Final

Site Investigation Report
Former Rifle/Machine Gun Range, Parcel 99Q

Fort McClellan
Calhoun County, Alabama

Prepared for:

U.S. Army Corps of Engineers, Mobile District
109 St. Joseph Street
Mobile, Alabama 36602

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Task Order CK10
Contract No. DACA21-96-D-0018
IT Project No. 796887

March 2003

Revision 0

Table of Contents

Page

Table of Contents *(Continued)*

Page

List of Appendices

List of Tables

List of Figures

Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK10, IT Corporation completed a site investigation (SI) at the Former Rifle/Machine Gun Range, Parcel 99Q, at Fort McClellan in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site and, if present, whether the concentrations pose an unacceptable risk to human health or the environment. The SI at the Former Rifle/Machine Gun Range, Parcel 99Q, consisted of the sampling and analysis of thirteen surface soil samples, thirteen subsurface soil samples, and one groundwater sample. One permanent monitoring well was also installed at the site to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Former Rifle/Machine Gun Range, Parcel 99Q, indicates that metals, volatile organic compounds (VOC), and one pesticide were detected in site media. Semivolatile organic compounds, herbicides, and explosives were not detected in any of the samples collected at the site. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan.

Although the site is projected for passive recreation reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for unrestricted land reuse. VOC concentrations in site media were below SSSLs. Chemicals of potential concern were limited to aluminum (subsurface soil), iron (subsurface soil), thallium (groundwater), and the chlorinated pesticide beta-BHC (groundwater). Although aluminum and iron exceeded their respective SSSLs and upper background ranges in one subsurface soil sample each, these metals are present at levels within the same order of magnitude as background and are common elements in native soils whose concentrations vary over a wide range. In groundwater, thallium exceeded its SSSL and upper background range in the one groundwater sample collected. However, the thallium result was flagged with a "B" data qualifier, indicating that the metal was detected in an associated laboratory method blank sample. The elevated metals results most likely reflect either a laboratory artifact (thallium) or variation in naturally occurring levels (aluminum and iron).

The chlorinated pesticide beta-BHC was detected in the groundwater sample at a concentration (0.000062 milligrams per liter [mg/L]) marginally exceeding its SSSL (0.000036 mg/L). However, the beta-BHC result was flagged with a "J" data qualifier indicating that the compound was detected at an estimated concentration below the laboratory reporting limit. Although a U.S.

Environmental Protection Agency drinking water standard (maximum contaminant level [MCL]) does not exist for beta-BHC, the pesticide's concentration was below the MCL of 0.0002 mg/L for gamma-BHC (lindane), a structurally similar isomer. Given the uncertainty associated with the analytical result (an estimated concentration below the reporting limit) and the small amount by which it exceeded its SSSL, beta-BHC is not expected to pose a threat to human health.

No chemicals of potential ecological concern were identified at the Former Rifle/Machine Gun Range, Parcel 99Q.

Based on the results of the SI, past operations at the Former Rifle/Machine Gun Range, Parcel 99Q, do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT Corporation recommends "No Further Action" and unrestricted land reuse with regard to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related hazardous substances at the Former Rifle/Machine Gun Range, Parcel 99Q.

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC), located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE)-Mobile District. The USACE contracted IT Corporation (IT) to perform the site investigation (SI) at the Former Rifle/Machine Gun Range, Parcel 99Q, under Contract Number DACA21-96-D-0018, Task Order CK10.

This report presents specific information and results compiled from the SI, including field sampling and analysis and monitoring well installation activities conducted at the Former Rifle/Machine Gun Range, Parcel 99Q.

1.1 Project Description

The Former Rifle/Machine Gun Range, Parcel 99Q, was identified as an area to be investigated prior to property transfer. The site was classified as a Category 1 Qualified parcel in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 1 Qualified parcels are areas that have no evidence of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related hazardous substance or petroleum product storage, release, or disposal but that do have other environmental or safety concerns. Parcel 99Q was qualified because chemicals of potential concern may be present as a result of historical range activities.

A site-specific field sampling plan (SFSP) (IT, 2001) and a site-specific safety and health plan (SSHP) were finalized in December 2001. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Former Rifle/Machine Gun Range, Parcel 99Q. The SFSP and the SSHP were used as attachments to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a; IT, 2002). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect thirteen surface soil samples, thirteen subsurface soil samples, and one groundwater sample to determine whether potential site-specific chemicals are present at the site.

1.2 Purpose and Objectives

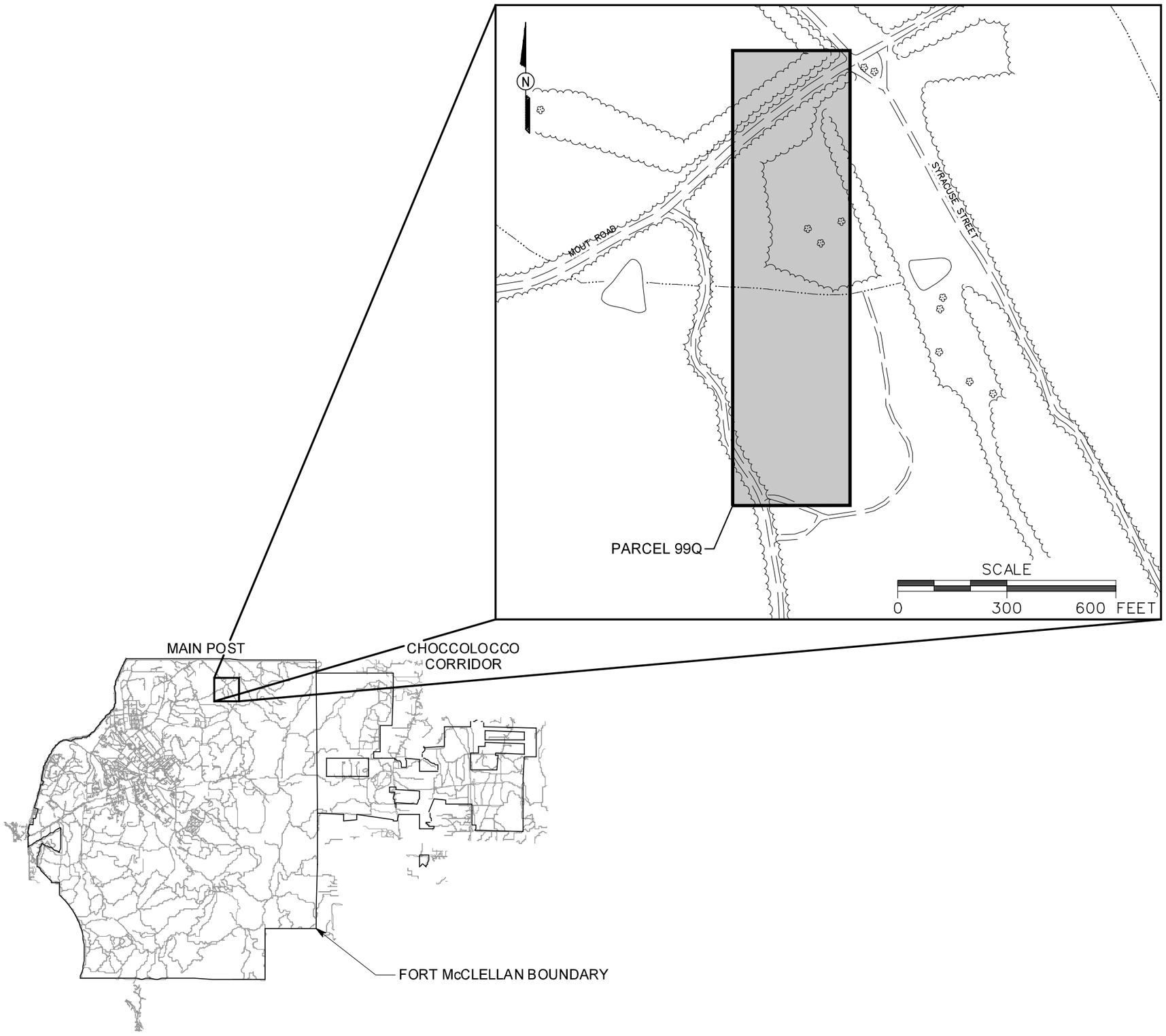
The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at the Former Rifle/Machine Gun Range, Parcel 99Q, at concentrations that pose an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs and ESVs are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BRAC Cleanup Team will decide either to propose "No Further Action" or to conduct additional work at the site.

1.3 Site Description and History

The Former Rifle/Machine Gun Range, Parcel 99Q, is located in the north-central portion of the Main Post at FTMC (Figure 1-1). According to the EBS, the Former Rifle/Machine Gun Range, Parcel 99Q is one of seven former rifle/machine gun ranges identified in the northern Main Post (ESE, 1998). Parcel 99Q is approximately 300 feet wide and 1,200 feet in length, and covers approximately 9 acres (Figure 1-2).

Dates of operation and types of ordnance fired are unknown. However, it is assumed that small arms were used at this range. Former Rifle/Machine Gun Range, Parcel 99Q, is shown on Plate 5 (World War II to 1950 Range Use), Plate 6 (1950 to 1973 Range Use) and Plate 10 (Cumulative Maps of All Range) of the *Archives Search Report, Maps, Fort McClellan, Anniston, Alabama* (ASR) (USACE, 2001). The ASR indicates that the range appears on a 1949 aerial photograph, but that by 1958 the range was abandoned. The area is also visible on a 1940 Environmental Photographic Interpretation Center photograph.



