4.0 Site-Specific Sampling and Analysis Plan

4.1 Sampling and Field Analysis

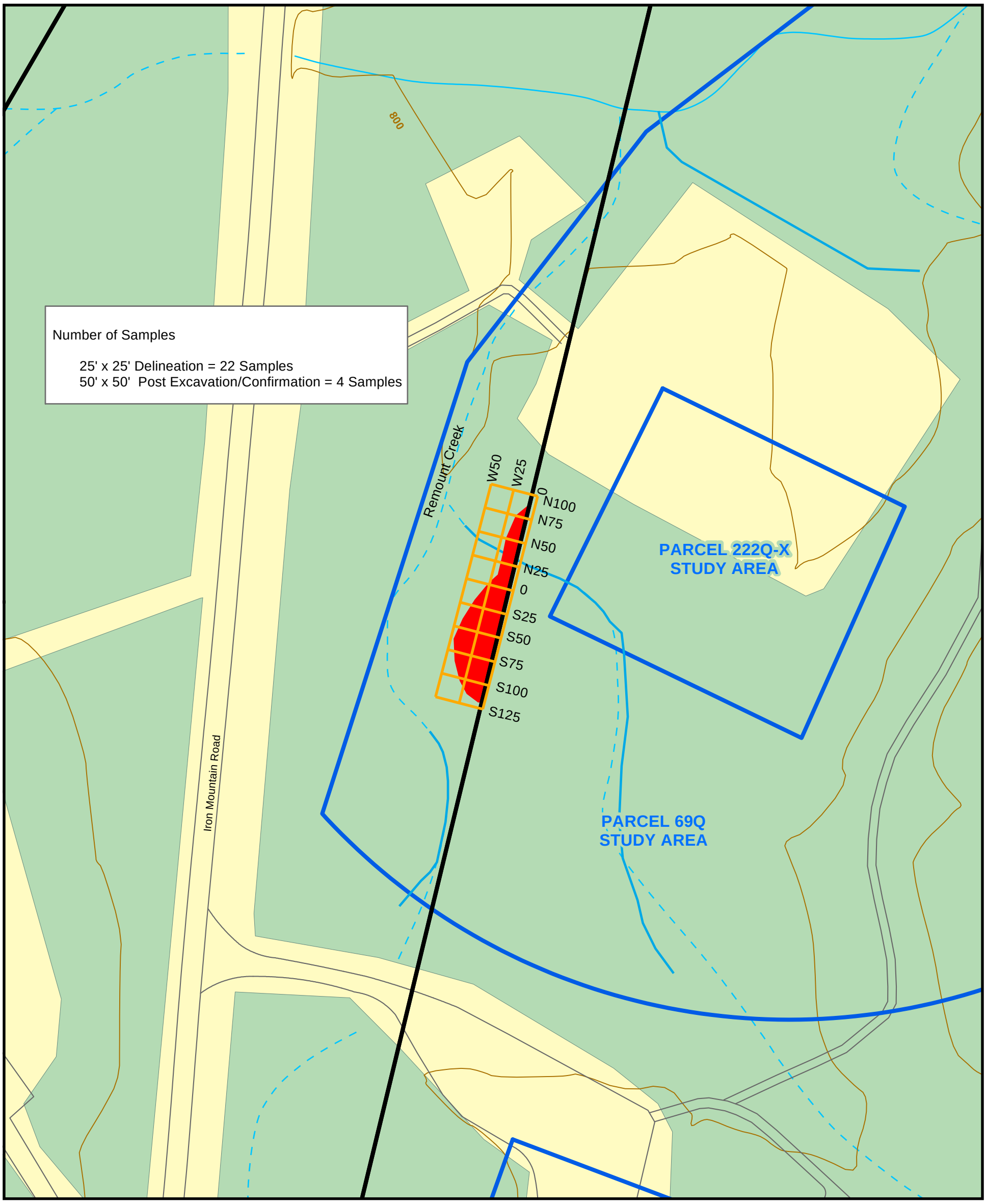
A combination of on-site and off-site analytical methods will be performed to characterize metals contamination on the ranges. This program will consist of three parts:

- Contamination delineation
- Post-excavation confirmation
- Treated soil characterization.

