task Order 5. Field work for the project will be conducted jointly by SAIC and the U.S. Army Technical Escort Unit (USATEU).

The chemical and biological agent training sites under investigation during the RI/FS were used for the controlled training of personnel in various facets of chemical and biological warfare decontamination, detection, and munitions/agent disposal. Training at these sites occurred at various times between the early 1950's and 1973, with operations involving various chemical agents. Limited, controlled usage of fixed quantities of dilute chemical warfare agent was typical during the training exercises. Usage included establishment of identification stations in which agent samples were set up for field identification. In addition, field equipment was contaminated with limited quantities of agent for identification and decontamination training. SAIC has not identified evidence of widespread dispersal or usage of training materials at the sites of concern based on review of records at the U.S. Army Chemical Museum at Fort McClellan and discussions with site personnel who were present during the training exercises.

Table 1-1. Sites to be Investigated Under RI/FS 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-24A Chemical Munitions Disposal Training Area	Main Post
Area T-38 Technical Escort Reaction Area	Main Post
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
Former Landfill #1	Main Post
Former Landfill #2	Main Post
Former Landfill #3	Main Post

Because of the controlled, surface usage of the chemical warfare agents and biological agent simulants, a general impersistence of the agents in the environment, and the lack of agent detection at sites T-4, T-5, and Range K, SAIC does not anticipate that these sites will warrant significant remediation. Subsurface burials at the four additional training sites (T-24A, T-38, Range J, and D&I) may require remediation of the buried materials. Based on qualitative metal detection surveys conducted by the USATEU during the 1992 site investigation (SI), the potential requirement for remediation of buried munitions at the Old Water Hole and Lima Pond sites is significant. The results of a preliminary surface geophysical survey and a site reconnaissance indicate that remedial action at Former Landfill #1 may not be warranted. Uncontrolled disposal of municipal and demolition wastes at Landfills #2 and #3 will warrant additional site characterization and will likely require remediation to mitigate surface exposure of waste materials and known or potential releases to groundwater and surface water. The results of the planned RI activities at each of these sites may require a reassessment of the necessity for remedial action at a particular site during the RI/FS process.

The RI/FS activities will follow site-specific project plans that include field sampling and laboratory chemical analyses conducted under project specific quality assurance/quality control (QA/QC) and health and safety protocols. RI/FS activities will be conducted utilizing U.S. Environmental Protection Agency (USEPA) and USAEC guidance including "*Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*" (USEPA 1988), and "*Data Quality Objectives for Remedial Response Activities*" (USEPA 1987), "*Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*" (USEPA, Region IV, 1991), "*Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports*" (USATHAMA 1987), and "*Quality Assurance Program*" (USATHAMA 1990). Additional specific regulatory guidance pertinent to risk assessment, aspects of the feasibility study, preparation of decision documents, and preparation of records of decision will be cited in the appropriate sections of this work plan.

2. SITE BACKGROUND AND SETTING

The Fort McClellan remedial investigation/feasibility study (RI/FS) will be conducted at 12 sites located on the Main Post of Fort McClellan and on the adjacent Pelham Range. Background information for the Post, the RI/FS sites, and the area surrounding the Post is provided in the following sections.

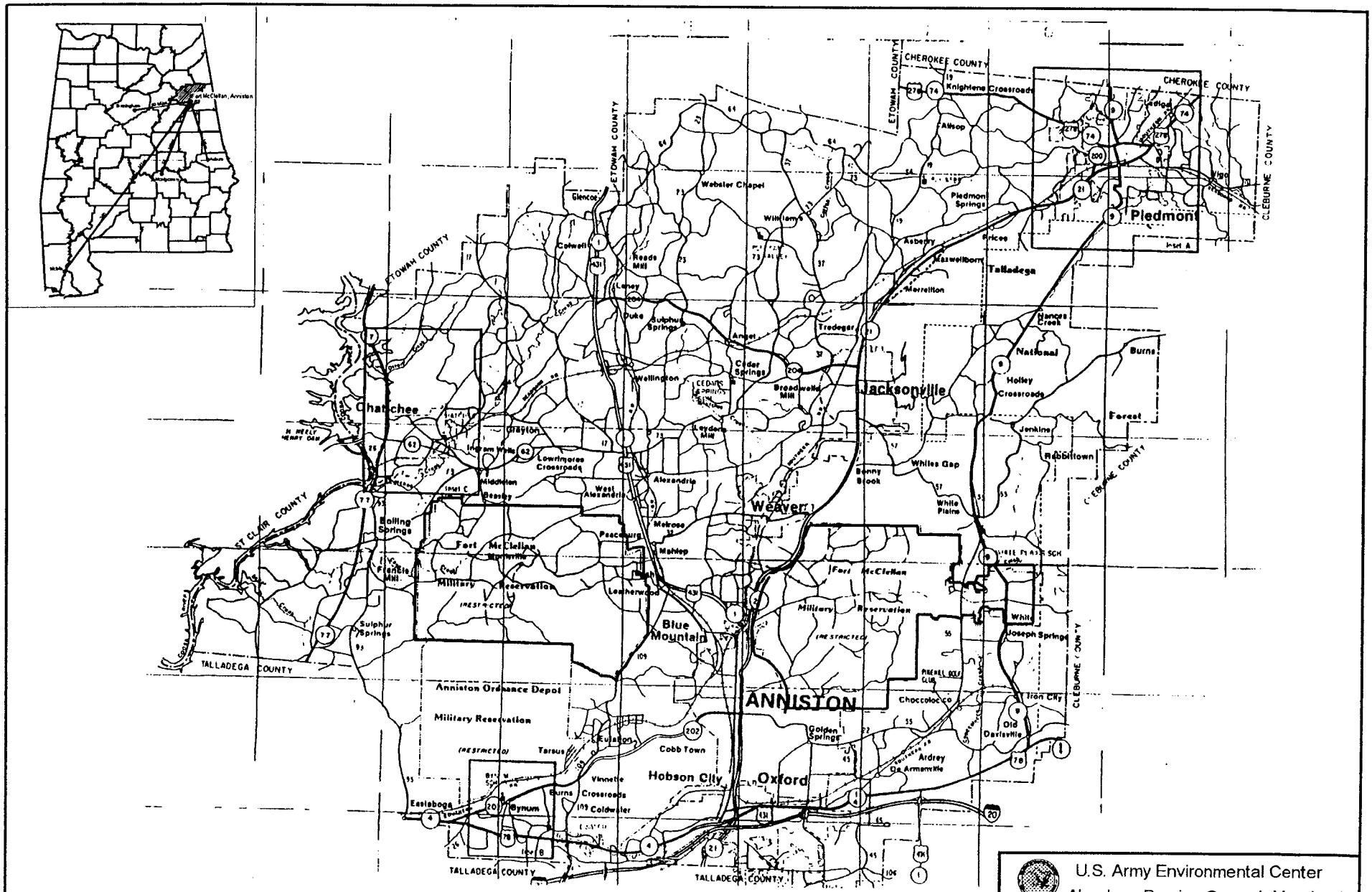
2.1 INSTALLATION DESCRIPTION AND HISTORY

Fort McClellan is located in northeastern Alabama near the cities of Anniston and Weaver in Calhoun County (Figure 2-1). The Post is approximately 60 miles northeast of Birmingham, approximately 75 miles northwest of Auburn, and approximately 95 miles from Atlanta, Georgia. Fort McClellan consists of three main bodies of government-owned and leased land situated in the foothills of the Appalachian Mountains of northwest Alabama. The size of each main parcel is as follows:

Main Installation	18,946 acres
Pelham Range	22,245 acres
Choccolocco Corridor (leased)	4,488 acres
	45,679 acres

The Main Post is bounded on the east by the Choccolocco Corridor, which connects the Post with Talladega National Forest. The Choccolocco Corridor is leased from the State of Alabama and designated for bivouac maneuvers by foot troops, wheeled vehicles, and tracked vehicles. The Morrisville Maneuver Area (Pelham Range), is located approximately 5 miles due west of the main installation and adjoins the Anniston Army Depot on the southwest. 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 installation houses three major organizations including the U.S. Army Military Police School, the U.S. Army Chemical School, and the Training Center (under the direction of the Training Brigade), in addition to other major support units and tenants.



U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

Installation Location Map

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-1 | Project: 01-0827-03-6520-004

SAIC

2.1.1 Ownership and Operational History

The Federal Government purchased 18,946 acres of land near Anniston in 1917 for use as an artillery range. With the outbreak of World War I, it was decided to use the property as a training camp, and it was named Camp McClellan in honor of Major General George B. McClellan. In 1917, Camp McClellan was used to train troops for World War I and served in that capacity until the armistice. It was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active army units and other civilian elements. Camp McClellan was redesignated as Fort McClellan in 1929 and continued to serve as a training area.

In 1940, the government acquired an additional 22,245 acres west of Fort McClellan. This tract of land was named Pelham Range in honor of Major John Pelham. In 1941, the Alabama Legislature leased approximately 4,488 acres to the Federal Government to provide an access corridor from the Main Post to Talladega National Forest. This corridor provided access to additional woodlands for training. Between 1945 and 1946, Fort McClellan served as a separation point. After a 3-month closing period, it was activated as a Recruit Training Center until May 1947. Once again, it ceased operation and was placed in an inactive status until 1951.

The Army reactivated Fort McClellan on January 4, 1951, for operation of the Chemical Corps School and as a replacement center for the Chemical Corps. The Chemical Corps School offered advance training in all phases of chemical, biological, and radiological warfare to students from all branches of the military service until the school was deactivated in 1973. The Army Combat Development Command Chemical/Biological Radiological Agency moved to Fort McClellan in 1962 and performed its mission until it also was deactivated in 1973.

The mission of the installation was changed in 1966 and Fort McClellan was renamed the U.S. Army School/Training Center and Fort McClellan. The 3rd Army non Commissioned Officers Academy was also stationed at Fort McClellan from 1967 to 1972. Ongoing activities at Fort McClellan can be divided into support activities, academic training, and practical training. Support activities include housing, feeding, and moving individuals during training. Academic training includes classroom, laboratory, and field instruction. Practical training

encompasses weapons, artillery and explosives, vehicle operation and maintenance, and physical and tactical training activities.

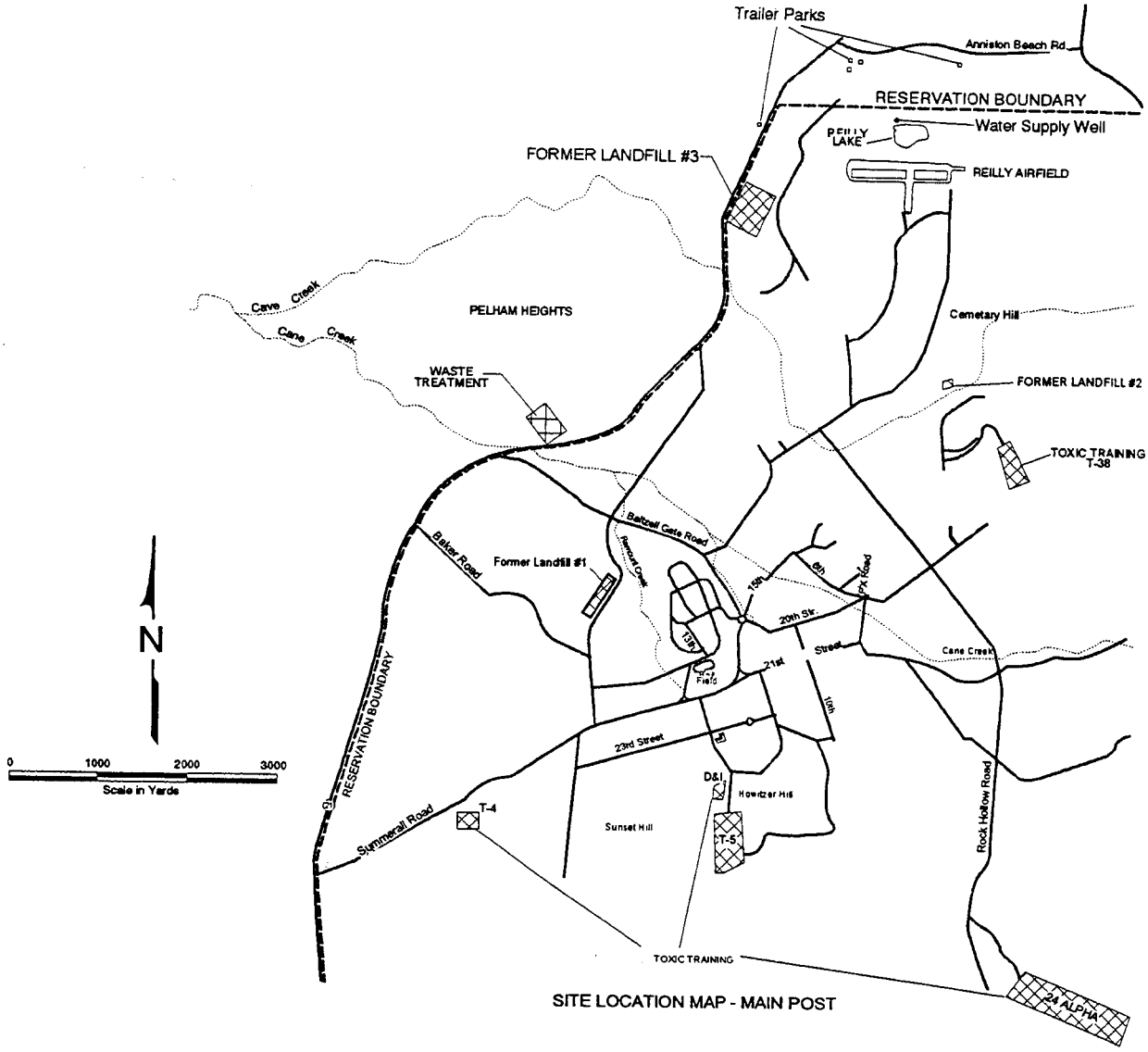
2.1.2 Demographics and Land Use

Two major municipalities are located near Fort McClellan. The City of Anniston (population 26,623; 1990 census) adjoins the main installation on the south and west, and the town of Gadsden (population 47,565; 1990 census) is located 28 miles to the north. The town of Weaver (population 2,715; 1990 census) is located less than 1 mile northwest of the Main Post and the town of Oxford (population 9362; 1990 census) is located immediately south of the City of Anniston. The City of Jacksonville (population 10,283; 1990 census) is located approximately 4 miles north-northeast of the Main Post. Smaller municipalities including Pelham Heights, Sherman Heights, and Anniston Beach are located immediately west or north of the Main Post. Population figures were provided by the Calhoun County Chamber of Commerce (personal communication).

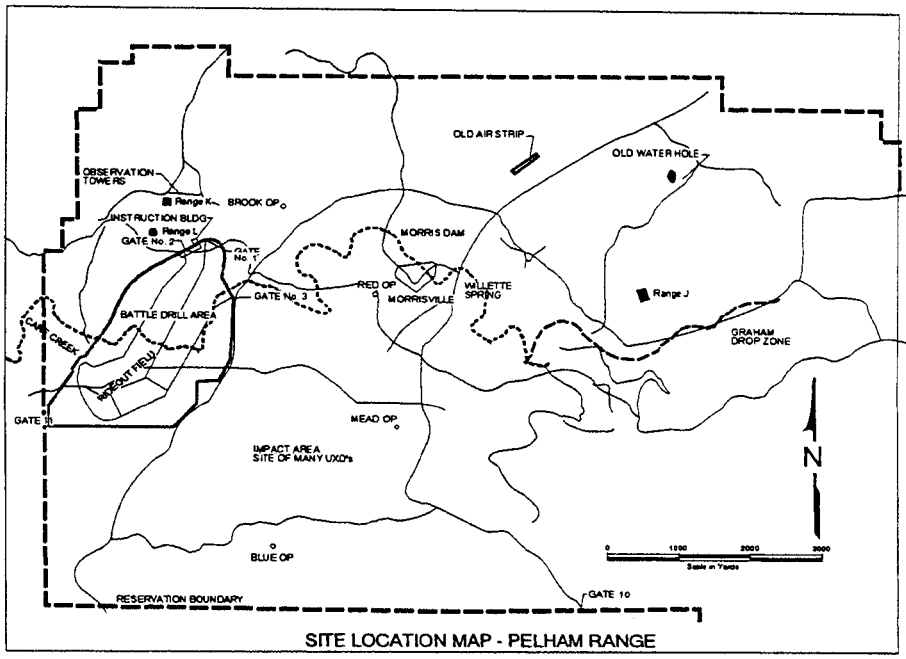
The Anniston area, of which Fort McClellan is a part, is one of two major population concentrations (population 25,000 or more) in the region. Fort McClellan contributes to the population of Anniston and surrounding areas. Besides the military personnel living off-Post, retired military personnel and their dependents live in the area surrounding Fort McClellan. Fort McClellan provides family housing units, Bachelor Officer Quarters, and Bachelor Enlisted Quarters to military personnel and their dependents.

2.2 SITE DESCRIPTIONS

Descriptions of the 12 sites to be investigated under the Fort McClellan RI/FS are summarized below. Information pertinent to the sites was obtained from the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA 1990), Environmental Science and Engineering (1984), the U.S. Army Environmental Hygiene Agency (USAEHA 1986), site visits conducted by SAIC in 1991 and 1992, and the 1992 site investigation report (SAIC 1993). The site locations are shown in Figure 2-2.



SITE LOCATION MAP - MAIN POST



SITE LOCATION MAP - PELHAM RANGE

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

RI/FS Site Locations

Fort McClellan, Alabama

Figure: 2-2 | Project: 01-0827-03-6520-006

The chemical agents used for training at Fort McClellan included mustard (HD), the nerve agents O-ethyl-S(diisopropylaminoethyl)-methylphosphonothiolate (VX) and Sarin (GB), and the biological simulants Bacillus globigii (BG) and Serratia mercesans (SM). HD is the predominant agent thought to have been used at Fort McClellan.

2.2.1 Site 1 - Area T-4

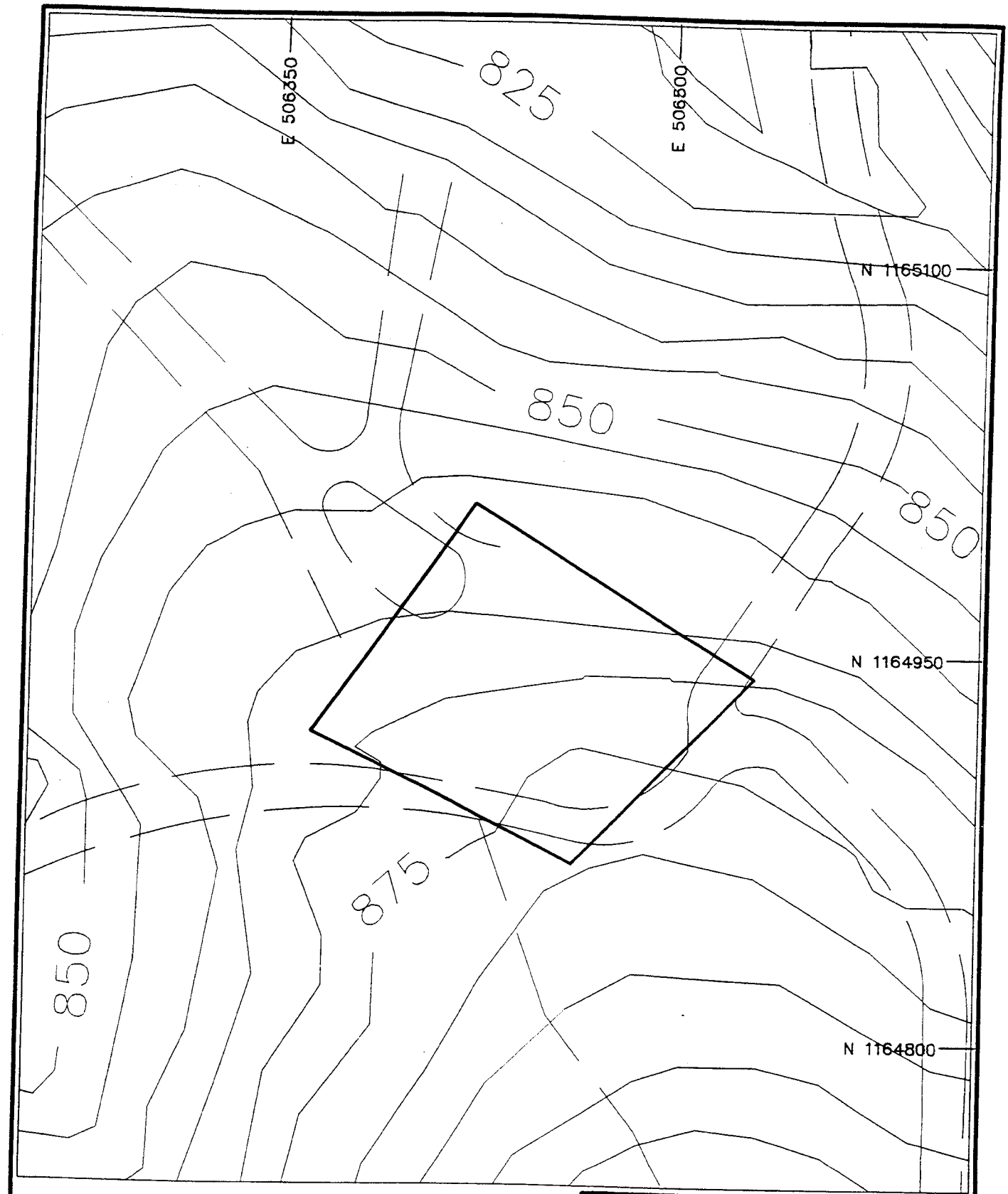
Site 1 - Area T-4 (Figure 2-3) was reportedly a Biological Simulant Test Area located on the Main Post. Records indicate that a 0.25-acre site was used between 1965 and 1971 for biological simulant (BG and SM) training. Decontamination of the simulants on the surface soils was performed by adding STB and DS-2.

2.2.2 Site 2 - Area T-5

Site 2 - Area T-5 is the Toxic Hazards Detection and Decontamination Training Area located between Sunset Hill and Howitzer Hill. The locations of suspected or potential chemical warfare agent training sites are shown in Figure 2-4. The 11.4-acre wooded site was used between 1961 and 1973 to train students in the methods of detecting and decontaminating toxic agents, including HD, GB, and VX. The quantities of agent used for training purposes ranged from 20 to 40 milliliters per exercise. The training sites were decontaminated and checked at the end of each exercise. Decontamination of the agents on residual soils was performed by adding STB and/or DS-2. In addition to HD, GB, and VX used during training, Site 2 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).

