DAIM-BD-H-MC

12 September 2006

MEMORANDUM FOR RECORD

SUBJECT: Draft Remedial Investigation Site Specific Field Sampling Plan, Site-Specific Safety and Health Plan, and Site-Specific Unexploded Ordnance Safety Plan Attachments, Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q, February 2003

1. Subject draft document will not be finalized by the U.S. Army. It is maintained in the Administrative Record and Information Repositories to provide information collected by the Army prior to implementation of the Environmental Services Cooperative Agreement (ESCA) between the Army and the Anniston-Calhoun County Fort McClellan Development Joint Powers Authority (JPA) executed on 15 September 2003, and as modified on 30 September 2005. The JPA will complete environmental services and achieve site closeout in accordance with the requirements of the ESCA.

2. Point of contact for this action is Lisa Holstein, Transition Force, Fort McClellan, AL, at 256-848-7455.

Draft

Remedial Investigation

Site-Specific Field Sampling Plan, Site-Specific Safety and Health Plan, and Site-Specific Unexploded Ordnance Safety Plan Attachments Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q

Fort McClellan
Calhoun County, Alabama

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

February 2003

Revision 0

Draft
Remedial Investigation
Site-Specific Field Sampling Plan Attachment
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q

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

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February 2003

Revision 0

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK10, IT Corporation (IT) will conduct a remedial investigation (RI) at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, at Fort McClellan, Calhoun County, Alabama. The RI will determine the nature and extent of contamination resulting from U.S. Army training activities that occurred at the site. The purpose of this site-specific RI field sampling plan is to provide technical guidance for the sampling activities proposed at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q.

The Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range is in the northern part of the Main Post of FTMC, southeast of Reilly Airfield. The impact area is a portion of Range 30: End-of-Cycle Test Range, Parcel 88Q, and Former Rifle/Machine Gun Range, Parcel 103Q, as defined in the Environmental Baseline Survey. Parcel 88Q was also known as Range 30: Confidence Course.

Range 30 (Parcel 88Q) was used from 1977 to sometime between 1983 and 1989 when the range was inactivated. Ordnance materials fired at this range included M-16 blanks, flares, and simulators. Reportedly, M-60 machine guns and .30-caliber ordnance were used historically. Range 30 was also used for end-of-cycle training prior to late 1980s. End-of-cycle training was the last phase of basic training prior to graduation.

Parcel 103Q is approximately 25 acres and Parcel 88Q is roughly 545 acres including the range safety fan. The portions of Parcels 88Q and 103Q that are the subject of this RI occupy approximately 40 acres. The area of investigation is bounded to the north by an unpaved road that travels east off of Falcon Road and bisects Parcel 231(7). The southern limit is bounded by an unpaved road oriented southwest-northeast near the top of an unnamed hillside.

IT personnel conducted a site walk as part of the nonintrusive site investigation (SI) at the Impact Area for Parcels 88Q and 103Q in October 2001. Numerous bullet fragments were observed over much of the area and were concentrated along the slope and base of the hillside. Surface soils at the impact area are expected to be contaminated with metals, particularly lead. As a result of this observation, environmental samples were not collected as part of the SI.

Based on the indications of the SI, past operations at the Impact Area for Parcels 88Q and 103Q appear to have adversely impacted the environment. The lead fragments observed on the surface may indicate that lead contamination in soil may pose an unacceptable risk to human health and the environment. The SI information for the Impact Area for Parcels 88Q and 103Q was presented to the BRAC Cleanup Team (BCT) in January 2003. Therefore, the BCT recommended that the nature and extent of the potential lead contamination in soil be defined at the Impact Area for Parcels 88Q and 103Q.

As part of the RI, IT will collect 5 groundwater samples, 20 surface soil samples, and 40 subsurface soil samples at this site. Also, prior to sample collection, IT will conduct x-ray fluorescence screening at approximately 80 surface soil locations to better define locations for soil borings and monitoring wells. Additional XRF screening locations will be selected in the area of investigation not covered by the grid to screen for hot spots. The potential contaminant sources at the Impact Area for Range 30, Parcel 88Q, and Former Rifle/Machine Gun, Parcel 103Q, are primarily metals. Chemical analyses of selected samples collected during the field program will include volatile organic compounds, semivolatile organic compounds, metals, nitroaromatic/nitramine explosives, chlorinated and organophosphorus pesticides, chlorinated herbicides and polychlorinated biphenyls. Results from these analyses will be compared with site-specific screening levels, ecological screening values, and background values to determine if potential site-specific chemicals are present at the site at concentrations that pose an unacceptable risk to human health or the environment.

This RI field sampling plan will be used in conjunction with the installation-wide sampling and analysis plan (SAP), the site-specific safety and health plan, and the site-specific unexploded ordnance (UXO) safety plan. The SAP includes the installation-wide safety and health plan, monitoring well installation and maintenance plan, investigation-derived waste management plan, ordnance and explosives management plan, and quality assurance plan. Site-specific hazard analyses are included in the site-specific safety and health plan and the site-specific UXO safety plan attachments.

The Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q falls within the "Possible Explosive Ordnance Impact Areas" shown on Plate 10 of the September 2001 *Archives Search Report, Maps, Revision 1, Fort McClellan, Anniston, Alabama*; therefore, UXO surface sweeps and downhole surveys of soil borings will be required to support field activities this site. The surface sweeps and downhole surveys will be conducted to identify anomalies for the purposes of UXO avoidance.

At the completion of the RI field work, a feasibility study (FS) will be conducted. The FS will identify, develop, screen, and evaluate remedial alternatives for contaminated media at the site as required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The FS report will be prepared in accordance with the guidelines, criteria, and considerations set forth in the 1988 U.S. Environmental Protection Agency guidance document entitled *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Final*. The FS will provide the Base Realignment and Closure Cleanup Team sufficient data to select a feasible and cost-effective remedial alternative that will protect human health and the environment.

1.0 Project Description

1.1 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected contaminants at Fort McClellan (FTMC) in Calhoun County, Alabama, under the management of the U.S. Army Corps of Engineers (USACE)-Mobile District. The USACE has contracted IT Corporation (IT) to provide environmental services for the remedial investigation (RI) at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, under Task Order CK10, Contract Number DACA21-96-D-0018.

This RI site-specific field sampling plan (SFSP) has been prepared to provide technical guidance and rationale for sample collection and analysis at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q (Impact Area for Parcels 88Q and 103Q). The objective of this investigation is to characterize the potential contamination resulting from training activities that occurred at the site and to define the extent of potential contamination observed during the previous SI. IT will screen surface soil by x-ray fluorescence (XRF) and collect samples to characterize the source, nature, and extent of potential contamination. The data collected will also be used to evaluate the level of risk to human health and the environment posed by releases of chemicals. This RI SFSP will be used in conjunction with the site-specific safety and health plan (SSHP), the site-specific unexploded ordnance (UXO) safety plan, the installation-wide sampling and analysis plan (SAP) (IT, 2002a), and the installation-wide work plan (IT, 2002b). The SAP includes the installation-wide safety and health plan, well installation and maintenance plan, investigation-derived waste (IDW) management plan, ordnance and explosives management plan, and quality assurance plan (QAP). Site-specific hazard analysis is included in the SSHP and the site-specific UXO safety plan attachments.

1.2 FTMC Site Description and History

FTMC is located in the foothills of the Appalachian Mountains of northeastern Alabama near the cities of Anniston and Weaver in Calhoun County. FTMC is approximately 60 miles northeast of Birmingham, 75 miles northwest of Auburn, and 95 miles west of Atlanta, Georgia. FTMC consists of three main areas of government-owned and leased properties: the Main Post, Pelham Range, and Choccolocco Corridor (the lease for Choccolocco Corridor terminated in May 1998). The size of each property is presented below:

- Main Post 18,929 acres
- Pelham Range 22,245 acres
- Choccolocco Corridor 4,488 acres.

The Main Post is bounded on the east by the Choccolocco Corridor, which connects the Main Post with the Talladega National Forest. Pelham Range is located approximately five miles west of the Main Post and adjoins the Anniston Army Depot on the southwest. Pelham Range is located to the west of U.S. Highway 431, approximately five miles from the Main Post.

FTMC is under the jurisdiction of the U.S. Army Training and Doctrine Command. Until September 1999, the installation housed three major organizations, the U.S. Army Military Police School, the U.S. Army Chemical School, and the Training Center (under the direction of the training brigade), in addition to other major support units and tenants.

In 1917 the U.S. government purchased 18,929 acres of land near Anniston for use as an artillery range and a training camp due to the outbreak of World War I. The site was named Camp McClellan in honor of Major General George B. McClellan, a leader of the Union Army during the Civil War. Camp McClellan was used to train troops for World War I from 1917 until the armistice. It was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active army units and other civilian elements. Camp McClellan was redesignated as Fort McClellan in 1929 and continued to serve as a training area.

In 1940, the government acquired an additional 22,245 acres west of FTMC. This tract of land was named Pelham Range. In 1941, the Alabama legislature leased approximately 4,488 acres to the U.S. government to provide an access corridor from the Main Post to Talladega National Forest. This corridor provided access to additional woodlands for training.

The U.S. Army operated the Chemical Corps School at FTMC from 1951 until the school was deactivated in 1973. The Chemical Corps School offered advanced training in all phases of chemical, biological, and radiological warfare to students from all branches of the military service.

Until closure in September 1999, activities at FTMC could be divided into support activities, academic training, and practical training. Support activities included housing, feeding, and moving individuals during training. Academic training included classroom, laboratory, and field instruction. Practical training included weapons, artillery and explosives, vehicle operation and maintenance, and physical and tactical training activities.

1.3 Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q: Site Description and History

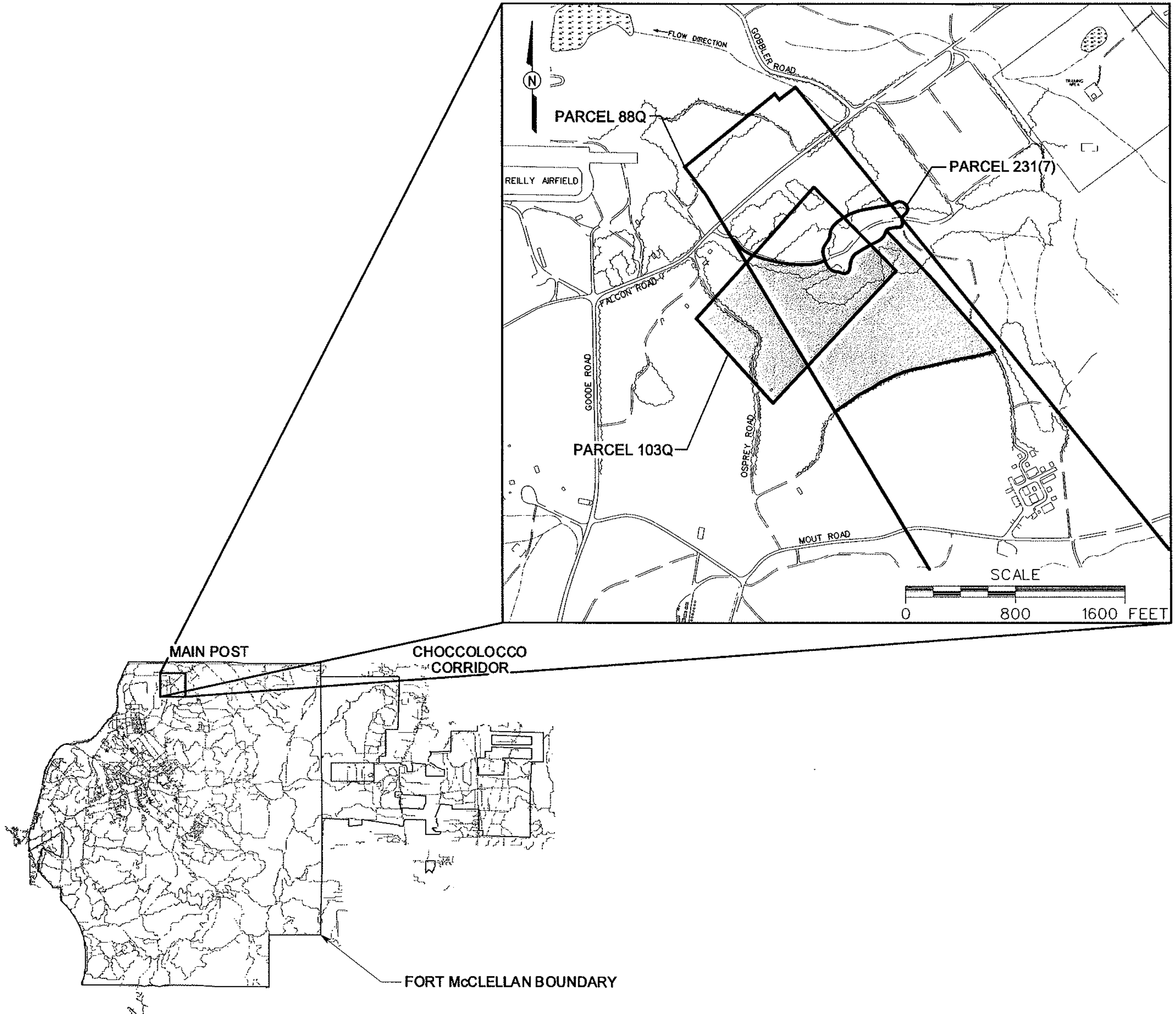
The Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range is in the northern part of the Main Post of FTMC, southeast of Reilly Airfield (Figure 1-1). The impact area is a portion of Range 30: End-of-Cycle Test Range, Parcel 88Q, and Former Rifle/Machine Gun Range, Parcel 103Q, as defined in the Environmental Baseline Survey (EBS), conducted by Environmental Science and Engineering, Inc. (ESE, 1998). Parcel 88Q was also known as Range 30: Confidence Course (ESE, 1998).

