DRAFT FINAL

Site Inspection Report for Fort Lee

DERP FUDS Project No. **C03VA002701**

Prepared Under: **Contract No. W912DY-04-D-0017**
Task Order # 00170001

Prepared for:
U.S. Army Engineering and Support Center, Huntsville
4280 University Square
Huntsville, AL 35807
and
U.S. Army Corps of Engineers, Baltimore District
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September 2007

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September 2007

CONTRACTOR STATEMENT OF AUTHORSHIP AND INDEPENDENT TECHNICAL REVIEW

Alion Science and Technology Corporation has prepared this Draft Final Site Inspection Report for Fort Lee, Formerly Used Defense Site (FUDS), Project No. C03VA002701. An independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Programmatic Work Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with existing Corps policy. In accordance with Corps requirements, significant authors to this report are presented below.

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Significant concerns and explanation of the resolutions are documented within the project file.

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LIST OF ACRONYMS AND ABBREVIATIONS

Alion	Alion Science and Technology Corporation
ASR	Archive Search Report
bgs	Below Ground Surface
CENAB	Corps of Engineers North Atlantic Baltimore
CENAO	Corps of Engineers North Atlantic Norfolk
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSM	Conceptual Site Model
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DNT	Dinitrotoluene
DoA	Department of the Army
DoD	Department of Defense
DoI	Department of the Interior
DoJ	Department of Justice
DQI	Data Quality Indicator
DQO	Data Quality Objective
EA	EA Engineering, Science, and Technology, Inc.
EBS	Environmental Baseline Survey
EDS	Environmental Data Services
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
°F	Degrees Fahrenheit
ft	Foot or Feet
FR	Federal Register
FUDS	Formerly Used Defense Site(s)

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

GPL	GPL Laboratories, LLLP
GPS	Global Positioning System
HQ	Hazard Quotient
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic, and Radioactive Waste
INPR	Inventory Project Report
LCS	Laboratory Control Spike
LLLP	Limited Liability Limited Partnership
MC	Munitions Constituents
MD	Munitions Debris
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
mi^2	Square Mile(s)
mm	Millimeter(s)
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDAI	No Department of Defense Action Indicated
NG	Nitroglycerin
NPS	National Park Service
NTCRA	Non-Time Critical Removal Action
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PWP	Programmatic Work Plan

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

QA/QC	Quality Assurance/Quality Control
QSM	Quality Systems Manual
RAC	Risk Assessment Code
RBC	Risk-Based Concentration
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RPD	Relative Percent Difference
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SS-WP	Final Site-Specific Work Plan Addendum
T&E	Threatened and Endangered
TCRA	Time Critical Removal Action
TNT	Trinitrotoluene
TPP	Technical Project Planning
ug/L	microgram per liter
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
VADEQ	Virginia Department of Environmental Quality
VDCR DNH	Virginia Department of Conservation and Recreation, Division of Natural Heritage
WW	World War

GLOSSARY OF TERMS

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)—Also known as "Superfund," this congressionally enacted legislation provides the methodology for the removal of hazardous substances resultant from past / former operations. Response actions must be performed in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (USACE 2003).

Discarded Military Munitions (DMM)—Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations (10 USC2710(e)(2)).

Explosive Ordnance Disposal (EOD)—The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration (DoA 2005).

Explosives Safety—A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks of potential mishaps involving military munitions (DoA 2005).

Formerly Used Defense Site (FUDS)—Locations that were owned by, leased to, or otherwise possessed by the Department of Defense (DoD) are considered FUDS. A FUDS is eligible for the Military Munitions Response Program if the release occurred prior to October 17, 1986; the property was transferred from DoD control prior to October 17, 1986; and the property or project meets other FUDS eligibility criteria. The FUDS Program focuses on compliance and cleanup efforts at FUDS (USACE 2004a).

Material Potentially Presenting an Explosive Hazard (MPPEH)—Material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially containing a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions (DoA 2005).

GLOSSARY OF TERMS

Military Munitions—Military munitions means all ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. The term does not include wholly inert items; improvised explosive devices; and nuclear weapons, nuclear devices, and nuclear components, other then nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed (10 USC 101(e)(4)(A) through (C)).

Munitions and Explosives of Concern (MEC)— This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance (UXO), as defined in 10 USC 101(e)(5); (B) Discarded military munitions (DMM), as defined in 10 USC 2710(e)(2); or (C) Munitions constituents (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard (10 USC 2710(e)(2)).

Munitions Constituents (MC)—Any materials originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 USC 2710(e)(3)).

Munitions Debris (MD)—Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal (10 USC 2710(e)(2)).

Munitions Response Area (MRA) —Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites (32 CFR 179.3).

Munitions Response Site (MRS) —A discrete location within an MRA that is known to require a munitions response (32 CFR 179.3).

GLOSSARY OF TERMS

Munitions Response Site Prioritization Protocol (MRSPP) — The MRSPP was published as a rule on October 5, 2005. This rule implements the requirement established in section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the Department to assign a relative priority for munitions responses to each location (hereinafter MRS) in the Department's inventory of defense sites known or suspected of containing unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC). The DoD adopted the MRSPP under the authority of 10 USC 2710(b). Provisions of 10 USC 2710(b) require that the DoD assign to each defense site in the inventory a relative priority for response activities based on the overall conditions at each location taking into consideration various factors related to safety and environmental hazards (710 FR 58016).

Non-Time Critical Removal Action (NTCRA)—Actions initiated in response to a release or threat of a release that poses a risk to human health or the environment where more than six months planning time is available (USACE 2000).

Range—A designated land or water area that is set aside, managed, and used for range activities of the DoD. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access and exclusionary areas. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration (10 USC 101(e)(1)(A) and (B)).

Range Activities—Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems (10 USC 101(e)(2)(A) and (B)).

Risk Assessment Code (RAC) —An expression of the risk associated with a hazard. The RAC combines the hazard severity and accident probability into a single Arabic number on a scale from 1 to 5, with 1 being the greatest risk and 5 the lowest risk. The RAC is used to prioritize response actions (USACE 2004a).

Time Critical Removal Action (TCRA)—Removal actions conducted to respond to an imminent danger posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment (USACE 2000).

Unexploded Ordnance (UXO)—Military munitions that (A) have been primed, fused, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause (10 USC 101(e)(5)(A) through (C)).

EXECUTIVE SUMMARY

ES.1 Under contract with the United States Army Corps of Engineers (USACE), Alion Science and Technology Corporation (Alion) prepared this Site Inspection (SI) Report to document SI activities and findings for the Fort Lee Formerly Used Defense Site (FUDS), Property No. C03VA0027 located in Prince George County, Virginia. The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) under the Defense Environmental Restoration Program (DERP) to address potential munitions and explosives of concern (MEC) and munitions constituents (MC) remaining at FUDS. This SI is being completed under MMRP Project No. C03VA002701 to addresses potential MMRP hazards remaining at the Fort Lee FUDS.

ES.2 **SI Objectives and Scope**. The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) with respect to the approved munitions FUDS project. Within this scope, the SI collects the minimum amount of information necessary to make this determination as well as (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (EPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the Remedial Investigation/Feasibility Study (RI/FS). An additional objective of the MMRP SI is to collect additional data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

ES.3 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of the FUDS prior to transfer. Potential releases of hazardous, toxic, and radioactive waste (HTRW) are not within the scope of the SI.

ES.4 **Fort Lee FUDS Site**. Many battles took place on the Fort Lee FUDS during the Civil War (prior to DoD ownership and control). Then, following DoD acquisition, the land was used for the training of soldiers during World War (WW) I. The Fort Lee site was occupied by the Army from 1917 to 1959. The Fort Lee FUDS is comprised of several noncontiguous parcels surrounding the active Fort Lee. The 2,519.98 acres associated with the Fort Lee FUDS site is variously owned by the Commonwealth of Virginia, Department of Justice (DoJ), and the Department of the Interior (DoI)/National Park Services (NPS) as well as various private

interests. Portions of the FUDS, owned by DoI and known as the Petersburg National Battlefield, are open to the public.

ES.5 **Technical Project Planning.** The SI approach was developed in concert with stakeholders through the USACE's technical project planning (TPP) framework, which was applied at the initial TPP meeting on 19 January 2006. Stakeholders debated the SI approach, as presented and modified during the TPP meeting and made limited modifications prior to finalizing the site-specific work plan (SS-WP). These agreements were to inspect the cited areas of concern and conduct multimedia sampling (with use of existing background sampling data) and complete the data assessment in accordance with the TPP Memorandum and as revised and agreed to in the Final SS-WP.

ES.6 USACE programmatic range documents (including the Archives Search Report (ASR) Supplement and the DERP Fiscal Year 2005 Annual Report to Congress) identified two ranges at the Fort Lee FUDs to include the WWI/WWII Small Arms Ranges and the Trench Training Area. The WWI/WWII Small Arms Ranges totals 748 acres and is designated as MRS 1. Trench Training Area totals 1,276 acres and is designated as MRS 2.

ES.7 **Site Reconnaissance and MEC Assessment.** SI field activities, including site reconnaissance and MC sampling, were performed on 12-14 February 2007. A qualitative site reconnaissance of the FUDS was performed using visual observations and analog geophysics. The field sampling approach presented included meandering reconnaissance in and around sampling locations to identify ranges, target areas, MEC, munitions debris (MD), or other areas of interest (areas containing possible trenches, backstops, or other areas containing distressed vegetation). The qualitative site reconnaissance covered approximately 65.5 acres of the FUDS. During SI activities, no evidence of berms, targets, MD, or MEC was observed at MRS 1. Evidence of past DoD use was observed in MRS 2, including the identification of suspect MD and numerous anomalies near a reported material potentially presenting an explosive hazard (MPPEH) burial area. No MEC was observed at MRS 2.

ES.8 A qualitative MEC screening level risk assessment was conducted based on the SI qualitative reconnaissance, as well as historical data documented in the Inventory Project Report (INPR), Archive Search Report (ASR), and the ASR Supplement. Historical documentation and interviews performed as part of the SI indicate that conventional munitions were used at both MRSs, including small arms. MRS 1 does not contain any former backstop areas from the former WWI/WWII Small Arms Ranges and consists of buffer lands that comprised the danger area. No MD or MEC has been reported at MRS 1. Previous MEC and MD findings in MRS 2

have included a dummy grenade, a live WWI artillery shell, and several small arms casings. Additionally, a live shell dating back to the Civil War era was also discovered in this area. Evidence of munitions use, such as suspect MEC/MD and subsurface anomalies, has been identified within MRS 2. The potential risk posed by MEC, assessed through three risk factors (i.e., presence of MEC source, accessibility or pathway presence, and potential receptor contact), indicated low risk for MRS 1, and a low to moderate risk for MRS 2.

ES.9 **MC Sampling and Risk Screening.** A total of 26 surface soil, 1 sediment, 1 surface water, and 2 groundwater samples were collected. Surface soil, surface water, and sediment samples were analyzed for the target compound list of explosives and target analyte list of metals. Groundwater samples were analyzed only for explosives in accordance with the approved SS-WP. A list of MC associated with munitions used at the site was generated and used to support analysis of results and the risk screening. For MRS 1 and MRS 2, the munitions-related MC list included two explosives (dinitrotoluene [DNT] and nitroglycerin [NG]) and six metals (antimony, copper, iron, lead, nickel, and zinc). Iron is an essential nutrient and was excluded from further consideration as a chemical of potential concern/chemical of potential ecological concern (COPC/COPEC). No munitions-related MC were detected exceeding human health criteria and background concentrations at MRS 1; therefore, all pathways are considered incomplete for all human receptors at MRS 1. Only one analyte (lead) associated with the munitions at MRS 2 exceeded background concentrations and human health screening criteria in surface soil. Therefore, the surface soil pathway in the CSM (Appendix J) is identified as complete at MRS 2 for all identified human receptors. Inorganics were detected in surface water and sediment samples collected in MRS 2. Since no background comparison could be made (no background surface water or sediment samples were collected), the surface water and sediment pathways were identified as complete for all identified human receptors. The detections did not exceed screening criteria, and no COPC were identified for surface water or sediment. No explosives were detected in the groundwater samples. Therefore, there are no COPCs for groundwater. Based on the sample results, the groundwater pathway in the CSM (Appendix J) remains incomplete for MRS 2 for human receptors.

ES.10 A screening level ecological risk assessment (SLERA) was required given the former FUDS is located in an area regulated by the Coastal Zone Management Program, contains designated wetlands, contains habitat known to be used by designated rare, threatened, and endangered species, and encompasses a national park. For MRS 1, the SLERA did not identify any munitions-related MC as COPECs and site concentrations of metals are similar to background; therefore, the pathways for all ecological receptors are considered incomplete for MRS 1. For MRS 2, the SLERA identified lead as exceeding both background concentrations

and screening criteria in surface soil at MRS 2. Antimony, copper and zinc at MRS 2 exceeded ecological screening values, but site concentrations were similar to background. Therefore, the surface soil pathway in the CSM (Appendix J) is considered complete for ecological receptors for MRS 2. Inorganics (metals) were detected in surface water and sediment samples collected in MRS 2. Since no background comparison could be made (no background surface water or sediment samples were collected), the surface water and sediment pathways were identified as complete for all identified ecological receptors. The detections did not exceed screening criteria and no COPEC were identified for surface water or sediment.

ES.11 **Recommendations**. ***WWI/WWII (MRS 1) –*** This area was used historically as a small arms range. MD and MEC have not been reported as being found within MRS 1 and the MEC risk is considered low. Human health and ecological risk screening assessments indicate there is no significant or appreciable risk from MC. No Department of Defense Action Indicated (NDAI) is recommended for MRS 1 with respect to both MEC and MC (Table ES-1). ***Trench Training Area (MRS 2) –*** MRS 2 was historically used as a trench training area, and MEC and MD have been found within MRS 2. Numerous subsurface anomalies were identified near a reported MPPEH burial site during SI reconnaissance. MEC risk is considered low to moderate for MRS 2. Human health and ecological risk screening assessments identified risk from MC in surface soil. RI/FS is recommended for MEC and MC. In conjunction with these recommendations, neither a time critical removal action (TCRA) nor a non-time critical removal action (NTCRA) is required for this site (including MRS 1 and MRS 2).

ES.12 The boundary and acreage of MRS 1 in the ASR Supplement should be reviewed and possibly revised. The ASR Supplement notes that there are 748 acres associated with this range; however, this acreage does not accurately define the FUDS eligible acreage that comprises MRS 1. This acreage took into account several parcels of the WWI/WWII Small Arms Ranges (MRS 1) that currently are part of the active DoD installation of Fort Lee. Additionally, part of the acreage for MRS 1 is outside the FUDS boundary.

Table ES-1 Summary of Site Recommendations for Fort Lee FUDS

(FUDS Project No. C03VA002701)

MRS	Recommendation	Basis for Recommendation	
		MEC	**MC**
MRS 1 - WWI/WWII Small Arms Ranges	NDAI TCRA/NTCRA not recommended	MEC Assessment: Low risk No suspected physical or historical evidence of MEC/MD	Risk Screening: Acceptable risk to human and ecological receptors.
MRS 2 - Trench Training Area	RI/FS Additional studies should focus on MEC and MC TCRA/NTCRA not recommended	MEC Assessment: Low to moderate risk Historical evidence of MEC/MD, suspect MD identified during SI, and numerous anomalies identified in reported MPPEH burial area.	Risk Screening: Potential risks to human and ecological receptors ***Surface Soil***- Background and risk screening exceedances for lead for human receptors and copper, lead, and zinc for ecological receptors.
MRS-Munitions Response Site MEC-munitions and explosives of concern MPPEH- Material Potentially Presenting an Explosive Hazard		MC-munitions constituents NDAI-No Department of Defense Action Indicated RI/FS-Remedial Investigation/Field Study	

1. INTRODUCTION

1.0.1 This report documents the findings of the Military Munitions Response Program (MMRP) Site Inspection (SI) performed at the Fort Lee Formerly Used Defense Site (FUDS) located in Prince George County, Virginia, MMRP Project No. C03VA002701. Alion Science and Technology Corporation (Alion), along with its subcontractors [EA Engineering, Science, and Technology, Inc. (EA), Environmental Data Services (EDS), and GPL Laboratories, Limited Liability Limited Partnership (LLLP) (GPL)], prepared this report under contract to the U.S. Army Engineering and Support Center, Huntsville (USAESCH). This work is being performed in accordance with Contract No. W912DY-04-D-0017, Task Order 00170001 for FUDS in the Northeast Region of the Continental United States. The Corps of Engineers North Atlantic Baltimore (CENAB) is working with USAESCH and its contractor, Alion, on the completion of this project in accordance with the SI performance work statement (see Appendix A).

1.0.2 The technical approach to this SI is based on the *Programmatic Work Plan for Formerly Used Defense Sites (FUDS) Military Munitions Response Program (MMRP) Site Inspections at Multiple Sites the Northeast Region* (PWP) (Alion 2005) and the *Final Site-Specific Work Plan Addendum to the MMRP Programmatic Work Plan for the Site Inspection of Fort Lee* (SS-WP) (Alion 2006b).

1.1 Project Authorization

1.1.1 The Department of Defense (DoD) has established the MMRP to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the U.S. Army Corps of Engineers (USACE) is conducting environmental response activities at FUDS for the Army, as DoD's Executive Agent for the FUDS program.

1.1.2 Pursuant to USACE's Engineer Regulation 200-3-1 (USACE, 10 May 2004) and the Management Guidance for the Defense Environmental Response Program (DERP) (Office of the Deputy Under Secretary of Defense [Installations and Environment], September 2001), USACE is conducting FUDS response activities in accordance with the DERP statute (10 USC 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC §9601 et seq.), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations Part 300). As such, USACE is conducting SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS. This MMRP is limited to munitions related releases.

1.1.3 While not all MEC/MC constitute CERCLA hazardous substances, pollutants or contaminants, the DERP statute provides DoD the authority to respond to releases of MEC/MC, and DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.2 Project Scope and Objectives

1.2.1 The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under CERCLA. The SI collects the minimum amount of information necessary to make this determination as well as (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (EPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the Remedial Investigation/Feasibility Study (RI/FS). An additional objective of the MMRP SI is to collect additional data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

1.2.2 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of this FUDS prior to transfer through records review, qualitative site reconnaissance to assess MEC presence/absence, and sampling where MC might be expected based on the conceptual site model (CSM). Potential releases of hazardous, toxic, and radioactive waste (HTRW) are not within the scope of this SI.

1.3 Project Location

1.3.1 The Fort Lee FUDS is located near the municipality of Petersburg, Virginia in Prince George County (see Figure 2-1). It is comprised of several non-contiguous parcels, approximately 2,494 acres of land. The FUDS eligible parcels of land surround the remaining active part of Fort Lee. The North American Datum 83 North coordinates for the site are Universal Transverse Mercator X and Y (meters) 292559 and 4130006, respectively. This site falls under the geographical jurisdiction of the Corps of Engineers North Atlantic Norfolk (CENAO). The SI for Fort Lee is being completed under DERP FUDS Project No. C03VA002701 which addresses MMRP at the FUDS.

1.4 Munitions Response Site Prioritization Protocol

1.4.1 This SI Report includes draft MRSPP rankings that apply to each of the two designated MRSs identified in this report (Appendix K). The MRSPP scoring will be updated by USACE on an annual basis to incorporate new information.

2. SITE DESCRIPTION

2.1 Site Description and History

2.1.1 The Fort Lee area was the site of many battles during the Civil War, including the Battle for Petersburg, during which numerous fortifications were constructed on the areas later occupied by Fort Lee (Figure 2-1). In 1917, the United States Government acquired approximately 9,000 acres of land to be used for Camp Lee. The camp was used for the training of soldiers during World War (WW) I. Operations at the site included training with small arms and trench training operations. A rifle range and rifle range danger area were established in the northern part of the site (Figure 2-2), and trench training operations reportedly occurred in the southern part of the site (Figure 2-3). In 1921, Camp Lee was deactivated, dismantled, and several parcels were transferred from military ownership (USACE 1996, Alion 2006b).

2.1.2 In 1940, the War Department ordered the reconstruction of Camp Lee. The rebuilt Camp Lee was ready for operations in February 1941. Camp Lee functioned as the operation training area of the Quartermaster Training Replacement Center and Medical Replacement Center throughout WWII. Operations at the site included training with small arms, grenades, and rockets. A rifle range and rifle range danger area were again established in the northern part of the site and some training operations reportedly occurred in the southern part of the site. Camp Lee was provided permanent status and renamed Fort Lee in 1950 (USACE 1996, Alion 2006b).

2.1.3 Following WWI and WWII, the DoD disposed of several non-contiguous parcels of land, including the danger area associated with the rifle range. Total acreage of land identified in the addendum to the Findings and Determination of Eligibility is 2,852.78 acres (USACE 1994). The remainder of the active Fort Lee is the home of the Quartermaster School. However, transactions subsequently have occurred to reduce the total DERP FUDS eligible acreage from 2,852.78 acres to 2,519.98 acres. In 2004, the Commonwealth of Virginia, Department of Corrections, transferred 275 acres to the United States Government (Army) for incorporation back into Fort Lee. An additional 57.8 acres were transferred on 19 January 2006 from the Department of Justice (DoJ) to the United States Government (Army) for incorporation back into Fort Lee (Brandon 2006). Both of these areas comprise the land immediately adjacent to the active range. Since this acreage has been transferred back to the Army, this area is no longer eligible for consideration under DERP-FUDS; therefore, these 332.8 acres were not evaluated during this SI. The remaining FUDS eligible acreage is owned by Federal government entities (Department of the Interior [DoI] and DoJ), as well as various private and municipal interests.

2.1.4 Both the Archive Search Report (ASR) (USACE 1996) and ASR Supplement (USACE 2004b) indicated MEC had been discovered on the southern portion of Fort Lee on the Petersburg National Battlefield. The ASR documented previous findings of MD on the surface including a dummy grenade and several small arms casings. Additionally a live WWI artillery shell was discovered in the subsurface by the National Park Service (NPS) while removing a tree stump. The shell was disposed of by ordinance personnel from active Fort Lee. Following the first TPP meeting (Alion 2006a), Mr. James Blankenship, the Chief Historian at Petersburg National Battlefield, noted that a live shell dating back to the Civil War era also was discovered at the battlefield (refer to contact record located in Appendix L). The dummy grenade, small arms casings, and live Civil War shell were discovered near the WWI magazine. Mr. Blankenship reported that additional munitions-related materials have been found on the surface of the battlefield since the ASR, including WWI small arms casings and a live WWI artillery shell. Mr. Blankenship also referenced a one-page document, from the "Accession Book Recopied March 1980 to Conform with NPS Museum Specifications," that cited the burial of "loaded projectiles" in 1964 on the northwestern part of the battlefield. This document specified a general location for the burial area, given in measurements from the corner of an existing structure, which is shown on Figure 2-3 (NPS Museum 1980).

2.2 MRS Identification and Munitions Information

2.2.1 USACE programmatic range documents (including the ASR Supplement and the DERP Fiscal Year 2005 Annual Report to Congress) identified two ranges at the Fort Lee FUDS (USACE 2004b and DoD 2005), as shown on Figure 2-1. These ranges include WWI/WWII Small Arms Ranges[1] and Trench Training Area, designated MRS 1 and MRS 2, respectively (refer to Table 2-1). Restoration Management Information System range identification numbers for these MRSs are C03VA002701R01 and C03VA002701R02, respectively. Munitions associated with these MRSs, derived from the ASR and ASR Supplement, are summarized on Table 2-2.

2.2.2 According to the 2004 ASR Supplement, the designated ranges, MRS 1 and MRS 2, include 748 and 1,276 acres, respectively. This acreage took into account several parcels of the WWI/WWII Small Arms Ranges (MRS 1) that currently are part of the active DoD installation of Fort Lee.[2] Additionally, part of the acreage for MRS 1 is outside the FUDS boundary.

[1] The 1996 Archive Search Report (ASR) uses the term Rifle Range Danger Area - West to refer to WWI/WWII Small Arms Ranges. The 2004 ASR Supplement uses the terminology WWI/WWII Small Arms Ranges. This SI Report uses the ASR Supplement and ASR terminology interchangeably.

[2] After 2004, 332.8 acres was transferred back to Fort Lee; therefore, the 748 acres associated with MRS 1 was revised to 415.2 acres for MRS 1.

Therefore, the 748 acres cited in the ASR Supplement do not accurately define the FUDS eligible acreage that comprises MRS 1.

2.3 Physical Setting

2.3.0.1 The following subsections provide a physical description of the FUDS property with respect to relief, vegetation, geology, hydrology, climate, local demographic, and land uses.

2.3.1 Topography and Vegetation

2.3.1.1 The Fort Lee site is part of the coastal plains region of Virginia, comprised of flat land with some rolling hills. The site elevations for the FUDS parcels range between 80 and 150 feet (ft) above mean sea level. Near the steep river bank grades of the Appomattox River, the elevation rises from near sea level to over 100 ft (USACE 1996). The vegetation throughout the site includes low grass and shrubs with forested areas (USACE 1996). The Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR DNH) identified Marsh Senna as the only vegetation threatened and endangered (T&E) species occurring within the boundary of Fort Lee (USACE 1996).

2.3.2 Climate

2.3.2.1 The area encompassing the FUDS is considered mild and semi-coastal. The average summer temperatures are in the upper 80s (degrees Fahrenheit [°F]) and the winter temperatures are in the 40s (°F). The total annual precipitation is approximately 44.5 inches, of which over half occurs between the months of April and September. The wettest month of the year is July. The average winter snowfall is about 9 inches per year. The average relative humidity is approximately 50 percent in the afternoon. Sunshine ranges from 70 percent in the summer to 50 percent in the winter. Prevailing winds are generally from the east and the highest average wind speeds occur in the spring at approximately 9 miles per hour (USACE 1996).

2.3.3 Local Demographics

2.3.3.1 The Fort Lee FUDS borders the active military base of Fort Lee, which is located in Prince George County. The population of Prince George County is 33,047 people and the population density is 124 persons per square mile (mi^2). The population of Fort Lee is 7,269 and the population density is 870.2 persons per mi^2. The northern portion of the Fort Lee FUDS is within the city limits of Hopewell. The population of Hopewell is 22,354 and the population density is 2,182.3 persons per mi^2. Two additional cities are located in the immediate vicinity of the FUDS property. On the western border of Petersburg National Battlefield, the southern parcel of the site, is the city of Petersburg. The distance from the western border of the

battlefield to Petersburg's city center is approximately 1 mile. The population of Petersburg is 33,740. Petersburg's population density is 1,474.6 persons per mi². North of Petersburg, approximately 4 miles from Petersburg National Battlefield, is the city of Colonial Heights, with a population of 16,897. The population density of Colonial Heights is 2,260.3 persons per mi² (U.S. Census Bureau 2000).

2.3.3.2 Robert E. Lee Elementary School is less than 500 ft from the southern part of the Fort Lee FUDS, located at 51 Gibbons Avenue, Petersburg, Virginia. Annually, this elementary school serves 260 students and 23 educators through its PK-5 education programs.

2.3.3.3 The Kids 4 Us Child Home Care daycare is less than a mile northeast of the northern part of the Fort Lee FUDS (part of which is MRS 1). The daycare has a total capacity of 12 and is located at 393 Libby Avenue, Hopewell, Virginia. Saint Mark's Preschool is less than a mile west of the southern part Fort Lee (MRS 2) and is located at 225 Claremont Street, Petersburg, Virginia.

2.3.4 Current and Future Land Use

2.3.4.1 The Commonwealth of Virginia, the DoJ, the DoI/National Park Service (NPS) (Trench Training Area), and private interests own the non-contiguous tracts of land which comprise the Fort Lee FUDS (USACE 1996). Currently, the Riverside Regional Jail Authority operates the Riverside Regional Jail for the Commonwealth of Virginia on the northern portion of the Fort Lee FUDS, which borders the former WWI/WWII Small Arms Ranges (MRS 1) to the north. Future plans include the expansion of this facility. The DoJ also houses a federal reformatory on the northern part of the FUDS. Portions of this reformatory are located within the former WWI/WWII Small Arms Ranges, while the remaining DoJ property borders MRS 1 to the northeast. A residential area, owned by the DoJ and associated with the reformatory, is located in this area. Future use of this reformatory is anticipated to remain unchanged. The ownership of the remaining parcels of MRS 1 is unknown. The DoI property houses the Petersburg National Battlefield on the southern part of the FUDS, which was the former Trench Training Area (MRS 2). As a designated battlefield the use of this land is not expected to change in the future. The remainder of the land which comprises the Fort Lee FUDS is zoned commercial and residential and is unlikely to change from these current uses in the future.

2.3.5 Geologic Setting

2.3.5.1 Fort Lee is located to the east of the Fall Line, which divides the Piedmont from the Coastal Plain. The Fall Line is an area where the sediments of the Coastal Plain terminate against the igneous and metamorphic basement rocks of the Piedmont physiographic province.

East of the Fall Line, the bedrock is buried beneath the sedimentary wedge of the Coastal Plain sediments. Bedrock in the vicinity of Fort Lee includes igneous and metamorphic rocks. These rocks are comprised of granitic gneisses and diorite gneiss as well as intrusive granite. (Thornberry-Erlich 2005).

2.3.5.2 Atlantic Coastal Plain sediments dominate the area from the Fall Line east to the Atlantic Ocean. In the area of Fort Lee, the sediments are approximately 300 ft thick. These sediments have been mapped as a number of different formations and groups. The individual units consist of varying percentages of sand, gravel, silt, and clay and include the Potomac Formation, the Chesapeake Group, the Windsor Formation, the Bacons Castle Formation, and Quaternary deposits. Recent deposits include sand, gravel site, and clay along river valleys and marsh and wetland deposits adjacent to larger rivers. These deposits can be up to 50 ft thick (U.S. Geological Survey [USGS] 2000).

2.3.5.3 The U.S. Department of Agriculture (USDA) has mapped a number of soil types in the Fort Lee area. The three prominent soil units in the area are the Ackwater-Montross-Aycock association, the Slagle-Emporia-Bonneau association, and Kinston soils (USDA 2003).

2.3.5.4 The Ackwater-Montross-Aycock association is characterized by deep, moderately drained and well drained soils that have clayey and loamy subsoil. These soils were formed in fluvial and marine sediments on uplands. Generally, soils of this association lie in nearly level and gently sloping areas between large drainageways. This soil unit covers almost all of the Fort Lee FUDS area except the western and southwestern margins of the FUDS (USACE 1996).

2.3.5.5 Slagle-Emporia-Bonneau soils are deep, moderately to extremely well drained soils that have loamy subsoil. They were formed in fluvial and marine sediments on uplands. These soils occur on broad areas of the nearly level and gently sloping soils between large drainageways and in narrow areas along the streams. Soils of this association occur only along the western boundary of the Fort Lee FUDS (USACE 1996).

2.3.5.6 The Kinston soil unit only occurs in the area along the Blackwater Swamp. Kinston soils are deep, poorly drained, and have a loamy substratum. They were formed in fluvial sediments on floodplains. Locations underlain with these soils are subject to seasonal wetness and flooding, therefore making these areas unlikely areas for human habitation (USACE 1996).

2.3.6 Hydrogeologic Setting

2.3.6.1 There are two aquifers in the Fort Lee region: the surface aquifer with locally confining conditions and the Yorktown-Eastover, a deeper confined or semi-confined aquifer (Environmental Science and Engineering, Inc. 1982).

2.3.6.2 The surficial aquifer within the Quaternary and Upper Tertiary formations occurs from the ground surface to a depth of approximately 30-40 ft below ground surface (bgs) (James M. Montgomery 1992). This aquifer is comprised of inter-stratified, fluvial sedimentary sequences consisting of channel and interchannel levee and overbank deposits. The channel deposits are characterized by silty sands, inorganic silts, and poorly graded sands with local occurrences of poorly graded gravels. The levee and overbank deposits are characterized by clay and inorganic clay and local occurrences of clayey sands. The discontinuous and variably permeable nature of these deposits appears to cause locally confining conditions in the surface aquifer (James M. Montgomery 1992).

2.3.6.3 Groundwater well logs completed at active Fort Lee indicate that the top 58 ft of sediment are sand and clay, suggesting a moderate permeability. Sediments from 58 to 195 ft bgs are sand and gravel, suggesting a high permeability. Sediments below the sand and gravel are sand, gravel, and clay, suggesting a moderate permeability, and clay, sand, and gravel, suggesting a low permeability (Environmental Science and Engineering, Inc. 1982).

2.3.6.4 The general direction of groundwater flow is toward the east. Locally, the water table aquifer appears to mimic topography and flows toward topographically low areas such as Blackwater Swamp or Bailey Creek (Environmental Science and Engineering, Inc. 1982). Topography appears to influence a northeasterly divergence along the northern margin of the site, while topography and induced surface water recharge appear to influence a southeasterly divergence along the southern margin of the site (James M. Montgomery 1992).

2.3.6.5 No drinking water wells were identified on the FUDS property. During the technical project planning (TPP) meeting, a representative from the Federal Bureau of Prisons estimated two wells (type unknown) are located on the DoJ portion of the Fort Lee FUDS. As a follow up to the TPP meeting the DoJ was contacted and five monitoring wells were determined to be located on the DoJ property, of which only four of the wells are operable. These monitoring wells are being used to monitor the landfill neighboring the FUDS that is no longer in service (Doukas 2007). NPS confirmed there are no drinking water (or monitoring) wells on the premises of the Petersburg National Battlefield (Alion 2006a and 2006b).

2.3.6.6 The majority of the surface water in this area consists of streams that drain away from Fort Lee into marshes and the Appomattox River to the north and west, to the James River to the east, and marshes and lakes to the south. The streams and creeks across the site typically are small and have eroded the unconsolidated sediments they flow across creating steep banks adjacent to the streams. Surface water bodies act as discharge points for groundwater. Therefore, the depths to groundwater in the vicinity of these water bodies are at approximately the same elevation of these water bodies. The main surface water features in the immediate vicinity of the site include marshes and the Appomattox River to the north and west, and smaller streams and ponds in the eastern and southern sections of the site, as depicted in Figure 2-4 (USFWS 2006).

2.3.7 Area Water Supply/Groundwater Use

2.3.7.1 According to the Petersburg City Public Works, American Water Company, and the Prince George County Water Department, the site and surrounding streets are served by public drinking water systems. Seventeen public water supply wells are located within a 4-mile radius of the site (Figure 2-5). A majority of these public wells are located to the south/southeast of Fort Lee.

2.3.7.2 Drinking water populations within 4 miles of the Fort Lee FUDS include the residents of Hopewell, Petersburg, and Colonial Heights, Virginia. The total population of these cities/towns is 77,991 (United States Census Bureau 2000).

2.3.7.3 Surface water is used as a drinking water source at the confluence of the James and Appomattox rivers, located to the east of Fort Lee. The source water protection zone for this drinking water source encompasses the entire acreage of MRS 1 and extends approximately a half mile from MRS 2 (Virginia Department of Health, Office of Drinking Water 2004). Additionally, there are many public groundwater well systems within 4 miles of the Fort Lee FUDS. Details for these public wells are provided on Table 2-3. Private properties neighboring the FUDS also may be served by private wells. The source water protection zones and public wells are identified on Figure 2-5. These drinking water sources, including both groundwater and surface water, are not expected to change in the future.

2.3.8 Sensitive Environments1

2.3.8.0.1 The following sections discuss the sensitive environments associated with the FUDS and the process used to determine the necessity for completing an ecological risk assessment at the FUDS.