2.2.3 Site 3 - Area T-24A

Site 3 - Area T-24A was a Chemical Munitions Disposal Training Area located on the Main Post south of Holloway Hill (Figure 2-5). The 1.5-acre site was used until 1973 for chemical munitions disposal training with CG, BZ, GB, and HD. During each training exercise, approximately 4.46 kilograms of HD were reportedly used; however, first-hand observers reported that as much as 2 gallons of HD was poured on six howitzers and later on armored

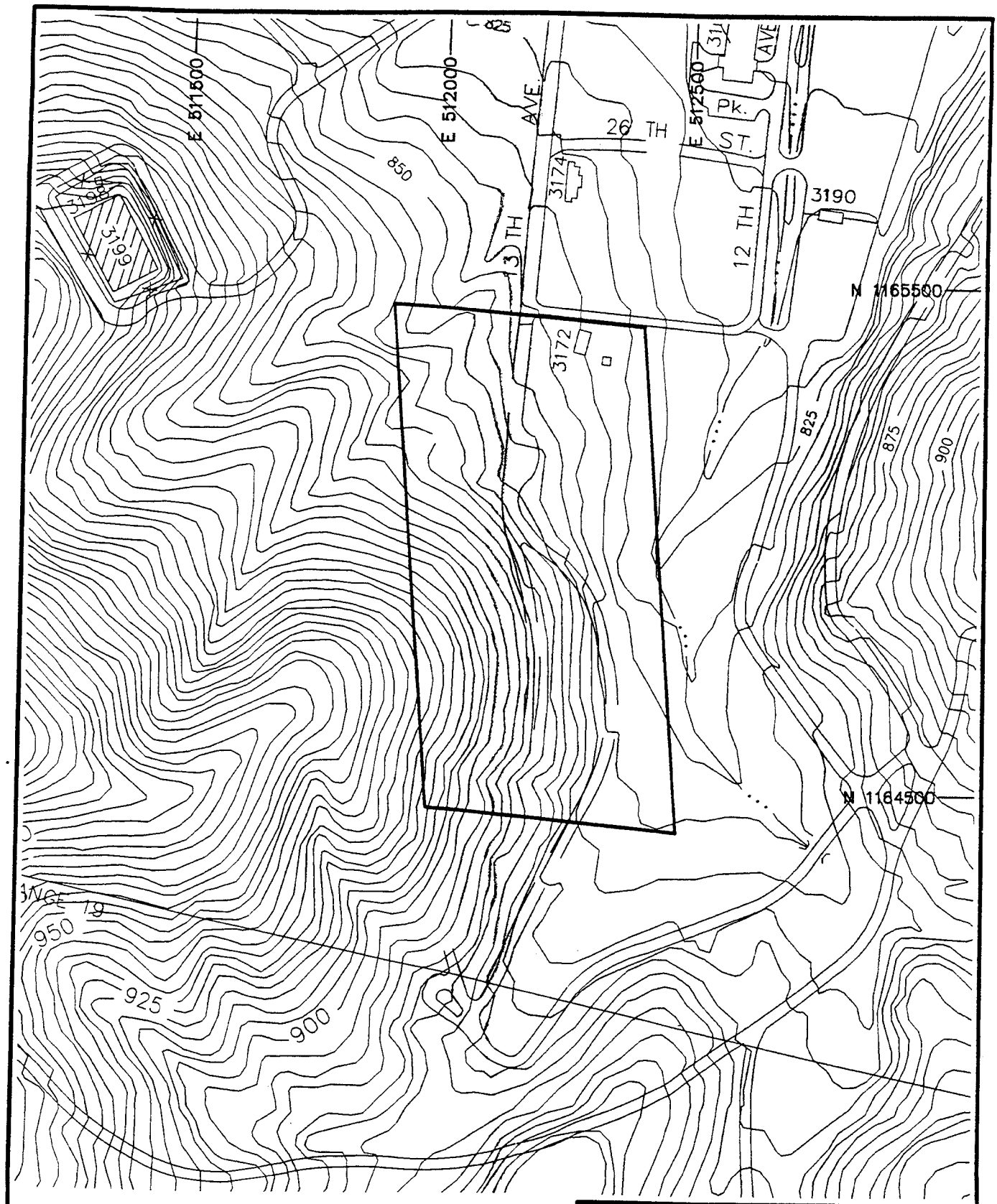


U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP AREA T-4

Fort McClellan RI/FS, Anniston, Alalbama

Figure: 2-3 | Project: 01-0827-03-6520-004

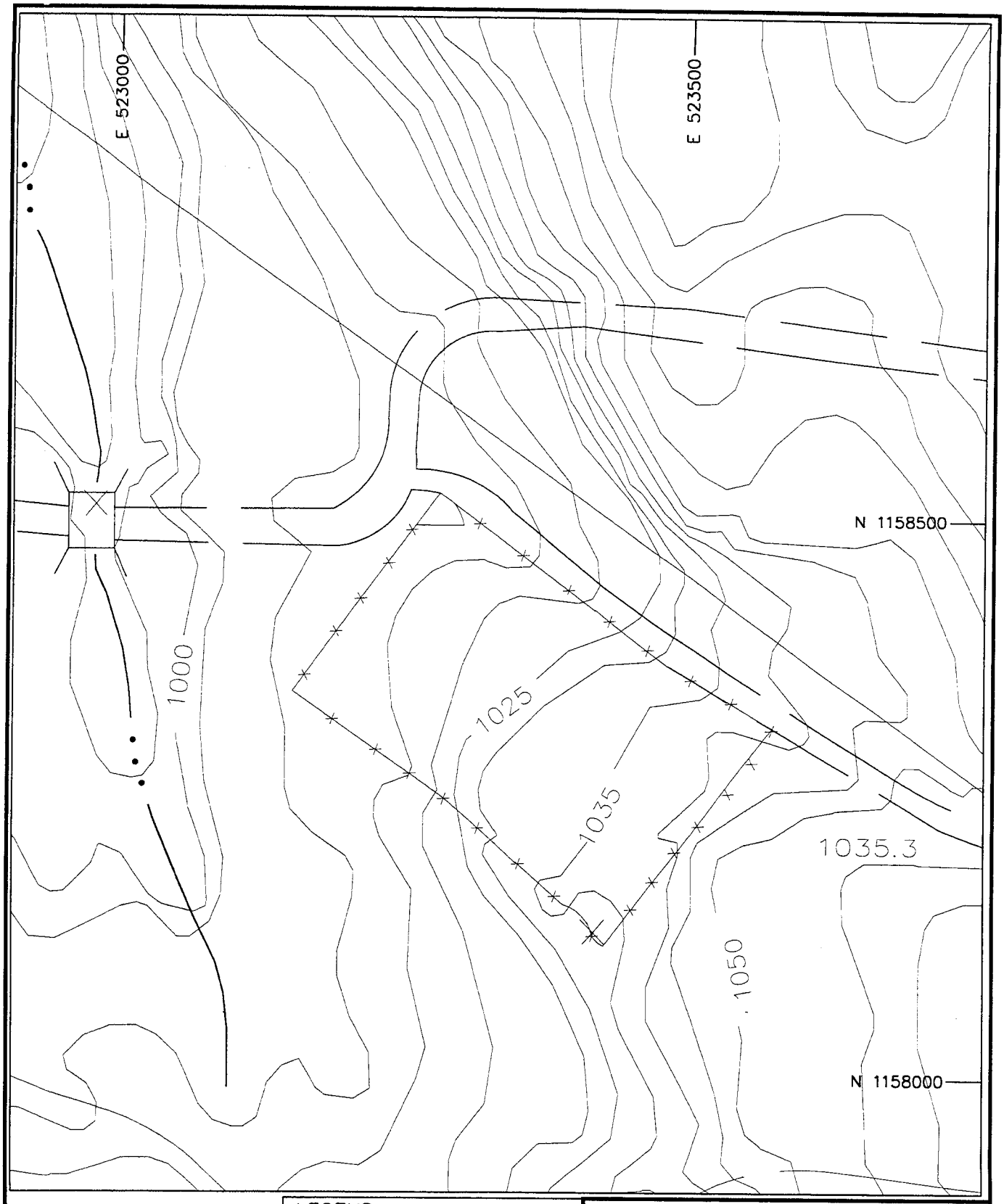


U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP—AREA T-5

Fort McClellan RI/FS, Anniston, Alalbama

Figure: 2-4 | Project: 01-0827-03-6520-004



N

0 100 200

SCALE IN FEET

LEGEND:

Site boundary from USATHATMA 1977.
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.

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Aberdeen Proving Ground, Maryland

SITE LOCATION MAP–AREA T–24A

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-5 | Project: 01-0827-03-6520-006

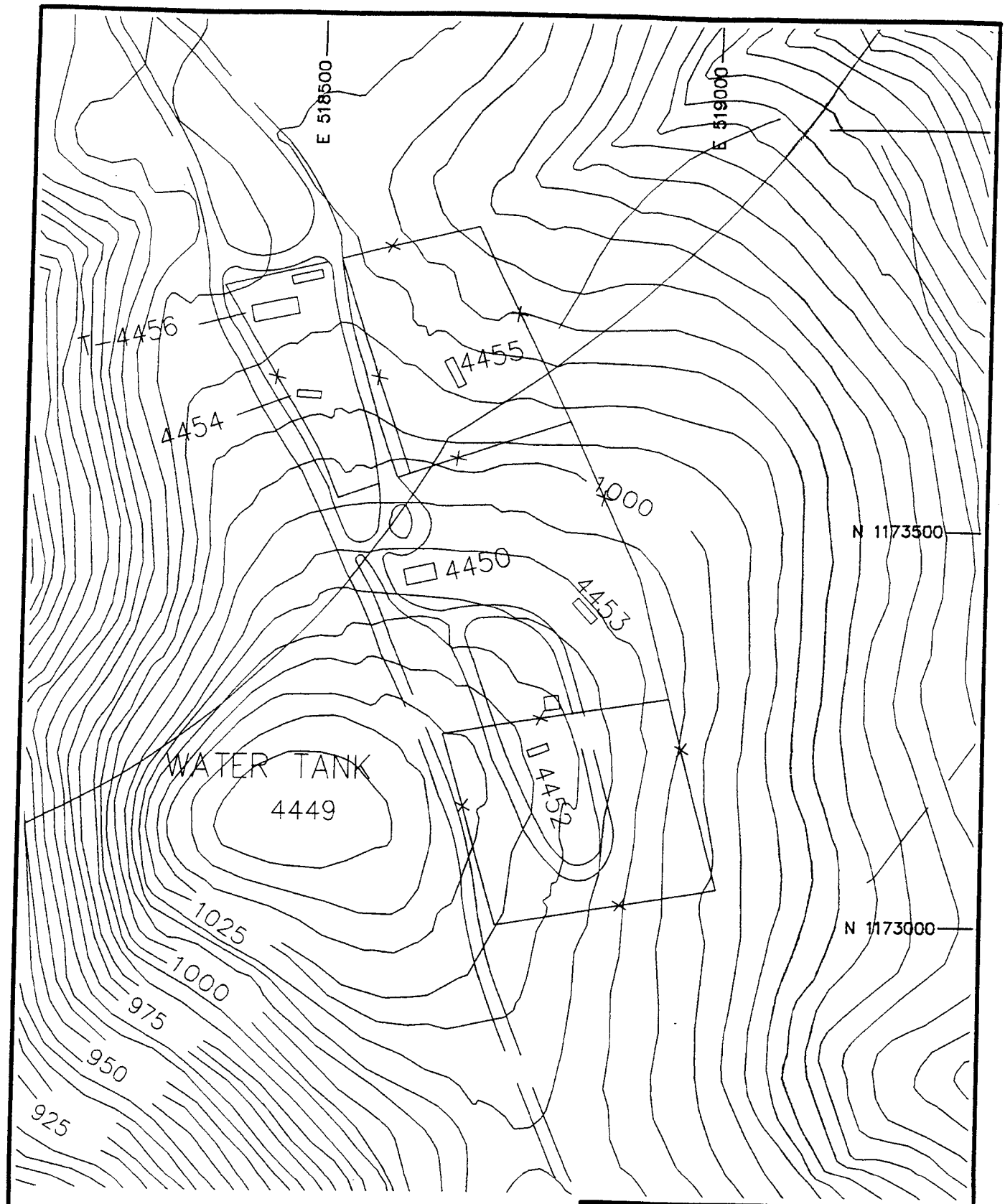
personnel carriers during training exercises. In addition, 40 milliliters of CG, one M-6 canister of BZ, and 740 grams of GB were used per exercise. Two square burning pits, each 16 feet on a side, were used for training exercises and were enclosed by a fenced area measuring 40 by 80 meters. The depths of the pits are unknown; however, standard operating procedures (SOPs) recommended a depth of 6 feet. At closure, the pits reportedly were filled with soil, although some depressions were observed in 1988. Decontamination of agents on residual soils was performed with STB and DS-2. A large HD spill may have occurred at this site but has not been confirmed.

2.2.4 Site 4 - Area T-38

Site 4 - Area T-38 (Technical Escort Reaction Area formerly Old Toxic Agent Yard) is located on the Main Post west of Reservoir Hill (Figure 2-6). 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 also was used to store, demonstrate and dispose of toxic agents and munitions, including GB, VX, and HD. In addition, unspecified decontaminants (likely STB, DS-2, and DANC) were stored on at least two sites, were used for demonstration purposes, and were disposed on site. Extensive decontamination was conducted on this site for reported spills and contaminated training aids. Liquid materials including tetrachloroethane were poured into an unlined pit (sump). The former disposal sump area was approximately 10 by 20 by 10 feet and was reportedly used to dispose of decontaminants and other hazardous wastes at the site. The sump was approximately located in the field during the April 1992 site visit (G. Harvey, oral communication). In addition, there is an unconfirmed report of the burial of a drum of chemical agent (mustard) in the southern portion of the site; however, efforts to determine the precise location of the drum were unsuccessful during the 1992 site investigation (SAIC 1993).

2.2.5 Site 5 - Range K

Site 5 - Range K was a 2-acre Agent Training Area located on Pelham Range (Figure 2-7). Limited information on the site is available, including time of operation and agents used. A reported shell tapping area where rounds were opened and decontaminated was operated in Range K prior to 1961 through the summer of 1963. During training exercises,



U.S. Army Environmental Center
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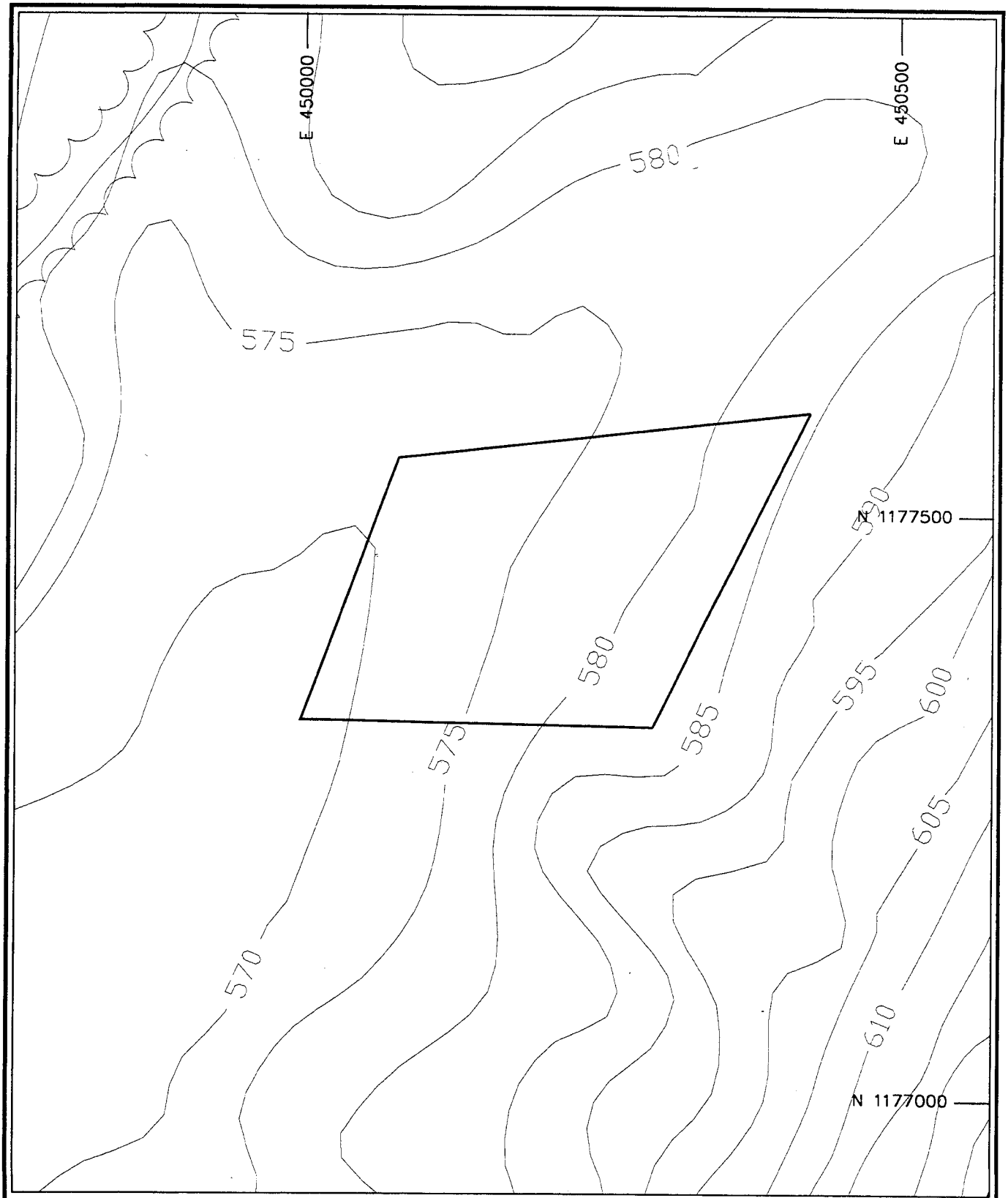
SITE LOCATION MAP—AREA T—38

Fort McClellan RI/FS, Anniston, Alabama

Figure:2—6 | Project: 01-0827-03-6520-004



N

0 50 100 150 200

SCALE IN FEET

LEGEND:

Site boundary from USATHATMA 1977.
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP–RANGE K

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-7 | Project: 01-0827-03-6520-006

breaking open of one 55-mm round of HD, one 105-mm GB, and one 4.2-mortar round of CG was standard practice (G. Harvey, written communication). The identified site has been physically rearranged (bulldozed) and records indicate that the area was cleared for surface usage in 1967. Spent 105- mm GB and 155-mm HD rounds and DS-2 cans were observed by USAEC beyond the tree line in November 1992 (T. Perry, written communication).

2.2.6 Site 6 - Range J

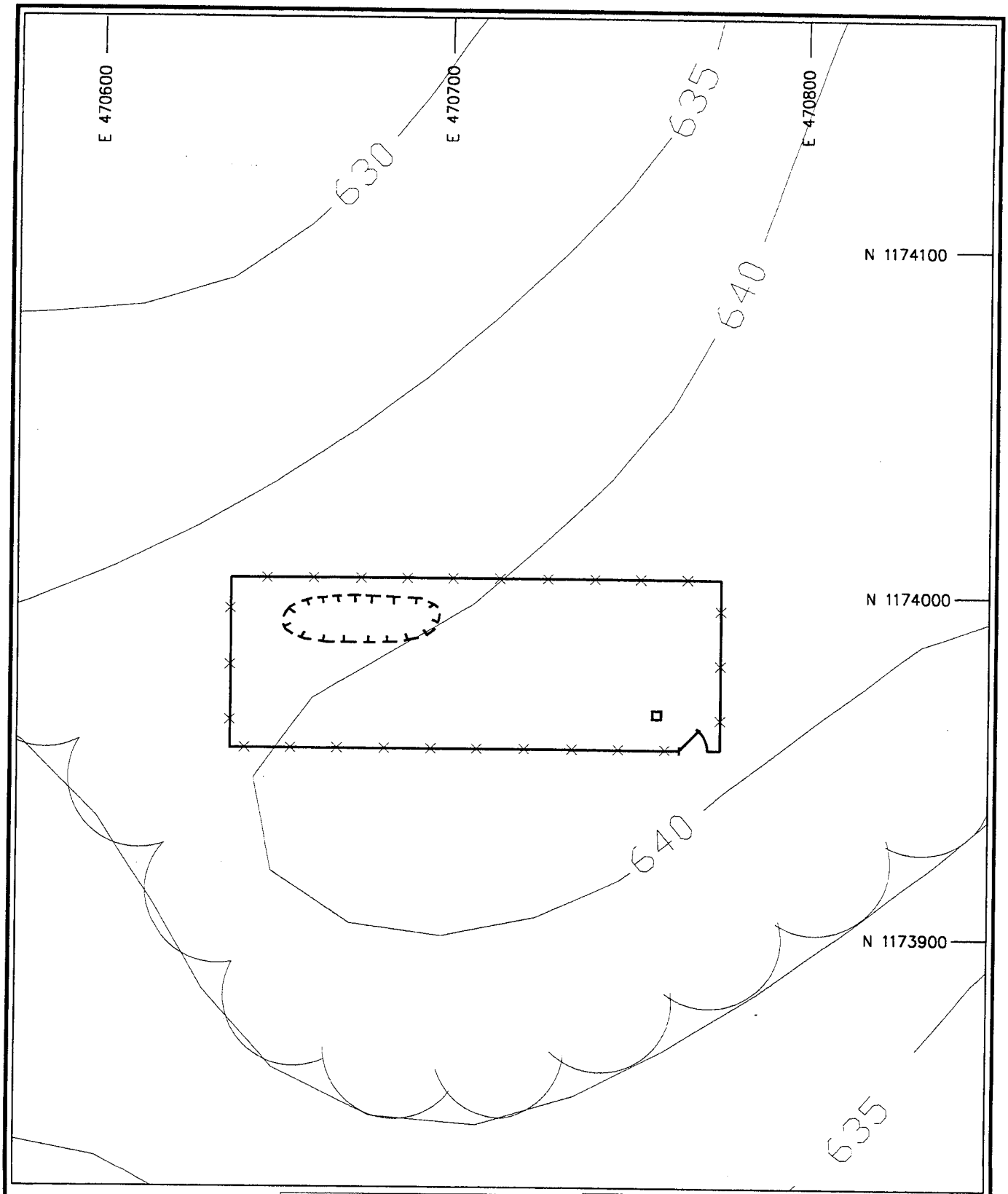
Site 6 - Range J was an Agent Training Area located on Pelham Range (Figure 2-8). The 50- by 139- meter fenced area was used until 1963 for training and agent disposal. The agents used at the site are unknown, but are believed to be HD. The site also was reportedly used for disposal of a 110-gallon HD spill that occurred on the Main Post in 1955. Evidence of drummed soil disposed of in a surface pit at the site was observed during October 1991, April 1992, and September 1993 site walkovers.

2.2.7 Site 7 - Detection and Identification Area

Site 7 - Detection and Identification (D and I) Area is located on the Main Post (Figure 2-9). The 1.1-acre site was used from the 1950's to 1972 for GB training. The Navy may have used HD at the site in the late 1950's for training purposes. Training routinely consisted of application of test kits to detect and identify agents contained in 40-milliliter vials. Agents often were mixed as a 10 percent solution with water. The agent simulants CK, GC, CX, and AC also were reportedly 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 remains are reportedly still located in the pit. The pit containing the burned materials is identified by stake F which was located during an October 1991 walkover.

2.2.8 Site 8 - Range L (Lima Pond)

Site 8 - Range L was a Chemical Munitions Disposal Area located on Pelham Range. The 0.5-acre site reportedly was used to dispose of captured World War II munitions, including chemical munitions. According to Post personnel, a shallow man-made pond (Lima Pond) was used as a dump site for the munitions. The pond is within a bermed area that is approximately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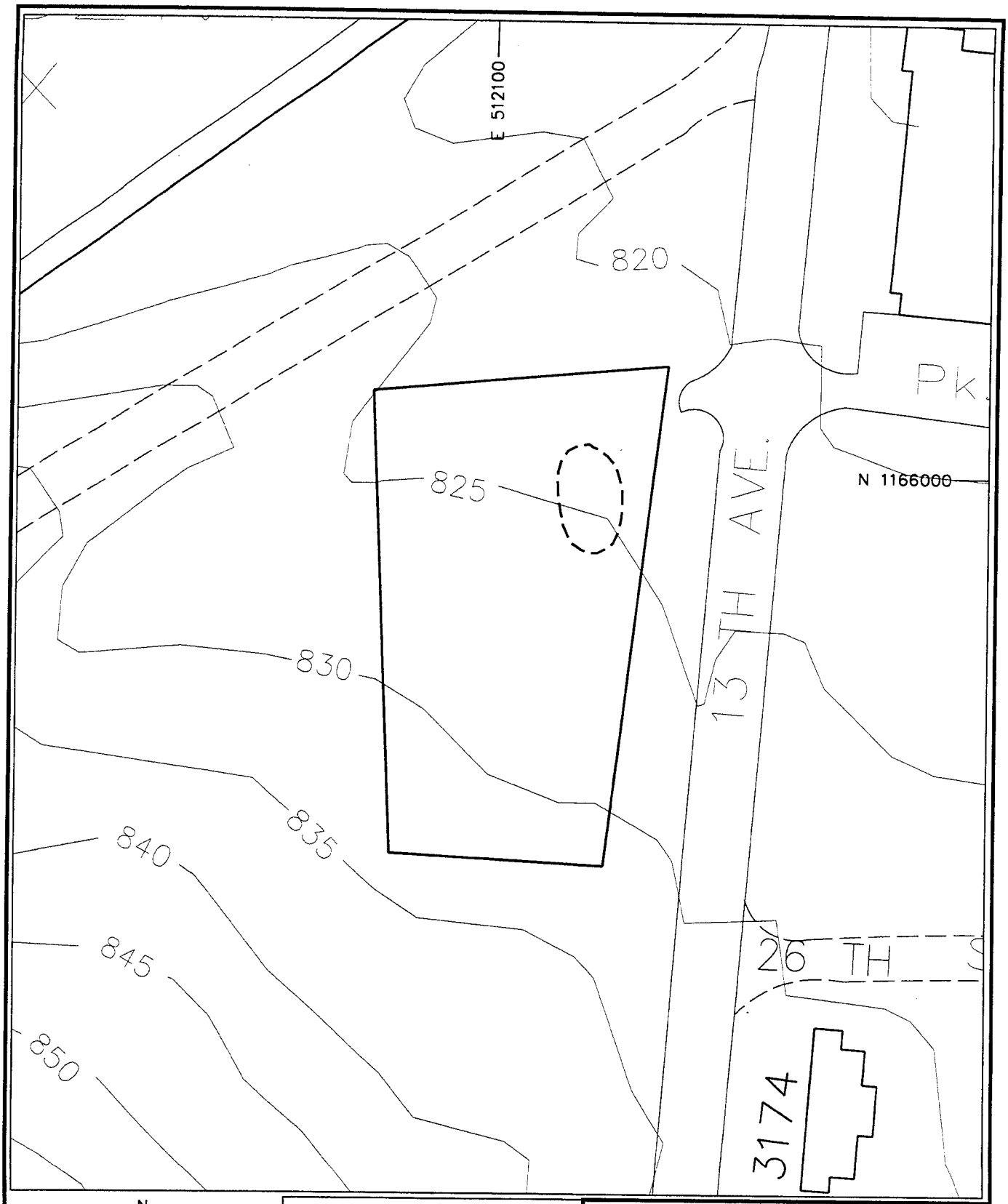
E 470700
E 470800
630
635
640
640
635
N 1174100
N 1174000
N 1173900
N
0
20
40
SCALE IN FEET
LEGEND:
Drum Disposal Pit
Fence
Concrete Monument
Site boundary from USATHATMA 1977.
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.
U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
SITE LOCATION MAP-RANGE J
Fort McClellan RI/FS, Anniston, Alabama
Figure: 2-8
Project: 01-0827-03-6520-006