Range 30 (Parcel 88Q) was used from 1977 to sometime between 1983 and 1989 at which time the range was inactivated. Ordnance materials fired at this range included M-16 blanks, flares, and simulators. Reportedly, M-60 machine guns and .30-caliber ordnance were used historically. Range 30 was also used for end-of-cycle training, but has not been used since the mid to late 1980s. End-of-cycle training was the last phase of basic training prior to graduation.

Based on the location of Reilly Airfield to the northwest, the position of the Range 30 (Parcel 88Q) firing line, and the orientation of the range fan presented in the EBS, the direction of fire for Range 30 would have been to the southeast toward the unnamed hillside (Figure 1-2). The EBS does not depict an impact area for Parcel 88Q firing activities. However, the impact area for Parcel 103Q is identified in the EBS. As shown in Figure 1-2, Parcel 103Q overlaps Parcel 88Q for most of the area covered in this investigation.

Parcel 103Q is approximately 25 acres and Parcel 88Q is roughly 545 acres including the range safety fan (Figure 1-2). The portions (area of investigation) of Parcels 88Q and 103Q that are the subject of this RI occupy approximately 40 acres. The area of investigation is bounded to the north by an unpaved road that extends east of Falcon Road and bisects Parcel 231(7) (Figure 1-2). The southern limit is bounded by an unpaved road oriented southwest-northeast near the top of an unnamed hillside (Figure 1-2).

Exact dates of use and ordnance used are not described in the EBS. Archive-Search Report (ASR) (U.S. Army Corps of Engineers [USACE], 2001) map plates show activity in this area as early as World War I. The ASR identifies the area as OA-08, or, during subsequent years, by one of the following names: Tank Sub-Caliber Range, Carbine Transition Range (R-32), and/or Machine Gun Range (R-34) (USACE, 2001). During the 1950's Sub-caliber devices for use in tank main guns, included 37mm ammunition with black powder charges (USACE, 2001).



LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TREES / TREELINE
- MARSH / WETLANDS
- PARCEL BOUNDARY
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- FENCE

FIGURE 1-1
SITE LOCATION MAP
IMPACT AREA
PARCELS 88Q AND 103Q

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

IT CORPORATION
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STARTING DATE: 11/27/02 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR: J. RAGSDALE | DWG. NO.: ...\796887es.628
DRAWN BY: D. BOMAR | DRAWN BY: | ENGR. CHCK. BY: S. MORAN | PROJ. MGR.: J. YACOUB | PROJ. NO.: 796887

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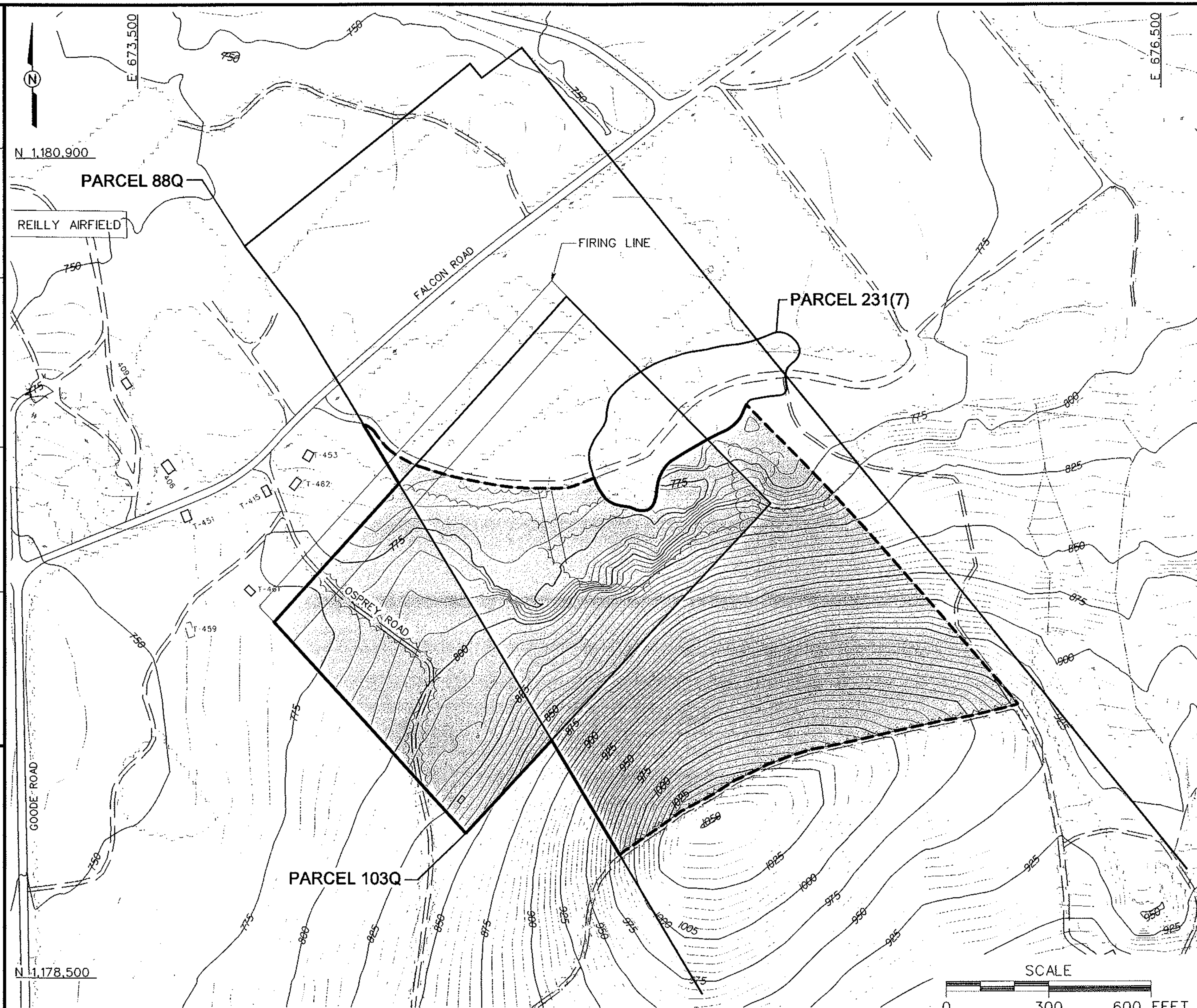

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- FENCE
- UTILITY POLE

FIGURE 1-2
SITE MAP
IMPACT AREA
PARCELS 88Q AND 103Q

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

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DWG. NO.: ...\796887es.629
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INITIATOR: J. RAGSDALE
PROJ. MGR.: J. YACOUB
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The ground surface of the area of investigation slopes to the northwest. Ground elevation ranges from approximately 750 feet above mean sea level (msl), in the relatively flat portion of the range near the dirt road to the northwest, to approximately 1,050 feet msl, at the peak of the unnamed hill used as the backstop for range activities. Surface drainage is to the northwest, toward Falcon Road.

IT personnel conducted a site walk at the Impact Area for Parcels 88Q and 103Q in October 2001. Numerous bullet fragments were observed over much of the area and were concentrated along the slope and base of the hillside. Surface soils at the impact area are expected to be contaminated with metals, particularly lead.

1.4 Regional and Site-Specific Geology

1.4.1 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 the 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 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 consists 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 toward 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). In Calhoun County, the Parkwood Formation 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 geologic 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. 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 is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks. It 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).

1.4.2 Site Specific Geology

The soil survey for Calhoun County, Alabama, classifies soil at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q, as Stony Rough Land sandstone, Anniston and Allen gravelly loam, and Anniston gravelly clay loam (U.S. Department of Agriculture [USDA], 1961). The Stony Rough Land sandstone consists of medium to strongly acidic, shallow or stony, well-drained, friable soils with many outcrops of sandstone and quartzite bedrock, loose rock fragments, and scattered patches of sandy soil material. It is found in rough mountainous areas with slopes generally greater than 25 percent (USDA, 1961). The Anniston and Allen gravelly loam consists of deep, strongly to very strongly acidic, well-drained, friable soils developed from weathered sandstone, shale and quartzite. The surface soil is dark brown to dark reddish-brown gravelly loam. The subsurface soil is dark red to yellowish-red, gravelly fine sandy clay loam to clay loam (USDA, 1961). The Anniston gravelly clay loam consists of friable, medium to strongly acidic, deep, well-drained soils that have developed from weathered sandstone, shale, and quartzite. Sandstone and quartzite gravel, cobbles, and fragments as large as eight inches in diameter are found on the surface and throughout the soil. The color of the Anniston gravelly clay loam surface soil ranges from dark brown and very dark brown to reddish brown and dark reddish brown. The texture of subsoil ranges from light clay loam to clay or silty clay loam (USDA, 1961).

The area of investigation is bisected by the Jacksonville fault. As shown on the site geologic map (Figure 1-3), the fault trace and geologic contacts strike generally northeast to southwest with transport direction of the thrust sheet to the northwest. Bedrock south of the fault is mapped as the Cambrian Chilhowee Group, undifferentiated. Most of the undifferentiated Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation based upon the abundance of orthoquartzitic sandstone and quartzite (Osborne and Szabo, 1984). Bedrock north

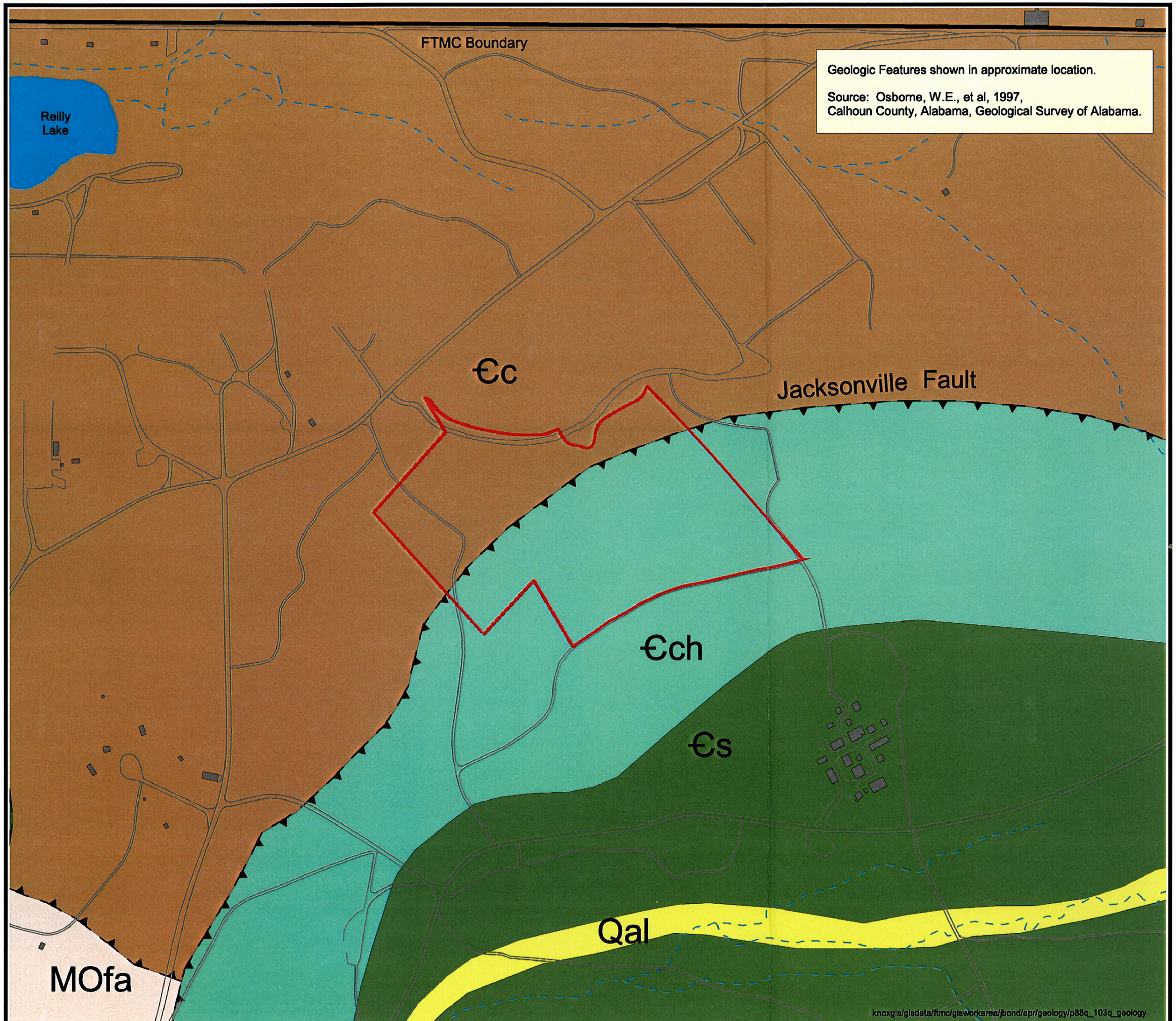

Figure 1-3

Site Geologic Map

Impact Area for Range 30, Parcel 88Q and Former Rifle/ Machine Gun Range, Parcel 103Q
Fort McClellan, Alabama

Legend

- FTMC Boundary
- Area of Investigation
- Roads
- Surface Drainage Feature (dashed where intermittent)
- Surface Water Feature (may be ephemeral)

Geology

Qal	Quaternary - Alluvium
MOfa	Mississippian/Ordovician - Floyd & Athens Shale, undifferentiated
Ꞓc	Cambrian - Conasauga Formation
Ꞓs	Cambrian - Shady Dolomite
Ꞓch	Cambrian - Chilhowee Group, undifferentiated

- Thrust Fault (dashed where inferred; barbs on upper sheet)

500 0 500 Feet

NAD83 State Plane Coordinates

N

U.S. Army Corps of Engineers Mobile District

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of the fault is mapped as the Cambrian Conasauga Formation. 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).