2.3.8.1 Army Checklist for Important Ecological Places

2.3.8.1.1 In accordance with USACE HTRW Center of Expertise guidance, the Army Checklist for Important Ecological Places is completed to determine if a FUDS may require a screening level ecological risk assessment (SLERA) (USACE 2006b and 2007). In the case of Fort Lee, because the site is within the Coastal Management Zone Management Program (authorized by the Coastal Zone Management Act of 1972) (Public Law 92-583, 16 USC 1451-1456), contains designated wetlands, contains habitat known to be used by designated rare, threatened, and endangered species, and encompasses a national park, the performance of a SLERA is required. The checklist is included as Table 2-4.

2.3.8.2 Wetlands

2.3.8.2.1 As shown in Figure 2-4, freshwater forested/shrub wetlands and freshwater emergent wetlands are located in the north-central and southeast portion of this site. (U.S. Fish and Wildlife Service [USFWS] 2006).

2.3.8.3 Coastal Zones

2.3.8.3.1 The Fort Lee FUDS is located within the Virginia Commonwealth's designated coastal zone. Prior to completing field activities, the Virginia Department of Environmental Quality (VADEQ) was contacted to determine if SI activities would require the development and submission of a consistency determination for coordinated review by VADEQ.[3] VADEQ determined that the proposed actions would have no effect on Virginia's coastal water resources or uses and the SI activities would not require the development and submission of a consistency determination for coordinated review by VADEQ. However, any future remediation activities undertaken as a result of the SI findings would require VADEQ review to determine if a consistency determination is required (VADEQ 2005a). Refer to Appendix L for this documentation.

[3] VADEQ serves as the lead agency of a network of state agencies that administer state regulations and policies to protect and enhance coastal resources.

2.4 Previous Investigations for Munitions Constituents and Munitions and Explosives of Concern

2.4.0.1 A summary of previous historical investigations and related discoveries of MC and MEC (if applicable) is provided in the following subsections.

2.4.1 1994 Inventory Project Report

2.4.1.1 USACE Norfolk District prepared an Inventory Project Report (INPR) for Fort Lee in 1994. The INPR concluded that approximately 2,827 acres associated with Fort Lee were eligible for restoration under DERP-FUDS. As Section 2.1 indicates, changes in ownership decreased the total FUDS eligible acreage from 2,827 acres to 2, 494 acres.

2.4.1.2 An MMRP project was proposed as a result of the INPR (USACE 1994). No HTRW projects were identified or proposed under this INPR. A Risk Assessment Code (RAC) scoring was completed to assess MMRP hazards.[4] The initial RAC score assigned to Fort Lee was 5; however, CENAO modified the RAC score to a score of 4 due to accessibility of the site to the public. The focus of the MMRP project was two areas identified as the DoI property referred to as the Trench Training Area and the DoJ property referred to as the WWI/WWII Small Arms Ranges. The INPR noted that a WWI artillery shell was found in the Trench Training Area. The specific location of the shell was not identified in the INPR. During the TPP meeting (Alion 2006a) the stakeholders from Petersburg National Battlefield identified where the shell was located and indicated that it was found in the subsurface during tree clearing activities. The approximate location is shown in Figure 2-3.

2.4.2 1996 USACE Archive Search Report

2.4.2.1 USACE completed an Archive Search Report (ASR) in 1996. The ASR identified the following areas as potentially FUDS eligible:

- Area A – Rifle Range Danger Area (referred to in this report as the WWI/WWII Small Arms Ranges)

- Area B – Trench Training Area (known as the Petersburg National Battlefield)

[4] An expression of the risk associated with a hazard. The RAC combines the hazard severity and accident probability into a single Arabic number on a scale from 1 to 5, with 1 being the greatest risk and 5 the lowest risk. The RAC is used to prioritize response actions.

- Area C – Remaining Inactive Lands

2.4.2.2 No revised RAC scores were available in the ASR documentation. The ASR indicated that only conventional munitions were used at the Fort Lee FUDS. CWM was not reportedly used or discovered on the FUDS (USACE 1996). During interviews at the Petersburg National Battlefield, several persons recalled various MEC-related items that were discovered in the Battlefield area. These MEC-related items included small arms casings, a magazine, and one WWI dummy grenade. The ASR concluded that the potential for MEC presence was likely at the Trench Training Area (Area B). The ASR also concluded that MEC was unlikely to be present at the Rifle Danger Area (Area A) and the remaining FUDS parcels (Area C). The ASR indicated that the MEC associated with the Trench Training Area most likely would be from the Civil War era. The remaining acreage, three non-contiguous parcels, comprise Area C. According to the ASR, Area C was part of the cantonment area of Fort Lee and no activities involving ordnance occurred in these areas.

2.4.2.3 The ASR identified an additional seven parcels of land as potentially associated with former Fort Lee operations. These parcels of land were grouped into the following three areas:

- Area D – Rifle Range Danger Area – East
- Area E – WWI/WWII Training Area
- Area F – Dutch Gap and Farrar's Island

2.4.2.4 As discussed in the SS-WP, Areas D, E, and F were not identified as being eligible in the 1994 INPR and, as such, were not eligible for evaluation under the current MMRP SI Program (USACE 1994, Alion 2006).

2.4.3 1999 Surface Soils Background Metals and Anthropogenic Pesticides Report

2.4.3.1 Fluor Daniel Inc. prepared the Final Surface Soil Background Metals and Anthropogenic Pesticides Report in January 1999. This report presents the data that was gathered from a background investigation at active Fort Lee, conducted to identify existing levels of metals and pesticides in the Fort Lee area. The rationale for the development of this data was to determine realistic values for metals and pesticides, to evaluate potential contamination at active Fort Lee (Fluor Daniel 1999). The data from the Fluor Daniel Background Investigation was applied in this SI Report to evaluate existing levels of background metals at the Fort Lee FUDS, as agreed upon in the SS-WP (Alion 2006b). The use of the Fluor Daniel Background Investigation is further discussed in Section 5.3.

2.4.4 2004 Archive Search Report Supplement

2.4.4.1 USACE prepared an ASR Supplement in 2004 (USACE 2004b). The ASR Supplement reviewed MMRP hazards and assigned an overall RAC score of 5 to the Fort Lee FUDS. The ASR Supplement identified two former small arms ranges. These ranges included the WWI/WWII Small Arms Ranges (MRS 1) and the Trench Training Area (MRS 2). Furthermore, this document noted that the FUDS property did not contain actual firing lines for the identified ranges. The acreage that comprises the WWI/WWII Small Arms Ranges (MRS 1) does not contain an actual firing lane or backstop area, but is made up of portions of the danger area associated with the small arms ranges. The remaining acreage defined in the ASR Supplement is the part of MRS 1 that is not located within the FUDS boundary and currently is part of active Fort Lee. The range fan for the Trench Training Area consists of the acreage that was used for trench training and was transferred to the DoI following WWI (USACE 2004b).

2.4.4.2 The ASR Supplement indicated that only conventional munitions were used at the Fort Lee FUDS. CWM was not reportedly used or discovered on the FUDS (USACE 2004b).

2.4.5 2004 Environmental Baseline Survey

2.4.5.1 An Environmental Baseline Survey (EBS) was completed for two parcels of land located adjacent to the active Fort Lee. This land was part of the land evaluated during the INPR and in the ASR. The purpose of the EBS was to evaluate the land for transfer back to the Army. Versar, Inc. performed a limited surface soil investigation and screened the site for the presence of pesticides and lead. Versar reported "no indication of known contamination problems on the subject site or in the vicinity that could potentially impact the property. As such, for the purposes of acquisition, the subject site should be considered a Category Type 1 property and the site should be acquired without restriction" (Versar 2004). The land subsequently was transferred back to the Army for incorporation into Fort Lee. Refer to Appendix L for a copy of this document.

2.5 Citizen Reports of Munitions and Explosives of Concern

2.5.1 During the TPP meeting the NPS explained that inert munitions from the Civil War have been recovered at Petersburg National Battlefield (MRS 2). Specifics relating to the recovered munitions and the areas in which they were observed were not identified.

2.6 Non-DoD Contamination/Regulatory Status

2.6.1 During the Civil War, extensive battles, including the Battle of Petersburg, took place over the acreage that is currently part of the Fort Lee FUDS. While these activities most likely have

contributed to present day MEC/MC findings, they do not qualify these sites for eligibility under the FUDS program. In fact, unless the properties qualify under later criteria, such as later DoD ranges, most of these areas are most likely ineligible under FUDS due to both the Non-DoD Ownership and the Act of War Properties criteria presented in ER 200-3-1 (Chapter 3) (USACE 2004a).

Table 2-1. Range Inventory (USACE 2004b)

Site Name	Range Name[2]	Subrange Name	RMIS Range Number	RAC Score[1]	Acreage
Fort Lee FUDS	WWI/WWI Small Arms Ranges (MRS 1)	N/A	C03VA002701R01	5	748
	Trench Training Area (MRS 2)	N/A	C03VA002701R02	4[3]	1,276

[1] RAC Scores are derived from the Supplemental ASR

[2] The Supplemental ASR did not consider Civil War MEC or MEC used on active Fort Lee, both of which may have influenced MRS 1 and 2.

[3] Original score was 5 in the ASR (USACE 1996).

Table 2-2. Military Munitions Type and Composition (USACE 1996; USACE 2004)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1,2,3,4]
WWI/WWII Small Arms Ranges (MRS 1) and Trench Training Area (MRS 2)	SMALL ARMS (CTT01)	.22 caliber cartridge	Projectile: Lead antimony with copper alloy jacket Propellant: nitrocellulose, dibutylphthalate, diphenylamine, nitroglycerin, graphite Filler: N/A.	*MC from small arms ranges are associated with the firing point for MRS 1; therefore, the projectile constituents in the "Composition" column are carried forward for analysis in this SI for MRS 1. MC from rifle/pistol ranges are associated with the firing point and the impact area for MRS 2; therefore, the propellant and the projectile constituents in the "Composition" column are carried forward for analysis in this SI for MRS 2. See Notes 1-4 below.* Explosives: • NG • Nitrocellulose (no analysis) Metals: • Antimony • Copper • Chromium • Iron • Lead • Zinc
		.30 caliber cartridge	Projectile: lead, iron, antimony, and potentially zinc with copper-plated steel jacket Propellant: black powder (sulfur, charcoal, and saltpeter), single or double-base powder (nitrocellulose and/or nitroglycerin), pyro-cellulose powder, tracer composite	Explosives: • Black powder (no analysis) • NG • Nitrocellulose (no analysis) • Pyrocellulose (no analysis) Metals: • Antimony • Copper • Iron • Lead • Zinc
		.30 caliber carbine cartridge	Projectile: lead, iron, antimony, and potentially zinc with copper-plated steel jacket Propellant: black powder (potassium nitrate, sulfur, and charcoal), nitrocellulose, and nitroglycerine (NG). Filler: N/A	Explosives: • Black powder (no analysis) • NG • Nitrocellulose (no analysis) Metals: • Antimony • Copper • Iron • Lead • Zinc

Table 2-2. Military Munitions Type and Composition (USACE 1996; USACE 2004)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1,2,3,4]
WWI/WWII Small Arms Ranges (MRS 1) and Trench Training Area (MRS 2) (continued)	SMALL ARMS (CTT01)	.45 caliber cartridge	Projectile .45 cal: Lead antimony with gilding metal jacket or cupro-nickel metal jacket. Propellant: Black Powder (Potassium Nitrate, Sulfur, and Charcoal), nitrocellulose, and nitroglycerine (NG) or Dinitrotoluene (DNT), Nitrocellulose, Diphenylamine, Graphite. Filler: N/A.	Explosives: • Black powder (no analysis) • NG • Nitrocellulose (no analysis) • DNT • Diphenylamine (no analysis) Metals: • Antimony • Copper • Iron • Lead • Nickel • Zinc
		.50 caliber cartridge	Projectile: steel, lead/antimony with copper alloy, gilding metal jacket Propellant: single or double-base powder (nitrocellulose and nitroglycerine) or smokeless powder (nitrocellulose, DNT, Diphenylamine, potassium sulfate, and graphite)	Explosives: • Nitrocellulose (no analysis) • NG • DNT • Diphenylamine (no analysis) Metals: • Iron • Lead • Antimony • Copper • Nickel
Additional Munitions Found at Trench Training Area (MRS 2)		Dummy Grenade	Body/projectile: cast iron (approximated the shape of the fragmentation grenade) Propellant: none Filler: none	Explosives: • None Metals: • Iron
	Civil War Ordinance (specifics unknown)	Civil War, Smoothbore Shot, 10 in., "Cannonballs, canister and grape shot'	Body - steel, brass, lead, and iron Propellant - black powder charge Filler – black powder (burster charge), or matrix of lead or iron balls	Explosives: • Black powder (no analysis) Metals: • Copper • Iron • Lead • Zinc

Table 2-2. Military Munitions Type and Composition (USACE 1996; USACE 2004)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1,2,3,4]
Additional Munitions Found at Trench Training Area (MRS 2) (continued)		Civil War, Projectiles; General	Body: - steel, brass, lead, and iron Propellant - black powder Charge Filler - black powder	Explosives: • Black powder (no analysis) Metals: • Copper • Iron • Lead • Nickel • Zinc
	Civil War Ordnance (specifics unknown) (continued)	Civil War, Projectiles; Smoothbore	Body: steel, brass, lead, and iron Propellant: black powder charge Filler: black powder	Explosives: • Black powder (no analysis) Metals: • Copper • Iron • Lead • Nickel • Zinc

MRS = Munitions Response Site
MC=munitions constituents
in=inch(es)
DNT=dinitrotoluene
NG= nitroglycerine

[1] Based on available technical manuals, MC identified for site munitions includes the following: Primer (potassium chlorate, lead thiocyanate, antimony sulfide, PETN, lead styphnate, barium nitrate, calcium silicade, acacia technical, acetylene black; Fuze (mercury fulminate, lead azide, tetryl, lead styphnate); Tracer (strontium nitrate, strontium peroxide, magnesium powder, calcium resinate, strontium oxalate, potassium perchlorate); Incendiary mixtures (barium nitrate, magnesium/aluminum powder, asphaltum, graphite). These materials when combined typically represent less than 5% of the weight of the material projectile for small and medium caliber munitions. Typical volumes are broken out as follows: Primer (less than 1% or 1 gram), Tracer (less than 1% or < 1 gram), Incendiary (less than 2% or < 2 grams) and fuze (less than 1% or < 1 gram). These materials along with the propellant typically burn as the projectile is fired. Therefore, the MC sampling/analysis typically focuses on primary constituents present in propellants and the projectile/casings in firing points and impact areas. Therefore these are not included in the list of Associated MC Analysis.

[2]Black powder consists of varying concentrations of charcoal, sulfur, and either potassium nitrate or sodium nitrate (DoA 1984). The constituents of black powder are not expected to persist in the environment above background concentrations for a significant period of time after initial exposure. In addition, no analysis is performed for Nitrocellulose (nitrated paper and/or a stabilizer).

[3] Non-CERCLA metals which are identified as MCs (aluminum, barium, iron, and magnesium) will not be carried forward to the risk screening unless they are significantly elevated above background concentrations.

[4] DNT includes 2,4-Dinitrotoluene and 2,6-Dinitrotoluene.

Additional sources for munitions constituents include TM 9-1300-214 and USACE technical data sheets.

Table 2-3. Groundwater Wells Near Fort Lee FUDS (Virginia Department of Health, Office of Drinking Water 2004; Tucker 2007)

PWSID	Well Name	Well Depth (ft)	Well Screened (ft)	Well Yield (gpm)
3149120	Pine Ridge MHP – Well 2A	280	-	-
3149159	Continental Motel	-	-	-
3149163	Cedarwood	-	-	-
3149515	Nannys Family BBQ	-	-	-
3149620	Prince George Woods Estates	181	161-181	116
3149885	Union Branch Baptist Church – Well 1	93	73-93	18
3149960	Whispering Winds – Well 1	200	-	1
3149960	Whispering Winds – Well 3	150	-	12
3149120	Pine Ridge MHP – Well 2B (Main)	-	-	-
3149164	County Video Bldg 2 – Well 1	185	165-185	20
3149180	Days Inn /Pumpkin Restaurant – Well 2B	-	-	110
3149210	Amir, Inc- Lighthouse/Comfort Inn – Well 002	-	-	-
3149210	Amir, Inc- Lighthouse/ Comfort Inn – Well 001	-	-	-
3149243	Circle D Mart – Deep Well	-	-	-
3149280	Hampton Inn – Well 1	227	160-170 202-222	57.7
3149290	Happy Acres Day Camp – Shallow Well	-	-	-
3149295	Salem Brothers Mini Mart – Deep Well	-	-	-
3149326	Hillside MHP – Well 1	29	-	10
3149480	La Salle Motel	-	-	-
3149510	Melvin Manning MHP Well 1	223	-	120
3149510	Melvin Manning MHP Well 2	220	200-220	120
3149570	Country Club of Petersburg Inc. – Deep Well	-	-	-
3149575	Petersburg Jail Farm – Well 1	-	-	-
3149845	Best Western / Steven Kent	-	-	100
3149950	Wildwood Farms – Well 2	215	195-215	146
3149950	Wildwood Farms – Well 1	215	187-215	133
4041065	Westover Farms – Well 2	90	-	3
4041065	Westover Farms – Well 1	90	-	3

UTM-Universal Transverse Mercator
NAD-North American Datum
PWSID – public water system identification
-, information unknown/unavailable
1, no longer used as public water supply wells

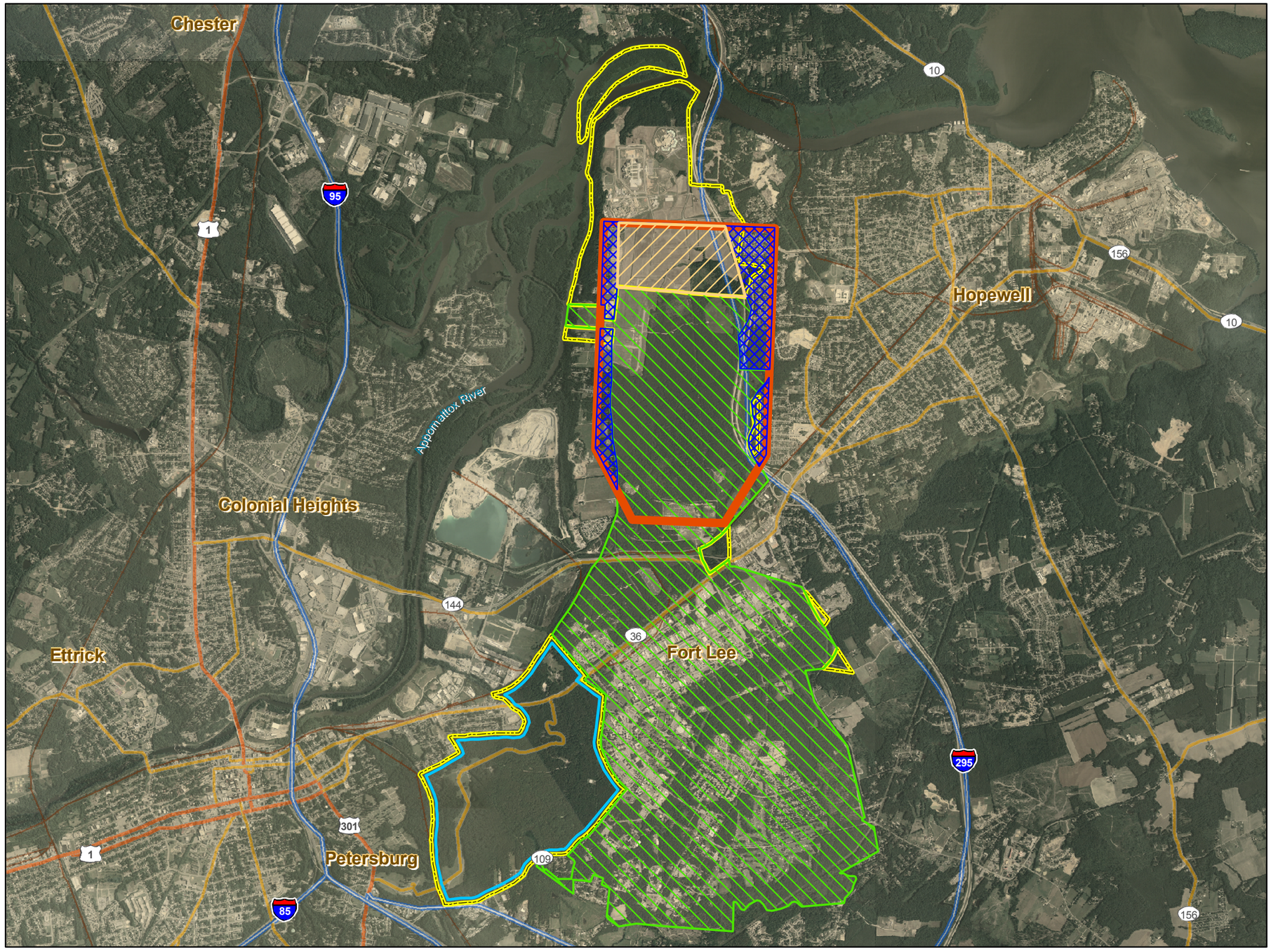
Table 2-4 Army Checklist for Important Ecological Places

No.	Checklist Item	Yes / No[1]		Comments
1.	Locally important ecological place identified by the Integrated Natural Resource Management Plan, BRAC Cleanup Plan or Redevelopment Plan, or other official land management plans.		X	
2.	Critical habitat for Federal designated endangered or threatened species. See No. 12 below.	X		Bald eagle is present on the site.
3.	Marine Sanctuary		X	
4.	National Park	X		Part of the FUDS encompasses Petersburg National Battlefield.
5.	Designated Federal Wilderness Area		X	
6.	Areas identified under the Coastal Zone Management Act	X		The site is located within the Virginia Coastal Zone.
7.	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program		X	
8.	Critical areas identified under the Clean Lakes Program		X	
9.	National Monument		X	
10.	National Seashore Recreational Area		X	
11.	National Lakeshore Recreational Area		X	
12.	Habitat known to be used by Federal designated or proposed endangered or threatened species	X		Bald eagle and marsh senna are present on this FUDS.
13.	National preserve		X	
14.	National or State Wildlife Refuge		X	
15.	Unit of Coastal Barrier Resources System		X	
16.	Coastal Barrier (undeveloped)		X	
17.	Federal land designated for protection of natural ecosystems		X	
18.	Administratively Proposed Federal Wilderness Area		X	
19.	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters		X	
20.	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time		X	
21.	Terrestrial areas utilized for breeding by large or dense aggregations of animals		X	
22.	National river reach designated as Recreational		X	
23.	Habitat known to be used by state designated endangered or threatened species	X		Bald eagle is present on the site.

Table 2-4 Army Checklist for Important Ecological Places

No.	Checklist Item	Yes / No[1]		Comments
24.	Habitat known to be used by species under review as to its Federal endangered or threatened status	X		Bald eagle and marsh senna are present on the site.
25.	Coastal Barrier (partially developed)		X	
26.	Federally designated Scenic or Wild River		X	
27.	State land designated for wildlife or game management		X	
28.	State-designated Scenic or Wild River		X	
29.	State-designated Natural Areas		X	
30.	Particular areas, relatively small in size, important to maintenance of unique biotic communities		X	
31.	State-designated areas for protection or maintenance of aquatic life		X	
32.	Wetlands	X		The area contains designated wetlands.
33.	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes		X	

[1] A SLERA is implemented if one or more questions is marked as yes.



Fort Lee
Petersburg, VA

Legend

- MRS1 - Small Arms Range
  Acreage = 2,090 Ac
- Former WWI/WWII Small Arms Ranges
  Acreage = 415.2 Ac
- Portion of MRS 1 Transferred Back to the Department of Defense in 2004 & 2006
  Acreage = 332.8 Ac
- Active Fort Lee
  Acreage = 5,422 Ac
- MRS 2 - Trench Training Area
  Acreage = 1,276 Ac
- FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

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Miles

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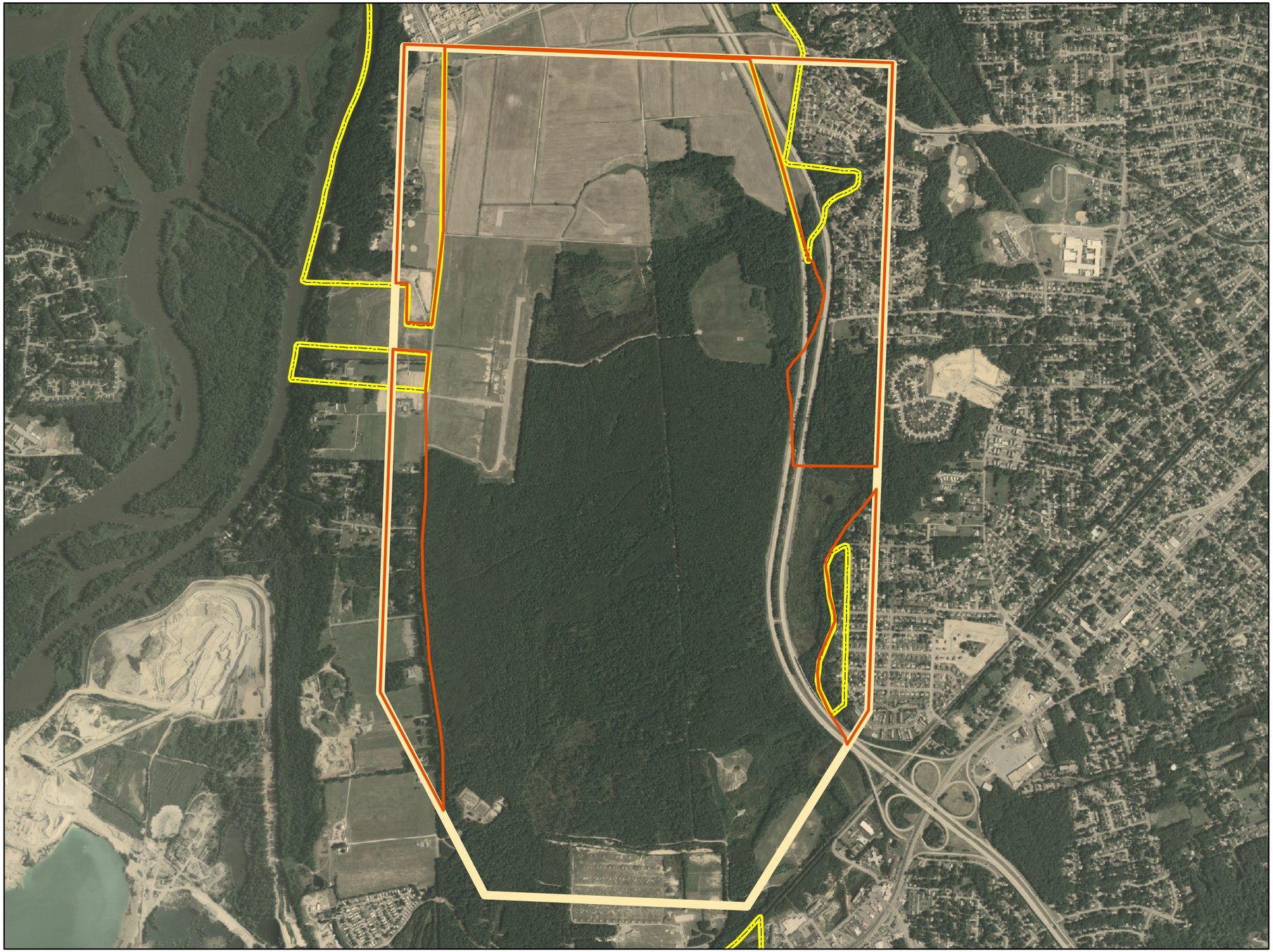
Figure 2-1. Munitions Response Sites (MRSs) for Fort Lee.



Fort Lee
Petersburg, VA

Legend

MRS1 - WWI/WWII Small Arms Ranges
Acreage = 415.2 Ac

Former WWI/WWII Small Arms Ranges
Acreage = 2,090 Ac

FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

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Meters

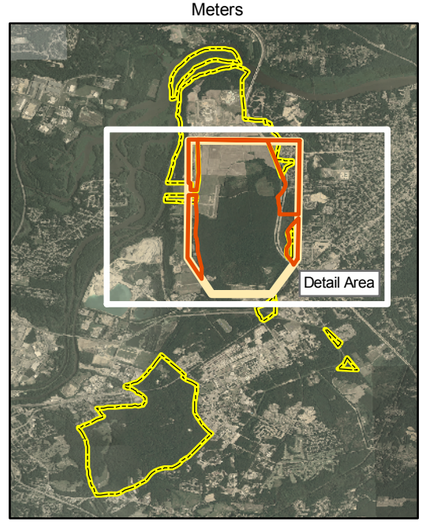

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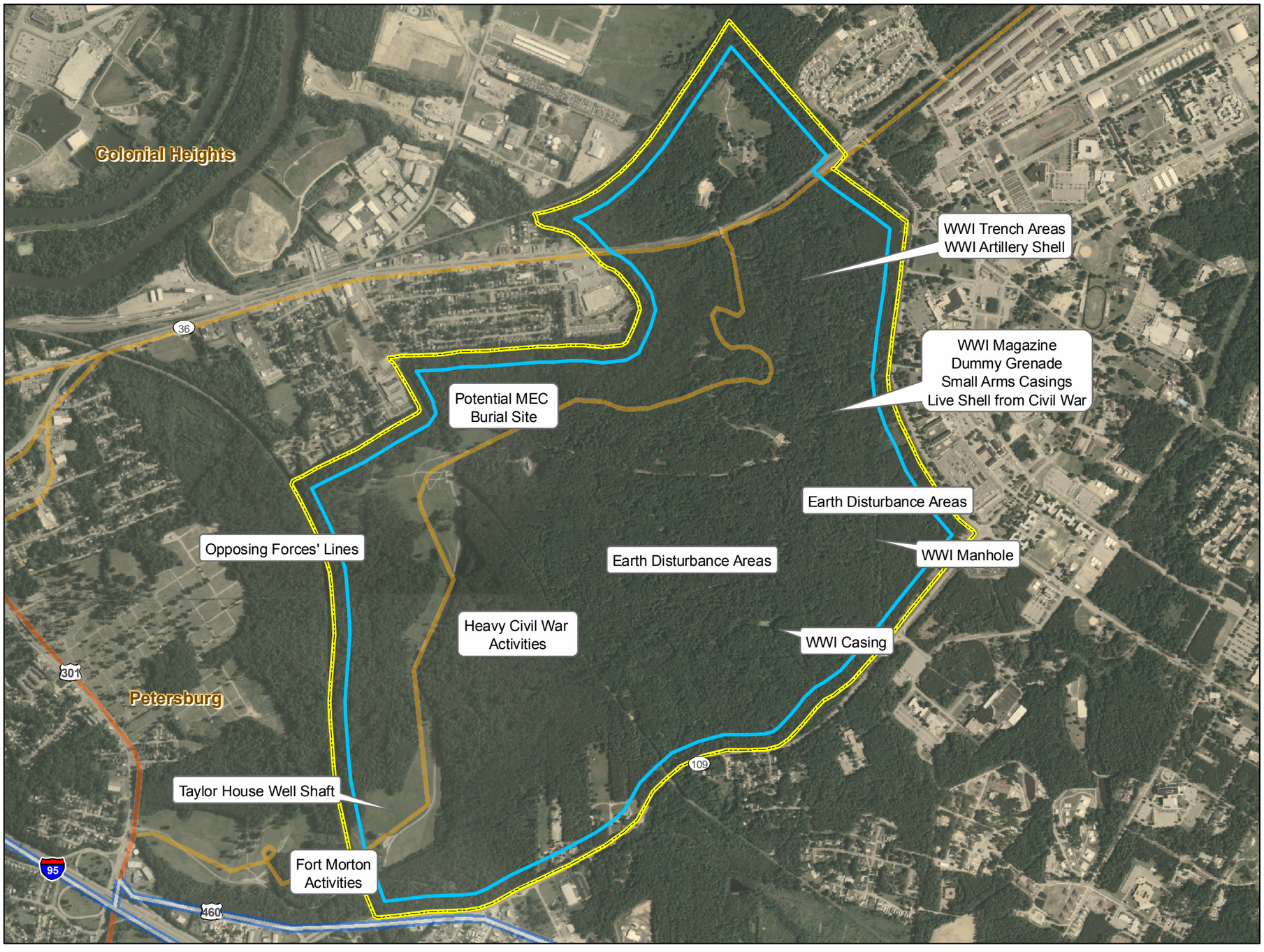
Figure 2-2. Locations of Historical Military Activities/Findings (MRS 1).



Fort Lee
Petersburg, VA

Legend

MRS2 - Trench Training Area (Petersburg National Battlefield)
Acreage = 1,276 Ac

FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site
MEC - Munitions and Explosives of Concern

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

0 500 1,000
Meters

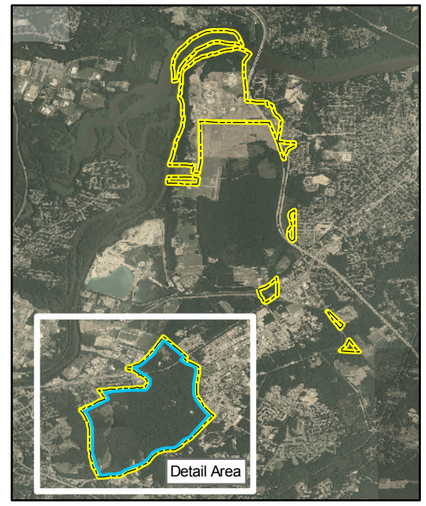


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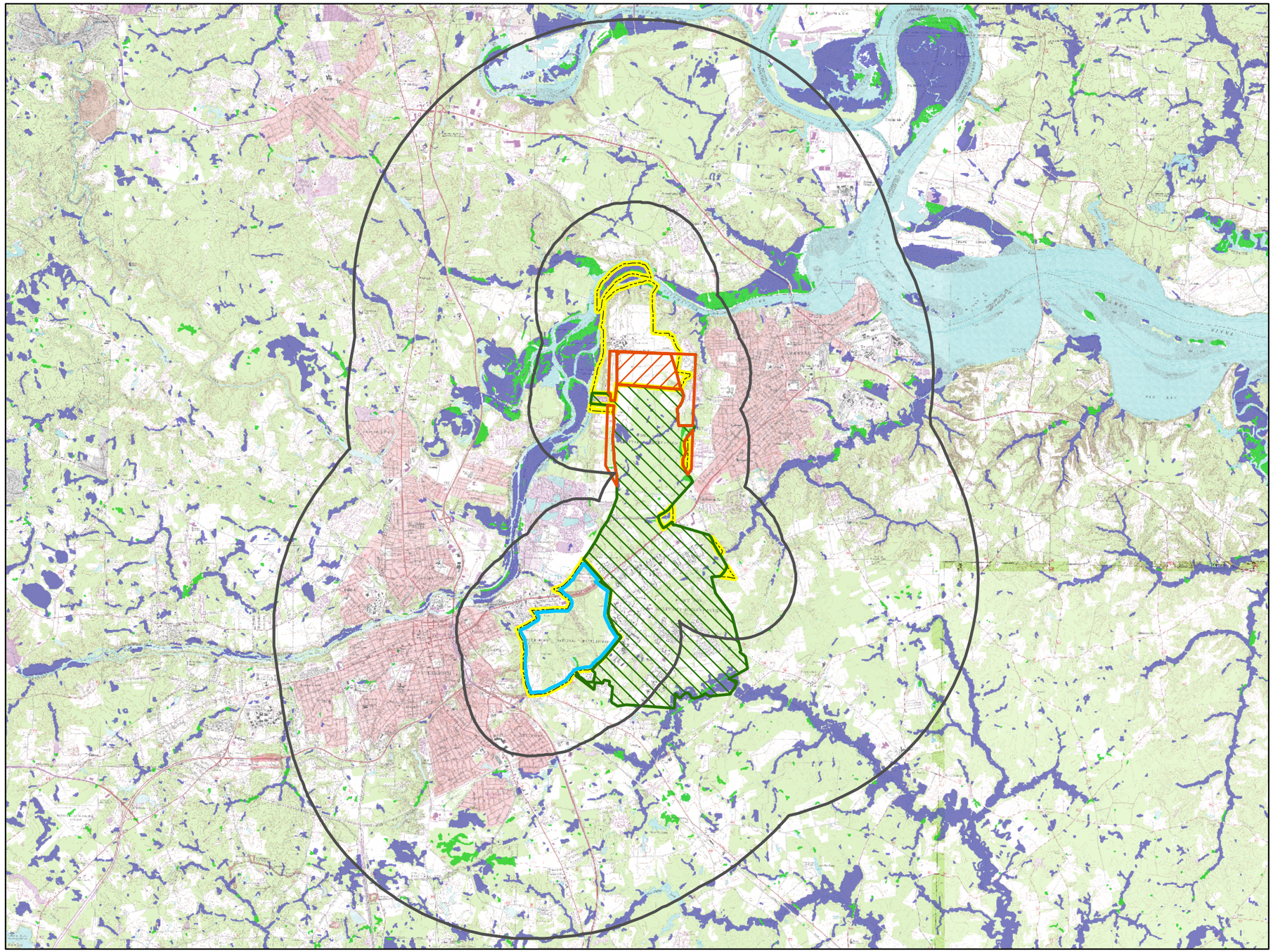
Figure 2-3. Locations of Historical Military Activities/Findings (MRS 2).