N

0 50 100

SCALE IN FEET

LEGEND:

Burial Pit

Site boundary from USATHATMA 1977.
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP–D & I AREA

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-9 | Project: 01-0827-03-6520-006

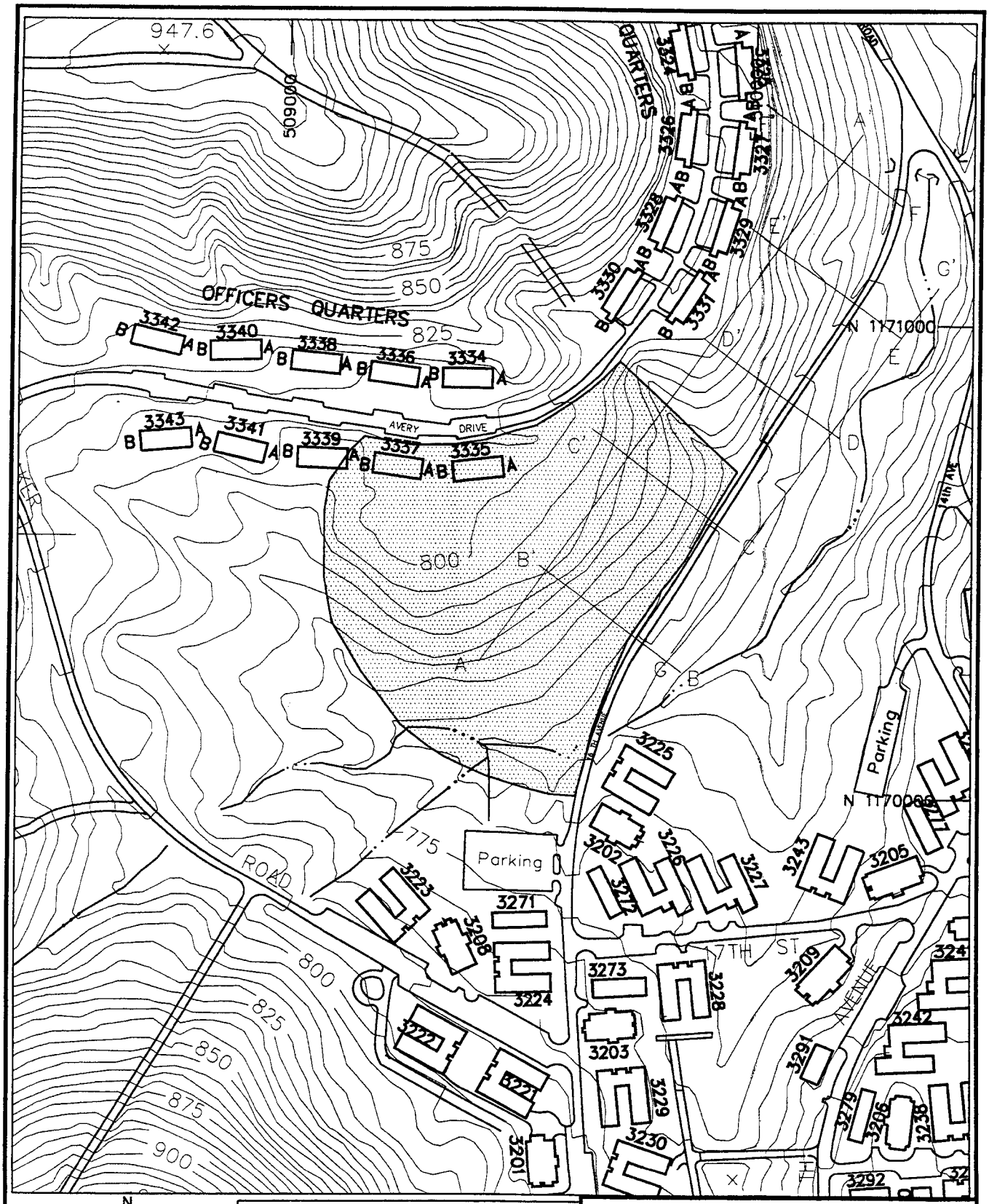
15 feet higher topographically than the surrounding wooded terrain. The pond is estimated to be approximately 30 feet deep from the top of the berm, although the actual depth of potential burials below the pit bed is unknown.

2.2.9 Site 9 - Former Landfill #1

Site 9 - Former Landfill #1 reportedly operated as the Post sanitary landfill between 1945 and 1947. The assumed site covers approximately 2 densely wooded acres and is located between 16th Avenue and Avery Drive, adjacent to the floodplain of an unnamed intermittent stream draining into Remount Creek (Figure 2-10). The site slopes to the southeast toward 16th Avenue. Information concerning the operation or content of the landfill has not been located. Known or suspected releases have not been documented and evidence of releases (leachate seeps) was not observed during the site preliminary assessment (USATHAMA 1990) or the October 1991 site visit. Aerial photographs of the site dated 1944 suggest that portions of the area may have been cleared, although the purpose for the clearing is unknown. A site walkover in October 1991 showed no evidence of previous landfilling at this location.

2.2.10 Site 10 - Former Landfill #2

Site 10 - Former Landfill #2 reportedly was used as 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 site is heavily wooded and is located in the floodplain of Cave Creek, which is an intermittent stream flowing south-southeast of the landfill (Figure 2-11). Shallow weathered bedrock was observed in the creek bed. The landfill reportedly was used to dispose of waste during deactivation of the installation. Rusted drums, metal, small containers (5-gallon cans and bottles), assorted building materials, and machinery parts were observed at the site in October 1991. Known or suspected releases have not been documented and evidence of releases (leachate seeps) was not observed during SAIC's October 1991 site visit. Demolition debris (asphalt, concrete, glass) was exposed at the landfill by road-building operations during the 1992 site investigation (SAIC 1993).



N

LEGEND:
- Approximate Site Boundary
- Stream
- A–A' SI Geophysical Survey Transect

0 50 100 150 200
SCALE IN FEET

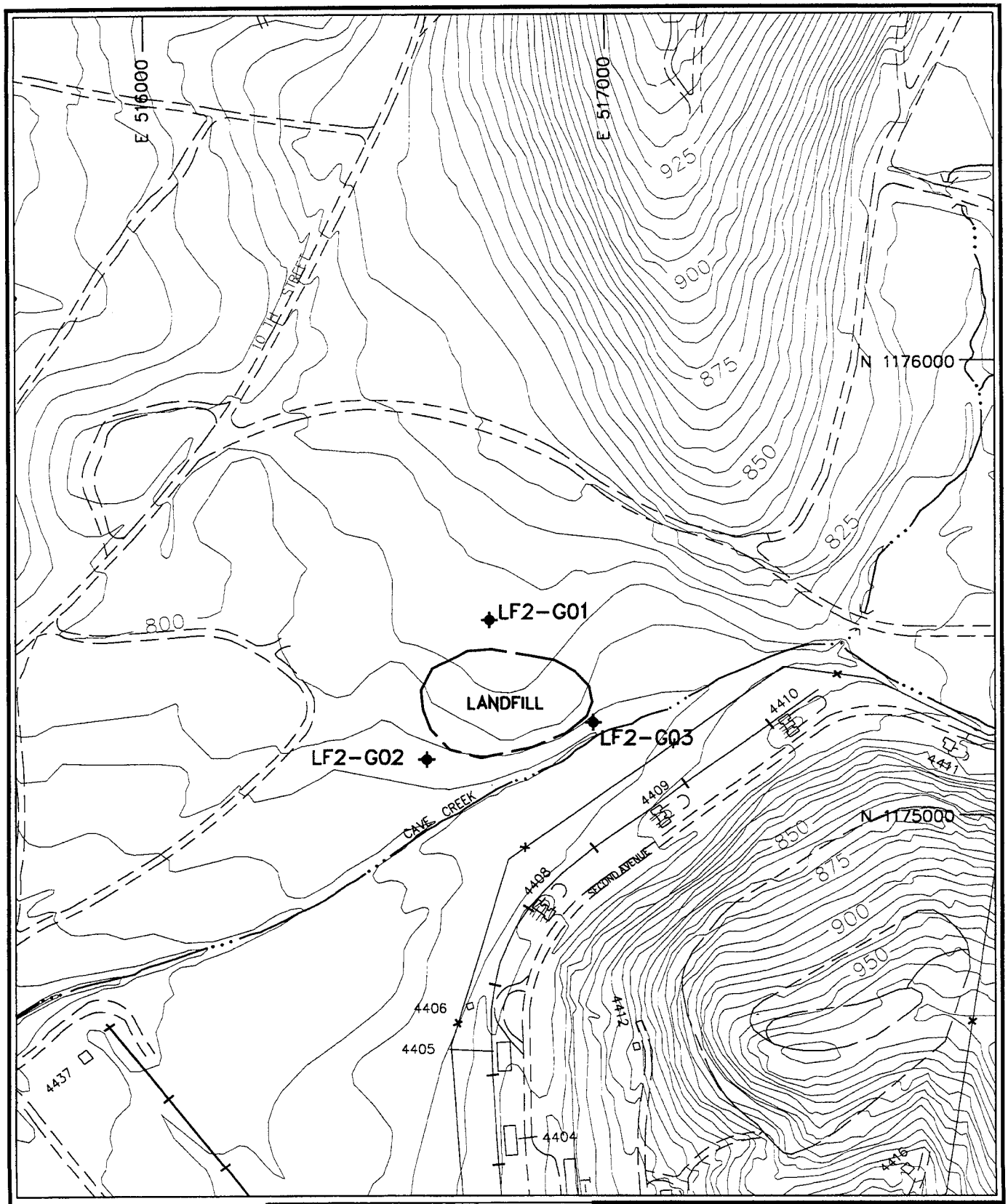
Site boundary from USDA-ASCS Aerial Photograph (12-09-54)
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP–FORMER LANDFILL #1

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2–10 | Project: 01-0827-03-6520-006



N

0 300

SCALE IN FEET

LEGEND:

◆ Monitoring Well (SAIC 1992)

Landfill Boundary

Site boundary from USATHATMA 1977.
Base map from U.S. Army Corps of Engineers, Mobile District, 1989.

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

SITE LOCATION MAP–FORMER LANDFILL #2

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-11 | Project: 01-0827-03-6520-006

2.2.11 Site 11 - Former Landfill #3

Site 11 - 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 southeast. Traces of the trenches due to settling over the old landfill cells have been noted in the past and have also been observed on high altitude aerial photographs. The linear depressions probably result in the ponding of water and accelerate leachate generation. 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 (Figure 2-12). Access to the landfill area is obtained along unpaved perimeter roads.

2.2.12 Site 12 - Old Water Hole

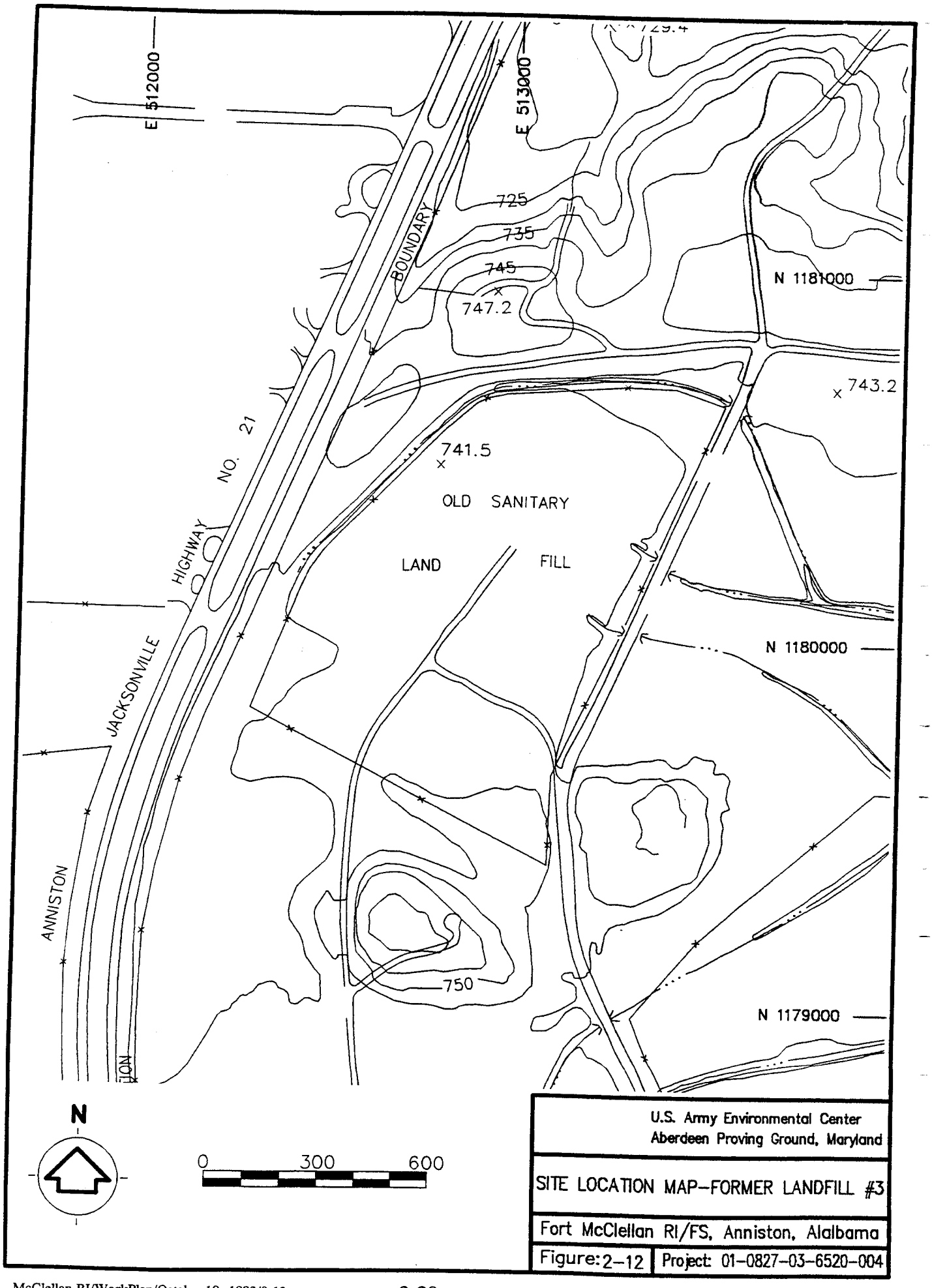
Site 12 - Old Water Hole is located between New Mt. Sellers Cemetery and the prisoner of war (POW) camp on Pelham Range. The site was reportedly was used for the disposal of a variety of munitions, including chemical agents, and is possibly a sinkhole without release controls. A rectangular, shallow, topographic depression approximately 35 by 85 feet was located by Fort McClellan Department of Environmental Management 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 SAIC's October 1991 site visit. The area was under water during SAIC's April 1992 site visit. Several small-caliber bullet shells were found at the site in 1992.

2.3 ENVIRONMENTAL/REGIONAL SETTING

The environmental setting at Fort McClellan is summarized in this section as a reference framework for the site-specific work proposed to address the environmental concerns at the RI/FS sites.

2.3.1 Meteorology

Fort McClellan is situated in a region with a temperate, humid climate. The average annual temperature is 63°F, with summer temperatures usually reaching 90°F or higher about


E 512000
E 513000
BOUNDARY
725
735
745
747.2
N 1181000
743.2
741.5
OLD SANITARY
LAND FILL
HIGHWAY NO. 21
JACKSONVILLE
ANNISTON
750
N 1180000
N 1179000
N
0
300
600
U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
SITE LOCATION MAP–FORMER LANDFILL #3
Fort McClellan RI/FS, Anniston, Alalbama
Figure: 2–12
Project: 01–0827–03–6520–004

70 days per year. Temperatures above 100° are relatively rare. Freezing temperatures are common, but are usually of short duration. The first frost may arrive by late October. At Anniston, the average date of the first 32°F temperature is November 6 and the last date is March 30. Snowfall averages 0.5 to 1 inch. On rare occasions, several inches of snow accumulate from a single storm, as was the case during the blizzard of 1993.

The average annual rainfall is approximately 53 inches and is fairly well-distributed throughout the year, as indicated in Table 2-1. The more intense rains usually occur during the warmer months and some flooding occurs nearly every year. Approximately 80 percent of the flood-producing storms are of the frontal type and occur in the winter and spring, lasting from 2 to 4 days each. Summer storms are usually thunderstorms with intense precipitation over small areas, and these sometimes result in serious local floods. Occasionally, several excessively wet years or dry years occur in series.

Table 2-1. Average Precipitation by Month at Anniston Airport, Anniston, Alabama

Month	29-year Average 1951 - 1980 Inches[a]	1990 Inches[b]	1991 Inches[c]	1992 Inches[d]
January	5.36	7.56	4.25	4.09
February	4.82	8.99	6.24	6.32
March	6.82	8.65	6.45	4.47
April	5.35	1.90	4.76	2.85
May	3.99	2.94	7.61	2.17
June	3.89	2.63	7.29	5.96
July	4.23	3.37	2.39	4.44
August	3.80	.58	2.4	6.47
September	4.15	.58	.3.53	5.28
October	2.50	2.65	.53	2.12
November	3.35	3.03	3.82	10.32
December	4.99	2.47	4.66	5.71

[a] Data obtained from *Climatography of United States No. 20, Anniston FAA AP*, NOAA, National Climatic Data Center.
[b] Data obtained from *Climatological Data Annual Summary, Alabama, 1990*, Vol. 96, No. 13, NOAA.
[c] Data obtained from *Annual Climatological Summary for 1991, Anniston FAA Airport* , NOAA, National Climatic Data Center, 1993.
[d] Data obtained from *Summary of the Day Data (Form 5670) for 1992, Anniston FAA Airport*, NOAA, National Climatic Data Center, 1993.

A study of wind velocity, duration, and direction reveals that winds in the Fort McClellan area are seldom strong and frequently blow down the valley from the northeast. However, there is no truly persistent wind direction. Most of the time, only light breezes or calm prevail, except during passages of cyclonic disturbances, when destructive local wind storms may develop into tornadoes, with winds of 100 miles per hour (mph) or more. Figure 2-13 is a wind rose of wind conditions for the Birmingham, Alabama area. Northeast winds occur most frequently, with a secondary maximum of north winds.

2.3.2 Physiography

Pelham Range and all but the easternmost portion of the Main Post lie within the Valley and Ridge Province of the Appalachian Highlands. The portion of Fort McClellan west of Choccolocco Creek lies within the Piedmont Province.

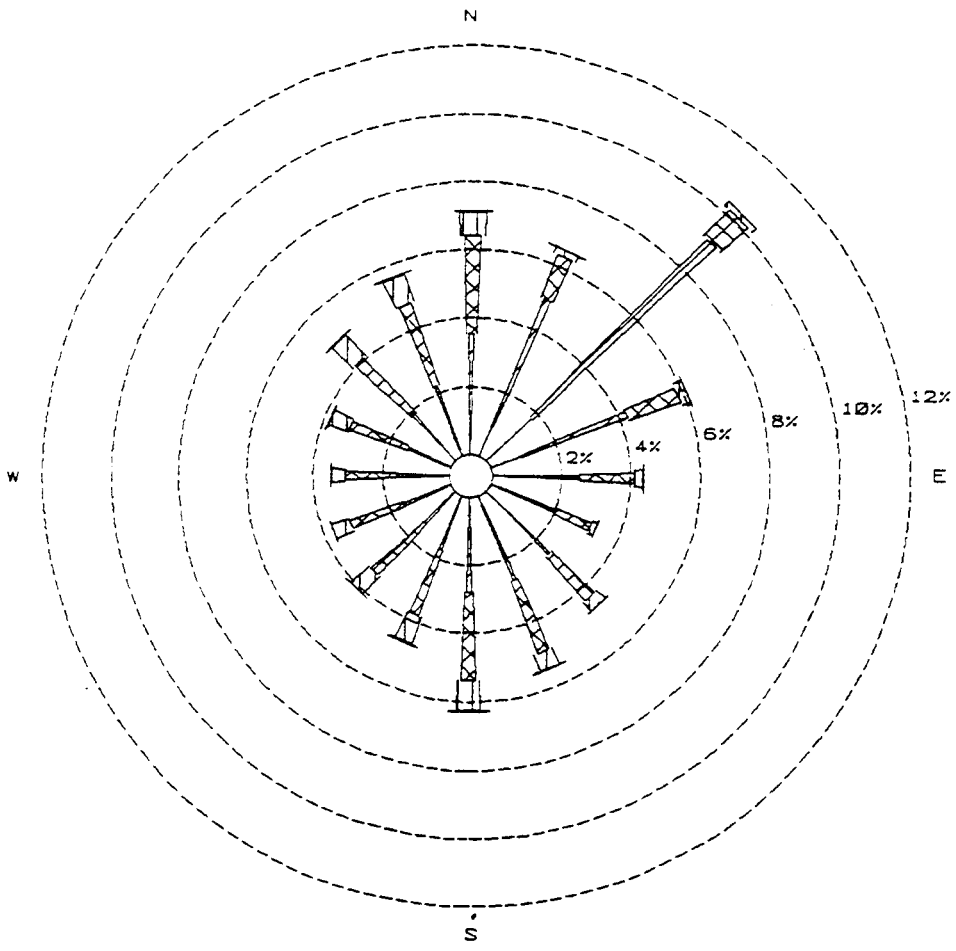
Local relief on Fort McClellan is in excess of 1,320 feet. The lower elevations (700 feet above mean sea level [MSL]) occur along Cane Creek, near Baltzell Gate Road, while the maximum elevation (2,063 feet above MSL) occurs on Choccolocco Mountain, which traverses the area in a north/south direction, with the steep easterly slopes grading abruptly into Choccolocco Valley. The western slopes are more continuous, with the southern extension maintaining elevations up to 900 feet above MSL near the western reservation boundary. The northern extension decreases in elevation in the vicinity of Reilly Heliport. The central portion of Fort McClellan is characterized by flat to gently sloping land. The topographic relief at Pelham Range is on the order of 445 feet. The minimum elevation is 500 feet above MSL, which occurs at the exit of Cane Creek from the range, and the maximum is 945 feet above MSL, near the southeastern boundary. The northern sector contains broad rolling topography capped with isolated round knobs rising 75 to 90 feet above the surrounding terrain. A large, relatively flat area called Battle Drill Area is situated near the western boundary.

2.3.3 Surface Water and Drainage

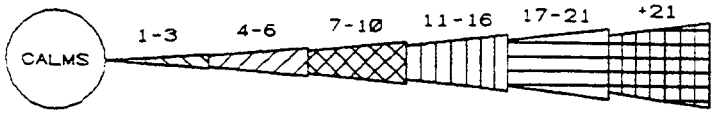
Fort McClellan is located within the Coosa River drainage basin. The Coosa river flows northwest of Pelham Range and is fed by tributaries including Ohatchee Creek, Cane creek, and Choccolocco Creek. Ohatchee Creek flows north of Fort McClellan and Pelham Range and

Birmingham 1985-1989

January 1-December 31: Midnight-11 PM



WIND SPEED (KNOTS)



CALM WINDS 15.27%

NOTE: Frequencies indicate direction from which the wind is blowing.

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

Wind Rose Diagram for Birmingham, Alabama
1985 - 1989

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-13 | Project: 01-0827-03-6520-004

Choccolocco Creek flows south and east of the Post and through the Choccolocco corridor. Cane Creek and its tributaries drain the majority of Fort McClellan and Pelham Range.

The Cane/Cave Creek watershed is one of the six major watersheds occurring within Calhoun County. Cane Creek, with its tributaries (Remount, South Branch, and Ingram Creeks), has its origin on the Fort McClellan Reservation. Cave Creek occurs as a tributary to Cane Creek and has its origin on the Main Post north of Caffey Hill. The on-Post drainage area of this system covers approximately 20 square miles. These creek systems originate in the Choccolocco Mountains on the eastern boundary of the installation and flow west through the main cantonment. They are fed by springs originating from underlying limestone strata. Cane Creek also passes through the entire length of Pelham Range, but its size and volume are greatly increased by the time it reaches this land area. One other major watershed, the Choccolocco Creek, occurs to the east of the Choccolocco Mountains, passing in a northerly to southerly direction through the Choccolocco Corridor. Other surface water features within Fort McClellan include Lakes Yahou (13.5 acres), Reilly (8.5 acres), Cappington Ridge (0.3 acres), Duck Pond (0.5 acres), and an aqueduct. Surface drainage is collected in small, independent networks that drain areas varying from 20 to 60 acres.