1.5 Regional Hydrogeology

The hydrogeology of Calhoun County has been investigated by the Geologic Survey of Alabama (Moser and DeJarnette, 1992) and the U.S. Geological Survey in cooperation with the General Services Administration (Warman and Causey, 1962) and Alabama Department of Environmental Management (ADEM) (Planert and Pritchette, 1989). Groundwater in the vicinity of FTMC occurs in residuum derived from bedrock decomposition, within fractured bedrock along fault zones, and from the development of karst frameworks. Groundwater flow may be estimated to be toward major surface water features. Areas with well-developed residuum horizons may subtly reflect the surface topography, but the groundwater flow direction also may exhibit the influence of pre-existing structural fabrics or the presence of perched water horizons on unweathered ledges or impermeable clay lenses.

Precipitation and subsequent infiltration provide recharge to the groundwater flow system in the region. The main recharge areas for the aquifers in Calhoun County are located in the valleys. The ridges generally consist of sandstone, quartzite, and slate which are resistant to weathering, relatively unaffected by faulting, and, therefore, relatively impermeable. The ridges have steep slopes and thin to no soil cover, which enhances runoff to the edges of the valleys (Planert and Pritchette, 1989).

The thrust fault zones typical of the county form large storage reservoirs for groundwater. Points of discharge occur as springs, effluent streams, and lakes. Coldwater Spring is one of the largest springs in the State of Alabama, with a discharge of approximately 32 million gallons per day. This spring is the main source of water for the Anniston Water Department, from which FTMC buys its water. The spring is located approximately five miles southwest of Anniston and discharges from the brecciated zone of the Jacksonville Fault (Warman and Causey, 1962).

Shallow groundwater on FTMC occurs principally in the residuum developed from Cambrian sedimentary and carbonate bedrock units of the Weisner Formation, Shady Dolomite, and locally in lower Ordovician carbonates. The residuum may yield adequate groundwater for domestic and livestock needs but may go dry during prolonged dry weather. Bedrock permeability is locally enhanced by fracture zones associated with thrust faults and by the development of solution (karst) features.

Two major aquifers were identified by Planert and Pritchette (1989): the Knox-Shady and Tuscumbia-Fort Payne aquifers. The continuity of the aquifers has been disrupted by the complex geologic structure of the region, such that each major aquifer occurs repeatedly in different areas. The Knox-Shady aquifer group occurs over most of Calhoun County and is the main source of groundwater in the county. It consists of the Cambrian- and Ordovician-aged quartzite and carbonates. The Conasauga Dolomite is the most utilized unit of the Knox-Shady aquifer, with twice as many wells drilled as any other unit (Moser and DeJarnette, 1992).

Regional groundwater flow in the bedrock was approximated for the FTMC vicinity by the U.S. Geological Survey (Scott et al., 1987). Regional groundwater elevation ranged from 800 feet above msl on the main base to about 600 feet above mean sea level to the west on Pelham Range, based on water depths in wells completed across multiple formations. Groundwater elevation contours suggest that regional groundwater flow is from the Main Post to the northwest.

Scott et al. (1987) concluded that the groundwater surface broadly coincides with the surface topography and that the regional aquifers are hydraulically connected. Groundwater flow on a local scale may be more complex and may be affected by geologic structures such as the shallow thrust faults, rock fracture systems, and karst development in soluble formations.

1.6 Scope of Work

The scope of work for activities associated with the RI Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, as specified by the USACE statement of work (USACE, 2002), includes the following tasks:

- Develop the RI SFSP attachment.

- Develop the RI SSHP attachment.

- Develop the UXO safety plan attachment.

- Conduct a surface and near surface UXO survey over all areas to be included in the sampling effort.

- Provide downhole UXO support for all intrusive direct-push and drilling activities to determine the presence of potential downhole hazards.

- Conduct a four phase investigation approach, including:

    1. XRF survey of surface soil to determine locations of soil borings and monitoring wells.

    2. Install 20 soil borings to collect surface soil and subsurface soil samples.

    3. Install 5 residuum monitoring wells.

    4. Collect 5 groundwater samples from 5 proposed residuum monitoring wells.

- Analyze samples for the parameter methods listed in Section 4.6.

- Conduct a feasibility study (FS) in accordance with the guidelines, criteria, and considerations set forth in the U.S. Environmental Protection Agency (EPA) 1988 guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final.*

Parcels 88Q and 103Q falls within the "Possible Explosive Ordnance Impact Areas" shown on Plate 10 of the *Archives Search Report, Maps, Revision 1, Fort McClellan, Anniston, Alabama* (USACE, 2001*)*; therefore, UXO surface sweeps and downhole surveys of soil borings will be required to support field activities at this site. The surface sweeps and downhole surveys will be conducted to identify anomalies for the purposes of UXO avoidance.

At the completion of the field activities and sample analyses, draft, draft final, and final RI summary reports will be prepared. Reports will be prepared in accordance with current EPA Region 4 and ADEM requirements.

Subsequent to completion of the RI field work, an FS will be conducted at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, to identify, develop, screen, and evaluate remedial alternatives for contaminated media at the site, as required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and as specified in the National Oil and Hazardous Substances Contingency Plan (40 *Code of Federal Regulations*, Part 300). An FS report will be prepared in accordance with the guidelines, criteria, and considerations set forth in the EPA guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988). The report will provide the Base Realignment and Closure (BRAC) Cleanup Team (BCT) sufficient data to select a feasible and cost-effective remedial alternative that will protect human health and the environment.

The sections in the FS report will provide the following:

- An introduction detailing site background information and a summary of the RI, including the nature and extent of contamination, contaminant fate and transport, and the results of the human health and ecological risk assessments.

- Identification and screening of remedial technologies.

- Development and screening of remedial alternatives.

- A detailed analysis of remedial alternatives.

The identification and screening of technologies section of the report will present objectives for remedial action(s), a summary of applicable health and environmental protection criteria and standards, and identification of volumes or areas of media to which remedial actions may be applied. It will also identify general response actions for each medium of interest, defining containment, treatment, excavation, or other actions, singly or in combination, that may be taken to satisfy the remedial action objectives. Potentially feasible technologies will be presented for each of the general response actions, along with the technical criteria and the site-specific requirements used in the technology screening process and the results of the remedial technology screening.

The development and screening of remedial alternatives section of the report will present the remedial alternatives developed by combining the technologies carried forward from the initial screening. Each of the identified alternatives will be screened against three evaluation criteria: 1) effectiveness, 2) implementability, and 3) cost.

The detailed analysis of remedial alternatives section will present a description and evaluation of each of the alternatives retained from the alternative screening process. Each alternative will be evaluated individually, and a comparative analysis among alternatives will be presented. The remedial action alternatives selected for evaluation will be individually evaluated against the following seven criteria:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume
- Short-term effectiveness
- Implementability
- Cost.

Although CERCLA requires the evaluation of alternatives against nine evaluation criteria, the state acceptance and community acceptance criteria will be evaluated in the record of decision after comments have been received on the FS report from the regulatory agencies and the public.

2.0 Summary of Existing Environmental Studies

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 U.S. Department of Defense 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.

The EBS was conducted in accordance with the Community Environmental Response Facilitation Act (CERFA) protocols (CERFA-Public Law 102-426) and U.S. Department of Defense policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, ADEM, 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 Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q Range is an area where no known or recorded storage, release, or disposal (including migration) has occurred on site property. The parcels, however, were qualified because the areas were used as active ranges and chemicals of potential concern may be present as a result of range activities. Therefore, Impact Area for Parcels 88Q and 103Q, required additional evaluation to determine their environmental condition.

The following sections summarize SI activities conducted by IT at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q.

2.1 Site Investigation

IT provided a letter report (February 26, 2002) to document the SI activities conducted at the Impact Area for Parcels 88Q and 103Q located at FTMC in Calhoun County, Alabama (Attachment 2). The SI consisted of a site walk by IT personnel at the Impact Area for Parcels 88Q and 103Q in October 2001. Numerous bullet fragments were observed over much of the area and were concentrated along the slope and base of the hillside. Surface soils at the impact area are expected to be contaminated with metals, particularly lead. As a result of this observation, no environmental samples were collected as part of the SI.

Based on the indications of the SI, past operations at the Impact Area for Parcels 88Q and 103Q appear to have adversely impacted the environment. The lead observed on the surface may indicate that lead concentrations in soil may pose an unacceptable risk to human health and the environment. The SI information for the Impact Area for Parcels 88Q and 103Q was presented to the BCT in January 2003. Based on the results of the SI, which included recommendations to conduct further investigation at the Impact Area for Parcels 88Q and 103Q, the BCT concluded that a RI be performed to define nature and extent of the lead contamination in soil.

3.0 Site-Specific Data Quality Objectives

3.1 Overview

The data quality objective (DQO) process is followed to establish data requirements. This process ensures that the proper quantity and quality of data are generated to support the decision-making process associated with the future action for Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q. This section incorporates the components of the DQO process described in the publication EPA 600/R-96/005 *Guidance for the Data Quality Process* (EPA, 2000). The DQO process as applied to the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q Range is described in more detail in Section 3.4 of this RI SFSP. Table 3-1 provides a summary of the factors used to determine the appropriate quantity of samples and the procedures necessary to meet the objectives of the RI and establish a basis for future action at this site.

To support the RI at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, three sample media will be collected for analysis: groundwater, surface soil, and subsurface soil.

The samples will be analyzed for this RI using EPA SW-846 methods, including Update III Methods where applicable, as presented in Chapter 4.0 in this RI SFSP and Section 5.0 of the QAP. Data will be reported in accordance with the definitive data requirements of the *USACE Engineer Manual 200-1-6, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects* (USACE, 1997) and evaluated by the stipulated requirements for the generation of definitive data (Section 7.2.2 of the QAP). Chemical data will be reported by the laboratory via hard-copy data packages using Contract Laboratory Program-like forms along with electronic copies. These packages will be validated in accordance with EPA National Functional Guidelines Level III criteria.

3.2 Data Users and Available Data

The available data related to the RI SFSP Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, presented in Table 3-1, have been used to formulate a site-specific conceptual model. This conceptual model was developed to support the development of this RI SFSP, which is necessary to meet the objectives of these activities and to establish a basis for future action at the site. The data users for information generated during field activities are primarily EPA, USACE, ADEM, FTMC, and the USACE supporting contractors. This RI SFSP, along with the necessary companion documents, has been designed to provide the regulatory

Table 3-1

Summary of Data Quality Objectives
Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Remedial Investigation
Fort McClellan, Calhoun County, Alabama

Users	Available Data	Conceptual Site Model	Media of Concern	Data Uses and Objectives	Data Types	Analytical Level	Data Quantity
EPA, ADEM USACE, DOD FTMC, IT Corporation Other contractors, and possible future land users	Previous site investigation by IT that indicate potential metals contamination.	Contaminant Source Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q Migration Pathways Rain runoff and erosion to surface soil, infiltration and leaching to subsurface soil and groundwater, dust emissions and volatilization to ambient air, and biotransfer to deer through browsing Potential Receptors Recreational site user (current and future) Resident (future) Groundskeeper (future) Construction Worker (future) PSSC Primarily metals	Surface soil Subsurface Soil Groundwater	RI to delineate vertical and horizontal extent of contamination in the site media Definitive quality data for future decision-making	Surface soil VOCs, SVOCs, metals, nitroaromatic/nitramine explosives, chlorinated and organophosphorus pesticides, chlorinated herbicides and PCBs	Definitive data in data packages (as defined in USACE EM200-1-6)	20 surface soil samples + QC
					Subsurface Soil VOCs, SVOCs, metals, nitroaromatic/nitramine explosives, chlorinated and organophosphorus pesticides, chlorinated herbicides and PCBs	Definitive data in data packages (as defined in USACE EM200-1-6)	40 subsurface soil samples + QC
					Groundwater VOCs, SVOCs, metals, nitroaromatic/nitramine explosives, chlorinated and organophosphorus pesticides, chlorinated herbicides and PCBs	Definitive data in data packages (as defined in USACE EM200-1-6)	5 groundwater samples + QC

ADEM - Alabama Department of Environmental Management.
EPA - U.S. Environmental Protection Agency.
FTMC - Fort McClellan.
PSSC - Potential site-specific chemical.
QC - Quality control.
RI - Remedial Investigation.