Fort Lee
Petersburg, VA

Legend

- MRS1 - Small Arms Range
- Portion of MRS 1 Transferred Back to the Department of Defense in 2006
- Portion of MRS 1 Identified in the ASR Supplement to be part of Active Fort Lee
- MRS 2 - Trench Training Area
- 1 and 4 Mile Radii
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site
ASR - Archive Search Report

Sources:
USACE, 2002; 2004
USFWS-NWI, 2006
USGS-NRCS-NCGC, 2002

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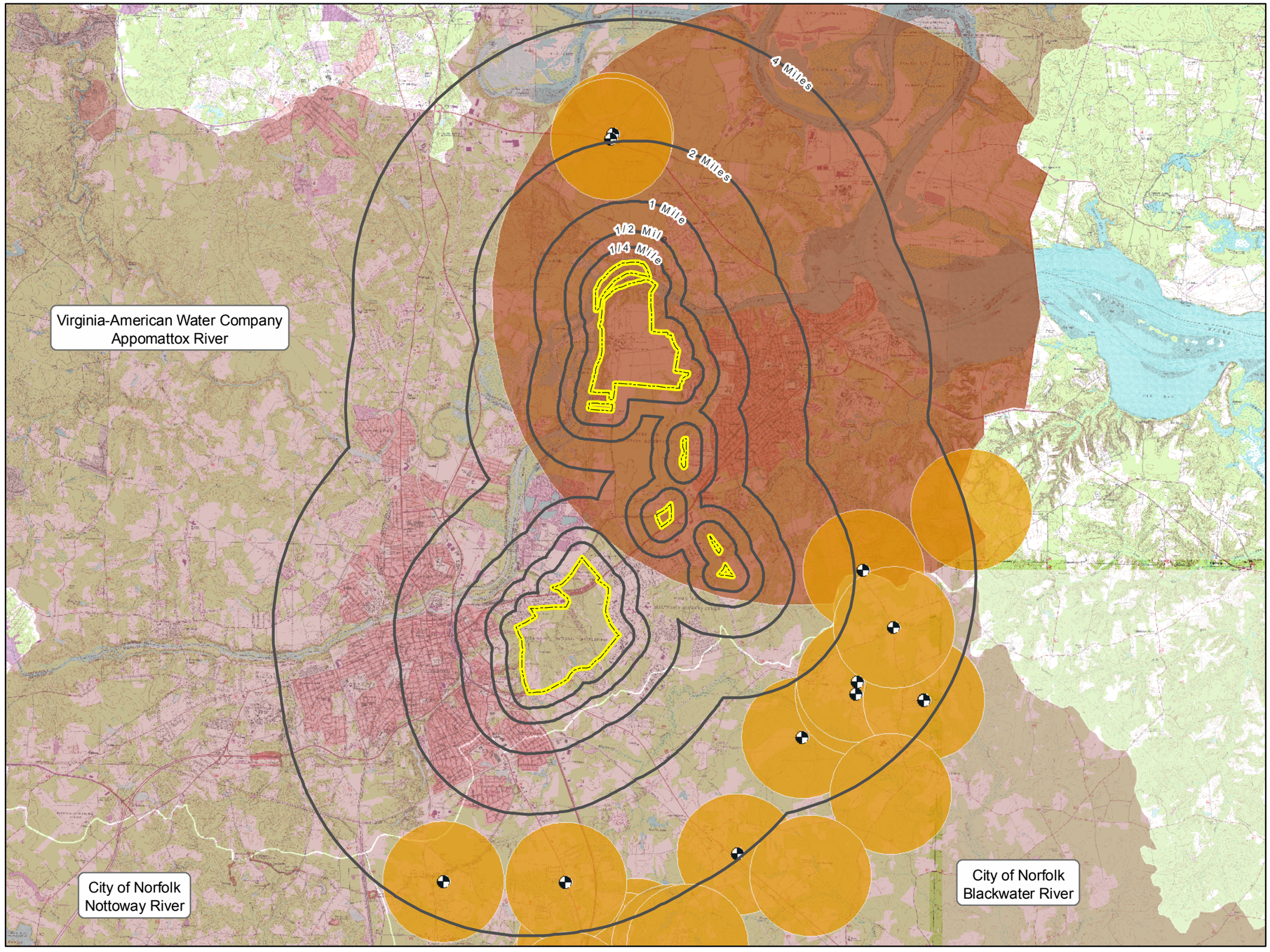
Figure 2-4. Site Location and Surroundings.

Fort Lee
Petersburg, VA



Legend

- Wells within 4 Miles of FUDS Boundary
- Contributing Watershed Boundary
- Source Water Protection Zone
- 1 Mile Wellhead Protection Area
- 1/4, 1/2, 1, 2, and 4 Mile Radii
- FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
VDH Office of Drinking Water, 2005
USGS-NRCS-NCGC, 2002

0 2 4
Miles

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Figure 2-5. Wells, Wellhead Protection Areas, and Source Water Protection Zones.

3. SITE INSPECTION ACTIVITIES

3.1 Technical Project Planning

3.1.1 The initial TPP meeting for the Fort Lee FUDS site was conducted on 19 January 2006 at the USACE Norfolk District Office on the active Fort Lee Army installation in Petersburg, Virginia. The final TPP Memorandum documenting the meeting was issued in April 2006. Participants in the TPP meeting included representatives from USACE (CENAB and CENAO), Prince William Forest Park (NPS), Quantico Marine Corps Base, VADEQ, and the Alion Team. During the first TPP meeting, the participants provided valuable information that guided SI activities. Six Data Quality Objectives (DQOs) were defined for this SI (Alion 2006a and 2006b). The TPP discussion involved a presentation of general decision rules for completing the SI objectives. These decision rules were summarized in the DQO worksheets and are summarized below.

DQO 1 – Determine the presence/absence of MEC. The basis for the MEC RI/FS recommendations is specified below[5]:

- Historic data that indicates the presence of MEC or munitions debris (MD)
- Visual evidence or anomalies classified as MEC, MD, or material potentially presenting an explosive hazard (MPPEH)
- One or more anomalies in a target area near historic or current MEC/MD finds or within an impact crater
- Physical evidence indicating the presence of MEC (e.g., distressed vegetation, stained soil, ground scarring, bomb craters, burial pits, etc.)

In each of these instances, all lines of evidence (e.g., historic data, field data, etc.) will be used to make a final recommendation for a No Department of Defense Action Indicated (NDAI) or RI/FS. If none of these scenarios occur above for MEC, then the recommendation for NDAI is a possible option.

[5] As defined in ER-200-3-1, properties where a release occurred solely as a result of an act of war are not eligible properties, unless additional qualifying use (DoD ownership/lease or interest) occurs. Secondly, for a hazard to become a project eligible for restoration under DERP-FUDS it needs to have been generated by DOD on properties determined to be eligible. By interpretation, this does not address MEC/MC hazards resulting solely from Civil War activities. However, this does not preclude DoD addressing Civil War ordnance commingled with MEC from DOD activities.

DQO 2 – Eliminate from further consideration those releases that pose no significant threat to public health or the environment by collecting adequate samples to assess the presence or absence of MC at the site. The basis for the MC RI/FS recommendations is specified below:

- Maximum concentrations at the site exceed site-specific background levels.
- Maximum concentrations at the site exceed EPA Region 3 Risk-Based Concentrations (RBCs) based on current and future land use.
- Maximum concentrations at the site exceed EPA interim ecological risk screening values.
- Data reporting the presence or absence (less than detection limits) of analytes for which no screening criteria (decision limits: RBCs, etc.) are available are to be used to support the weight-of- evidence evaluation of MC at the site.

All lines of evidence, including secondary lines of evidence, such as historic data, field data, comparison to screening/cleanup criteria, will be used to make a final recommendation for an NDAI or RI/FS.

DQO 3 – Determine the potential need for an emergency response action and/or Time Critical Removal Action (TCRA) of MEC by collecting and analyzing data from previous investigations/reports, conducting site visits, and performing analog geophysical activities, as appropriate.[6] The basis for recommendations is specified below:

- A TCRA would be recommended if there is a complete pathway between source and receptor and if the MEC and the situation are viewed as an imminent danger posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment.
- A non-TCRA (NTCRA) would be recommended if a release or threat of release that poses a risk where more than six months planning time is available.

In each of these instances, all lines of evidence (e.g., historic data, field data, etc.) will be used to make a final recommendation for a TCRA or NTCRA.

DQO 4 – Collect data and complete related analyses to determine if an RI/FS is necessary.

- Refers to culmination of DQOs 1 and 2.

[6] MMRP Programmatic guidance has suggested the terminology "emergency response action" be replaced with TCRA and NTCRA. The DQO as written is what was presented in the SS-WP, but the decision criteria match the current guidance.

DQO 5 – Collect or develop additional data for EPA to support the potential HRS scoring.

- Verification that data were collected in accordance with the Final SS-WP in the SI Report.

DQO 6 – Collect the additional data necessary to the complete the MRSPP.

- Completion of the MRSPP for each MRS with all available data and documentation of any data gaps for future annual MRSPP updates.

3.1.2 The TPP meeting participants concurred with the DQOs and the general technical approach for the planned SI activities discussed during the TPP (Alion 2006a) and as revised and subsequently documented in the Final SS-WP (Alion 2006b). In summary, these agreements were to inspect the cited areas of concern, conduct multimedia sampling (with use of existing background sampling data), and complete the data assessment in accordance with the TPP Memorandum (Appendix B) agreements, as modified and agreed to in the Final SS-WP. (Alion 2006a and 2006b). As part of this SI Report, Alion evaluated the DQOs presented in the SS-WP and completed a DQO attainment verification worksheet to document completion of the DQOs (included in Appendix B).

3.2 Supplemental Records Review

3.2.0.1 State agencies were contacted regarding threatened and endangered (T&E) species and cultural and ecological resources at the FUDS property.

3.2.1 Threatened and Endangered Species

3.2.1.1 State and federal T&E species were identified as present in Prince George County, Virginia (USACE 1996). Prior to SI fieldwork, a consultation letter was submitted to the VDCR DNH for acceptance of the sampling approach with regards to the T&E species onsite. The VDCR DNH provided concurrence to SI sampling activities (refer to Appendix L). The specific T&E species identified at the site, which include the bald eagle and marsh senna, are listed in Table 7-1 of the SS-WP (Alion 2006b).

3.2.2 Cultural and Archaeological Resources

3.2.2.1 Archaeological surveys have been performed at multiple locations within the Fort Lee FUDS (Alion 2006b). Cultural and archaeological areas, which were identified on both the

northern (MRS 1) and southern (MRS 2) portions of the FUDS, were avoided during the SI. Prior to SI fieldwork, the State Historic Preservation Office (SHPO) was consulted for acceptance of the sampling approach with regards to the cultural resources onsite. The SHPO provided concurrence to SI sampling activities providing that an archaeologist oversee the SI field activities located on Petersburg National Battlefield (MRS 2) (Kirby 2006, DoI 2007). Refer to Appendix L for a copy of this document. In accordance with the SHPO's requirements, CENAO provided the field team with Mr. Timothy Thompson to oversee the field activities at Petersburg National Battlefield. Samples were not collected in those areas deemed significant areas for cultural and/or archeological resources as many other appropriate alternative sampling locations were available.

3.3 Site Inspection Field Work

3.3.1 The SI field work included one sampling event: 12-14 February 2007, which was conducted in accordance with the PWP (Alion 2005) and the Final SS-WP (Alion 2006b). A qualitative site reconnaissance for MEC and sample collection and analyses for MC was completed. A total of 65.5[7] acres were assessed through the qualitative reconnaissance. A total of 26 surface soil, 1 sediment, 1 surface water, and 2 groundwater samples were collected. Surface soil samples were collected as 7-point composite wheel samples, and the remaining sediment, surface water, and groundwater samples were collected as discrete samples in accordance with the SS-WP.

3.3.2 MEC reconnaissance findings and MC sample results are discussed in Sections 4 and 5, respectively. As-collected sample locations, sample designations, and sampling rationale are summarized in Table 3-1. Sampling locations are depicted on Figures 3-1, 3-2, and 3-3. Additional information pertaining to the field activities, including the field notes and forms, is included in Appendix D. Photograph locations and descriptions are presented in Appendix E.

3.4 Work Plan Deviations and Field Determinations

3.4.1 Minor deviations from the Final SS-WP (Alion 2006b) occurred with respect to sample locations. One of the surface soil samples located in MRS 2, FLE-TT-SS-02-04, was relocated because the only way to access this sample was to traverse an eagle's nesting area. Therefore, the sample was moved south, near another Civil War era fortification and in an area with potential impact craters. The locations of the temporary groundwater wells, FLE-TT-GW-20-01

[7] Extent of reconnaissance estimated from global positioning system (GPS) tracks and includes a 25-ft radius around each sample and observations along the GPS tracks covering a 6-ft swath. Of the 65.5 acres of geophysical reconnaissance conducted at Fort Lee, 2 acres were within MRS 1 and 47.6 acres were within MRS 2.

and FLE-TT-GW-20-02, were modified due to access issues. These samples were located to more accessible areas downgradient of the WWI trench area and the reported MPPEH disposal area, respectively. These deviations were necessary in order to stay within compliance of special use permit provided by the NPS (provided in Appendix L) and do not affect the quality of data gathered during the SI. The remaining surface soil, sediment, and surface water samples were located in the areas specified in the SS-WP. Additional information pertaining to the field activities, including the field notes and forms, is provided in Appendix D.

3.5 Site Inspection Laboratory Data Quality Indicators

3.5.1 This section summarizes the data quality assessment for the Fort Lee SI analytical data. Data were generated by GPL under the DoD Quality Systems Manual (QSM) and validated by a third-party validator (EDS) using EPA Region III Data Validation Guidelines. The detailed GPL and EDS reports are contained in Appendix F and G, respectively, and the following text summarizes the findings. Data Quality Indicators (DQIs) include precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS).

3.5.2 Precision is a measure of the reproducibility of repetitive measurements of the same process under similar conditions. Precision is determined by measuring the agreement among individual measurements of the same property, under similar conditions, and is calculated as an absolute value. The degree of agreement was expressed as the relative percent difference (RPD) between the separate measurements (usually matrix spike/matrix spike duplicate [MS/MSD] pairs) and the observed RPD using Region III Data Validation Guidelines. There were a few MS/MSD pairs that did not achieve acceptable values, and these samples were qualified appropriately (Appendix G). Field precision is measured by the comparison of field duplicate samples, which are also discussed as appropriate in Appendix G.

3.5.3 Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. To determine accuracy, a sample which has been spiked with a known concentration is analyzed by the laboratory as the MS, MSD, or Laboratory Control Spike (LCS). EDS assessed accuracy according to the Region III Data Validation Guidelines and assigned qualifiers as appropriate (Appendix G).

3.5.4 Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is achieved through proper development of the field sampling

program during the TPP and work plan development. All samples were collected and analyzed as planned; therefore, the representative DQI has been achieved for Fort Lee.

3.5.5 Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data are complete and valid if the data achieve all acceptance criteria including accuracy, precision, and any other criteria specified by the particular analytical method being used. All samples were collected as planned for Fort Lee. None of the 1,376 total analyte results associated with this sample effort were rejected; therefore, the completeness indicator is 100 percent, and the Fort Lee data meet the completeness DQI.

3.5.6 Comparability expresses the confidence with which one data set can be compared to another. There are no previous analyses of data at Fort Lee for comparison of reported concentrations from this project. Standard methods for sampling and analyses were followed as documented in the SS-WP; therefore, the comparability DQI has been achieved.

3.5.7 Sensitivity is a measure of the screening criteria as they compare to detection limits[8]. If screening criteria exceed detection limits, the certainty of the "non-detected" data is called into question. The laboratory reported to the reporting limit (RL) for explosives which represents the lowest concentration at which calibration standards were assessed. Consequently, if sensitivity DQIs have been satisfied for explosives, there are no issues. For metals, the laboratory reported to the method detection limit which represents the lowest concentration detectable above instrument noise. Calibration standards are not analyzed between the MDL and RL. Any issues with RLs or MDLs are discussed in Section 5.1.4. All screening values are higher than the detection limits for the analytes of concern at Fort Lee; consequently, sensitivity has been achieved for all MC associated with Fort Lee. Further discussion on data sensitivity is presented in Section 5.1.4.

3.6 Second TPP Meeting

3.6.1 Following the completion of the Draft Final SI Report, stakeholders will have an opportunity to participate in a second TPP meeting to discuss the finding, conclusions, and

[8] The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater then zero and is determined from analysis of a sample in a given matrix containing the analyte (Alion 2005). The method reporting limit (RL) lies within the calibration range and is always at or above the limit of quantitation (DoD QSM Version III).

recommendations of the Draft Final SI Report; review the MRSPP; and confirm that the project objectives and DQOs have been achieved (Alion 2006 a and 2006b).

Table 3-1 Fort Lee Sample Locations and Field Observations

Range Location (MRS)	Sampling ID	Coordinates (UTM,NAD83, ZONE 18, Meters)		Rationale for Sampling Locations (Alion 2006b)	Comments
		Easting (m)	Northing (m)		
WWI/WWI Small Arms Range - MRS 1	FLE-RR-SS-02-01	292045	4131910	Near potential Civil War Fort.	No fort was observed in the specified area; sample was collected as planned.
	FLE-RR-SS-02-02	292289	4131766	Undisturbed/ undeveloped area.	Area had been previously farmed/developed.
	FLE-RR-SS-02-03	292599	4130691	Undisturbed/ undeveloped area.	Area had been previously farmed/developed.
	FLE-RR-SS-02-04	292358	4130639	Undisturbed/ undeveloped area.	Area had been previously farmed/developed.
	FLE-RR-SS-02-05	291998	4130550	Undisturbed/ undeveloped area.	Area had been previously farmed/developed.
	FLE-RR-SS-02-06	291721	4130192	Undisturbed/ undeveloped area.	Area had been previously farmed/developed.
Trench Training Area - MRS 2	FLE-TT-SS-02-01	290230	4123391	Near suspect MEC burial site.	Collected sample near burial area. Many subsurface anomalies observed nearby.
	FLE-TT-SS-02-02	289580	4121795	Near the Taylor House well. Metals/munitions reported dumped down well shaft.	None.
	FLE-TT-SS-02-03	289752	4121710	Near Fort Morton.	None.
	FLE-TT-SS-02-04	289663	4122642	Near Colquitt's Salient, near opposing force lines during Civil War.	Due to limited access in eagle protection area sample was collected down gradient in a suspect crater area.
	FLE-TT-SS-02-05	290167	4122995	Central part of site where heavy civil war activity occurred.	Modified this sample location to suspect Civil War bomb crater.
	FLE-TT-SS-02-06	291330	4122962	Near Manhole from WWI.	None.
	FLE-TT-SS-02-07	291193	4123421	Near tour stop #3, close to WWI magazine and area where dummy grenade and live shell from civil war were found.	Collected sample near specified location, south of magazine.
	FLE-TT-SS-02-08	291213	4123457	Near tour stop #3, close to WWI magazine and area where dummy grenade and live shell from civil war were found.	Collected sample near specified location, north of magazine.

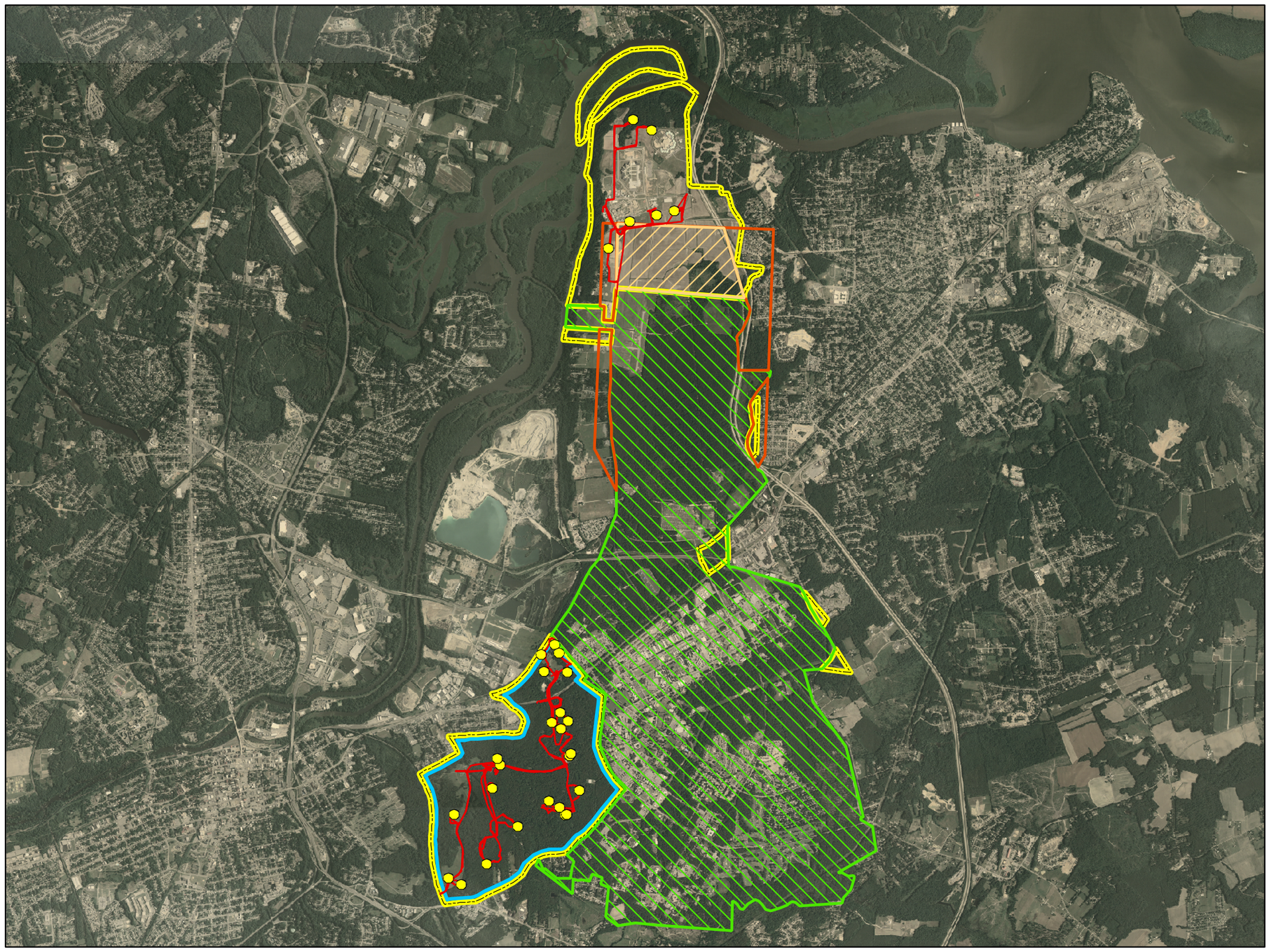
Table 3-1 Fort Lee Sample Locations and Field Observations

Range Location (MRS)	Sampling ID	Coordinates (UTM,NAD83, ZONE 18, Meters)		Rationale for Sampling Locations (Alion 2006b)	Comments
		Easting (m)	Northing (m)		
	FLE-TT-SS-02-09	291084	4123784	Near WWI Trench Training Area.	Collected sample in trench area.
	FLE-TT-SS-02-10	291179	4123886	Near WWI Trench Training Area.	Collected sample in trench area.
	FLE-TT-SS-02-11	291079	4213999	Near WWI Trench Training Area.	Collected sample in trench area.
	FLE-TT-SS-02-12	291001	4124909	Northern area near Battery Lines from Opposing Armies – Civil War	None.
	FLE-TT-SS-02-13	291054	4124797	Northern area near Battery Lines from Opposing Armies – Civil War	None.
	FLE-TT-SS-02-14	290823	4124774	Northern area near Battery Lines from Opposing Armies – Civil War	None.
	FLE-TT-SS-02-15	291170	4124541	Northern area near Battery Lines from Opposing Armies – Civil War	None.
	FLE-TT-SS-02-16	290862	4124545	Northern area near Battery Lines from Opposing Armies – Civil War	None.
	FLE-TT-SS-02-17	290926	4122821	In area of Earth Disturbance Near Harrison's Creek.	Collected sample in specified area near manhole.
	FLE-TT-SS-02-18	291067	4122735	In area of Earth Disturbance Near Harrison's Creek.	Collected sample in specified area near trenches. Pipes and other debris observed in the area.
	FLE-TT-SS-02-19	290093	4121980	Central part of site where heavy Civil War activity occurred.	Collected sample from a potential bomb crater.
	FLE-TT-SS-02-20	290505	4122484	Central part of site where heavy Civil War activity occurred.	None.
	FLE-TT-SD-02-01	291140	4122636	From pond where WWI bullet casing was found (south of Harrison's Creek Trail).	None.
	FLE-TT-SW-00-01	291160	4122644	From pond where WWI bullet casing was found (south of Harrison's Creek Trail).	None.

Table 3-1 Fort Lee Sample Locations and Field Observations

Range Location (MRS)	Sampling ID	Coordinates (UTM,NAD83, ZONE 18, Meters)		Rationale for Sampling Locations (Alion 2006b)	Comments
		Easting (m)	Northing (m)		
	FLE-TT-GW-20-01	290966	4123868	Near WWI Trench Training Area.	Minor modification to sample location was made due to access issues. Sample was still collected in near the WWI Trench Training Area.
	FLE-TT-GW-20-02	290275	4123305	Near potential MEC burial site.	Minor modification to sample location was made due to access issues. Sample was still collected near the potential MEC burial site.

ID=identification
MRS=munitions response site
M=meter
NAD=North American Datum
UTM= Universal Transverse Mercator
FLE=Fort Lee
MEC=munitions and explosives of concern
TT=Trench Training Area
RR=WWI/WWII Small Arms Ranges
GW=groundwater
SS=surface soil
SW=surface water
SD=sediment
WWI=World War I
WWII= World War II



Fort Lee
Petersburg, VA

Legend

- Sample Location
- Geophysical Site Reconnaissance Route
- MRS1 - WWI/WWII Small Arms Ranges
- Portion of MRS1 Transferred Back to the Department of Defense in 2004 & 2006
- Portion of MRS 1 Identified in the ASR Supplement to be part of Active Fort Lee
- MRS 2 - Trench Training Area
- FUDS Boundary

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

N W E S

0 1 2
Miles

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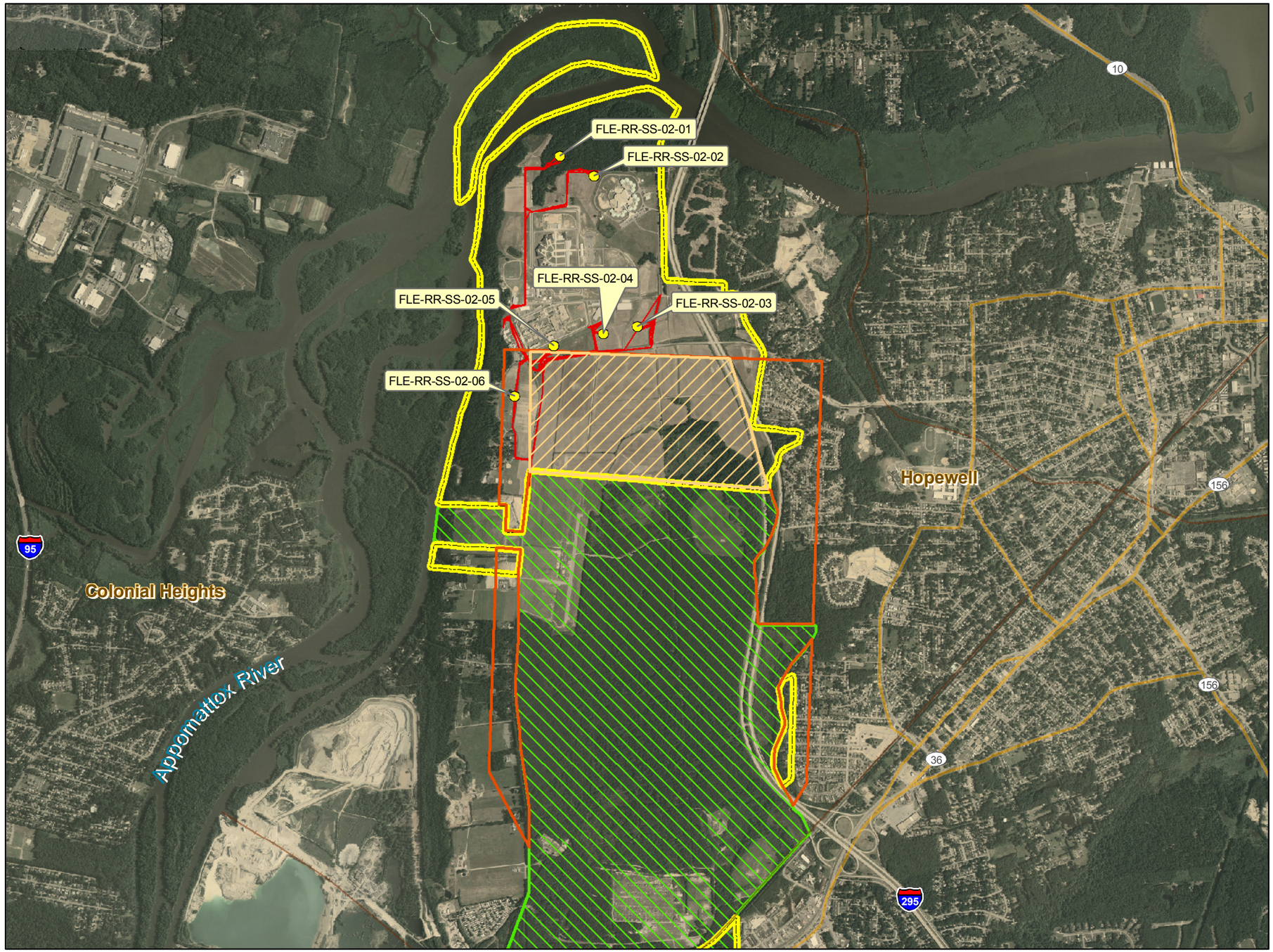
Figure 3-1. Sample Locations and Geophysical Site Reconnaissance Findings (Overview).



Fort Lee
Petersburg, VA

Legend

- Surface Soil Sample Location
- Geophysical Site Reconnaissance Route
- MRS1 - WWI/WWII Small Arms Ranges
- Portion of MRS1 Transferred Back to the Department of Defense in 2004 & 2006
- Portion of MRS 1 Identified in the ASR Supplement to be part of Active Fort Lee
- FUDS Boundary

Sample ID Designation
"R-SS-02-01"
Sampling Location-Sample Type-Sample Depth-Sample #
SS - Soil Sample
GW - Groundwater
SW - Surface Water
SD - Sediment
R - Small Arms Range
T - Trench Training Area

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

0 1,000 2,000
Meters

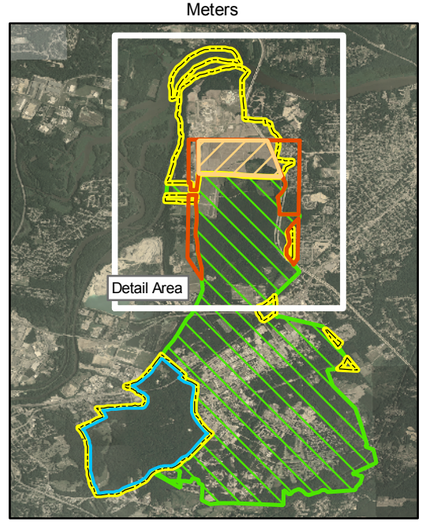


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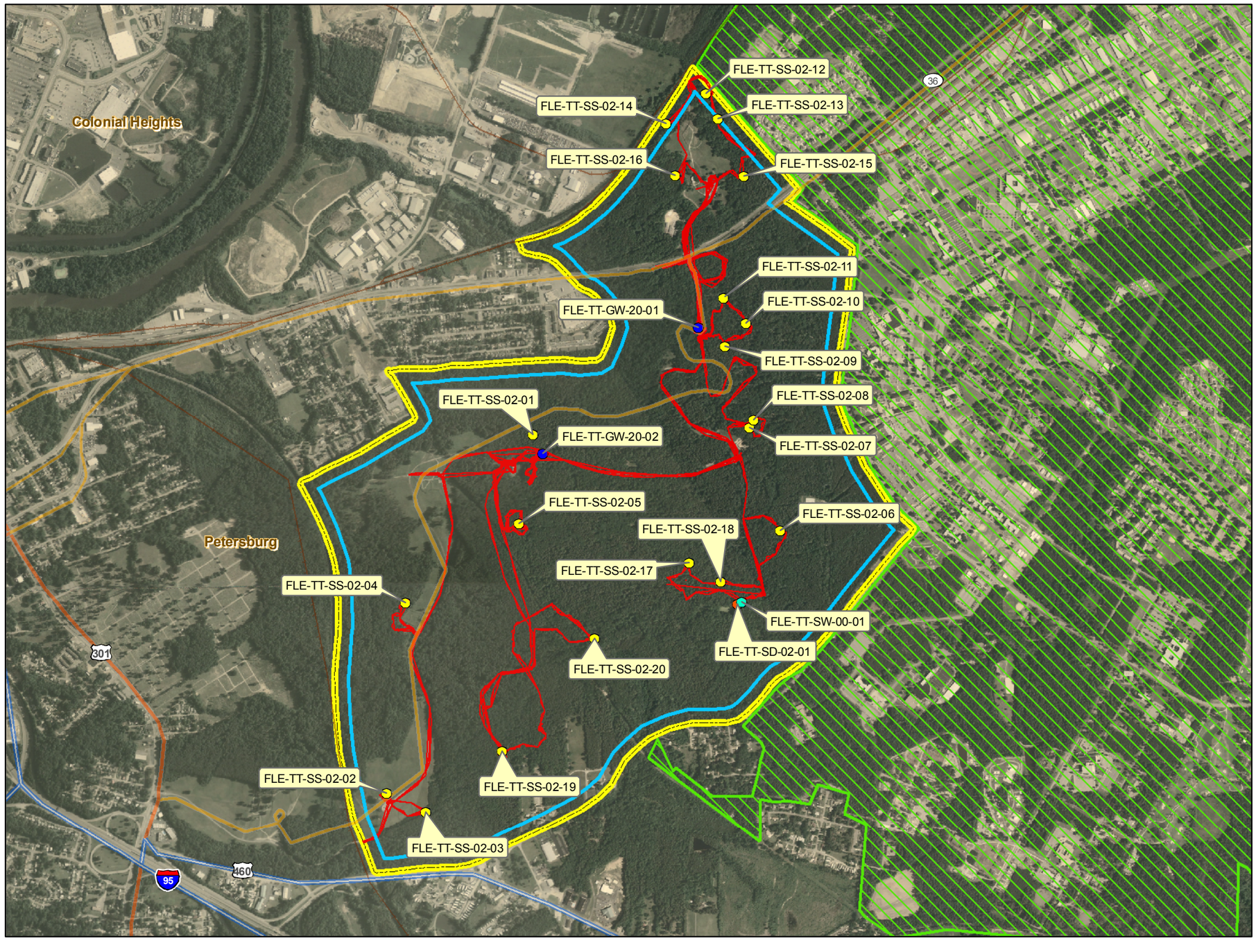
Figure 3-2. Sample Locations and Geophysical Site Reconnaissance Findings (MRS 1).