The Choccolocco Mountains, located in the eastern portion of the Post, form a major surface water divide. East of this divide the reservation consists of a relatively narrow valley called Choccolocco Corridor, which extends approximately 3.5 to 4 miles from the mountains, across the floodplain of Choccolocco Creek to the base of Rattlesnake Mountain and Brymer Mountain. Choccolocco Creek and its tributaries drain this portion of Fort McClellan and flows southward to the Coosa River. West of the drainage divide the entire central portion of Fort McClellan is drained by three major creeks and their tributaries. South Branch of Cane Creek, Ingram Creek, and Remount Creek receive runoff and baseflow from the south-central portion of the Main Post before joining Cane Creek at various points before it egresses the Post on the western boundary. Cane Creek drains the central portion of the Post. The north-central section of the Post is drained by Cave Creek, which leaves the Post along the northwestern boundary south of Former Landfill #3.

The 100-year floodplain for stream drainage on Fort McClellan includes Sanitary Landfills 2, 3, and 4; the Alabama Military Academy facilities; and a portion of the golf course area. Other facilities within the 100-year floodplain include the training aids and temporary Military Police (MP) academic facilities; transportation motor pool yard; industrial storage areas along Baltzell Gate Road; Directorate of Industrial Operations and Supply warehouses; Post Engineer facilities; facilities along Seventh Avenue, 21st Street, and 22nd Street; and the main training ranges within the Ingram Creek system.

Cane Creek, which flows westwardly across the center of Pelham Range, and its tributaries drain almost all of Pelham Range. Drainage entering the range from the south originates in the Anniston Army Depot, which joins Pelham Range to the south. One drainageway, located in the southwestern corner of Pelham Range, flows in a northerly direction and empties into a large topographic low (Battle Drill Area). Cane Creek traverses this low some 800 yards to the north, and all water collected in the low eventually drains into Cane Creek. Other surface water features include Lake Contreras (27 acres), Cane Creek Lake (7.5 acres), Willet Springs (0.8 acres), and Blue Hole (0.2 acres). All drainage from Fort McClellan and Pelham Range ultimately empties westward to the Coosa River. Floodplains up to 2,500 feet wide traverse this sector and slope toward the center of the Pelham Range. The wide floodplains are absent in the southern portion of the range.

2.3.4 Ponds, Lakes, and Springs

The named water bodies on the Main Post include Lake Yahou (13.5 acres), Reilly (8.5 acres), Cappington Ridge (.3 acres), and the Duck Pond (.5 acres), or approximately 23 acres of named water bodies. Surface water bodies on Pelham Range include Lake Contreras (27 acres), Cane Creek Lake (7.5 acres), Willet Springs (.8 acres), and Blue Hole (.2 acres). Fresh water springs occur abundantly on installation lands, often appearing along the trace of thrust faults. All described water bodies are at least in part spring-fed with the exception of Lake Yahou and Lake Contreras.

2.3.5 Fresh-water Marshes

Expansion of the installation over the years has altered the drainage patterns of the flats on the Main Post. Although many fresh-water marshes are located along Cane Creek, most are limited to the cumulatively larger downstream watershed of Pelham Range. However, marshy areas occur on the Main Post in the vicinity of Former Landfill #3 and the 25-acre area surrounding Reilly Lake. The drainage area of Cane Creek on Pelham Range has an abundance of riparian flora and fauna. Marsh areas include the 75-acre marsh beginning to the right of Gate 3 entrance, a 75-acre area to the right of Cane Creek on the Battle Drill Area, a seasonal area surrounding Blue Hole Pond, an area south of the impact area road, and a large block from Gate 13 to the Battle Drill Area where flats occur.

Wetlands are protected by the Federal Government primarily through Section 404 of the Clean Water Act. This act empowered the U.S. Army Corps of Engineers and USEPA to regulate most forms of wetlands management. Fort McClellan, Pelham Range, and the Choccolocco Corridor have an abundance of wetlands representing important habitats for a wide variety of plants and animals as well as providing a wealth of other values for the public, including:

- Flood control
- Water quality maintenance
- Erosion buffers
- Groundwater recharge and stream flow maintenance
- Timber production.

The landscape is dominated by dry ridges composed of sandstone and chert and by valleys and stream terraces that are made up of alluvium over limestone and shale. Fort McClellan's wetlands are found in the valley along creek floodplains, along stream terraces, and in depressions.

2.3.6 Surface Water Quality

The streams of Fort McClellan are of good chemical quality and are in good biological condition. The State has classified these systems as suitable for fish and wildlife use. Averaged profiles at 16 stations over Main Post and Pelham Range (USAEHA 1976) indicate that at an average temperature of 17.8°C, the dissolved oxygen is 9.3 and the pH is 7.5. These and other parameters are regularly measured by stationary probes at the exit of Cane Creek on Main Post, and just past the Unit Training Equipment Site at Pelham Range.

A comprehensive water quality biological study of installation receiving waters was conducted by the USAEHA (1976) to determine the impact of industrial and domestic wastes generated by activities at Fort McClellan. The condition of receiving waters was assessed through analyses of benthic diatom and macroinvertebrate communities and fish and bacterial populations, as well as chemical analyses for metals and other compounds. Average diatom diversity at Fort McClellan is 4.0, and average macroinvertebrate diversity is 3.1. Diversity in clean streams commonly ranges between 3 and 4, while polluted streams are usually less than 1 unit.

The largest municipal supplier and the source of potable water for Fort McClellan is the City of Anniston Department of Sewer and Water (CADSW). Fort McClellan obtains water from this system but maintains its own storage, pumping, and distribution system. The sources for the water are primarily Coldwater Spring, located approximately 12 miles southwest of the Main Post, and a surface water impoundment on Hillsbee Creek. The impoundment and intake are located upstream of the installation. Coldwater Spring contributes the majority of the flow to the CADSW system, averaging 17 million gallons per day (mgd) with a permitted withdrawal of 24 mgd (USATHAMA 1992). The City of Weaver obtains water from two supply wells (Nos. 1,3), which produce approximately 0.65 mgd.

2.4 GEOLOGY AND HYDROGEOLOGY

Subsurface geologic and hydrogeologic conditions were investigated at Former Landfills #2 and #3 during the 1992 site investigation. Hydrogeologic assessment was confined to measurement of water levels in eight new wells and five existing wells and determination of

hydraulic gradients and flow directions. The scope of the SI was not established to fully characterize the geologic and hydrogeologic conditions impacting the investigated sites; however, sufficient data were collected to allow a preliminary assessment of contaminant migration pathways from the two landfill sites. The regional and local geologic and hydrogeologic conditions in the Fort McClellan area are summarized below.

2.4.1 Geology

Fort McClellan (Main Post) and Pelham Range lie within the Appalachian fold and thrust structural belt (Valley and Ridge province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold and thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted. Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo 1984). Geologic contacts in this region generally strike parallel to the faults and repetition of the lithologic units is common in vertical sequences. The extreme eastern portion of Fort McClellan lies within the Piedmont physiographic province. A stratigraphic column (Moser and DeJarnette 1992) for the Fort McClellan area is shown in Figure 2-14. Geologic formations within Fort McClellan and Pelham Range have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Precambrian to Mississippian (Figure 2-15). On the eastern boundary of Fort McClellan, Talladega Slate crops out in a narrow band between the county line and the easternmost exposure of the Paleozoic rocks. (Warman and Causey 1962).

The Jacksonville Thrust Fault is the most significant structural geologic feature in the vicinity of Fort McClellan both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the faults extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo 1984). In the vicinity of Fort McClellan, the Jacksonville fault has juxtaposed the Cambrian Chilhowee Group

and Shady Dolomite against Ordovician rocks of the underlying Eden thrust sheet (Osborne and Szabo 1984). The Ordovician sequence comprising the Eden thrust sheet is exposed at Fort McClellan through an eroded "window" or "fenster" in the overlying thrust sheet. The Fort McClellan window is framed on the northwest by the Rome and Conasauga formations, and by the Knox Group of the Pell City thrust sheet. Exposures of the Jacksonville Fault are rare because of deep weathering and thick colluvium accumulation. The fault contact has been observed (Osborne and Szabo 1984) in an excavated trench at Fort McClellan and was marked by approximately 6 feet of brecciated shale and mudstone in thrust contact with residuum of Shady Dolomite. The Jacksonville Fault is thought to provide a principal reservoir and conduit for groundwater movement in the region including the consistent supply of groundwater to Coldwater Spring. The Coldwater Spring has supplied water to the Anniston and Fort McClellan areas since 1890 producing an average of 32,000 mgd (Moser and DeJarnette 1992).

The Cambrian Weisner Formation consists of interlayered shale, siltstone, sandstone, quartzite, and conglomerate and is the basal formation of the sedimentary rock sequence (Warman and Causey 1962). The Weisner Formation, locally sandstone and quartzite with thin-bedded shale, underlies a large portion of the Main Post at Fort McClellan and occurs beneath RI Sites T-4, T-24A, and Former Landfill #1. The Weisner Formation is mapped by Osborne and Szabo (1984) as the uppermost formation in the undifferentiated Chilhowee Group.

The Cambrian Shady Dolomite overlies the Weisner Formation east and south of the Main Post and consists of interlayered limestone and dolomite. The Cambrian Rome Formation is composed of red and green shale and siltstone with thinly interbedded light gray sandstone and calcareous layers. The Rome Formation locally occurs to the northwest and southeast of the Main Post and underlies the area of Former Landfill #3 as mapped by Warman and Causey (1962) and Osborne and Szabo (1984). The Conasauga Formation comprises the uppermost Cambrian unit and occurs northwest and southeast of the Main Post. A narrow band of the Conasauga Formation has been mapped (Osborne and Szabo 1984) immediately to the east of Former Landfill #3. The Conasauga Formation also occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey 1962) but does not appear to

EXPLANATION

System	Map symbols	Descriptions	
Pennsylvanian	IPpv	Pottsville Formation	Light-gray thin- to thick-bedded quartzose sandstone and conglomerate.
Mississippian	IPMpw	Parkwood Formation	Parkwood Formation—Interbedded medium- to dark-gray shale and light- to medium-gray sandstone; locally contains dusky-red and grayish-green mudstone, argillaceous limestone, and clayey coal. Floyd Shale—Dark-gray shale, sideritic in part; thin beds of sandstone, limestone, and chert are locally present.
	IPMpwf	Parkwood Formation and Floyd Shale undifferentiated	
	Mf	Floyd Shale	
	Pzu	Paleozoic shale undifferentiated	Dark-gray shale and mudstone, locally containing thin interbeds and lenses of dark-greenish-gray sandstone. Includes Athens Shale and probable Floyd Shale in the structural windows near Fort McClellan.
	Mttp	Tuscumbia Limestone and Fort Payne Chert undifferentiated	Tuscumbia Limestone—light- to dark-gray, fossiliferous and oolitic, partly argillaceous and cherty limestone. Fort Payne Chert—dark-gray to light-gray limestone with abundant irregular light-gray chert nodules and beds. Commonly present below the Fort Payne is greenish-gray to grayish-red phosphatic shale (Maury Formation) which is mapped with the Tuscumbia Limestone and Fort Payne Chert undifferentiated.
Devonian	Dcfm	Chattanooga Shale and Frog Mountain Formation undifferentiated	Chattanooga Shale—brownish-black to black organic shale containing light- to dark-gray sandstone interbeds near the base. Frog Mountain Sandstone—Light- to dark-gray sandstone with thin dark-gray shale interbeds; light-gray to black dolomudstone, glauconitic limestone, and fossiliferous chert locally in lower part.
	Dfm	Frog Mountain Formation	
Silurian	Srm	Red Mountain Formation	Interbedded yellowish-gray to moderate-red sandstone, siltstone and shale; greenish-gray to moderate-red fossiliferous partly silty and sandy limestone; few thin hematitic beds.
Ordovician	Oscmg Os, Ocm, Og	Sequatchie Formation, Colvin Mountain Sandstone and Greensport Formation undifferentiated in part	Sequatchie Formation—Dusky-red to light-olive-gray siltstone, sandstone, shale, and dolomite, regular but uneven bedding. Colvin Mountain Sandstone—Light-gray quartzose sandstone, pebbly in part. Locally contains thin beds of bentonite in the upper part. Greensport Formation—Variegated dusky-red and dark-yellowish-orange shale, calcareous mudstone, limestone, siltstone, and minor sandstone.
	Oa	Athens Shale	Athens Shale—Black graptolitic shale, locally contains interbedded dark-gray limestone. Lenoir Limestone—Dark-gray medium- to thick-bedded argillaceous limestone; locally contains an interval of fenestral mudstone at the base (Mosheim Limestone Member). Little Oak Limestone—Dark-gray medium- to thick-bedded fossiliferous, argillaceous to silty limestone containing chert nodules. Locally includes thin beds of bentonite in the upper part. Newala Limestone—Light- to dark-gray thick-bedded micritic and peloidal limestone and minor dolomite.
	Olol	Little Oak and Lenoir Limestones undifferentiated	
	Olo	Little Oak Limestone	
	Olon	Little Oak and Newala Limestones undifferentiated	
	On	Newala Limestone	
Cambrian	Oєk	Knox Group undifferentiated in part	Light-gray to light-brown locally sandy dolomite, dolomitic limestone, and limestone; characterized by abundant light-colored chert.
	Єc	Conasauga Formation	Light- to dark-gray finely to coarsely crystalline, medium- to thick-bedded dolomite containing minor greenish-gray shale and light-bluish-gray chert.
	Єcl	Unnamed Lower Member	Dark-green to pale-olive fossiliferous shale with a few dark-gray limestone interbeds.
	Єr	Rome Formation	Variegated thinly interbedded mudstone, shale, siltstone, and sandstone; limestone and dolomite occur locally. Quartzose sandstone commonly present near top of formation.
	Єs	Shady Dolomite	Bluish-gray or pale-yellowish-gray thick-bedded siliceous dolomite; characterized by coarsely crystalline porous chert.
	Єch Єwwr	Chilhowee Group undif. in part: Weisner and Wilson Ridge Formations undifferentiated	Interbedded quartzose to slightly feldspathic sandstone and laterally continuous conglomerate in ledge-forming units separated by greenish-gray silty mudstone.
	Єch Єn	Nichols Formation	Massive to laminated greenish-gray and black micaceous mudstone containing minor interbeds of siltstone and very fine-grained sandstone.
	Єch Єcn	Cochran Formation	Poorly sorted arkosic sandstone and conglomerate containing interbedded greenish-gray siltstone and mudstone.
Silurian(?) to Devonian	tld	Lay Dam Formation	Interbedded dark-green phyllite, medium-gray to light-brown and black metasiltstone, dark-green feldspathic metagraywacke, and white to light-gray and dark-gray medium- to coarse-grained arkosic quartzite and metaconglomerate; graphitic phyllite common in upper part. Includes the Abel Gap Formation of Bearce (1973) which consist of interbedded greenish-gray metasiltstone and quartzite, black phyllitic metasiltstone, medium-gray to greenish-gray arkosic quartzite, and dark-gray pyritic quartzite.
Cambrian(?)	hp	Heflin Phyllite	Grayish-green, medium-gray, and medium-bluish-gray calcareous sandy metasiltstone interbedded with minor greenish-gray fine- to coarse-grained metasandstone and rare thin lenses of calcite and dolomite marble; an interval of greenish-gray to dark-gray phyllitic quartzite or quartz-pebble metaconglomerate is locally present near the base.

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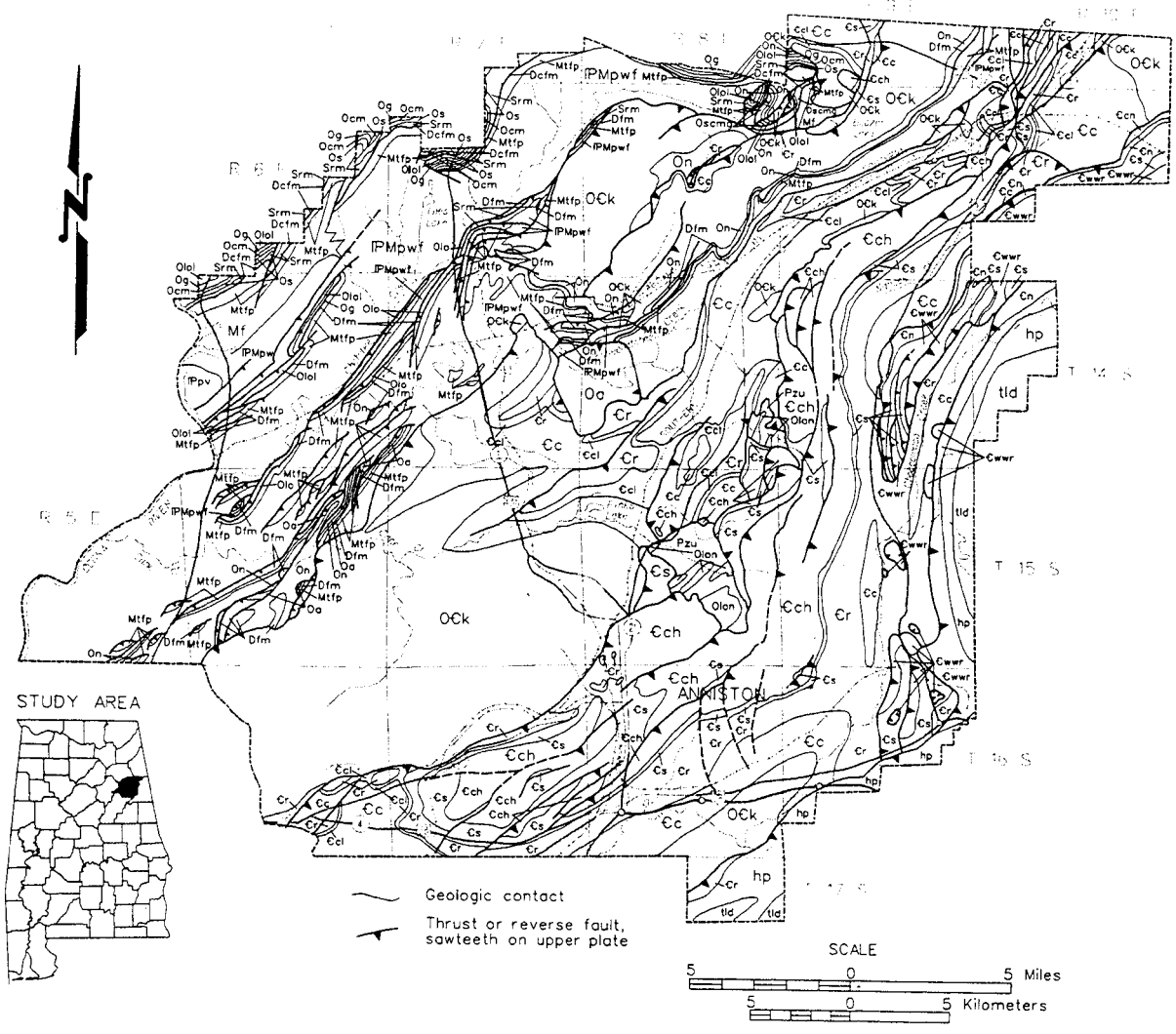
Aberdeen Proving Ground, Maryland

Stratigraphic Column for Calhoun County, Alabama

Fort McClellan RI/FS, Anniston, Alabama

Figure: 2-14 | Project: 01-0827-03-6520-004



U.S. Army Environmental Center Aberdeen Proving Ground, Maryland	
Geologic Map of Calhoun County, Alabama	
Fort McClellan RI/FS, Anniston, Alabama	
Figure: 2-15	Project: 01-0827-03-6520-004

immediately underlie any of the RI/FS sites. The Conasauga Formation is composed of interbedded limestone, dolomite, and shale.

Overlying the Conasauga Formation is the Knox Group, composed of the Copper Ridge and Chepultepec dolomite of Cambro-Ordovician age. The Knox Group carbonates consist of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolostone that weathers to a chert residuum (Osborne and Szabo 1984). The Knox Group underlies a large portion of the Pelham Range area, including Range J and the Old Water Hole. The Knox Group is overlain by Ordovician limestone and shale formations, including the Newala and Longview Limestones, Lenoir Limestone, Athens Shale, Little Oak Limestone, and Chickamauga Limestone. These units occur within an eroded "window" in the uppermost structural thrust sheet at Fort McClellan. Ordovician limestone underlies much of the developed area of the Main Post, including Area T-38, Former Landfill #2, Area T-5, and the Detection and Identification Area. The limestone units also underlie Range L on Pelham Range, occurring in a narrow, northeast-southwest trending, thrust fault-bounded area flanked by Devonian to Mississippian clastic units in the western portion of Pelham Range. The Silurian Red Mountain Sandstone unit does not occur in the Fort McClellan area. The Frog Mountain Sandstone, of Devonian Age, is composed of sandstone and quartzitic sandstone and locally occurs in the western portion of Pelham Range possibly underlying Range K, depending on the accuracy of geologic mapping in this area.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of claystone with increasing amounts of calcareous chert toward the upper portion of the formation. These units occur in the northwestern portion of Pelham Range and potentially underlie Range K, depending on the accuracy of geologic mapping in this area. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian Age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Floyd Shale mapped by Warman and Causey (1962) on the Main Post of Fort McClellan was reassigned to the Ordovician Athens Shale by Osborne and Szabo (1984) on the basis of fossil data.

Borehole samples obtained during monitoring well drilling at the landfill sites indicate that the subsurface materials underlying these areas are variably dense and consist predominantly of low plasticity silt and clay residual soils. Bedrock mapped (USGS 1962) beneath Former Landfill #2 consists of Ordovician limestone with thinly interbedded black shale that attains an aggregate thickness of approximately 230 feet in Calhoun County. Bedrock underlying Former Landfill #3 is mapped as Cambrian Rome Formation and consists of interlayered red to green shale and siltstone, and red to light gray sandstone. Local light gray limestone or dolomite interbeds may be encountered in the Rome Formation. The Rome Formation attains an aggregate thickness of approximately 1,000 feet in Calhoun County.

2.4.2 Soils

The soil associations found at Fort McClellan and Pelham Range (SCS 1961) include:

- ***Anniston-Allen-Decatur-Cumberland:*** alluvium resulting from weathering of older saprolitic soils developed from sandstone, shale, and quartzite; deep, well-drained, level to moderately steep soils in valleys underlain by limestone and shale; subsoil is dark red sandy clay loam; Cumberland and Decatur soils are dark reddish-brown gravelly loam developed from limestone saprolite source.
- ***Clarksville-Fullerton:*** well-drained to moderately well-drained stony or cherty soils developed in the residuum of cherty limestone. This association is limited to the Pelham Range. The soils are generally dark brown to dark gray brown silt loam.
- ***Rarden-Montevallo-Lehew:*** moderately deep or shallow soils on ridgetops and steep slopes and in local alluvium in draws; soils developed from the residuum of shale and fine-grained, micaceous sandstone; reddish-brown to dark gray brown to yellow-brown silt loam, clay, or silty clay.
- ***Stony Rough Land:*** shallow, steep, and stony soils formed from the weathering of sandstone, limestone, and Talladega Slate; infiltration slow; contains many boulders and fragments with clayey residuum. This association underlies a large portion of the Main Post at Fort McClellan.

In general, the soils are acidic to very strongly acidic with pH between 4.5 and 5.5 units. Table 2-2 summarizes the physical properties and ranges of permeabilities measured for the major soil types of each soil association listed above (SCS 1961). These tests are based on soils sampled throughout Calhoun County.

Soils at Former Landfill #2 are predominantly massive silt and clay except at monitoring well LF2MW3, where approximately 10 feet of sand and silty sand was encountered. SI boring LF2MW2 was located adjacent to the floodplain of Cane Creek and may have encountered alluvial deposits associated with the creek migration. Fill debris, including glass and metal, was encountered at LF2MW1 after portions of the landfill were reworked to construct an access road to the well location. Standard penetration test values in the soil horizons ranged from 6 to 55 blows per foot (bpf). Hard siltstone and claystone units were encountered at 16.5 to 25.7 feet below land surface (BLS) at Former Landfill #2. The bedrock showed evidence of iron staining, differential weathering, and horizontal bedding.

The observed soil profile underlying Former Landfill #3 is the result of differential weathering of the Cambrian Rome Formation shale and siltstone layers to predominantly silt and clay soils. Sand horizons observed during drilling were typically discontinuous and likely the result of weathering of formerly interlayered sandstone. The soil horizons are variably colored yellow-brown (10YR 5/0) to reddish-yellow (7.5YR) to red-brown (2.5YR 5/3). Hard claystone to siltstone bedrock units were encountered at depths ranging between 25.0 and 40.0 feet BLS. The bedrock units are highly weathered, laminated to thinly bedded, and highly fractured, as evidenced by the observed variable weathering and the poor core recoveries. Differential weathering of the fine-grained siltstone and claystone bedrock in the area of Former Landfill #3 has resulted in a variable subsurface bedrock topography. Highly weathered bedrock that required diamond bit coring was encountered at wells OLF-6 and OLF-7; however, in other areas, the claystone bedrock was augered to depth.