TOC - Total organic carbon.
PCB - polychlorinated biphenyls.
VOC - Volatile Organic Compounds.
SVOC - Semi-volatile Organic Compounds.
EM200-1-6 - USACE Engineering Manual, Chemical Quality Assurance for HTRW Projects, October 10, 1997.
USACE - U.S. Army Corps of Engineers.

Migration Pathways
Rain runoff and erosion to surface soil,
surface water and sediment; infiltration
and leaching to subsurface soil and groundwater;
dust emissions and volatilization to ambient air;
and biotransfer to deer through browsing

Potential Receptors
Recreational site user (current and future)
Resident (future)
Groundskeeper (future)
Construction Worker (future)

agencies with sufficient detail to reach a determination as to the adequacy of the scope of work. The program has also been designed to provide defensible information required to confirm or deny the existence and nature of residual chemical contamination in site media.

3.3 Conceptual Site Exposure Model

The conceptual site exposure model (CSEM) provides the basis for identifying and evaluating potential risks to human health in the risk assessment. The CSEM includes all receptors and potential exposure pathways appropriate to all plausible scenarios. The CSEM facilitates consistent and comprehensive evaluation of risk to human health through graphically presenting all possible exposure pathways, including all sources, release and transport pathways, and exposure routes. In addition, the CSEM helps to ensure that potential pathways are not overlooked. The elements of a complete exposure pathway and CSEM are:

- Source (i.e., contaminated environmental) media
- Contaminant release mechanisms
- Contaminant transport pathways
- Receptors
- Exposure pathways.

Contaminant release mechanisms and transport pathways are not relevant for direct receptor contact with a contaminated source medium.

Primary contaminant release mechanisms were associated with training exercises through leaks and spills. Potential contaminant transport pathways include rain runoff and erosion to surface soil, infiltration and leaching to subsurface soil and groundwater, dust emissions and volatilization to ambient air, and biotransfer to deer through browsing.

The Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, is a wooded area located on the northwestern slope of an unnamed hill. The area of investigation encompasses about 40 acres and is not fenced; thus, the area is accessible to trespassers. The trespassers may use the site for hunting purposes. There is not any work or further training occurring at the site and it is not currently maintained by a groundskeeper. Therefore, the only plausible receptor evaluated under the current land-use scenario is the recreational site user who hunts. Fish ingestion will not be evaluated because the surface water is insufficient to support fish for consumption. Potential receptor scenarios considered, but not included under current land-use scenarios, are as follows:

- ***Groundskeeper.*** The site is not currently maintained by a groundskeeper.

- ***Construction Worker.*** The site is unused, and no development or construction is occurring.

- ***Resident.*** The site is not currently used for residential purposes.

Future land use for the area of investigation is shown as industrial and passive recreation (EDAW, Inc., 1997). Potential receptor scenarios evaluated for the future include the following:

- ***Recreational Site User.*** Because future land use is passive recreation, and hunting near this site may be possible, the recreational site user who hunts is included.

- ***Groundskeeper.*** The portion of the site developed for industrial uses will be maintained.

- ***Construction Worker.*** The portion of the site developed for industrial uses will undergo construction and utilities will need to be maintained.

- ***Resident.*** Although the site is not expected to be used for residential purposes, the resident is considered in order to provide information for the project manager and regulators.

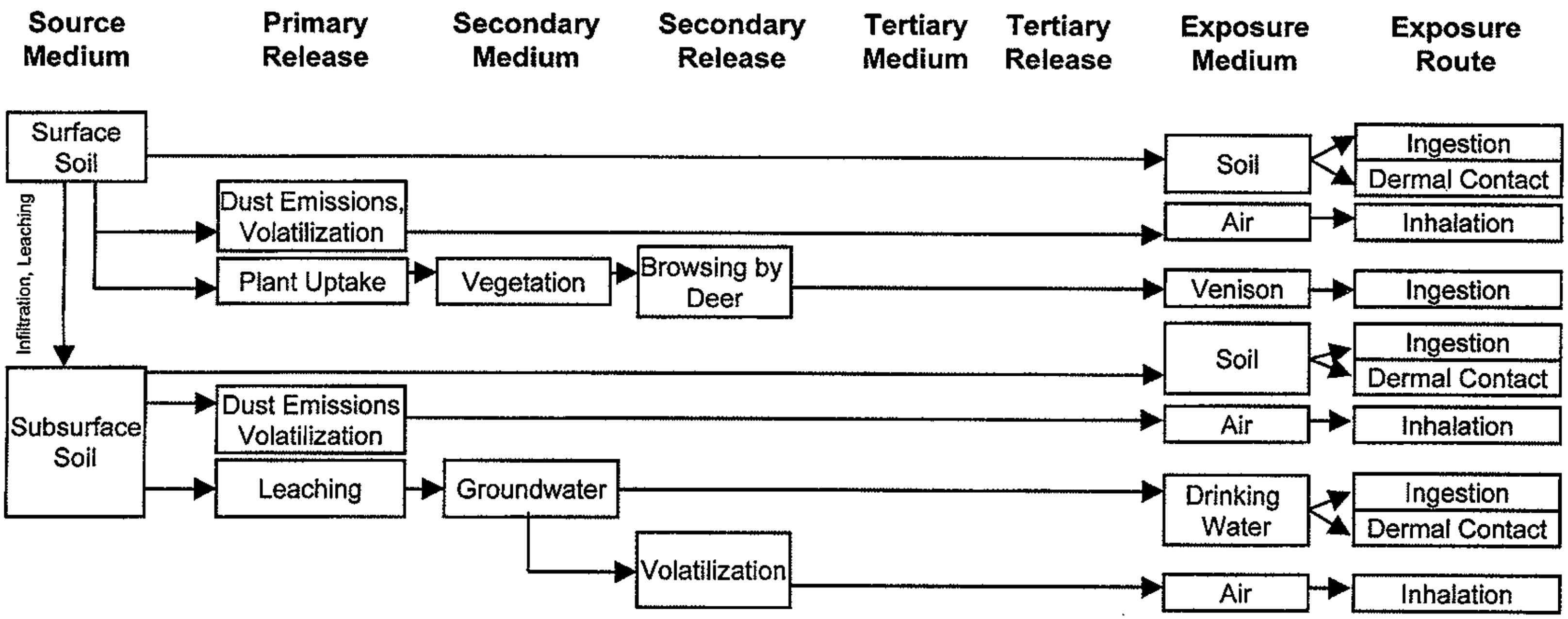
A summary of relevant contaminant release and transport mechanisms, source and exposure media, and receptor scenarios and exposure pathways for this site is provided in Table 3-1 and Figure 3-1.

3.4 Decision-Making Process, Data Uses, and Needs

3.4.1 Risk Evaluation

Confirmation of contamination at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, will be based on using EPA-definitive data to determine whether or not potential site-specific chemicals (PSSC) are detected in site media. Results from these analyses will be compared with site-specific screening levels (SSSL), environmental screening values (ESV), and background values to determine if PSSC are present at the site at concentrations that pose an unacceptable risk to human health or the environment. Definitive data will be adequate for confirming the presence of site contamination and for supporting a FS and risk assessment. Assessment of potential ecological risk associated with sites or parcels (e.g., specific ecological assessment methods) will be addressed in accordance with the procedures in Section 5.3 of the work plan (IT, 2002b).

Figure 3-1
Human Health Conceptual Site Exposure Model
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q
Fort McClellan, Alabama



Receptor Scenarios

Pathway	Groundskeeper - Future	Construction Worker - Future	Resident - Future	Recreational Site User - Current	Recreational Site User - Future
Surface Soil – Soil – Ingestion	*	*	*	*	*
Surface Soil – Soil – Dermal Contact	*	*	*	*	*
Surface Soil – Air – Inhalation	*	*	2	2	2
Surface Soil – Venison – Ingestion	1	1	*	*	*
Subsurface Soil – Soil – Ingestion	1	*	1	1	1
Subsurface Soil – Soil – Dermal Contact	1	*	1	1	1
Subsurface Soil – Air – Inhalation	1	*	1	1	1
Groundwater – Drinking Water – Ingestion	*	*	*	1	1
Groundwater – Drinking Water – Dermal Contact	*	*	*	1	1
Groundwater – Air – Inhalation	2	2	*	1	1

* = Complete exposure pathway evaluated in the streamlined risk assessment.
1 = Incomplete exposure pathway.
2 = Although theoretically complete, this pathway is judged to be insignificant and is not evaluated in the streamlined risk assessment.

KN3/4040/P88-103q/Fig 3-1.ppt/2/5/03 12:30 PM

3.4.2 Data Types and Quality

Surface soil, subsurface soil, and groundwater will be sampled and analyzed to meet the objectives of the RI at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q. In association with these definitive samples, quality assurance/quality control (QA/QC) samples will be collected for sample types as described in Chapter 5.0 of this RI SFSP.

Samples will be analyzed by EPA-approved SW-846 methods Update III, where available comply with EPA-definitive data requirements, and be reported using hard-copy data packages. In addition to meeting the quality needs of this RI SFSP, data analyzed at this level of quality are appropriate for all phases of site characterization, RI, and risk assessment.

3.4.3 Precision, Accuracy, and Completeness

Laboratory requirements of precision, accuracy, and completeness for this RI SFSP are defined in Section 3.1 and presented in Section 5.0 of the QAP (IT, 2002a).

4.0 Field Investigations

This remedial investigation will consist of a four-phase approach. The investigation phases are as follows:

- XRF survey of surface soil to determine soil boring and monitoring well locations.

- Install a total of 20 soil borings and collect one surface soil sample and two discrete subsurface soil samples from each soil boring (a total of 20 surface soil samples and 40 subsurface soil samples).

- Install five monitoring wells.

- Collect five groundwater samples from five proposed residuum monitoring wells.

XRF surface soil screening will be carried out in situ at approximately 80 locations within a grid installed in the area of investigation at the Impact Area for Parcels 88Q and 103Q as shown on Figure 4-1. Samples for XRF screening will be collected at the grid line intersections or "grid nodes" and listed on Table 4-1. Additional XRF screening locations will be selected in the area of investigation not covered by the grid to screen for hot spots. The purpose of the XRF surface soil screening will be to screen the surface soils in the area the impact area where bullet fragments were observed and surface soil is potentially contaminated with lead. Soil borings and monitoring will be installed using the XRF surface soil screening results to collect samples for analysis to define the horizontal extent of the presence of lead.

A total of 20 soil borings will be installed at the Impact Area for Parcels 88Q and 103Q to provide data to determine the vertical and horizontal extent of potential metals contamination in soil. A total of 20 surface soil samples and 40 subsurface soil samples will be collected. Six of the twenty soil boring locations have been selected and are shown on Figure 4-2 and listed on Table 4-2. XRF surface soil screening data may be used to adjust the final locations of these selected soil borings. Fourteen additional soil borings will be installed using XRF screening data and field conditions to select the locations. One surface soil and two discrete subsurface soil samples will be collected from each of the 12 soil borings (a total of 12 surface soil samples and 24 subsurface soil samples). The selection of the intervals for the discrete subsurface samples will be based on XRF screening of the subsurface soil showing the highest lead concentrations.