LEGEND

- UNIMPROVED ROADS AND PARKING
- TREES / TREELINE
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK

FIGURE 1-1
SITE LOCATION MAP
FORMER RIFLE/MACHINE GUN RANGE
PARCEL 99Q

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
A Member of The IT Group

DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
INITIATOR: D. ALLAN
PROJ. MGR.: J. YACOUB
DWG. NO.: ...\796887es.461
PROJ. NO.: 796887
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 05/23/02
DRAWN BY: D. BOMAR
05/23/02 09:50:38 AM
DBILLING
c:\cadd\design\796887es.461

DWG. NO.: ...\796887es.462 | PROJ. NO.: 796887
INITIATOR: D. ALLAN | PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY: | ENGR. CHCK. BY: S. MORAN
DATE LAST REV.: | DRAWN BY:
STARTING DATE: 05/23/02 | DRAWN BY: D. BOMAR
09/09/02 10:32:35 AM
dbomar
c:\cadd\design\796887es.462

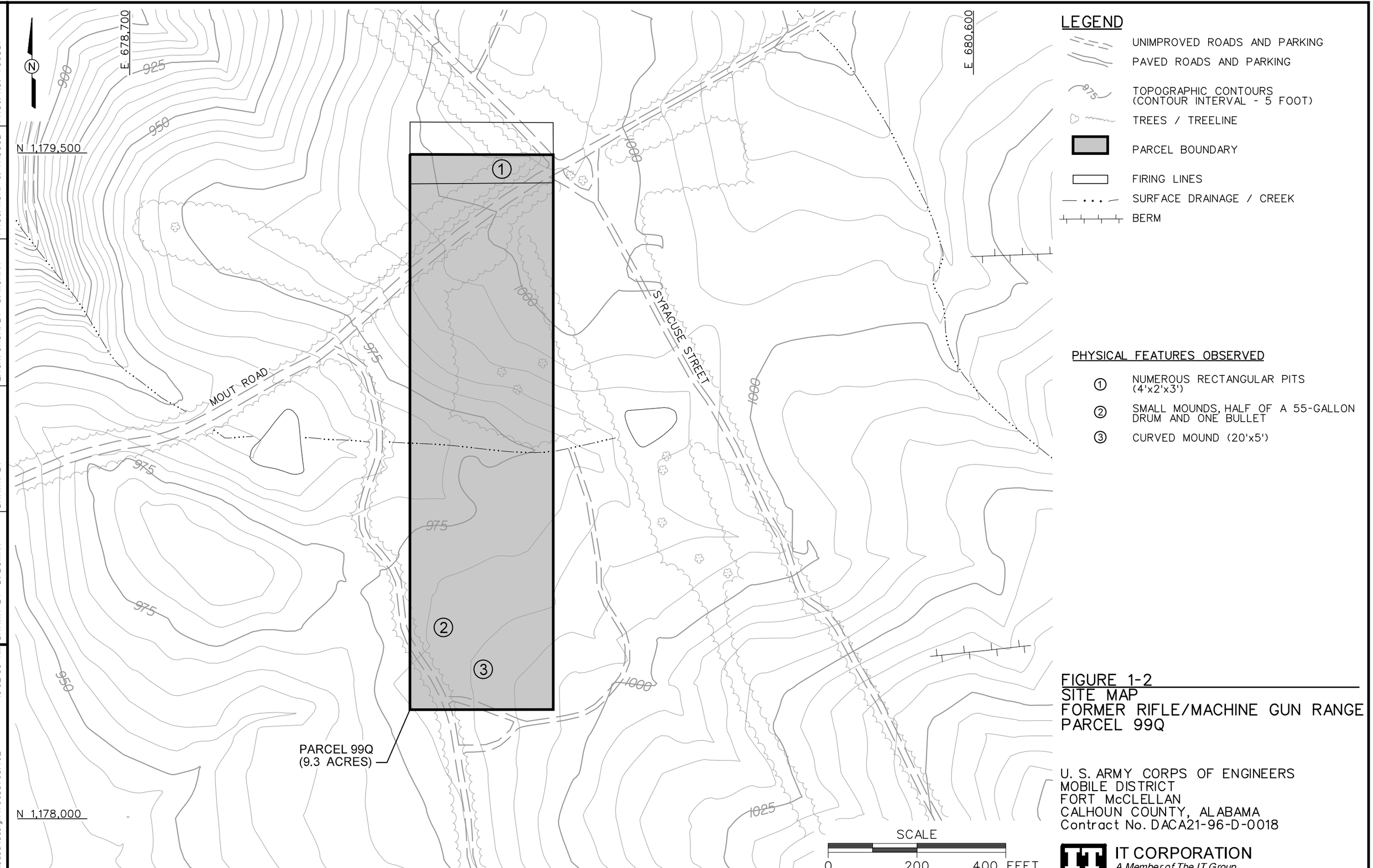


FIGURE 1-2
SITE MAP
FORMER RIFLE/MACHINE GUN RANGE
PARCEL 99Q

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
A Member of The IT Group

During site walks conducted by IT personnel in November 2001, several features were observed. In the north-central portion of the parcel, north of MOUT Road, there were numerous rectangular pits (4 feet, by 2 feet, by 3 feet deep). In the southwestern portion of the parcel, small mounds, half of a 55-gallon drum and one bullet fragment were found. In addition, a curved mound, approximately 20 feet long and 5 feet wide, was observed in the south-central portion of the site.

2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

For non-CERCLA environmental or safety issues, the parcel label includes the following components: a unique non-CERCLA issue number; the letter "Q" designating the parcel as a Community Environmental Response Facilitation Act (CERFA) Category 1 Qualified parcel; and the code of the specific non-CERCLA issue(s) present (ESE, 1998). The non-CERCLA issue codes used are:

- A = Asbestos (in buildings)
- L = Lead-based paint (in buildings)
- P = Polychlorinated biphenyls
- R = Radon (in buildings)
- RD = Radionuclides/radiological issues

- X = Unexploded ordnance (UXO)
- CWM = Chemical warfare material.

The EBS was conducted in accordance with CERFA protocols (Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region 4, and Calhoun County, as well as a database search of CERCLA-regulated substances, petroleum products; and Resource Conservation and Recovery Act-regulated facilities. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

The Former Rifle/Machine Gun Range, Parcel 99Q is an area where no known or recorded storage, release, or disposal (including migration) has occurred on site property. The parcel, however, was qualified because chemicals of potential concern may be present as a result of range activities. Therefore, the Former Rifle/Machine Gun Range, Parcel 99Q, required additional evaluation to determine its environmental condition.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the Former Rifle/Machine Gun Range, Parcel 99Q, including UXO avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO Avoidance

UXO avoidance was performed at the Former Rifle/Machine Gun Range, Parcel 99Q, following methodology outlined in the SAP. IT UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the site was cleared for access, sample locations were monitored by UXO personnel following procedures outlined in the SAP.

3.2 Environmental Sampling

Environmental sampling performed during the SI at the Former Rifle/Machine Gun Range, Parcel 99Q, included the collection of surface soil samples, subsurface soil samples, and one groundwater sample for chemical analysis. Sample locations were determined by observing site physical characteristics during a site walk and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

3.2.1 Surface Soil Sampling

Surface soil samples were collected from thirteen locations at the Former Rifle/Machine Gun Range, Parcel 99Q, as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface soil samples were collected from the uppermost foot of soil using a stainless-steel hand auger, following the methodology specified in the SAP. Surface soil samples were collected by first removing surface debris (e.g., rocks and vegetation) from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with procedures outlined in the SAP. As necessary, the soil fraction for volatile organic compound (VOC) analysis was collected directly from the sampler using three EnCore® samplers. The remaining soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers.

Table 3-1

Sampling Locations and Rationale
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-99Q-GP01	Surface soil and subsurface soil	Surface and subsurface soil samples were collected near the northwest corner of Parcel 99Q in the firing line area to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP02	Surface soil and subsurface soil	Surface and subsurface soil samples were collected near the northeast corner of Parcel 99Q, in the vicinity of pits in the firing line area to determine if contaminant releases into the environment have from use of this area.
HR-99Q-GP03	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the north-central section of Parcel 99Q, approximately 200 feet south of MOUT Road, to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP04	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the western-central portion of Parcel 99Q to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP05	Surface soil and subsurface soil	Surface and subsurface soil samples were collected near the center of Parcel 99Q to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP06	Surface soil and subsurface soil	Surface and subsurface soil samples were collected near the eastern border of Parcel 99Q to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP07	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the central area of Parcel 99Q to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP08	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the southwestern portion of Parcel 99Q, downslope of mounds and a 55-gallon drum, to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP09	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the southeastern portion of Parcel 99Q, downslope of a curved mound, to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP10	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the southwestern corner of Parcel 99Q, downslope of a curved mound, to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-GP11	Surface soil and subsurface soil	Surface and subsurface soil samples were collected upslope of the curved mound located in the southern portion of Parcel 99Q to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-MW01	Surface soil and subsurface soil	Surface and subsurface soil samples were collected in the north-central section of Parcel 99Q, south of MOUT Road to determine if contaminant releases into the environment have occurred from use of this area.
HR-99Q-MW02	Surface soil, subsurface soil and groundwater	Surface soil, subsurface soil, and groundwater samples were collected in the south-central portion of Parcel 99Q, downgradient of the mounds and 55-gallon drum in the southern portion of the parcel, to determine if contaminant releases into the environment have occurred from use of this area.