2.4.3 Hydrogeology

Precipitation in the form of rain is the source of most groundwater in Calhoun County, and the thrust fault zones typical of the county form large storage reservoirs for groundwater. Primary controls on groundwater flow are topography and bedrock permeability. Precipitation and subsequent infiltration provide recharge to the groundwater flow system. Points of discharge occur as springs, effluent streams, and lakes. Groundwater on Fort McClellan occurs principally in the quartzites of the Weisner Formation in the Choccolocco Mountains and locally in lower Ordovician carbonates. Bedrock permeability may be locally enhanced by fracture zones

Table 2-2. Summary of Physical Properties for Soil Associations

Association	LL	PL	USCS	Average Depth to Water (feet)	Average Depth to Bedrock (feet)	Permeability (cm/sec)
Anniston-Allen-Decatur-Cumberland	ND	ND	ML, CL, MH, CH	20+	2 - 20+	5.61E-4 to 1.4E-3
Clarksville-Fullerton	20 - 41	1 - 3	SM, GM, GC	20+	20+	1.4E-3 to 7.0E-3
Rarden-Montevallo-Lehew	12 - 86	3 - 43	ML, CL, MH, CH	20+	1 - 4	1.4E-4 to 7.0E-3
Stony Rough Land	ND	ND	ML, CL, SC, CH, GM, GC	20+	0 - 3	1.4E-3 to 7.0E-3

Data obtained from soil survey of Calhoun County, Alabama, Soil Conservation Service, 1961.

CH - Inorganic clays of high plasticity, fat clays.
CL - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
GC - Clayey gravels, gravel-sand-clay mixtures.
GM - Silty gravels, gravel sand silt mixtures.
LL - Liquid Limit; PL - Plastic Limit
ND - Not determined.
MH - Inorganic silts, micaceous or diatomaceous find sandy or silty soils, elastic silts.
ML - Inorganic silts and very fine sands, rock floor, silty or clayey fine sands, or clayey silts, with slight plasticity.
SC - Clayey sand, sand clay mixtures.
SM - Silty sands, sand silt mixtures.
USCS - Unified Soil Classification System.

associated with thrust faults and by the development of solution (karst) features. Pelham Range groundwater flow has not been mapped due to insufficient control data; however, several sinkholes have been mapped within the Range boundaries. It is probable that shallow groundwater flow follows topography, with groundwater movement toward Cane Creek. The general movement of groundwater is southward along the east of the Choccolocco Mountains and then west at the southern end of the mountains. Groundwater in the Weisner Formation predominating the Main Post is typically of good quality. Abundance is dependent upon existence of fractures, and springs typically occur along fault lines. The Jacksonville Fault enters the Post in the vicinity of the Anniston Beach Club, and is generally bounded by the western foothills of the Choccolocco Mountains. Several inferred faults also are indicated across the southwestern part of the installation proper, and one fault occurs through the northeastern ridge of the Choccolocco Mountains. Extensive faulting also occurs in the leased corridor east of the Choccolocco Mountains. The dolomites of Pelham Range typically provide adequate groundwater and yield springs at fractures or solution channels. The Pelham Fault enters the Range near Gate 6 (north) and along Brook Mountain and exit on the southwestern boundary. A wedge of Consuaga underlies 2.5 miles of Cane Creek at its eastern entrance to Pelham Range, and several large springs occur in this general vicinity, both on and off Government property.

SAIC obtained groundwater level measurements from 10 wells located in the vicinity of Former Landfill #3 and from the 3 wells at Former Landfill #2 during the recent SI. Groundwater flow maps for these sites are shown in Figures 2-16 and 2-17. Measured groundwater elevations ranged between approximately 787 and 793 feet above mean sea level (MSL) at Former Landfill #2. Groundwater elevations ranged between approximately 683 and 730 feet MSL at Former Landfill #3.

Groundwater flow direction and hydraulic gradient calculations were completed by triangulation between the measured groundwater elevations in the monitoring wells at Former Landfills #2 and #3. The inferred groundwater flow direction (see Figure 2-17) at Former Landfill #2 is south-southeast toward a tributary of Cane Creek. The calculated hydraulic gradient for this site is 0.018 ft/ft.

Groundwater flow at Former Landfill #3 is more complex, with two wells (OLF-6 and -7) screened in the weathered claystone bedrock showing groundwater elevations much lower than the surrounding wells. Generally, wells that were screened in whole or partly in the hard, highly weathered claystone and siltstone layers (OLF-4, -6, and -7) produced lower observed water levels than wells screened in the soil horizons (OLF-1, -2, -9, and -10 in Figure 2-16). Wells OLF-5 and -8 appear to be in a transitional zone where the bedrock weathering extends deeper. Groundwater flow directions at Former Landfill #3 are inferred from triangulation between the measured groundwater elevations at each well excluding wells OLF-6 and -7. The inferred flow directions are to the west and northwest under a hydraulic gradient of approximately .07 ft/ft. Lower groundwater production rates were observed at wells OLF-6 and -7 during well development. Hydrogeologic characterization of the remaining 10 RI/FS sites has not been previously conducted at Fort McClellan.

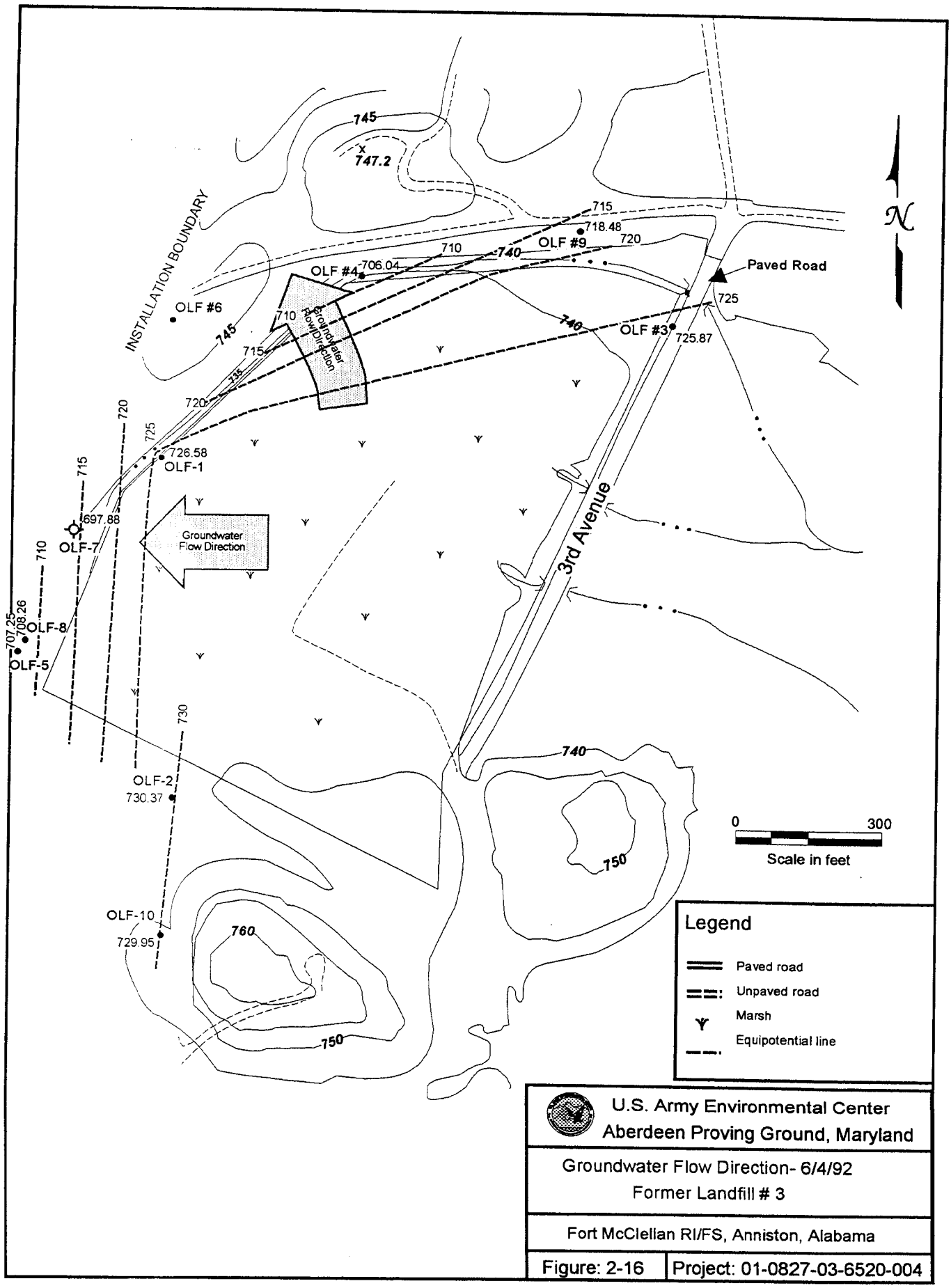
2.5 SENSITIVE ENVIRONMENTS

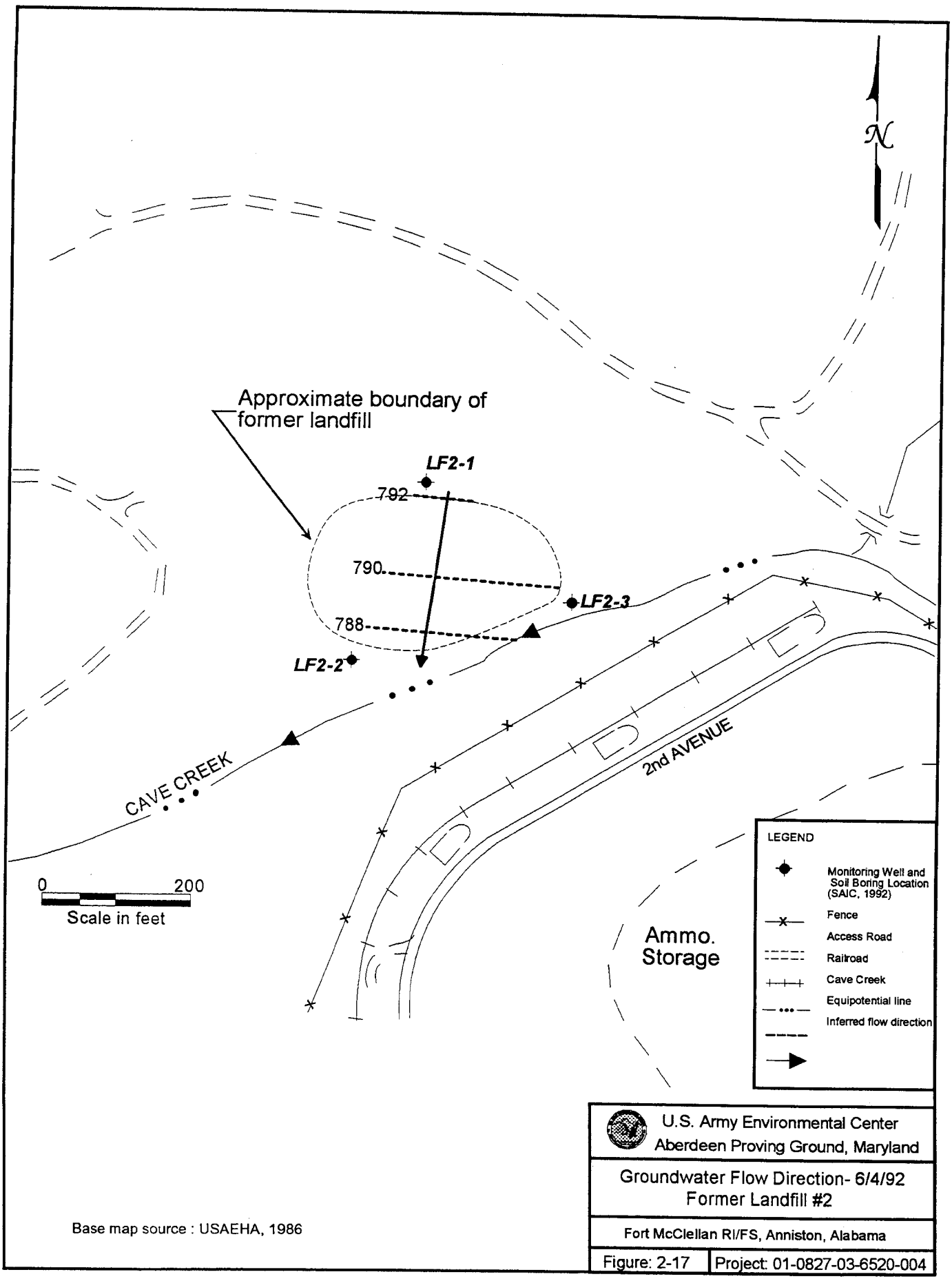
This subsection provides information on the sensitive species and habitats of Fort McClellan, Pelham Range, and the Choccolocco Corridor (USATHAMA 1977).

2.5.1 Wetlands

The wetlands plant communities of Fort McClellan and its ancillary facilities have been described and include the following information:

- Community name
- National Wetlands Inventory (NWI) designation
- Dominant and associated plant species
- General location
- Site-specific location
- Wildlife value
- Management recommendations.


745
747.2
715
718.48
OLF #9
720
710
740
OLF #4
706.04
INSTALLATION BOUNDARY
OLF #6
Paved Road
725
710
Groundwater Flow Direction
740
OLF #3
725.87
745
715
735
720
720
725
726.58
OLF-1
715
697.88
OLF-7
Groundwater Flow Direction
3rd Avenue
710
707.25
708.26
OLF-8
OLF-5
730
740
OLF-2
730.37
0
300
Scale in feet
750
OLF-10
729.95
760
750
Legend
Paved road
Unpaved road
Marsh
Equipotential line
U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
Groundwater Flow Direction- 6/4/92
Former Landfill # 3
Fort McClellan RI/FS, Anniston, Alabama
Figure: 2-16
Project: 01-0827-03-6520-004


N
Approximate boundary of former landfill
LF2-1
792
790
788
LF2-3
LF2-2
CAVE CREEK
2nd AVENUE
Ammo. Storage
0
200
Scale in feet
LEGEND
Monitoring Well and Soil Boring Location (SAIC, 1992)
Fence
Access Road
Railroad
Cave Creek
Equipotential line
Inferred flow direction
U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
Groundwater Flow Direction- 6/4/92
Former Landfill #2
Fort McClellan RI/FS, Anniston, Alabama
Figure: 2-17
Project: 01-0827-03-6520-004
Base map source : USAEHA, 1986

In all, 13 types of wetlands plant communities have been described on the reservation. These communities and their NWI designations are as follows:

- Mixed bottomland hardwoods: first bottoms (palustrine, forested [deciduous], seasonally flooded wetlands)
- Mixed bottomland hardwoods: second bottoms (palustrine, forested [deciduous or deciduous-evergreen], temporarily flooded wetlands)
- Stream terrace hardwoods (Palustrine, forested [deciduous or deciduous-evergreen], temporarily flooded wetlands)
- Creekbank hardwoods (palustrine, forested [deciduous], seasonally flooded wetlands)
- Water oak flat (palustrine, forested [deciduous], temporarily flooded wetlands)
- Sweetgum/bulrush community (palustrine, forested [deciduous], seasonally flooded wetlands)
- Sweetgum depression (palustrine, forested [deciduous], temporarily flooded wetlands)
- Mixed shrub community (palustrine, scrub/shrub [deciduous], temporarily and seasonally flooded wetlands)
- Mixed shrub/bulrush/needlerush community (palustrine, scrub/shrub/emergent [persistent], seasonally flooded, impounded, or seasonally flooded wetlands)
- Buttonbush/bulrush community (palustrine, shrub/scrub [deciduous], semipermanently flooded wetlands)
- Bulrush/needlerush/cattail community (palustrine, emergent [persistent], temporarily and seasonally flooded wetlands)
- Nonforested creekback community (palustrine, emergent [persistent and non-persistent], seasonally flooded wetlands)
- Mud flat community (palustrine, emergent [non-persistent], seasonally flooded and semipermanently flooded wetlands).

2.5.2 Flora and Fauna

Fort McClellan and its ancillary grounds are composed of a variety of aquatic, riparian, and terrestrial habitats that provide for numerous species of game and non-game animals. An estimate of populations and habitats was presented based on surveys performed in 1986 and is as follows:

- Approximately 38,361 acres (government-owned or leased from the State of Alabama) are suitable for wildlife habitat; this includes 16,915 acres in Pelham Range, 18,946 acres in the Main Post, and 2,500 acres in the Choccolocco Corridor.
- Range conditions are generally good, with the exception of numerous areas where dense growth prohibits the production of certain wildlife foods.
- The popular game species on the fort are white-tailed deer, northern bobwhite, turkey, mourning dove, eastern cottontail, gray squirrel, raccoon, wood duck, and opossum.

The military mission at Fort McClellan supersedes fish and wildlife management and associated recreational activities, and such activities must in all instances be compatible with the military mission and the provisions of the Endangered Species Act or other applicable statutes.

The only federally recognized endangered species known to occur on Fort McClellan is the red-cockaded woodpecker (*Picoides borealis*); no federally endangered species are known for Pelham Range. This was the conclusion of a study conducted from April through October 1979. A recent survey conducted in June 1992 indicated that the Red Cockaded woodpecker colonies were no longer active at Fort McClellan (Red Cockaded woodpecker survey, June 1992). A flora and fauna survey is currently being conducted under the Alabama Heritage Program. Tennessee Yellow Eyed grass, which is a listed endangered species, is known to occur on Pelham Range.

3. INITIAL EVALUATION

An initial evaluation of the remedial investigation/feasibility study (RI/FS) sites including summaries of previous environmental studies, identification of potential contaminants of concern and potential environmental pathways, qualitative assessment of risk, and preliminary identification of response objectives and remedial action alternatives, is provided in the following sections.

3.1 PREVIOUS ENVIRONMENTAL STUDIES

As referenced in the following section, numerous environmental studies have been published on some aspect of Fort McClellan and Pelham Range. Nine facility-wide studies are available and are discussed chronologically below.

The U.S. Army Environmental Hygiene Agency (USAEHA 1975) documented a 2-year investigation into the status and historical use of chemical, biological, and radiological (CBR) training areas. Based upon a limited records review and interview, USAEHA identified 12 areas that were possibly contaminated. USAEHA recommended restricted access for these areas and inclusion in future land restoration and recovery programs.

A second investigation consisting of records reviews, personnel interviews, and field inspections was conducted in 1977 (USATHAMA 1977). This investigation identified burial grounds and training areas within the facility in which chemical or radiological contamination existed or was suspected. In addition, records indicated that unexploded ordnance (UXO) may be present in several training areas. This study also concluded that CBR contamination has not been detected in surface water at the site and that a potential may exist for groundwater contamination from documented landfill operations.

The final environmental impact statement (EIS) for the ongoing mission was published in 1980. This document takes a broad look at the effect of current facility operations on the environment.

Based upon a current literature review of fate and transport of chemical agents, decontaminants, agent decontaminant byproducts, and past onsite CBR training practices, a 1983 study identified the most probable groundwater and soil contaminants that could still be present at Fort McClellan and Pelham Range. A second broad review of facility operations and their effects on the environment also was published in 1983. This study was compiled for the facility's Installation Planning Board.

A 1977 records search conducted by USATHAMA was re-evaluated by Engineering-Science, Inc., and integrated with subsequent data in 1984. This study was limited to chemical agents and restricted compounds and resulted in 21 site-specific contamination assessments.

USAEHA conducted an investigation at Fort McClellan in 1986 to identify all of the solid waste management units (SWMUs) on the Post. USAEHA (1986) formally identified 41 SWMUs for Fort McClellan and Pelham Range. Each SWMU was, to the extent possible, located, described, and evaluated. Five monitoring wells were installed by the Agency at Former Landfill #3 as part of the investigation.

An enhanced Preliminary Assessment was conducted by Roy F. Weston, Inc. in 1990 to evaluate the status of active non-CERCLA (Comprehensive Response, Compensation, and Liability Act) and inactive CERCLA sites potentially impacting the planned closure of Fort McClellan by the U.S. Army. The preliminary assessment identified 67 active and inactive sites on the Main Post and Pelham Range.

SAIC, in cooperation with the U.S. Army Technical Escort Unit (USATEU), completed site investigations at 17 sites on Fort McClellan and Pelham Range in 1992. Based on subsurface sampling and laboratory analysis, chemical warfare agents or their degradation products were not detected at high probability sample locations within the former training areas. Extensive accumulations of metallic debris were detected geophysically at two former munitions disposal sites. Inorganic and organic chemical contamination was detected in groundwater at Former Landfill #3.

3.2 TARGET COMPOUNDS

Historical information regarding the activities conducted at the sites to be investigated under the RI/FS program is taken from USATHAMA (1990) and Environmental Science and Engineering (1984). The available information is summarized in Table 3-1.

The chemical and biological agent training sites under investigation during the RI/FS were used for the controlled training of personnel in various facets of chemical and biological warfare decontamination, detection, and munitions/agent disposal. Training at these sites occurred at various times between the early 1950's and 1973, with operations involving various and multiple agents. Limited, controlled usage of fixed quantities of chemical warfare agent was typical during the training exercises. Usage included establishment of identification stations at which agent samples were set up for field identification, in addition to contaminating field equipment with limited quantities of agent for identification and decontamination training. Evidence of widespread dispersal or usage of training materials at the sites of concern was not identified by SAIC based on review of records at the U.S. Army Chemical Museum at Fort McClellan and discussions with site personnel who were present during the training exercises. The chemical agents included mustard (HD), the nerve agents O-ethyl-S(diisopropylaminoethyl)-methylphosphonothiolate (VX) and Sarin (GB), and the biological simulants *Bacillus globigii* (BG) and *Serratia mercesans* (SM). HD is the predominant agent thought to have been used at Fort McClellan. HD readily undergoes hydrolysis to form thiodiglycol, a relatively nontoxic compound. The HD also may polymerize on its surface in aqueous situations to form a protective insoluble coat, thus inhibiting further hydrolysis.

The potential persistence of subsurface contamination in soils and groundwater for these agents, agent degradation byproducts, decontaminant DS-2 (70 percent diethylenetriamine, 2 percent sodium hydroxide, and 28 percent ethylene glycol monomethyl ether) and supertropical bleach (STB) constituents, and byproducts from the reactions of agent with decontaminants has been evaluated (Small 1983). Based on the solubility, volatility, toxicity, and formation potential of the compounds evaluated, it was concluded that the only toxic compounds likely to persist in the subsurface soils at Fort McClellan are HD and bis(2-diisopropylaminoethyl) disulfide (DES_2). The latter compound is the principal byproduct formed from the decontamination of VX with

Table 3-1. Summary of Process and Waste Disposal Activity RI/FS Sites, Fort McClellan, Alabama

Range	Range Size	Probable Date Opened	Last Used	Agents Used	Process and Waste Disposal History
T-4	0.3 acres	1965	1971	BG, SM, HD**, VX**	Testing biologic simulants BG, SM.
T-5	11.4 acres	1961	1973	HD, GB, VX, BG, SM	Training for detection and decontamination of HD, GB, VX agents and simulants BG, SM. 110-gallon HD spill.
T-24 Alpha	1.5 acres	Unknown	1973	HD, GB*	Chemical munitions disposal training for CG, BZ, HD, GB agents. Two square (256 sq ft) decontamination burn pits, depth possibly 6 feet. Possible HD spill (unconfirmed).
T-38	6.0 acres	1961	1972	HD, GB, VX	Training in elimination of toxic hazards for chemical munitions and storage of HD, GB, VX agents. STB, DANC, DS-2 decontaminants used.
Pelham Range K	2.0 acres	Unknown	Unknown	HD**	Chemical/biological agent (GB, HD) training; shell tapping area for GB, CG rounds.
Pelham Range J	0.1 acres	Unknown	1963	HD**	Training and chemical/biological agent disposal, possibly HD. Possible HD spill disposal area.
Detection and Identification	1.1 acres	Early 1950s	1973	HD, GB*	Testing and training with chemical/biological agents HD, GB, CK, GC, CX, AC. Training aids burned in pit onsite.
Pelham Range L	0.5 acres	Unknown	Unknown	HD**	Disposal of captured WWII munitions, including chemical munitions (Lima Pond).
Former Landfill 1	2 acres	1945	1947	None	Possible sanitary landfill disposal.
Former Landfill 2	4 acres	1947	Unknown	None	Demolition debris waste disposal during deactivation of installation.
Former Landfill 3	22 acres	1946	1967	None	Sanitary landfill disposal.
Old Water Hole	2,975 sq ft	Unknown	Unknown	Unknown	Disposal site (possible sinkhole), chemical agents, munitions.

