Final

Site Investigation Report
Impact Area Near Stump Dump, Parcel 135Q-X

Fort McClellan
Calhoun County, Alabama

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK10, IT Corporation (IT) completed a site investigation (SI) at the Impact Area Near Stump Dump, Parcel 135Q-X, at Fort McClellan (FTMC), in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site, and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the Impact Area Near Stump Dump, Parcel 135Q-X, consisted of the sampling and analysis of four surface soil samples, four subsurface soil samples, and two groundwater samples. In addition, two permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at Parcel 135Q-X indicates that metals were detected in the environmental media sampled. Explosive compounds and perchlorate were not detected in any of the samples collected at the site. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC.

The potential threat to human receptors is expected to be low. Although the site is projected for passive recreation reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for potential unrestricted land reuse. With the exception of antimony in one subsurface soil sample, the metals concentrations that exceeded SSSLs were below their respective background concentrations or were within the range of background values. The antimony concentration (4.13 milligrams per kilogram [mg/kg]) marginally exceeded its SSSL (3.11 mg/kg) in one subsurface soil sample. Antimony was not detected in any of the other samples collected at the site.

Eight metals (aluminum, beryllium, chromium, cobalt, iron, manganese, selenium, and vanadium) were detected in site media at concentrations exceeding ESVs and their respective background concentration. With the exception of beryllium in one surface soil sample, the concentrations of these metals were below their respective background concentrations or within the range of background values. The site is located within a wooded area of the Main Post and is expected to support viable ecological habitat. Based on the low levels of metals detected, the potential threat to ecological receptors is expected to be low.

Based on the results of the SI, past operations at the Impact Area Near Stump Dump, Parcel 135Q-X, do not appear to have adversely impacted the environment. The metals detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Impact Area Near Stump Dump, Parcel 135Q-X.

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE), Mobile District. The USACE contracted IT Corporation (IT) to perform the site investigation (SI) at the Impact Area Near Stump Dump, Parcel 135Q-X, under Contract Number DACA21-96-D-0018, Task Order CK10.

This SI report presents specific information and results compiled from the SI, including field sampling and analysis and monitoring well installation activities, conducted at the Impact Area Near Stump Dump, Parcel 135Q-X.

1.1 Project Description

The Impact Area Near Stump Dump was identified as an area to be investigated prior to property transfer. The site was classified as a Category 1 Qualified Parcel in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 1 parcels are areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas). The parcel, however, was qualified ("X") because of the potential presence of unexploded ordnance (UXO).

A site-specific field sampling plan (SFSP) attachment (IT, 2000a) and a site-specific safety and health plan (SSHP) attachment were finalized in August 2000. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Impact Area Near Stump Dump, Parcel 135Q-X. The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998), and the installation-wide sampling and analysis plan (SAP) (IT, 2000b). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect four surface soil samples, four subsurface soil samples, and two groundwater samples. Data from the field investigation were used to determine whether

potential site-specific chemicals are present at the Impact Area Near Stump Dump, Parcel 135Q-X.

1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at the Impact Area Near Stump Dump, Parcel 135Q-X, at concentrations that present an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs and ESVs are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000c). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

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

1.3 Site Description and History

The Impact Area Near Stump Dump, Parcel 135Q-X, is located in the central portion of the FTMC Main Post, approximately 1,000 feet northwest of the Stump Dump, Parcel 82(7) (Figure 1-1). Parcel 135Q-X is located west of an unnamed, unimproved road and occupies approximately 2.3 acres (Figure 1-2). Parcel 135Q-X was identified as a small impact area on a 1961 aerial photograph (ESE, 1998). The impact area was active prior to 1961, but historical use of the area is unknown. The site is within the World War I Artillery Range where artillery and mortar use took place from 1912 to the beginning of World War II (USACE, 1999). Currently the area is wooded.

Elevation at Parcel 135Q-X ranges from approximately 890 to 915 feet above mean sea level (msl). Surface drainage at the site flows to the west-southwest and eventually into Cane Creek.