Fort Lee
Petersburg, VA

Legend

- Surface Soil Sample Location
- Sediment Sample Location
- Surface Water Sample Location
- Groundwater Sample Location
- Geophysical Site Reconnaissance Route
- MRS 2 - Trench Training Area
- Portion of MRS 1 Identified in the ASR Supplement to be part of Active Fort Lee
- FUDS Boundary

Sample ID Designation
"R-SS-02-01"
Sampling Location-Sample Type-Sample Depth-Sample #
SS - Soil Sample
GW - Groundwater
SW - Surface Water
SD - Sediment
R - Small Arms Range
T - Trench Training Area

Acronyms
MRS - Munitions Response Sites
FUDS - Formerly Used Defense Site

Sources:
USACE, 2002
USDA-FSA-APFO, 2006

0 500 1,000
Meters

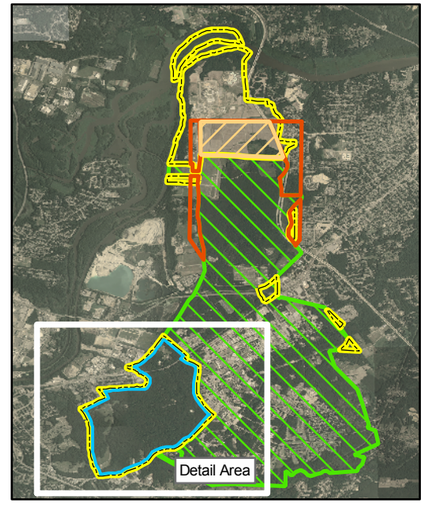


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Figure 3-3. Sample Locations and Geophysical Site Reconnaissance Findings (MRS 2).

4. MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING LEVEL RISK ASSESSMENT

4.1 Operational History

4.1.1 The WWI/WWII Small Arms Ranges (MRS 1) were operational from 1917 to 1959. The 1996 ASR indicated that the exact nature of activities on MRS 1 was not known and that many range fans may have overlapped within this MRS; therefore, the ASR included the entire list of munitions that were present in the Fort Lee arsenal throughout its years of operation. As noted in the SS-WP, this list included small arms, hand grenades, rifle grenades, 3-inch stokes mortars, and projectiles (37mm, 75mm, 4.7-inch), rockets (2.36-inch, 3.5-inch). No munitions discoveries have been reported on MRS 1. Prior to the 2007 SI, only a dummy grenade, a live WWI artillery shell, small arms casings, and a live shell from the Civil War have been reported on MRS 2. According to the 2004 ASR Supplement, only conventional small arms were used at the WWI/WWII Small Arms Ranges (MRS 1); therefore, the presence of MC was assessed at MRS 1 with respect to small arms only.

4.1.2 The Trench Training Area (MRS 2) was used to train soldiers in trench warfare from 1917 to 1921. According to the 2004 ASR Supplement, only conventional small arms were used at MRS 2. Even so, MD and MEC have been observed on MRS 2 pertaining to other types of ordnance; therefore, the presence of MC was assessed at MRS 2 with respect to small arms, Civil War ordnance, dummy grenades, and small arms. Insufficient data are available on the WWI shell that was discovered to speculate on the related MC.

4.1.3 The ranges, as documented in the ASR Supplement and described in Section 2.2, include the WWI/WWII Small Arms Ranges (MRS 1) and the Trench Training Area (MRS 2). The munitions associated with these ranges are presented in Table 2-2.

4.2 Site Inspection and Munitions and Explosives of Concern Field Observations

4.2.0.1 A qualitative reconnaissance consisting of visual reconnaissance of the site surface to provide qualitative data on potential subsurface anomalies and the identification of visual indicators of suspect areas, such as distressed vegetation, stained soil, target remnants, and visual metallic debris, was completed. This survey included use of analog geophysics to support anomaly avoidance activities for the field crew. Where appropriate, anomalies possibly attributable to MEC or MD were documented.

4.2.0.2 The SI findings are presented below, and MD and cultural debris items observed during the SI reconnaissance and sampling are summarized in Table 4-1. The total acreage estimated to have been covered during reconnaissance was approximately 65.5 acres[9].

4.2.1 WWI/WWII Small Arms Ranges (MRS 1)

4.2.1.1 WWI/WWII Small Arms Ranges (MRS 1) encompass 748 acres[10]. Only conventional weapons were reported to have been used (USACE 2004b). Alion completed a qualitative reconnaissance of the former range areas within MRS 1 using analog geophysics (magnetometer) following a meandering path. The qualitative reconnaissance and sampling locations are shown on Figures 3-1 and 3-2. Field observations related to cultural debris, range-related features, and MD/MEC finds are summarized in Table 4-1 and presented below:

- The area was developed, with high security for the prison and jail located north of the MRS area.
- A small graveyard was observed on the western parcel of the MRS near residential homes.
- There was no evidence of former use as a small arms firing range.
- No MD/MEC was observed.
- No subsurface anomalies were detected using an "all metals" detector.
- Six surface soil samples were collected near designated sampling locations.

4.2.2 Trench Training Area (MRS 2)

4.2.2.1 The former Trench Training area (MRS 2) is now known as the Petersburg National Battlefield. Alion completed the qualitative reconnaissance of MRS 2 using analog geophysics (magnetometer) following a meandering path. The qualitative reconnaissance and sampling locations are shown on Figures 3-1 and 3-3. Field observations related to cultural debris, range-related features, and MD/MEC finds are summarized in Table 4-1 and presented below:

- This MRS was densely wooded off the trails that are maintained by the NPS.
- Former training trenches were observed in the northern part of the MRS.

[9] The extent of reconnaissance was estimated from global positioning system (GPS) tracks and includes a 25-ft radius around each sample and observations along the GPS tracks covering a 6-ft swath.

[10] This acreage, as was cited in the ASR Supplement, is predominately comprised of acreage that is not FUDS eligible under the MMRP SIs. A large portion of this MRS is either outside the FUDS boundary or is currently part of the active DoD installation of Fort Lee. The actual FUDS eligible acreage associated with this MRS has not been assessed.

- Potential MD from a suspect flare was observed in the trench training area.
- Potential MD from a suspect grenade spoon was observed.
- Subsurface anomalies were irregularly dispersed throughout the trench training area.
- Subsurface anomalies were highly concentrated in the "potential disposal" area.
- Twenty surface soil, 1 sediment, 1 surface water, and 2 groundwater samples were collected in this area as specified in the SS-WP.

4.2.3 Background Samples

4.2.3.1 In accordance with the SS-WP, background samples were not collected at the Fort Lee FUDS (Alion 2006b). In 1999, Fluor Daniel Inc. conducted an investigation regarding the background concentrations of metals (and anthropogenic pesticides) at the active Fort Lee Military base, which is adjacent to the Fort Lee FUDS (Fluor Daniel 1999). These background data met the data acceptance criteria and were used to establish the baseline level of metals as specified in the SS-WP (Alion 2006b). Refer to Appendix L for a copy of the Fluor Daniel 1999 report.

4.3 MEC Risk Assessment

4.3.0.1 A qualitative MEC screening level risk assessment was conducted based on the SI qualitative reconnaissance, as well as historical data documented in the INPR, ASR, and ASR Supplement (USAESCH 2001). An explosive safety risk is the probability for an MEC item to detonate and potentially cause harm as a result of human activities. An explosive safety risk exists if a person can come near or in contact with MEC and act on it to cause a detonation. The potential for an explosive safety risk depends on the presence of three elements: a source (presence of MEC), a receptor (person), and interaction (e.g., touching or picking up an item). The CSM for each MRS reflects this MEC assessment strategy (Appendix J).

4.3.0.2 The exposure route for an MEC receptor typically is direct contact with an MEC item on the surface or through subsurface activities (e.g., digging during farming or construction). An MEC item tends to remain in place unless disturbed through human or natural forces (e.g., frost heaving and erosion). If MEC movement occurs, the probability of direct human contact may increase, but not necessarily result in direct contact or exposure.

4.3.0.3 Each of these primary risk factors were used to evaluate the field and historic data to generate an overall hazard assessment rating of either low, moderate, or high. An evaluation of low risk indicates that the MEC type would not result in major injury or the item is insensitive or inert; site characteristics are such that there is limited to no site access and the site is stable; and

potential for contact is low for either surface or subsurface based on human receptor activities and the population accessing the site. An evaluation of high risk indicates that the MEC type would result in major injury or the item is sensitive; site characteristics are such that there is frequent access and the site is unstable; and potential for contact is high for either surface or subsurface based on human receptor activities and the population accessing the site.

4.3.1 WWI/WWII Small Arms Ranges (MRS 1)

4.3.1.1 MRS 1 encompasses the small arms ranges. More specifically, MRS 1 is comprised of the "danger area" and outer range fans that were used as buffer zones for the small arms ranges. No backstops are located within the MRS. As discussed in Section 4.1, MEC/MD have not been found in MRS 1 and no subsurface anomalies were observed during the SI qualitative reconnaissance.

4.3.1.2 No documented injuries have occurred since DoD transferred the FUDS property to the current owners. The former range danger area is comprised of residential areas and open terrain which surrounds the correctional facilities. There are no fences restricting access in this MRS. The MRS borders the Riverside Regional Jail for the Commonwealth of Virginia and a federal reformatory operated by the DoJ. The northeastern parcels of MRS 1, bordering the federal reformatory, are owned by the DoJ and the owners of the remaining parcels are unknown. The most likely human receptors include construction workers, site workers, residents, and trespassers.

4.3.1.3 Considering that this MRS is comprised of only the outer range fans of former WWI/WWII Small Arms Ranges, and based on historical documentation, the extent of contamination is estimated to be relatively small. This conclusion is based on the type of munitions used on this site, which were small arms, and historical documents which indicate no MEC or MD has been reported in the area. The overall MEC risk for MRS 1 is considered low.

4.3.2 Trench Training Area (MRS 2)

4.3.2.1 MRS 2 encompasses the Trench Training Area, also known as the Petersburg National Battlefield. Historically, MEC and MD have been discovered in MRS 2, including a dummy grenade, a live shell dating back to the Civil War era, a live WWI artillery shell (found in the subsurface during tree removal activities), and several small arms casings. Suspect MD, including the remnants of a flare and a grenade (thought to have been a suspect grenade spoon assembly) were observed on the surface during the SI reconnaissance. Additionally, a high

number of subsurface anomalies were identified in the area reported as an MPPEH burial area. Given the limited SI qualitative reconnaissance, MEC could be present in MRS 2.

4.3.2.2 No documented injuries have occurred since the site was transferred to the NPS. MRS 2 is comprised of wooded terrain with varying elevations and a single paved road that acts as a guide through the historic battlefield. The main road providing access to MRS 2 is gated and is open to the public seven days a week from 9 a.m. to 5 p.m. The MRS is a national battlefield and contains walking trails which are accessible to visitors. There are no fences restricting pedestrian traffic. The most likely human receptors are site workers, recreational users, and trespassers.

4.3.2.3 Historically MEC and MD have been discovered at MRS 2. Additionally, during the 2006 SI reconnaissance, suspect MD was identified and numerous subsurface anomalies were observed in a reported MPPEH burial area; therefore, MEC may be present at MRS 2. The overall MEC risk is considered low to moderate.

Table 4-1 Locations of Site Inspection Reconnaissance Findings/Field Observations.

No.[1]	ITEM	NAD 83, UTM Zone 18 North	
		Easting (m)	Northing (m)
1	Former magazine	291193	4123421
2	Pond where surface water was collected	291160	4122644
3	WWI/WWII manholes	290908	4122741
4	Ground depression (possible fox hole, trench, etc.)	290082	4121990
5	Ground depression (possible fox hole, trench, etc.)	290086	4121985
6	Non-munitions debris (i.e. scrap metal)	290269	4122102
7	Possible MD from flare.	291085	4123471
8	Trench area with metal debris including pipes, etc.	291067	4122735
9	Potential disposal area.	290230	4123291
10	Possible historic WWI trash/dump area.	290188	4122984
11	Syracuse Hotel Ware/Ink bottle or medicine bottle	290187	4122985

[1]-Numbers arbitrarily assigned.
UTM-Universal Transverse Mercator
NAD-North American Datum
m-meter
No.-Number

5. MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS

5.0.1 The analytical results for the MC sampling are presented below along with the screening methodology and the results of the screening assessment. Data are provided by MRS and grouped by media within each MRS.

5.1 Data Evaluation Methodology

5.1.0.1 The following sections present the process used to evaluate the MC data collected for the FUDS. This process is consistent with the decision rules outlined in Section 3.1. Identification/refinement of MC associated with munitions used at the site is discussed below.

5.1.1 Refinement of Munitions Constituents

5.1.1.1 During the SI process, the Alion Team further evaluated the munitions reportedly used at the site. Research was conducted to refine the specific list of constituents potentially associated with each MRS/range based on munitions reportedly used. Refinement of the MC list is presented in Table 2-2. Samples were analyzed for the full target analyte list of metals and target compound list of explosives in accordance with the approved SS-WP (Alion 2006b). Summary tables are arranged by media and contain the complete analyte lists. ***However, the following discussions are limited to those analytes associated with the specific past munitions used and how these munitions were used (i.e., the full analyte list has been reduced to reflect actual munitions, firing conditions, and operational procedures).*** Specifically, based on the ranges and munitions-related operations, MC from small arms ranges are associated with the firing point and the impact area (backstop). Although neither the firing point nor backstop area is located within MRS 1, both the propellant and the projectile constituents are carried forward in this SI. In the trench training area (also used as a battlefield during the Civil War), specific notable areas of interest are not as easily identifiable; therefore, the propellant and the projectile constituents are carried forward in this SI. Specific MCs associated with MRS 1 and MRS 2, as presented in Table 2-2, are summarized below:

5.1.1.2 WWI/WWII Small Arms Ranges (MRS 1)

- Explosives (dinitrotoluene[DNT] and nitroglycerin [NG])

- Metals (antimony, copper, iron[11], lead, nickel, and zinc)

5.1.1.3 Trench Training Area (MRS 2)

- Explosives (DNT and NG)
- Metals (antimony, copper, iron[7], lead, nickel, and zinc)

5.1.1.4 Each MRS was evaluated for the combined list of MC of potential use which includes two explosives (NG and DNT) and five metals (antimony, copper, lead, nickel, and zinc)

5.1.2 Data Quality

5.1.2.1 Only validated data are used in the screening process. All of the samples noted in this list below have been sampled by Alion, analyzed by GPL Laboratories, and validated using EPA Region III validation guidance:

- Twenty surface soil samples (between 0 and 2 inches bgs) at MRS 2
- Six surface soil samples[12] (between 0 and 2 inches bgs) at MRS 1
- One surface water sample at MRS 2
- One sediment sample at MRS 2
- Two groundwater samples at MRS 2
- Four duplicate samples (three soil and one surface water)

5.1.2.2 The first step in the process of identifying chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) is the evaluation of analytical data on the basis of qualifiers in each medium of concern. Inclusion or exclusion of data on the basis of analytical qualifiers is performed in accordance with EPA guidance (EPA 1989) and considers the following:

[11] Iron is an essential nutrient and is excluded from further consideration as a chemical of potential concern/chemical of potential ecological concern (COPC/COPEC). For completeness, iron is listed with the other MC but it is not further evaluated as MC. Refer to Section 5.1.3 for additional information regarding the screening process.

[12] Only one of the six surface soil samples used to assess MRS 1 was located within the MRS boundary. As specified in the SS-WP, three of the samples were located as close to the central part of the range fan as possible (within the FUDS boundary, but outside the MRS boundary). Two samples were collected north of the MRS 1 boundary, near where a Civil War fort was suspected to be located. During the SI field activities the Civil War fort was not located.

- Analytical results bearing the U or UL qualifiers (indicating that the analyte was not detected at the given detection limit) are retained in the data set. These are considered a quantitation estimate of the concentration based on EPA guidance (EPA 1989).
- Analytical results bearing the J qualifier (indicating that the reported value was estimated) are retained at the measured concentration.
- Analytical results bearing the K qualifier (indicating that the reported value may be biased high) are retained at the measured concentration.
- Analytical results bearing the L qualifier (indicating that the reported value may be biased low) are retained at the measured concentration.
- Analytical results bearing the B qualifier (indicating the chemical was detected in an associated blank) are retained at the measured concentration if greater than five times the concentration reported for the associated blank or ten times for common laboratory contaminants.
- Analytical results bearing the R qualifier (indicating that the analytical results are not usable) are deleted from the data set.

5.1.3 Screening Values

5.1.3.1 Screening for human health COPCs is conducted by comparing maximum detected chemical concentrations to EPA Region III RBCs, as shown in Tables 5-1 through 5-4. The complete report of the analytical results and the analytical quality assurance/quality control (QA/QC) report are included in Appendix F and G, respectively. In accordance with EPA guidance, RBC values used are those at a cancer risk level of $1x10^{-6}$ and a non-cancer hazard quotient (HQ) of 0.1, for the purposes of screening. Sediment sample analytical results are compared to the residential and industrial soil RBCs. The soil RBCs are increased by a factor of ten to account for typical reduced sediment exposures compared to that of soils, based on professional judgment. For groundwater, the tap water RBCs are utilized (EPA 2007). Surface water sample analytical results are compared to the tap water RBCs, which are increased by a factor of ten to account for reduced surface water exposures compared to that of tap water, based on best professional judgment.

5.1.3.2 For the ecological risk screening, the soil sample results are compared to ecological soil screening levels as presented in Table 5-5. The site concentration in soil was compared to the corresponding screening value (Tables 5-1 through 5-4).

5.1.3.3 Per EPA guidance, the following screening process is utilized:

1. The concentration of each chemical detected in each medium is identified.

2. If the concentration of a specific chemical exceeds its screening value, the chemical is retained as a possible COPC/COPEC.

3. If a chemical was detected in at least one sample in a specific medium, the chemical is retained for consideration in the screening of COPCs/COPECs.

4. If a screening concentration is not available for a specific chemical in a particular medium, the screening concentration for a structurally similar compound is used, if warranted. The screening tables list any surrogates that are used.

5. An analyte is eliminated from the list of COPCs/COPECs if the analyte is an essential nutrient of low toxicity. COPCs/COPECs excluded from further consideration on this basis include iron.

5.1.4 Comparison of Screening Levels with Reporting Limits for Non-detected Analytes

5.1.4.1 Current EPA guidance (EPA 2001 and 1989) requires that detection limits be addressed, particularly as related to the screening values used to select COPCs/COPECs. The laboratory reported non-detected explosives to the RL and non-detected metals to the MDL. Insufficient information is available in this case to exclude or include the chemical and this would be noted as a source of uncertainty in the risk assessment screening.

5.1.4.2 Table 5-6 compares the reporting limits and screening values for all analytes in sediment, soil, groundwater and surface water for those analytes never detected with respect to human health and ecological risk screening values. Based on these tables, the screening values are higher than the reporting limits for all MC analytes except for antimony in surface water and NG in groundwater, surface water, and soil. The laboratory reporting limit for antimony in surface water is 1 µg/L which is lower than the screening values of 15 and 30 µg/L for human health and ecological risk, respectively (Table 5-6); therefore, the antimony DQI has been achieved. The human health screening values were recently revised (April 2007) and the revised screening criteria for NG in groundwater are now below the detection limits (Tables 5-1 and 5-6). The new screening values for NG are based on an unknown (and unobtainable) document and reflects a proposed and not final value that could be removed at any time. However, because the new screening value is below the detection limit for NG the data quality indicator has not been achieved for this analyte, and this represents a source of uncertainty in the risk screening. The absence of risk in groundwater from other explosives would imply, although not confirm,

that risks from explosives due to the consumption of this groundwater with NG are acceptable. As noted, this represents a source of uncertainty. Using a weight-of-evidence approach, any perceived risks from potential exposure to nitroglycerin in surface soil, groundwater and surface water are low for the following reasons:

1. Both MRS 1 and 2 were used for small arms; consequently, any DNT or NG would have been associated with propellants, and are expected to have dispersed rapidly,
2. The target organ associated with the new Region III RBC for NG is unknown.
3. The other explosive MC of concern (DNT) was only detected once in a surface soil sample, Field Duplicate #2, at an estimated concentration (below the RL but above the MDL) at 0.018 mg/kg, considerably below the screening value of 7.8 mg/kg.

5.1.4.3 Given the reporting limits for nitroglycerin are greater than the screening value the non-detects for nitroglycerin are not usable for demonstrating without a doubt that nitroglycerin is present at concentrations less than these thresholds, nor is it possible to state without a doubt that nitroglycerin is not present at the site. However, the weight-of-evidence would indicate that it is likely that acceptable risks from nitroglycerin are likely found at Fort Lee.

5.1.4.4 The remaining non-detection results for MC are valid and the measurement quality objectives have been achieved. Where no screening values are available, no conclusions can be drawn regarding whether or not the available reporting limits were sufficient to detect these chemicals at concentrations that may pose risk to ecological receptors.

5.2 Conceptual Site Model

5.2.1 A CSM diagram for each MRS evaluated at Fort Lee is provided in Appendix J. Each CSM defines the source(s) (e.g., the secondary source/media), interaction (e.g., the secondary release mechanism, the tertiary source, and the exposure route), and receptors. In this SI Report, the CSMs have been revised from those presented in the Final SS-WP to reflect the results of the human health and ecological risk screening.

5.2.2 Potential current and future human receptors for MC are expected to be trespassers, construction workers, site workers, and residents at MRS 1 and trespassers, site workers, and recreational users at MRS 2 (CSM diagrams, Appendix J). The ecological receptors of concern for the two MRSs include terrestrial plants /invertebrates (insects and worms), benthic organisms, aquatic organisms, terrestrial-feeding/predatory animals, terrestrial-feeding/predatory birds, aquatic-feeding mammals, and aquatic-feeding birds.

5.2.3 The media of concern are distinct for each class of receptor and are based on the CSMs presented in the Final SS-WP (Alion 2006b). The media of concern for human receptors at the MRS 1 are surface soil and for MRS 2 are soil, surface water, and sediment. Groundwater was not identified as a media of concern since the pathway for groundwater on the FUDS in MRS 2 is not complete (no receptors consuming groundwater from onsite wells); however, groundwater was evaluated in accordance with the decisions made in the SS-WP (Alion 2006b). The media of concern for ecological receptors for each MRS are surface soil, surface water, and sediment.

5.2.4 A pathway is considered potentially complete if all of the following conditions are present:

1. Source and mechanism of chemical release
2. Transfer mechanisms e.g. overland flow of contaminants into an adjacent stream, advection of contaminants with groundwater flow.
3. Point of contact (exposure point e.g. drinking water, soil)
4. Exposure route to receptor (ingestion, inhalation, etc.)

5.2.5 If a munition-related chemical is detected, than a given pathway is complete. A complete pathway may or may not pose risk to the specific receptor.

5.2.6 Both residential and industrial receptor scenarios are evaluated in the human health screening-level risk assessment. No residences exist on MRS 2 but residential screening values have been used as a surrogate for the recreational user/receptor. The residential receptor is evaluated for potential residents at MRS 1 due to the presence of residents on the FUDS. The industrial scenario was assessed for the protection of construction or other workers who may frequent the FUDS.

5.2.7 Consistent with DQOs, a weight of evidence approach is used to determine if identified COPC/COPEC (s) should be retained. In the case where screening criteria are exceeded, a weight of evidence approach is used to determine if the identified exeedances warrant an RI/FS recommendation. See the discussion in Section 5.1 and 5.4 for additional detail on the risk screening.

5.3 Background Data Evaluation

5.3.1 Background data based on 10 surface soil samples were generated by Fluor Daniel (1999) following a work plan approved by the U.S. Army Corps of Engineers, the U.S. Army, and VADEQ. These analyses were performed using the same analytical methods followed by the MMRP program (SW 846 Method 6010). The data quality of these data were examined and found to be acceptable as documented in Fluor Daniel (1997a and 1997b). Consequently, the

PARCC parameters have been found acceptable. In addition, assessment of the sensitivity of these data shows that the concentrations reported in Fluor Daniel (1999) achieve this project's requirements. These data were used for the qualitative background data evaluation.

5.3.2 Tables 5-7 and 5-8 present the maximum and average concentrations in the background soil samples and site samples for inorganic compounds for MRS 1 and MRS 2 respectively. A qualitative comparison was made between the maximum and mean concentrations for on-site samples and the maximum and mean concentrations found in background samples. The mean background concentrations of two MC (antimony at 0.29 mg/kg and lead at 15 mg/kg) are above the ecological screening criteria of 0.27 mg/kg and 11 mg/kg respectively. In those instances, where analytes exceed screening criteria but not background values, a weight of evidence approach is applied to determine if those analytes are considered COPECs in a particular MRS. These instances are documented in the results sections below and conclusions are drawn based on the weight of evidence in each case.

5.4 WWI/WWII Small Arms Ranges (MRS 1)

5.4.0.1 As presented in Section 5.1.1, two explosives (NG and DNT) and five metals (antimony, copper, lead, nickel, and zinc) are the MC of interest in MRS 1. Surface soil was collected at MRS 1, and Table 5-4 presents a summary of the data generated, including those analytes not specifically associated with the munitions used in MRS 1 (as detailed in Table 2-2).

5.4.1 Groundwater Pathway and Screening Results

5.4.1.1 Groundwater was not considered a potentially complete pathway for this MRS in the SS-WP (Alion 2006b). No groundwater sampling was conducted in this MRS. The pathway in the CSM is identified as incomplete in this SI Report.

5.4.2 Surface Water and Sediment Pathway and Screening Results

5.4.2.1 Surface water was not considered as potentially complete pathway for MC for MRS 1 in the SS-WP (Alion 2006b). No surface water sampling was conducted in this MRS. The pathway in the CSM is identified as incomplete in this SI Report.

5.4.2.2 Sediment was not considered as potentially complete pathway for MC for MRS 1 in the SS-WP (Alion 2006b). No sediment sampling was conducted in this MRS. The pathway in the CSM is identified as incomplete in this SI Report.

5.4.3 Terrestrial Pathway and Screening Results

5.4.3.1 Surface soil in MRS 1 was viewed as a potentially complete pathway for exposure of human and ecological receptors to MC in the CSM documented in the SS-WP (Alion 2006b). A total of six surface soil samples and one field duplicate sample were collected from MRS 1. Table 5-4 presents a summary of soil sample results compared to human health screening values (residential and industrial) and ecological screening criteria for MRS 1. Sampling results indicate that one explosive (nitrobenzene) was detected in several soil samples collected from MRS 1; however, this explosive was not identified as an MC of concern related to DoD activities in MRS 1.[13] Several metals including those identified as MC of concern associated with MRS 1 (antimony, copper, lead, nickel, and zinc) were reported in soil samples collected from MRS 1. Comparison of specific munitions related MC sampling results to screening criteria is discussed below.

5.4.3.2 None of the munitions-related explosives MC was detected in the soil samples at concentrations greater than human health screening criteria. Each of the munitions-related inorganic MC, including antimony, copper, lead, nickel, and zinc, were detected in one or more the six surface soil samples. Antimony and zinc were considered to be within background concentrations when considering maximum concentrations (Table 5-7). None of the detected MC concentrations exceeded human health criteria and no COPCs are identified in soil at MRS 1. Only one soil sample from MRS 1 (FLE-RR-SS-02-06 at 49 mg/kg) was above the maximum level of lead detected in background data provided by Fluor-Daniel (21.7 milligrams per kilogram [mg/kg]). Furthermore, the screening level for lead is lower than 50 percent of the reported lead background concentrations in U.S. soils and the maximum lead concentration detected at MRS 1 (49 mg/kg) is below maximum but slightly higher than 95 percent of the published lead background concentrations in the Eastern U.S. (38 mg/kg) (EPA 2005k). The nonparametric Wilcoxon Ranked Sum (WRS) test was used to test the null hypothesis that constituent concentrations of copper, lead, and nickel at MRS 1 were equal to background versus the alternative hypothesis that constituent concentrations at MRS 1 exceeded background. The WRS test was conducted at the 95% significance level. For copper, lead, and nickel, the WRS test did not reject the null hypothesis; therefore, copper, lead, and nickel at MRS 1 are not significantly different than background. Consequently, the lead detected in soil sample FLE-RR-SS-02-06 at MRS 1 is most likely attributed to background and acceptable risks to humans are expected based on comparison to conservative human health risk screening values. Because site

[13] Nitrobenzene was detected in several of the soil sample from MRS 1 at estimated quantities above the method detection limit but below the reporting limit and corresponding human health and ecological screening criteria. Nitrobenzene is also used in industrial applications and has non-explosive related sources.

lead concentrations are similar to background the human health pathways for soil in the CSM are considered incomplete.

5.4.3.3 Neither of the munitions-related explosives MC was detected in the soil samples at concentrations greater than ecological screening criteria. Antimony was detected in four of the six soil samples at levels exceeding the ecological screening criteria. The maximum concentration of antimony detected on site did not exceed the maximum concentration detected in background (Table 5-7). Lead was detected in three of the six soil samples at concentrations exceeding the ecological screening criteria (Table 5-4). Antimony and lead concentrations in surface soil at MRS 1; however, concentrations of these metals at MRS 1 were similar to concentrations in background. Based on these results, the pathways for soil in the CSM (Appendix J) are considered incomplete for all receptors.

5.4.4 Air Pathway

5.4.2.1 The air migration pathway for MRS 1 has an extremely low potential, if any, for human and/or environmental receptors to come into contact with MC in surface soil (metals and explosives). None of the MC detected in soil were found at concentrations greater than human health screening criteria, and given the non-volatile nature of the constituents detected, and the fact that suspension of constituents in air is limited to airborne particulates, the fraction of COPCs/COPECs susceptible to being suspended in air is negligible. With a negligible air contamination source, there is low potential for the air pathway at MRS 1 to negatively impact any human or environmental receptors. Therefore, the air pathway is incomplete for all receptors in the CSM (Appendix J).

5.5 Trench Training Area (MRS 2)

5.5.0.1 As presented in Section 5.1.1, two explosives (NG and DNT) and five metals (antimony, copper, lead, nickel, and zinc) are the MC of interest in MRS 2. Groundwater, surface water, sediment, and surface soil were collected at MRS 2, and Tables 5-2 through 5-5 include a summary of all data generated, including those analytes not specifically associated with the munitions used in MRS 2 (as detailed in Table 2-2). Sampling results indicate that one explosive of concern (2,6-dinitrotoluene) was detected in soil samples collected from MRS 2.[14] Several metals including MC related metals associated with MRS 2 (antimony, copper, lead, nickel, and

[14] Nitrobenzene was detected in several of the soil sample from MRS 1 at estimated quantities above the method detection limit but below the reporting limit and corresponding human health and ecological screening criteria. Nitrobenzene is also used in industrial applications and has non explosive related sources.

zinc) were reported in soil samples collected from MRS 2. Comparison of specific munitions related MC sampling results to screening criteria is discussed below.

5.5.1 Groundwater Pathway and Screening Results

5.5.1.1 The locations of nearby drinking water wells were discussed in Section 2.3.7. No groundwater supply wells were identified within MRS 2. Groundwater was identified as an incomplete pathway for MRS 2 in the SS-WP. In accordance with VADEQ guidance comments and as discussed in the SS-WP, groundwater was sampled to determine the presence or absence of MC (VADEQ 2006). Table 5-1 presents a summary of groundwater sample results compared to human health screening values (EPA Region III RBCs). In accordance with the SS-WP, metals were not analyzed in the groundwater samples. No explosives were detected in the groundwater samples. Therefore, there are no COPCs for groundwater. Based on the sample results, the groundwater pathway in the CSM (Appendix J) remains incomplete for MRS 2 for human receptors.

5.5.2 Surface Water and Sediment Pathway and Screening Results

5.5.2.1 Surface water exists at MRS 2 in the form of fresh water ponds. The surface water pathway was viewed as a potentially complete pathway for exposure of human and ecological receptors to MC in the CSM documented in the SS-WP (Alion 2006b). Samples were collected from one of the pools located in MRS 2 to evaluate the surface water pathway. Table 5-2 presents a summary of surface water sample results compared to human health and ecological screening values for MRS 2. No explosives were detected in the surface water sample. Four inorganic MC (copper, lead, nickel, and zinc) were detected in the surface water sample collected from MRS 2. None of the results were at a concentration greater than the adjusted tap water RBCs or ecological screening criteria. Based on these results, the surface water pathways in the CSM (Appendix J) are complete for MRS 2 for both human and ecological receptors, but no risk was identified for ecological or human receptors. There are no COPCs/COPECs for surface water at MRS 2.

5.5.2.2 The sediment pathway was viewed as a potentially complete pathway for exposure of human and ecological receptors to MC in the CSM documented in the SS-WP (Alion 2006b). One sediment sample was collected from MRS 2 to evaluate the sediment pathway. Table 5-3 presents a summary of sediment sample results compared to human health and ecological screening values for MRS 2. No explosives were detected in the sediment sample. The identified inorganic MC were all detected in the sample, and all were detected at concentrations below human health and ecological screening criteria. Based on these results, the sediment

pathways in the CSM (Appendix J) are complete for both human and ecological receptors, but no risk to ecological or human receptors was identified. There are no COPCs/COPECs for sediment identified for MRS 2.

5.5.3 Terrestrial Pathway and Screening Results

5.5.3.1 Surface soil in MRS 2 was viewed as a potentially complete pathway for exposure of human and ecological receptors to MC in the CSM documented in the SS-WP (Alion 2006b). A total of 20 and two duplicate surface soil samples were collected from MRS 2. Table 5-4 presents a summary of soil sample results compared to human health screening values (residential and industrial) and ecological screening criteria for MRS 2.