* Other simulants also used
** Assumed HD or VX used
BG Bacillus Gobi
SM Serratia Marcescens

Reference: Solid Waste Study No. 99-056-73/76, Fort McClellan, AL, Jul 73-Aug 75

DS-2. The limited quantities of VX used on these sites essentially eliminates the potential for sufficiently large quantities of DES_2 to be of significance as environmental contaminants.

Based on similar considerations, it was concluded that the only toxic compounds associated with chemical warfare agents and their decontaminants with potential to persist in groundwater are divinyl sulfide (DVS), mustard sulfoxide (HO), DES_2, and S-(diisopropylaminoethyl) methylphosphonothioate (DESMP). Divinyl sulfide is formed from the alkaline hydrolysis of HD with DS-2, and HO is formed from the oxidation of HD with STB. The 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 decontaminated during training exercises. Several chemical agents/decontaminants were used in great quantities in the 1950's and 1960's principally at Area T-38 (G. Harvey, written communication). The decontaminant DANC (6.25 percent solution of RH 195 in acetylene tetrachloride, RH195-1, 3 dichloro-5, 5 dimethylhydantoin) was used extensively for mustard agents prior to the usage of DS-2. The chemicals FS (sulphur trioxide-chlorosulfonic acid) and CNB (chloroacetophenone solution (chloroacetophene in benzene and carbon tetrachloride)) were also reported to have been widely used (G. Harvey, written communication). The chemical and physical properties of the CWA's and CWA decontaminants are summarized in Appendix A.

Disposal inventories for the munitions burial sites and the former municipal/demolition debris landfills are not available. The buried munitions may include the remains of captured World War II chemical or conventional armaments. Chemicals of concern for these sites would include explosives, chemical warfare agent and its breakdown products, decontaminant compounds, heavy metals, and degreasing compounds. Similarly, disposal inventories are not available for buried municipal wastes; therefore, precise accountings of the contents of the former landfills is not possible.

3.2.1 Environmental Contamination

Previous studies have been conducted at the RI/FS sites with minimal detection of chemical contamination. MINICAMS field screening for chemical warfare agents (GB, HD, and VX) in soil, sediment, and water samples collected from high probability locations within the former

chemical training areas did not detect agent in concentrations exceeding established time weighted average (TWA) values or site background for these compounds (SAIC 1992). Laboratory analysis of the screened samples for agent breakdown products yielded nondetect results. However, organic compounds and metals were detected in groundwater samples taken at Former Landfill #3. In addition, geophysical surveys indicated the presence of near surface metallic debris or shallow soil disturbance at Landfill #1, Range L, Old Water Hole, Area T-24A, and Area T-38. Metallic surface debris was visually observed at Landfill #2. Qualitative geophysical (metal detection) surveys by the USATEU indicate the presence of substantial metallic objects buried at Range L and the Old Water Hole. Quantitative EM surveys at Area T-38 suggest the presence of subsurface disturbance at the approximate location of a former disposal sump.

Three former municipal landfill sites were investigated by SAIC (1992) using surface geophysics and environmental sampling of groundwater, surface water, and sediment at the sites. Chemical analyses for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls (PCBs), explosives, and chemical agent breakdown products were completed for groundwater, surface water, and sediment samples collected at Former Landfills #2 and #3. Quantitative magnetometer surveys at Former Landfill #1 detected the presence of scattered near-surface metallic debris. Broad anomalous areas were delineated in the southwestern portion of the site.

Environmental analyses at former Landfill #2 did not indicate the presence of groundwater contamination at the site (SAIC 1993). Groundwater contamination by organic compounds and metals was detected at former Landfill #3. Concentrations of organics (trichloroethylene, 1,1-dichloroethene, benzene, methyl isobutyl ketone, and 1,1,2,2-trichloroethane) were generally detected below or slightly exceeding regulatory maximum contaminant levels (MCLs). Metals concentrations, including chromium, nickel, lead, and beryllium, exceeded MCLs at wells OLF-2 and OLF-3. Explosive-related compounds 1,3,5-trinitrobenzene and 2,4-dinitrotoluene were detected in well OLF-10. The former Landfill #3 groundwater and surface water pathways produced a Hazard Ranking System (HRS) score of 16.08.

3.3 PREVIOUS REMEDIAL/REMOVAL ACTIONS

Historical information regarding previous actions taken at the SI sites to mitigate environmental contamination is taken from USATHAMA (1990). Table 3-2 summarizes the available information.

3.4 POTENTIAL PATHWAYS

The pathways by which human and environmental receptors may be exposed to releases of site-related contaminants are discussed below.

3.4.1 Releases to Groundwater

Potential sources of groundwater contamination include:

- Leaching of chemical agent, chemical agent byproducts, and decontaminants from soils in former and current training, decontamination, storage, and disposal sites
- Percolation from Range L (Lima Pond) or from the Old Water Hole
- Uncontrolled spillage
- Leakage of volatile and semivolatile organic compounds, heavy metals from uncapped former landfills.

Groundwater is used directly in Calhoun County through groundwater wells. Groundwater also supplies spring discharge and the base flow of Cane, Cave, and Choccolocco Creeks. The most used spring in Calhoun County is Coldwater Spring. This spring, with an average discharge rate of 49.5 cubic feet per second, is located approximately 5 miles south of Pelham Range and 8 miles southwest of the Main Post. Work by the Geological Survey of Alabama has determined that the spring is recharged primarily by quartzites of the Weisner Formation and dolomites of the Knox Group. The most probable recharge area for this spring includes an irregular band of land averaging 1 mile in width along the southwestern corner of Fort McClellan. The recharge area also extends through the Anniston Army Depot up to but not beyond the southernmost tip of Pelham Range. Five drinking water wells are located on Fort McClellan. A drinking water well is located at Lake Reilly on the Main Post upgradient of Landfill #3, and four drinking water wells are located on Pelham Range for military personnel use.

Table 3-2. Summary of Previous Remedial/Removal Actions RI/FS Sites, Fort McClellan, Alabama

Range	Site Size	Probable Date Opened	Last Used	Agents Used	Process and Waste Disposal History
T-4	0.3 acres	1965	1971	BG, SM, HD**, VX**	Decontamination of agents and surface soils using STB and DS-2. Surface soil sampling and analysis.
T-5	11.4 acres	1961	1973	HD, GB, VX, BG, SM	Training sites decontaminated and tested at end of each exercise, using STB and/or DS-2. Contaminated soil possibly removed and disposed of at Range J. Surface and subsurface soil sampling and analysis for CWA and CWA breakdown products.
T-24 Alpha	1.5 acres	Unknown	1973	HD, GB*	Pits filled with soil. Decontamination of agents on soils using STB and DS-2. Surface and subsurface soil sampling and analysis for CWA and CWA breakdown products.
T-38	6.0 acres	1961	1972	HD, GB, VX	Extensive decontamination for reported spills and contaminated training aids. Surface and subsurface soil sampling and analysis for CWA and CWA breakdown products; Electromagnetics surveys.
Pelham Range K	2.0 acres	Unknown	Unknown	HD**	Site was physically rearranged (bulldozed). Surface monitoring conducted. HD, GB rounds, DS-2 cans observed on site.
Pelham Range J	0.1 acres	Unknown	1963	HD**	Surface and subsurface soil sampling and analysis for CWA and CWA breakdown products.
Detection and Identification	1.1 acres	Early 1950s	1973	HD, GB*	Decontaminants STB and DS-2 used on surface soils. Training aids burned in open, onsite pit and subsequently buried. Surface and subsurface soil samples analyzed for CWA and CWA breakdown products.
Pelham Range L	0.5 acres	Unknown	Unknown	HD**	Sampled and analyzed surface water and soil samples for CWA.
Former Landfill 1	2 acres	1945	1947	None	Magnetometer survey over site area. Visual inspection.
Former Landfill 2	4 acres	1947	Unknown	None	Groundwater sampling and analysis for VOC's, SVOC's, pesticides/PCB's, metals; 3 wells installed around site perimeter.
Former Landfill 3	22 acres	1946	1967	None	Groundwater sampling and analysis for VOC's, SVOC's, pesticides/PCB's, metals; 10 wells installed around site perimeter.
Old Water Hole	2,975 sq ft	Unknown	Unknown	Unknown	USATEU metal detection survey.

* Other simulants also used
** Assumed HD or VX used
BG Bacillus Gobi
CWA Chemical Warfare Agent
SM Serratia Marcescens
STB Supertropical Bleach
Reference: Solid Waste Study No. 99-056-73/76, Fort McClellan, AL, Jul 73-Aug 75

3.4.2 Releases to Surface Water

Surface water analyses conducted in 1982 indicate no detectable surface water contamination within Range L (Lima Pond), a man-made pond reportedly used for the disposal of captured World War II munitions. Overland flow over training and decontamination sites may result in contamination from residual chemical agents and chemical agent byproducts. These contaminants may also enter the surface water system attached to eroded soil or resuspended sediment. Landfill sites #2 and #3 are adjacent to the Cave Creek tributary of Cane Creek.

All surface water drainage from Fort McClellan and Pelham Range eventually drains into the Coosa River, the Alabama River, and Mobile Bay. This large drainage system provides downstream municipal water supplies and habitat for aquatic wildlife that is consumed in part by wildlife predators and humans.

3.4.3 Releases to Soil

Potential sources of soil contamination include:

- Surface contact with chemical agents, chemical agent byproducts, and decontaminants associated with previous training, decontamination, storage, and disposal sites and subsequent downward leaching into the subsoil
- Surface contact with unexploded ordnance within impact areas
- Soil contact with saturated, buried municipal wastes.

Contaminated soils would provide a hazard wherever intrusive activities such as excavation, plowing, and road construction are conducted.

Sediments that have been eroded and redeposited within streams are a special case. Because surface soil is the most likely to be both eroded and contaminated, higher concentrations of some persistent contaminants are likely in sediment. Persistent contaminants and contaminated byproducts that might be present in sediment include:

- HD (distilled mustard)

- Bis(2-diisopropylaminoethyl) disulfide — the principal byproduct formed from the decomposition of nerve agent VX with DS-2.

Sediments provide habitat to a portion of the aquatic food chain. Sediments are also a potential source of contamination to surface water, either through leaching within effluent streams or resuspension.

3.4.4 Releases to Air

Ongoing sources of air contamination include fog oil and hydrocarbons from smoke-generating training sites, smoke from controlled burning of underbrush, and atmospheric suspension of particulates resulting from ordnance explosions. These activities are no longer occurring at the sites of concern, but may be occurring in adjacent training areas.

3.5 ASSOCIATED HAZARDS

Hazards associated with the RI/FS sites and which may result in environmental releases or health and safety issues for site personnel include fire and explosion hazards and direct contact with chemical warfare agents or their byproducts.

3.5.1 Fire and Explosion

A potential safety hazard associated with several of the sites under the RI/FS is UXO and munitions debris. These hazards may be particularly acute at the Old Water Hole, Lima Pond, Area T-24A, and possibly Range K. The potential for encountering physical hazards including exploded ordnance fragments, smoke grenades, flares, or other training materials at the RI/FS sites is high because of ongoing training activities in adjacent ranges. Many of the RI/FS sites are within fan area for artillery activity.

3.5.2 Direct Contact

A potential safety hazard may be associated with direct contact with chemical warfare agents either in sampled media or in subsurface burial pits. Chemical warfare agent or agent breakdown products were not detected at high probability sample locations during the 1992 SI,

however, the possibility of encountering unknown sources of buried agent is not remote. Activities at the training sites are not well documented and first hand accounts of random burials have been previously reported. Direct contact with surface water or groundwater is not presently regarded as hazardous, however, caution is warranted in areas adjacent to training areas or waste disposal sites.

4. WORK PLAN RATIONALE

This section provides an overview of SAIC's approach to conducting the Fort McClellan remedial investigation/feasibility study (RI/FS). The objectives of the project, rationale for the investigative approach, and a preliminary identification of Applicable or Relevant and Appropriate Requirements (ARARs) and data quality objectives are also provided.

4.1 RI/FS OBJECTIVES

Data requirements for the RI/FS phase of an Installation Restoration Program (IRP) project are more extensive than those necessary for a site investigation phase because of the need for detailed information to support engineering and risk assessment activities. The objectives of the RI/FS at Fort McClellan require that sufficient data be obtained to:

- Determine the presence, chemical nature, concentration, and distribution of identified constituents
- Evaluate the potential for contaminant release and migration
- Conduct quantitative human health and ecological risk assessment
- Evaluate potential hazards associated with site remediation
- Evaluate the necessity for immediate response actions
- Prepare recommendations for remedial actions to mitigate quantified contamination.

4.2 DATA QUALITY OBJECTIVES

Analytical data are required from the Fort McClellan RI/FS 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 U.S. Environmental Protection Agency (USEPA) data quality objective (DQO) Levels II and 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 to be used during the initial RI/FS, are detailed in the Quality

Assurance Project Plan (QAPP). Specific sampling methods and protocols are detailed in the project Sampling and Analysis Plan (SAP).

4.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

CERCLA specifies that remedial actions for the cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are applicable or relevant and appropriate (ARAR) to the hazardous substances or particular circumstances at a site. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured. A preliminary list of ARARs for the State of Alabama is provided in Table 4-1. This list will be revised as contamination of environmental media at Fort McClellan is further quantified.

4.3.1 Definition of ARARs

A requirement under CERCLA, as amended, may be either "applicable" or "relevant and appropriate" to a site-specific remedial action, but not both. The distinction is critical to understanding the constraints imposed on remedial alternatives by environmental regulations other than CERCLA.

4.3.1.1 Applicable Requirements

Applicable requirements pertain to those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law specifically addressing a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. These requirements would have to be met under any circumstance. Applicable requirements are defined in the National Contingency Plan (NCP), 40 CFR 300.5 Subpart F - State Involvement in Hazardous Substance Response.

Table 4-1. List of Potential State of Alabama ARARs for Fort McClellan

Water Quality Program

1.	Chapter 335-6-1:	General Provisions
2.	Chapter 335-6-5:	Indirect Discharge Permit and Pretreatment Rules
3.	Chapter 335-6-6:	National Pollutant Discharge Elimination System
4.	Chapter 335-6-10:	Water Quality Criteria
5.	Chapter 335-6-11:	Water Use Classifications.

Water Supply Program

1.	Chapter 335-7-1:	General Provisions
2.	Chapter 335-7-2:	Primary Drinking Water Standards
3.	Chapter 335-7-3:	Secondary Drinking Water Standards
4.	Chapter 335-7-4:	Permit Requirements and Procedures
5.	Chapter 335-7-5:	Groundwater Sources and Treatment
6.	Chapter 335-7-6:	Surface Water and Treatment
7.	Chapter 335-7-7:	Distribution of Drinking Water
8.	Chapter 335-7-8:	Lead Ban Requirements
9.	Chapter 335-7-9:	Cross-Connection Control Requirements
10.	Chapter 335-7-10:	Operation, Record Keeping, and Reports
11.	Chapter 335-7-11:	Control of Lead and Copper.

Solid Waste Program

1.	Chapter 335-13-1:	General Provisions
2.	Chapter 335-13-2:	Storage, Collection, and Transportation
3.	Chapter 335-13-3:	Processing and Recycling
4.	Chapter 335-13-4:	Permit Requirements
5.	Chapter 335-13-5:	Procedure for Obtaining Permits
6.	Chapter 335-13-6:	Inspection of Facilities

Hazardous Waste Program

1.	Chapter 335-14-1:	Hazardous Waste Management-General
2.	Chapter 335-14-2:	Identification and Listing of Hazardous waste
3.	Chapter 335-14-3:	Standards Applicable to Generators of Hazardous Waste
4.	Chapter 335-14-4:	Standards Applicable to Transporters of Hazardous Waste.
5.	Chapter 335-14-5:	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
6.	Chapter 335-14-6:	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
7.	Chapter 335-14-8:	Permit Program
8.	Chapter 335-14-9:	Land Disposal Restrictions.

4.3.1.2 Relevant and Appropriate Requirements

Relevant and appropriate requirements pertain to those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site. Relevant and appropriate requirements are defined in the NCP, 40 CFR 300.5 Subpart F - State Involvement in Hazardous Substance Response.

4.3.1.3 Other Requirements To Be Considered (TBCs)

These requirements pertain to federal and state criteria, advisories, guidelines, or proposed standards that are not generally enforceable but are advisory and that do not have the status of potential ARARs. Guidance documents or advisories "to be considered" (TBCs) in determining the necessary level of cleanup for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective.

4.3.1.4 Waivers

Superfund specifies situations under which ARARs may be waived [40 CFR 300.430: Remedial Investigation/Feasibility Study (f) Selection of remedy]. Where remedial actions are selected that do not attain ARARs, the lead agency must publish an explanation in the form of a waiver. The situations eligible for waivers include:

- The selected remedial action is only part of a total remedial action that will attain ARARs (interim remedy).
- Remedies in which attainment of the ARAR would pose a greater risk to human health or the environment than would nonattainment.
- Attainment of the ARAR is not practicable from an engineering perspective.
- The ARAR is a state requirement and is inconsistently applied or enforced.
- In cases of actions under Section 104, compliance with the ARAR will not result in balance of available CERCLA funds with the protection of human health and the

environment (i.e., compliance with the ARAR will be too expensive relative to benefits that could be attained at other sites).

- Equivalent performance or standard of control can be obtained without the ARAR.

ARARs apply to actions or conditions located onsite and offsite. Onsite actions implemented under CERCLA are exempt from administrative requirements of federal and state regulations, such as permits, as long as the substantive requirements of the ARARs are met. Offsite actions are subject to the full requirements of the applicable standards or regulations, including all administrative and procedural requirements.

Based on the CERCLA statutory requirements, the remedial actions developed in this FS will be analyzed for compliance with federal and state environmental regulations. This process involves the initial identification of potential requirements, the evaluation of the potential requirements for applicability or relevance and appropriateness, and finally, a determination of the ability of the remedial alternatives to achieve the ARARs. The determination of whether an ARAR will be met by a remedial alternative will be discussed in the detailed analysis of the alternative.

4.3.2 Identification of ARARs

Three classifications of requirements are defined by USEPA in the ARAR determination process:

- ***Chemical-specific***: These requirements set protective remediation levels for the chemicals of concern.
- ***Location-specific***: These requirements restrict remedial actions based on the characteristics of the site or its immediate surroundings.
- ***Action-specific***: These requirements set controls or restrictions on the design, implementation, and performance levels of activities related to the management of hazardous substances, pollutants, or contaminants.

4.3.2.1 Chemical-specific ARARs

Chemical-specific requirements set health or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants. These requirements generally set protective cleanup levels for the chemicals of concern in the designated media or else indicate a safe level of discharge that may be incorporated when considering a specific remedial activity. Although limited in number, chemical-specific standards have been established under several statutes, including the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), and the Clean Air Act (CAA).

Groundwater and Surface Water — Table 4-2 lists available chemical-specific ARARs that have been promulgated under Federal law for groundwater, surface water, and air. As stated in the NCP (55 FR 8666, March 8, 1990), the goal of USEPA's approach to cleanup of contaminated groundwater is to return usable groundwater to its beneficial use within a given time frame that is reasonable for the particular circumstances at a CERCLA site. Groundwater at Fort McClellan has not been given an USEPA classification. Although not an ARAR unless promulgated, the USEPA guidance on groundwater classification will be used to determine whether groundwater at Fort McClellan falls within Class I, II, or III. Classes I and IIA represent current sources of drinking water of varying value, Class IIB represents potential sources of drinking water, and Class III groundwater is not considered to be a potential source of drinking water and is of limited beneficial use. Restoration time periods vary, depending on the use classification of the groundwater, and may range from 1 year to several decades.

In the NCP, USEPA states the preference for SDWA maximum contaminant levels (MCLs) and nonzero maximum contaminant level goals (MCLGs) or other health-based standards, criteria, or guidance for cleanup of Class I and II groundwater at CERCLA sites (55 FR 8732). Alternate concentration limits (ACLs) also may be used when active restoration of the groundwater to MCLs or non-zero MCLGs is not practical (55 FR 8754). For Class III groundwaters, USEPA establishes remediation levels based on specific site conditions, the beneficial use of the groundwater, and environmental receptors (55 FR 8732). Final

Table 4-2. Potential Federal Chemical-specific ARARs
Fort McClellan, Alabama

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable or Relevant and Appropriate
Safe Drinking Water Act	40 USC Section 300		
National Primary Drinking Water Standards	40 CFR Part 141	Establishes health-based standards for public water systems (maximum contaminant levels).	Applicable to the groundwater contaminated by the site since it is a drinking water source.
Maximum Contaminant Level Goals	Publication L. Nº 99-399, 100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects.	Proposed MCLGs for organic and inorganic contaminants are relevant and appropriate to the groundwater used for drinking water, for contaminants with no Federal and state MCLs.
Clean Water Act	33 USC Section 1251-1376		
Water Quality Criteria	40 CFR Part 131	Sets criteria for water quality based on toxicity to aquatic organisms and human health.	The AWQC for organic and inorganic contaminants are relevant and appropriate.
Resource Conservation and Recovery Act (RCRA), as amended	42 USC 6905, 6912, 6924, 6925		
RCRA Groundwater Protection	40 CFR Part 264	Provides for groundwater protection standards, general monitoring requirements, and technical requirements.	The RCRA MCLs are relevant and appropriate for groundwater at the site.
Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)	42 USC 9601 et. seq.	Provides for response to hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites.	Applicable.
Clean Air Act	40 USC 1857		
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Sets primary and secondary air standards at levels to protect public health and public welfare.	Relevant or appropriate for onsite treatment units.
National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61	Provides emissions standard for hazardous air pollutants for which no ambient air quality standard exists.	Relevant or appropriate for onsite treatment units.
Occupational Safety and Health Administration	29 CFR 1910 Part 120	Provides safety rules for handling specific chemicals for site workers during remedial activities.	Applicable to all potential remedial actions.

determination of ARARs for site-specific cleanup of groundwater at Fort McClellan will depend on the chosen groundwater classification.

Resource Conservation and Recovery Act — Subtitle C of RCRA lists maximum concentration levels for 14 chemicals; the concentration of these chemicals in groundwater at the plant boundary of a RCRA-permitted treatment, storage, or disposal (TSD) facility may not exceed the stated maximum concentration level (Title 40, Code of Federal Regulations, Part 264, §94 [40 CFR 264.94]). In addition, background concentrations or ACLs are established in 40 CFR 264.94 as groundwater protection standards. USEPA has specified SDWA MCLs for cleanup of Class I and II groundwater and site-specific remediation levels for Class III groundwaters. This approach is consistent with the substantive requirements of RCRA MCLs, ACLs, or background limits (53 FR 51433).

Safe Drinking Water Act — USEPA has promulgated primary and secondary drinking water regulations applicable to public water systems that have at least 15 service connections or serve an average of at least 25 people daily at least 60 days of the year. National Primary Drinking Water Standards (NPDWS) are established in 40 CFR 141 and include MCLs and MCLGs. New drinking water standards promulgated for eight synthetic organic chemicals (52 FR 25690, July 8, 1987) added a new category of suppliers referred to as noncommunity, nontransient systems that regularly serve at least 25 people for 6 months of the year. Table 4-3 lists SDWA MCLs and MCLGs.

MCLs are enforceable standards that take into consideration human health effects, available treatment technologies, and costs of treatment. MCLGs are strictly health-based standards that disregard cost or treatment feasibility and are not legally enforceable. MCLs are legally applicable to water "at the tap" but are not applicable to cleanup of groundwater or surface water. However, they may be considered as relevant and appropriate in situations where groundwater or surface water may be used for drinking water. CERCLA regulations (§121(d)(2)(A)) specifically mention that remedial actions must require a level or standard of control that at least attains MCLGs and Federal ambient water quality criteria (WQC) where such goals or criteria are relevant and appropriate under the circumstances of the release.