2.0 Previous Investigations

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

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

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

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

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

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

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

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

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

- A = Asbestos (in buildings)
- L = Lead-Based Paint (in buildings)
- P = Polychlorinated Biphenyls
- R = Radon (in buildings)
- RD = Radionuclides/Radiological Issues

- X = Unexploded Ordnance
- CWM = Chemical Warfare Material.

The EBS was conducted in accordance with CERFA protocols (CERFA-Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region IV, and Calhoun County, as well as a database search of CERCLA-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historic maps and aerial photographs were reviewed to document historic 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 Near Stump Dump, Parcel 135Q-X, was identified as a CERFA Category 1 Qualified Parcel. This CERFA site is a parcel where no known or recorded storage, release, or disposal of hazardous substances or petroleum products has occurred (including migration of these substances from adjacent areas), but was qualified for potential UXO. The site required further evaluation to determine the environmental condition of the parcel.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the Impact Area Near Stump Dump, Parcel 135Q-X, including UXO avoidance activities, environmental sampling and analysis, and groundwater monitoring well installation activities.

3.1 UXO Avoidance

UXO avoidance was performed at the Impact Area Near Stump Dump, Parcel 135Q-X, following methodology outlined in Section 4.1.7 of the SAP (IT, 2000b). IT UXO personnel used a Schonstedt Heliflux Magnetic Locator to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were cleared using a Foerster Ferex Electromagnetic Detector following procedures outlined in Section 4.1.7.3 of the SAP (IT, 2000b).

3.2 Environmental Sampling

The environmental sampling performed during the SI at the Impact Area Near Stump Dump, Parcel 135Q-X, included the collection of surface soil samples, subsurface soil samples, and groundwater samples for chemical analysis. The sample locations were determined by observing site physical characteristics during a site walkover and by reviewing historical aerial photographs. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4. IT contracted Environmental Services Network, Inc. (ESN), a direct-push technology (DPT) subcontractor, to assist in surface and subsurface soil sample collection.

3.2.1 Surface Soil Sampling

Surface soil samples were collected from four locations at the Impact Area Near Stump Dump, Parcel 135Q-X, as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and quality assurance/quality control (QA/QC) samples are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on the sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface soil samples were collected from the upper 1-foot of soil using DPT following the methodology specified in Section 4.9.1.1 of the SAP (IT, 2000b). Surface soil samples were collected by first removing surface debris, such as rocks and vegetation, from the immediate sample area. The soil was collected with the sampling device and screened with a

photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000b). The soil was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from four soil borings at the Impact Area Near Stump Dump, Parcel 135Q-X, as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and QA/QC samples are listed in Table 3-2. Soil boring sampling locations were determined in the field by the on-site geologist based on the sampling rationale, presence of surface structures, and site topography.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1-foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and samples collected using the DPT sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000b). Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously to 12 feet bgs or until direct-push sampler refusal was encountered. Samples were field screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000b) to measure for volatile organic vapors. The sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the deepest sample interval above the saturated zone was submitted for analysis. The soil was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The on-site geologist constructed a detailed boring log for each soil boring. The boring log for each borehole is included in Appendix B. At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in Appendix B of the SAP (IT, 2000b).

3.2.3 Well Installation

Two permanent groundwater monitoring wells were installed in the saturated zone at the Impact Area Near Stump Dump, Parcel 135Q-X, to collect groundwater samples for laboratory analysis. The well/groundwater sampling locations are shown on Figure 3-1. Table 3-3 summarizes

construction details of the wells installed at the Impact Area Near Stump Dump, Parcel 135Q-X. The well construction logs are included in Appendix B.

IT contracted Miller Drilling, Inc. to install the permanent wells with a hollow-stem auger rig at two of the DPT soil boring locations (HR-135Q-MW01 and HR-135Q-MW02). The wells were installed following procedures outlined in Section 4.7 and Appendix C of the SAP (IT, 2000b). The borehole at each well location was advanced with a 4.25-inch inside diameter (ID) hollow-stem auger from ground surface to the saturated zone. The borehole was augured to the completion depth of the DPT boring and samples were collected from that depth to the bottom of the borehole. A 2-foot-long, 2-inch ID carbon steel split-spoon sampler was driven at 5-foot intervals to collect residuum for observing and describing lithology. Where split-spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered. The on-site geologist logging the auger boreholes continued the lithological log for each borehole from the depth of split-spoon refusal to the bottom of the auger borehole by logging the auger drill cuttings. The drill cuttings were logged to determine lithologic changes and the approximate depth of groundwater encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geological and hydrogeological information. The boring log for each borehole is included in Appendix B.