On-site metals analysis will be performed during contamination delineation and post-excavation confirmation using a portable, energy-dispersive XRF instrument to optimize the analytical program and provide real-time data to the soil excavation crew. Standard EPA SW-846 analytical methods will be performed at the off-site laboratory to confirm the results of the on-site XRF analysis, to provide certified, validatable data for site closure after excavation, and to characterize the treated soil for disposal.

Shaw will provide a XRF analyst who will be on site to perform XRF analysis; collect, manage, and document samples for on-site and off-site analyses; perform on-site data management; and coordinate excavation and sampling activities with the site superintendent. Approximately one week will be required to perform the XRF survey/contamination delineation phase. Approximately two weeks will be required to complete the post-excavation confirmation sampling and the treated soil waste characterization sampling. Field sampling and analysis will be performed concurrently with the preconstruction and construction support tasks.

Metals Characterization Technical Approach. Two phases of sampling will be required to characterize the lead contamination at the ranges, a contamination delineation phase and a post-excavation confirmation sampling phase. The delineation phase will be conducted prior to excavation and yield lead concentration data that is compared to the project's remedial goal (lead less than 880 mg/kg). After evaluating the delineation data, the excavation crew will be directed toward the site areas and depths targeted for removal. Following excavation, the lead characterization will enter the post-excavation confirmation sampling phase to document that the concentration of the remaining site soil meets the lead objective. Both phases of the lead characterization will rely on a sampling grid system (Figures 4-1 and 4-2).



Legend

- Lead Concentrations Above 880 mg/kg
- Study Area
- 25-Ft Grid
- Wooded
- Not Wooded
- Roads
- Surface Drainage Feature (Dashed where Intermittent)
- Topographic Contour (25-foot interval)
- Eastern Bypass Corridor

N

100 0 100 Feet

NAD83 State Plane Coordinates

Figure 4-1

Planned Grid Sample Locations for Metals Delineation/Confirmation Skeet Range, Parcel 69Q Eastern Bypass Corridor Iron Mountain Road Ranges

Shaw™ Shaw Environmental, Inc.