Five residuum monitoring wells are proposed at the Impact Area for Parcels 88Q and 103Q to be installed to approximate depth of 30 feet. Two of the five monitoring well locations have been

DWG. NO.: ..\796887es.630
PROJ. NO.: 796887
INITIATOR: J. RAGSDALE
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 11/27/02
DRAWN BY: D. BOMAR
02/06/03
10:06:18 AM
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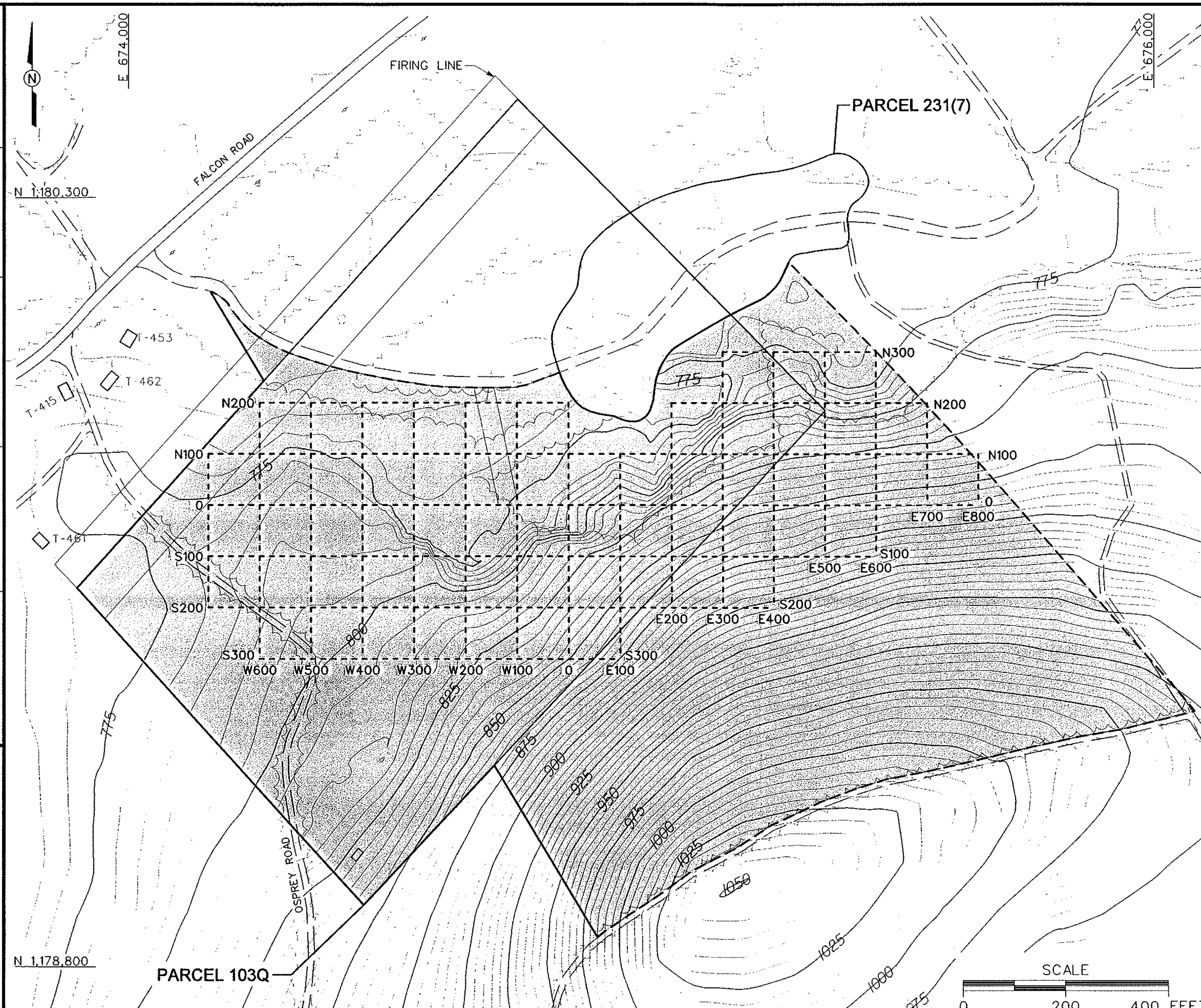


LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- FENCE
- UTILITY POLE
- XRF SAMPLE LOCATION GRID (100 ft x 100 ft). XRF SURFACE SOIL SAMPLE LOCATION WILL BE COLLECTED AT EACH GRID NODE.

NOTES:

1. GRID NODES ARE LABELED BY DISTANCE AND DIRECTION FROM CENTER POINT OF GRID (e.g., N100, W100) AND WILL BE LOCATED BY ACTUAL COORDINATES OF THE U.S. STATE PLANE COORDINATE SYSTEM, ALABAMA EAST ZONE, NORTH AMERICAN DATUM OF 1983. LOCATION OF MONITORING WELL PPMP-231-GP11 EQUALS GRID NODE E200,N300.
2. ADDITIONAL XRF SCREENING LOCATIONS WILL BE SELECTED IN THE AREA OF INVESTIGATION NOT COVERED BY THE GRID.

FIGURE 4-1
XRF SAMPLE LOCATION MAP
IMPACT AREA RANGE 30
PARCEL 88Q AND
FORMER RIFLE/MACHINE GUN
PARCEL 103Q

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

Table 4-1

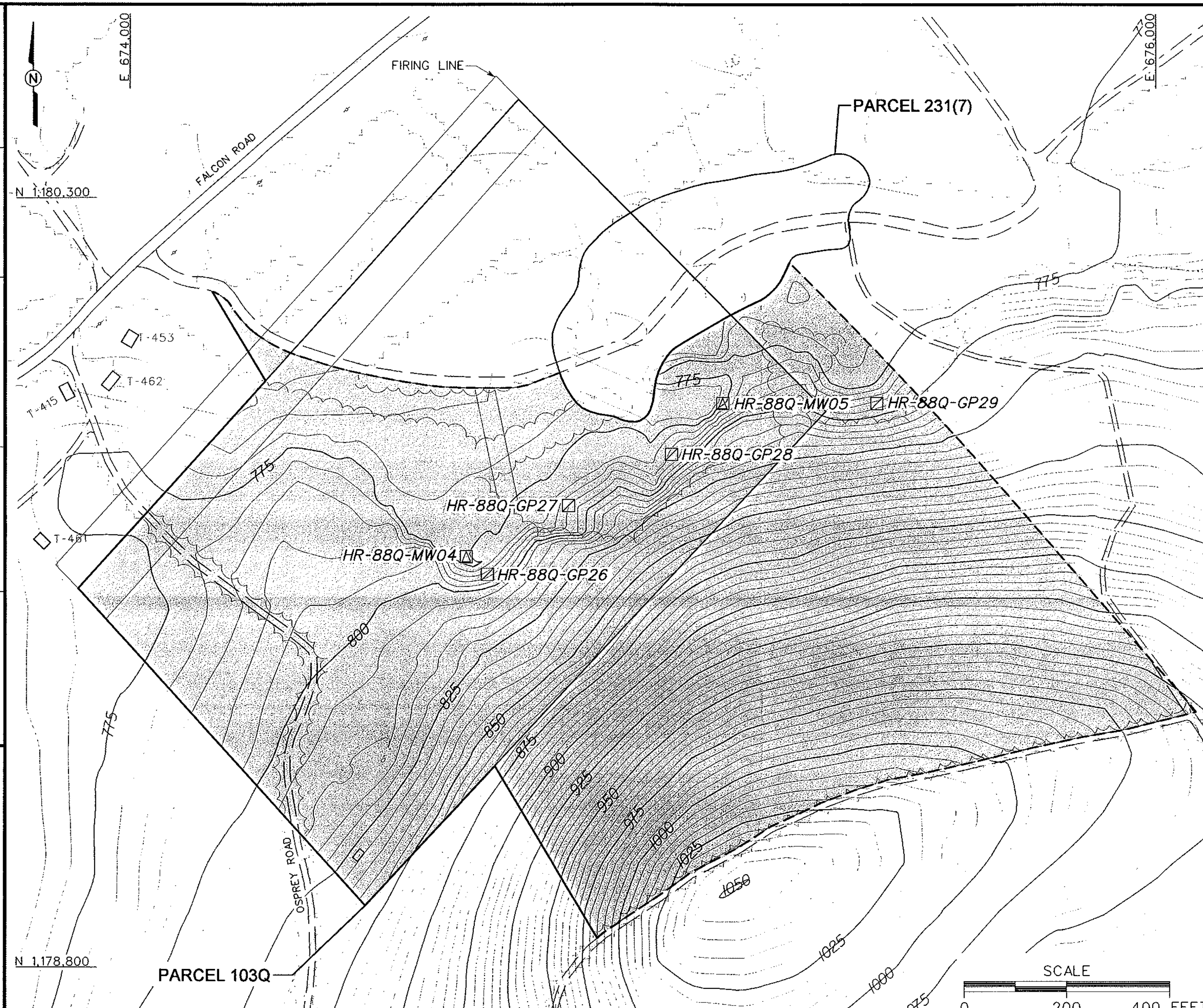
XRF Grid Node Coordinates
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Grid Node	Northing	Easting
0, 0	1179696.19	674859.13
N100, 0	1179796.19	674859.13
N200, 0	1179896.19	674859.13
S100, 0	1179596.19	674859.13
S200, 0	1179496.19	674859.13
S300, 0	1179396.19	674859.13
0, E100	1179696.19	674959.13
N100, E100	1179796.19	674959.13
S100, E100	1179596.19	674959.13
S200, E100	1179496.19	674959.13
S300, E100	1179396.19	674959.13
0, W100	1179696.19	674759.13
N100, W100	1179796.19	674759.13
N200, W100	1179896.19	674759.13
S100, W100	1179596.19	674759.13
S200, W100	1179496.19	674759.13
S300, W100	1179396.19	674759.13
0, E200	1179696.19	675059.13
N100, E200	1179796.19	675059.13
N200, E200	1179896.19	675059.13
S100, E200	1179596.19	675059.13
S200, E200	1179496.19	675059.13
0, W200	1179696.19	674659.13
N100, W200	1179796.19	674659.13
N200, W200	1179896.19	674659.13
S100, W200	1179596.19	674659.13
S200, W200	1179496.19	674659.13
S300, W200	1179396.19	674659.13
0, E300	1179696.19	675159.13
N100, E300	1179796.19	675159.13
N200, E300	1179896.19	675159.13
N300, E300	1179996.19	675159.13
S100, E300	1179596.19	675159.13
S200, E300	1179496.19	675159.13
0, W300	1179696.19	674559.13
N100, W300	1179796.19	674559.13
N200, W300	1179896.19	674559.13
S100, W300	1179596.19	674559.13
S200, W300	1179496.19	674559.13
S300, W300	1179396.19	674559.13
0, E400	1179696.19	675259.13
N100, E400	1179796.19	675259.13
N200, E400	1179896.19	675259.13
N300, E400	1179996.19	675259.13
S100, E400	1179596.19	675259.13
S200, E400	1179496.19	675259.13

Table 4-1

XRF Grid Node Coordinates
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Grid Node	Northing	Easting
0, W400	1179696.19	674459.13
N100, W400	1179796.19	674459.13
N200, W400	1179896.19	674459.13
S100, W400	1179596.19	674459.13
S200, W400	1179496.19	674459.13
S300, W400	1179396.19	674459.13
0, E500	1179696.19	675359.13
N100, E500	1179796.19	675359.13
N200, E500	1179896.19	675359.13
N300, E500	1179996.19	675359.13
S100, E500	1179596.19	675359.13
0, W500	1179696.19	674359.13
N100, W500	1179796.19	674359.13
N 200, W500	1179896.19	674359.13
S100, W500	1179596.19	674359.13
S200, W500	1179496.19	674359.13
S300, W500	1179396.19	674359.13
0, E600	1179696.19	675459.13
N100, E600	1179796.19	675459.13
N200, E600	1179896.19	675459.13
N300, E600	1179996.19	675459.13
S100, E600	1179596.19	675459.13
0, W600	1179696.19	674259.13
N100, W600	1179796.19	674259.13
N 200, W600	1179896.19	674259.13
S100, W600	1179596.19	674259.13
S200, W600	1179496.19	674259.13
S300, W600	1179396.19	674259.13
0, E700	1179696.19	675559.13
N100, E700	1179796.19	675559.13
N200, E700	1179896.19	675559.13
0, W700	1179696.19	674159.13
N100, W700	1179796.19	674159.13
S100, W700	1179596.19	674159.13
S200, W700	1179496.19	674159.13
0, E800	1179696.19	675659.13
N100, E800	1179796.19	675659.13



LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- TREES / TREELINE
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- FENCE
- UTILITY POLE
- PROPOSED MONITORING WELL / GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

NOTE:

1. APPROXIMATELY 14 ADDITIONAL SOIL BORINGS AND 3 ADDITIONAL MONITORING WELLS (NOT SHOWN) WILL BE INSTALLED BASED ON XRF SOIL SCREENING RESULTS.