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- PARCEL BOUNDARY
- FIRING LINES
- SURFACE DRAINAGE / CREEK
- BERM
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- MONITORING WELL / GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

PHYSICAL FEATURES OBSERVED

1. NUMEROUS RECTANGULAR PITS (4'x2'x3')
2. SMALL MOUNDS, HALF OF A 55-GALLON DRUM AND ONE BULLET
3. CURVED MOUND (20'x5')

SCALE
0 200 400 FEET

FIGURE 3-1
SAMPLE LOCATION MAP
FORMER RIFLE/MACHINE GUN RANGE
PARCEL 99Q

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
A Member of The IT Group

DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
PROJ. MGR.: J. YACOUB
INITIATOR: D. ALLAN
DWG. NO.: ...\796887es.463
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 05/23/02
DRAWN BY: D. BOMAR
PROJ. NO.: 796887
09/09/02 10:38:32 AM
dbomar
c:\cadd\design\796887es.463

Table 3-2

Soil Sample Designations and Analytical Parameters
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft)	QA/QC Samples		Analytical Parameters
			Field Duplicates	MS/MSD	
HR-99Q-GP01	HR-99Q-GP01-SS-PH0001-REG	0-1		HR-99Q-GP01-SS-PH0001-MS/MSD	Metals and Explosives
	HR-99Q-GP01-DS-PH0002-REG	3-3.5			
HR-99Q-GP02	HR-99Q-GP02-SS-PH0003-REG	0-1			Metals and Explosives
	HR-99Q-GP02-DS-PH0004-REG	1-2			
HR-99Q-GP03	HR-99Q-GP03-SS-PH0005-REG	0-1			Metals and Explosives
	HR-99Q-GP03-DS-PH0006-REG	3-4			
HR-99Q-GP04	HR-99Q-GP04-SS-PH0007-REG	0-1			Metals and Explosives
	HR-99Q-GP04-DS-PH0008-REG	3-4			
HR-99Q-GP05	HR-99Q-GP05-SS-PH0009-REG	0-1			Metals and Explosives
	HR-99Q-GP05-DS-PH0010-REG	3-4			
HR-99Q-GP06	HR-99Q-GP06-SS-PH0011-REG	0-1			Metals and Explosives
	HR-99Q-GP06-DS-PH0012-REG	3-4			
HR-99Q-GP07	HR-99Q-GP07-SS-PH0013-REG	0-1			Metals and Explosives
	HR-99Q-GP07-DS-PH0014-REG	3-4			
HR-99Q-GP08	HR-99Q-GP08-SS-PH0015-REG	0-1			Metals and Explosives
	HR-99Q-GP08-DS-PH0016-REG	2-3			
HR-99Q-GP09	HR-99Q-GP09-SS-PH0017-REG	0-1			Metals and Explosives
	HR-99Q-GP09-DS-PH0018-REG	3-4			
HR-99Q-GP10	HR-99Q-GP10-SS-PH0019-REG	0-1			Metals and Explosives
	HR-99Q-GP10-DS-PH0020-REG	3-4			
HR-99Q-GP11	HR-99Q-GP11-SS-PH0021-REG	0-1			Metals and Explosives
	HR-99Q-GP11-DS-PH0022-REG	2-3			
HR-99Q-MW01	HR-99Q-MW01-SS-PH0023-REG	0-1	HR-99Q-MW01-SS-PH0024-FD		Metals, VOCs, SVOCs, Explosives, Pesticides, and Herbicides
	HR-99Q-MW01-DS-PH0025-REG	3-4			
HR-99Q-MW02	HR-99Q-MW02-SS-PH0026-REG	0-1	HR-99Q-MW02-SS-PH0027-FD		Metals, VOCs, SVOCs, Explosives, Pesticides, and Herbicides
	HR-99Q-MW02-DS-PH0028-REG	2-3			

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from thirteen soil borings at the Former Rifle/Machine Gun Range, Parcel 99Q, as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than one foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using a stainless-steel hand auger following procedures specified in the SAP. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously to 4 feet bgs or until hand-auger refusal was encountered. Samples were field screened using a PID to measure volatile organic vapors. The portion of the boring displaying the highest PID reading was sent to the laboratory for analysis; at locations where PID readings were equal to background levels, the volatile samples were taken from the deepest section of the boring. As necessary, the soil fraction for VOC analysis was collected directly from the sampler using three EnCore® samplers. The remaining soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring. The boring logs are included in Appendix B. At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in the SAP.

3.2.3 Monitoring Well Installation

One permanent monitoring well was installed in the saturated zone at the Former Rifle/Machine Gun Range, Parcel 99Q, to collect a groundwater sample for laboratory analysis. The well location is shown on Figure 3-1. IT attempted to install a second proposed monitoring well (HR-99Q-MW01) using hollow-stem auger and air-rotary drilling techniques. However, groundwater was not encountered within a depth of 100 feet bgs. Therefore, a decision was made not to install the well. Table 3-3 summarizes construction details of the monitoring well installed at the site. The well construction log is included in Appendix B.

Table 3-3

Monitoring Well Construction Summary
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Well Location	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)	Well Material
HR-99Q-MW02	1178600.56	679466.16	983.67	985.81	70	20	50 - 70	2" ID Sch. 40 PVC

Permanent well installed using hollow-stem auger.
Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983 (NAD83).
Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
2" ID Sch. 40 PVC - 2-inch inside diameter, Schedule 40, polyvinyl chloride.
amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet.
TOC - Top of casing.

IT contracted Miller Drilling Company to install the permanent well using a hollow-stem auger rig at one of the hand-auger soil boring locations (HR-99Q-MW02). The well was installed following procedures outlined in the SAP. The borehole was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augured to the completion depth of the hand auger boring, and soil samples were collected at that depth to the bottom of the borehole. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. The samples were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. The boring log is included in AppendixB.

Upon reaching the target depth in the auger borehole, a 20-foot length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a PVC end cap was placed through the auger to the bottom of the borehole. The screen and end cap were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A filter pack consisting of Number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 5 feet above the top of the well screen as the augers were removed. The filter pack also included a 5-foot layer of extra fine filter sand (sieve size 30 to 60). A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the filter pack and hydrated with potable water. The bentonite seal placement and hydration followed procedures in the SAP. Bentonite-cement grout was tremied into the remaining annular space of the well from the top of the bentonite seal to the ground surface. A locking protective steel casing was placed over the PVC well riser and a concrete pad was constructed around the well. Four protective steel posts were installed around the well pad. A locking well cap was placed on the PVC well riser.

The monitoring well was developed by surging and pumping with a submersible pump in accordance with methodology outlined in the SAP. The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to re-establish the natural hydraulic flow conditions. Development continued for a minimum of 8 hours. The well development log is included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in the permanent well at the site on July 26, 2002, following procedures outlined in the SAP. Depth to groundwater was measured with an electronic water-level meter. The meter probe and cable were cleaned before use following decontamination methodology presented in the SAP. The measurement was referenced to the top of the PVC well casing, as summarized in Table 3-4.

3.2.5 Groundwater Sampling

A groundwater sample was collected from the monitoring well installed at the Former Rifle/Machine Gun Range, Parcel 99Q. The well/groundwater sample location is shown on Figure 3-1. The groundwater sampling location and rationale are listed in Table 3-1. The groundwater sample designation and analytical parameters are listed in Table 3-5.

Sample Collection. The groundwater sample was collected using a bladder pump equipped with Teflon™ tubing, following the procedures outlined in the SAP. Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Field parameters were measured using a calibrated water-quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The sample was analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system and conventional civil survey techniques described in the SAP. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Former Rifle/Machine Gun Range, Parcel 99Q, were analyzed for the following parameters:

Table 3-4

Groundwater Elevations
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
HR-99Q-MW02	26-Jul-02	67.59	985.81	983.67	918.22

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).
BTOC - Below top of casing.
ft - Feet.
amsl - Above mean sea level.

Table 3-5

Groundwater Sample Designations and Analytical Parameters
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples		Analytical Parameters
		Field Duplicates	MS/MSD	
HR-99Q-MW02	HR-99Q-MW02-GW-PH3002-REG	HR-99Q-MW02-GW-PH3003-FD		Metals, VOCs, SVOCs, Explosives, Pesticides, and Herbicides

*Groundwater sample was collected from the approximate midpoint of the saturated screened interval of the monitoring well.

FD - Field duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Table 3-6

Groundwater Field Parameters
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Date	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
HR-99Q-MW02	21-May-02	0.265	5.65	142	16.09	10	8.18

°C - Degrees Celsius.
mg/L - Milligrams per liter.
mS/cm - Millisiemens per centimeter.
mV - Millivolts.
NTU - Nephelometric turbidity units.
ORP - Oxidation-reduction potential.
SU - Standard units.

- Target analyte list metals – EPA Method 6010B/7000
- Nitroaromatic/nitramine explosives – EPA Method 8330.

In addition, a minimum of ten percent of the samples were analyzed for the following additional parameters:

- Target compound list (TCL) VOCs – EPA Method 8260B
- TCL semivolatile organic compounds (SVOC) – EPA Method 8270C
- Chlorinated herbicides – EPA Method 8151A
- Chlorinated pesticides – EPA Method 8081A
- Organophosphorous pesticides – EPA Method 8141A.

The samples were analyzed using EPA SW-846 methods, including Update III methods where applicable.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in the SAP. Sample documentation and chain-of-custody records were completed as specified in the SAP.

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in the SAP. The IDW generated during the SI at the Former Rifle/Machine Gun Range, Parcel 99Q, was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment.

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analysis. Based on the results, drill cuttings, spent well materials, and personal protective equipment generated during the SI were disposed as nonregulated waste at the Three Corners Landfill in Piedmont, Alabama.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

One variance to the SFSP was recorded during completion of the SI at the Former Rifle/Machine Gun Range, Parcel 99Q, as summarized in Table 3-7. The variance did not alter the intent of the investigation or the sampling rationale presented in the SFSP (IT, 2001). The variance report is presented in Appendix E.

No nonconformances were recorded during completion of the SI at the Former Rifle/Machine Gun Range, Parcel 99Q.

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix F. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan, the FTMC SAP and quality assurance plan, and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data presented in the SAP. Chemical data were reported by the laboratory via hard-copy data packages using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in a quality assurance report, which includes the data validation summary report (Appendix G). Selected results were qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System database for tracking and reporting. The qualified data were used in comparisons to the SSSLs and ESVs developed by IT. Rejected data (assigned an "R" qualifier) were not used in the comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

Table 3-7

Variance to the Site-Specific Field Sampling Plan
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Variance to the SFSP	Justification for variance	Impact to Site Investigation
Monitoring well HR-99Q-MW01 was not installed and a groundwater sample was not collected.	The monitoring well was not installed because competent bedrock was encountered, but groundwater was not encountered before reaching a depth of 100 feet bgs. It was decided to drill into the bedrock for groundwater. The decision to stop drilling was based upon the fact that the likelihood of lead contamination being present in groundwater at depths greater than 100 feet bgs was extremely minimal.	None. The likelihood of contamination at a depth of 100 feet bgs is very low. Also, groundwater data from HR-99Q-MW02 were used to characterize the groundwater at the site.

SFSP - Site-specific field sampling plan.

4.0 Site Characterization

Subsurface investigations performed at the Former Rifle/Machine Gun Range, Parcel 99Q, provided soil, geologic, and groundwater data used to characterize the geology and hydrogeology of the site.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces: the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies 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, with major structures and faults striking in a northeast-southwest direction.