U.S. Army Corps of Engineers Mobile District

Contract No. DACA21-96-D-0018

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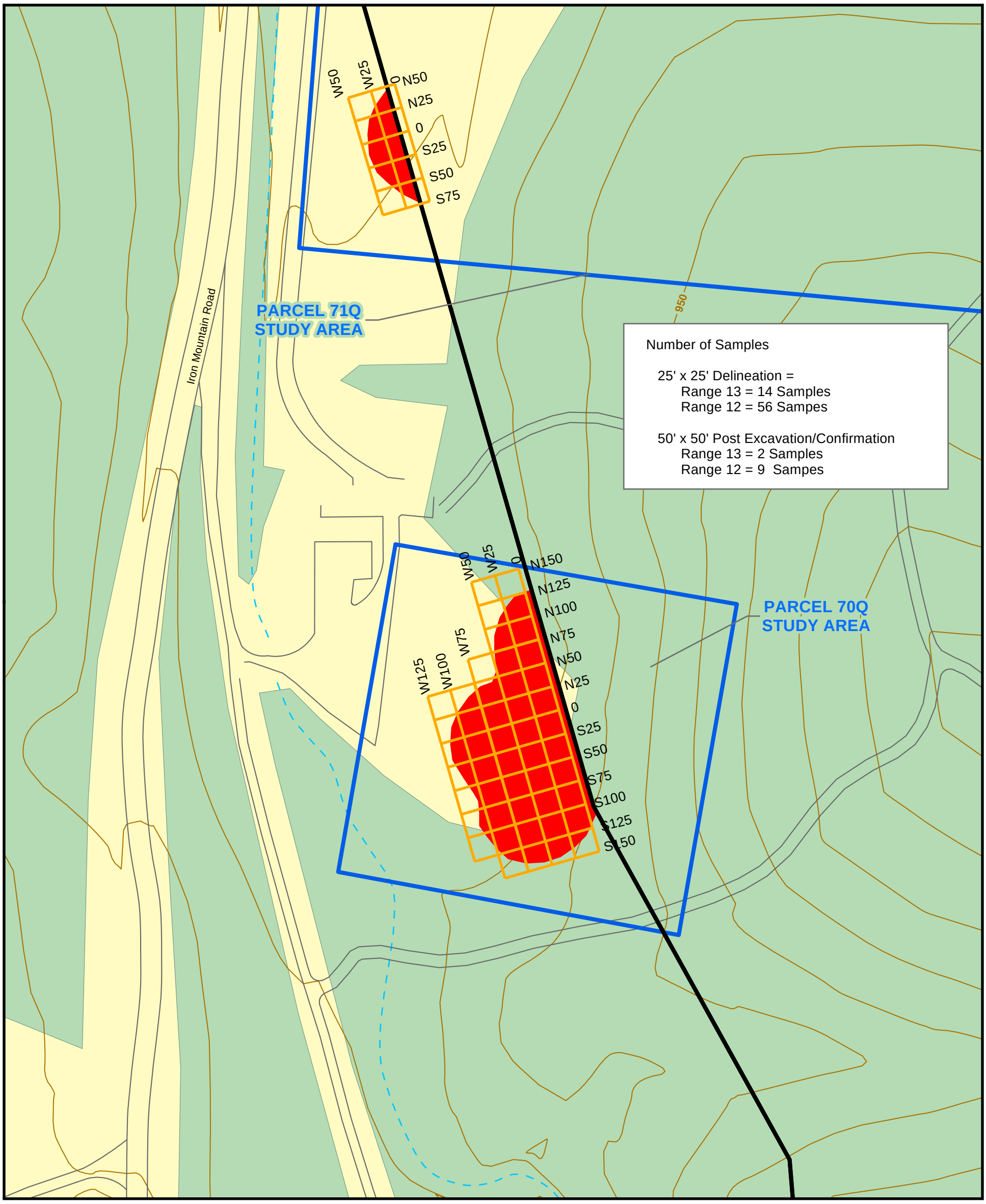

Legend

- Lead Concentrations Above 880 mg/kg
- Study Area
- 25-Ft Grid
- Wooded
- Not Wooded
- Roads
- Surface Drainage Feature (Dashed where Intermittent)
- Topographic Contour (25-foot interval)
- Eastern Bypass Corridor

N

100 0 100 Feet

NAD83 State Plane Coordinates

Figure 4-2

Planned Grid Sample Locations for Metals Delineation/Confirmation Range12, Parcel 70Q and Range13, Parcel 71Q Eastern Bypass Corridor Iron Mountain Road Ranges

Shaw™ Shaw Environmental, Inc.

U.S. Army Corps of Engineers Mobile District

Contract No. DACA21-96-D-0018

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Field Sampling Approach. Two general types of field samples will be collected during the soil removal activities for off-site laboratory analysis:

- Lead characterization
- Treated soil disposal characterization samples.

Lead characterization samples will be collected in two phases, the XRF confirmation phase and the post-excavation confirmation phase. XRF confirmation consists of split samples that are analyzed for quality assurance (QA) to verify the accuracy of the XRF data against the off-site laboratory method. The post-excavation confirmation phase is comprised of analyzing composite samples of excavated sampling grids to verify that the remaining site soils meet the remedial goal of less than 880 mg/kg of lead.

Treated soil samples will be collected by building a representative composite sample of the material on a batch-specific basis. The composite sample is then submitted for waste characterization analysis to determine if the treatment was successful in stabilizing the lead. TCLP lead concentration in the treated sample must be less than 5 mg/L in the extract for the waste to be disposed of as a RCRA special waste.