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)					Aquatic			
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	organisms and drinking water (mg/l)	Aquatic organisms alone (mg/l)	Maximum Concentration (mg/l)	Continuous Concentration (mg/l)
Acenaphthene				-					0.06							
Acifluorfen	B2	zero		-	2	2	0.1	0.4	0.013	0.4		0.1				
Acrolein													0.32	0.78		
Acrylamide	B2	zero	TT	-	1.5	0.3	0.02	0.07	0.0002	0.007	-	0.001				
Acrylonitrile	B1	zero		-	-	-	-	-	-	-	-	0.006	0.000059	0.00066		
Adipates (diethylhexyl)	C		0.05	-	-	-	-	-	0.7	20	0.5	-				
Alachlor	B2	zero	0.002	-	0.1	0.1	-	-	0.01	0.4	-	0.04				
Aldicarb	D	0.001	0.003	-	-	-	-	-	0.001	0.035	0.007	-				
Aldicarb sulfone	D	0.001	0.002	-	-	-	-	-	0.001	0.035	0.007	-				
Aldicarb sulfoxide	D	0.001	0.004	-	-	-	-	-	0.001	0.035	0.007	-				
Aldrin	B2	-	-	-	0.0003	0.0003	0.0003	0.0003	0.00003	0.001	-	0.0002	1.30E-07	1.40E-07	0.003	
Ametryn	D	-	-	-	9	9	0.9	3	0.009	0.3	0.06	-				
Ammonium sulfamate	D	-	-	-	20	20	20	80	0.28	8	2	-				
Anthracene (PAH)	D	-	-	-	-	-	-	-	0.3	-	-	-	9.6	110		
Atrazine	C	0.003	0.003	-	0.1	0.1	0.05	0.2	0.035	0.2*	0.003*	-				
Baygon	C	-	-	-	0.04	0.04	0.04	0.1	0.004	0.1	0.003	-				
Bentazon	D	0.02		-	0.3	0.3	0.3	0.9	0.0025	0.09	0.02	-				
Benz(a)anthracene (PAH)	B2	zero	0.0001	-	-	-	-	-	-	-	-	-	2.80E-06	0.000031		
Benzene	A	zero	0.005	-	0.2	0.2	-	-	-	-	-	-	0.0012	0.071		
Benzidene													1.20E-07	5.40E-07		
Benzo(a)pyrene (PAH)	B2	zero	0.0002	-	-	-	-	-	-	-	-	-	2.80E-06	0.000031		
Benzo(b)fluoranthene (PAH)	B2	zero	0.0002	-	-	-	-	-	-	-	-	-	2.80E-06	0.000031		
Benzo(g,h,i)perylene (PAH)	D	-	-	-	-	-	-	-	-	-	-	-				
Benzo(k)fluoranthene (PAH)	B2	zero	0.0002	-	-	-	-	-	-	-	-	-	2.80E-06	0.000031		
alpha-BHC													3.90E-06	0.000013		
beta-BHC													0.000014	0.000046		
gamma-BHC													0.000019	0.000063	0.002	0.00008
bis-(2-Chloroethyl)Ether													0.000031	0.0014		
bis-2-Chloroisopropyl ether	D	-	-	-	4	4	4	13	0.04	1	0.3	-	1.4	170		
bis-(2-Ethyl-hexyl) Phthalate													0.0018	0.0059		
Bromacil	C	-	-	-	5	5	3	9	0.13	5	0.09					
Bromobenzene	-	-	-	-	-	-	-									
Bromochloroacetonitrile	D	-	-	-	-	-	-									
Bromochloromethane	-	-	-	-	50	1	1	5	0.013	0.5	0.09	-				
Bromodichloromethane (THM)	B2	zero	0.1*	-	7	7	4	13	0.02	0.7		0.06				
Bromoform (THM)	B2	zero	0.1*	-	5	2	2	6	0.02	0.7		0.4	0.0043	0.36		
Bromomethane	D	-	-	-	0.1	0.1	0.1	0.5	0.001	0.04	0.01					
Butyl benzyl phthalate (PAE)	C	zero	0.1	-	-	-	-	-	0.2	6	-	-				
Butylate	D	-	-	-	2	2	1	4	0.05	2	0.35	-				
Butylbenzene n-	-	-	-	-	-	-	-	-	-	-	-	-				
Butylbenzene sec-	-	-	-	-	-	-	-	-	-	-	-	-				
Butylbenzene tert-	-	-	-	-	-	-	-	-	-	-	-	-				
Carbaryl	D	-	-	-	1	1	1	1	0.1	4	0.7	-				
Carbofuran	E	0.04	0.04	-	0.05	0.05	0.05	0.2	0.005	0.2	0.04	0.03				
Carbon tetrachloride	B2	zero	0.005	-	4	0.2	0.07	0.3	0.0007	0.03	-	0.03	0.00025	0.0044		
Carboxin	D	-	-	-	1	1	1	4	0.1	4	0.7	-				
Chloral hydrate	C	0.06	-	-	7	1.4	0.2	0.6	0.0002	0.07	0.06					
Chloramben	D	-	-	-	3	3	0.2	0.5	0.015	0.5	0.1					
Chlordane	B2	zero	0.002	-	0.06	0.06	-	-	0.00006	0.002		0.003	5.70E-07	5.90E-07	0.0024	4.3000E-06
Chlorobenzene													0.68	21		
Chlorodibromomethane (THM)	C	zero	0.1*	-	7	7	2	8	0.02	0.7	0.06		0.00041	0.034		
Chloroform (THM)	B2	zero	0.1*	-	4	4	0.1	0.4	0.01	0.4		0.6	0.0057	0.47		

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS (continued)

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)					Aquatic organisms and drinking water	Aquatic organisms alone	Maximum Concentration	Continuous Concentration
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Chloromethane	C	–	–	–	9	0.4	0.4	1	0.004	0.1	0.003					
Chlorophenol (2-)	D	–	–	–	0.05	0.05	0.05	0.2	0.005	0.2	0.04	–				
p-Chlorophenyl methyl sulfide/sulfone/sulfoxide	– D	–	–	– –	–	–	–	–	–	–	–	–				
Chloropicrin	–	–	–	–	–	–	–									
Chlorothalonil	B2	–	–	–	0.2	0.2	0.2	0.5	0.015	0.5		0.15				
Chlorotoluene o-	D	–	–	–	2	2	2	7	0.02	0.7	0.1					
Chlorotoluene p-	D	–	–	–	2	2	2	7	0.02	0.7	0.1					
Chlorpyrifos	D	–	–	–	0.03	0.03	0.03	0.1	0.003	0.1	0.02					
Chrysene (PAH)	B2	zero	0.0002	–	–	–	–	–	–	–	–	–	2.80E-06	0.000031		
Cyanazine	C	0.0001		–	0.1	0.1	0.02	0.07	0.002	0.07	0.001					
Cyanogen chloride	–	–	–	–	–	–	–									
Cymene p-	–	–	–	–	–	–	–	–	–	–	–	–				
2,4-D	D	0.07	0.07	–	1	0.3	0.1	0.4	0.01	0.4	4	–				
DCPA (Dacthal)	D	–	–	–	80	80	5	20	0.5	20	4					
Dalapon	D	0.2	0.2	–	3	3	0.3	0.9	0.026	0.9	0.2	–				
4,4'-DDT													5.90E-07	5.90E-07	0.0011	1.0000E-06
4,4'-DDE													5.90E-07	5.90E-07		
4,4'-DDD													8.30E-07	8.40E-07		
Di[2-ethylhexyl]adipate	C	0.4	0.4	–	20	20	20	60	0.6	20	0.4	3				
Diazinon	E	–	–	–	0.02	0.02	0.005	0.02	0.00009	0.003	0.0006	–				
Dibenz(a,h)anthracene (PAH)	B2	zero	0.0003	–	–	–	–	–	–	–	–	–	2.80E-06	0.000031		
Dibromoacetonitrile	C	–	–	–	2	2	2	8	0.02	0.8	0.02					
Dibromochloropropane (DBCP)	B2	zero	0.0002	–	0.2	0.05	–	–	–	–	–	0.003				
Dibutyl phthalate (PAE)	D	–	–	–	–	–	–	–	0.1	4	–	–				
Dicamba	D	–	–	–	0.3	0.3	0.3	1	0.03	1	0.2					
Dichloroacetic acid	B2	zero	–	–	–	50	5	20	0.008	0.3						
Dichloroacetonitrile	C	–	–	–	1	1	0.8	3	0.008	0.3	0.006					
Dichlorobenzene o-	D	0.6	0.6	–	9	9	9	30	0.09	3	0.6	–	2.7	17		
Dichlorobenzene m-*	D	0.6	0.6	–	9	9	9	30	0.09	3	0.6	–	0.4	2.6		
Dichlorobenzene p-	C	0.075	0.075	–	10	10	10	40	0.1	4	0.075	–	0.4	2.6		
Dichlorobenzidene (3,3-)													0.00004	0.000077		
Dichlorobromomethane													0.00027	0.022		
Dichlorodifluoromethane	D	–	–	–	40	40	9	30	0.2	5	1					
Dichloroethane (1,1-)	–	–	–	–	–	–	–									
Dichloroethane (1,2-)	B2	zero	0.005	–	0.7	0.7	0.7	2.6	–	–	–	0.04	0.0038	0.099		
Dichloroethylene (1,1-)	C	0.007	0.007	–	2	1	1	4	0.009	0.4	0.007	–	0.000057	0.0032		
Dichloroethylene (cis-1,2-)	D	0.07	0.07	–	4	3	3	11	0.01	0.4	0.07	–				
Dichloroethylene (trans-1,2-)	D	0.1	0.1	–	20	2	2	6	0.02	0.6	0.1	–				
Dichloromethane	B2	zero	0.005	–	10	2	–	–	0.06	2	–	0.5				
Dichlorophenol (2,4-)	D	–	–	–	0.03	0.03	0.03	0.1	0.003	0.1	0.02	–	0.093	0.79		
Dichloropropane (1,1-)	–	–	–	–	–	–	–	–	–	–	–	–				
Dichloropropane (1,2-)	B2	zero	0.005	–	–	0.09	–	–	–	–	–	0.05				
Dichloropropane (1,3-)	–	–	–	–	–	–	–									
Dichloropropene (1,3-)	B2	zero	–	–	0.03	0.03	0.03	0.1	0.0003	0.01		0.02	0.01	17		
Dieldrin	B2	–	–	–	0.0005	0.0005	0.0005	0.002	0.00005	0.002	–	0.0002	1.40E-07	1.40E-07	0.0025	1.9000E-06
Diethyl phthalate (PAE)	D	–	–	–	–	–	–	–	0.8	30	5	–	23	120		
Diethylene glycol dinitrate	–	–	–	–	–	–	–	–	–	–	–	–				
Diethylhexyl phthalate (PAE)	B2*	zero	0.006	–	–	–	–	–	0.02	0.7	–	0.3				
Diisopropyl methylphosphonate	D	–	–	–	8	8	8	30	0.08	3	0.6	–				
Dimethrin	D	–	–	–	10	10	10	40	0.3	10	2	–				
Dimethyl methylphosphonate	C	–	–	–	2	2	2	7	0.09	0.1	0.1	7				

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS (continued)

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)								
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	Aquatic organisms and drinking water (mg/l)	Aquatic organisms alone (mg/l)	Maximum Concentration (mg/l)	Continuous Concentration (mg/l)
Dimethyl phthalate (PAE)	D	–	–	–	–	–	–	–	–	–	–	–	313	2900		
Di-n-butyl Phthalate													2.7	12		
2,4-Dinitrophenol													0.07	14		
1,3-dinitrobenzene	D			–	0.04	0.04	0.04	0.14	0.0001	0.005	0.001					
2,4-dinitrotoluene	B2			–	0.5	0.5	0.3	1	0.002	0.1			0.00011	0.0091		
2,6-dinitrotoluene	B2			–	0.4	0.4	0.4	1	0.001	0.04		0.005				
Dinoseb	D	0.007	0.007	–	0.3	0.3	0.01	0.04	0.001	0.04	0.007	–				
Dioxane p-	B2	–	–	–	4	0.04	–	–	–	–	–	0.7				
Diphenamid	D	–	–	–	0.3	0.3	0.3	1	0.03	1	0.2	–				
Diphenylamine	D	–	–	–	1	1	0.3	1	0.03	1	0.2					
Diphenylhydrazine (1,2-)													0.00004	0.00054		
Diquat	D	0.02	0.02	–	–	–	–	–	0.0022	0.08	0.02	–				
Disulfoton	E	–	–	–	0.01	0.01	0.003	0.009	0.00004	0.001	0.0003	–				
Dithiane (1,4-)	D	–	–	–	0.4	0.4	0.4	1	0.01	0.4	0.08	–				
Diuron	D	–	–	–	1	1	0.3	0.9	0.002	0.07	0.01	–				
alpha-Endosulfan													0.00093	0.002	0.00022	0.000056
beta-Endosulfan													0.00093	0.002	0.00022	0.000056
Endosulfan sulfate													0.00093	0.002		
Endothall	D	0.1	0.1	–	0.8	0.8	0.2	0.2	0.02	0.7	0.1	–				
Endrin	D	0.002	0.002	–	0.02	0.02	0.003	0.01	0.0003	0.01	0.002	–	0.00076	0.00081	0.00018	2.3000E-06
Endrin Aldehyde													0.00076	0.00081		
Epichlorohydrin	B2	zero	TT	–	0.1	0.1	0.07	0.07	0.002	0.07	–	0.4				
Ethylbenzene	D	0.7	0.7	–	30	3	1	3	0.1	3	0.7		3.1	29		
Ethylene dibromide (EDB)	B2	zero	0.00005	–	0.008	0.008	–	–	–	–	–	0.00004				
Ethylene glycol	D	–	–	–	20	6	6	20	2	40	7					
ETU	B2	–	–	–	0.3	0.3	0.1	0.4	0.00008	0.003		0.03				
Fenamiphos	D	–	–	–	0.009	0.009	0.005	0.02	0.00025	0.009	0.002					
Fluometron	D	–	–	–	2	2	2	5	0.013	0.4	0.09					
Fluoranthene													0.3	0.37		
Fluorene (PAH)	D	–	–	–	–	–	–	–	0.04	–	–	–	1.3	14		
Fluorotrichloromethane	D	–	–	–	7	7	3	10	0.3	10	2					
Fonofos	D	–	–	–	0.02	0.02	0.02	0.07	0.002	0.07	0.01	–				
Formaldehyde	B1	–	–	–	10	5	5	20	0.15	5	1	–				
Gasoline, unleaded (benzene)	–	–	–	–	–	–	–	–	–	–	0.005	–				
Glyphosate	D	0.7	0.7	–	20	20	1	1	0.1	4	0.7	–				
Heptachlor	B2	zero	0.0004	–	0.01	0.01	0.005	0.005	0.0005	0.02	–	0.0008	2.10E-07	2.10E-07	0.00052	3.8000E-06
Heptachlor epoxide	B2	zero	0.0002	–	0.01	–	0.0001	0.0001	1.3E-0.5	0.0004	–	0.0004	1.00E-07	1.10E-07	0.00052	3.8000E-06
Hexachlorobenzene	B2	zero	0.001	–	0.05	0.05	0.05	0.2	0.0008	0.03	–	0.002	7.50E-07	7.70E-07		
Hexachlorobutadiene	C	0.001		–	0.3	0.3	0.1	0.4	0.002	0.07	0.001		0.00044	0.05		
Hexachlorocyclopentadiene	D	0.05	0.05	–	–	–	–	–	0.007	0.2	–	–	0.24	17		
Hexachloroethane	C	–	–	–	5	5	0.1	0.5	0.001	0.04	0.001		0.0019	0.0089		
Hexane (n-)	D	–	–	–	10	4	4	10	–	–	–	–				
Hexazinone	D	–	–	–	3	3	3	9	0.033	1	0.2	–				
HMX	D	–	–	–	5	5	5	20	0.05	2	0.4	–				
Indeno(1,2,3,-c,d)pyrene (PAH)	B2	zero	0.0004	–	–	–	–	–	–	–	–	–	2.80E-06	0.000031		
Isophorone	C	–	–	–	15	15	15	15	0.2	7	0.1		0.0084	0.6		
Isopropyl methylphosphonate	D	–	–	–	30	30	30	100	0.1	4	0.7	–				
Lindane	C	0.0002	0.0002	–	1	1	0.03	0.1	0.0003	0.01	0.0002	–				
Malathion	D	–	–	–	0.2	0.2	0.2	0.8	0.02	0.8	0.2	–				
Maleic hydrazide	D	–	–	–	10	10	5	20	0.5	20	4	–				
MCPA	E	–	–	–	0.1	0.1	0.1	0.4	0.0015	0.05	0.01	–				
Methomyl	D	–	–	–	0.3	0.3	0.3	0.3	0.025	0.9	0.2					

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS (continued)

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)								
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	Aquatic organisms and drinking water (mg/l)	Aquatic organisms alone (mg/l)	Maximum Concentration (mg/l)	Continuous Concentration (mg/l)
Methoxychlor	D	0.04	0.04	–	0.05	0.05	0.05	0.2	0.005	0.2	0.04	–				
Methyl Bromide													0.048	4		
Methylene Chloride													0.0047	1.6		
2-Methyl-4,6-dinitrophenol													0.0134	0.765		
Methyl parathion	D	–	–	–	0.3	0.3	0.03	0.1	0.00025	0.009	0.002	–				
Methyl tert butyl ether	D	–	–	–	8	3	0.5	2	0.005	0.02	0.04					
Metolachlor	C	–	–	–	2	2	2	5	0.15	5	0.1					
Metribuzin	D	–	–	–	5	5	0.3	0.9	0.025	0.9	0.2					
Monochlorobenzene	D	0.1	0.1	–	2	2	2	7	0.02	0.7	0.1	–				
Naphthalene	D	–	–	–	0.5	0.5	0.4	1	0.004	0.1	0.02					
Nitrobenzene													0.017	1.9		
Nitroguanidine	D	–	–	–	10	10	10	40	0.1	4	0.7	–				
Nitrophenols p-	D	–	–	–	0.8	0.8	0.8	3	0.008	0.3	0.06	–				
N-Nitrosodimethylamine													6.90E-07	0.0081		
N-Nitrosodiphenylamine													0.005	0.016		
Oxamil (Vydate)	E	0.2	0.2	–	0.2	0.2	0.2	0.9	0.025	0.9	0.2	–				
Paraquat	E	–	–	–	0.1	0.1	0.05	0.2	0.0045	0.2	0.03	–				
Pentachloroethane	–	–	–	–	–	–	–	–	–	–	–	–				
Pentachlorophenol	B2	zero	0.001	–	1	0.3	0.3	1	0.03	1	–	0.03	0.00028	0.0082	0.02	0.013
Phenanthrene (PAH)	–	–	–	–	–	–	–	–	–	–	–	–				
Phenol	D	–	–	–	6	6	6	20	0.6	20	4	–	21	4600		
Picloram	D	0.5	0.5	–	20	20	0.7	2	0.07	2	0.5	–				
Polychlorinated biphenyls (PCBs)	B2	zero	0.0005	–	–	–	–	–	–	–	–	0.0005	4.40E-08	4.50E-08		0.000014
Prometon	D	–	–	–	0.2	0.2	0.2	0.5	0.015	0.5	0.1					
Pronamide	C	–	–	–	0.8	0.8	0.8	3	0.075	3	0.05	–				
Propachlor	D	–	–	–	0.5	0.5	0.1	0.5	0.013	0.5	0.09	–				
Propazine	C	–	–	–	1	1	0.5	2	0.02	0.7	0.01	–				
Propham	D	–	–	–	5	5	5	20	0.02	0.6	0.1	–				
Propylbenzene n-	–	–	–	–	–	–	–	–	–	–	–	–				
Pyrene (PAH)	D	–	–	–	–	–	–	–	0.03	–	–	–	0.96	11		
RDX	C	–	–	–	0.1	0.1	0.1	0.4	0.003	0.1	0.002	0.03				
Simazine	C	0.004	0.004	–	0.07	0.07	0.07	0.07	0.005	0.2	0.004	–				
Styrene	C	0.1	0.1	–	20	2	2	7	0.2	7	0.1	–				
2,4,5-T	D	–	–	–	0.8	0.8	0.8	1	0.01	0.35	0.07					
2,3,7,8-TCDD (Dioxin)	B2	zero	3E-08	–	1E-06	1E-07	1E-08	4E-08	1E-09	4E-08	–	2E-08	1.30E-11	1.40E-11		
Tebuthiuron	D	–	–	–	3	3	0.7	2	0.07	2	0.5	–				
Terbacil	E	–	–	–	0.3	0.3	0.3	0.9	0.013	0.4	0.09	–				
Terbufos	D	–	–	–	0.005	0.005	0.001	0.005	0.00013	0.005	0.0009	–				
Tetrachloroethane (1,1,1,2-)	–	–	–	–	2	2	0.9	3	0.03	1	0.07	0.1				
Tetrachloroethane (1,1,2,2-)													0.00017	0.011		
Tetrachloroethylene	–	zero	0.005	–	2	2	1	5	0.01	0.5	–	0.07	0.0008	0.00885		
Tetranitromethane	–	–	–	–	–	–	–	–	–	–	–	–				
Toluene	D	1	1	–	20	2	2	7	0.2	7	1		6.8	200		
Toxaphene	B2	zero	0.003	–	0.5	0.04	–	–	0.1	0.0035	–	0.003	7.30E-07	7.50E-07	0.00073	2.0000E-07
2,4,5-TP	D	0.05	0.05	–	0.2	0.2	0.07	0.3	0.0075	0.3	0.05	–				
1,1,2-Trichloro 1,2,2-trifluoroethane	–	–	–	–	–	–	–	–	–	–	–	–				
Trichloroacetic acid	C	0.1		–	–	2	4	13	0.04	1.3	1					
Trichloroacentonitrile	–	–	–	–	0.05	0.05	–									
Trichlorobenzene (1,2,4-)	D	0.07	0.07	–	0.1	0.1	0.1	0.5	0.01	0.4	0.07	–				
Trichlorobenzene (1,3,5-)	D	–	–	–	0.6	0.6	0.6	2	0.006	0.2	0.04	–				
Trichlo[illegible]e (1,1[illegible]	[illegible]	[illegible]	0.[illegible]		100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.2					

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS (continued)

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)								
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	Aquatic organisms and drinking water (mg/l)	Aquatic organisms alone (mg/l)	Maximum Concentration (mg/l)	Continuous Concentration (mg/l)
Trichloroethane (1,1,2-)	C	0.003	0.005	–	0.6	0.4	0.4	1	0.004	0.1	0.003	–	0.0006	0.042		
Trichloroethanol (2,2,2-)	–	–	–	–	–	–	–									
Trichloroethylene	B2	zero	0.005	–	–	–	–	–	–	0.3	–	0.3	0.0027	0.081		
Trichlorophenol (2,4,6-)	B2	–	–	–	–	–	–					0.3	0.0021	0.0065		
Trichloropropane (1,1,1-)	–	–	–	–	–	–	–	–	–	–	–	–				
Trichloropropane (1,2,3-)	B2	–	–	–	0.6	0.6	0.6	2	0.006	0.2	0.04					
Trifluralin	C	–	–	–	0.08	0.08	0.08	0.3	0.0075	0.3	0.005					
Trimethylbenzene (1,2,4-)	–	–	–	–	–	–	–	–	–	–	–	–				
Trimethylbenzene (1,3,5-)	–	–	–	–	–	–	–	–	–	–	–	–				
Trinitroglycerol	–	–	–	–	0.005	0.005	0.005	0.005	–	–	0.005	–				
Trinitrotoluene	C	–	–	–	0.02	0.02	0.02	0.02	0.0005	0.02	0.002	0.1				
Vinyl Chloride	A	zero	0.002	–	3	3	0.01	0.05				0.0015	0.002	0.525		
Xylenes	D	10	10	–	40	40	40	100	2	60	10					
				–												
INORGANICS				–												
Aluminum		–	–	0.05 to 0.2	–	–	–									
Ammonia	D	–	–	–	–	–	–	–	–	–	30	–				
Antimony	D	0.006	0.006	–	0.015	0.015	0.015	0.015	0.0004	0.015	0.003	–	0.014	43		
Arsenic	A	–	0.05	–	–	–	–					0.002	0.000018	0.00014	0.36	0.19
Asbestos (fibers/l >10 m length	A	7MFL	7MFL	–	–	–	–	–	–	–	–	700 MFL	7000000			
Barium	D	2	2	–	–	–	–		0.07	2	2					
Beryllium	B2	0.004	0.004	–	30	30	4	20	0.005	0.2	–	*				
Boron	D	–	–	–	4	0.9	0.9	3	0.09	3	0.6					
Cadmium	D	0.005	0.005	–	0.04	0.04	0.005	0.02	0.0005	0.02	0.005	–			0.0039	0.0011
Chloramine	–	4	–	–	1	1	1	1	0.1	3.3	2.6					
Chlorate	–	–	–	–	–	–	–									
Chloride	–	–	–	250	–	–	–									
Chlorine	D	4	–	–	–	–	–									
Chlorine Dioxide	D	0.08	–	–	–	–	–		0.003	0.1	0.08					
Chlorite	D	–	–	–	–	–	–									
Chromium (total)	D	0.1	0.1	–	1	1	0.2	0.8	0.005	0.2	0.1					
Chromium (III)															1.7	0.21
Chromium (VI)															0.016	0.011
Copper	D	1.3	TT	1.0	–	–	–								0.018	0.012
Cyanide	D	0.2	0.2	–	0.2	0.2	0.2	0.8	0.022	0.8	0.2	–	0.7	220	0.022	0.0052
Fluoride	–	4	4	2.0	–	–	–	–	0.12	–	–	–				
Hypochlorite	–	4	–	–	–	–	–									
Hypochlorous acid	–	4	–	–	–	–	–									
Iron	–	–	–	0.3	–	–	–									
Lead (at tap)	B2	zero	TT	–	–	–	–	–	–	–	–	–			0.082	0.0032
Manganese	–	0.2	–	0.05	–	–	–		0.005							
Mercury (inorganic)	D	0.002	0.002	–	–	–	–	0.002	0.0003	0.01	0.002		0.00014	0.00015	0.0024	0.000012
Molybdenium	D	–	–	–	–	0.08	0.01	0.05	0.005	0.2	0.04	–				
Nickel	D	0.1	0.1	–	1	1	0.5	1.7	0.02	0.6	0.1		0.61	46	1.4	0.16
Nitrate (as N)	*	10	10	–	–	10*	–	–	1.6	–	–	–				
Nitrite (as N)	*	1	1	–	–	1*	–	–	0.16*	–	–	–				
Nitrate + Nitrite (both as N)	*	10	10	–	–	–	–	–		–	–	–				
Selenium	–	0.05	0.05	–	–	–	–		0.005						0.02	0.005
Silver	D	–	–	0.1	0.2	0.2	0.2	0.2	0.005	0.2	0.1	–			0.0041	
Sodium	–	–	–	–	–	–	–			20						
Strontium	D	–	–	–	25	25	25	90	0.6	90	17					
Sulfate	–	–	–	250	–	–	–	–	–	–	–	–				

Table 4-3. Chemical Specific ARARs for Fort McClellan RI/FS (continued)

Chemical	Cancer Group	Standards			Health Advisories								WQC Protection of human health (10^{-6} risk for carcinogens)		WQC Protection of Freshwater Organisms	
					Child (10-kg)			Adult (70-kg)					Aquatic organisms and drinking water	Aquatic organisms alone	Maximum Concentration	Continuous Concentration
		MCLG (mg/L)	MCL (mg/L)	SMCL (mg/L)	1-day (mg/L)	10-day (mg/L)	Long-term (mg/L)	Long-term (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Lifetime (mg/L)	10^{-4} Cancer risk (mg/L)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Thallium	-	0.0005	0.002	-	0.007	0.007	0.007	0.02	0.00007	0.002	0.0004	-	0.0017	0.0063		
Vanadium	D	-	-	-	-	-	-									
White phosphorous	D	0.0005	0.002	-	-	-	-	-	0.00002	0.0005	0.0001	-				
Zinc	D	-	-	5.0	6	6	3	12	0.3	11	2				0.12	0.11
Zinc chloride (measured as zinc)	D	-	-	-	6	6	3	12	0.3	11	2					

Sources:

Drinking water standards and health advisories - EPA (May 1993), Drinking Water Regulations and Health Advisories, Office of Water, Washington, D.C.

Water Quality Criteria - 56 FR 223.58418 (Nov., 1991), "Amendments to the Water Quality Standards Regulation; Compliance with CWA Section 303 (c)(2)(B); Proposed Rule" Washington, D.C.

Cancer Groups:

A - Human carcinogen (sufficient evidence of carcinogenicity in humans).

B - Probable human carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans).

C - Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data).

D - Not classifiable as to human carcinogenicity (inadequate or no evidence).

* MCL for total trihalomethanes represented by bromoform, chloroform, bromodichloromethane, and chlorodibromomethane.

(a) - the criterion value of zero for all potential carcinogens is listed in the table. Concentrations in parentheses for potential carcinogens correspond to a risk of 10^ -6.

(b) - These adjusted criteria, for drinking water ingestion only, are estimated using a reference dose or carcinogen potency factor and a body weight of 70 kg and water ingestion rate of 2 L/day.

Although MCLGs and WQC are nonenforceable guidelines, Congress elevated them to a higher status by specifically mentioning them in CERCLA. Therefore, promulgated MCLGs are listed in Table 4-3. At present, USEPA is planning to use the SDWA MCLs for remedial action compliance for carcinogens which have an MCLG of zero and any nonzero MCLG for systemic toxicants (55 FR 8752). If MCLGs are considered as ARARs for cleanup at CERCLA sites, the more stringent value, either the MCL or the MCLG, will be considered for Fort McClellan.

National Secondary Drinking Water Standards (NSDWS) regulate contaminants that affect the aesthetic qualities related to public acceptance of drinking water and are implemented in 40 CFR 143.3 as secondary maximum contaminant levels. These regulations are not Federally enforceable, but rather are intended to serve as guidelines for use by states in regulating water supplies. These regulations are designed to provide water to the consumer that is aesthetically pleasing, and they apply to all community water systems and to those noncommunity water systems "as may be deemed necessary" by the Department of Health and Environment. In that context, they would not be legally applicable to cleanup of groundwater or surface water, but may be considered as relevant and appropriate in instances where these media may provide private drinking water sources.

Clean Water Act — CERCLA regulations specifically state that remedial actions shall at least attain Federal ambient WQC established under the CWA if they are relevant and appropriate. In determining whether any WQC are relevant and appropriate, one must consider the designated or potential use of the surface or groundwater, the environmental media affected, the purposes for which the criteria were developed, and the latest information available (CERCLA §121[d][2][B]). Federal WQC are derived for the protection of freshwater aquatic organisms and for the protection of human health from the consumption of contaminated drinking water and/or aquatic organisms.

Table 4-3 lists ambient WQC for the protection of human health. USEPA has derived WQC for ingestion of drinking water and aquatic organisms and for the ingestion of aquatic organisms alone. Since neither of these categories is relevant and appropriate for consideration of contaminated groundwater, WQC derived for the ingestion of drinking water alone also are

included in Table 4-3. During the process of ARAR refinement as the remedial investigation (RI) process progresses, Federal WQC will be analyzed and compared with more current USEPA chemical-specific health-based guidance values (e.g., reference doses [RfDs]) to determine whether the WQC are actually relevant and appropriate for cleanup at Fort McClellan.

Table 4-3 lists Federal WQC for the protection of freshwater aquatic life. When the designated use classification requires protection of aquatic life or when environmental factors are being considered at a remedial action site, a WQC for the protection of aquatic life that is more stringent than the SDWA MCL may be relevant and appropriate (55 FR 8754) for CERCLA cleanup.

Soil — Legislation or guidance governing cleanup criteria for contaminated soils at CERCLA sites is limited. RCRA has addressed land disposal of treated hazardous wastes in its land disposal restrictions (40 CFR 268).

Other "To-Be-Considered" (TBC) Guidance — In the absence of Federally or state-promulgated ARARs, or in the case where ARARs are not adequately protective, USEPA states a preference for Office of Drinking Water (ODW) Health Advisories (HAs), RfDs for systemic toxicants, and carcinogen potency factors (CPFs) for carcinogens (USEPA 1988). However, USEPA suggests that other criteria may be considered on the basis of the pertinence of the criteria to exposure conditions at the site and on the quality of the value.

The USEPA ODW has developed nonregulatory HAs for concentrations of noncarcinogenic contaminants in drinking water at which no adverse health effects would be expected to occur. Table 4-3 lists 1-d, 10-d, and longer-term (several months to several years) HAs for a child weighing 10 kg. These advisories have been developed as guidance values for short-term exposure situations such as spills or accidents and are not intended for use in estimating acceptable lifetime intakes (50 FR 46936). Longer-term and lifetime advisory levels for a 70-kg adult also are listed in Table 4-3.

USEPA uses the lifetime HA (for noncarcinogens only) to develop MCLs and MCLGs; HAs will most likely represent future MCL proposals. However, these values assume that 20 percent of a persons exposure to a compound is via the drinking water pathway. Therefore, if site-specific information indicates that there are no other sources of exposure to a particular compound, the lifetime HA may be increased by a factor of 5. This will be considered as site-specific exposure pathways are developed. The USEPA ODW also has determined the concentration of specific carcinogens in drinking water that will result in one excess cancer in one million people (a risk of 10^{-6}) following a lifetime exposure. Although not HAs, which are only developed for noncarcinogens, the carcinogenic values are listed in Table 4-3 as they were developed by the ODW.

USEPA also has developed other TBC guidance values in the form of RfDs and CPFs which are available through the USEPA *Integrated Risk Information System (IRIS)* (USEPA 1986b, 1989b) and the USEPA *Health Effects Assessment Summary Tables* (USEPA 1992). The information found in IRIS is continuously updated as the data are constantly undergoing USEPA review and verification. The Biomedical and Environmental Information Analysis Section at Fort McClellan receives monthly updates to the IRIS database; therefore, the most current RfDs and CPFs will be developed on a site-specific basis for Fort McClellan and submitted as such for approval of USEPA.

4.3.2.2 Location-specific ARARs

Location-specific requirements set restrictions on the concentration of hazardous substances or on the conduct of activities solely because they are in special locations. In determining the use of location-specific ARARs for selection of remedial actions at CERCLA sites, the jurisdictional prerequisites of each regulation must be investigated. Basic definitions/exemptions should be analyzed on a site-specific basis to confirm the correct applicability of the requirements. If any remedial alternatives are selected that would impact floodplains or wetland areas, the requirements found in Executive Order (EO) 11988 and EO 11990, 40 CFR 264.18(b), and §404 of CWA might be ARARs for Fort McClellan. Potential Federal location-specific ARARs are listed in Table 4-4. Identified preliminary ARARs for the State of Alabama are provided in Table 4-1.

Table 4-4. Potential Location-specific ARARs
Fort McClellan, Alabama

Standard Requirement Criteria or Limitation	Citation	Description
FEDERAL		
Resource Conservation and Recovery Act (RCRA), as amended	42 USC 6901	
RCRA Location Standards	40 CFR 264.18(b)	A TSD facility must be designed, constructed, operated, and maintained to avoid washout on a 100-year floodplain.
Fish and Wildlife Coordination Act	16 USC 661-666	This regulation requires that any federal agency that proposes to modify a body of water must consult with the U.S. Fish and Wildlife Services. This requirement is addressed under CWA Section 404 Requirements.
Floodplain Management Executive Order	Executive Order 11988; 40 CFR 6.302	Actions that are to occur in floodplain should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial value.
Endangered Species Act	16 USC 1531	Requires action to conserve endangered species or threatened species, including consultation with the Department of Interior.
Clean Water Act	33 USC Section 1251	
Dredge or Fill Requirements (Section 404)	40 CFR 230	Requires permit for discharge of dredged or fill material into aquatic environment.
Rivers and Harbors Act of 1889 (Section 10 Permit)	33 USC Section 403	Requires permit for structures or work in or affecting navigable waters.
Wilderness Act	16 USC 1311	Area must be administered in such a way as will leave it un-impaired as wilderness and will preserve it as a wilderness.
National Wildlife Refuge System	16 USC 688 50 CFR 27	Restricts activities within National Wildlife Refuges.

4.3.2.3 Action-specific ARARs

Action-specific ARARs are technology-based, establishing performance, design, or other similar action-specific controls or regulations on activities related to the management of hazardous substances or pollutants (USEPA 1988). Action-specific requirements are triggered by the particular remedial alternatives that are selected to accomplish the cleanup of hazardous wastes. An example includes Resource Conservation and Recovery Act (RCRA) incineration regulations. Potential Federal action-specific ARARs for groundwater are listed in Table 4-5. The ARARs for soil will be developed after preliminary development of remedial alternatives.

4.4 WORK PLAN APPROACH

SAIC's overall approach to investigating the RI/FS sites at Fort McClellan emphasizes the use of multiple tiers of project information. The data tiers will range from assessment of aerial photography to field screening surveys to well installation, field sampling, and hydrogeologic assessments. The combination of the multiple layers of information will result in sufficient characterization to support engineering and risk evaluations. A flow diagram for the RI project tasks is provided in Figure 4-1.

4.4.1 Remedial Investigation Overview

The search for additional historical information for the sites is an ongoing process that will continue throughout the RI/FS process. Available aerial photography for the sites, additional field reconnaissance, interviews with identified personnel with first-hand site experience, and the results of previous investigations will be utilized to formulate an initial assessment of the project sites.

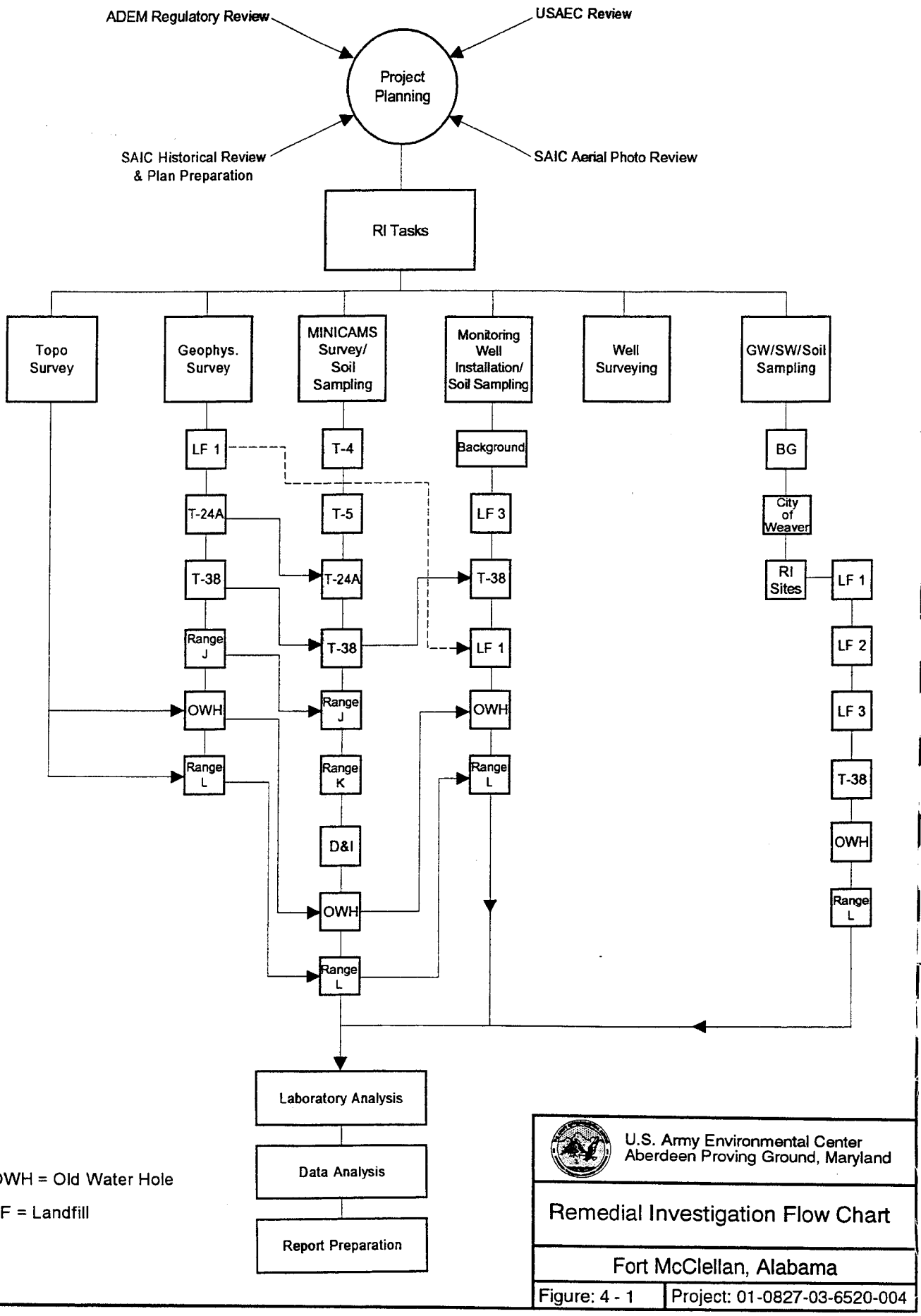
Field screening of shallow soil, sediment, surface water, and groundwater using MINICAMS detectors will provide the foundation for the RI assessment of chemical contamination at the former training areas and the munitions disposal sites. The MINICAMS instrumentation uses a flame ionization detector or a flame-photometric detector and can detect sulfur and phosphorous-bearing chemical warfare agents (CWA) and simulants in addition to other volatile organic compounds. Chemical field screening in this manner will provide broader

Table 4-5. Potential Federal Action-specific ARARs for Groundwater Fort McClellan, Alabama

Standard Requirement Criteria or Limitation	Citation	Description	Applicable or Relevant and Appropriate
FEDERAL			
Groundwater Extraction and Treatment			
Resource Conservation and Recovery Act (RCRA), as amended	42 USC Section 6901 et. seq.		
Identification of Hazardous Waste	40 CFR 261	Federal requirements for classification and identification of hazardous wastes.	Applicable.
Treatment of Hazardous Wastes in a Unit	40 CFR 264.601 40 CFR 265.400	Rules and requirements for the treatment of hazardous wastes.	Applicable.
Requirements for Generation, Storage, Transportation, and Disposal of Hazardous Waste	40 CFR 263 40 CFR 264	Regulates storage, transportation, and operation of hazardous waste generators.	Applicable.
Safe Drinking Water Act (SDWA)	42 USC Section 3001 et. seq.		
Primary Maximum Contaminant Levels (MCL)	40 CFR 142	Primary MCLs are adopted for the protection of human health but include an analysis of feasibility and cost of attainment.	Applicable.
Maximum Contaminant Level Goals (MCLG)	40 CFR 142 50 FR 46936 (November 13, 1985)	EPA has also established Maximum Contaminant Level Goals (MCLGs). The nonenforceable standards are based on health criteria. The MCLGs are goals for the nation's water supply.	Relevant and Appropriate.

Table 4-5. Potential Federal Action-specific ARARs for Groundwater Fort McClellan, Alabama (continued)

Standard Requirement Criteria or Limitation	Citation	Description	Applicable or Relevant and Appropriate
Disposal - Discharge to Surface Water/POTW			
Clean Water Act (CWA)	33 USC Section 1351-1376		
Requires use of Best Available Treatment Technology (BACT)	40 CFR 122	Use of best available technology economically achievable is required to control discharge of toxic pollutants to POTW.	Relevant and Appropriate.
National Pollutant Discharge Elimination System Permit Regulations	40 CFR 122 Subpart C	Use of best available technology economically achievable for toxic pollutants discharged to surface waters.	Relevant and Appropriate.
Discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA	40 CFR 122	Discharge must comply with EPA-approved Water Quality Management Plan.	Applicable.
Discharge must not increase contaminant concentrations in offsite surface water.	Section 121 (d)(2)(B)(iii)	Selected remedial action must establish a standard of control to maintain surface water quality.	Relevant and Appropriate.
Superfund Amendments and Reauthorization Act (SARA)	42 USC Section 9801 et. seq.	Discharge must comply with Federal Water Quality Criteria.	Applicable.


ADEM Regulatory Review
USAEC Review
Project Planning
SAIC Historical Review & Plan Preparation
SAIC Aerial Photo Review
RI Tasks
Topo Survey
Geophys. Survey
MINICAMS Survey/ Soil Sampling
Monitoring Well Installation/ Soil Sampling
Well Surveying
GW/SW/Soil Sampling
LF 1
T-24A
T-38
Range J
OWH
Range L
T-4
T-5
T-24A
T-38
Range J
Range K
D&I
OWH
Range L
Background
LF 3
T-38
LF 1
OWH
Range L
BG
City of Weaver
RI Sites
LF 1
LF 2
LF 3
T-38
OWH
Range L
Laboratory Analysis
Data Analysis
Report Preparation
OWH = Old Water Hole
LF = Landfill
U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
Remedial Investigation Flow Chart
Fort McClellan, Alabama
Figure: 4 - 1
Project: 01-0827-03-6520-004

site coverage and can be used to locate areas where more intensive subsurface sampling may be warranted. Additional field screening will be accomplished using geophysical methods to characterize source areas particularly at sites T-38, Old Water Hole, and Range L.

Intrusive sampling and monitoring well installation will be conducted in areas that are identified during the field screening process, in areas where potential groundwater contamination is suspected, and in areas that warrant additional hydrogeologic characterization. These areas presently include T-38, Old Water Hole, Range L, and Former Landfills #2 and #3. Monitoring well installation at Former Landfill #1 will be installed only in the event that further geophysical surveying and assessment of historical aerial photographs indicate the presence of a former landfill. Intrusive sampling will include collection of subsurface soil and groundwater samples. Surface water and sediment samples will be collected at influent and effluent points at each site that is impacted by surface streams. A minimum of two groundwater sampling rounds will be conducted for the project. Intrusive sampling will not be conducted within suspected landfill or munitions disposal sites (Range L, Old Water Hole) but will concentrate around the known periphery of the sites. U.S. Army Technical Escort Unit (USATEU) sampling will be conducted within identified burial pit locations (excluding Range L and Old Water Hole) at areas T-24A, Range J, and the Detection and Identification Area.

Hydrogeologic assessment of the RI/FS sites will be accomplished through measurement of water levels in monitoring wells and slug testing for aquifer properties. Groundwater elevations will be obtained on a monthly basis at all installed well locations surrounding the RI/FS sites. Hydrogeologic assessments are not planned at areas T-4, T-5, T-24A, Range K, and the Detection and Identification Area because of the predominantly surface usage of the sites and the absence of detected subsurface contamination from previous sampling. The need for groundwater assessments at the sites with a history of subsurface burial (Area T-24A, D&I Area) will be reevaluated based on the results of test pit excavations at these sites.

Chemical assessment of the RI/FS sites will be accomplished through field screening and laboratory analysis of soil and water media. A summary of the field and laboratory analyses to be conducted during the Fort McClellan RI/FS is provided in section 5.2.3.

4.4.2 Risk Assessment Overview

Chemical and physical data regarding the nature and extent of site contamination and the distribution of buried munitions will be integrated for risk assessment and engineering evaluations. Ecological risk assessment will be ongoing during the RI using data collected by the Fort McClellan Natural Resources office, field observations and measurements obtained during the RI, and information pertinent to the identification and delineation of ecologically sensitive areas on Fort McClellan and Pelham Range (ie wetlands delineation maps).

The objectives of the baseline public health risk assessment will be to evaluate the potential risks of adverse health effects and to determine the need for site remediation. Three exposure scenarios will be developed as the basis of the baseline risk assessment: residential (future land use only), trespasser-recreational (current land use), and occupational (current land use) scenarios. Each of these exposure scenarios will be defined by a set of exposure pathways. Each of the exposure pathways will be characterized by a set of assumptions for evaluating "most likely" and "upper-bound" risks of noncarcinogenic and carcinogenic effects, in adult receptors and children. The baseline risk assessment will in this manner avoid reporting overly simplistic single point estimates and will thus provide more flexibility for interpretation of the results.

A summary of some of the anticipated features of the risk assessment includes:

- Human health risk results will be presented separately for noncancer and carcinogenic effects.
- For noncarcinogens, Hazard Quotients (HQ) will be developed to estimate the potential for adverse noncancer effects. For potentially carcinogenic chemicals (EPA Weight-of-Evidence Classes A, B, and C) estimates of excess lifetime cancer risk will be developed.
- Combined risk estimates across chemicals, for a given exposure pathway, will be derived assuming additivity of effect in the absence of data or synergism or antagonism. A Hazard Index (HI) will be derived for noncarcinogenic effects and a combined excess lifetime cancer risk estimate will be determined for carcinogenic chemicals.
- The HI scores and the estimates of cancer risk for a given exposure pathway will be based on "most likely (MLE)" and "reasonable maximum exposure (RME)" assumptions.

- Final MLE and RME risk estimates will be calculated for adults and children, for noncarcinogenic and carcinogenic effects, for each exposure scenario, by combining respective MLE and RME risk estimates across all relevant exposure pathways (e.g., soil contact, ingestion of water, inhalation exposure).
- Lead exposures will be characterized by estimating blood lead uptake in children. For adults, the soil lead exposure point concentrations (EPCs) will be compared to USEPA soil lead guidelines (USEPA 1991f).
- The results of ecological surveys conducted by Fort McClellan to characterize the ecological communities will be evaluated. Analysis of effects will be by means of comparison to communities in reference areas not impacted by releases from the sites.
- If appropriate, preliminary remediation goals (PRGs) for soil will be developed. The PRGs are concentrations for each substance in soil below which USEPA targets are not exceeded as defined by the risk assessment. PRGs are useful tools for use in preliminary risk management of Fort McClellan.

4.4.3 Feasibility Study Overview

The Feasibility Study (FS) will consist of evaluating the data generated during the RI to develop an appropriate range of waste management options that ensure protection of human health and the environment by:

- Complete removal or destruction of hazardous substances at the site,
- The reduction of hazardous substance concentrations to acceptable health-based levels,
- Prevention of exposure to the hazardous substances through engineering controls,
- or, a combination of the above.

The approach for conducting the FS will consist of six tasks:

- Development of the remedial action objectives specifying the contaminants and the media of interest, exposure pathways, and preliminary remediation goals (PRGs) that permit a range of treatment and containment alternatives for evaluation.
- Development of the general response actions for each medium of interest to satisfy the remedial action objectives for the site. Typical general response actions include containment, treatment, excavation, and pumping, singly or in combination.

- Identify the volumes or areas of media to which the general response actions apply, taking into account the protectiveness identified in the remedial action objectives and the characterization of the site.
- Identify and screen technologies and process options applicable to each general response action.
- Assemble selected technologies and process options into alternatives representing a range of treatment and containment combinations.
- Perform a detailed evaluation of the alternatives to provide a comparison of the alternatives.