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 lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992) and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984), but in Calhoun County it is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated

greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately one mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in

Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne, et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert towards the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. 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. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty clay, shale, and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray, argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geological feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault 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). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation; north by the Conasauga Formation; northeast, east, and southwest by the Shady Dolomite; and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham Range is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults

along the western boundary of the FTMC window and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 5 to 20 miles wide and approximately 90 miles in length) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

The soils at the Former Rifle/Machine Gun Range, Parcel 99Q, fall into the Anniston and Allen gravelly loams unit. This mapping unit consists of friable soils that have developed in old alluvium on foot slopes and along the base of mountains. The color of the surface soil ranges from very dark brown and dark brown to reddish brown and dark reddish brown. The texture of subsoil ranges from light clay loam to clay or silty clay loam. The alluvium ranges in thickness from 2 feet to more than 8 feet. Infiltration and runoff are medium, permeability is moderate, and the capacity for available moisture is high. Organic matter is moderately low. Some severely eroded areas may be common on the surface, as well as a few shallow gullies (U.S. Department of Agriculture, 1961).

Bedrock in the area of the Former Rifle/Machine Gun Range, Parcel 99Q is mapped as the Cambrian Shady Dolomite (Osborne et al., 1997) (Figure 4-1). This unit is a bluish gray or pale yellowish gray thick bedded sandy dolomitic limestone or siliceous dolomite, characterized by coarsely crystalline porous chert (Moser and DeJarnette, 1992).

The residuum encountered during drilling activities at the Former Rifle/Machine Gun Range, Parcel 99Q, was a light brown to yellowish orange to olive-gray clay with some sand and varying amounts of silt and quartz-rich gravel. At HR-99Q-MW01, hollow-stem auger refusal was encountered at 28 feet bgs on white to gray to black, coarse grained, poorly cemented, weathered, highly oxidized, quartz-rich sandstone. The boring was continued using an air-rotary drill rig to a depth of 100 feet where it was terminated without encountering groundwater. The lithology from 28 to 100 feet bgs was similar to the rock which auger refusal had occurred on, some of the cuttings are described as quartzite. At HR-99Q-MW02 gray, weathered sandstone with calcite cement was encountered at approximately 60 feet bgs. Auger refusal was encountered on more competent sandstone with calcite cement at 70 feet bgs.

From the lithological descriptions during boring activities, it is more likely that the rock being drilled through is part of the Cambrian Chilhowee Group rather than the Cambrian Shady Dolomite as mapped (Osborne et al 1997) (Figure 4-1). The Chilhowee group consists of the

676000
678000
680000
1180000
1178000

Parcel 99Q

€c
€ch
€s
Qal

Geologic Features shown in approximate location.

Source: Osborne, W.E., et al, 1997,
Calhoun County, Alabama, Geological Survey of Alabama.

KNOXGIS\GISdata\ftmc\gisworkarea\jbond\apr\p99q_geology.apr\p99q_geology

Figure 4-1

Site Geologic Map

Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Alabama

Legend

- Parcel Boundary
- Buildings
- Surface Water Features (may be ephemeral)
- Roads
- Streams (dashed where intermittent)

Geology

- Qal — Quaternary - alluvium
- €c — Cambrian - Conasauga
- €s — Cambrian - Shady Dolomite
- €ch — Cambrian - Chilhowee Group, undifferentiated
- Fault (dashed where inferred; barbs on upper plate)

400 0 400 Feet

NAD83 State Plane Coordinates

N

U.S. Army Corps
of Engineers
Mobile District

IT CORPORATION
A Member of The IT Group

Contract No. DACA21-96-D-0018

Cochran Formation, Nichols Formation, and Weisner and Wilson Ridge Formations, undifferented. The rock encountered is probably part of the Weisner and Wilson Ridge Formations, undifferented, which are composed of interbedded quartzose to slightly feldspathic sandstone and laterally continuous conglomerate in ledge-forming units separated by greenish gray silty mudstone (Moser and DeJarnette, 1992).

4.2 Site Hydrology

4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

Elevation of the Former Rifle/Machine Gun Range, Parcel 99Q, ranges from approximately 970 to 1,005 feet above mean sea level. Surface water runoff in the area of Parcel 99Q flows to the southwest and northwest towards an intermittent creek, which flows to the west bisecting the parcel, and then to the northwest after leaving parcel 99Q.

4.2.2 Hydrogeology

During soil boring and monitoring well installation activities, groundwater was encountered at only one borehole at a depth of 70 feet bgs (Appendix B). In the northern portion of the parcel, a boring was advanced to a depth of 100 feet bgs without encountering groundwater. Because of the limited water level data, the groundwater flow direction at the site is unable to be determined. However, based on water level data from other monitoring wells in the vicinity of Parcel 99Q, groundwater is influenced by topography and flows generally to the northwest in the area of Parcel 99Q.

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Former Rifle/Machine Gun Range, Parcel 99Q, indicate that metals, VOCs, and one pesticide were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metals concentrations are within natural background concentrations (SAIC, 1998). Summary statistics for background metals samples collected at FTMC are included in Appendix H.

The following sections and Tables 5-1 through 5-3 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix F.

5.1 Surface Soil Analytical Results

Thirteen surface soil samples were collected for chemical analysis at the Former Rifle/Machine Gun Range, Parcel 99Q. Surface soil samples were collected from the upper 1-foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values, as presented in Table 5-1.

Metals. Nineteen metals were detected in surface soil samples collected at the site. The concentrations of four metals (aluminum, arsenic, iron, and manganese) exceeded SSSLs, but were below their respective background concentrations.

The concentrations of six metals (aluminum, chromium, iron, manganese, mercury and vanadium) exceeded ESVs, but were below their respective background concentrations except for mercury in one sample. The mercury result, however, was within its upper background range (Appendix H). It should be noted that upper background range values are provided as additional information for risk managers.

Table 5-1

Surface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location						HR-99Q-GP01						HR-99Q-GP02						HR-99Q-GP03					
Sample Number						PH0001						PH0003						PH0005					
Sample Date						4-Mar-02						4-Mar-02						4-Mar-02					
Sample Depth (Feet)						0- 1						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																							
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	1.36E+04				YES	YES	1.28E+04				YES	YES	9.67E+03				YES	YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	4.20E+00				YES		3.30E+00				YES		2.15E+00				YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	6.35E+01						4.59E+01						2.34E+01					
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	ND						ND						ND					
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	4.01E+02						1.75E+02						9.14E+02					
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	1.63E+01	J				YES	1.14E+01	J				YES	7.91E+00	J				YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	2.60E+00						1.57E+00	J					ND					
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	6.40E+00						5.96E+00						4.24E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	1.10E+04				YES	YES	8.64E+03				YES	YES	6.71E+03				YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	1.75E+01						7.71E+00						9.02E+00					
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	3.84E+02						4.91E+02						4.81E+02					
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	3.84E+02	J			YES	YES	6.65E+01	J					3.32E+01	J				
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	ND						ND						4.16E-02	J				
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	4.96E+00						5.02E+00						3.22E+00					
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	3.45E+02	J					4.10E+02	J					3.49E+02	J				
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	7.33E-01	J		YES			ND						ND					
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	5.81E+01	J					4.76E+01	J					5.86E+01	J				
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	1.88E+01	J				YES	1.99E+01	J				YES	1.43E+01	J				YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	2.29E+01						1.62E+01						1.29E+01					
VOLATILE ORGANIC COMPOUNDS																							
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	NR						NR						NR					
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	NR						NR						NR					

Table 5-1

Surface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location						HR-99Q-GP04						HR-99Q-GP05						HR-99Q-GP06					
Sample Number						PH0007						PH0009						PH0011					
Sample Date						5-Mar-02						5-Mar-02						5-Mar-02					
Sample Depth (Feet)						0- 1						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																							
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	8.22E+03				YES	YES	6.59E+03					YES	6.47E+03					YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	1.62E+00				YES		1.85E+00				YES		1.36E+00				YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	4.26E+01						3.28E+01						3.09E+01					
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	ND						ND						ND					
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	2.32E+02						5.42E+02						8.30E+02					
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	6.89E+00	J				YES	5.16E+00	J				YES	4.74E+00	J				YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	2.83E+00						1.58E+00	J					1.64E+00	J				
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	4.32E+00						4.15E+00						3.58E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	5.69E+03				YES	YES	4.56E+03				YES	YES	4.31E+03				YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	1.03E+01						9.29E+00						6.88E+00					
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	3.51E+02						3.83E+02						4.56E+02					
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	1.06E+02	J				YES	8.87E+01	J					1.03E+02	J				YES
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	ND						3.27E-02	J					ND					
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	3.46E+00						2.43E+00						2.78E+00					
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	2.63E+02	J					3.43E+02	J					2.10E+02	J				
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	ND						ND						ND					
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	ND						ND						5.31E+01	J				
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	1.19E+01	J				YES	9.38E+00	J				YES	9.35E+00	J				YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	1.21E+01						1.10E+01						1.18E+01					
VOLATILE ORGANIC COMPOUNDS																							
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	NR						NR						NR					
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	NR						NR						NR					

Table 5-1

Surface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location						HR-99Q-GP07						HR-99Q-GP08						HR-99Q-GP09					
Sample Number						PH0013						PH0015						PH0017					
Sample Date						5-Mar-02						13-Feb-02						5-Mar-02					
Sample Depth (Feet)						0- 1						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																							
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	9.31E+03				YES	YES	1.11E+04				YES	YES	6.08E+03					YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	2.61E+00				YES		1.93E+00				YES		1.32E+00				YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	1.17E+02						2.08E+01						2.78E+01					
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	4.61E-01	J					ND						ND					
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	1.12E+03						9.77E+01	J					2.25E+02					
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	1.09E+01	J				YES	7.41E+00					YES	3.87E+00	J				YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	2.64E+00						1.24E+00	J					ND					
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	6.96E+00						5.16E+00						3.35E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	6.81E+03				YES	YES	9.63E+03				YES	YES	3.41E+03				YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	2.35E+01						6.09E+00						9.91E+00					
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	4.49E+02						2.57E+02						2.81E+02					
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	6.19E+02	J			YES	YES	1.59E+01						7.62E+01	J				
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	ND						1.63E-01			YES		YES	ND					
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	3.68E+00						3.32E+00						1.89E+00	J				
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	2.96E+02	J					2.31E+02	J					1.84E+02	J				
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	ND						5.84E-01	J		YES			ND					
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	6.38E+01	J					ND						ND					
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	1.19E+01	J				YES	1.79E+01					YES	7.46E+00	J				YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	2.04E+01						9.11E+00						9.54E+00					
VOLATILE ORGANIC COMPOUNDS																							
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	NR						NR						NR					
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	NR						NR						NR					