5.5.3.2 No explosive MC of concern were found in the soil samples at concentrations greater than human health criteria although 2,6-dinitrotoluene was detected once in a field duplicate with an estimated concentration of 0.018 µg/kg. This chemical was not detected in the original sample, although the reported concentration is below the standard reporting limit of 0.04 µg/kg, hence the estimated concentration. Because the explosive 2,6-dinitrotoluene was detected the soil pathway is considered complete, although the reported concentrations are below human health screening values. Each of the inorganic MC were detected in one or more of the surface soil samples and lead was the only analyte detected at a concentration exceeding industrial and residential human health criteria at one sampling point (FLE-TT-SS-02-14). Lead was identified as a COPC which exceeded background (Table 5-8). The WRS test was used to test the null hypothesis that constituent concentrations at MRS 2 were equal to background versus the alternative hypothesis that constituent concentrations at MRS 2 exceeded background. The WRS test was conducted at the 95% significance level. For lead, the WRS test rejected the null hypothesis, and therefore it was concluded that lead at MRS 2 is significantly different than background lead. Based on these results, the surface soil pathway in the CSM (Appendix J) is complete for human receptors and lead has been identified as a COPC.

5.5.3.3 No explosives MC were found in the soil samples at concentrations greater than ecological screening criteria. As discussed above, the detection of 2,6-dinitrotoluene, even though the concentration is below the ecological screening value, indicates a complete pathway to ecological receptors. Antimony, copper, lead, nickel, and zinc were detected at MRS 2. The maximum concentrations of antimony, copper, lead, and zinc were greater than ecological screening criteria. Only antimony was considered to be within background concentrations when considering maximum concentrations (Table 5-8). The WRS test was used to determine if copper and zinc at MRS 2 were significantly different from background using $\alpha > 0.05$. The WRS test revealed that copper and zinc were not significantly different than background, even

though maximum average site concentrations exceed background concentrations (Table 5-8). As discussed in paragraph 5.5.3.2, using the WRS test it was concluded that lead at MRS 1 is significantly different than background lead. Based on this assessment, the surface soil pathway in the CSM is considered complete for ecological receptors and lead has been identified as a COPEC.

5.5.3.4 Based on these results the surface soil pathway in the CSM (Appendix J) is complete for all human and ecological receptors at MRS 2.

5.5.4 Air Pathway

5.5.4.1 The air migration pathway for MRS 2 has an extremely low potential, if any, for human and/or environmental receptors to come into contact with MC in surface soil (metals and explosives). Given the non-volatile nature of the constituents detected, and the fact that suspension of constituents in air is limited to airborne particulates, the fraction of COPCs/COPECs susceptible to being suspended in air is negligible. With a negligible air contamination source, there is low potential for the air pathway at MRS 2 to negatively impact any human or environmental receptors. Therefore, the air pathway is incomplete for all receptors in the CSM (Appendix J).

Table 5-5. Sediment, Soil, and Surface Water Ecological Screening Values and Sources

Analyte	Screening Value	Screening Source
Sediment (mg/kg)		
1,3,5-TRINITROBENZENE	2659	Spectrum (2003a), from K_{ow} values
1,3-DINITROBENZENE	371	Spectrum (2003b), from K_{ow} values
2,4-DINITROTOLUENE	0.0416	USEPA (2006a), from K_{ow} values for 2,4-Dinitrotoluene
2,6-DINITROTOLUENE	0.0416	USEPA (2006a), from K_{ow} values for 2,4-Dinitrotoluene
2-AMINO-4,6-DINITROTOLUENE	876	Robb et al. (2002), from K_{ow} values
2-NITROTOLUENE	4.06	4-Nitrotoluene as surrogate
3-NITROTOLUENE	4.06	4-Nitrotoluene as surrogate
4-AMINO-2,6-DINITROTOLUENE	444	Robb et al. (2002), from K_{ow} values
4-NITROTOLUENE	4.06	Talmage et al. (1999)
HMX	2.17	Robb et al. (2002), from K_{ow} values
NITROBENZENE	4729	Derived using lowest surface water screening value and K_{oc} and K_{ow} values, USEPA (1995a)
NITROGLYCERIN	NA	
PETN	34627	USCHPPM (2001), from K_{ow} values
RDX	NA	
TETRYL	NA	
TNT	100	USEPA (2006a), from K_{ow} values
ALUMINUM	26000	Ingersoll et. al. (1996)
ANTIMONY	2	Long and Morgan (1990)
ARSENIC	9.8	MacDonald et al. (2000)
BARIUM	NA	
BERYLLIUM	NA	
CADMIUM	0.99	MacDonald et al. (2000)
CALCIUM	NA	
CHROMIUM	43.4	MacDonald et al. (2000)
COBALT	50	Persaud et al. (1993)
COPPER	31.6	MacDonald et al. (2000)
IRON	NA	
LEAD	35.8	MacDonald et al. (2000)
MAGNESIUM	NA	
MANGANESE	460	Persaud et al. (1993)
MERCURY	0.18	MacDonald et al. (2000)
MOLYBDENUM	NA	
NICKEL	22.7	MacDonald et al. (2000)
POTASSIUM	NA	
SELENIUM	2	Lemley (2002)
SILVER	1	Long and Morgan (1990)
SODIUM	NA	
STRONTIUM	NA	
THALLIUM	NA	
TITANIUM	NA	
VANADIUM	NA	
ZINC	121	MacDonald et al. (2000)

Yellow shaded analytes are those constituents associated with past munitions use.
NA - No screening value
mg/kg = milligram per kilogram

Table 5-5. Sediment, Soil, and Surface Water Ecological Screening Values and Sources

Analyte	Screening Value	Screening Source
Surface Soil (mg/kg)		
1,3,5-TRINITROBENZENE	NA	
1,3-DINITROBENZENE	NA	
2,4-DINITROTOLUENE	30	TNT as surrogate
2,6-DINITROTOLUENE	30	TNT as surrogate
2-AMINO-4,6-DINITROTOLUENE	20	Talmage et al. (1999)
2-NITROTOLUENE	30	TNT as surrogate
3-NITROTOLUENE	30	TNT as surrogate
4-AMINO-2,6-DINITROTOLUENE	30	TNT as surrogate
4-NITROTOLUENE	30	TNT as surrogate
HMX	NA	
NITROBENZENE	40	Efroymson et al. (1997b)
NITROGLYCERIN	NA	
PETN	NA	
RDX	100	Talmage et al. (1999)
TETRYL	NA	
TNT	30	Talmage et al. (1999)
ALUMINUM	pH > 5.5	USEPA (2003)
ANTIMONY	0.27	USEPA (2005a)
ARSENIC	18	USEPA (2005b)
BARIUM	330	USEPA (2005c)
BERYLLIUM	21	USEPA (2005d)
CADMIUM	0.36	USEPA (2005e)
CALCIUM	NA	
CHROMIUM	81	USEPA (2005f)
COBALT	13	USEPA (2005g)
COPPER	28	USEPA (2007a)
IRON	NA	
LEAD	11	USEPA (2005h)
MAGNESIUM	NA	
MANGANESE	500	Efroymson et al. (1997a)
MERCURY	0.1	Efroymson et al. (1997b)
MOLYBDENUM	2	Efroymson et al. (1997a)
NICKEL	38	USEPA (2007b)
POTASSIUM	NA	
SELENIUM	1	Efroymson et al. (1997a)
SILVER	4.2	USEPA (2006c)
SODIUM	NA	
STRONTIUM	NA	
THALLIUM	1	Efroymson et al. (1997a)
TITANIUM	NA	
VANADIUM	7.8	USEPA (2005i)
ZINC	50	Efroymson et al. (1997a)

Yellow shaded analytes are those constituents associated with past munitions use.
NA - No screening value
mg/kg = milligram per kilogram

Table 5-5. Sediment, Soil, and Surface Water Ecological Screening Values and Sources

Analyte	Screening Value	Screening Source
Surface Water (ug/L)		
1,3,5-TRINITROBENZENE	11	Talmage et al. (1999)
1,3-DINITROBENZENE	20	Talmage et al. (1999)
2,4-DINITROTOLUENE	310	USEPA (2005j), from LC50 values
2,6-DINITROTOLUENE	81	USEPA (2005j), from LC50 values
2-AMINO-4,6-DINITROTOLUENE	20	Talmage et al. (1999)
2-NITROTOLUENE	750	3-Nitrotoluene as surrogate
3-NITROTOLUENE	750	USEPA (2005j), from LC50 values
4-AMINO-2,6-DINITROTOLUENE	NA	
4-NITROTOLUENE	1900	USEPA (2005j), from LC50 values
HMX	330	Talmage et al. (1999)
NITROBENZENE	6680	USEPA (1995b)
NITROGLYCERIN	138	USEPA (2005j), from LC50 values
PETN	85000	USEPA (2005j), from LC50 values
RDX	190	Talmage et al. (1999)
TETRYL	NA	
TNT	90	Talmage et al. (1999)
ALUMINUM	87	USEPA (2006b)
ANTIMONY	30	Suter and Tsao (1996)
ARSENIC	5	USEPA (1996)
BARIUM	4	Suter and Tsao (1996)
BERYLLIUM	0.66	Suter and Tsao (1996)
CADMIUM	0.25	USEPA (2006b)
CALCIUM	NA	
CHROMIUM	74	USEPA (2006b)
COBALT	23	Suter and Tsao (1996)
COPPER	9	USEPA (2006b)
IRON	NA	
LEAD	2.5	USEPA (2006b)
MAGNESIUM	NA	
MANGANESE	120	Suter and Tsao (1996)
MERCURY	0.77	USEPA (2006b)
MOLYBDENUM	370	Suter and Tsao (1996)
NICKEL	52	USEPA (2006b)
POTASSIUM	NA	
SELENIUM	5	USEPA (2006b)
SILVER	3.2	USEPA (2006b)
SODIUM	NA	
STRONTIUM	1500	Suter and Tsao (1996)
THALLIUM	NA	
TITANIUM	NA	
VANADIUM	19	USEPA (1996)
ZINC	120	USEPA (2006b)

Yellow shaded analytes are those constituents associated with past munitions use.
NA - No screening value
ug/L = microgram per liter

Table 5-5. Sediment, Soil, and Surface Water Ecological Screening Values and Sources

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	Sample Name:			EPA Region III RBC Screening Value [1]	FLE-TT-GW-20-01	FLE-TT-GW-20-02
	Sample Date:				2/13/2007	2/13/2007
	Parent Sample:					
	MRS:				MRS 2	MRS 2
Analyte	**CAS**	**T/D**	**Unit**			
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	N	ug/L	110	0.21 U	0.21 U
1,3-DINITROBENZENE	99-65-0	N	ug/L	0.37	0.21 U	0.21 U
2,4-DINITROTOLUENE	121-14-2	N	ug/L	7.3	0.21 U	0.21 U
2,6-DINITROTOLUENE	606-20-2	N	ug/L	3.7	0.21 U	0.21 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	N	ug/L	7.3	0.21 U	0.21 U
2-NITROTOLUENE	88-72-2	N	ug/L	6.1	0.42 U	0.42 U
3-NITROTOLUENE	99-08-1	N	ug/L	NSL	0.42 U	0.42 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	N	ug/L	7.3	0.21 U	0.21 U
4-NITROTOLUENE	99-99-0	N	ug/L	NSL	0.42 U	0.42 U
HMX	2691-41-0	N	ug/L	180	0.42 U	0.42 U
NITROBENZENE	98-95-3	N	ug/L	0.35	0.21 U	0.21 U
NITROGLYCERIN	55-63-0	N	ug/L	0.37	21 U	21 U
PETN	78-11-5	N	ug/L	NSL	1 U	1.1 U
RDX	121-82-4	N	ug/L	0.61	0.42 U	0.42 U
TETRYL	479-45-8	N	ug/L	15	0.42 U	0.42 U
TNT	118-96-7	N	ug/L	2.2	0.21 U	0.21 U

(1) USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the tap water RBC value.
For carcinogens the value shown is equal to the tap water RBC value.
N=Not applicable (total only for organic chemicals)
GW=ground water
U=Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
ug/L=micrograms per liter
CAS=Chemical Abstract Service

NSL=No Screening Level
NUT=Essential Nutrient
T/D=Total/Disolved

Notes:

Blue shaded and bolded values represent exceedance of human health screening criteria.

Yellow shaded analytes are those constituents associated with past munitions use.Only items not considered essential nutrients are compared to decision limits.

Analyte	CAS	T/D	Unit	EPA Region III RBC Screening Value [1]	Ecological Screening Values [2]	FLE-TT-SW-00-01	FD#4
Sample Name:						FLE-TT-SW-00-01	FD#4
Sample Date:						2/12/2007	2/12/2007
Parent Sample:							FLE-TT-SW-00-01
MRS:						MRS 2	MRS 2
Explosives							
1,3,5-TRINITROBENZENE	99-35-4	N	ug/L	1100	11	0.21 U	0.21 U
1,3-DINITROBENZENE	99-65-0	N	ug/L	3.7	20	0.21 U	0.21 U
2,4-DINITROTOLUENE	121-14-2	N	ug/L	73	310	0.21 U	0.21 U
2,6-DINITROTOLUENE	606-20-2	N	ug/L	37	81	0.21 U	0.21 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	N	ug/L	73	20	0.21 U	0.21 U
2-NITROTOLUENE	88-72-2	N	ug/L	61	750	0.41 U	0.42 U
3-NITROTOLUENE	99-08-1	N	ug/L	NSL	750	0.41 U	0.42 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	N	ug/L	73	NSL	0.21 U	0.21 U
4-NITROTOLUENE	99-99-0	N	ug/L	NSL	1900	0.41 U	0.42 U
HMX	2691-41-0	N	ug/L	1800	330	0.41 U	0.42 U
NITROBENZENE	98-95-3	N	ug/L	3.5	6680	0.21 U	0.21 U
NITROGLYCERIN	55-63-0	N	ug/L	3.7	138	21 U	21 U
PETN	78-11-5	N	ug/L	NSL	85000	1 U	1.1 U
RDX	121-82-4	N	ug/L	6.1	190	0.41 U	0.42 U
TETRYL	479-45-8	N	ug/L	150	NSL	0.41 U	0.42 U
TNT	118-96-7	N	ug/L	22	90	0.21 U	0.21 U
Metals							
ALUMINUM	7429-90-5	T	ug/L	37000	87	22.8 B	29.1 B
ANTIMONY	7440-36-0	T	ug/L	15	30	0.13 U	0.13 U
ARSENIC	7440-38-2	T	ug/L	0.45	5	1 U	1 U
BARIUM	7440-39-3	T	ug/L	7300	4	*43.7*	*44*
BERYLLIUM	7440-41-7	T	ug/L	73	0.66	0.064 J	0.07 J
CADMIUM	7440-43-9	T	ug/L	18	0.25	0.17 U	0.17 U
CALCIUM	7440-70-2	T	ug/L	NUT	NUT	4050	4310
CHROMIUM	7440-47-3	T	ug/L	110	74	1.3 UL	1.3 UL
COBALT	7440-48-4	T	ug/L	NSL	23	4.3 J	4.3 J
COPPER	7440-50-8	T	ug/L	1500	9	1.7 B	1 B
IRON	7439-89-6	T	ug/L	NUT	NUT	562	575
LEAD	7439-92-1	T	ug/L	150	2.5	0.27 B	0.3 B
MAGNESIUM	7439-95-4	T	ug/L	NUT	NUT	842	849
MANGANESE	7439-96-5	T	ug/L	730	120	70.8	72.8
MERCURY	7439-97-6	T	ug/L	3.7	0.77	0.058 B	0.066 B
MOLYBDENUM	7439-98-7	T	ug/L	180	370	0.4 B	0.27 B
NICKEL	7440-02-0	T	ug/L	730	52	2.2 B	1.8 B
POTASSIUM	9/7/7440	T	ug/L	NUT	NUT	1210	1250
SELENIUM	7782-49-2	T	ug/L	180	5	0.75 U	0.75 U
SILVER	7440-22-4	T	ug/L	180	3.2	0.029 U	0.029 U
SODIUM	7440-23-5	T	ug/L	NUT	NUT	2880	2950
STRONTIUM	7440-24-6	T	ug/L	22000	1500	27.8 K	29.1 K
THALLIUM	7440-28-0	T	ug/L	2.6	NSL	0.26 B	0.17 B
TITANIUM	7440-32-6	T	ug/L	NSL	NSL	0.91 J	1.2 J
VANADIUM	7440-62-2	T	ug/L	37	19	2.5 U	2.5 U
ZINC	7440-66-6	T	ug/L	11000	120	16.7 B	47.9

(1) USEPA Region III Risk-Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the tap water RBC value.
For carcinogens the value shown is equal to the tap water RBC value. To account for surface water exposures, the resulting values have been increased by a factor of ten.
(2) Ecological Screening Value references are found in Table 5-6.

SW=surface water
B=Not detected substantially above the level reported in the laboratory field blanks.
J=Analyte is present. Reported value may not be accurate or precise.
K=Analyte is present. Reported value may be biased high. Actual value is expected to be lower.
U=Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
UL=Not detected, quantitation limit is probably higher.
ug/L=micrograms per liter
CAS=Chemical Abstract Service

NSL=No Screening Level
NUT=Essential Nutrient
T/D=Total/Dissolved
N=Not applicable (total only for organic chemicals)
Notes:
Blue shaded and bolded values represent exceedance of human health screening criteria.
Blue shaded and italicized values represent exceedance of ecological screening criteria.
Blue shaded, bolded and italicized values represent exceedance of both human health and ecological screening criteria.
Yellow shaded analytes are those constituents associated with past munitions use.Only items not considered essential nutrients are compared to decision limits.

			Sample Name:	EPA Region III RBC Screening Value [1]	EPA Region III RBC Screening Value [2]	Ecological Screening Values [3]	FLE-TT-SD-02-01
			Sample Date:				2/12/2007
			Parent Sample:				
			MRS:				MRS 2
Analyte	**CAS**	**Unit**					
Explosives							
1,3,5-TRINITROBENZENE	99-35-4	mg/kg		2300	31000	2659	0.04 U
1,3-DINITROBENZENE	99-65-0	mg/kg		7.8	100	371	0.04 U
2,4-DINITROTOLUENE	121-14-2	mg/kg		160	2000	0.0416	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg		78	1000	0.0416	0.04 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg		160	2000	876	0.04 U
2-NITROTOLUENE	88-72-2	mg/kg		780	10000	4.06	0.08 U
3-NITROTOLUENE	99-08-1	mg/kg		NSL	NSL	4.06	0.08 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg		160	2000	444	0.04 U
4-NITROTOLUENE	99-99-0	mg/kg		NSL	NSL	4.06	0.08 U
HMX	2691-41-0	mg/kg		3900	51000	2.17	0.08 U
NITROBENZENE	98-95-3	mg/kg		39	510	4729	0.04 U
NITROGLYCERIN	55-63-0	mg/kg		7.8	100	NSL	4 U
PETN	78-11-5	mg/kg		NSL	NSL	34627	0.2 U
RDX	121-82-4	mg/kg		58	260	NSL	0.08 U
TETRYL	479-45-8	mg/kg		310	4100	NSL	0.08 U
TNT	118-96-7	mg/kg		210	950	100	0.04 U
Metals							
ALUMINUM	7429-90-5	mg/kg		78000	1000000	26000	1660
ANTIMONY	7440-36-0	mg/kg		31	410	2	0.36 J
ARSENIC	7440-38-2	mg/kg		4.3	19	9.8	0.87 J
BARIUM	7440-39-3	mg/kg		16000	200000	NSL	25.2
BERYLLIUM	7440-41-7	mg/kg		160	2000	NSL	0.38
CADMIUM	7440-43-9	mg/kg		39	510	0.99	0.079 B
CALCIUM	7440-70-2	mg/kg		NUT	NUT	NSL	356
CHROMIUM	7440-47-3	mg/kg		230	3100	43.4	3
COBALT	7440-48-4	mg/kg		NSL	NSL	50	5.1
COPPER	7440-50-8	mg/kg		3100	41000	31.6	2.9
IRON	7439-89-6	mg/kg		NUT	NUT	NSL	5500
LEAD	7439-92-1	mg/kg		400[4]	800[4]	35.8	9.5
MAGNESIUM	7439-95-4	mg/kg		NUT	NUT	NSL	94.7
MANGANESE	7439-96-5	mg/kg		1600	20000	460	66.7
MERCURY	7439-97-6	mg/kg		7.8	100	0.18	0.005 J
MOLYBDENUM	7439-98-7	mg/kg		390	5100	NSL	0.16 B
NICKEL	7440-02-0	mg/kg		1600	20000	22.7	1.9
POTASSIUM	9/7/7440	mg/kg		NUT	NUT	NSL	82
SELENIUM	7782-49-2	mg/kg		390	5100	2	0.32 U
SILVER	7440-22-4	mg/kg		390	5100	1	0.041 U
SODIUM	7440-23-5	mg/kg		NUT	NUT	NSL	89.9 B
STRONTIUM	7440-24-6	mg/kg		47000	610000	NSL	3.2 K
THALLIUM	7440-28-0	mg/kg		5.5	72	NSL	0.62 U
TITANIUM	7440-32-6	mg/kg		NSL	NSL	NSL	22.9
VANADIUM	7440-62-2	mg/kg		78	1000	NSL	4.8
ZINC	7440-66-6	mg/kg		23000	310000	121	9.5

(1) USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the residential soil RBC value.

For carcinogens the value shown is equal to the residential soil RBC value. To account for sediment exposure, the resulting values have been increased by a factor of ten.
(2) USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the industrial soil RBC value.

For carcinogens the value shown is equal to the industrial soil RBC value. To account for sediment exposure, the resulting values have been increased by a factor of ten.
(3) Ecological Screening Value references are found in Table 5-6.
(4) Lead screening is based on EPA Region III Guidance.
SD=sediment
B=Not detected substantially above the level reported in the laboratory field blanks.
J=Analyte is present. Reported value may not be accurate or precise.
K=Analyte is present. Reported value may be biased high. Actual value is expected to be lower.
U=Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
mg/kg=milligrams per kilogram
CAS=Chemical Abstract Service

NSL=No Screening Level
NUT= Essential Nutrient

Notes:

Blue shaded and bolded values represent exceedance of human health screening criteria.
Blue shaded and italicized values represent exceedance of ecological screening criteria.
Blue shaded, bolded and italicized values represent exceedance of both human health and ecological screening criteria.

Yellow shaded analytes are those constituents associated with past munitions use. Only items not considered essential nutrients are compared to decision limits.

Sample Name:			EPA Region III RBC Screening Value [1]	EPA Region III RBC Screening Value [2]	Ecological Screening Values [3]	FLE-TT-SS-02-01	FD#2	FLE-TT-SS-02-02	FLE-TT-SS-02-03	FLE-TT-SS-02-04	FLE-TT-SS-02-05	FLE-TT-SS-02-06
Sample Date:						2/13/2007	2/13/2007	2/13/2007	2/13/2007	2/13/2007	2/13/2007	2/12/2007
Parent Sample:							FLE-TT-SS-02-01					
MRS:						MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2
Analyte	**CAS**	**Unit**										
Explosives												
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	230	3100	NSL	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DINITROBENZENE	99-65-0	mg/kg	0.78	10	NSL	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	16	200	30	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg	7.8	100	30	0.04 U	0.018 J	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	16	200	20	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-NITROTOLUENE	88-72-2	mg/kg	78	1000	30	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
3-NITROTOLUENE	99-08-1	mg/kg	NSL	NSL	30	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	16	200	30	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-NITROTOLUENE	99-99-0	mg/kg	NSL	NSL	30	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
HMX	2691-41-0	mg/kg	390	5100	NSL	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
NITROBENZENE	98-95-3	mg/kg	3.9	51	40	0.04 U	0.019 J	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
NITROGLYCERIN	55-63-0	mg/kg	0.78	10	NSL	4 U	4 U	4 U	4 U	4 U	4 U	4 U
PETN	78-11-5	mg/kg	NSL	NSL	NSL	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
RDX	121-82-4	mg/kg	5.8	26	100	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TETRYL	479-45-8	mg/kg	31	410	NSL	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TNT	118-96-7	mg/kg	21	95	30	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Metals												
ALUMINUM	7429-90-5	mg/kg	7800	100000	pH > 5.5	7860	8910	3390	5140	4310	5460	2320
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27	*0.7 J*	*0.57 J*	*0.35 J*	*0.37 J*	0.33 UL	*0.47 J*	*0.5 J*
ARSENIC	7440-38-2	mg/kg	0.43	1.9	18	**2.2 J**	**2.2 J**	**0.8 J**	**1.7 J**	**1.3 J**	**1.4 J**	**1.3 J**
BARIUM	7440-39-3	mg/kg	1600	20000	330	126	128	41.5	28.3	80.6	73.1	41.8
BERYLLIUM	7440-41-7	mg/kg	16	200	21	0.62	0.7	0.14 J	0.16 J	0.51	0.38	0.11
CADMIUM	7440-43-9	mg/kg	3.9	51	0.36	*0.72 J*	*0.61 J*	0.084	0.088	0.15	0.1	0.067
CALCIUM	7440-70-2	mg/kg	NUT	NUT	NUT	2940	2930	497	362	1150	758	441
CHROMIUM	7440-47-3	mg/kg	23	310	81	12.7	14.3	3.2	6	3.5	5.4	3.2
COBALT	7440-48-4	mg/kg	NSL	NSL	13	7.7	8.3	0.77	0.74	2	2.3	0.38 J
COPPER	7440-50-8	mg/kg	310	4100	28	16.4	16.9	4.6	3.5	5.3	4.1	3.2
IRON	7439-89-6	mg/kg	NUT	NUT	NUT	9470	10600 K	2620	4780	2230	4200	2740
LEAD	7439-92-1	mg/kg	400[4]	800[4]	11	*85.2*	*89*	*43.3*	*28.8*	*32.6*	*32.5*	*39.7*
MAGNESIUM	7439-95-4	mg/kg	NUT	NUT	NUT	780	830	223	184	254	305	119
MANGANESE	7439-96-5	mg/kg	160	2000	500	**456**	**490 K**	134	61.8	**375**	***555***	55.4
MERCURY	7439-97-6	mg/kg	0.78	10	0.1	*0.27*	*0.3*	*0.11*	0.034 J	*0.21*	0.053	0.037
MOLYBDENUM	7439-98-7	mg/kg	39	510	2	0.45 J	0.52	0.2	0.26	0.22	0.27	0.26
NICKEL	7440-02-0	mg/kg	160	2000	38	6.3	6.9	1.4	1.8	3.5	3.4	1.6
POTASSIUM	9/7/7440	mg/kg	NUT	NUT	NUT	475	522	204	198	252	235	136
SELENIUM	7782-49-2	mg/kg	39	510	1	0.5 U	0.71 J	0.31 U	0.31 U	0.72 J	0.34 U	0.29 U
SILVER	7440-22-4	mg/kg	39	510	4.2	0.065 U	0.059 U	0.04 U	0.041 U	0.047 U	0.044 U	0.038 U
SODIUM	7440-23-5	mg/kg	NUT	NUT	NUT	139 J	142	88.9	91.4	97.4	97.2	84.9
STRONTIUM	7440-24-6	mg/kg	4700	61000	NSL	19.7 K	21.3 K	2.5 K	2.6 K	12 K	6.1 K	4.9 K
THALLIUM	7440-28-0	mg/kg	0.55	7.2	1	0.99 U	0.89 U	0.61 U	0.62 U	0.71 U	0.67 U	0.58 U
TITANIUM	7440-32-6	mg/kg	NSL	NSL	NSL	104	126 K	52.5	50.3	43.5	43.6	47.7
VANADIUM	7440-62-2	mg/kg	7.8	100	7.8	***27.8***	***30.9***	6.5	***13***	***9.3***	***12***	***10.1***
ZINC	7440-66-6	mg/kg	2300	31000	50	*81*	*91.3*	15.6	14.4	18.2	16.7	10.1

		Sample Name:	FLE-TT-SS-02-07	FLE-TT-SS-02-08	FD#3	FLE-TT-SS-02-09	FLE-TT-SS-02-10	FLE-TT-SS-02-11	FLE-TT-SS-02-12	FLE-TT-SS-02-13	FLE-TT-SS-02-14	FLE-TT-SS-02-15
		Sample Date:	2/12/2007	2/12/2007	2/12/2007	2/12/2007	2/12/2007	2/12/2007	2/13/2007	2/13/2007	2/13/2007	2/13/2007
		Parent Sample:			FLE-TT-SS-02-08							
		MRS:	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2
Analyte	**CAS**	**Unit**										
Explosives												
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DINITROBENZENE	99-65-0	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-NITROTOLUENE	88-72-2	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
3-NITROTOLUENE	99-08-1	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-NITROTOLUENE	99-99-0	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
HMX	2691-41-0	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
NITROBENZENE	98-95-3	mg/kg	0.04 U	0.04 U	0.016 J	0.04 U	0.04 U	0.04 U	0.018 J	0.04 U	0.023 J	0.04 U
NITROGLYCERIN	55-63-0	mg/kg	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
PETN	78-11-5	mg/kg	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
RDX	121-82-4	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TETRYL	479-45-8	mg/kg	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TNT	118-96-7	mg/kg	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Metals												
ALUMINUM	7429-90-5	mg/kg	3440	3540	3360	3600	9250	6880	3030 K	4150 K	3310 K	5870 K
ANTIMONY	7440-36-0	mg/kg	0.25 UL	*0.42 J*	*0.44 J*	0.27 UL	*0.47 J*	*0.41 J*	*0.55*	*0.66*	*1.1*	*0.66*
ARSENIC	7440-38-2	mg/kg	**0.81 J**	**1.5 J**	**1.5 J**	**0.99 J**	**2.3**	**2.1**	**1.1**	**1.9 J**	**2.7 L**	**2.1 J**
BARIUM	7440-39-3	mg/kg	12.6	16.1	14.3	10.8	43.4	34.6	52.9	86	106	25.1
BERYLLIUM	7440-41-7	mg/kg	0.044	0.069	0.095	0.079	0.2	0.17 J	0.23 J	0.29	0.27	0.11 J
CADMIUM	7440-43-9	mg/kg	0.031	0.055	0.021 U	0.043	0.077	0.069	0.07 J	0.088 J	*0.43 J*	0.026 U
CALCIUM	7440-70-2	mg/kg	144	99.6	91.8	66.8	142	424	1690	471	3710	211
CHROMIUM	7440-47-3	mg/kg	4.5	4.3	4.1	9.4	12.6	9.5	3.3	2.8	15.7	9
COBALT	7440-48-4	mg/kg	0.22	0.52	0.45	0.18	1.1	0.92	0.98	0.41 J	1.3	0.25 J
COPPER	7440-50-8	mg/kg	1.5	2.8	2.6	3	5.6	6.4	4.3	*7*	*69.9*	4.1
IRON	7439-89-6	mg/kg	3260	3090	3100 K	5540	11800	9040	1590 K	2160 K	5500 K	6840 K
LEAD	7439-92-1	mg/kg	*11.2*	*22.6*	*22.7*	*16*	*24.1*	*33.4*	*25.4*	*57.9*	***1390***	*35.6*
MAGNESIUM	7439-95-4	mg/kg	134	136	128	110	261	221	285	180	474	214
MANGANESE	7439-96-5	mg/kg	11.1	13.9	16.1 K	12.5	17.6	79.9	93.3	65.7	**242**	19.9
MERCURY	7439-97-6	mg/kg	0.024 J	0.04	0.031 J	0.018 J	0.047	0.057	0.054	0.097	*0.76*	0.055
MOLYBDENUM	7439-98-7	mg/kg	0.18	0.22	0.38	0.2	0.51	0.4	0.23	0.3	0.73	0.66
NICKEL	7440-02-0	mg/kg	0.99	1.4	1.2	1	2.7	2.2	1.5	2.4	4.7	1.7
POTASSIUM	9/7/7440	mg/kg	122	132	123	105	260	261	206	208	306	263
SELENIUM	7782-49-2	mg/kg	0.28 U	0.3 U	0.44 J	0.5 J	0.7 J	0.43 J	0.45 U	0.73 J	0.77 J	0.48 J
SILVER	7440-22-4	mg/kg	0.036 U	0.039 U	0.039 U	0.039 U	0.043 U	0.04 U	0.058 U	0.048 U	0.47 J	0.048 U
SODIUM	7440-23-5	mg/kg	80.1	89.1	87	89.5	107	94.5	110	80.5	95.5	95.6
STRONTIUM	7440-24-6	mg/kg	1.5 K	1.6 K	1.4 K	1 K	3.5 K	3.8 K	14.7 K	6.2 K	18.4 K	6.1 K
THALLIUM	7440-28-0	mg/kg	0.55 U	0.59 U	0.59 U	0.59 U	0.66 U	0.61 U	0.88 U	0.73 U	0.68 U	0.74 U
TITANIUM	7440-32-6	mg/kg	56.1	62.8	63.9 K	60.8	75.7	66.5	57.4	48.3	55.5	61.1
VANADIUM	7440-62-2	mg/kg	***11.1***	***12.7***	***12.6***	***14.8***	***27.6***	***21.4***	7.3	***10.3***	***13.2***	***22.6***
ZINC	7440-66-6	mg/kg	4.2	6.9	6.7	5.8	11.5	12.5	14.3	11.8	*205*	8.4