FIGURE 4-2
PROPOSED SAMPLE LOCATION MAP
IMPACT AREA RANGE 30
PARCEL 88Q AND
FORMER RIFLE/MACHINE GUN
PARCEL 103Q

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

DWG. NO.: ...\796887es.637
PROJ. NO.: 796887
INITIATOR: J. RAGSDALE
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 11/27/02
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Tab.. 4-2

Sampling Locations and Rationale
Remedial Investigation
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-MW04	One surface soil, two subsurface soils, and one groundwater	Soil boring location for one surface soil and two subsurface soil samples and permanent residuum monitoring well to an approximate depth of 30 feet bgs for groundwater sample to be located at the base of the bluff in the central area of the investigation at grid node W200, S100. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and groundwater. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-MW05	One surface soil, two subsurface soils, and one groundwater	Soil boring location for one surface soil and two subsurface soil samples and permanent residuum monitoring well to an approximate depth of 30 feet bgs for groundwater sample to be located at the base of the bluff in the northeastern area of the investigation at grid node E300, N200. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and groundwater. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-MW06	One surface soil, two subsurface soils, and one groundwater	Soil boring location and permanent residuum monitoring well to an approximate depth of 30 feet bgs to be determined based on XRF surface soil screening results for one surface soil, two subsurface soil samples and groundwater sample. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-MW07	One surface soil, two subsurface soils, and one groundwater	Soil boring location and permanent residuum monitoring well to an approximate depth of 30 feet bgs to be determined based on XRF surface soil screening results for one surface soil, two subsurface soil samples and groundwater sample. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-MW08	One surface soil, two subsurface soils, and one groundwater	Soil boring location and permanent residuum monitoring well to an approximate depth of 30 feet bgs to be determined based on XRF surface soil screening results for one surface soil, two subsurface soil samples, and groundwater sample. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP26	One surface soil and two subsurface soils	Soil boring for one surface soil and two subsurface soil samples to be located in the middle of the north facing bluff. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and sample data will confirm if contaminant releases into the environment have occurred from the use of this area. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.

Sampling Locations and Rationale
Remedial Investigation
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-GP27	One surface soil and two subsurface soils	Soil boring for one surface soil and two subsurface soil samples to be located in the middle of the north facing bluff at grid node 0, 0. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and sample data will confirm if contaminant releases into the environment have occurred from the use of this area. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP28	One surface soil and two subsurface soils	Soil boring for one surface soil and two subsurface soil samples to be located in the middle of the north facing bluff at grid node E200, N100. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and sample data will confirm if contaminant releases into the environment have occurred from the use of this area. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP29	One surface soil and two subsurface soils	Soil boring for one surface soil and two subsurface soil samples to be located in the middle of the north facing bluff at grid node E600, N200. Sample data will confirm if contamination previously observed on the surface is in the subsurface soil and sample data will confirm if contaminant releases into the environment have occurred from the use of this area. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP30	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP31	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP32	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP33	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.

Table 4-2

Sampling Locations and Rationale
Remedial Investigation
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-88Q-GP34	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP35	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP36	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP37	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP38	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP39	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-88Q-GP40	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined based on XRF surface soil screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentration. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.

previously selected and are shown on Figure 4-2. The remaining three proposed residuum monitoring well locations will be determined based on XRF surface soil screening results.

Five groundwater samples will be collected from the monitoring wells in the vicinity of the Impact Area for Parcels 88Q and 103Q. Groundwater samples will be collected from the five proposed residuum monitoring wells.

The following sections describe the field activities required to conduct the remedial investigations at the Impact Area for Parcels 88Q and 103Q.

4.1 UXO Survey Requirements and Utility Clearances

The Impact Area for Parcels 88Q and 103Q falls within the "Possible Explosive Ordnance Impact Areas" shown on Plate 10 of the *Archives Search Report, Maps, Revision 1, Fort McClellan, Anniston, Alabama* (USACE, 2001); therefore, UXO surface sweeps and downhole surveys of soil borings will be required to support field activities this site. The surface sweeps and downhole surveys will be conducted to identify anomalies for the purposes of UXO avoidance. IT will conduct UXO avoidance activities as outlined in Appendix E of the SAP (IT, 2002a) and the attached site-specific UXO safety plan.

4.1.1 Surface UXO Survey

A UXO sweep will be conducted over areas that will be included in the sampling and surveying activities to identify UXO on or near the surface that may present a hazard to on-site workers during field activities. Low-sensitivity magnetometers will be used to locate surface and shallow-buried metal objects. UXO located on the surface will be identified and conspicuously marked for easy avoidance. UXO personnel requirements, procedures, and detailed descriptions of the geophysical equipment to be used are provided in Chapter 4.0 and Appendix E of the SAP (IT, 2002a).

4.1.2 Downhole UXO Survey

During the soil boring and downhole sampling activities, a downhole UXO survey will be performed to determine if buried metallic objects are present. UXO monitoring as described in Appendix E of the SAP (IT, 2002a) will continue until undisturbed soils are encountered or the borehole has been advanced to 12 feet bgs, whichever is reached first.

4.1.3 Utility Clearances

After the UXO surface survey has cleared the area to be sampled and prior to performing any intrusive sampling, a utility clearance will be performed at all locations where soil and groundwater samples will be collected, using the procedure outlined in Section 4.2 of the SAP (IT, 2002a). The site manager will mark the proposed locations with stakes, coordinate with the appropriate utility companies to clear the proposed locations for utilities, and obtain digging permits. Once the locations are approved (for both UXO and utility avoidance) for intrusive sampling, the stakes will be labeled as cleared.

4.2 X-Ray Fluorescence Surface Soil Screening

XRF surface soil screening will be carried out in situ at approximately 80 locations within a grid installed in the area of investigation for the Impact Area for Parcels 88Q and 103Q, shown on Figure 4-1. Additional XRF screening locations will be selected at random in the area of investigation outside the grid to screen for "hot spots." The purpose of the XRF surface soil screening will be to analyze the surface soils in the impact area to define the horizontal extent of the presence of lead. The 100- foot grid shown in Figure 4-1 presents the proposed XRF surface soil sample locations surrounding the impact area. Samples will be collected at the grid line intersections or "grid nodes." Surface soil samples will be screened by XRF starting at the grid nodes and moving out to subsequent grid nodes. Table 4-1 presents the coordinates for each grid node where surface soil may be collected for XRF screening. The limits of the grid were determined from observations of lead fragments on the surface during the SI by IT that is presented in Chapter 2.0 of this SFSP. XRF surface soil screening results will be compared to the ESV for lead (50 milligrams per kilogram [mg/kg]) to determine the actual limits of the grid boundaries. The XRF grid may be expanded if surface soil results at grid nodes along the perimeter of the grid indicate high levels of lead. After the initial XRF screening of surface soil at each grid node locations has been completed, additional sample locations between grid nodes may be selected for XRF screening to further define the extent of potential lead contamination. Results from the XRF surface soil screening will be used to aid in placing soil borings and monitoring well locations and may be used to adjust the locations of the sample locations shown on Figure 4-2.

The XRF surface soil screening will be conducted in accordance with the procedures specified in Section 6.9 of the SAP. Sample documentation and chain-of-custody (COC) will be recorded as specified in Chapter 6.0 of the SAP.

To perform this phase of the investigation, metals screening will be completed on site using an energy-dispersive portable XRF instrument. Site soil surface areas will be prepared and analyzed in situ according to the methodology specified in this SFSP. Although the XRF instrument will measure and record a number of metals present at the screening location, lead has been selected as the primary indicator element of contamination from range use. XRF surface soil analysis provides screening-level data.

XRF surface soil screening measurements involve exposing the soil to a series of x-rays generated by radioactive sources stored within the instrument. Qualitative and quantitative data are generated by measuring the wavelength and frequency of the fluorescence of the metallic elements present in the soil. The fluorescence is a function of the x-ray strength and length of exposure during analysis. These data are captured and interpreted using an onboard data processor, then reported via the display screen for manual recording in terms of concentration and standard deviation. The manufacturer's directions for instrument calibration, operation, and maintenance shall be followed explicitly. Select samples will be measured in duplicate to assess analytical precision.

Prior to the measurement, the analyst will perform the daily instrument calibration checks. In situ measurements will be conducted by the XRF analyst placing the instrument probe in direct contact with the soil. In situ measurements will be performed on areas where the soil has been prepared. This preparation will include the following steps:

- A visual assessment to ensure the soil is not wet (if the location is wet, an aliquot will be collected and prepared by oven drying in a mobile lab to remove moisture before analysis).

- Removal of rocks, vegetative material, and bullet fragments from the surface using a trowel or spoon.

- Thorough surficial mixing to break up the compacted soil.

- Hand tamping the soil into a small, compacted dome with a level surface for probe interface.

When a compacted, level surface is achieved, the probe is then placed onto the prepared surface and is checked for consistency of contact and the analysis initiated. When the measurement is complete, the analyst will record the XRF surface soil sample result manually on the XRF surface soil sample collection log. The XRF instrument logger will also record the analytical result associated with the sample location identity in its internal memory. This process will be repeated to gather data for all identified locations.

During XRF calibration, the analyst will perform measurements on a blank matrix (Teflon® or quartz) and on two standard reference materials (SRM) purchased from the National Institute of Standards and Technology. SRM 2586 has a certified concentration of 432 mg/kg of lead, and SRM 2711 has a certified concentration of 1,162 mg/kg and 114 mg/kg of copper. Successful calibration of the instrument will be based on a nondetect value for lead on the blank matrix sample while achieving a relative percent difference of less than 25 percent for the SRM-measured concentrations compared to the certified values for lead and copper. Calibrations will be performed at the beginning and end of each day's analysis.

In addition to the accuracy check of the calibration, the XRF instrument will be used to periodically measure the same location in duplicate to assess analytical precision. The check will be performed once every 20 field measurements at the discretion of the XRF analyst.

XRF QA/QC surface soil samples will be collected and submitted for laboratory analysis by EPA Method 6010B for lead. If the XRF instrument indicates locations with a high concentration of lead, the calibration surface soil samples will be collected from these locations. The calibration surface soil samples will be collected at a frequency of 10 percent. Therefore, if approximately 80 surface soil sample locations are proposed, there will be eight XRF QA/QC surface soil samples collected. However, the number of actual XRF QA/QC surface soil samples will be determined on the actual number of surface soil samples screened by XRF. The XRF QA/QC samples, as listed in Table 4-3 of this SFSP, will be analyzed in the laboratory for lead using the method presented in Section 4.6.

The XRF analyst will be responsible for manually recording the results of the instrument calibration and the results of each field measurement using the XRF calibration forms and the XRF QA/QC surface soil sample collection form.

4.3 Environmental Sampling

The environmental sampling program during the RI Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, includes the collection of surface and subsurface soil, and groundwater samples for chemical analyses. The proposed sampling is intended to provide sufficient data to complete the RI; however, if additional contaminants are detected, additional phases of soil boring installation, groundwater monitoring well installation, and sampling may be required.

Table 4-3

XRF QA/QC Surface Soil Sample Designations and QA/QC Sample Quantities,
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1	HR-88Q-####-SS-SG$$$$-FD		Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1		HR-88Q-####-SS-SG$$$$-MS/MSD	Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper
HR-88Q-####	HR-88Q-####-SS-SG$$$$-REG	0-1			Lead and Copper

- Unique location identifier
$$$$ - Unique sample number
FD - Field duplicate.

MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.

4.3.1 Surface Soil Sampling

Twenty surface soil samples will be collected at the 20 soil boring locations proposed at Parcels 88Q and 103Q.

4.3.1.1 Sample Locations and Rationale

The sampling rationale for each surface soil sample is listed in Table 4-2. Six of the 20 soil boring locations where surface soil samples will be collected have been selected and are shown on Figure 4-2. The remaining 14 soil boring locations, where surface soil samples will be collected, will be determined based on results from XRF surface soil screening for lead. Surface soil sample designations and QA/QC sample requirements are summarized in Table 4-4. The final soil boring sampling locations will be determined in the field by the on-site geologist based on actual field conditions.

4.3.1.2 Sample Collection

Surface soil samples will be collected from the uppermost foot of soil by direct-push methodology as specified in Sections 5.1.1.1 and 6.1.1.1 of the SAP (IT, 2002a). In areas where site access does not permit the use of a direct-push rig, the samples will be collected using a stainless-steel hand auger as specified in Sections 5.1.1.2 and 6.1.1.1 of the SAP. Collected soil samples will be screened using a photoionization detector (PID) in accordance with Section 6.8.3 of the SAP. Surface soil samples will be screened for information purposes only, not to aid in the selection of samples for analysis. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are discussed in Section 4.0 and listed in Table 4-1 of the QAP. Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP. The six surface soil samples from the selected soil boring locations shown on Figure 4-2 will be analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals, explosives, pesticides, herbicides, and polychlorinated biphenyls (PCB). Additionally, four surface soil samples from the remaining 14 soil boring locations to be determined based on XRF surface soil screening results will be analyzed for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs (Table 4-2). The remaining ten surface soil samples will be analyzed for metals and explosives only.