Upon reaching the target depth in each borehole, a 15-foot-length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a 2-foot PVC sump was placed through the auger to the bottom of the borehole. The screen and sump were attached to 2-inch ID, flush-threaded Schedule 40 PVC riser. A number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 2 feet above the top of the well screen as the augers were removed. The well was surged using a solid PVC surge block for approximately 10 minutes, or until no more settling of the filter sand occurred inside the borehole. A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the filter sand and hydrated with potable water. At wells where the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. The bentonite seal placement and hydration followed procedures in Appendix C of the SAP (IT, 2000b). Bentonite-cement grout was tremied into the annular space of the well from the top of the bentonite seal to the ground surface. A locking protective steel casing was placed over the PVC well riser and a concrete pad was constructed around the well. Four steel protective posts were installed around the well pad. A locking well cap was placed on the PVC well riser.

The wells were developed by surging and pumping with a 2-inch diameter submersible pump in accordance with methodology outlined in Section 4.8 and Appendix C of the SAP (IT, 2000b). The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well in order to re-establish the natural hydraulic flow conditions. Development was performed until the water turbidity was less than or equal to 20 nephelometric turbidity units (NTU) or for a maximum of 8 hours. The well development logs are included in Appendix C.

3.2.4 Water Level Measurements

The depth to groundwater was measured in the permanent wells at the site on June 19, 2001, following procedures outlined in Section 4.18 of the SAP (IT, 2000b). Depth to groundwater was measured with an electronic water level meter. Each meter probe and cable were cleaned between use at each well following decontamination methodology presented in Section 4.10 of the SAP (IT, 2000b). Measurements were referenced to the top of each well casing. A summary of groundwater level measurements for the Impact Area Near Stump Dump, Parcel 135Q-X, is presented in Table 3-4.

3.2.5 Groundwater Sampling

Groundwater samples were collected from each of the two permanent wells installed at the Impact Stump Dump, Parcel 135Q-X. The groundwater sampling locations are shown on Figure 3-1. The groundwater sampling locations and rationale are listed in Table 3-1. The groundwater sample designations and QA/QC samples are listed in Table 3-5.

Sample Collection. Groundwater samples were collected using a submersible pump equipped with Teflon™ tubing following the procedures outlined in Section 4.9.1.4 of the SAP (IT, 2000b). Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, dissolved oxygen, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Field parameters were measured using a calibrated water-quality meter. Field parameter readings are summarized in Table 3-6. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-5 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000b). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical parameters based on the potential site-specific chemicals historically at the site and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Impact Area Near Stump Dump, Parcel 135Q-X, were analyzed for the following parameters:

- Target analyte list metals – EPA Method 6010B/7000
- Nitroaromatic and nitramine explosives – EPA Method 8330
- Perchlorate – EPA Method 314.0.

The samples were analyzed using EPA SW-846 methods, including Update III Methods where applicable, as presented in Table 6-1 in Appendix B of the SAP (IT, 2000b). Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data (Section 3.1.2 of Appendix B of the SAP [IT, 2000b]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms. These packages were validated in accordance with EPA National Functional Guidelines by Level III criteria. A summary of validated data is included in Appendix E. The data validation summary report is included as Appendix F.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000b). Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Chapter 5.0, Table 5-1, of Appendix B of the SAP (IT, 2000b). Sample documentation and chain-of-custody records were recorded as specified in Section 4.13 of the SAP (IT, 2000b).

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

California. Split samples were shipped to USACE South Atlantic Division Laboratory in Marietta, Georgia.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000b). The IDW generated during the SI at the Impact Area Near Stump Dump, Parcel 135Q-X, was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Personal protective equipment (PPE).

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, drill cuttings and PPE generated during the SI at the Impact Area Near Stump Dump, Parcel 135Q-X, were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

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

3.7 Variances/Nonconformances

No variances or nonconformances to the SFSP were recorded during completion of the SI at the Impact Area Near Stump Dump, Parcel 135Q-X.