			Sample Name:	FLE-TT-SS-02-16	FLE-TT-SS-02-17	FLE-TT-SS-02-18	FLE-TT-SS-02-19	FLE-TT-SS-02-20	FLE-RR-SS-02-01	FD#1	FLE-RR-SS-02-02	FLE-RR-SS-02-03	FLE-RR-SS-02-04
			Sample Date:	2/13/2007	2/12/2007	2/12/2007	2/13/2007	2/13/2007	2/14/2007	2/14/2007	2/14/2007	2/14/2007	2/14/2007
			Parent Sample:							FLE-RR-SS-02-01			
			MRS:	MRS 2	MRS 2	MRS 2	MRS 2	MRS 2	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1
Analyte	**CAS**	**Unit**											
Explosives													
1,3,5-TRINITROBENZENE	99-35-4	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DINITROBENZENE	99-65-0	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,4-DINITROTOLUENE	121-14-2	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-NITROTOLUENE	88-72-2	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
3-NITROTOLUENE	99-08-1	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-NITROTOLUENE	99-99-0	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
HMX	2691-41-0	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
NITROBENZENE	98-95-3	mg/kg		0.023 J	0.04 U	0.027 J	0.04 U	0.025 J	0.019 J	0.022 J	0.029 J	0.032 J	0.035 J
NITROGLYCERIN	55-63-0	mg/kg		4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
PETN	78-11-5	mg/kg		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
RDX	121-82-4	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TETRYL	479-45-8	mg/kg		0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
TNT	118-96-7	mg/kg		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Metals													
ALUMINUM	7429-90-5	mg/kg		2730 K	9670 K	6060 K	1840 K	1640 K	4540	4570	6070	5410	3940
ANTIMONY	7440-36-0	mg/kg		*0.54*	*0.85*	*0.8*	*0.52*	*0.42*	*0.32 J*	0.27 U	0.3 U	*0.34 J*	*0.3 J*
ARSENIC	7440-38-2	mg/kg		**1.4 J**	**3.1 L**	**2 J**	**0.92**	**0.61**	**0.99 J**	**0.84 J**	**1.4 J**	**0.98 J**	**0.9 J**
BARIUM	7440-39-3	mg/kg		16.2	97.8	35	9.8	10.1	22.5	26.5	38.4	20.6	28.5
BERYLLIUM	7440-41-7	mg/kg		0.14 J	0.3 J	0.16 J	0.042 J	0.085 J	0.11	0.16	0.18	0.12	0.1
CADMIUM	7440-43-9	mg/kg		0.024 U	0.14 J	0.08 J	0.023 U	0.045 J	0.022 U	0.021 U	0.073	0.067	0.088
CALCIUM	7440-70-2	mg/kg		141	3910	2570	80.1 J	163	50.9 J	56.4 J	1130	837	850
CHROMIUM	7440-47-3	mg/kg		8.1	18.8	9.2	1.9	3.8	3.4	3	6.7	7	4.5
COBALT	7440-48-4	mg/kg		0.41 J	2.9	0.79	0.041 U	0.36 J	0.67	0.61	0.98	0.41	0.36
COPPER	7440-50-8	mg/kg		3.1	14.1	5.8	1.4	1.5	1.6	1.5	2.2	1.8	1.8
IRON	7439-89-6	mg/kg		4710 K	22300 K	9440 K	1900 K	2360 K	3240 K	3080 K	4990 K	5950 K	2720 K
LEAD	7439-92-1	mg/kg		*30*	*45.4*	*35.9*	*17.5*	10.4	8.7	8.7	*13.3*	9.2	11
MAGNESIUM	7439-95-4	mg/kg		122	919	353	84.2	150	169	171	479	360	263
MANGANESE	7439-96-5	mg/kg		57.6	***645***	108	9.3	9.8	33.3 K	34 K	81.9 K	26.6 K	34.6 K
MERCURY	7439-97-6	mg/kg		0.052	*0.11*	0.07	0.019 J	0.021 J	0.031 J	0.034 J	0.021 J	0.013 J	0.014 J
MOLYBDENUM	7439-98-7	mg/kg		0.18	0.54	0.31	0.19	0.25	0.26	0.17	0.31	0.2	0.088
NICKEL	7440-02-0	mg/kg		0.89 J	5.3	2	0.57 J	0.93	1.8	1.6	2.1	1.3	1.2
POTASSIUM	9/7/7440	mg/kg		108	647	391	76.1	169	114	120	305	285	283
SELENIUM	7782-49-2	mg/kg		0.35 U	1 J	0.41 U	0.33 U	0.35 J	0.31 J	0.44 J	0.33 U	0.48 J	0.23 U
SILVER	7440-22-4	mg/kg		0.045 U	0.067 U	0.053 U	0.042 U	0.04 U	0.04 U	0.039 U	0.043 U	0.031 U	0.029 U
SODIUM	7440-23-5	mg/kg		81	120	97.3	79.8	78.7	93.1	89.4	99.2	72.8	63.4
STRONTIUM	7440-24-6	mg/kg		1.2 J	30.7 K	13.8 K	1.3 J	3.3 K	1.4 K	1.5 K	2.6 K	1.8 K	2.3 K
THALLIUM	7440-28-0	mg/kg		0.68 U	1 U	0.8 U	0.64 U	0.6 U	0.61 U	0.59 U	0.65 U	0.47 U	0.45 U
TITANIUM	7440-32-6	mg/kg		53.7	138	77.4	51.6	34.6	62.2 K	61.7 K	60.3 K	41.6 K	36.7 K
VANADIUM	7440-62-2	mg/kg		***13.5***	***49.8***	***24.5***	7	7.5	***9.2***	***8.7***	***13.5***	***14.5***	***8.5***
ZINC	7440-66-6	mg/kg		9.4	*51.7*	21.3	3.8	5.9	7.7	8	13.1	6.3	10.3

			Sample Name:	FLE-RR-SS-02-05	FLE-RR-SS-02-06
			Sample Date:	2/14/2007	2/14/2007
			Parent Sample:		
			MRS:	MRS 1	MRS 1
Analyte	**CAS**	**Unit**			
Explosives					
1,3,5-TRINITROBENZENE	99-35-4	mg/kg		0.04 U	0.04 U
1,3-DINITROBENZENE	99-65-0	mg/kg		0.04 U	0.04 U
2,4-DINITROTOLUENE	121-14-2	mg/kg		0.04 U	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg		0.04 U	0.04 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg		0.04 U	0.04 U
2-NITROTOLUENE	88-72-2	mg/kg		0.08 U	0.08 U
3-NITROTOLUENE	99-08-1	mg/kg		0.08 U	0.08 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg		0.04 U	0.04 U
4-NITROTOLUENE	99-99-0	mg/kg		0.08 U	0.08 U
HMX	2691-41-0	mg/kg		0.08 U	0.08 U
NITROBENZENE	98-95-3	mg/kg		0.032 J	0.026 J
NITROGLYCERIN	55-63-0	mg/kg		4 U	4 U
PETN	78-11-5	mg/kg		0.2 U	0.2 U
RDX	121-82-4	mg/kg		0.08 U	0.08 U
TETRYL	479-45-8	mg/kg		0.08 U	0.08 U
TNT	118-96-7	mg/kg		0.04 U	0.04 U
Metals					
ALUMINUM	7429-90-5	mg/kg		4550	10100
ANTIMONY	7440-36-0	mg/kg		0.34 U	*0.29 J*
ARSENIC	7440-38-2	mg/kg		**1.4 J**	**3.6**
BARIUM	7440-39-3	mg/kg		38.1	148
BERYLLIUM	7440-41-7	mg/kg		0.17	0.54
CADMIUM	7440-43-9	mg/kg		0.13	0.18 J
CALCIUM	7440-70-2	mg/kg		714	1590
CHROMIUM	7440-47-3	mg/kg		4.9	12
COBALT	7440-48-4	mg/kg		0.58	5.7
COPPER	7440-50-8	mg/kg		4.2	7.7
IRON	7439-89-6	mg/kg		3160 K	9680 K
LEAD	7439-92-1	mg/kg		*18*	*49.2*
MAGNESIUM	7439-95-4	mg/kg		333	454
MANGANESE	7439-96-5	mg/kg		96.2 K	***851 K***
MERCURY	7439-97-6	mg/kg		0.029 J	0.051
MOLYBDENUM	7439-98-7	mg/kg		0.24	0.62
NICKEL	7440-02-0	mg/kg		1.7	5.6
POTASSIUM	9/7/7440	mg/kg		249	597
SELENIUM	7782-49-2	mg/kg		0.37 U	0.3 U
SILVER	7440-22-4	mg/kg		0.048 U	0.078 U
SODIUM	7440-23-5	mg/kg		115	84.8
STRONTIUM	7440-24-6	mg/kg		3 K	13.1 K
THALLIUM	7440-28-0	mg/kg		0.74 U	0.6 U
TITANIUM	7440-32-6	mg/kg		67.2 K	128 K
VANADIUM	7440-62-2	mg/kg		***10.7***	***25***
ZINC	7440-66-6	mg/kg		23.3	31.4

(1) USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the residential soil RBC value.
For carcinogens the value shown is equal to the residential soil RBC value.
(2) USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the industrial soil RBC value.
For carcinogens the value shown is equal to the industrial soil RBC value.
(3) Ecological Screening Value references are found in Table 5-6.
(4) Lead screening is based on EPA Region III Guidance.
BG=background sample
SS=surface soil
B=Not detected substantially above the level reported in the laboratory field blanks.
J=Analyte is present. Reported value may not be accurate or precise.
K=Analyte is present. Reported value may be biased high. Actual value is expected to be lower.
L=Analyte is present. Reported value may be biased low. Actual value is expected to be higher.
U=Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
UL=Not detected, quantitation limit is probably higher.
mg/kg=milligrams per kilogram
CAS=Chemical Abstract Service

NSL=No Screening Level
NUT= Essential Nutrient

Notes:
Blue shaded and bolded values represent exceedance of human health screening criteria.
Blue shaded and italicized values represent exceedance of ecological screening criteria.
Blue shaded, bolded and italicized values represent exceedance of both human health and ecological screening criteria.
Yellow shaded analytes are those constituents associated with past munitions use. Only items not considered essential nutrients are compared to decision limits.

Table 5-6
Non-Detection Concentrations and Screening Values for Human Health at Fort Lee MMRP FUDS

Analyte	Cas no.	Units	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	EPA Region III Screening Value [1]	Ecological Screening Value [2]
Sediment						
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.04	0.04	2300	2659
1,3-DINITROBENZENE	99-65-0	mg/kg	0.04	0.04	7.8	371
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.04	0.04	160	0.0416
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.04	0.04	78	0.0416
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.04	0.04	160	876
2-NITROTOLUENE	88-72-2	mg/kg	0.08	0.08	780	4.06
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.04	0.04	160	444
HMX	2691-41-0	mg/kg	0.08	0.08	3900	2.17
NITROBENZENE	98-95-3	mg/kg	0.04	0.04	39	4729
NITROGLYCERIN	55-63-0	mg/kg	4	4	7.8	NSL
RDX	121-82-4	mg/kg	0.08	0.08	58	NSL
TETRYL	479-45-8	mg/kg	0.08	0.08	310	NSL
TNT	118-96-7	mg/kg	0.04	0.04	210	100
Inorganics						NSL
CADMIUM	7440-43-9	mg/kg	0.022	0.022	78	0.99
MOLYBDENUM	7439-98-7	mg/kg	0.082	0.082	390	NSL
SELENIUM	7782-49-2	mg/kg	0.32	0.32	390	2
SILVER	7440-22-4	mg/kg	0.041	0.041	390	1
THALLIUM	7440-28-0	mg/kg	0.62	0.62	5.5	NSL
Surface Soil						
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.04	0.04	230	NSL
1,3-DINITROBENZENE	99-65-0	mg/kg	0.04	0.04	0.78	NSL
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.04	0.04	16	30
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.04	0.04	7.8	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.04	0.04	16	20
2-NITROTOLUENE	88-72-2	mg/kg	0.08	0.08	78	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.04	0.04	16	30
HMX	2691-41-0	mg/kg	0.08	0.08	390	NSL
NITROGLYCERIN	55-63-0	mg/kg	4	4	0.78	NSL
RDX	121-82-4	mg/kg	0.08	0.08	5.8	100
TETRYL	479-45-8	mg/kg	0.08	0.08	31	NSL
TNT	118-96-7	mg/kg	0.04	0.04	21	30
Inorganics						NSL
MOLYBDENUM	7439-98-7	mg/kg	0.059	0.13	39	2
SILVER	7440-22-4	mg/kg	0.029	0.078	39	4.2
THALLIUM	7440-28-0	mg/kg	0.45	1	0.55	1

Table 5-6
Non-Detection Concentrations and Screening Values for Human Health at Fort Lee MMRP FUDS

Analyte	Cas no.	Units	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	EPA Region III Screening Value [1]	Ecological Screening Value [2]
Groundwater						
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	ug/L	0.21	0.21	110	NSL
1,3-DINITROBENZENE	99-65-0	ug/L	0.21	0.21	0.37	NSL
2,4-DINITROTOLUENE	121-14-2	ug/L	0.21	0.21	7.3	NSL
2,6-DINITROTOLUENE	606-20-2	ug/L	0.21	0.21	3.7	NSL
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	ug/L	0.21	0.21	7.3	NSL
2-NITROTOLUENE	88-72-2	ug/L	0.42	0.42	6.1	NSL
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	ug/L	0.21	0.21	7.3	NSL
HMX	2691-41-0	ug/L	0.42	0.42	180	NSL
NITROBENZENE	98-95-3	ug/L	0.21	0.21	0.35	NSL
NITROGLYCERIN	55-63-0	ug/L	21	21	0.37	NSL
RDX	121-82-4	ug/L	0.42	0.42	0.61	NSL
TETRYL	479-45-8	ug/L	0.42	0.42	15	NSL
TNT	118-96-7	ug/L	0.21	0.21	2.2	NSL
Surface water						
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	ug/L	0.21	0.21	1100	11
1,3-DINITROBENZENE	99-65-0	ug/L	0.21	0.21	3.7	20
2,4-DINITROTOLUENE	121-14-2	ug/L	0.21	0.21	73	310
2,6-DINITROTOLUENE	606-20-2	ug/L	0.21	0.21	37	81
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	ug/L	0.21	0.21	73	20
2-NITROTOLUENE	88-72-2	ug/L	0.415	0.415	61	750
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	ug/L	0.21	0.21	73	NSL
HMX	2691-41-0	ug/L	0.415	0.415	1800	330
NITROBENZENE	98-95-3	ug/L	0.21	0.21	3.5	6680
NITROGLYCERIN	55-63-0	ug/L	21	21	3.7	138
RDX	121-82-4	ug/L	0.415	0.415	6.1	190
TETRYL	479-45-8	ug/L	0.415	0.415	150	NSL
TNT	118-96-7	ug/L	0.21	0.21	22	90

Table 5-6
Non-Detection Concentrations and Screening Values for Human Health at Fort Lee MMRP FUDS

Analyte	Cas no.	Units	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	EPA Region III Screening Value [1]	Ecological Screening Value [2]
Inorganics						
ALUMINUM	7429-90-5	ug/L	5.5	5.5	37000	87
ANTIMONY	7440-36-0	ug/L	0.13	0.13	15	30
ARSENIC	7440-38-2	ug/L	1	1	0.45	5
CADMIUM	7440-43-9	ug/L	0.17	0.17	18	0.25
CHROMIUM	7440-47-3	ug/L	1.3	1.3	110	74
COPPER	7440-50-8	ug/L	0.43	0.43	1500	9
MERCURY	7439-97-6	ug/L	0.021	0.021	3.7	0.94
MOLYBDENUM	7439-98-7	ug/L	0.12	0.12	180	370
NICKEL	7440-02-0	ug/L	0.15	0.15	730	52
SELENIUM	7782-49-2	ug/L	0.75	0.75	180	71
SILVER	7440-22-4	ug/L	0.029	0.029	180	3.2
THALLIUM	7440-28-0	ug/L	0.074	0.074	2.6	NSL
VANADIUM	7440-62-2	ug/L	2.5	2.5	37	19

[1]USEPA Region III Risk Based (RBCs) Table, April 2007. For non-carcinogens, value shown is equal to 1/10 the residential soil RBC value. For carcinogens the value shown is equal to the residential soil RBC value. To account for sediment and surface water exposure, the resulting values have been increased by a factor of ten..

[2]Ecological Screening Value references are found in Table 5-6.

NSL = No Screening Level
mg/kg = milligram per kilogram
ug/L = microgram per liter
Yellow shaded analytes are those constituents associated with past munitions use.

TABLE 5-7
COMPARISON OF ON-SITE AND BACKGROUND SURFACE SOIL CONCENTRATIONS (MRS 1)
FORT LEE MMRP FUDS

		On-site				Background				Comparisons	
Chemical	Units	Minimum Concentration/Qualifier	Maximum Concentration/Qualifier	Mean Concentration	Detection Frequency	Minimum Concentration/Qualifier	Maximum Concentration/Qualifier	Mean Concentration	Detection Frequency	Site Maximum > Background Maximum	Site Mean > Background Mean
ALUMINUM	mg/kg	3940	10100	5600	7/7	1350	8200	3495	10/10	Yes	Yes
ANTIMONY	mg/kg	0.27 U	0.34 J/U	0.309	4/7	1.2	1.2	0.29	1/10	No	No
ARSENIC	mg/kg	0.84 J	3.6	1.44	7/7	0.9	10.9	3.08	10/10	No	No
BARIUM	mg/kg	20.6	148	46.1	7/7	6.1	31.1	19.4	10/10	Yes	Yes
BERYLLIUM	mg/kg	0.1 B	0.54	0.197	1/7	0.14	2.5	0.37	5/10	No	No
CADMIUM	mg/kg	0.021 U	0.18 J	0.0830	1/7	0.08	1.9	0.24	3/10	No	No
CALCIUM	mg/kg	50.9 J	1590	747	7/7	183	1240	442	10/10	Yes	Yes
CHROMIUM	mg/kg	3	12	5.93	7/7	1.2	4.8	3.2	10/10	Yes	Yes
COBALT	mg/kg	0.36	5.7	1.33	7/7	0.3	3.4	1.22	9/10	Yes	Yes
COPPER	mg/kg	1.5	7.7	2.97	7/7	1.6	7.4	3.4	10/10	Yes	No
IRON	mg/kg	2720 K	9680 K	4690	7/7	759	3850	2254	10/10	Yes	Yes
LEAD	mg/kg	8.7 /	49.2	16.9	7/7	8.8	21.7	14.9	10/10	Yes	Yes
MAGNESIUM	mg/kg	169	479	318	7/7	63.5	275	172	10/10	Yes	Yes
MANGANESE	mg/kg	26.6 K	851 K	165	7/7	6.2	41.9	22	10/10	Yes	Yes
MERCURY	mg/kg	0.013 J	0.051	0.0276	7/7	0.08	0.08	0.03	1/10	No	No
NICKEL	mg/kg	1.2	5.6	2.19	7/7	0.7	1.6	1.10	9/10	Yes	Yes
POTASSIUM	mg/kg	114	597	279	7/7	94.4	267	163.3	10/10	Yes	Yes
SELENIUM	mg/kg	0.23 U	0.48 J	0.351	3/7	0.39	4.3	1	5/10	No	No
SILVER	mg/kg	0.029 U	0.078 U	0.0440	0/7	0.39	2.1	0.35	2/10	No	No
SODIUM	mg/kg	63.4 B	115 B	88.2	0/7	314	450	381.20	10/10	No	No
THALLIUM	mg/kg	0.45 U	0.74 U	0.587	0/7	4.2	4.2	0.6	1/10	No	No
VANADIUM	mg/kg	8.5	25	12.9	7/7	6.3	17.2	9.89	10/10	Yes	Yes
ZINC	mg/kg	6.3	31.4	14.3	7/7	7.3	32.9	14.47	10/10	No	No

Source: Final Surface Soils Background Metals and Anthropogenic Pesticides Report, Fort Lee, Virginia, Revision No. 1 - January 1999, Table 3.1-1 Surface Soil Background Levels for TAL Metals.(Fluor Daniel 1999)
Qualifiers:
B = Value is less than the reporting limit (RL) but greater than the method detection limit (MDL).
J = Analyte is present. Reported value may not be accurate or precise.
K = Reported value may be biased high.
L = Reported value may be biased low.
U = Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
Yellow shaded analytes are those constituents associated with past munitions use.

TABLE 5-8
COMPARISON OF ON-SITE AND BACKGROUND SURFACE SOIL CONCENTRATIONS (MRS 2)
FORT LEE MMRP FUDS

		On-site				Background				Comparisons	
Chemical	Units	Minimum Concentration/Qualifier	Maximum Concentration/Qualifier	Mean Concentration	Detection Frequency	Minimum Concentration/Qualifier	Maximum Concentration/Qualifier	Mean Concentration	Detection Frequency	Site Maximum > Background Maximum	Site Mean > Background Mean
ALUMINUM	mg/kg	1640 K	9670 K	4810	22/22	1350	8200	3495	10/10	Yes	Yes
ANTIMONY	mg/kg	0.25 UL	1.1 B	0.530	10/22	1.2	1.2	0.29	1/10	No	Yes
ARSENIC	mg/kg	0.61 B	3.1 L	1.63	19/22	0.9	10.9	3.08	10/10	No	No
BARIUM	mg/kg	9.8	128	49.5	22/22	6.1	31.1	19.4	10/10	Yes	Yes
BERYLLIUM	mg/kg	0.042 J	0.7	0.223	17/22	0.14	2.5	0.37	5/10	No	No
CADMIUM	mg/kg	0.021 U	0.72 J	0.138	8/22	0.08	1.9	0.24	3/10	No	No
CALCIUM	mg/kg	66.8 B	3910	1050	21/22	183	1240	442	10/10	Yes	Yes
CHROMIUM	mg/kg	1.9	18.8	7.51	22/22	1.2	4.8	3.2	10/10	Yes	Yes
COBALT	mg/kg	0.041 U	8.3	1.5	19/22	0.3	3.4	1.22	9/10	Yes	Yes
COPPER	mg/kg	1.4	69.9	8.5	22/22	1.6	7.4	3.4	10/10	Yes	Yes
IRON	mg/kg	1590 K	22300 K	5880	22/22	759	3850	2254	10/10	Yes	Yes
LEAD	mg/kg	10.4	1390	96.8	22/22	8.8	21.7	14.9	10/10	Yes	Yes
MAGNESIUM	mg/kg	84.2	919	294	22/22	63.5	275	172	10/10	Yes	Yes
MANGANESE	mg/kg	9.3	645	160	22/22	6.2	41.9	22	10/10	Yes	Yes
MERCURY	mg/kg	0.018 J	0.76	0.112	22/22	0.08	0.08	0.03	1/10	Yes	Yes
NICKEL	mg/kg	0.57 J	6.9	2.47	22/22	0.7	1.6	1.10	9/10	Yes	Yes
POTASSIUM	mg/kg	76.1	647	245	22/22	94.4	267	163.3	10/10	Yes	Yes
SELENIUM	mg/kg	0.28 U	1 J	0.486	11/22	0.39	4.3	1	5/10	No	No
SILVER	mg/kg	0.036 U	0.47 J	0.0655	1/22	0.39	2.1	0.35	2/10	No	No
SODIUM	mg/kg	78.7 B	142 B	96.7	1/22	314	450	381.20	10/10	No	No
THALLIUM	mg/kg	0.55 U	1 U	0.700	0/22	4.2	4.2	0.6	1/10	No	No
VANADIUM	mg/kg	6.5	49.8	16.6	22/22	6.3	17.2	9.89	10/10	Yes	Yes
ZINC	mg/kg	3.8	205	28.5	22/22	7.3	32.9	14.47	10/10	Yes	Yes

Source: Final Surface Soils Background Metals and Anthropogenic Pesticides Report, Fort Lee, Virginia, Revision No. 1 - January 1999, Table 3.1-1 Surface Soil Background Levels for TAL Metals.(Fluor Daniel 1999)
Qualifiers:
B = Value is less than the reporting limit (RL) but greater than the method detection limit (MDL).
J = Analyte is present. Reported value may not be accurate or precise.
K = Reported value may be biased high.
L = Reported value may be biased low.
U = Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
Yellow shaded analytes are those constituents associated with past munitions use.

6. SUMMARY AND CONCLUSIONS

6.0.1 Fort Lee was an active military training site during WWI and WWII. Two MRSs were identified at the site and were addressed in this SI, consistent with the MMRP Inventory in the DERP Fiscal Year 2005 Annual Report to Congress (DoD 2005). The two identified ranges (see Table 2-1) are:

- MRS 1 – WWI/WWII Small Arms Ranges
- MRS 2 – Trench Training Area

6.0.2 A summary of the results and conclusions, by MRS, is presented below and included in Table 6-1.

6.1 WWI/WWII Small Arms Ranges (MRS 1)

6.1.1 MRS 1 consists of approximately 784 acres (not all of which are within the FUDS boundary). No MEC or MD has been reported as being found in this area. Qualitative reconnaissance covered approximately 2 acres of MRS 1 during the SI. No MEC, MD, or subsurface anomalies were identified. The former range area is comprised of residential areas and open terrain which surrounds the correctional facilities. There are no fences restricting access in this MRS. The overall MEC risk is considered low. Neither a TCRA nor an NTCRA was determined to be necessary for this MRS.

6.1.2 None of the MC for MRS 1 were identified as COPCs/COPECs exceeding background concentrations in the human health and ecological screening assessments. Based on these screening results, all pathways to all receptors are considered incomplete for MRS 1.

6.2 Trench Training Area (MRS 2)

6.2.1 MRS 2 consists of approximately 1,276 acres and is situated between Petersburg and the active Fort Lee. MEC and MD were historically discovered in MRS 2 including a dummy hand grenade, a live shell dating back to the Civil War era, a live WWI artillery shell, and small arms casings. Qualitative reconnaissance covered approximately 47.6 acres of MRS 2 during the SI. During SI reconnaissance no MEC was found, but suspect MD from a flare and grenade spoon were observed. Additionally, numerous subsurface anomalies were identified in a reported MPPEH burial area. This site is Petersburg National Battlefield, which is maintained by the NPS. The park is open to the public, and by vehicle, park access is limited to the hours of 9 a.m.

to 5 p.m. (7 days a week). The overall MEC risk is considered low to moderate. Neither a TCRA nor NTCRA was determined to be necessary for this MRS.

6.2.2 Of the samples collected from each media (including soil, sediment, surface water, and groundwater) only one MC (lead) for surface soil was reported as exceeding background concentrations and human health and ecological screening criteria and was identified as a COPC and COPEC at MRS 2. Three MC in MRS 2 (antimony, copper, and zinc) were reported as exceeding ecological screening criteria for surface soil however site concentrations of these metals were similar to background soil concentrations. Based on these results, the surface soil pathways are complete for all human and ecological receptors. Based on the lack of source, the other pathways/receptors are considered incomplete for MRS 2.

Table 6-1. Summary of Human Health and Ecological Screening-Level Risk Assessment Results.

Medium of Concern	Human Health COPCs[1]		Ecological COPECs (SLERA)[2]	
	MRS 1. WWI/WWII Small Arms Ranges	**MRS 2. Trench Training Area**	**MRS 1. WWI/WWII Small Arms Ranges**	**MRS 2. Trench Training Area**
Groundwater	Not Evaluated.	No exceedances of EPA Region III screening values.	Not Evaluated.	No exceedances of ecological screening values.
Surface Water	Not Evaluated.	No exceedances of EPA Region III screening values.	Not Evaluated.	No exceedances of ecological screening values.
Sediment	Not Evaluated	No exceedances of EPA Region III screening values.	Not Evaluated.	No exceedances of ecological screening values.
Surface Soil	No exceedances of EPA Region III screening values.	One exceedance (lead) of EPA Region III screening values, which was above background concentrations and selected as a COPC.	Two exceedances (antimony and lead) of ecological screening values. Not above background /Not COPECs.	Four exceedances (antimony, copper, lead, and zinc) of ecological screening values. Only copper, lead and zinc were above background and selected as COPECs.

1. For the Human Health Risk Screen, EPA Region III RBC screening values were used for soil, sediment, surface water, and groundwater comparisons. See Tables 5-1 through 5-4 for the screening values.
2. For Ecological Risk Screen, the screening values identified in Tables 5-5 were applied.

7. RECOMMENDATIONS

7.0.1 The Fort Lee FUDS has two designated MRSs, and the recommendations for these MRSs are presented below:

7.0.2 ***MRS 1 – WWI/WWII Small Arms Ranges:*** MRS 1 historically was used as a buffer zone for the small arms range and MEC risk is considered low. NDAI is recommended for MEC and MC based on the following rationale: the human health and ecological risk screening assessments did not identify any immediate risk from MC and no MEC or MD has been found at MRS 1.

7.0.3. The boundary and acreage of MRS 1 in the ASR Supplement should be reviewed and possibly revised. The ASR Supplement notes that there are 748 acres associated with this range; however, this acreage does not accurately define the FUDS eligible acreage that comprises MRS 1. This acreage took into account several parcels of the WWI/WWII Small Arms Ranges (MRS 1) that currently are part of the active DoD installation of Fort Lee. Additionally, part of the acreage for MRS 1 is outside the FUDS boundary.

7.0.4 ***MRS 2 – Trench Training Area:*** MRS 2 was historically used by the DoD as a trench training area and MEC risk is considered low to moderate. An RI/FS is recommended for MEC and MC in MRS 2 based on the following rationale: Human health and ecological risk screening assessments identified lead as a COPC exceeding background concentrations, and copper, lead, and zinc as COPECs exceeding background concentrations in soil, both MEC and MD have been found at MRS 2, suspect MD was observed in MRS 2, and numerous subsurface anomalies were identified in a reported MPPEH burial area.

7.0.5 A TCRA/NTCRA is not recommended for either of the MRSs addressed in this SI.

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APPENDIX A - SCOPE OF WORK

Located on CD.

APPENDIX B - TPP MEMORANDUM

- TPP Memorandum (Located on CD)
- DQO Verification Worksheets (Located on CD)

APPENDIX C - INTERVIEW DOCUMENTATION

Appendix not used.

APPENDIX D - FIELD NOTES AND FIELD FORMS

- Daily Quality Control Reports
- Logbook
- Fieldsheets
- Chains of Custody

Field Log Book For the Site Inspection at Fort Lee

"Rite in the Rain"®
ALL-WEATHER
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No. 550F

MMRP FUDS –
C03VA002701

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

ALL-WEATHER

ENVIRONMENTAL FIELD BOOK

Name Ivy Able & Stu Carr

Address 15 Lavetan Circle
Sparks, MD 21152

Phone 410-329-5114

Project MMRP FHDS - Fort Lee
C03VA002701
QC'd by Mark O'Neill

This book is printed on "Rite in the Rain" All-Weather Writing Paper - A unique paper created to shed water and enhance the written image. It is widely used throughout the world for recording critical field data in all kinds of weather. For best results, use a pencil or an all-weather pen.

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CONTENTS

Reference Page Index

Location Fort Lee Date 2/12/07

Project / Client C03VA002701 / USACE

0730 Field team met up and reviewed the planned activities for the day. Conducted a safety meeting with:

Stu Carr
Ivy Able
Mike O'Neill
Sarah Moore
delyn Alumbaugh

The Site specific APP was reviewed.

0800 Field team went to the northern portion of Fort Lee (near the FCI & RRJ) to get an idea of how to access the sample points.

Part of the Team (Mike O & Stu Carr) met with Tim Thompson (CENHO) from USACE and Ms. Julie Steele from NPS. The Alion team discussed sampling locations & access to sample locations. The NPS told Alion that travel was restricted to roads & paths and gave Alion the ROE. Alion & Tim Thompson left.

by M Allen Stu

Location Fort Lee Date 2/12/07

Project / Client C03VA002701 / USACE

1000 Benchmarked GPS unit garmin reading = 37° 13' 50.5" N
77° 24' 13.3" W

and a trimble reading (HAND Held GPS [HH GPS])
37° 13' 50.839" N
77° 24' 13.164" W

1100 Conducted 2nd safety meeting with entire group including discussion regarding archeological concerns (Additional personnel included Tim Thompson & Jeff Zoeckler)
- reviewed safety plan
- reviewed possible munitions
- reviewed weather concerns

1130 Started recon in the training trench area as field team "meandered" to the first sampling location. Several anomalies were noted on the way to the sampling point:
Used handheld GPS unit to log locations

by M Allen Stu

Location Fort Lee Date 2/12/07

Project / Client C03VA002701/USACE

- anomalie noted next trench training area logged as (C1) (waypoints)
- anomalie (C2) - large
- anomalie (C3)
- anomalie (C4)

1215 Collected soil sample (7 wheel) Composite in trench bottom located at:
37°14'20.865 N
77°21'18.984 W
soil; moist sandy loam, with high organics
sample: FLE-TT-SS-02-11
+ QA sample

1250 Collected soil sample FLE-TT-SS-02-10 (Composite 7 wheel) in trench, at:
37°14'15.361 N
77°21'15.506 W
Soil - dark brown, v. moist with sand & clay, high organics

by M Allen Stte

Location Fort Lee Date 2/12/07

Project / Client C03VA002701/USACE

1315 Collected sample (Composite 7-wheel)
FLE-TT-SS-02-09
291054 N (UTM)
4123784 E
- in trench area, near an anomalie

1410 - anomalie noted on surface in the field, possible MD - flare? (waypt [WP] 013) [WP-13]

1425 - collected soil sample FLE-TT-SS-02-07 at the following:
291193 N (UTM)
4123421 E
South of magazine

1440 collected soil sample FLE-TT-SS-02-08 + FD #3
291213 N (UTM)
4123457 E
- North of magazine, down gradient
- dark soil, with high organics

by M Allen Stte

Location Fort Lee Date 2/12/07

Project / Client ... C03VA002701/USACE

1530 Collected sediment (discrete) sample at pond
FLE-TT-SD-02-01
291140N/4122636E

1540 Collected surface water discrete sample FLE-TT-SW-02-01
+QA + FD #4
Water Readings:
pH: 6.79
temp: 51.0F
turb.: 6.8 NTU
cond: 36 mS/cm
ORP: 118.0
DO: 12.39 mg/L
-sample was collected from small creek emptying into the pond (note: the pond was mostly dried up, very small in size compared to what it appeared to have been)
291160/4122644

hr M Atr Stn

Location Fort Lee Date 2/12/07

Project / Client C03VA002701/USACE

1600 Anomalies noted (waypoint #20) near manholes
Collected soil samples
FLE-TT-SS-02-17
in depressed area, low lying, near anomalies
-dark soil w/ high organics

1615 collected soil samples near trenches, possible dump area, pipes nearby (general debris)
FLE-TT-SS-02-18
291067 ~~290911~~
4122735 ~~4122810~~
collected samples at 290926 4122821 #17

1650 collected soil sample at 291929 4122962
FLE-TT-SS-02-06
-dark soil w/ high organics

hr M Atr Stn

Location Fort Lee Date 2/12/07

Project / Client CO3UA002701/USACE

1700 • Filtered sw sample back at the suburban, using a 0.45 micron filter.
• Packed up samples w/ ice & stored them in coolers
• Discussed the next day's sampling plan & reviewed general location of the 1st groundwater sample.

Note: All samples moved in accordance with SS-WP. Locations were selected based on site conditions and meandering geophysics. All Soil Samples were 7-wheel composite samples.

NO Archeological features identified or impacted.

Jay M Stu

Location Fort Lee Date 2/13/07

Project / Client CO3UA002701/USACE

745 Benchmarked both GPS unit.
Trimble 37 13 50.844
77 24 13.066
Garmin 37 13.845
77 24.221
at Petersburg Courthouse Tower,
checked within a meter

830 Conducted safety meeting with: Stu Cerr
Jay Able Tim Thompson
Sarah Moore Andrew Knickerbocker
Mike O'Neil
delyn Al.

900 Mobilized to the first Geoprobe location (near a possible disposal area). Conducted avoidance reconnaissance in the area to confirm location of disposal areas. Many subsurface anomalies noted.