Table 5-1

Surface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location						HR-99Q-GP10						HR-99Q-GP11					
Sample Number						PH0019						PH0021					
Sample Date						5-Mar-02						5-Mar-02					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																	
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	4.46E+03					YES	5.59E+03					YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	1.20E+00				YES		1.39E+00				YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	2.42E+01						1.93E+01					
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	ND						ND					
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	1.05E+02	J					1.22E+02					
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	4.09E+00	J				YES	7.63E+00	J				YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	ND						1.21E+00	J				
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	2.79E+00						3.07E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	3.31E+03				YES	YES	6.40E+03				YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	6.09E+00						4.84E+00					
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	1.64E+02						2.56E+02					
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	3.46E+01	J					3.02E+01	J				
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	ND						7.76E-02	J				
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	1.21E+00	J					1.87E+00	J				
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	1.60E+02	J					1.70E+02	J				
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	ND						ND					
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	ND						ND					
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	6.93E+00	J				YES	9.66E+00	J				YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	8.18E+00						7.82E+00					
VOLATILE ORGANIC COMPOUNDS																	
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	NR						NR					
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	NR						NR					

Table 5-1

Surface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location						HR-99Q-MW01						HR-99Q-MW02					
Sample Number						PH0023						PH0026					
Sample Date						6-Mar-02						6-Mar-02					
Sample Depth (Feet)						0- 1						0- 1					
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	ESV[c]	Result	Qual	>UBR	>BKG	>SSSL	>ESV	Result	Qual	>UBR	>BKG	>SSSL	>ESV
METALS																	
Aluminum	mg/kg	3.99E+04	1.63E+04	7.80E+03	5.00E+01	6.50E+03					YES	4.03E+03					YES
Arsenic	mg/kg	4.90E+01	1.37E+01	4.26E-01	1.00E+01	1.92E+00				YES		1.11E+00	J			YES	
Barium	mg/kg	2.88E+02	1.24E+02	5.47E+02	1.65E+02	2.25E+01						2.01E+01					
Beryllium	mg/kg	8.70E-01	8.00E-01	9.60E+00	1.10E+00	ND						ND					
Calcium	mg/kg	1.79E+04	1.72E+03	NA	NA	5.77E+02						6.40E+01	J				
Chromium	mg/kg	1.34E+02	3.70E+01	2.32E+01	4.00E-01	6.91E+00					YES	3.12E+00	J				YES
Cobalt	mg/kg	7.10E+01	1.52E+01	4.68E+02	2.00E+01	ND						ND					
Copper	mg/kg	2.40E+01	1.27E+01	3.13E+02	4.00E+01	4.09E+00						3.12E+00					
Iron	mg/kg	5.63E+04	3.42E+04	2.34E+03	2.00E+02	6.83E+03				YES	YES	3.11E+03				YES	YES
Lead	mg/kg	8.30E+01	4.01E+01	4.00E+02	5.00E+01	5.94E+00						3.60E+00					
Magnesium	mg/kg	9.60E+03	1.03E+03	NA	4.40E+05	3.81E+02						1.68E+02					
Manganese	mg/kg	6.85E+03	1.58E+03	3.63E+02	1.00E+02	3.98E+01						1.89E+01					
Mercury	mg/kg	3.20E-01	8.00E-02	2.33E+00	1.00E-01	3.50E-02	J					ND					
Nickel	mg/kg	2.20E+01	1.03E+01	1.54E+02	3.00E+01	1.94E+00	J					1.52E+00	J				
Potassium	mg/kg	6.01E+03	8.00E+02	NA	NA	2.85E+02	B					2.09E+02	B				
Selenium	mg/kg	1.30E+00	4.80E-01	3.91E+01	8.10E-01	ND						ND					
Sodium	mg/kg	5.63E+02	6.34E+02	NA	NA	ND						2.22E+01	J				
Vanadium	mg/kg	1.58E+02	5.88E+01	5.31E+01	2.00E+00	1.22E+01					YES	5.75E+00					YES
Zinc	mg/kg	2.09E+02	4.06E+01	2.34E+03	5.00E+01	8.11E+00						5.47E+00					
VOLATILE ORGANIC COMPOUNDS																	
2-Butanone	mg/kg	NA	NA	4.66E+03	8.96E+01	ND						4.20E-03	J				
Acetone	mg/kg	NA	NA	7.76E+02	2.50E+00	1.50E-02	J					6.30E-02	J				

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998.

[c] Residential human health site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT, 2000, *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

NR - Not requested.

Qual - Data validation qualifier.

Table 5-2

Subsurface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location					HR-99Q-GP01					HR-99Q-GP02					HR-99Q-GP03					HR-99Q-GP04				
Sample Number					PH0002					PH0004					PH0006					PH0008				
Sample Date					4-Mar-02					4-Mar-02					4-Mar-02					5-Mar-02				
Sample Depth (Feet)					3- 3.5					1 - 2					3 - 4					3 - 4				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS																								
Aluminum	mg/kg	2.46E+04	1.36E+04	7.80E+03	4.60E+04		YES	YES	YES	5.52E+03					1.35E+04				YES	9.18E+03				YES
Arsenic	mg/kg	3.80E+01	1.83E+01	4.26E-01	9.13E+00				YES	2.70E+00				YES	4.62E+00				YES	1.78E+00				YES
Barium	mg/kg	4.50E+03	2.34E+02	5.47E+02	3.86E+01					1.47E+01					1.60E+01					2.61E+01				
Beryllium	mg/kg	2.00E+00	8.60E-01	9.60E+00	ND					ND					ND					ND				
Calcium	mg/kg	3.65E+03	6.37E+02	NA	1.10E+02	J				5.31E+01	J				5.24E+01	J				1.24E+02				
Chromium	mg/kg	5.50E+01	3.83E+01	2.32E+01	2.53E+01	J			YES	1.27E+01	J				3.28E+01	J			YES	8.57E+00	J			
Cobalt	mg/kg	9.60E+01	1.75E+01	4.68E+02	2.54E+00					ND					3.90E+00					2.46E+00				
Copper	mg/kg	6.10E+01	1.94E+01	3.13E+02	1.27E+01					3.01E+00					1.37E+01					3.99E+00				
Iron	mg/kg	4.80E+04	4.48E+04	2.34E+03	2.75E+04				YES	7.43E+03				YES	4.31E+04				YES	7.54E+03				YES
Lead	mg/kg	5.00E+02	3.85E+01	4.00E+02	1.61E+01					3.40E+00					9.53E+00					6.76E+00				
Magnesium	mg/kg	5.94E+03	7.66E+02	NA	6.46E+02					1.99E+02					3.04E+02					3.87E+02				
Manganese	mg/kg	1.90E+04	1.36E+03	3.63E+02	1.22E+02	J				1.47E+01	J				3.50E+01	J				5.84E+01	J			
Mercury	mg/kg	1.20E-01	7.00E-02	2.33E+00	1.24E-01		YES	YES		ND					4.02E-02	J				ND				
Nickel	mg/kg	3.80E+01	1.29E+01	1.54E+02	1.00E+01					1.92E+00	J				5.76E+00					3.12E+00				
Potassium	mg/kg	6.15E+03	7.11E+02	NA	4.58E+02	J				2.59E+02	J				4.73E+02	J				2.21E+02	J			
Selenium	mg/kg	5.50E-01	4.70E-01	3.91E+01	6.65E-01	J	YES	YES		ND					1.40E+00		YES	YES		ND				
Silver	mg/kg	6.60E-01	2.40E-01	3.91E+01	1.48E+00	J	YES	YES		ND					2.13E+00	J	YES	YES		ND				
Sodium	mg/kg	6.43E+02	7.02E+02	NA	5.32E+01	J				ND					ND					3.80E+01	J			
Vanadium	mg/kg	9.90E+01	6.49E+01	5.31E+01	5.32E+01	J			YES	1.44E+01	J				5.35E+01	J			YES	1.51E+01	J			
Zinc	mg/kg	8.90E+01	3.49E+01	2.34E+03	3.18E+01					6.14E+00					2.31E+01					1.11E+01				
VOLATILE ORGANIC COMPOUNDS																								
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	NR					NR					NR					NR				
Acetone	mg/kg	NA	NA	7.76E+02	NR					NR					NR					NR				
p-Cymene	mg/kg	NA	NA	1.55E+03	NR					NR					NR					NR				