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and installation-wide quality assurance plan; and standard, accepted methods and procedures.

Data Validation. A complete (100 percent) Level III data validation effort was performed on the reported analytical data. Appendix F consists of a data validation summary report that

discusses the results of the validation. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System (ITEMS™) database for tracking and reporting. The qualified data were used in comparing to the SSSLs and ESVs developed by IT. Rejected data (assigned an "R" qualifier) were not used in comparison to the SSSLs and ESVs. The data presented in this report, except where qualified, meets the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at the Impact Area Near Stump Dump, Parcel 135Q-X, provided soil, bedrock, and groundwater data used to characterize the geology and hydrogeology of the site.

4.1 Regional and Site Geology

4.1.1 Regional Geology

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

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold and thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted with major structures and faults striking in a northeast-southwest direction. Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group is comprised 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 (Szabo 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 appear to dominate the unit and consist primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consist 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 southwest of the Main Post as mapped by Warman and Causey (1962) and 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. 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 weathers to a chert residuum

(Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped together as undifferentiated at FTMC and 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 (Szabo 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 on the basis of fossil data.

The Jacksonville Thrust Fault is the most significant structural geologic feature in the vicinity 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 comprising 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).

4.1.2 Site Geology

Soils in the vicinity of the Impact Area Near Stump Dump, Parcel 135Q-X, are mapped as the Anniston and Allen Series. The Anniston and Allen Series Soils consist of strongly acidic, deep, well-drained soils that have developed in old local alluvium. The parent material washed from the adjacent higher-lying Linker, Muskingum, Enders, and Montevallo soils. The soils in these series generally are friable, have medium infiltration and runoff rates, moderate permeability, high available moisture, and moderately low organic matter (U.S. Department of Agriculture, 1961).

Description of the soil from the direct-push and hollow-stem auger borings revealed that soils beneath the site consist of silts and clays overlying weathered shale. The weathered shale was encountered during drilling at HR-135Q-MW01 at a depth of approximately 9 feet bgs. Competent bedrock was not encountered during drilling.

The bedrock at the site is mapped as the Cambrian Shady Dolomite (Osborne et al., 1997). The Shady Dolomite 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). During well installation activities at the site, weathered purple shale was encountered at HR-135Q-MW01 at a depth of approximately 14 feet bgs to the bottom of the boring. Drilling logs for the two monitoring wells and the two direct-push borings are located in Appendix B.

4.2 Site Hydrology

4.2.1 Surface Hydrology

Precipitation in the form of rainfall averages about 54 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

Elevation of the Impact Area Near Stump Dump, Parcel 135Q-X, ranges from approximately 890 to 915 feet msl. Surface drainage at the site follows site topography and flows to the west-southwest. The surface runoff eventually drains into Cane Creek located west of the parcel.

4.2.2 Hydrogeology

During soil boring and well installation activities, groundwater was encountered between 26 and 29 feet bgs (Appendix B). Static groundwater levels were measured in monitoring wells at the site on June 19, 2001 (Table 3-4). Groundwater elevations were calculated by measuring the depth to groundwater relative to the surveyed top-of-casing elevations. Groundwater flow at the site is expected to be to the west-southwest following the topography.

Static groundwater levels summarized in the Table 3-4 are at shallower depths than the depth to groundwater encountered during drilling (Appendix B). This indicates that groundwater is under confined to semi-confined conditions and has an upward vertical hydraulic head.

5.0 Summary of Analytical Results

The results of the chemical analysis of samples collected at the Impact Area Near Stump Dump, Parcel 135Q-X, indicate that metals were detected in the various site media. Explosives and perchlorate were not detected in any of the samples collected. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the on-going SIs being performed under the BRAC Environmental Restoration Program at FTMC.

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

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

5.1 Surface Soil Analytical Results

Four surface soil samples were collected for chemical analysis at the Impact Area Near Stump Dump, Parcel 135Q-X. Surface soil samples were collected from the upper 1-foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values as presented in Table 5-1.