Standard EPA SW-846 analytical methods will be performed at the off-site laboratory to confirm the results of the XRF analysis, to provide certified, validatable data for site closure after excavation, and to characterize the treated soil for disposal. A summary of the samples planned for off-site analysis, the QA/QC samples, and the corresponding analytical program are summarized in Table 4-1.

To ensure consistency in analytical data, all analytical services will be provided under subcontract to Shaw by the EMAX laboratory in Torrance, California. EMAX is currently validated by the USACE Hazardous, Toxic, and Radioactive Waste Center of Expertise for the applicable methods.

4.1.1 Metals Delineation Sampling

Using a 25-by-25-foot sampling grid during the delineation phase, the area will be characterized for lead contamination (Figures 4-1 and 4-2). Approximately 100 samples for XRF screening will be collected from the grid nodes to determine the excavation limits during this phase. The grid will be expanded if soils within the ALDOT EBC contain lead greater than the remediation goal of 880 mg/kg, but the grid will not be expanded beyond the boundary of the EBC. In this manner, only the areas that show lead contamination greater than 880 mg/kg will be included in the excavation zones.

Table 4-1

Summary of Proposed Sampling, Analysis, and QC Program
Soil Removal Activities for Iron Mountain Road Ranges in ALDOT EBC
Fort McClellan, Calhoun, County, Alabama

Parameters	Analysis Method	Sample Matrix	TAT Needed	Field Samples: No. of Sample Points	Field Samples: No. of Events	Field Samples: No. of Field Samples	QA/QC Samples (1): Field Dups (10%)	QA/QC Samples (1): MS/MSD (5%)	QA/QC Samples (1): Trip Blank (1/ship)	QA/QC Samples (1): Eq. Rinse (1/wk/matrix)	EMAX Total No. Analysis
IMR Ranges ALDOT EBC Soil Removal Samples: 10 XRF Confirmation, 15 Post-excavation confirmation, 8 Treated soil composites											
Lead	6010B	soil	Normal	10	1	10					10
Lead	6010B	soil	**48-hr**	15	1	15	2	1		2	21
TCLP Metals	1311/6010B	soil	**72-hr**	8	1	8					8
IMR Ranges ALDOT EBC Soil Removal Total:						33	2	1	0	2	39

ALDOT - Alabama Department of Transportation
EBC - Eastern Bypass Corridor
XRF - X-ray fluorescence
MS/MSD - matrix spike/MS duplicate
TCLP - Toxicity Characteristic Leaching Procedure

(1) Field duplicate and MS/MSD samples were calculated as a percentage of the field samples collected and were rounded up to the nearest whole number. Equipment blanks will be collected at least once per event whenever sampling equipment is field decontaminated and re-used. They will be repeated weekly. No QC was assigned for waste disposal samples.

4.1.1.1 XRF Screening

Lead analysis on contamination delineation and confirmation samples will be initially performed on site by the analyst using the XRF instrument. It will provide timely analytical data and allow the site superintendent to effectively direct the excavation crew. The on-site XRF results will be confirmed using lead analysis by EPA Method 6010B at the off-site laboratory using QA split samples.

Shaw will use a Niton 733 portable XRF (or equivalent) to perform the onsite metals analysis as described in the FTMC SAP. The instrument will be calibrated daily using a blank and three certified standard reference materials of known lead concentrations. The instrument readings will agree within +/- 20% relative percent difference of the certified value for field sample analysis to continue.