Jay M Stu

Location Fort Lee Date 2/13/07
Project / Client C03VA002701 / USACE

910 Geophysical near possible disposal area at the following location:
371357.672N
772150.786 W
Note - hand augered 1st 6 feet for anomaly avoidance & to clear potential utilities
915 Collected soil sample near possible disposal area Alot of subsurface Anomalies noted.
7-wheel Composite FLE-TT-SS-02-01
+ FD #2
- many anomalies nearby which were logged in GPS unit.
Historic Trash dump
WWI ?
37°13'47".227N
77°21'59".132W
(2) Syracuse Note/Ware
drink bottle
Medecine
bottles
4122984.92N
290186.79 E
4123291
290230
by M R Ste

Location Fort Lee Date 2/13/07
Project / Client C03VA002701/USACE

Walked around to sample
Location FLE-TT-SS-02-05
Nothing noted in target area.
Found several small craters which could be related to fallen trees or potentially civil war ordnance impact areas. identified suspect railroad bed. Identified trash dump with various objects (previous page). Continued walking in general area of proposed sample location.
No subsurface anomalies noted
No surface evidence of MEC or MD was observed.
1000 Collected sample FLE-TT-GW-20-02
by M R Ste

Location Fort Lee Date 2/13/07

Project / Client C03UA002701 / USACE

Sample
FLE-TT-SS-02-05
4122944.32 N
290155.90 E

Collected at 10:10am in suspect Civil War bomb crater (one of 2 Bomb craters seen)

Moved on to Find Sample location FLE-TT-SS-02-04

~~Had to offset~~ from Eagle protection area. No access to Eagle area from multiple routes so sample was relocated. WP # 013 (H Held GPS)

Sample 4122640.01
289660.15
FLE-TT-SS-02-04 Time 1058

Collected sample downgradient of/ Fortification in crater area. other craters in Area no subsurface hits in Area Near tour Stop #6 Fort Haskell.

by M Ahern Stte

Location Fort Lee Date 2/13/07

Project / Client C03UA002701 / USACE

1200 Installed perz. using geophone near trench training area, low lying spot

1240 collected FLE-TT-GW-20-01 located at 0290966
4123868
+ collected rinse blank

1330 Scrap metal noted at waypoint ~~#3~~ ~~290446~~ #4
2/13 ~~4122481~~

misc. metal wires noted throughout the area

1415 collected sample FLE-TT-SS-02-20 at the following locations
291075
4122484
New specified sample location, in low lying area

by M Ahern Stte

12 14

Location Fort Lee Date 2/13/07

Project / Client C03VA002701/USACE

1450 Collected soil sample FLE-TT-SS-02-13 near small depressions in ground (possible fox holes from civil war or depression from bombing)

290094
2/2/1980

1530 Collected soil sample FLE-TT-SS-02-02 + QA from the following location

289580
4121795

- open field near Taylor House (Room Civil War)
- no anomalies noted in or around sample location

M M Hm Stte

15 Location Fort Lee Date 2/13/07

Project / Client C03VA002701/USACE

1545 Collected soil sample FLE-TT-SS-02-03

289752
4121710

- near Fort Norton ~~area~~ 2/13 activity areas

1610 Collected soil sample FLE-TT-SS-02-16 at the following location

290862
4124545

- From northern area w/ significant Civil War activity

1630 Collected sample FLE-TT-SS-02-14 near numerous 10+ anomalies in an area w/ diameter of 30 ft; lowlying area near civil war activities

291023
4124775

(bottom of trenches)

by M Hm Stte

Location Fort Lee Date 2/13/07

Project / Client COSVA00 2701 / USACE

1705 Collected soil sample FLE-TT-SS-02-12 from following location: 291001 4124909 - high organics, v. moist - no anomalies noted

1715 Collected soil sample FLE-TT-SS-02-13 from following location: 291055 4124798 - high organics, v. moist - no anomalies noted

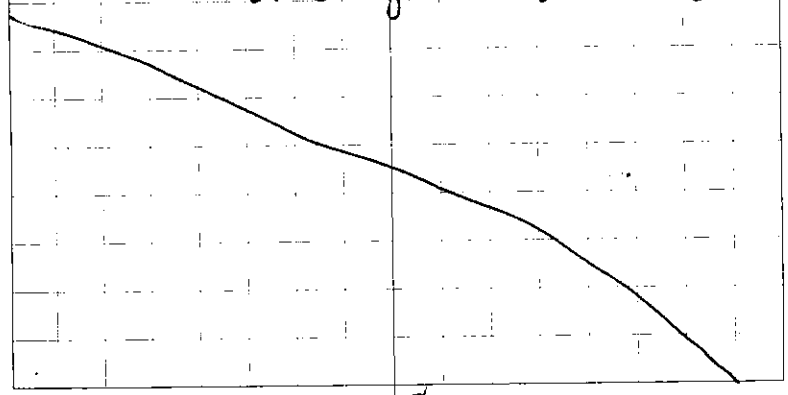
1740 Collected soil sample FLE-TT-SS-02-15 from following location: 291176 4124541 - high organics, v. moist - no anomalies noted in or/around sampling area

by M Ann Stu

Location, Fort Lee Date 2/13/07

Project / Client COSVA002701 / USACE

1745 Loaded up suburban, packed samples, etc. Note: All of the previous five samples FLE-TT-SS-02-16, FLE-TT-SS-02-14, FLE-TT-SS-02-12, FLE-TT-SS-02-13, FLE-TT-SS-02-15 were collected in areas of historic civil war combat were taken place. These samples were located just off the main paths maintained by the NPS in an effort to avoid groomed areas.



by M Ann Stu

Location Fort Lee Date 2/14/07

Project / Client C03VA002701 / USACE

645 Benchmarked the GPS units at the Petersburg Courthouse Tower
Trimble: 37 13 50.822
77 24 13.009
Garmin 37 13.849
77 24.219

730 Conducted safety meeting with: Duy Abe
Sarah Moore
Stu Carr
- reviewed safety concerns and planned field activities for the day

8:00 met up with Mr. Steven Jablonski (property manager) to review sample locations & possible access points. He provided field team with an escort to areas behind the prisms - Mr. Bill Wilmoth. Meandering was minimized due to property status (prism) & escorts time constraints

by M Stu

Location Fort Lee Date 2/14/07

Project / Client C03VA002701 / USACE

830 Collected soil sample FLE-RR-SS-02-02 + QA
- at the following location:
292279
4131766 detector
- used an all metals ✓ 2/14
no anomalies noted ~~work~~ DA
DA 2/14 ~~not~~ on the path to sample or near sample

905 Collected soil sample FLE-RR-SS-02-01 + FD #1
in forested area back by Appomattox River
at the following location:
292046
4131910
- again no anomalies were noted (some metal debris such as wire/trash was identified on surface)
- all metals detector was used
- no remnants of a camel war Part identified

by M Stu

20

Location Fort Lee Date 2/14/07

Project / Client C03VA002701 / USACE

940 Collected soil sample FLE-RR-SS-02-06 at the following location:
2911721
4130192
- soil v moist due to rains, silty, w/clay & organics

1035 Collected soil sample FLE-RR-SS-02-03 at the following location:
2925799
4130691
- soil v. moist, silty w/clay & organics

1100 Collected soil sample FLE-RR-SS-02-04 at the following location:
2923578
4130639
- soil v. moist, silty w/clay and organics

by M Ann Stc

21

Location Fort Lee Date 2/14/07

Project / Client C03VA002701 / USACE

1115 Collected soil sample FLE-RR-SS-02-05 at the following location:
2911998
4130550
(Former cow pasture area according to Mr. Bill Wilmoth who has worked/lived in the area for 20+ years)

Additional Notes:
- Samples FLE-RR-SS-02-02, FLE-RR-SS-02-03, FLE-RR-SS-02-04 were all collected from areas that appeared to have been farmed (possibly for soy beans?)
- Sample FLE-RR-SS-02-06 was located near an old cemetery used for enslaved prisoners of TA 2/14

by M Ann Stc

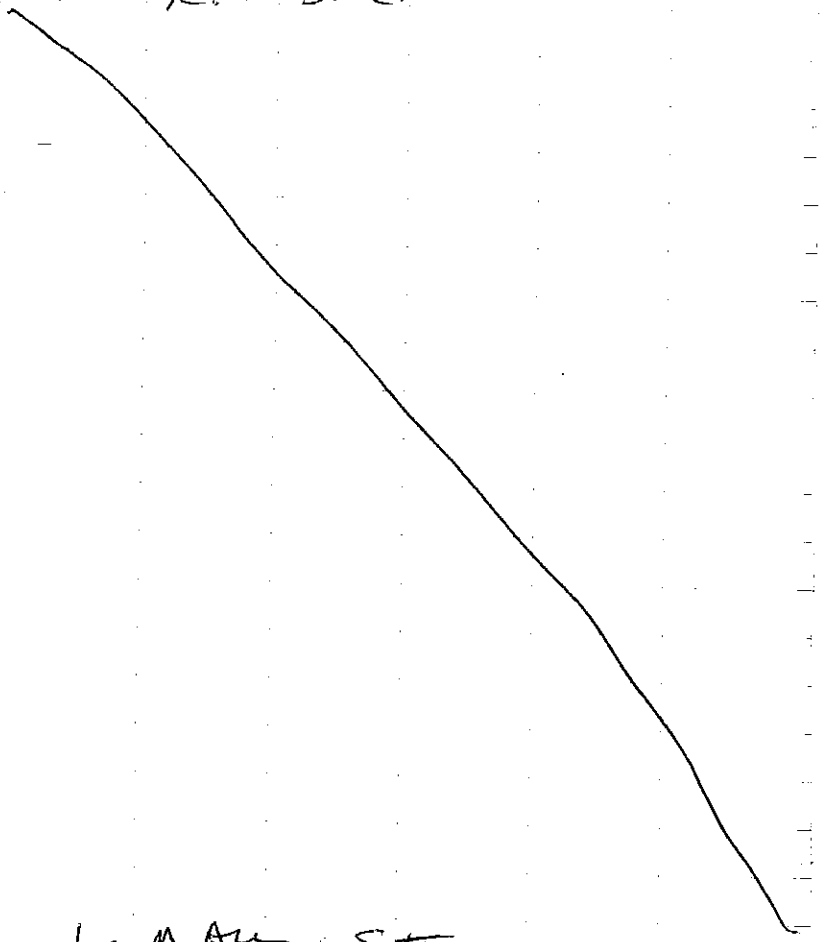
22

Location Fort Lee Date 2/14/07

Project / Client C03VA002701 / USACE

- No anomalies noted, work on all metals detectors.

1200 Packed up samples & left site.



by M Allen Sta

23

Location _____ Date _____

Project / Client _____

Alion Science and Technology, Inc.

DAILY QUALITY CONTROL REPORT

Report Number: 2-13-07-01		**Date:** 2-13-07	
Project Name: Fort Lee C03VA002701		**Contract Number:** W912DY-04-D-0017	
Location of Work: Petersburg, Virginia			
Description of Work: Meandering path geophysical reconnaissance and sampling.			
Weather: Rainy, Cold, Windy	**Rainfall:** <1 inch	**Temperature:** **Min.** 28	**Max.** 40
			Wind Chill = none

1. Work performed today by Alion Team.

Health and Safety briefing for the team. Recorded anomaly counts, locations, descriptions, if present while performing reconnaissance (meandering paths) and sample collection. Used a Geoprobe to install two temporary wells for the collection of groundwater samples.

Reconnaissance Acreage / Discussion:

Reconnaissance was conducted in the meandering path fashion. Travel paths varied from the geophysical site reconnaissance figures in the SS-WP due to natural terrain and the addition of more reconnaissance to try and verify sample locations.

Samples Collected:

FLE-TT-GW-20-01	FLE-TT-GW-20-02	FLE-TT-SS-02-01
FLE-TT-SS-02-04	FLE-TT-SS-02-05	FLE-TT-SS-02-19
FLE-TT-SS-02-20	FLE-TT-SS-02-02	FLE-TT-SS-02-02-QA
FLE-TT-SS-02-03	FLE-TT-SS-02-16	FLE-TT-SS-02-14
FLE-TT-SS-02-12	FLE-TT-SS-02-13	FLE-TT-SS-02-15
Field Duplicate #2		

Field Tests:

Schonstedt checked ok.

Trimble-Benchmark confirmed to be within 1 meter. Handheld GPS benchmarked at the Petersburg Courthouse Tower; 37 13 50.84740 (N) 077 24 12.84699 (W).

Calibration of Instruments:

YSI Calibrated. See field sheet.

Other:

None.

2. Work performed today by other subcontractors.

ARM Geophysics provided drilling/Geoprobe services. Two temporary wells were installed.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to Fort Lee in Virginia. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

YSI readings for the stabilization of groundwater samples FLE-TT-GW-20-01 and FLE-TT-GW-20-02 were

were recorded. See attached Well Purging and Sampling Records.

5. List material and equipment received.

None.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No safety violations.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

Worked with ARM Geophysics to install two temporary wells to collect groundwater samples. Performed meandering path geophysical reconnaissance in and around areas where there were intense Civil War activities took place, where a suspected burial site was reported (near the NPS maintenance building in central part of the site-this area contained numerous anomalies but no obervations of MEC/MD), near where the Taylor House (from Civil War) was located, Fort Morton, and near Battery Lines from Opposing Armies from the Civil War. Surface soil and groundwater samples were collected in these areas in the general vicinity of predetermined sample locations. The groundwater temporary well location had to be moved due to access issues. The wells were located in accessible areas downgradient of the WWI trench area and the suspect MEC/MD disposal area. One sample, FLE-TT-SS-02-04, was significantly moved from its predetermined location. The only way to access this sample location would have been to traverse an eagle's nesting area; therefore, the sample was moved to the south near another fortification in an area with suspect impact craters. No health and safety issues and/or violations occurred during field work. No DOD related MEC or MD was found during geophysical reconnaissance or sampling activities. As was previously mentioned, the only deviations from the work plan included adjustments to sample locations.

Note: The soil/sediment sample analysis method specified for mercury in the SS-WP was 7471B. This has been changed to 7471A.

Alion Science and Technology, Inc's Verification: On behalf of Alion, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

Alion Science and Technology, Inc.

DAILY QUALITY CONTROL REPORT

Report Number:	2-12-07-01	**Date:** 2-12-07	
Project Name:	Fort Lee C03VA002701	**Contract Number:** W912DY-04-D-0017	
Location of Work:	Petersburg, Virginia		
Description of Work:	Meandering path geophysical reconnaissance and sampling.		
Weather:	Clear and Sunny, Cold, Windy	**Rainfall:** none	**Temperature:** **Min.** 29 **Max.** 53 Wind Chill = none

1. Work performed today by Alion Team.

Meeting with project team to go over site rules/proceedures for accessing sampling locations. Meeting with National Park Service (NPS) Personnel and USACE archeologist to go over sampling procedures.

Health and Safety briefing for the team including USACE personnel. Recorded anomaly counts, locations, Descriptions (if appropriate), while performing reconnaissance (meandering paths) and sample collection.

Reconnaissance Acreage / Discussion:

Reconnaissance was conducted in the meandering path fashion. Travel paths varied from the geophysical site reconnaissance figures in the SS-WP due to natural terrain and the addition of more reconnaissance to try and verify sample locations.

Samples Collected:

FLE-TT-SS-02-10	FLE-TT-SS-02-09	FLE-TT-SS-02-08
FLE-TT-SS-02-07	FLE-TT-SS-02-06	FLE-TT-SS-02-17
FLE-TT-SS-02-18	FLE-TT-SS-02-11	FLE-TT-SS-02-11-QA
FLE-TT-SD-02-01	FLE-TT-SW-00-01	FLE-TT-SW-00-01-QA
Field Duplicate #3	Field Duplicate #4	

Field Tests:

Schonstedt checked ok.

Trimble-Benchmark confirmed to be within 1 meter. Handheld GPS also benchmarked. Benchmark location Petersburg Courthouse Tower; 37 13 50.84740 (N) 077 24 12.84699 (W).

Calibration of Instruments:

YSI Calibrated. See field sheet.

Other:

None.

2. Work performed today by other subcontractors.

None.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to Fort Lee in Virginia. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

YSI Readings for surface water sample FLE-TT-SW-00-01

T = 51.08 °F, pH =6.79, turbidity = 6.8 NTU,

conductivity = 26 mS/cm.

5. List material and equipment received.

None.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No safety violations.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

Performed meandering path geophysical reconnaissance in and around the trench training area, a WWI magazine, earth disturbance areas in the southeastern part of the battlefield, and near several WWI manholes and pond area. Surface soil, sediment, and surface water samples were collected in these areas in the general vicinity of predetermined sample locations. No health and safety issues and/or violations occurred during field work. No DOD related MEC was found during geophysical reconnaissance or sampling activities. A suspect flare identified to be expended (MD), was located during the meandering path geophysical reconnaissance southwest of the WWI magazine. Pictures of the suspect flare were taken, GPS location and coordinates marked, and its description was recorded in the field log book. Unknown deteriorated metal pieces, speculated to be pieces of the spoon assembly from a handgrenade were also observed near the WWI magazine. Deviations from the work plan included typical minor adjustments to sample locations due to site conditions and the fact that no evidence of MEC/MD was noted in some areas.

Note: The soil/sediment sample analysis method specified for mercury in the SS-WP was 7471B. This has been changed to 7471A in accordance with the latest analytical procedures.

Alion Science and Technology, Inc's Verification: On behalf of Alion, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

Alion Science and Technology, Inc.

DAILY QUALITY CONTROL REPORT

Report Number:	2-14-07-01	**Date:** 2-14-07	
Project Name:	Fort Lee C03VA002701	**Contract Number:** W912DY-04-D-0017	
Location of Work:	Petersburg, Virginia		
Description of Work:	Meandering path geophysical reconnaissance and sampling.		
Weather:	Cloudy, Cold, Windy	**Rainfall:** none	**Temperature:** **Min.** 28 **Max.** 40 Wind Chill = none

1. Work performed today by Alion Team.

Health and Safety briefing for the team. Recorded anomaly counts, locations, descriptions, if present while performing reconnaissance (meandering paths) and sample collection.

Reconnaissance Acreage / Discussion:

Reconnaissance was conducted in the meandering path fashion. Travel paths varied from the geophysical site reconnaissance figures in the SS-WP due to natural terrain. General meandering around the site was limited due to the current status of the site, which is comprised of a Federal Correctional Institution and the Riverside Regional Jail.

Samples Collected:

FLE-RR-SS-02-01	FLE-RR-SS-02-02	FLE-RR-SS-02-03
FLE-RR-SS-02-04	FLE-RR-SS-02-05	FLE-RR-SS-02-06
FLE-RR-SS-02-02-QA	Field Duplicate #1	

Field Tests:

Schonstedt checked ok.

Trimble-Benchmark confirmed to be within 1 meter. Handheld GPS benchmarked at the Petersburg Courthouse Tower; 37 13 50.84740 (N) 077 24 12.84699 (W).

Calibration of Instruments:

None.

Other:

None.

2. Work performed today by other subcontractors.

None.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to Fort Lee in Virginia. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

None.

5. List material and equipment received.

None.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No safety violations.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

Performed limited meandering path geophysical reconnaissance in and around an area where a former Civil War Fort was suspected (no evidence of a fort was observed) and in the safety zone established for the small arms range formerly located on the Fort Lee FUDS. Surface soil samples were collected in these areas in the general vicinity of predetermined sample locations. No health and safety issues and/or violations occurred during field work. No DOD related MEC or MD was found during geophysical reconnaissance or sampling activities. The only deviations from the work plan included minor adjustments to sample locations.

Note: The soil/sediment sample analysis method specified for mercury in the SS-WP was 7471B. This has been changed to 7471A.

Alion Science and Technology, Inc's Verification: On behalf of Alion, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Curtis Mitchell
Quality Control System Manager

SITE ENTRY AND EXIT LOG

Project/Site : Fort Lee (FUDS)
Project No. : 6202301.0012

Date	Name	Representing	Time In	Time Out
2/12/07	Ivy Able	EA	1100	1745
2/12/07	delyn Humbaugh	EA	1100	1745
2/12/07	Timothy Thompson	Norfolk USACE	1100	1745
2/12/07	Jeff Zoeckler	NORFOLK USACE	1100	1400
2/12/07	Sarah Moore	ALION/HFA	1100	1745
2-12-07	Stuart Carr	HFA	1100	1745
2/12/07	Michael O'Neill	EA	1100	1745
2/13/07	Andrew Knickerbocker		8:30	1315
2/13/07	Sarah Moore	ALION/HFA	8:30	1750
2/13/07	Ivy Able	EA	8:30	1750
2-13-07	Stuart Carr	HFA	0830	1750
2/13/07	Michael O'Neill	EA	0830	1200
2/17/07	delyn Humbaugh	EA	0830	1200
2/17/07	Timothy Thompson	USACECENAO	0830	1750
2/14/07	Ivy Able	EA	0745	1200
2/14/07	Sarah Moore	ALION/HFA	0745	1200
2 14 07	Stuart Carr	HFA	0745	1200

HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: Fort Lee (FUDS)

Project No. 6202301.0012

I have read the Health and Safety Plan (s) and have been briefed on the nature, level, and degree of exposure likely as a result of participation of field activities. I agree to conform to all the requirements of this Plan.

Name	Signature	Affiliation	Date
Ivy Able	Ivy M Able	EA	2/12/07
Delyn Humbaugh	Delyn Humbaugh	EA	2/12/07
Sarah Moore	Sarah Moore	ALION	2/12/07
STUART CARR	Stuart Carr	HFA	2·12·07
Michael CNeill	Michael ONeill	EA	2/12/07
Jeff Zoecklein	Jeff Zoecklein	USACE - NAO	2/12/07
Timothy Thornton	Timothy Thornton	Norfolk USACE	2/12/07
Andrew Kwiatkowski	Andrew Kwiatkowski	ARCH Group	2/13/07
~~Sarah Moore~~	~~Sarah Moore~~	~~ALION/HFA~~	~~2/13/07~~
~~Ivy Able~~			

WELL PURGING AND SAMPLING RECORD

WELL ID N/A SAMPLE NO. FLE-TT-GW-20-02
WELL/SITE DESCRIPTION Near possible disposal area

DATE 2/13/07 TIME 935 AIR TEMP. 40°F

WELL DEPTH 9.35 ft CASING HEIGHT 2.10 ft
WATER DEPTH 4.1 ft WELL DIAMETER 1.0 in
WATER COL. HEIGHT ft SANDPACK DIAM. in
EQUIVALENT VOLUME OF STANDING WATER (gal) (L)
PUMP RATE (gpm) (LPM)
PUMP TIME min
WELL WENT DRY? ( ) Yes ( ) No PUMP TIME min
VOL. REMOVED (gal) (L) RECOVERY TIME min
PURGE AGAIN? ( )Yes ( ) No TOTAL VOL. REMOVED (gal) (L)

removed 2gal +

Date	Time	Volume Removed Unit: L	pH	Cond. mS/cm	Temp. °F	ORP	Turb. NTU	DO mg/L	Depth to Water from TOC	Pump Rate L/min
2/13/07	940		6.27	213	52.63	53.3	10.76	1.46	4.1	1
	944	4	6.30	214	52.52	-54.2	354	0.27		1
	948	8	6.31	216	52.52	-79.9	240	0.23		1
	952	12	6.32	216	52.53	-126.5	112	0.26		1
	956	16	6.33	216	52.52	-121.3	43	0.24		1
	1000	20	6.33	217	52.53	-126.1	39	0.26		1

COMMENTS Collected sample at 10:00

SIGNATURE

WELL PURGING AND SAMPLING RECORD

WELL ID N/A SAMPLE NO. FLE-TT-GW-[illegible]-01

WELL/SITE DESCRIPTION Near trench training area

DATE 2/13/07 TIME 1200 AIR TEMP. 40°F

WELL DEPTH 16.42 ft CASING HEIGHT 2.2 ft

WATER DEPTH 11.85 ft WELL DIAMETER 1.0 in

WATER COL. HEIGHT _____ ft SANDPACK DIAM. _____ in

EQUIVALENT VOLUME OF STANDING WATER _____ (gal) (L)

PUMP RATE _____ (gpm) (LPM)

PUMP TIME _____ min

WELL WENT DRY? ( ) Yes ( ) No PUMP TIME _____ min

VOL. REMOVED _____ (gal) (L) RECOVERY TIME _____ min

PURGE AGAIN? ( )Yes ( ) No TOTAL VOL. REMOVED _____ (gal) (L)

1.5gal +

Date	Time	Volume Removed Unit: L	pH	Cond. mS/cm	Temp. °F	ORP	Turb. NTU	DO mg/L	Depth to Water from TOC	Pump Rate L/min
2/13/07	Removed	1.5 gallons; well	went dry						11.85	
	left it	recharge.								
	12:16		5.78	29	54.74	-50.0	48.3	11.36		0.5
	12:20	2	5.74	29	54.98	-46.5	36.0	11.57		0.5
	12:24	4	5.73	29	55.01	-44.9	33.2	11.53		0.5
	12:28	6	5.71	29	55.00	-40.4	45.5	11.60		0.5
	12:32	8	5.70	29	55.00	-39.0	49.0	11.61		0.5
			Collected Sample at 1240							

COMMENTS Well went dry; had to reduce flow to stabilize parameters.

SIGNATURE [signature]

FIELD CALIBRATION FORM - YSI

(pH, CONDUCTIVITY, TURBIDITY)

Site Name: Fort Lee

CALIBRATION
DATE: 2/12/07
TIME: 6:30
METER ID: 03A0751 4B

pH CALIBRATION

pH STANDARD	INITIAL READING	FINAL READING
4.0	3.94	4.00
7.0	7.02	7.00

CONDUCTIVITY CALIBARATION

CONDUCTIVITY STANDARD	STANDARD READING	FINAL READING
1409	1570	1409

TURBIDITY CALIBRATION

STANDARD	INITIAL READING	FINAL READING
0 NTU	-2.6	0.0
100 NTU	61.1	100.0

FIELD CALIBRATION FORM (continued) - YSI

COMMENTS

None

SIGNATURE

FIELD CALIBRATION FORM - YSI

(pH, CONDUCTIVITY, TURBIDITY)

Site Name: Fort Lee

CALIBRATION
DATE: 2/13/07
TIME: 6:15
METER ID: 03A0751AB

pH CALIBRATION

pH STANDARD	INITIAL READING	FINAL READING
4.0	3.98	4.00
7.0	6.99	7.01

CONDUCTIVITY CALIBARATION

CONDUCTIVITY STANDARD	STANDARD READING	FINAL READING
1.409	1.454	1.409

TURBIDITY CALIBRATION

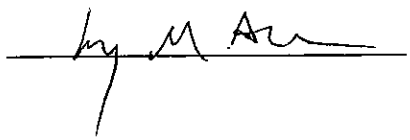
STANDARD	INITIAL READING	FINAL READING
0 NTU	7.6	0.0
100 NTU	~~100.8~~ 100.8	100.0

FIELD CALIBRATION FORM (continued) - YSI

COMMENTS

None

SIGNATURE



DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 2/12/07	PROJECT: Fort Lee
SUXOS: Stu Carr	PM: Mike O'Neill
SSO:	QCO:

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures	✓	
Field office, inside	✓	
Field office grounds	✓	
	✓	

- [ ] Last Work Days Events
- [✓] Site Description
- [✓] Work Area Description
- [✓] Work Area Hazards
- [✓] On-Site Emergency
- [✓] Site Evacuation Procedures
- [✓] Emergency Response Personnel
- [✓] Emergency Telephone Numbers
- [✓] Directions to Hospital
- [✓] First Aid
- [✓] Heat / Cold Stress
- [ ] Asbestos Awareness & ID
- [ ] Ticks
- [✓] Safety Concerns
- [✓] Personnel Protective Equipment
- [✓] Safe Work Practices
- [✓] Emergency Response Plan
- [✓] Chemical Hazards
- [✓] Emergency Equipment, Location
- [✓] Emergency Equipment, by Type
- [✓] Emergency Decontamination
- [✓] Safe Work Practices - General
- [✓] Site specific OE Safety Precautions
- [✓] Site specific OE Identification Features
- [ ] Liquid Contaminates / Landfill Material
- [ ] Other _____

Comments:

SSO SIGNATURE: Stuart Carr

F-13

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 2/12/07
Page 2 of 2

	Name	Affiliation
1	Ivy Able	EA
2	delyn Alumbaugh	EA
3	Sarah Moore	ALION/HFA
4	Stuart Carr	HFA
5	Michael O'Neill	EA
6	Jeff Zoeckler	USACE - NAO
7	Timothy Thompson	USACE - Norfolk
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DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 13 Feb 07	PROJECT: Fort Lee
SUXOS: S. Carr	PM: M. O'Neill
SSO:	QCO:

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures	✓	
Field office, inside	✓	
Field office grounds	✓	
	✓	
	✓	

[ ] Last Work Days Events
[ ] Site Description
[ ] Work Area Description
[ ] Work Area Hazards
[ ] On-Site Emergency
[ ] Site Evacuation Procedures
[ ] Emergency Response Personnel
[ ] Emergency Telephone Numbers
[ ] Directions to Hospital
[ ] First Aid
[ ] Heat / Cold Stress
[ ] Asbestos Awareness & ID
[ ] Ticks
[ ] Safety Concerns
[ ] Personnel Protective Equipment
[ ] Safe Work Practices
[ ] Emergency Response Plan
[ ] Chemical Hazards
[ ] Emergency Equipment, Location
[ ] Emergency Equipment, by Type
[ ] Emergency Decontamination
[ ] Safe Work Practices - General
[ ] Site specific OE Safety Precautions
[ ] Site specific OE Identification Features
[ ] Liquid Contaminates / Landfill Material
[ ] Other _____

Comments:

SSO SIGNATURE:

F-13

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 2/13/07
Page 2 of 2

	Name	Affiliation
1	Jay Abe	EA
2	Jeldyn Aluwihaare	EA
3	Mike O'Neill	EA
4	Stu Carr	HFA
5	Sarah Moore	Alion/HFA
6	Andrew Knickerbocker	ARM
7	Timothy Thompson	Norfolk USACE
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DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 2/14/07	PROJECT: Ft Lee
SUXOS: Stu Carr	PM:
SSO:	QCO:

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)		
Vehicle condition		
Emergency equipment		
Safe demolition procedures		
Field office, inside		
Field office grounds		

[✓] Last Work Days Events
[ ] Site Description
[✓] Work Area Description
[ ] Work Area Hazards
[ ] On-Site Emergency
[✓] Site Evacuation Procedures
[ ] Emergency Response Personnel
[ ] Emergency Telephone Numbers
[ ] Directions to Hospital
[✓] First Aid
[ ] Heat / Cold Stress
[ ] Asbestos Awareness & ID
[ ] Ticks
[ ] Safety Concerns
[ ] Personnel Protective Equipment
[✓] Safe Work Practices
[ ] Emergency Response Plan
[ ] Chemical Hazards
[ ] Emergency Equipment, Location
[ ] Emergency Equipment, by Type
[ ] Emergency Decontamination
[✓] Safe Work Practices - General
[ ] Site specific OE Safety Precautions
[ ] Site specific OE Identification Features
[ ] Liquid Contaminates / Landfill Material
[ ] Other _____

Comments:

SSO SIGNATURE: Stuart Carr

F-13

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 2/14/07
Page 2 of 2

	Name	Affiliation
1	Jay Abe	EA
2	Sarah Moore	ALION/HFA
3	Stu Carr	HFA
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STL Denver
4955 Yarrow Street
Arvada, CO 80002
phone 303-736-0100 fax 303-431-7171

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

Client Contact	Project Manager: Alan Warminski	Site Contact: Carrie Shea	Date: 2/15/07	COC No:
USACE Baltimore District, CENAB	Tel/Fax: (410) 962-2179	Lab Contact: Lyn Benkers	Carrier:	1 of 1 COCs
City Crescent Building, 10 S. Howard St., 10th	**Analysis Turnaround Time**			Job No.
Baltimore, MD 21201	Calendar (C) or Work Days (W)			
(410) 962-2179 Phone	TAT if different from Below standard			SDG No.
(410) 962-4266 FAX	☐ 2 weeks			
Project Name: MMRP FUDS - Fort Lee	☐ 1 week			
Site: FORT LEE - C03VA002701	☐ 2 days			
PO #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered (Y/N)	Metals, Mercury 6020, 7470A	Explosives, RDX, HMX 8330A	Metals, Mercury 6010B, 7471A	Explosives, RDX, HMX 8330A
FLE-TT-SW-00-01-QA	2/12/07	1540	water	SW	2	Y	X			
FLE-TT-SW-00-01-QA	2/12/07	1540	water	SW	3	N		X		
FLE-TT-SS-02-02-QA	2/12/07	1530	soil	SS	1	N			X	X
FLE-TT-SS-02-11-QA	2/12/07	1215	soil	SS	1	N			X	X
FLE-RR-SS-02-07-QA	2/14/07	830	soil	SS	1	N			X	X

Sample Specific Notes:
1, 4
1
1
1
1

Preservation Used (1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Izzy Able	EA Engineering	2/15/07 1400			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference

1 of 4 Pgs.

Project: MMRP FUDS - Fort Lee C03VA002701
Client: Alion
Send Results To: Corinne Shin
Address: 3975 Fair Ridge Drive, Suite 125 South
Fairfax, VA 22033
Phone: 703-254-5147

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Turnaround Time: Standard	# of Containers	Container Type	Preservative Used	Type of Analysis: Metals; Mercury 6020; 7470A	Explosives; PETN; NG 8330A; 8330A Mod.	Metals; Mercury 6010B; 7471A	Explosives; PETN; NG 8330A; 8330A (Mod.)	Lab Cooler No.	CLIENT COMMENTS
						2	1L Plastic	HNO3						
						3	1L Amber	—						
						2 (total)	250 mL	—						
FLE-TT-SW-00-01	2/12/07	1540	SW	IA		X	X						#1	*Sample was field filtered (for metals).
FLE-RR-SS-02-01	2/14/05	905	SS					X	X					
FLE-RR-SS-02-02	2/14/05	830	SS											
FLE-RR-SS-02-03	2/14/05	1035	SS											
FLE-RR-SS-02-04	2/14/05	1100	SS											
FLE-RR-SS-02-05	2/14/05	1415	SS											
FLE-RR-SS-02-06	2/14/05	940	SS											

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Ivy Able	2/15 1400				
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: MS/MSD from my appropriate sample	Temp:	

G.P. W.O. _____

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference:

Project: MMRP FUDS - Fort Lee C03VA002701
Client: Alion
Send Results To: Corinne Shea
Address: 3975 Fair Ridge Drive, Suite 175 South
Fairfax, VA 22033
Phone: 703-254-5147

Turnaround Time: Standard

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	# of Containers	Container Type	Preservative Used	Type of Analysis: Metals; Mercury 6020; 7470A	Explosives, VOC, PETN 8330A, 8330A mod.	Metals; Mercury 6010B; 7471A	Explosives, NG, PETN 8330A 8330A mod.	Lab Cooler No.	CLIENT COMMENTS
Rinse/Equipment Blk	2/13/07	1220	water	TA	2	1L Plastic	HNO3		X		X	2	
FLE-TT-GW-20-02	2/13/07	1000	GW		3	1L Amber	—		X		X		
FLE-TT-GW-20-01	2/13/07	1240	GW		3	1L Amber	—		X		X		
FD#1	2/11/07		SS		2	250ml	—			X	X		
FD#2	2/13/07		SS							X	X		
FD#3	2/12/07		SS							X	X		
FD#4	2/12/07		SW					X	X				X sample WO3 Field Filtered/Preserved

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Ivy Able	2/15 1400				
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: MS/MSD from any appropriate sample.	Temp:	

G.P. W.O. _____

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference

3 of 4 Pgs.

CO3VA002701

Project: MMRP FUDS - Fort Lee
Client: Alion
Send Results To: Corinne Shea
Address: 3975 Fair Ridge Drive, Suite 125 South
Fairfax, VA 22033
Phone: 703-259-5147

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Turnaround Time: Standard	# of Containers: 2 (total)	Container Type: 250mL	Preservative Used: — —	Type of Analysis: Metals; Mercury 6010B, 7471A	Explosives, NG PETN 8330A, 8330A mod	Lab Cooler No.	CLIENT COMMENTS
FLE-TT-SD-02-01	2/12/07	1530	SD	LA					X	X	3	
FLE-TT-SS-02-01	2/13/07	915	SS									
FLE-TT-SS-02-02	2/13/07	1530	SS									
FLE-TT-SS-02-03	2/13/07	1545	SS									
FLE-TT-SS-02-04	2/13/07	1058	SS									
FLE-TT-SS-02-05	2/13/07	1010	SS									
FLE-TT-SS-02-06	2/12/07	1650	SS									
FLE-TT-SS-02-07	2/12/07	1445	SS									
FLE-TT-SS-02-08	2/12/07	1440	SS									
FLE-TT-SS-02-09	2/12/07	1315	SS									
FLE-TT-SS-02-10	2/12/07	1250	SS									
FLE-TT-SS-02-11	2/12/07	1215	SS	—					—	—	—	

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Ivy Abke	2/15 1400				
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: MS/MSD from any appropriate sample	Temp:	

G.P. W.O. _____

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference

4 of 4 Pgs.