Metals. Twenty metals were detected in the surface soil samples collected at Parcel 135Q-X. The selenium results were flagged with a "B" data qualifier signifying that this metal was also detected in an associated laboratory or field blank.

The concentrations of five metals (aluminum, arsenic, iron, manganese, and thallium) exceeded SSSLs. Of these metals, only aluminum (at HR-135Q-GP01, HR-135Q-MW01, and HR-135Q-MW02) and manganese (HR-135Q-MW02) also exceeded their respective background concentrations. However, the aluminum and manganese results were within the range of background values (Appendix G).

Eight metals (aluminum, beryllium, chromium, cobalt, iron, manganese, selenium, and vanadium) were detected at concentrations exceeding ESVs. Only aluminum (at HR-135Q-GP01, HR-135Q-MW01, and HR-135Q-MW02), beryllium (HR-135Q-MW02), cobalt (HR-135Q-MW01), manganese (HR-135Q-MW02), and selenium (HR-135Q-GP01) also exceeded their respective background concentrations. However, with the exception of the beryllium result at HR-135Q-MW02, the concentrations of the metals that exceeded ESVs and their respective background concentrations were within the range of background values (Appendix G).

5.2 Subsurface Soil Analytical Results

Four subsurface soil samples were collected for chemical analysis at the Impact Area Near Stump Dump, Parcel 135Q-X. Subsurface soil samples were collected at depths greater than 1-foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-2.

Metals. Twenty-two metals were detected in subsurface soil samples collected at Parcel 135Q-X. The selenium results were flagged with a "B" data qualifier signifying that this metal was also detected in an associated laboratory or field blank.

The concentrations of six metals (aluminum, antimony, arsenic, iron, manganese, and thallium) exceeded SSSLs. Of these metals, only aluminum (at HR-135Q-MW01), antimony (HR-135Q-MW02), and thallium (HR-135Q-MW01) also exceeded their respective background concentrations. With the exception of the antimony result (4.13 mg/kg), these metals concentrations were within the range of background values (Appendix G).

5.3 Groundwater Analytical Results

Two groundwater samples were collected for chemical analysis at the Impact Area Near Stump Dump, Parcel 135Q-X, at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 5-3.

Metals. Ten metals were detected in groundwater samples collected at Parcel 135Q-X. The concentrations of two metals (iron and manganese) exceeded SSSLs but were below their respective background concentrations (Appendix G).

6.0 Summary, Conclusions, and Recommendations

IT, under contract to USACE, completed an SI at the Impact Area Near Stump Dump, Parcel 135Q-X, at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site, and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the Impact Area Near Stump Dump, Parcel 135Q-X, consisted of the sampling and analysis of four surface soil samples, four subsurface soil samples, and two groundwater samples. In addition, two permanent monitoring wells were installed in the saturated zone to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information.

Chemical analysis of samples collected at Parcel 135Q-X, indicates that metals were detected in the environmental media sampled. Explosive compounds and perchlorate were not detected in any of the samples collected. Analytical results were compared to the SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metal concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998).

The potential threat to human receptors is expected to be low. Although the site is projected for passive recreation reuse, the analytical data were screened against residential human health SSSLs to evaluate the site for potential unrestricted land reuse. With the exception of antimony in one subsurface soil sample, the metals concentrations that exceeded SSSLs were below their respective background concentrations or were within the range of background values. The antimony concentration (4.13 mg/kg) marginally exceeded its SSSL (3.11 mg/kg) in one subsurface face soil sample. Antimony was not detected in any of the other samples collected at the site.

Eight metals (aluminum, beryllium, chromium, cobalt, iron, manganese, selenium, and vanadium) were detected in site media at concentrations exceeding ESVs and their respective background concentration. With the exception of beryllium in one surface soil sample (HR-135-MW02), the concentrations of these metals were below their respective background concentrations or within the range of background values. The site is located within a wooded area of the Main Post and is expected to support viable ecological habitat. However, based on the low levels of metals detected, the potential threat to ecological receptors is expected to be low.

Based on the results of the SI, past operations at the Impact Area Near Stump Dump, Parcel 135Q-X, do not appear to have adversely impacted the environment. The metals detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Impact Area Near Stump Dump, Parcel 135Q-X.

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