Samples for XRF analysis will be collected from the surface (0 to 3 inches) of the sample location in disposable aluminum pans using a steel sampling trowel. The sample will be homogenized by the analyst and rocks, vegetative matter, bullets, shot, and bullet fragments will be removed by the analyst by hand prior to analysis. If bullets, shot, or bullet fragments are found in the sample, notes will be made on the sample collection/analysis sheet recording the type, number, and condition of what was found in the sample. If the sample cannot be homogenized well and large particle-size differences exist, or if the sample contains free moisture, the analyst may elect to take the sample to the on-site laboratory to further prepare the sample by drying, crushing, and sieving. If so, the sample will be dried at 120 degrees Celsius for approximately 4 hours or until dry, crushed with a decontaminated ceramic mortar and pestle, and sieved through a standard #10 (2 millimeter pore size) sieve. The resulting soil will be collected on wax paper and analyzed.

Once homogenized (either in the field or laboratory-prepared), the soil will be directly analyzed using the XRF at the sample location. Data from the analysis is manually recorded from the instrument display by the analyst on the sample collection/analysis form and is automatically stored in the instrument data logger. Data in the data logger will be downloaded electronically to a laptop computer at the end of each day's analysis. The data can then be easily transferred into an Excel-based database of all XRF results.

An analysis rate of no less than 15-20 XRF samples is anticipated to be performed per day.

4.1.1.2 XRF Confirmation

Ten percent of the XRF-analyzed samples will be split with EMAX for confirmation analysis for lead using EPA Method 6010B (Table 4-1). Assuming a total of 100 samples for XRF analysis, approximately ten will be split to EMAX. The purpose of these samples is to perform a quality check of the XRF data. Normal data turnaround time will be required.

4.1.2 Post-Excavation Sampling

For the post-excavation confirmation sampling phase, approximately 15 samples will be collected using a 50-by-50-foot sampling grid pattern. This larger grid system will overlap the 25-by-25-foot grid used in the lead delineation. For planning purposes it was assumed that a single composite sample will be built from each 50-by-50-foot grid square using a total of five evenly spaced surface soil grab sample locations.

4.1.2.1 XRF Screening

For planning purposes, it was assumed that a single composite sample will be built from a total of five evenly spaced, surface soil grab sample locations within the square. A combination of on-site XRF analysis and lead analysis by EPA Method 6010B at the off-site laboratory will be used. The purpose of the XRF analysis will be to reduce the total number of samples for off-site analysis by pre-screening the sample to ensure the lead concentration is less than the remedial goal before it is sent to the off-site laboratory.

4.1.2.2 Laboratory Confirmation

Only the certified, validatable total lead data provided by the off-site laboratory will be used to determine when the area sampled is less than 880 mg/kg and the excavation is complete. As shown in Table 4-1, off-site confirmation samples will be collected using routine QA/QC sample frequencies (i.e., 10 percent field duplicates, 5 percent matrix spike/matrix spike duplicate [MS/MSD], and weekly equipment rinsate blanks) and analyzed for lead. Note that the off-site laboratory data will be reported directly to the Shaw personnel on site on a 48-hour turnaround to facilitate excavation closure during remediation.

4.1.3 Treated Soil Disposal Characterization Sampling

Once the soil is excavated and treated on site to stabilize the lead, batch composite samples will be required to characterize the waste treated for disposal. These composite samples will be built after treatment by the stabilization technician or the XRF analyst from the soil stockpile. Composite samples will be collected using a minimum of 7 representative grab samples from the top, center, and sides of the treated soil stockpile.

A licensed commercial landfill will be used for disposal of the stabilized soil and a disposal criterion of less than 5 mg/L for EPA Method 1311 TCLP lead is required. For planning purposes an average rate of 300 tons of treated soil per day is anticipated. A total of eight treated soil composite samples for TCLP metals analysis are estimated (Table 4-1). Supplemental samples may be required if the soil treatment process fails to meet the TCLP lead criterion initially and the pile needs to be treated again. As shown in Table 4-1, the sample purpose for these treated soil composites is waste characterization, and as such, no additional QA/QC (other than the method-required batch QC) will be performed. The TCLP metals results will be reported directly to the Shaw personnel on site within a 72-hour turnaround to ensure the treated soil stockpiles can be removed from the area for disposal in a timely manner.