4.3.2 Subsurface Soil Sampling

Forty subsurface soil samples will be collected at the 20 soil boring locations proposed at the impact area for Parcels 88Q and 108Q. Two discrete subsurface soil samples from each soil boring will be collected. The additional upper subsurface soil samples will be collected at depth

Table 4-4

Surface Soil and Subsurface Soil Sample Designations and QA/QC Sample Quantities
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-88Q-MW04	HR-88Q-MW04-SS-SG0057-REG HR-88Q-MW04-DS-SG0058-REG HR-88Q-MW04-DS-SG0059-REG	0-1 1-12 2-12[b]		HR-88Q-MW04-SS-SG0021-MS/MSD	TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-MW05	HR-88Q-MW05-SS-SG0060-REG HR-88Q-MW05-DS-SG0061-REG HR-88Q-MW05-DS-SG0063-REG	0-1 1-12 2-12[b]	HR-88Q-MW05-DS-SG0062-FD		TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-MW06	HR-88Q-MW06-SS-SG0064-REG HR-88Q-MW06-DS-SG0065-REG HR-88Q-MW06-DS-SG0066-REG	0-1 1-12 2-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-MW07	HR-88Q-MW07-SS-SG0067-REG HR-88Q-MW07-DS-SG0068-REG HR-88Q-MW07-DS-SG0069-REG	0-1 1-12 2-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-MW08	HR-88Q-MW08-SS-SG0070-REG	0-1			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
	HR-88Q-MW08-DS-SG0071-REG HR-88Q-MW08-DS-SG0072-REG	1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP26	HR-88Q-GP26-SS-SG0073-REG HR-88Q-GP26-DS-SG0074-REG HR-88Q-GP26-DS-SG0075-REG	0-1 1-12 2-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-GP27	HR-88Q-GP27-SS-SG0076-REG HR-88Q-GP27-DS-SG0077-REG HR-88Q-GP27-DS-SG0078-REG	0-1 1-12 2-12[b]	HR-88Q-GP27-DS-SG0079-FD		TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-88Q-GP28	HR-88Q-GP28-SS-SG0080-REG HR-88Q-GP28-DS-SG0081-REG HR-88Q-GP28-DS-SG0082-REG	0-1 1-12 2-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's

Table 4-4

Surface Soil and Subsurface Soil Sample Designations and QA/QC Sample Quantities
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples Field Duplicates	QA/QC Samples MS/MSD	Analytical Suite
HR-88Q-GP29	HR-88Q-GP29-SS-SG0083-REG HR-88Q-GP29-DS-SG0084-REG	0-1[a] 1-12			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
	HR-88Q-GP29-DS-SG0085-REG	2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP30	HR-88Q-GP31-SS-SG0086-REG	0-1[a]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
	HR-88Q-GP31-DS-SG0087-REG HR-88Q-GP31-DS-SG0088-REG	1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP31	HR-88Q-GP31-SS-SG0089-REG HR-88Q-GP31-DS-SG0090-REG HR-88Q-GP31-DS-SG0091-REG	0-1 1-12 2-12[b]		HR-88Q-GP31-DS-SG0090-MS/MSD	TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP32	HR-88Q-GP32-SS-SG0092-REG HR-88Q-GP32-DS-SG0093-REG HR-88Q-GP32-DS-SG0094-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP33	HR-88Q-GP33-SS-SG0095-REG HR-88Q-GP33-DS-SG0096-REG HR-88Q-GP33-DS-SG0097-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP34	HR-88Q-GP34-SS-SG0098-REG HR-88Q-GP34-DS-SG0100-REG HR-88Q-GP34-DS-SG0101-REG	0-1 1-12 2-12[b]	HR-88Q-GP34-SS-SG099-FD		TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP35	HR-88Q-GP35-SS-SG0102-REG HR-88Q-GP35-DS-SG0103-REG HR-88Q-GP35-DS-SG0104-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP36	HR-88Q-GP36-SS-SG0105-REG HR-88Q-GP36-DS-SG0106-REG HR-88Q-GP36-DS-SG0107-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives

Table 4-4

Surface Soil and Subsurface Soil Sample Designations and QA/QC Sample Quantities
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples Field Duplicates	MS/MSD	Analytical Suite
HR-88Q-GP37	HR-88Q-GP37-SS-SG0108-REG HR-88Q-GP37-DS-SG0109-REG HR-88Q-GP37-DS-SG0110-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP38	HR-88Q-GP38-SS-SG0111-REG HR-88Q-GP38-DS-SG0112-REG HR-88Q-GP38-DS-SG0113-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP39	HR-88Q-GP39-SS-SG0114-REG HR-88Q-GP39-DS-SG0115-REG HR-88Q-GP39-DS-SG0116-REG	0-1 1-12 2-12[b]	HR-88Q-GP39-DS-SG0117-FD		TAL Metals and Nitroaromatic/Nitramine Explosives
HR-88Q-GP40	HR-88Q-GP40-SS-SG0118-REG HR-88Q-GP40-DS-SG0119-REG HR-88Q-GP40-DS-SG0120-REG	0-1 1-12 2-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives

a Only the surface soil sample from this soil boring will be analyzed for the full suite of analyses
b Second subsurface soil sample to be collected from a different depth interval lower than the first subsurface soil sample so a to collect two discrete subsurface soil samples from each soil boring.

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.

TAL - Target analyte list.
TCL - Target compound list.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

intervals based on XRF screening of the subsurface soil intervals. The second (lower) subsurface soil sample from each soil boring will be collected from an interval below the first subsurface soil sample based on the XRF screening, but not any deeper than 12 feet bgs. Section 4.3.2.2 describes the procedure for selecting the subsurface soil sample interval by XRF screening.

4.3.2.1 Sample Locations and Rationale

The sampling rationale for each subsurface soil sample is listed in Table 4-2. Proposed sampling locations are shown in Figure 4-2. Subsurface soil sample designations and QA/QC sample requirements are summarized in Table 4-4. The final soil boring sampling locations will be determined in the field by the on-site geologist based on actual field conditions.

4.3.2.2 Sample Collection

Subsurface soil samples will be collected from soil borings at a depth greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings will be advanced and soil samples collected using the direct-push sampling procedures specified in Sections 5.1.1.1 and 6.1.1.1 of the SAP (IT, 2002a). In areas where site access does not permit the use of a direct-push rig, the samples will be collected using a hand auger, as specified in Sections 5.1.1.2 and 6.1.1.1 of the SAP.

Soil samples will be collected continuously for the first 12 feet or until either groundwater or refusal is met. A detailed lithogical log will be recorded by the on-site geologist for each borehole. The soil borings will be logged in accordance with ASTM Method D 2488 using the Unified Soil Classification System (ASTM, 1993). Two subsurface soil samples will be collected from each soil boring at the Impact Area for Parcels 88Q and 103Q either using direct-push technology (DPT) or hand auger. XRF will be used in the field to screen the collected depth intervals to determine the subsurface soil samples with the highest lead concentrations, which will be sent to the laboratory for additional analysis. The following describes the sample handling procedure that will be used to screen the subsurface soil intervals.

Whether the boring is installed with DPT or hand auger, the site geologist will describe the soil interval for the boring log and take headspace readings for organic vapors as per the procedures specified in the SAP. The XRF technician will then composite the sample in a decontaminated stainless steel mixing bowl and transfer a representative aliquot for on-site analysis into a labeled disposable aluminum pan. Remaining soil will be transferred temporarily into a labeled Ziploc® bag and stored in a cooler on ice until the boring is complete. The aliquot for onsite analysis will be visually assessed for moisture content, and if the content is too high, the soil will be further prepared by oven drying. If the technician judges the soil is dry enough, the aliquot will be further mixed and hand-tamped using a sampling spoon, the XRF cover plate will be placed over the soil in a way to ensure good contact with the film window. The XRF will be placed over the cover plate and the analysis initiated. The XRF technician will monitor the output from the XRF and when an adequate amount of time to quantify the lead and copper soil concentrations (approximately 120 seconds) has passed, the analysis will be stopped and the technician will record the results presented on the XRF liquid crystal display screen onto the XRF analysis form. This process will be repeated until all collected intervals for a boring have been collected and DPT or auger refusal is encountered.

At that point, the XRF technician and the geologist will confer and review the available data. Intervals will then be selected for offsite analysis based on geological conditions, results of the headspace screening, and the XRF analysis. Selected depth intervals samples will be removed from temporary storage in the cooler and aliquots will be collected to fulfill the analytical requirements specified in this SFSP. Site conditions such as lithology may also determine the actual sample depth interval submitted for analysis. The collected subsurface soil samples will be field-screened using a PID in accordance with Section 6.8.3 of the SAP to measure samples exhibiting elevated readings exceeding background (readings in ambient air). Subsurface soil samples will be PID-screened for information purposes only, not to aid in selection of samples for analysis.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are discussed in Section 4.0 and listed in Table 4-1 of the QAP. The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP. The 12 subsurface soil samples from the 6 selected borings shown on Figure 4-2 and 3 subsurface soil samples from the 14 soil borings to be determined based on XRF screening will be analyzed for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs. The remaining 25 subsurface soil samples collected from the 14 soil borings to be determined based on XRF screening will be analyzed for metals and explosives, only

4.3.3 Monitoring Well Installation

Five residuum monitoring wells are proposed at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q Range (Figure 4-1). The monitoring wells will be installed using hollow-stem auger drilling methods. The wells will be installed to provide additional information on water quality and groundwater flow in the residuum groundwater saturated zone.

4.3.3.1 Monitoring Well Locations and Rationale

Five proposed residuum monitoring wells will be installed to further characterize the local groundwater flow and delineate the horizontal extent of contamination in the residuum saturated zone. The locations of two of the five proposed monitoring wells are presented on Figure 4-2. The remaining three proposed monitoring well locations will be selected based on the results of XRF screening of the surface soil discussed in Section 4.2. Table 4-2 presents proposed monitoring well location and sampling rationale. The exact location of each proposed monitoring well will be determined in the field by the on-site geologist, based on XRF surface soil screening results and actual field conditions.

4.3.3.2 Residuum Monitoring Wells

Five permanent residuum monitoring wells will be installed at the Impact Area for Parcels 88Q and 103Q using 4-1/4-inch inside diameter (ID) hollow-stem augers. Residuum monitoring wells will be drilled to a minimum of 20 feet below the first groundwater-bearing zone or to the top of bedrock, whichever is encountered first. Estimated depth of the proposed residuum monitoring wells is approximately 30 feet bgs. Samples will be collected at 5-foot intervals from 5 feet bgs (or at direct-push sample refusal) to the total well depth by the on-site geologist (to record lithologic information). The samples will be collected using a 24-inch-long, 2-inch-or-larger-diameter split-spoon sampler. The soil borings will be logged in accordance with ASTM Method D 2488 using the Unified Soil Classification System. The soil samples will be screened in the field for the presence of VOC contamination using a PID for information purposes only, not to select soil sample intervals.

The well casing will consist of new 2-inch ID, Schedule 40, threaded, flush-joint, polyvinyl chloride (PVC) pipe. Attached to the bottom of the well casing will be a section of new threaded, flush-joint, 0.010-inch continuous wrap PVC well screen, 10 to 20 feet long. At the discretion of the IT site manager, a sump (composed of a new 2-inch ID, Schedule 40, threaded, flush-joint, PVC pipe) may be attached to the bottom of the well screen. After the casing and screen materials are lowered into the boring, a filter pack will be installed around the well screen. In wells installed to depths of 20 feet or less, the filter pack material will be gravity filled. In wells installed to depths of 20 feet or more, the filter pack will be tremied into place. The filter pack will be installed from the bottom of the well to approximately 5 feet above the top of the screen. The filter pack will consist of 20/40 silica sand. A fine sand (30/70 silica sand), approximately 5 feet thick, may be placed above the filter pack. A bentonite seal, approximately 5 feet thick, will be placed above the filter pack (or fine sand if used). The remaining annular space will be grouted with a bentonite-cement mixture, using approximately 7 to 8 gallons of water and approximately 5 pounds of bentonite per 94-pound bag of Type I or Type II Portland cement. The grout will be tremied into place from the top of the bentonite seal to ground surface. Monitoring wells will be completed with stick-up or flush-mount construction as determined by the site geologist. Investigation-derived waste (IDW) will be containerized and staged in accordance with Section 4.7 of this RI SFSP.

The monitoring wells will be drilled, installed, and developed as specified in Section 5.1 and Appendix C of the SAP (IT, 2002a). The exact monitoring well locations will be determined in the field by the on-site geologist, based on actual field conditions. Monitoring wells will be allowed to equilibrate for 14 days after well development prior to collecting groundwater samples.

4.3.4 Groundwater Sampling

Five groundwater samples will be collected from the 5 residuum monitoring wells proposed at the Impact Area for Parcels 88Q and 103Q.

4.3.4.1 Sample Locations and Rationale

Two of the five proposed groundwater monitoring wells are depicted in Figure 4-2. The remaining three proposed residuum monitoring well location will be determined based on XRF surface soil screening results. The groundwater sampling rationale is listed in Table 4-2. The monitoring well locations were selected to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. The groundwater sample designations, depths, and required QA/QC sample quantities are listed in Table 4-5.

4.3.4.2 Sample Collection

Prior to sampling monitoring wells, static water levels will be measured from the monitoring wells to be sampled as part of this RI. Groundwater elevations will be used to define the groundwater flow in the residuum and bedrock aquifers. Water level measurement procedures are outlined in Section 5.5 of the SAP (IT, 2002a). Groundwater samples will be collected in accordance with the procedures outlined in Section 6.1.1.5 and Attachment 5 of the SAP. Low-flow groundwater sampling methodology outlined in Attachment 5 of the SAP may be used as deemed necessary by the IT site manager. Field parameters to be measured at the time of groundwater sample collection are detailed in Section 6.3 of the SAP.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in

Table 4-5

Groundwater Sample Designations and QA/QC Sample Quantities
Remedial Investigation
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-88Q-MW04	HR-88Q-MW04-GW-SG3004-REG	Groundwater		HR-88Q-MW04-GW-SG3004-MS/MSD	TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-88Q-MW05	HR-88Q-MW05-GW-SG3005-REG	Groundwater	HR-88Q-MW05-GW-SG3006-FD		TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-88Q-MW06	HR-88Q-MW06-GW-SG3007-REG	Groundwater			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-88Q-MW07	HR-88Q-MW07-GW-SG3008-REG	Groundwater			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-88Q-MW08	HR-88Q-MW08-GW-SG3009-REG	Groundwater			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.