Table 5-2

Subsurface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location					HR-99Q-GP05					HR-99Q-GP06					HR-99Q-GP07					HR-99Q-GP08				
Sample Number					PH0010					PH0012					PH0014					PH0016				
Sample Date					5-Mar-02					5-Mar-02					5-Mar-02					13-Feb-02				
Sample Depth (Feet)					3 - 4					3 - 4					3 - 4					2 - 3				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS																								
Aluminum	mg/kg	2.46E+04	1.36E+04	7.80E+03	9.79E+03				YES	2.05E+04			YES	YES	1.07E+04				YES	1.37E+04			YES	YES
Arsenic	mg/kg	3.80E+01	1.83E+01	4.26E-01	2.00E+00				YES	4.65E+00				YES	4.48E+00				YES	2.98E+00				YES
Barium	mg/kg	4.50E+03	2.34E+02	5.47E+02	1.69E+01					2.49E+01					3.18E+01					1.52E+01				
Beryllium	mg/kg	2.00E+00	8.60E-01	9.60E+00	ND					ND					ND					ND				
Calcium	mg/kg	3.65E+03	6.37E+02	NA	9.07E+01	J				1.21E+02					2.44E+02					5.22E+01	J			
Chromium	mg/kg	5.50E+01	3.83E+01	2.32E+01	8.43E+00	J				2.17E+01	J				1.47E+01	J				1.74E+01				
Cobalt	mg/kg	9.60E+01	1.75E+01	4.68E+02	1.46E+00	J				2.27E+00	J				2.56E+00					1.21E+00	J			
Copper	mg/kg	6.10E+01	1.94E+01	3.13E+02	7.85E+00					1.29E+01					6.22E+00					8.18E+00				
Iron	mg/kg	4.80E+04	4.48E+04	2.34E+03	1.10E+04				YES	2.37E+04				YES	1.78E+04				YES	1.92E+04				YES
Lead	mg/kg	5.00E+02	3.85E+01	4.00E+02	7.10E+00					1.15E+01					5.88E+00					7.72E+00				
Magnesium	mg/kg	5.94E+03	7.66E+02	NA	3.71E+02					6.02E+02					3.08E+02					2.06E+02				
Manganese	mg/kg	1.90E+04	1.36E+03	3.63E+02	4.73E+01	J				4.48E+01	J				7.36E+01	J				2.05E+01				
Mercury	mg/kg	1.20E-01	7.00E-02	2.33E+00	3.63E-02	J				3.21E-02	J				ND					8.35E-02	B		YES	
Nickel	mg/kg	3.80E+01	1.29E+01	1.54E+02	2.81E+00					7.09E+00					2.59E+00					3.06E+00				
Potassium	mg/kg	6.15E+03	7.11E+02	NA	2.99E+02	J				3.87E+02	J				2.53E+02	J				1.92E+02	J			
Selenium	mg/kg	5.50E-01	4.70E-01	3.91E+01	ND					ND					5.61E-01	J	YES	YES		7.61E-01	J	YES	YES	
Silver	mg/kg	6.60E-01	2.40E-01	3.91E+01	ND					ND					ND					ND				
Sodium	mg/kg	6.43E+02	7.02E+02	NA	ND					ND					4.76E+01	J				3.56E+01	J			
Vanadium	mg/kg	9.90E+01	6.49E+01	5.31E+01	1.96E+01	J				3.95E+01	J				2.60E+01	J				3.20E+01				
Zinc	mg/kg	8.90E+01	3.49E+01	2.34E+03	1.22E+01					2.42E+01					1.14E+01					1.04E+01				
VOLATILE ORGANIC COMPOUNDS																								
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	NR					NR					NR					NR				
Acetone	mg/kg	NA	NA	7.76E+02	NR					NR					NR					NR				
p-Cymene	mg/kg	NA	NA	1.55E+03	NR					NR					NR					NR				

Table 5-2

Subsurface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location					HR-99Q-GP09					HR-99Q-GP10					HR-99Q-GP11				
Sample Number					PH0018					PH0020					PH0022				
Sample Date					5-Mar-02					5-Mar-02					5-Mar-02				
Sample Depth (Feet)					3 - 4					3 - 4					2 - 3				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS																			
Aluminum	mg/kg	2.46E+04	1.36E+04	7.80E+03	1.98E+04			YES	YES	2.24E+04			YES	YES	2.27E+04			YES	YES
Arsenic	mg/kg	3.80E+01	1.83E+01	4.26E-01	3.58E+00				YES	3.69E+00				YES	4.39E+00				YES
Barium	mg/kg	4.50E+03	2.34E+02	5.47E+02	2.31E+01					2.19E+01					2.63E+01				
Beryllium	mg/kg	2.00E+00	8.60E-01	9.60E+00	ND					ND					ND				
Calcium	mg/kg	3.65E+03	6.37E+02	NA	9.32E+01	J				8.71E+01	J				4.79E+01	J			
Chromium	mg/kg	5.50E+01	3.83E+01	2.32E+01	1.53E+01	J				3.41E+01	J			YES	2.63E+01	J			YES
Cobalt	mg/kg	9.60E+01	1.75E+01	4.68E+02	1.62E+00	J				ND					1.85E+00	J			
Copper	mg/kg	6.10E+01	1.94E+01	3.13E+02	1.04E+01					1.30E+01					1.12E+01				
Iron	mg/kg	4.80E+04	4.48E+04	2.34E+03	1.48E+04				YES	2.97E+04				YES	2.78E+04				YES
Lead	mg/kg	5.00E+02	3.85E+01	4.00E+02	7.81E+00					8.72E+00					1.05E+01				
Magnesium	mg/kg	5.94E+03	7.66E+02	NA	5.33E+02					4.15E+02					5.39E+02				
Manganese	mg/kg	1.90E+04	1.36E+03	3.63E+02	2.18E+01	J				2.01E+01	J				2.80E+01	J			
Mercury	mg/kg	1.20E-01	7.00E-02	2.33E+00	4.00E-02	J				1.27E-01		YES	YES		4.81E-02	J			
Nickel	mg/kg	3.80E+01	1.29E+01	1.54E+02	5.52E+00					4.13E+00					5.62E+00				
Potassium	mg/kg	6.15E+03	7.11E+02	NA	4.09E+02	J				4.01E+02	J				4.17E+02	J			
Selenium	mg/kg	5.50E-01	4.70E-01	3.91E+01	ND					9.81E-01	J	YES	YES		ND				
Silver	mg/kg	6.60E-01	2.40E-01	3.91E+01	ND					1.34E+00	J	YES	YES		1.34E+00	J	YES	YES	
Sodium	mg/kg	6.43E+02	7.02E+02	NA	5.74E+01	J				4.95E+01	J				4.93E+01	J			
Vanadium	mg/kg	9.90E+01	6.49E+01	5.31E+01	2.85E+01	J				5.89E+01	J			YES	4.62E+01	J			
Zinc	mg/kg	8.90E+01	3.49E+01	2.34E+03	1.98E+01					1.70E+01					2.02E+01				
VOLATILE ORGANIC COMPOUNDS																			
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	NR					NR					NR				
Acetone	mg/kg	NA	NA	7.76E+02	NR					NR					NR				
p-Cymene	mg/kg	NA	NA	1.55E+03	NR					NR					NR				

Table 5-2

Subsurface Soil Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location					HR-99Q-MW01					HR-99Q-MW02				
Sample Number					PH0025					PH0028				
Sample Date					6-Mar-02					6-Mar-02				
Sample Depth (Feet)					3 - 4					2 - 3				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL	Result	Qual	>UBR	>BKG	>SSSL
METALS														
Aluminum	mg/kg	2.46E+04	1.36E+04	7.80E+03	1.12E+04				YES	8.15E+03				YES
Arsenic	mg/kg	3.80E+01	1.83E+01	4.26E-01	5.28E+00				YES	2.70E+00				YES
Barium	mg/kg	4.50E+03	2.34E+02	5.47E+02	1.85E+01					1.91E+01				
Beryllium	mg/kg	2.00E+00	8.60E-01	9.60E+00	7.07E-01	J				ND				
Calcium	mg/kg	3.65E+03	6.37E+02	NA	3.32E+02					8.54E+01	J			
Chromium	mg/kg	5.50E+01	3.83E+01	2.32E+01	2.74E+01				YES	1.87E+01				
Cobalt	mg/kg	9.60E+01	1.75E+01	4.68E+02	2.18E+00	J				ND				
Copper	mg/kg	6.10E+01	1.94E+01	3.13E+02	1.89E+01					5.82E+00				
Iron	mg/kg	4.80E+04	4.48E+04	2.34E+03	5.59E+04		YES	YES	YES	1.55E+04				YES
Lead	mg/kg	5.00E+02	3.85E+01	4.00E+02	1.47E+01					5.15E+00				
Magnesium	mg/kg	5.94E+03	7.66E+02	NA	3.76E+02					1.99E+02				
Manganese	mg/kg	1.90E+04	1.36E+03	3.63E+02	9.87E+01					2.18E+01				
Mercury	mg/kg	1.20E-01	7.00E-02	2.33E+00	2.32E-01		YES	YES		1.04E-01	J		YES	
Nickel	mg/kg	3.80E+01	1.29E+01	1.54E+02	2.24E+00	J				1.58E+00	J			
Potassium	mg/kg	6.15E+03	7.11E+02	NA	4.19E+02	J				2.26E+02	B			
Selenium	mg/kg	5.50E-01	4.70E-01	3.91E+01	1.69E+00		YES	YES		ND				
Silver	mg/kg	6.60E-01	2.40E-01	3.91E+01	2.97E+00		YES	YES		1.34E+00	J	YES	YES	
Sodium	mg/kg	6.43E+02	7.02E+02	NA	ND					ND				
Vanadium	mg/kg	9.90E+01	6.49E+01	5.31E+01	8.09E+01			YES	YES	2.20E+01				
Zinc	mg/kg	8.90E+01	3.49E+01	2.34E+03	3.68E+01			YES		8.16E+00				
VOLATILE ORGANIC COMPOUNDS														
4-Methyl-2-pentanone	mg/kg	NA	NA	6.21E+02	ND					2.90E-03	J			
Acetone	mg/kg	NA	NA	7.76E+02	2.40E-02	J				4.10E-02	J			
p-Cymene	mg/kg	NA	NA	1.55E+03	ND					2.40E-03	J			

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998.

[c] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

NR - Not requested.

Qual - Data validation qualifier.

Table 5-3

Groundwater Analytical Results
Former Rifle/Machine Gun Range, Parcel 99Q
Fort McClellan, Calhoun County, Alabama

Sample Location					HR-99Q-MW02				
Sample Number					PH3002				
Sample Date					21-May-02				
Parameter	Units	UBR[a]	BKG[b]	SSSL[c]	Result	Qual	>UBR	>BKG	>SSSL
METALS									
Aluminum	mg/L	9.60E+00	2.34E+00	1.56E+00	8.79E-02	J			
Barium	mg/L	4.01E-01	1.27E-01	1.10E-01	5.88E-02				
Calcium	mg/L	4.52E+02	5.65E+01	NA	2.72E+01	J			
Iron	mg/L	2.58E+01	7.04E+00	4.69E-01	5.91E-02	J			
Magnesium	mg/L	1.49E+02	2.13E+01	NA	1.91E+01	J			
Manganese	mg/L	5.82E+00	5.81E-01	7.35E-02	1.42E-01				YES
Sodium	mg/L	6.47E+01	1.48E+01	NA	1.48E+00				
Thallium	mg/L	5.30E-03	1.46E-03	1.01E-04	7.68E-03	B	YES	YES	YES
PESTICIDES									
beta-BHC	mg/L	NA	NA	3.60E-05	6.20E-05	J			YES

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] UBR - Upper background range as given in Science Applications International Corporation (SAIC), 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998.