Project: MMRP FUDS - Fort Lee (03VA002701
Client: Alion
Send Results To: Corinne Shea
Address: 3975 Fair Ridge Drive, Suite 1255
Fairfax, VA 22033
Phone: 703-259-5147

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Turnaround Time: Standard	# of Containers: 2 (total)	Container Type: 250 mL	Preservative Used: — —	Type of Analysis: Metals, mercury 6010B / 7471A	Explosives, NG, PETN 8330A, 8330A Mod.	Lab Cooler No.	CLIENT COMMENTS
FLE-TT-SS-02-12	2/13/07	1705	SS	EA					X	X	3	
FLE-TT-SS-02-13	2/13/07	1715	SS									
FLE-TT-SS-02-14	2/13/07	1630	SS									
FLE-TT-SS-02-15	2/13/07	1740	SS									
FLE-TT-SS-02-16	2/13/07	1610	SS									
FLE-TT-SS-02-17	2/12/07	1600	SS									
FLE-TT-SS-02-18	2/12/07	1615	SS									
FLE-TT-SS-02-19	2/13/07	1450	SS									
FLE-TT-SS-02-20	2/13/07	1415	SS									

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Ivy Able	2/15 1400				

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			MS/MSD from any appropriate sample	

G.P. W.O. _____

APPENDIX E - PHOTO DOCUMENTATION LOG

PHOTOGRAPHIC LOG

Project/Site : Fort Lee
Project No.: C03VA002701

Date	Taken By	Photo ID	Description
2/12/2007	I. Able	E.1	Trenches observed in Trench Training Area.
2/12/2007	I. Able	E.2	Wooded terrain in observed in Trench Training Area.
2/12/2007	I. Able	E.3	Magazine in the Trench Training Area.
2/12/2007	I. Able	E.4	Possible munitions debris (MD) from a flare observed in the Trench Training Area.
2/12/2007	I. Able	E.5	Pond where surface water was collected from the Trench Training Area.
2/12/2007	I. Able	E.6	Debris from old metal drum observed in trenches near pond in the Trench Training Area.
2/12/2007	I. Able	E.7	Concrete structures observed that were partially uncovered in Trench Training Area.
2/12/2007	I. Able	E.8	Metal debris, including metal rods and metal piping, observed in Trench Training Area.
2/13/2007	I. Able	E.9	Potential burial area behind the NPS maintenance shop in the Trench Training Area.
2/13/2007	I. Able	E.10	Installation of Geoprobe down gradient of potential burial area.
2/12/2007	I. Able	E.11	Multiple WWI manholes were observed in the Trench Training Area.
2/14/2007	I. Able	E.12	Southern part of former WWI/WWII Small Arms Range, looking north towards the prison.
2/14/2007	I. Able	E.13	Several homes and small graveyard on the southwest part of the former WWI/WWII Small Arms Range.
2/14/2007	I. Able	E.14	Area north of the prison and jail used for farming.
2/14/2007	I. Able	E.15	Vacant lands and forested terrain on the northern part of the WWI/WWII Small Arms Range.

E.1– Trenches observed in Trench Training Area.

E.2 – Wooded terrain in observed in Trench Training Area.

E.3 – Magazine in the Trench Training Area.

E.4 – Possible munitions debris (MD) from a flare observed in the Trench Training Area.

E.5 – Pond where surface water was collected from the Trench Training Area.

E.6 – Debris from old metal drum observed in trenches near pond in the Trench Training Area.

E.7 – Concrete structures observed that were partially uncovered in Trench Training Area.

E.8 – Metal debris, including metal rods and metal piping, observed in Trench Training Area.

E.9 – Potential burial area behind the NPS maintenance shop in the Trench Training Area.

E.10 – Installation of Geoprobe down gradient of potential burial area.

E.11 – Multiple WWI manholes were observed in the Trench Training Area.

E.12 – Southern part of former WWI/WWII Small Arms Range, looking north towards the prison.

E.13 – Several homes and small graveyard on the southwest part of the former WWI/WWII Small Arms Range.

E.14 – Area north of the prison and jail used for farming.

E.15 – Vacant lands and forested terrain on the northern part of the WWI/WWII Small Arms Range.

APPENDIX F - ANALYTICAL DATA

- Screening Tables
- ADR Library
- ADR EDDs
- EDMS
- Analytical Summary Reports
- Analytical Data Reports
- SEDD Deliverable

Located on CD.

APPENDIX G - ANALYTICAL DATA QA/QC REPORT

- Validated Data from EDS
- USACE Memorandum for Record-CQAR of QA Split Samples (Not provided for this version of the SIR).

Located on CD.

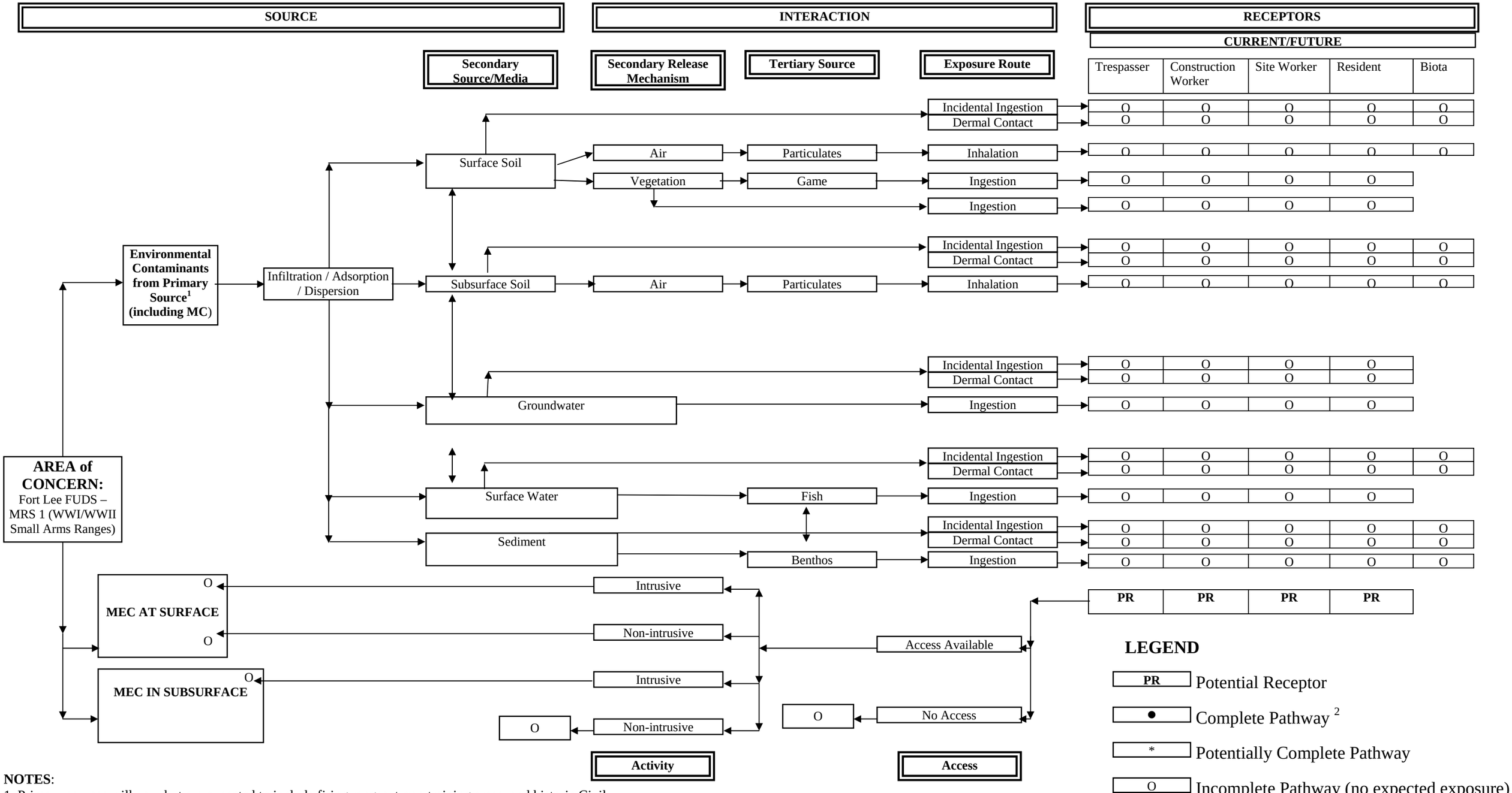
APPENDIX H - GEOGRAPHIC INFORMATION SYSTEMS DATA

Located on CD.

APPENDIX I - GEOPHYSICAL DATA

Appendix not used.

APPENDIX J - CONCEPTUAL SITE MODEL

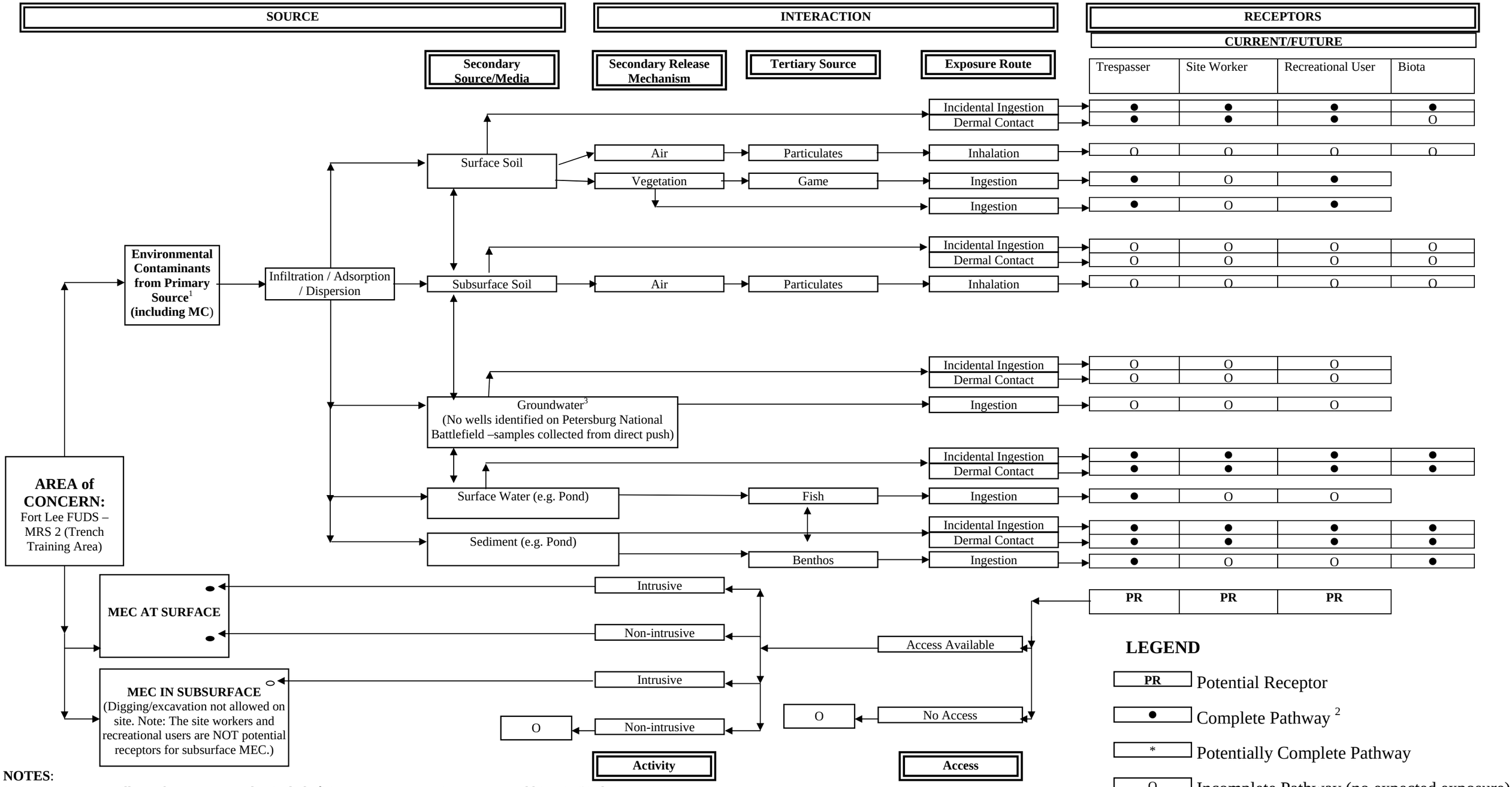


NOTES:

1. Primary sources will vary but are expected to include firing ranges, troop training areas, and historic Civil War activities.
2. For a pathway to be complete, it must include a source, an exposure medium, an exposure route, and a receptor. A complete pathway may also include a release mechanism and a transport medium.
3. This CSM has evolved throughout the SI process to reflect a current understanding following the SI of the source, pathway and receptors potentially affected by MEC and MC.

Source: USACE. 2003. *Conceptual Site Modals for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Wastes (HTRW) Projects.* EM1110-1-1200.

DIAGRAM OF THE INTEGRATED CONCEPTUAL SITE MODEL FOR WWI/WWII SMALL ARMS RANGES (MRS 1) AT FORT LEE MMRP FUDS[3]



NOTES:

1. Primary sources will vary but are expected to include firing ranges, troop training areas, and historic Civil War activities.
2. For a pathway to be complete, it must include a source, an exposure medium, an exposure route, and a receptor. A complete pathway may also include a release mechanism and a transport medium.
3. In accordance with Virginia Department of Environmental Quality guidance comments, groundwater was sampled to determine the presence or absence of MC (VDEQ 2006)
4. This CSM has evolved throughout the SI process to reflect a current understanding following the SI of the source, pathway and receptors potentially affected by MEC and MC.

Source: USACE. 2003. *Conceptual Site Modals for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Wastes (HTRW) Projects.* EM1110-1-1200.

DIAGRAM OF THE INTEGRATED CONCEPTUAL SITE MODEL FOR THE TRENCH TRAINING AREA (MRS 2) AT FORT LEE MMRP FUDS[4]

APPENDIX K - MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL RESULTS

MRS 1
WWI / WWII
Small Arms Ranges

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site Name: _ WWI/WWII Small Arms Ranges – MRS 1

Component: U.S. Army

Installation/Property Name: Fort Lee

Location (City, County, State): Petersburg, Prince George County, Virginia

Site Name (RMIS ID)/Project Name (Project No.): Fort Lee C03VA002701R01/ Fort Lee C03VA002701

Date Information Entered/Updated: **September 2007**

Point of Contact (Name/Phone): **George Mears (757) 201-7181**

Project Phase (check only one):

❑ PA	☑ SI	❑ RI	❑ FS	❑ RD
❑ RA-C	❑ RIP	❑ RA-O	❑ RC	❑ LTM

Media Evaluated (check all that apply):

❑ Groundwater	❑ Sediment (human receptor)
☑ Surface soil	❑ Surface Water (ecological receptor)
❑ Sediment (ecological receptor)	❑ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present): Fort Lee FUDS was used from 1917 to 1959 for training with small arms, grenades, and rockets, and trench training by the Army during WWI and WWII. During this time MRS 1 was used as a small arms range. Small arms were used at this MRS. Potential MC includes metals and explosives (refer to Table 2-2 in SI Report). Two explosives (NG and DNT) and seven metals (antimony, chromium, copper, iron, lead, nickel, and zinc) are the MC of interest in MRS 1. According to the ASR Supplement MRS 1 consists of 748 acres of land.

Description of Pathways for Human and Ecological Receptors: At MRS 1, exposure to MC might occur in surface soil considering the historical use of the area as a small arms range. Additionally, surface water and sediment were not identified on the MRS.

Description of Receptors (Human and Ecological): Human receptors include trespassers, construction workers, site workers, and residents. Ecological receptors include terrestrial plants and invertebrates, benthic organisms, aquatic organisms, predatory animals, and predatory birds.

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorus (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. ◆ All hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	◆ All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ All DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ◆ All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ All DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. ◆ Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ All DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ All UXO that are practice munitions that are not associated with a sensitive fuze. ◆ All DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	**(2)**
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	**2**

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

The 2004 ASR Supplement indicates that this area consists solely of range fans and that only general small arms were used at the ranges (Refer to Sections 2.4.3 and 4.1 of the SI Report). Additionally, no additional MEC or MD have been reported at MRS 1 (Refer to Section 4.3.1 of the SI Report).

Table 2
EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the score(s) that correspond with **all** sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range, practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	◆ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include: impact or target areas, associated buffer and safety zones, firing points, and live-fire maneuver areas.	10
Former munitions treatment (i.e., OB/OD) unit	◆ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	◆ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	◆ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	◆ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	◆ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	◆ The MRS is a firing point, ◆ where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	◆ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	◆ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	◆ The MRS is a former military range where only small arms ammunition was used [There must be evidence that no other types of munitions (e.g., grenades) were used or are present to place an MRS into this category.].	**(1)**
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

MRS 1 consists of the range fans of small arms ranges (Refer to Section 2.4.3 and 4.1 of the SI Report). Small arms (0.30 and 0.45 caliber cartridges) were used at the ranges that may have impacted MRS 1 (Refer to Table 2-2 of the SI Report).

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms *surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	◆ Physical evidence indicates that there are UXO or DMM on the surface of the MRS ◆ Historical evidence (e.g., a confirmed incident report or accident report) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS, and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	◆ There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	◆ There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	◆ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	◆ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability [There must be evidence that no other types of munitions (e.g., grenades) were used or are present at the MRS to place an MRS into this category.].	**1**
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

There are no reported discoveries of MD/MEC in MRS 1 (Refer to Section 4.3.1 of the SI Report).

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to any explosive materiel. Circle the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	◆ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	**(10)**
Barrier to MRS access is incomplete	◆ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**10**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

There are no fences restricting access to this MRS. Refer to Sections 4.3.1 of the SI Report.

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	◆ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	**5**
Scheduled for transfer from DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the rule is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

The land associated with MRS 1 is owned by the Commonwealth of Virginia, the Department of Justice, and other unnamed interests. Refer to Sections 2.3.4 of the SI report.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications of population density and their descriptions. Determine the population density per square mile in the vicinity of the MRS and circle the score that corresponds with the associated population density.

Note: If an MRS is located in more than one county, use the largest population density value among the counties. If the MRS is within or borders a city or town, use the population density for the city or town, rather than that of the county.

Classification	Description	Score
> 500 persons per square mile	◆ There are more than 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	**(5)**
100–500 persons per square mile	◆ There are 100 to 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	3
< 100 persons per square mile	◆ There are fewer than 100 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

The U.S. Census Bureau cited there are 1,651 persons per square mile (mi^2) in Prince George County, Virginia. (U.S. Census Bureau 2000). Refer to Section 2.3.3 of the SI Report.

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the population near the hazard. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the associated population near the known or suspected hazard.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	◆ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	**5**
16 to 25 inhabited structures	◆ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	◆ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	◆ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	◆ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	◆ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

The Fort Lee FUDS is situated within the immediate vicinity of several population centers including Fort Lee, Hopewell, and Petersburg. Refer to Section 2.3.3 of the SI report.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures near the hazard and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the score(s) that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structure* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	(5)
Parks and recreational areas	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	(4)
Agricultural, forestry	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	(2)
No known or recurring activities	◆ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The land associated and bordering MRS 1 is within the city limits of Hopewell, VA and is used for a state jail and a federal reformatory. Additionally, part of MRS 1 is within a 2 mile radius of MRS 2, Petersburg National Battlefield. Refer to Sections 2.3.3 and 2.3.4 of the SI Report.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resource classifications at the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	◆ There are both ecological and cultural resources present on the MRS.	**5**
Ecological resources present	◆ There are ecological resources present on the MRS.	3
Cultural resources present	◆ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	◆ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

Cultural resources and threatened or endangered species are present onsite (Refer to Sections 3.2.1 and 3.2.2 of the SI report).

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	2	**3**
Source of Hazard	Table 2	1	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	1	**16**
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	5	**20**
Population Near Hazard	Table 7	5	
Types of Activities/ Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	5	
EHE MODULE TOTAL			**39**

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	**F**
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	

Table 11
CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is: ◆ Explosively configured CWM that are UXO (i.e., CWM/UXO). ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: ◆ Nonexplosively configured CWM/DMM. ◆ Bulk CWM/DMM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	**(0)**
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

CWM is not present at the MRS. Refer to Sections 2.4.2 and 2.4.4 of the SI Report. _____

_____

_____

TABLES 12 THROUGH 19 EXCLUDED AS PER CX GUIDANCE

Table 20
Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11		
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			**0**

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	**No Known or Suspected CWM Hazard**

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total metals analyses when both are available.

Evaluation Note: No groundwater was collected at MRS 1

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Groundwater MC Hazard	☑

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Evaluation Note: No surface water samples were collected at MRS 1

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum The Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ☑

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the site's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Evaluation Note: No sediment samples were collected at MRS 1.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum The Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Sediment (Human Endpoint) MC Hazard	☑

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total metals analyses when both are available.

Evaluation Note: No surface water samples were collected at MRS 1

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ☑

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Evaluation Note: No sediment samples were collected at MRS 1.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ☑

Table 26
HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Evaluation Note: Samples FLE-RR-SS-02-01, FD#1, FLE-RR-SS-02-02, FLE-RR-SS-02-03, FLE-RR-SS-02-04, FLE-RR-SS-02-05, FLE-RR-SS-02-06

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Surface Soil MC Hazard ☑

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Remember not to add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28
Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard, Migration Pathway, and Receptor Factors** for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each media's rating (A–G) and record the letter in the corresponding **Media Rating** box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value		Three-Letter Combination (Hs-Ms-Ls)		Media Rating (A-G)
Groundwater (Table 21)	Not Applicable (N/A)	N/A	N/A		N/A		N/A
Surface Water/Human Endpoint (Table 22)	N/A	N/A	N/A		N/A		N/A
Sediment/Human Endpoint (Table 23)	N/A	N/A	N/A		N/A		N/A
Surface Water/Ecological Endpoint (Table 24)	N/A	N/A	N/A		N/A		N/A
Sediment/Ecological Endpoint (Table 25)	N/A	N/A	N/A		N/A		N/A
Surface Soil (Table 26)	N/A	N/A	N/A		N/A		N/A

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the **HHE Module Rating** box below.

Note:

An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

Evaluation Note: N/A=not applicable

HHE MODULE RATING	No Known or Suspected MC Hazard

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	
HML	D
MMM	
HLL	E
MML	
MLL	F
LLL	G

Alternative Module Ratings	
	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	**B**	2	**A**	2
B	3	**C**	3	**B**	3
C	4	**D**	4	**C**	4
D	5	**E**	5	**D**	5
E	6	**F**	6	**E**	6
F	(7)	**G**	7	**F**	7
G	8			**G**	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		(No Known or Suspected CWM Hazard)		(No Known or Suspected MC Hazard)	
MRS or ALTERNATIVE PRIORITY				**7**	

MRS 2
Trench Training Area

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site Name: Trench Training Area – MRS 2

Component: U. S. Army

Installation/Property Name: Fort Lee

Location (City, County, State): Petersburg, Prince George County, Virginia

Site Name (RMIS ID)/Project Name (Project No.): Fort Lee C03VA002701R02/ Fort Lee C03VA002701

Date Information Entered/Updated: **September 2007**

Point of Contact (Name/Phone): **George Mears (757) 201-7181**

Project Phase (check only one):

❑ PA	☑ SI	❑ RI	❑ FS	❑ RD
❑ RA-C	❑ RIP	❑ RA-O	❑ RC	❑ LTM

Media Evaluated (check all that apply):

☑ Groundwater	☑ Sediment (human receptor)
☑ Surface soil	☑ Surface Water (ecological receptor)
☑ Sediment (ecological receptor)	☑ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present): The Fort Lee FUDS was used from 1917 to 1959 for training with small arms, grenades, and rockets as well as trench training by the Army during WWI and WWII. From 1917 to 1921 MRS 2 was used for trench training. Small arms were used at this MRS. Potential MC includes metals and explosives. Two explosives (NG and DNT) and seven metals (antimony, chromium, copper, iron, lead, nickel, and zinc) are the MC of interest in MRS 2 (refer to Table 2-2 in SI Report). According to the ASR Supplement MRS 2 consists of 1,276 acres of land.

Description of Pathways for Human and Ecological Receptors: At MRS 2, potential pathways include surface water, sediment, surface soil, and groundwater.

Description of Receptors (Human and Ecological): Human receptors include trespassers, site workers, and recreational users. Ecological receptors include terrestrial plants and invertebrates, benthic organisms, aquatic organisms, predatory animals, and predatory birds.

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorus (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. ◆ All hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	◆ All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ All DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ◆ All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ All DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	**15**
Propellant	◆ All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. ◆ Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ All DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	**10**
Practice	◆ All UXO that are practice munitions that are not associated with a sensitive fuze. ◆ All DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	**5**
Riot control	◆ All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	**15**

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

The 2004 ASR Supplement indicates small arms were used in this area for trench training (Section 2.4.3 of the SI Report). Even so, a dummy grenade, a live World War I artillery shell and small arms casing dating back to World War I along with a Civil War era shell have been documented in this area. Additionally, historic documentation indicates there was a burial area located on Petersburg National Battlefield (MRS 2). The condition (UXO versus DMM) and specific types of munitions buried are not documented. Suspect MD was observed during the SI reconnaissance in MRS 2 to include a spent flare and suspect grenade spoon (refer to Section 4.3.2 of the SI Report).

Table 2
EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the score(s) that correspond with **all** sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range, practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	◆ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include: impact or target areas, associated buffer and safety zones, firing points, and live-fire maneuver areas.	10
Former munitions treatment (i.e., OB/OD) unit	◆ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	◆ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	◆ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	**5**
Former burial pit or other disposal area	◆ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	◆ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	◆ The MRS is a firing point, ◆ where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	◆ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	◆ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	◆ The MRS is a former military range where only small arms ammunition was used [There must be evidence that no other types of munitions (e.g., grenades) were used or are present to place an MRS into this category.].	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

MRS 2 consists of the area which makes up Petersburg National Battlefield located on the southern part of the FUDS. This area was used for trench warfare training during WWI. The area was impacted by civil war battles. Additionally, historic documentation indicates there was a burial area located on Petersburg National Battlefield (MRS 2). The condition (UXO versus DMM) and specific types of munitions buried are not documented. Refer to Section 2.1 of the SI Report.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms *surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	◆ Physical evidence indicates that there are UXO or DMM on the surface of the MRS ◆ Historical evidence (e.g., a confirmed incident report or accident report) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS, and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost, heat heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	**20**
Confirmed subsurface, stable	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	◆ There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	**10**
Suspected (historical evidence)	◆ There is historical evidence indicating that UXO or DMM may be present at the MRS.	**5**
Subsurface, physical constraint	◆ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	◆ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability [There must be evidence that no other types of munitions (e.g., grenades) were used or are present at the MRS to place an MRS into this category.].	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	**20**

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms *surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

Historically, a dummy grenade, Civil War era items (cannon balls, bullets, and a live shell), and small arms casings have been documented on the surface and a live WWI artillery shell has been documented as being removed from the subsurface at MRS 2. Additionally, suspect MD was observed to include a spent flare and suspect grenade spoon during the SI reconnaissance in MRS 2. Additionally, historic documentation indicates there was a burial area located on Petersburg National Battlefield (MRS 2). Refer to Section 2.1 and 4.3.2 of the SI Report.

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to any explosive materiel. Circle the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	◆ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	**(10)**
Barrier to MRS access is incomplete	◆ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**10**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

The main road providing access to MRS 2 is gated but is open to the public seven days a week from 9 a.m. to 5 p.m. The MRS is a national battlefield and contains walking trails which are accessible to visitors. There are no fences restricting pedestrian traffic. Refer to Sections 4.3.2 of the SI Report.

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	◆ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	**(5)**
Scheduled for transfer from DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the rule is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **<u>the single highest score</u>** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

<u>The land associated with MRS 2, known as Petersburg National Battlefield, is owned by the Department of Interior/National Park Service. Refer to Section 2.3.4 of the SI report.</u>

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications of population density and their descriptions. Determine the population density per square mile in the vicinity of the MRS and circle the score that corresponds with the associated population density.

Note: If an MRS is located in more than one county, use the largest population density value among the counties. If the MRS is within or borders a city or town, use the population density for the city or town, rather than that of the county.

Classification	Description	Score
> 500 persons per square mile	◆ There are more than 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	**5**
100–500 persons per square mile	◆ There are 100 to 500 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	3
< 100 persons per square mile	◆ There are fewer than 100 persons per square mile in the county in which the MRS is located, based on U.S. Census Bureau data.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

The U.S. Census Bureau cited there are 1,651 persons per square mile (mi^2) in Prince George County, Virginia. (U.S. Census Bureau 2000). Refer to Section 2.3.3 of the SI Report.

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the population near the hazard. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the associated population near the known or suspected hazard.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	◆ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	**(5)**
16 to 25 inhabited structures	◆ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	◆ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	◆ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	◆ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	◆ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **<u>the single highest score</u>** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

<u>The Fort Lee FUDS is situated within the immediate vicinity of several population centers including Fort Lee, Hopewell, and Petersburg. Refer to Section 2.3.3 of the SI report.</u>

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures near the hazard and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the score(s) that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structure* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	(5)
Parks and recreational areas	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	(4)
Agricultural, forestry	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	◆ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The land associated with MRS 2 is approximately 1 mile from the city Petersburg VA. Refer to Section 2.3.3 of the SI Report. Additionally, the National Battlefield, which makes up MRS 2, is owned by the NPS and is open to public year round. Refer to Sections 2.3.3, 2.3.4, and 4.3.2 of the SI Report.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resource classifications at the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	◆ There are both ecological and cultural resources present on the MRS.	**(5)**
Ecological resources present	◆ There are ecological resources present on the MRS.	3
Cultural resources present	◆ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	◆ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

Cultural resources and threatened or endangered species are present onsite (refer to Sections 3.2.1 and 3.2.2 of the SI report).

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	15	**20**
Source of Hazard	Table 2	5	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	20	**35**
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	5	**20**
Population Near Hazard	Table 7	5	
Types of Activities/ Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	5	
EHE MODULE TOTAL			**75**

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	(C)
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	**C**

Table 11
CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is: ◆ Explosively configured CWM that are UXO (i.e., CWM/UXO). ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: ◆ Nonexplosively configured CWM/DMM. ◆ Bulk CWM/DMM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	**0**
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

CWM is not present at the MRS. Refer to Sections 2.4.2 and 2.4.4 of the SI Report. _____

_____

_____

TABLES 12 THROUGH 19 EXCLUDED AS PER CX GUIDANCE

Table 20
Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11		
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	**No Known or Suspected CWM Hazard**

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total metals analyses when both are available.

Evaluation Note: Sample FLE-TT-GW-20-01 and FLE-TT-GW-20-02; no MC were detected in groundwater

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	Not Applicable (N/A)

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	N/A

No Known or Suspected Groundwater MC Hazard	☑

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Evaluation Note: Sample FLE-TT-SW-00-01, FD #4

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
COPPER	1.70E+00	9.00E+00	1.9E-01
LEAD	3.00E-01	2.50E+00	1.2E-01
NICKEL	2.20E+00	5.20E+01	4.2E-02
ZINC	4.79E+01	1.10E+04	4.4E-03
CHF Scale	**CHF Value**	**Sum The Ratios**	3.6E-01
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	**L**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	**L**
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	**M**
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ☐

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the site's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Evaluation Note: Sample FLE-TT-SD-02-01.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
ANTIMONY	3.60E-01	3.10E+01	1.2E-02
COPPER	2.90E+00	3.10E+03	9.4E-04
LEAD	9.50E+00	4.00E+02	2.4E-02
NICKEL	1.90E+00	1.60E+03	1.2E-03
ZINC	9.50E+00	2.30E+04	4.1E-04
CHF Scale	**CHF Value**	**Sum The Ratios**	3.8E-02
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right maximum value = H).	**L**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	**L**
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	**M**
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

No Known or Suspected Sediment (Human Endpoint) MC Hazard ❑

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total metals analyses when both are available.

Evaluation Note: Sample FLE-TT-SW-00-01, FD#4

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
COPPER	1.70E+00	9.00E+00	1.9E-01
LEAD	3.00E-01	2.50E+00	1.2E-01
NICKEL	2.20E+00	5.20E+01	4.2E-02
ZINC	4.79E+01	1.20E+02	4.0E-01
CHF Scale	**CHF Value**	**Sum the Ratios**	7.5E-01
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
2 > CHF	**L (Low)**		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	**L**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	(L)

MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	(M)
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L

RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ❑

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Evaluation Note: Sample FLE-TT-SD-02-01.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
ANTIMONY	3.60E-01	2.00E+00	1.8E-01
COPPER	2.90E+00	3.16E+01	9.2E-02
LEAD	9.50E+00	3.58E+01	2.7E-01
NICKEL	1.90E+00	2.27E+01	8.4E-02
ZINC	9.50E+00	1.21E+02	7.9E-02
CHF Scale	**CHF Value**	**Sum the Ratios**	7.0E-01
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		**L**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	**L**
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	**M**
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ❑

Table 26
HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Evaluation Note: Samples include FLE-TT-SS-02-01, FD#2, FLE-TT-SS-02-02, FLE-TT-SS-02-03, FLE-TT-SS-02-04, FLE-TT-SS-02-05, FLE-TT-SS-02-06, FLE-TT-SS-02-07, FLE-TT-SS-02-08, FD#3, FLE-TT-SS-02-09, FLE-TT-SS-02-10, FLE-TT-SS-02-11, FLE-TT-SS-02-12, FLE-TT-SS-02-13, FLE-TT-SS-02-14, FLE-TT-SS-02-15, FLE-TT-SS-02-16, FLE-TT-SS-02-17, FLE-TT-SS-02-18, FLE-TT-SS-02-19, FLE-TT-SS-02-20

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio
2,6-DINITROTOLUENE	1.80E-02	6.10E+01	3.0E-04
LEAD	1.39E+03	4.00E+02	3.5E+00
CHF Scale	**CHF Value**	**Sum the Ratios**	3.5E+00
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		**M**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	**M**
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	**M**
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**M**

No Known or Suspected Surface Soil MC Hazard ❑

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Remember not to add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28
Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard, Migration Pathway, and Receptor Factors** for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each media's rating (A–G) and record the letter in the corresponding **Media Rating** box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)	Not Applicable (N/A)	N/A	N/A	N/A	N/A
Surface Water/Human Endpoint (Table 22)	L	L	M	MLL	**F**
Sediment/Human Endpoint (Table 23)	L	L	M	MLL	**F**
Surface Water/Ecological Endpoint (Table 24)	L	L	M	MLL	**F**
Sediment/Ecological Endpoint (Table 25)	L	L	M	MLL	**F**
Surface Soil (Table 26)	M	M	M	MMM	**D**

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the **HHE Module Rating** box below.

Note:

An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

Evaluation Note: N/A=not applicable

HHE MODULE RATING	**D**

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	**B**	2	**A**	2
B	3	**C**	3	**B**	3
C	(4)	**D**	4	**C**	4
D	5	**E**	5	**D**	(5)
E	6	**F**	6	**E**	6
F	7	**G**	7	**F**	7
G	8			**G**	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		(No Known or Suspected CWM Hazard)		No Known or Suspected MC Hazard	
MRS or ALTERNATIVE PRIORITY				(4)	

APPENDIX L - REFERENCE COPIES

Located on CD.