TAL - Target analyte list.
TCL - Target compound list.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

this RI SFSP are discussed in Section 4.0, Table 4-1 of the QAP (IT, 2002a). The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP.

4.4 Decontamination Requirements

Decontamination will be performed on sampling and nonsampling equipment to prevent cross-contamination between sampling locations. Decontamination of sampling equipment will be performed in accordance with the requirements presented in Section 6.5.1.1 of the SAP (IT, 2002a). Decontamination of non-sampling equipment will be performed in accordance with the requirements presented in Section 6.5.1.2 of the SAP.

4.5 Surveying of Sample Locations

Sampling locations will be marked with pin flags, stakes, and/or flagging and will be surveyed using either global positioning system (GPS) or conventional civil survey techniques, as necessary to obtain the required level of accuracy. Horizontal coordinates will be referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum 1983. Elevations will be referenced to the North American Vertical Datum of 1988.

Horizontal coordinates for soil boring and monitoring well locations will be recorded using a GPS to provide accuracy within one meter. Because of the need to use monitoring wells to determine water levels, a higher level of accuracy is required. Monitoring wells will be surveyed to an accuracy of 0.1 foot for horizontal coordinates and 0.01 foot for elevations, using survey-grade GPS techniques and/or conventional civil survey techniques, as required. Procedures to be used for GPS surveying are described in Section 4.4.1.1 of the SAP. Conventional land survey requirements are presented in Section 4.4.1.2 of the SAP.

4.6 Analytical Program

Selected samples collected at locations specified in this chapter of this SFSP will be analyzed for the specific suites of chemicals and elements based on the history of site usage and previous investigation data, as well as EPA, ADEM, FTMC, and USACE requirements. Definitive target analyses for samples collected from the Impact Area for Parcels 88Q and 103Q site consist of the following list of analytical suites:

- Target Compound List (TCL) VOCs - EPA Method 5035/8260B
- TCL SVOCs - EPA Method 8270C
- Target Analyte List metals - EPA Method 6010B/7000
- Nitroaromatic/Nitramine Explosives - EPA Method 8330
- Chlorinated pesticides - EPA Method 8081A
- Organophosphorus pesticides - EPA Method 8141A

- Chlorinated herbicides - EPA Method 8151A
- PCBs - EPA Method 8082.

The following is the analysis summary of the of the proposed samples to be collected at the Impact Area for Parcels 88Q and 103Q:

- Analyze 10 surface soil samples for metals and explosives, only.

- Analyze 10 surface soil samples for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs.

- Analyze 25 subsurface soil samples for metals and explosives, only.

- Analyze 15 subsurface soil samples for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs.

- Analyze five groundwater samples for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs.

The samples will be analyzed using EPA SW-846 Update III methods where applicable, as presented in Table 4-6 of this RI SFSP and Section 5.0 of the QAP. Data will be reported in accordance with definitive data requirements of Chapter 2 of the USACE Engineer Manual 200-1-6, *Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects* (USACE, 1997), and evaluated by the stipulated requirements for the generation of definitive data (Section 7.2.2 of the QAP). Chemical data will be reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms, along with electronic copies. These packages will be validated in accordance with EPA National Functional Guidelines by Level III criteria.

4.7 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping will follow the procedures specified in Sections 6.1.3 through 6.1.7 of the SAP (IT, 2002a). Completed analysis request/COC records will be secured and included with each shipment of coolers to:

The samples will be shipped to the following laboratory:

Attention: Sample Receiving/ Elizabeth McIntyre
EMAX Laboratories Inc.
1835 205th Street
Torrence, California 90501
Telephone: (310) 618-8889.

Table 4-6

Analytical Samples
Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun Range, Parcel 103Q
Fort McClellan, Calhoun County, Alabama

Parameters	Analysis Method	Sample Matrix	TAT Needed	Field Samples			QA/QC Samples[a]				EMAX
				No. of Sample Points	No. of Events	No. of Field Samples	Field Dups (10%)	MS/MSD (5%)	Trip Blank (1/ship)	Eq. Rinse (1/wk/matrix)	Total No. Analysis
Parcel 88Q and 103Q: 5 water matrix samples (5 groundwater) and 60 soil matrix samples (20 surface soil samples and 40 subsurface soil samples)											
TCL VOCs	8260B	water	normal	5	1	5	1	1	2	1	11
TCL SVOCs	8270C	water	normal	5	1	5	1	1	0	1	9
TAL Metals	6010B/7000	water	normal	5	1	5	1	1	0	1	9
Explosives	8330	water	normal	5	1	5	1	1	0	1	9
Cl Pesticides	8081	water	normal	5	1	5	1	1	0	1	9
Op Pesticides	8141A	water	normal	5	1	5	1	1	0	1	9
Cl Herbicides	8151	water	normal	5	1	5	1	1	0	1	9
PCB's	8082	water	normal	5	1	5	1	1	0	1	9
TCL VOCs	8260B	soil	normal	25	1	25	3	1	0	1	31
TCL SVOCs	8270C	soil	normal	25	1	25	3	1	0	1	31
TAL Metals	6010B/7000	soil	normal	60	1	60	6	1	0	1	69
Explosives	8330	soil	normal	60	1	60	6	1	0	1	69
Cl Pesticides	8081	soil	normal	25	1	25	3	1	0	1	31
Op Pesticides	8141A	soil	normal	25	1	25	3	1	0	1	31
Cl Herbicides	8151	soil	normal	25	1	25	3	1	0	1	31
PCB's	8082	soil	normal	25	1	25	3	1	0	1	31
				Parcels 88Q and 103Q Subtotal:		300	36	14	0	14	378

[a]Field duplicate, QA split, and MS/MSD samples were calculated as a percentage of the field samples collected per site and were rounded to the nearest whole number. Trip blank samples will be collected with water matrix samples for VOC analysis only. Assumed four field samples per day to estimate trip blanks. Equipment blanks will be collected once per event whenever sampling equipment is field decontaminated and re-used. They will be repeated weekly for sampling events that last more than 1 week. Assumed 20 field samples will be collected per week to estimate number of equipment blanks.

Cl - Chlorinated.
Explosives - Nitroaromatic and Nitramine.
MS/MSD - Matrix spike/matrix spike duplicate.
Op - Organophosphorus.
QA/QC - Quality assurance/quality control.

SVOCs - Semivolatile organic compounds.
TAL - Target analyte list.
TAT - Turn-around time
TCL - Target compound list.
VOCs - Volatile organic compounds.

Ship samples to:
EMAX Laboratories, Inc.
1835 205th Street
Torrance, CA 90501
Attn: Elizabeth McIntyre
Tel: 310-618-8889
Fax: 310-618-0818

4.8 Investigation-Derived Waste Management

Management and disposal of IDW will follow procedures and requirements described in Appendix D of the SAP (IT, 2002a). The IDW expected to be generated at the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q, will include drill cuttings, purge water from permanent monitoring well development and sampling activities, decontamination fluids, and disposable personal protective equipment. The IDW will be characterized and staged at a secure location designated by the site manager while awaiting final disposal. Sampling of IDW to obtain analytical results for characterizing the waste for disposal will follow the procedures specified in Section 6.1.1.8 of the SAP (IT, 2002a). The cuttings and water shall be directly diverted into a lined, watertight, roll-off box per methodology previously established during drilling activities at FTMC.

4.9 Site-Specific Safety and Health

Safety and health requirements for the RI are provided in the SSHP attachment for the Impact Area for Range 30, Parcel 88Q and Former Rifle/Machine Gun, Parcel 103Q. The SSHP attachment will be used in conjunction with the installation-wide safety and health plan, Appendix A of the SAP (IT, 2002a), and the site-specific UXO safety plan.

5.0 Project Schedule

The project schedule for the RI activities will be provided by the IT project manager to the BRAC Cleanup Team.

6.0 References

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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	ä-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
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	betahexachlorocyclohexane
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
°C	degrees Celsius
°F	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene
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
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
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
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
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.
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	cyclonite
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
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

ATTACHMENT 2

FEBRUARY 2002, SITE INVESTIGATION AT THE IMPACT AREA FOR PARCELS 103Q AND 88Q, FORT MCCLELLAN, CALHOUN COUNTY, ALABAMA

IT Corporation
312 Directors Drive
Knoxville, TN 37923-4799
Tel. 865.690.3211
Fax. 865.690.3626

A Member of The IT Group

February 26, 2002

IT-MC-CK10-0183
Project No. 796887

Mr. Ellis Pope
U.S. Army Corps of Engineers, Mobile District
Attn: CESAM-EN-GE (Pope)
109 St. Joseph Street
Mobile, Alabama 36602

Contract: **Contract No. DACA21-96-D-0018/CK10**
Fort McClellan, Alabama

Subject: **Site Investigation at the Impact Area for Parcels 103Q and 88Q**

Dear Mr. Pope:

This letter report serves to document the site investigation (SI) activities conducted at the Impact Area for Parcels 103Q and 88Q located at Fort McClellan (FTMC) in Calhoun County, Alabama. The impact area is a portion of Former Rifle/Machine Gun Range, Parcel 103Q, and Range 30: End-of-Cycle Test Range, Parcel 88Q, as defined in the Environmental Baseline Survey (EBS), conducted by Environmental Science and Engineering, Inc. (ESE, 1998). Parcel 88Q was also known as Range 30: Confidence Course (ESE, 1998).

Parcels 103Q and 88Q are located in the northern part of the Main Post of FTMC, southeast of Reilly Airfield (Figure 1). Parcel 103Q is approximately 25 acres and Parcel 88Q is roughly 545 acres including the range safety fan. The portions of Parcels 103Q and 88Q that are the subject of this SI occupy approximately 40 acres. The area of investigation is bounded to the north by an unpaved road that travels east off of Falcon Road and bisects Parcel 231(7). The southern limit is bounded by an unpaved road oriented southwest-northeast near the top of an unnamed hillside (Figure 2).

A 1937 aerial photograph reveals a clearing in the area occupied by Parcel 103Q. Exact dates of use and ordnance used are not described in the EBS. Archive Search Report (ASR, U.S. Army Corps of Engineers [USACE], 1999) plates show activity in this area as early as World War I. The ASR identifies the area as OA-08, or, during subsequent years, by one of the following names: Tank Sub-Caliber Range, Carbine Transition Range (R-32), and/or Machine Gun Range (R-34) (USACE, 1999).

Range 30 (Parcel 88Q) was used from 1977 to sometime between 1983 and 1989 at which time the range was inactivated. Explosive materials fired at this range included M-16 blanks, flares, and simulators. Historically, M-60 machine guns and .30-caliber ordnance were used. Range 30 was also used for end-of-cycle training but has not been used since the mid to late 1980s. End-of-cycle tests were the last phase of basic training prior to graduation.

Based on the location of Reilly Airfield to the northwest, the position of the Range 30 (Parcel 88Q) firing line, and the orientation of the range fan presented in the EBS, the direction of fire for Range 30 would have been to the southeast toward the unnamed hillside. The EBS does not depict an impact area for Parcel 88Q firing activities. However, the impact area for Parcel 103Q is identified in the EBS. Parcel 103Q overlaps Parcel 88Q for most of the area covered in this investigation.

The ground surface of the area of investigation slopes to the northwest. Ground elevation ranges from approximately 750 feet above mean sea level (msl), in the relatively flat portion of the range near the dirt road, to approximately 1,050 feet msl, at the peak of the unnamed hill used as the backstop for range activities. Surface drainage is to the northwest, crossing Falcon Road and eventually emptying into Reilly Lake.

IT personnel conducted a site walk at the Impact Area for Parcels 103Q and 88Q in October 2001. Numerous bullet fragments were observed over much of the area and were concentrated along the slope and base of the hillside. Surface soils at the impact area are expected to be contaminated with metals, particularly lead. As a result of this observation, no environmental samples were collected as part of the SI. Therefore, IT recommends that the Army conduct an Engineering Evaluation and Cost Analysis (EE/CA) at the Impact Area for Parcels 103Q and 88Q to determine the nature and extent of contamination at the site. The EE/CA would identify and evaluate remedial action alternatives and recommend one alternative for the site.

At your request, I have distributed copies of this letter report as indicated below. If you have questions, or need further information, please contact me at (770) 663-1429 or Steve Moran at (865) 694-7361.

Sincerely,

Stephen G. Moran for

Jeanne A. Yacoub, P.E.
Project Manager

Attachments

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