[c] Residential human health site-specific screening level (SSSL) as given in IT Corporation (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).

J - Compound was positively identified; reported value is an estimated concentration.

mg/L - Milligrams per liter.

NA - Not available.

Qual - Data validation qualifier.

Volatile Organic Compounds. Two of the surface soil samples were analyzed for VOCs. A total of two VOCs (2-butanone and acetone) were detected in the samples at concentrations below SSSLs and ESVs.

Semivolatile Organic Compounds. Two of the surface soil samples were analyzed for SVOCs. SVOCs were not detected in the samples.

Pesticides. Two of the surface soil samples were analyzed for pesticides. Pesticides were not detected in the samples.

Herbicides. Two of the surface soil samples were analyzed for herbicides. Herbicides were not detected in the samples.

Explosives. Explosives were not detected in the surface soil samples collected at the site.

5.2 Subsurface Soil Analytical Results

Thirteen subsurface soil samples were collected for chemical analysis at the Former Rifle/Machine Gun Range, Parcel 99Q. Subsurface soil samples were collected at depths greater than 1-foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-2.

Metals. Twenty metals were detected in subsurface soil samples collected at the site. The concentrations of five metals (aluminum, arsenic, chromium, iron, and vanadium) exceeded SSSLs. Of these metals, the concentrations of aluminum (six samples), iron (one sample), and vanadium (one sample) also exceeded their respective background concentrations. However, these metals concentrations were within their respective upper background ranges, except for the following:

- Aluminum (46,000 mg/kg) exceeded its SSSL (7,803 mg/kg) and upper background range (24,600 mg/kg) at one sample location (HR-99Q-GP01).
- Iron (55,900 mg/kg) exceeded its SSSL (2,345 mg/kg) and upper background range (48,000 mg/kg) at one sample location (HR-99Q-MW01).

Volatile Organic Compounds. Two of the subsurface soil samples were analyzed for VOCs. A total of three VOCs (4-methyl-2-pentanone, acetone, and p-cymene) were detected in the samples at concentrations below SSSLs.

Semivolatile Organic Compounds. Two of the subsurface soil samples were analyzed for SVOCs. SVOCs were not detected in the samples.

Pesticides. Two of the subsurface soil samples were analyzed for pesticides. Pesticides were not detected in the samples.

Herbicides. Two of the subsurface soil samples were analyzed for herbicides. Herbicides were not detected in the samples.

Explosives. Explosives were not detected in the subsurface soil samples collected at the site.

5.3 Groundwater Analytical Results

One groundwater sample was collected for chemical analysis at the Former Rifle/Machine Gun Range, Parcel 99Q, at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-3.

Metals. Eight metals were detected in the groundwater sample collected at the site. The concentrations of two metals (manganese and thallium) exceeded SSSLs. The manganese result was below its background concentration. The concentration of thallium (0.0077 mg/L) exceeded its SSSL (0.0001 mg/L) and upper background range (0.0053 mg/L). However, the thallium result was flagged with a "B" data qualifier, indicating that the metal was also detected in an associated laboratory method blank sample.

Volatile Organic Compounds. VOCs were not detected in the groundwater sample collected at the site.

Semivolatile Organic Compounds. SVOCs were not detected in the groundwater sample collected at the site.

Pesticides. One pesticide (beta-BHC) was detected in the groundwater sample at a concentration (0.000062 mg/L) marginally exceeding its SSSL (0.000036 mg/L). However, the beta-BHC result was flagged with a "J" data qualifier, indicating that the compound was detected at an estimated concentration below the method reporting limit.

Herbicides. Herbicides were not detected in the groundwater sample collected at the site.

Explosives. Explosives were not detected in the groundwater sample collected at the site.

6.0 Summary, Conclusions, and Recommendations

Under contract with USACE, IT completed an SI at the Former Rifle/Machine Gun Range, Parcel 99Q, at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site at concentrations that pose an unacceptable risk to human health or the environment. The SI at the Former Rifle/Machine Gun Range, Parcel 99Q, consisted of the sampling and analysis of 13 surface soil samples, 13 subsurface soil samples, and 1 groundwater sample. In addition, one permanent monitoring well was installed in the saturated zone to facilitate groundwater sample collection and provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at the Former Rifle/Machine Gun Range, Parcel 99Q, indicates that metals, VOCs, and one pesticide were detected in site media. SVOCs, herbicides, and explosives were not detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health SSSLs, ESVs, and background screening values for Fort McClellan.

Although the site is projected for passive recreation reuse (EDAW, 1997), the analytical data were screened against residential human health SSSLs to evaluate the site for unrestricted land reuse. VOC concentrations in site media were below SSSLs. Chemicals of potential concern were limited to aluminum (subsurface soil), iron (subsurface soil), thallium (groundwater), and the pesticide beta-BHC (groundwater). Although aluminum and iron exceeded their respective SSSLs and upper background ranges in one subsurface soil sample each, these metals are present at levels within the same order of magnitude as background and are common elements in native soils whose concentrations vary over a wide range. In groundwater, thallium (0.0077 mg/L) exceeded its SSSL (0.0001 mg/L) and upper background range (0.0053 mg/L) in one sample. However, the thallium result was flagged with a "B" data qualifier, indicating that the metal was detected in an associated laboratory method blank sample. The elevated metals results most likely reflect either a laboratory artifact (thallium) or variation in naturally occurring levels (aluminum and iron).

The chlorinated pesticide beta-BHC was detected in the groundwater sample at a concentration (0.000062 mg/L) marginally exceeding its SSSL (0.000036 mg/L). However, the beta-BHC result was flagged with a "J" data qualifier indicating that the compound was detected at an estimated concentration below the laboratory reporting limit. Although an EPA drinking water standard (MCL) does not exist for beta-BHC, the pesticide's concentration was below the MCL

of 0.0002 mg/L for gamma-BHC (lindane), a structurally similar isomer. Given the uncertainty associated with the analytical result and the small amount by which it exceeded its SSSL, beta-BHC is not expected to pose a threat to human health.

No chemicals of potential ecological concern were identified at the Former Rifle/Machine Gun Range, Parcel 99Q.

Based on the results of the SI, past operations at the Former Rifle/Machine Gun Range, Parcel 99Q, do not appear to have adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at the Former Rifle/Machine Gun Range, Parcel 99Q.

7.0 References

Cloud, P. E., Jr., 1966, ***Bauxite Deposits of the Anniston, Fort Payne, and Asheville Areas, Northeast Alabama***, U. S. Geological Survey Bulletin 1199-O, 35p.

EDAW Inc., 1997, ***Fort McClellan Comprehensive Reuse Plan, Fort McClellan Reuse and Redevelopment Authority of Alabama,*** November, Fort McClellan, Updated Reuse Map, Rev. March 2000.

Environmental Science and Engineering, Inc. (ESE), 1998, ***Final Environmental Baseline Survey, Fort McClellan, Alabama***, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, January.

IT Corporation (IT), 2002, ***Draft Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun Country, Alabama,*** Revision 3, prepared for the U.S. Army Corps of Engineers, Mobile District, February.

IT Corporation (IT), 2001, ***Final Site-Specific Field Sampling Plan Attachment, Former Rifle/Machine Gun Range, Parcel 99Q, Fort McClellan, Calhoun County, Alabama***, December.

IT Corporation (IT), 2000a, ***Final Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun County, Alabama***, March.

IT Corporation (IT), 2000b, ***Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama***, July.

IT Corporation (IT), 1998, ***Final Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama***, August.

Moser, P. H., and S. S. DeJarnette, 1992, ***Ground-water Availability in Calhoun County, Alabama***, Geological Survey of Alabama Special Map 228.

Osborne, W. E., 1999, Personal communication with John Hofer, IT Corporation.

Osborne, W. E., and M. W. Szabo, 1984, ***Stratigraphy and Structure of the Jacksonville Fault, Calhoun County, Alabama***, Geological Survey of Alabama Circular 117.

Osborne, W. E., G. D. Irving, and W. E. Ward, 1997, ***Geologic Map of the Anniston 7.5' Quadrangle, Calhoun County, Alabama***, Geological Survey of Alabama Preliminary Map, 1 sheet.

Osborne, W. E., M. W. Szabo, C. W. Copeland, Jr., and T. L. Neathery, 1989, ***Geologic Map of Alabama***, Geological Survey of Alabama Special Map 221, scale 1:500,000, 1 sheet.

Osborne, W. E., M. W. Szabo, T. L. Neathery, and C. W. Copeland, compilers, 1988, ***Geologic Map of Alabama, Northeast Sheet***, Geological Survey of Alabama Special Map 220, Scale 1:250,000.

Raymond, D. E., W. E. Osborne, C. W. Copeland, and T. L. Neathery, 1988, ***Alabama Stratigraphy***, Geological Survey of Alabama, Tuscaloosa, Alabama.

Science Applications International Corporation (SAIC), 1998, ***Final Background Metals Survey Report, Fort McClellan, Alabama***, July.

Thomas, W. A., and T. L. Neathery, 1982, ***Appalachian Thrust Belts in Alabama: Tectonics and Sedimentation***, Geologic Society of America 1982 Annual Meeting, New Orleans, Louisiana, Field Trip, Alabama Geological Society Guidebook 19A.

Thomas, W. A., and J. A. Drahovzal, 1974, ***The Coosa Deformed Belt in the Alabama Appalachians***, Alabama Geological Society, 12th Annual Field Trip Guidebook 98 p.

U.S. Army Corps of Engineers (USACE), 2001, ***Archives Search Report, Maps, Fort McClellan, Anniston, Alabama***, Revision 1, September.

U.S. Army Corps of Engineers (USACE), 1994, ***Requirements for the Preparation of Sampling and Analysis Plans***, Engineer Manual EM 200-1-3, September.

U.S. Department of Agriculture, 1961, ***Soil Survey, Calhoun County, Alabama***, Soil Conservation Service, Series 1958, No. 9, September.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1998, Unedited Local Climatological Data, Anniston, Alabama, January - December 1998.