4.2 Laboratory Analysis Program

Samples collected during the soil removal activity at IMR Ranges will be sent to EMAX for the analyses as shown on Table 4-1. The analytical methods used will be from the U.S. EPA SW-846 as discussed in the FTMC SAP and quality assurance project plan. These methods include:

- Lead – Method 6010B
- TCLP metals – Methods 1311/6010B.

Lead data will be reported to the field on a preliminary basis on a 24-hour turnaround basis to facilitate grid closure. TCLP metals results of the treated soil composite samples will be reported to the field on a 72-hour turnaround basis. EMAX will be able to send the preliminary data via electronic mail.

Final data deliverables will include Level III data packages and electronic data deliverables (EDD). Packages and EDDs are due on a standard 4-week turnaround and will be sent to the Shaw office in Knoxville.

4.3 QA/QC Sampling

Typical field QC samples will be collected as described in the FTMC SAP. These include field duplicates, MS/MSD aliquots, and weekly equipment rinsate blanks. Standard laboratory batch QC will be performed also. Trip blanks are not anticipated. The frequency of collection and specifics are summarized on Table 4-1.

4.4 Sample Numbering and Identification (ID)

Table 4-2 summarizes the planned sample designations from this activity. Metals delineation samples analyzed by XRF in the field will be assigned unique sample identifications tied to the sample grid system. The grid system nomenclature is comprised of the range ID and grid node

Table 4-2

Proposed Sample Designations and QA/QC Sample Quantities
Soil Removal Activities for Iron Mountain Road Ranges in ALDOT EBC
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth[a] (ft bgs)	QA/QC Samples			Analytical Suite
			Field Duplicates	Field Splits	MS/MSD	
10 Surface Samples for XRF Confirmation[b]						
HR-69Q-N__, W___	HR-69Q-N__, W___-SS-SN0001-XRF	0-0.5				Lead
HR-69Q-N__, W___	HR-69Q-N__, W___-SS-SN0002-XRF	0-0.5				Lead
HR-71Q-N__, W___	HR-71Q-N__, W___-SS-SN0003-XRF	0-0.5				Lead
HR-71Q-N__, W___	HR-71Q-N__, W___-SS-SN0004-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0005-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0006-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0007-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0008-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0009-XRF	0-0.5				Lead
HR-70Q-N__, W___	HR-70Q-N__, W___-SS-SN0010-XRF	0-0.5				Lead
15 Composite Samples for Post-Excavation Confirmation						
HR-69Q-GRID1	HR-69Q-GRID1-CS-SN0011-REG	0-0.5				Lead
HR-69Q-GRID2	HR-69Q-GRID2-CS-SN0012-REG	0-0.5				Lead
HR-69Q-GRID3	HR-69Q-GRID3-CS-SN0013-REG	0-0.5	HR-69Q-GRID3-CS-SN0014-FD			Lead
HR-69Q-GRID4	HR-69Q-GRID4-CS-SN0015-REG	0-0.5				Lead
HR-71Q-GRID1	HR-71Q-GRID1-CS-SN0016-REG	0-0.5				Lead
HR-71Q-GRID2	HR-71Q-GRID2-CS-SN0017-REG	0-0.5	HR-71Q-GRID2-CS-SN0018-FD			Lead
HR-70Q-GRID1	HR-70Q-GRID1-CS-SN0019-REG	0-0.5				Lead
HR-70Q-GRID2	HR-70Q-GRID2-CS-SN0020-REG	0-0.5				Lead
HR-70Q-GRID3	HR-70Q-GRID3-CS-SN0021-REG	0-0.5				Lead
HR-70Q-GRID4	HR-70Q-GRID4-CS-SN0022-REG	0-0.5			HR-70Q-GRID4-CS-SN0022-MS/MSD	Lead
HR-70Q-GRID5	HR-70Q-GRID5-CS-SN0023-REG	0-0.5				Lead
HR-70Q-GRID6	HR-70Q-GRID6-CS-SN0024-REG	0-0.5				Lead
HR-70Q-GRID7	HR-70Q-GRID7-CS-SN0025-REG	0-0.5				Lead
HR-70Q-GRID8	HR-70Q-GRID8-CS-SN0026-REG	0-0.5				Lead
HR-70Q-GRID9	HR-70Q-GRID9-CS-SN0027-REG	0-0.5				Lead

Table 4-2

Proposed Sample Designations and QA/QC Sample Quantities
Soil Removal Activities for Iron Mountain Road Ranges in ALDOT EBC
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth[a] (ft bgs)	QA/QC Samples			Analytical Suite
			Field Duplicates	Field Splits	MS/MSD	
8 Treated Soil Composite Samples						
IMR-BATCH1	IMR-BATCH1-WC-SN0028-REG	Comp				TCLP Metals
IMR-BATCH2	IMR-BATCH2-WC-SN0029-REG	Comp				TCLP Metals
IMR-BATCH3	IMR-BATCH3-WC-SN0030-REG	Comp				TCLP Metals
IMR-BATCH4	IMR-BATCH4-WC-SN0031-REG	Comp				TCLP Metals
IMR-BATCH5	IMR-BATCH5-WC-SN0032-REG	Comp				TCLP Metals
IMR-BATCH6	IMR-BATCH6-WC-SN0033-REG	Comp				TCLP Metals
IMR-BATCH7	IMR-BATCH7-WC-SN0034-REG	Comp				TCLP Metals
IMR-BATCH8	IMR-BATCH8-WC-SN0035-REG	Comp				TCLP Metals

[a] Comp - composite sample collected from waste stockpile.

[b] "N__, W___" - refers to a specific grid node that will be selected in the field.

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
ft bgs - feet below ground surface.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TCLP - Toxicity characteristic leaching procedure.

address. These IDs will be carried forward in identifying the samples sent to the laboratory for offsite analysis. Post-excavation confirmation samples will be identified using the range ID and a sequential grid number. A sequential batch number and the sample date will be used to uniquely identify the treated soil characterization samples.

4.5 Documentation, Custody, and Tracking

Sample documentation, custody, and tracking procedures will reflect those described in the FTMC SAP. Combination sample collection and analysis forms will be used to document the results of the XRF field screening program. Custody will be maintained at all times by the Shaw sampling team prior to transfer to EMAX using the typical chain-of-custody forms cited in the SAP. The XRF analyst will maintain control of the samples collected and track the samples through the various XRF screening, reporting, and confirmation analysis stages.

4.6 Data Management Plan

The XRF analyst will maintain the data during all onsite activities. The analyst will report the results of the XRF screening analysis and coordinate with the site superintendent on how best to integrate the results into the site activities. He will also receive and manage all the laboratory data reported to the site on fast turnaround including the confirmation data and treated soil stockpile data.

The final data packages and EDDs will be sent from the laboratory to the Shaw office in Knoxville for routine data management, validation, and reporting.

5.0 Project Management Plan

5.1 Technical Approach

Technical project management support and oversight will be provided from the Shaw office in Knoxville. Daily decisions concerning grid sampling, excavation, soil treatment will be made onsite in compliance with the general guidance of this construction work plan. Shaw will coordinate with its subcontractors and the USACE to ensure all of the technical requirements of this work plan are met.

5.2 Field Schedule

The anticipated field project schedule is 5 weeks total (all durations are approximate):

- Site surveying and XRF analysis - 1 week
- Procurement, pre-construction and site setup - 1 week
- Excavation/construction support, soil treatment – 2 weeks
- Transportation and disposal, site restoration – 1 week.

5.3 Personnel

Shaw will use a project manager supplemented by a QA officer and safety and health officer to oversee all operations compliance with this construction plan. In the field, a site superintendent will oversee all day-to-day operations and manage the field construction crew. He will be supported by the XRF analyst and the soil stabilization technician. The field crew will also include an onsite quality manager and safety and heath technician.

5.4 Reporting

A construction report will be issued to summarize the field activities and present the documentation of the sampling and analysis, soil treatment, and disposal from this soil removal at the IMR Ranges. The report will be issued by Shaw in a draft and final form following final laboratory data validation, review and analysis.

6.0 References

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

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

List of Abbreviations and Acronyms

2-ADNT	2-amino-4,6-dinitrotoluene
4-ADNT	4-amino-2,6-dinitrotoluene
2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	2,4,5-trichlorophenoxypropionic acid
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
ABLM	adult blood lead model
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
AEDA	ammunition, explosives, and other dangerous articles
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	δ-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
AP	armor piercing
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
AS/SVE	air sparging/soil vapor extraction
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
atm-m^3/mol	atmospheres per cubic meter per mole
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)
BAF	bioaccumulation factor
BBGR	Baby Bains Gap Road
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	hexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
$CaCO_3$	calcium carbonate
CAA	Clean Air Act
CAB	chemical warfare agent breakdown products
CACM	Chemical Agent Contaminated Media
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	phosgene (carbonyl chloride)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CIH	Certified Industrial Hygienist
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 of potential concern
COPEC	constituent of potential ecological concern
CPOM	coarse particulate organic matter
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 agent monitoring station
DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
ºC	degrees Celsius
ºF	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEHP	di(2-ethylhexyl)phthalate
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized
DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DNAPL	dense nonaqueous-phase liquid
DNT	dinitrotoluene
DO	dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DSERTS	Defense Site Environmental Restoration Tracking System
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{20}	effects concentration for 20 percent of a test population
EC_{50}	effects concentration for 50 percent of a test population
ECBC	Edgewood Chemical Biological Center
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Eh	oxidation-reduction potential
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
EPT	Ephemeroptera, Plecoptera, Trichoptera
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESL	ecological screening level
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	Explosives
EXTOXNET	Extension Toxicology Network
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FBI	Family Biotic Index
FD	field duplicate
FDC	Former Decontamination Complex
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
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 (isopropyl methylphosphonofluoridate)
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
HC	mixture of hexachloroethane, aluminum powder, and zinc oxide (smoke producer)
HCl	hydrochloric acid
HD	distilled mustard (bis-[dichloroethyl]sulfide)

HDPE	high-density polyethylene
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index
H_2O_2	hydrogen peroxide
HPLC	high-performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen releasing compound
HSA	hollow-stem auger
HSDB	Hazardous Substance Data Bank
HTRW	hazardous, toxic, and radioactive waste
'I'	out of control, data rejected due to low recovery
IASPOW	Impact Area South of POW Training Facility
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	liter; Lewisite (dichloro-[2-chloroethyl]sulfide)
L/kg/day	liters per kilogram per day
l	liter
LAW	light anti-tank weapon
lb	pound
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LOEC	lowest-observable-effect-concentration
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
MPC	maximum permissible concentration
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&MP	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

List of Abbreviations and Acronyms *(Continued)*

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
NOEC	no-observable-effect-concentration
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
NRT	near real time
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
PERC	perchloroethene
PES	potential explosive site
Pest.	pesticides
PETN	pentaerythritoltetranitrate
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
ppbv	parts per billion by volume
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
RBRG	risk-based remedial goal
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Material
RD	remedial design
RDX	cyclotrimethylenetrinitramine
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RR	range residue
RRF	relative response factor
RRSE	Relative Risk Site Evaluation
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
RWIMR	Ranges West of Iron Mountain Road
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
Shaw	Shaw Environmental, Inc.
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
SRI	supplemental remedial investigation
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level
SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TEA	triethylaluminum
Tetryl	trinitrophenylmethylnitramine
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNB	trinitrobenzene
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
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TSS	total suspended solids
TWA	time-weighted average
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UIC	underground injection control
UF	uncertainty factor
URF	unit risk 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