Warman, J. C., and L. V. Causey, 1962, ***Geology and Ground-water Resources of Calhoun County, Alabama,*** Geological Survey of Alabama County Report 7.

ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

List of Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	silvex
3D	3D International Environmental Group
AB	ambient blank
AbB3	Anniston gravelly clay loam, 2 to 6 percent slopes, severely eroded
AbC3	Anniston gravelly clay loam, 6 to 10 percent slopes, severely eroded
AbD3	Anniston and Allen gravelly clay loams, 10 to 15 percent slopes, eroded
Abs	skin absorption
ABS	dermal absorption factor
AC	hydrogen cyanide
ACAD	AutoCadd
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
AdE	Anniston and Allen stony loam, 10 to 25 percent slope
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEC	U.S. Army Environmental Center
AEL	airborne exposure limit
AET	adverse effect threshold
AF	soil-to-skin adherence factor
AHA	ammunition holding area
AL	Alabama
ALARNG	Alabama Army National Guard
ALAD	d-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
AP	armor piercing
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
AS/SVE	air sparging/soil vapor extraction
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AUF	area use factor
AWARE	Associated Water and Air Resources Engineers, Inc.
AWQC	ambient water quality criteria
AWWSB	Anniston Water Works and Sewer Board
'B'	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	hexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
$CaCO_3$	calcium carbonate
CAA	Clean Air Act
CAB	chemical warfare agent breakdown products
CAMU	corrective action management unit
CBR	chemical, biological, and radiological
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
CD	compact disc
CDTF	Chemical Defense Training Facility
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CF	conversion factor
CFC	chlorofluorocarbon
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CG	carbonyl chloride (phosgene)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl	chlorinated
CLP	Contract Laboratory Program
cm	centimeter
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
CoA	Code of Alabama
COC	chain of custody; chemical of concern
COE	Corps of Engineers
Con	skin or eye contact
COPC	chemical(s) of potential concern
COPEC	chemical(s)/constituent(s) of potential ecological concern
CPSS	chemicals present in site samples
CQCSM	Contract Quality Control System Manager
CRDL	contract-required detection limit
CRL	certified reporting limit
CRQL	contract-required quantitation limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
CSM	conceptual site model
CT	central tendency
ctr.	container
CWA	chemical warfare agent; Clean Water Act
CWM	chemical warfare material; clear, wide mouth
CX	dichloroformoxime
'D'	duplicate; dilution
D&I	detection and identification
DAAMS	depot area air monitoring system
DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
ºC	degrees Celsius
ºF	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene

List of Abbreviations and Acronyms *(Continued)*

DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized
DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DO	dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DSERTS	Defense Site Environmental Restoration Tracking System
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{50}	effects concentration for 50 percent of a population
ECBC	Edgewood Chemical/Biological Command
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Elev.	elevation
EM	electromagnetic
EMI	Environmental Management Inc.
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
EPRI	Electrical Power Research Institute
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	explosives
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FD	field duplicate
FDA	U.S. Food and Drug Administration
Fe^{+3}	ferric iron
Fe^{+2}	ferrous iron
FedEx	Federal Express, Inc.
FEMA	Federal Emergency Management Agency
FFCA	Federal Facilities Compliance Act
FFE	field flame expedient
FFS	focused feasibility study
FI	fraction of exposure
Fil	filtered
Flt	filtered
FMDC	Fort McClellan Development Commission
FML	flexible membrane liner
FMP 1300	Former Motor Pool 1300
f_{oc}	fraction organic carbon
FOMRA	Former Ordnance Motor Repair Area
FOST	Finding of Suitability to Transfer
Foster Wheeler	Foster Wheeler Environmental Corporation
FR	Federal Register
Frtn	fraction
FS	field split; feasibility study
FSP	field sampling plan
ft	feet
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
FTA	Fire Training Area
FTMC	Fort McClellan
FTRRA	FTMC Reuse & Redevelopment Authority
g	gram
g/m^3	gram per cubic meter
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
GAF	gastrointestinal absorption factor
gal	gallon
gal/min	gallons per minute
GB	sarin
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GCL	geosynthetic clay liner
GC/MS	gas chromatograph/mass spectrometer
GCR	geosynthetic clay liner
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GRA	general response action
GS	ground scar
GSA	General Services Administration; Geologic Survey of Alabama
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain
GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
H&S	health and safety
HA	hand auger
HCl	hydrochloric acid
HD	distilled mustard
HDPE	high-density polyethylene
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index
H_2O_2	hydrogen peroxide
HPLC	high performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen releasing compound
HSA	hollow-stem auger
HTRW	hazardous, toxic, and radioactive waste
‘I’	out of control, data rejected due to low recovery
IATA	International Air Transport Authority
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma

List of Abbreviations and Acronyms *(Continued)*

ICRP	International Commission on Radiological Protection
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDM	investigative-derived media
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IF	ingestion factor; inhalation factor
ILCR	incremental lifetime cancer risk
IMPA	isopropylmethyl phosphonic acid
IMR	Iron Mountain Road
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard
IR	ingestion rate
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Service
IRP	Installation Restoration Program
IS	internal standard
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
JPA	Joint Powers Authority
K	conductivity
K_d	soil-water distribution coefficient
kg	kilogram
KeV	kilo electron volt
K_{oc}	organic carbon partioning coefficient
K_{ow}	octonal-water partition coefficient
$KMnO_4$	potassium permanganate
L	lewisite; liter
L/kg/day	liters per kilogram per day
l	liter
LAW	light anti-tank weapon
lb	pound
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LRA	land redevelopment authority
LT	less than the certified reporting limit
LUC	land-use control
LUCAP	land-use control assurance plan
LUCIP	land-use control implementation plan
max	maximum
MB	method blank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	4-chloro-2-methylphenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
MCS	media cleanup standard
MD	matrix duplicate
MDC	maximum detected concentration
MDCC	maximum detected constituent concentration
MDL	method detection limit
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
mg/kgbw/day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MeV	mega electron volt
min	minimum
MINICAMS	miniature continuous air monitoring system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MMBtu/hr	million Btu per hour
MNA	monitored natural attenuation
MnO_4-	permanganate ion
MOA	Memorandum of Agreement
MOGAS	motor vehicle gasoline
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPA	methyl phosphonic acid
MPM	most probable munition
MQL	method quantitation limit
MR	molasses residue
MRL	method reporting limit
MS	matrix spike
mS/cm	millisiemens per centimeter
mS/m	millisiemens per meter
MSD	matrix spike duplicate
MTBE	methyl tertiary butyl ether
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
MWI&P	Monitoring Well Installation and Management Plan
Na	sodium
NA	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
$NaMnO_4$	sodium permanganate
NAVD88	North American Vertical Datum of 1988
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	not detected
NE	no evidence; northeast
ne	not evaluated
NEW	net explosive weight
NFA	No Further Action
NG	National Guard
NGP	National Guardsperson
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
Ni	nickel
NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
NO_3^-	nitrate
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effects-level
NR	not requested; not recorded; no risk
NRC	National Research Council
NRCC	National Research Council of Canada
NRHP	National Register of Historic Places
ns	nanosecond
N-S	north to south
NS	not surveyed
NSA	New South Associates, Inc.

List of Abbreviations and Acronyms *(Continued)*

nT	nanotesla
nT/m	nanoteslas per meter
NTU	nephelometric turbidity unit
nv	not validated
O_2	oxygen
O_3	ozone
O&G	oil and grease
O&M	operation and maintenance
OB/OD	open burning/open detonation
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
OH•	hydroxyl radical
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORC	Oxygen Releasing Compound
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVM-PID/FID	organic vapor meter-photoionization detector/flame ionization detector
OWS	oil/water separator
oz	ounce
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PBMS	performance-based measurement system
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEF	particulate emission factor
PEL	permissible exposure limit
PERA	preliminary ecological risk assessment
PES	potential explosive site
Pest.	pesticides
PETN	pentarey thritol tetranitrate
PFT	portable flamethrower
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
PM	project manager
POC	point of contact
POL	petroleum, oils, and lubricants
POTW	publicly owned treatment works
POW	prisoner of war
PP	peristaltic pump; Proposed Plan
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PR	potential risk
PRA	preliminary risk assessment
PRG	preliminary remediation goal
PS	chloropicrin
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	quality assurance manual
QAO	quality assurance officer
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental, Inc.
qty	quantity
Qual	qualifier
R	rejected data; resample; retardation factor
R&A	relevant and appropriate
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration; red blood cell
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDX	cyclotrimethylenetrinitramine
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
SA	exposed skin surface area
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
sc	clayey sands; sand-clay mixtures
Sch.	Schedule
SCM	site conceptual model
SD	sediment
SDG	sample delivery group
SDWA	Safe Drinking Water Act
SDZ	safe distance zone; surface danger zone
SEMS	Southern Environmental Management & Specialties, Inc.
SF	cancer slope factor
SFSP	site-specific field sampling plan
SGF	standard grade fuels
SHP	installation-wide safety and health plan
SI	site investigation
SINA	Special Interest Natural Area
SL	standing liquid
SLERA	screening-level ecological risk assessment
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SMDP	Scientific Management Decision Point
s/n	signal-to-noise ratio
SO_4^{-2}	sulfate
SOD	soil oxidant demand
SOP	standard operating procedure
SOPQAM	U.S. EPA's *Standard Operating Procedure/Quality Assurance Manual*
sp	poorly graded sands; gravelly sands
SP	submersible pump
SPCC	system performance calibration compound
SPCS	State Plane Coordinate System
SPM	sample planning module
SQRT	screening quick reference tables
Sr-90	strontium-90
SRA	streamlined human health risk assessment
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level

SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TEA	triethylaluminum
Tetryl	trinitrophenylmethylnitramine
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNT	trinitrotoluene
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons
TR	target cancer risk
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UBR	upper background range
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UIC	underground injection control
UF	uncertainty factor
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATCES	U.S. Army Technical Center for Explosive Safety
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance level; upper tolerance limit
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Supervisor
UXOSO	UXO safety officer
V	vanadium
VC	vinyl chloride
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
WAC	Women's Army Corps
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WRS	Wilcoxon rank sum
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards