DRAFT FINAL

Site Inspection Report for Fort Tilden

DERP FUDS Project No. **C02NY001604**

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

Prepared for:
U.S. Army Engineering and Support Center, Huntsville
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Huntsville, AL 35807
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July 2007

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ALION
SCIENCE AND TECHNOLOGY

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July 2007

CONTRACTOR STATEMENT OF AUTHORSHIP AND INDEPENDENT TECHNICAL REVIEW

Alion Science and Technology Corporation has prepared this Draft Final Site Inspection Report for Fort Tilden, Formerly Used Defense Site (FUDS), Project No. C02NY001604. 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
AOC	Area of Concern
ASR	Archive Search Report
CENAB	Corps of Engineers North Atlantic Baltimore
CENAN	Corps of Engineers North Atlantic New York
CEHNC	Corps of Engineers Huntsville Engineering and Support Center
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
DNT	Dinitrotoluene
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
EA	EA Engineering, Science, and Technology, Inc.
EDS	Environmental Data Services, Inc.
EPA	U.S. Environmental Protection Agency
ft	Foot or Feet
FUDS	Formerly Used Defense Site(s)
GPL	GPL Laboratories, LLLP
GPS	Global Positioning System
HQ	Hazard Quotient
HRS	Hazard Ranking System
HTRW	Hazardous, Toxic, and Radioactive Waste

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

INPR	Inventory Project Report
LCS	Laboratory Control Spike
MC	Munitions Constituents
MD	Munitions Debris
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
mm	Millimeter(s)
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
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
OB/OD	Open Burn/Open Detonation
OEW	Ordnance and Explosive Waste
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PRG	Preliminary Remediation Goal
PWP	Programmatic Work Plan for Formerly Used Defense Sites FUDS) Military Munitions Response Program (MMRP) Site Inspections at Multiple Sites in the Northeast Region
QA/QC	Quality Assurance/Quality Control
QSM	Quality Systems Manual
RAC	Risk Assessment Code
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

RI/FS	Remedial Investigation/Feasibility Study
RBC	Risk-Based Concentration
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 to the MMRP Programmatic Work Plan for the Site Inspection of Fort Tilden
TCRA	Time Critical Removal Action
Tetryl	2,4,6-Trinitrophenyl-n-methylnitramine
TNT	Trinitrotoluene
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USAESCH	U. S. Army Engineering and Support Center, Huntsville
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

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 2004b).

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 U.S.C 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)).

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 U.S.C 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) has prepared the following Site Inspection (SI) Report to document SI activities and findings for the Fort Tilden Formerly Used Defense Site (FUDS), Property No. C02NY001604. 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. C02NY001604 to address potential MMRP hazards remaining at the Fort Tilden 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). 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.

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.

ES.4 **Fort Tilden**. Fort Tilden was established as a coastal defense site in 1917 and utilized for military purposes until 1974. During the period of interest, Fort Tilden included coast artillery, anti-aircraft artillery, and Nike missile sites. The 311.53 acres of the fort, also included separate pistol and rifle ranges. The National Park Service currently owns and operates most of the site as part of the Gateway National Recreation Area.

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 discussed at the initial TPP meeting on 25 April 2006. Stakeholders agreed to the SI objectives

and approach, as presented and modified during the TPP meeting and finalized in the site-specific work plan (SS-WP).

ES.6 The FUDS is defined in the programmatic range documents as one MRS with five areas of concern (AOCs) or subranges. Three subranges identified within Range Complex No. 1 include: Battery Harris East and West, Battery Kessler, Battery Ferguson. The two AOCs include the Pistol Range and Rifle Range. The former Nike Missile Base was not identified as an AOC in historic documents, and according to information presented during the TPP meeting, was addressed previously. Therefore, the Nike site was not included as an AOC in this SI.

ES.7 **Site Reconnaissance and MEC Assessment.** SI field activities, including site reconnaissance and MC sampling, were performed during January 2007. The qualitative site reconnaissance of the FUDS was performed for MEC over approximately 8 acres of the site using visual observations and analog geophysical techniques. The field team used a meandering path in and around sampling locations to identify ranges, target areas, MEC, munitions debris (MD), or other areas of interest (areas containing backstops or other areas containing distressed vegetation). Evidence of past DoD use, including MD and remnants of backstops, was documented during this reconnaissance task.

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), Archives Search Report (ASR), and the INPR Supplement. Historical documentation and interviews indicated the following munitions were used at the Fort Tilden FUDS: small arms, practice ground rockets, and high explosive artillery. Previous MD findings at the site include a 3.5-inch practice rocket and expended small arms ammunition. MD items (spent small caliber bullets) were observed during the January 2007 SI site activities; however, no suspect subsurface anomalies were recorded. 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 the MRS.

ES.9 **MC Sampling and Risk Screening.** A total of eight surface soil samples, four subsurface soil, and five background soil samples were collected. Samples were analyzed for the target compound list of explosives and target analyte list of metals. A list of MC associated with munitions used at the site was developed and used to support analysis of results and the risk screening. The list of associated MC explosives and metals includes: dinitrotoluene (DNT), nitroglycerin (NG), antimony, barium, copper, iron, lead, nickel, and zinc associated with the batteries and small arms range firing points and impact/backstop. The concentrations of two

analytes associated with the munitions expended at Fort Tilden (antimony and lead) exceeded human health screening criteria in surface soil. A screening level ecological risk assessment (SLERA) was required given the FUDS is located in a Coastal Management Zone, contains wetland habitats, and is within the Gateway National Recreation Area. The SLERA identified various combinations of antimony, copper, lead, nickel, and zinc as exceeding screening criteria in MRS 1.

ES.10 Recommendations. ***Range Complex No. 1 (MRS 1).*** Based on the findings of this SI, an RI/FS is recommended for the MRS with additional studies to focus on MC at the FUDS (Table ES-1). Neither a time critical removal action (TCRA) nor non-TCRA (NTCRA) is recommended for the MRS.

Table ES-1. Summary of Site Recommendations for the Former Fort Tilden Site

(FUDS Project No. C02NY001604)

MRS	Recommendation	Basis for Recommendation	
		MEC	MC
MRS 1 – Range Complex No. 1	RI/FS Additional studies should focus on MC TCRA/NTCRA not recommended	MEC Assessment: Low Risk Past finds of MD	Risk Screening: Potential risk to humans and ecological receptors. ***Surface Soil –*** Background and risk screening exceedances for antimony and lead for humans receptors and antimony, copper, lead and zinc for ecological receptors

COPC=Chemical of Potential Concern
COPEC=Chemical of Potential Ecological Concern
FUDS=Formerly Used Defense Site
MRS=Munitions Response Site
MD=Munitions Debris
RI/FS=Remedial Investigation/Feasibility Study
MEC=Munitions and Explosives of Concern
MC=Munitions Constituents
NDAI=No Department of Defense Action Indicated
NTCRA=Non -Time Critical Removal Action
TCRA= Time Critical Removal Action

1. INTRODUCTION

1.0.1 This report documents the findings of the Military Munitions Response Program (MMRP) site inspection (SI) performed at the Fort Tilden Formerly Used Defense Site (FUDS) located on Rockaway Peninsula in Queens County, New York City, New York, MMRP Project No. C02NY001604. Alion Science and Technology Corporation (Alion), along with its subcontractors [EA Engineering, Science, and Technology, Inc. (EA), Environmental Data Services, Inc. (EDS), and GPL Laboratories, 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 Tilden* (SS-WP) (Alion 2007).

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 the FUDS for the Army, DoD's Executive Agent for the FUDS program.

1.1.2 Pursuant to USACE Engineer Regulation 200-3-1 (USACE, 10 May 2004a) 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.

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 Fort Tilden is comprised of 311.53 acres of land located on Rockaway Peninsula in Queens County, New York City, New York. The North American Datum 83 Universal Transverse Mercator X and Y coordinates for the most centrally located part of the installation are 605812.54 and 4469972.64, respectively. Fort Tilden falls under the geographical jurisdiction of Corps of Engineers North Atlantic New York (CENAN). The SI for Fort Tilden is being completed under DERP FUDS Project No. C02NY001604, 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 the designated MRS 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 Fort Tilden occupies approximately 311 acres of land located on Rockaway Peninsula in Queens County, New York City, New York. The site was used for military purposes from 1917 until 1974. In 1974, 302 acres of the total 311 acre property were transferred to the National Park Service (NPS) and became part of Gateway National Recreation Area. The remaining 9 acres were transferred to the U.S. Army Reserve Center. Both of these stakeholders retain ownership to the present day (Alion 2007). Historically, Fort Tilden hosted three coastal gun batteries, several styles of anti-aircraft artillery, small arms ranges, and, from the 1950s through to 1967, and Nike Ajax and Nike Hercules missile facilities (USACE 2005). The Fort Tilden range boundary includes a total of 302,813 tidal water acres.

2.2 Munitions Response Site Identification and Munitions Information

2.2.1 USACE programmatic range documents (including the INPR Supplement and the DERP Fiscal Year 2005 Annual Report to Congress) identified one range at the Fort Tilden FUDS (USACE 2005 and DoD 2005), as shown on Figure 2-1. This range is designated MRS 1 - Range Complex No. 1 (refer to Table 2-1). The Restoration Management Information System range identification number for this MRS is C02NY001604R01. Munitions associated with this MRS are derived from the ASR and INPR Supplement and are summarized on Table 2-2. This MRS designation was used to develop the CSM and complete the MRSPP risk ranking. A discussion of the CSM (Appendix J) is presented below and the associated MRSPP risk ranking is presented in Appendix K.

2.2.2 The designated range includes three subranges (Battery Harris East and West, Battery Kessler, Battery Ferguson and two areas of concern (AOC) (the Pistol Range and Rifle Range). The range consists of approximately 132 acres of land located within the FUDS property boundary, and the remaining acreage, 302,813 acres of tidal waters, is beyond the designated FUDS property boundary (Figure 2-1 and Table 2-1). Currently, DERP management guidance and USACE guidance have determined that the range area in the water beyond the 100-yard mean high tide line is not eligible for inclusion in DERP-FUDS. Therefore, the tidal water in the range fans (beyond the line that denotes the area which is 100 yards beyond the mean high tide line) to include the majority of the 302,813 acres of tidal waters beneath the range fans for MRS 1 is not addressed in the SI findings or recommendations.

2.2.3 Range Complex No. 1 (MRS 1) was used as a coastal battery as well as a rifle and pistol range. The coastal battery was used to fire from the land and impact area was in the Atlantic Ocean beyond the 100-yard mean high tide line. The rifle and pistol ranges had both a firing point and impact area on the land.

2.3 Physical Setting

2.3.1 Topography and Vegetation

2.3.1.1 The Fort Tilden site is comprised of relatively flat land with gently rolling hills. The property is situated on a peninsula and is highly susceptible to erosion by winds and storm surge. Bordered on the south by the Atlantic Ocean and the north by Rockaway Inlet to Jamaica Bay, the site is characterized by shifting sand dunes, rising to an interior elevation of about 15 feet (ft) above sea level at its highest point. The average elevation of the ground surface is about 11 ft (USACE 2005). Fort Tilden consists of developed fields and lawns in the areas surrounding the site structures, with heavy brush and grasses located throughout the remainder of the site.

2.3.2 Climate

2.3.2.1 The site is close to the path of most storm and frontal systems that move across the North American continent. Therefore, weather conditions affecting the site most often approach from a westerly direction. The site can thus experience higher temperatures in summer and lower temperatures in winter than would otherwise be expected in a coastal area. The frequent passage of weather systems reduces the length of both warm and cold spells, and also is a major factor in keeping periods of prolonged air stagnation to a minimum.

2.3.2.2 Although continental influence predominates, oceanic influence still occurs. During the summer, local sea breezes and winds blowing onshore from the cool water surface often moderate the afternoon heat. The effect of the sea breeze diminishes inland. On winter mornings, ocean temperatures, which are warm relative to the land, reinforce the effect of the city heat island, and low temperatures are often l0-20 degrees lower in the inland suburbs than in the central city. The relatively warm water temperatures also delay the advent of winter snows. Conversely, the lag in warming of water temperatures keeps spring temperatures relatively cool.

2.3.2.3 Most of the rainfall from May through October comes from thunderstorms, which are. usually intense and of brief duration. Heavy rains of long duration associated with tropical storms occur infrequently in late summer or fall. For the other months of the year, precipitation is more likely to be associated with widespread storm areas, so that day-long rain, snow, or a mixture of both rain and snow is more common. Precipitation accompanying winter storms

sometimes starts as snow, later changes to rain, and perhaps briefly changes back to snow before ending. Coastal storms, occurring most often in the fall and winter months, on occasion produce considerable amounts of precipitation and have been responsible for record rains, snows, and high winds. Relative humidity averages about the same over the metropolitan area except that the immediate coastal areas are more humid than inland locations.

2.3.3 Local Demographics

2.3.3.1 The FUDS property is situated on a barrier island dividing Jamaica Bay from the Atlantic Ocean in Queens County, New York. As of 2000, Queens County had a population density of 20,409 persons per square mile, consisting of a year-round population of 2,224,516 people, 817,250 households, and 537,991 families.

2.3.4 Current and Future Land Use

2.3.4.1 Fort Tilden is comprised predominantly of the Gateway National Recreation Area, which the NPS owns and manages. Nine acres of former Fort Tilden is utilized for the United States Army Reserve Center. The Archive Search Report (ASR) also states that there is an active lease to various local art and theatrical groups. As discussed at the technical project planning (TPP) meeting (Alion 2006), the current uses and land management practices of the site will continue into the future.

2.3.5 Geologic Setting

2.3.5.0.1 Presented in the following sections is geologic information which is utilized during the risk-screening process to identify potential receptors at the site.

2.3.5.1 Geology

2.3.5.1.1 The former Fort Tilden site lies entirely within the re-worked glacial and marine deposits as part of the Atlantic Coastal Plain physiographic province. The province is characterized by a gently rolling, slightly dissected, southward sloping plain. The relatively even surface is cut by very shallow valleys that contain streams or lakes, many of which have been artificially ponded for water supply purposes or recreation. South of these hills and shallow valleys is the outwash plain sloping gently south to tidal marshes, mud flats, and partly interconnected shallow bays. These marshes and flats are separated from the open ocean by barrier islands and beaches (USACE 2005). Fort Tilden is located on Rockaway Spit which has undergone accretionary growth as the westerly flowing long-shore current has moved sediment from the barrier island on the south shore of Long Island toward Rockaway Inlet. Construction

of groin fields at Fort Tilden (Figure 2-2) and the Breezy Point Jetty west of Fort Tilden has accelerated the accumulation of sediments in this area.

2.3.5.1.2 The unconsolidated tertiary aged sediments are underlain by southeasterly dipping Pre-Cambrian crystalline basement bedrock.

2.3.5.2 Soils

2.3.5.2.1 The soil type at the Fort Tilden site can be generally described as sand-silt/sand-clay. In large areas, the site surface is covered with concrete, asphalt, and buildings. The soils underlying these areas have been greatly altered from their original state. The soil is excessively drained and deep. Commonly, the soil has a surface layer of dark yellowish brown silty-clayey sand about 3 inches thick. The substratum extends to a depth of 60 inches or more. It is layers of strong brown or yellowish brown sand or gravelly sand. The permeability of the soil is rapid or very rapid. The available water capacity is very low and runoff is typically slow. The potential for frost development in the soil of the Fort Tilden site extends to a depth of 48 inches (USACE 2005).

2.3.6 Hydrogeologic Setting

2.3.6.0.1 The following sections detail site specific hydrologic information which is utilized during the risk-screening process to identify potential migration pathways as well as receptors at the site.

2.3.6.1 Groundwater

2.3.6.1.1 The important water-bearing formations beneath the site consist of unconsolidated Late Cretaceous and Pleistocene sands, gravels, and clays having a maximum total thickness of about 1,000 ft. The formations are (from oldest to youngest): the Lloyd sand member of the Raritan Formation, the Magothy Formation, and the upper Pleistocene glacial deposits. There are a few clay zones, such as the clay member of the Raritan Formation, as well as zones within the Magothy and Pleistocene formations, that form aquitards and confine the water within the adjacent aquifers (USACE 2005). The depth to potable groundwater underneath Fort Tilden is approximately 250 ft below ground surface within the Magothy Formation. The underlying crystalline basement rocks are of Precambrian Age and are not water bearing (USACE 2005).

2.3.6.1.2 These unconsolidated deposits are highly permeable and contain large quantities of water. The average permeability for these deposits is 6.1308×10^{-2}. The deep artesian aquifers are recharged by downward leakage from the overlying unconfined water to the north of the site (USACE 2005).

2.3.6.2 Surface Water

2.3.6.2.1 Fort Tilden is bordered by Rockaway Inlet on the northwest side and by the Atlantic Ocean on the southeast side of the peninsula. Rockaway Beach extends along the entire Atlantic Ocean side of the site (Figure 2-3) (USACE 2005).

2.3.7 Area Water Supply/Groundwater Use

2.3.7.1 NPS noted during the TPP Meeting that no drinking water wells were located on the subject site (Alion 2006). In addition, the site and surrounding areas (five boroughs of New York City) are serviced by public water supplies from upstate New York. There are no public supply wells within 4 miles of the site as shown on Figure 2-4 and indicated in Table 2-3 (Appendix C).

2.3.8 Sensitive Environments

2.3.8.0.1 Sensitive Environments consist of areas or items of cultural or ecological significance and site specific details of these sensitive items is provided in the following sections.

2.3.8.1 Army Checklist for Important Ecological Places

2.3.8.1.1 In accordance with USACE Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise guidance, the Army Checklist for Important Ecological Places is completed to determine if a FUDS requires a screening level ecological risk assessment (SLERA) (USACE 2006 and 2007). In the case of Fort Tilden, the FUDS contains numerous wetland areas and is within Coastal Zone Management Area (authorized by the Coastal Zone Management Act of 1972, Public Law 92-583, 16 USC 1451-1456). The waters and land within the FUDS boundary have been identified as providing valuable and recognized habitat for ecological receptors, including for more than 30 rare, threatened, or endangered species, three species of whale, four species of sea turtle, 15 bird species, and 16 plant species (USACE 2005); therefore, a SLERA is required (USACE 2006). Refer to Table 2-4 for the completed checklist for Fort Tilden.

2.3.8.2 Wetlands

2.3.8.2.1 As shown in Figure 2-3, the predominant types of wetland system present at Fort Tilden are estuarine and marine wetlands. The estuarine and marine wetlands are the tidal beaches located along the southern border of the subject site. In addition, an area of freshwater forested/shrub wetlands is located in the northwestern corner of the site (U.S. Department of Agriculture 2004).

2.3.8.3 Coastal Zones

2.3.8.3.1 As per the New York State Coastal Zone Management office, Fort Tilden is within a federally excluded land area for coastal zones (New York State Coastal Zone Management 2007). The National Park Service (NPS), the federal owner of the site, approved the SI activities to be completed as planned (Alion 2006). The SI activities were limited to surface soil and subsurface soil sample collection activities at depths of 12 to 18 inches.

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

2.4.0.1 A summary of historical investigations and discoveries of on site MC and MEC is provided in the following sections.

2.4.1 2003 Inventory Project Report

2.4.1.1 A site visit was conducted as part of the Inventory Project Report (INPR) in 1995 by USACE based on the NPS report of on-site MEC. There were no findings of live munitions; however, other ordnance was observed including a 3.5-inch rocket, several 0.50-caliber machine gun bullets, 37-millimeter (mm) machine gun belt links, unidentifiable igniters attached to expended incendiaries, a small burn pit, and a bullets burial pit. No locations of the burn pit or bullet burial pit were presented in the INPR. The INPR noted the presence of expended small arms at two separate locations: the former pistol range and the former rifle range. There was no evidence of any larger caliber MEC on-site (USACE 2005).

2.4.1.2 In 2003, CENAN conducted a Preliminary Assessment of Fort Tilden under the DERP FUDS program. An amendment was requested due to the potential for HTRW and the presence of MEC to be present on-site. The addendum concluded that there were two projects that could be conducted at the site. An ASR could be completed to verify potential presence of MEC. Also, the former pistol range could be evaluated for potential of lead-contaminated soils and a groundwater investigation conducted at the former location of an underground gasoline storage tank. Based on the findings of facts, the INPR dated 19 August 2003 concluded that the site had been determined to be formerly used by the DoD (USACE 2005).

2.4.2 2005 Archive Search Report

2.4.2.1 In 2005, USACE St. Louis District completed an ASR for Fort Tilden. The provided historical information on the former fortifications located at the site, which were identified as Battery Harris East and Battery Harris West, Battery Kessler, Battery Ferguson, the rifle and

pistol ranges, and the Nike installations. The ASR also noted that no evidence of a burn pit or bullet burial pit were observed during the ASR site visit (USACE 2005).

2.4.2.1 Results of the ASR indicated that there was no documentation relating to chemical warfare materiel (CWM) training, storage, or disposal at the site. In addition, no certificates of ordnance clearance or decontamination associated with the site were located.

2.4.2.2 The ASR concluded the site has potential for MEC and MC and recommended these areas for further inspection (USACE 2005). A copy of the ASR is provided in Appendix L.

2.4.3 2004 INPR Supplement

2.4.3.1 An INPR Supplement[1] was prepared (USACE 2004c) which assigned a Risk Assessment Code (RAC) score of 5 (lowest possible RAC score) to the site. One range (Range Complex No. 1) was identified for the site, which consisted of three subranges: Battery Harris, Battery Kessler, and Battery Ferguson. Total acreage for the range complex is 302,952 acres which includes land and water portions of firing positions and range fans, etc.

2.4.3.2 The INPR Supplement provides the general class of munitions used at the site. The information provided in the INPR Supplement was combined with the information regarding specific munitions presented in the ASR and used to generate Table 2-2, which lists the military munitions type and composition for the FUDS for each MRS. A copy of the 2004 INPR Supplement is provided in Appendix L.

2.5 Citizen Reports of Munitions and Explosives of Concern

2.5.1 At the TPP meeting in January 2006, NPS personnel noted that a 3.5-inch practice rocket was found by children on-site in approximately 1991 (Alion 2006 and 2007). No other munitions components have been found on-site other than expended bullets.

2.6 Non-Department of Defense Contamination/Regulatory Status

2.6.1 There is no evidence that activities occurring prior to or after DoD use of the land contributed to present day MEC/Munitions Debris (MD) and MC findings.

[1] Note: this Supplement was called an "INPR Supplement" because it was finalized prior to the ASR being finalized

Table 2-1. Range Inventory (USACE 2005)

Site Name	Range Name[2]	Subrange Name	RMIS Range Number	RAC Score	Acreage[1]
Fort Tilden	Range Complex No. 1 (MRS 1)	Three Subranges (see below)	C02NY001604r01	5	302
		Battery Harris	C02NY001604r01-sr01	5	302
		Battery Kessler	C02NY001604r01-sr02	5	42
		Battery Ferguson	C02NY001604r01-sr03	5	45

RMIS = Restoration Management Information System

1 – Acreage included in Range inventory. May include land outside FUDS Boundary. Subranges within range complexes overlap; therefore, acreage totals for subranges are greater than range complex numbers.

2- MRS designation completed by Alion.

RAC – Risk Assessment Code Score. The RAC allows a score of 1 to 5.

Table 2-2. Military Munitions Type and Composition (USACE 2005)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1, 2]
Range Complex No. 1 (MRS 1)/Coastal Batteries	Large Caliber (37-mm and larger), HE (CTT18)	Coast Artillery Early 1900s/ 37mm, M54, HE w/Tracer	*Projectile:* Common Steel *Filler*: Tetryl or Comp A (RDX and Desensitizer) Weight: varies up to 2.62 lb *Primer:* M61 primer (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) and Black Powder *Detonator:* M23 Potassium Chlorate, Antimony Sulfide, Lead Azide, Carborundum (silicon carbide) Tetryl *Booster* : Tetryl *Propellant*: M1 -Nitrocellulose, Dinitrotoluene [DNT], Dibutylphthalate, Diphenylamine, or M2 - Nitrocellulose, Nitroglycerin [NG], Barium Nitrate, Potassium Nitrate, Ethyl Centralite, Graphite *Tracer* : tracer compound not determined	*MC from coastal batteries are associated with the firing point; therefore, only propellant constituents (in the "Composition" column) are carried forward for analysis in this SI. See Note #2.* Explosives: • Ethyl Centralite (no analysis) • Nitrocellulose (no analysis) • Black Powder (no analysis) • Diphenylamine (stabilizer - no analysis) • DNT • NG Metals: • Barium
		37-mm, Cartridge, M55A1	*Projectile:* Common Steel *Filler:* M55A1 Practice – Empty, *Propellant*: 6 oz of FNH (Flashless Non-hydroscopic Smokeless Powder)	*MC from coastal batteries are associated with the firing point; therefore, propellant constituents (in the "Composition" column) are carried forward for analysis in this SI. See Note #2.* Explosives: • Flashless Non-hydroscopic Smokeless Powder (no analysis) • Nitrocellulose (no analysis) Metals: • None
		3-inch Armor Piercing – M9, M10 & M79	*Filler*: Explosive D (Ammonium Picrate) in M79; M9 & M10 are hollow bronze castings Weight: N/A *Propellant*: 4.38 lb of FNH (Flashless Non-hydroscopic Smokeless Powder)	
		155-mm, HE, M102, MK I, MK IA1	*Filler*: TNT 15.56 lb Weight: 95 lb (total) *Propellant*: smokeless powder	
		16-inch, AP, Mk 5 Mod 1-5	*Filler*: Explosive D (Ammonium Picrate) 34 lb Weight: 2,240 lb (total) *Propellant*: smokeless powder	

Table 2-2. Military Munitions Type and Composition (USACE 2005)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1, 2]
Range Complex No. 1 (MRS 1)/ Rifle Range Range Complex No. 1 (MRS 1)/ Pistol Range	SMALL ARMS (CTT01)	General Small Arms (Various through 30-mm)	*Projectile:* .50 cal: Lead, Antimony, cupro-nickel, and Soft Steel. *Propellant*: Single or Double-base powder (Nitrocellulose and NG) or smokeless powder Nitrocellulose (91.18%), DNT (7.0%), Diphenylamine (.87%), Potassium sulfate (.55%), Graphite (.4%). *Tracer:* R-256 (Strontium Peroxide, Calcium Resinate, Strontium Oxalate, Strontium Nitrate, Magnesium) and I-276 (Barium Peroxide, Magnesium, Zinc Stearate, Toluidine dry red) or R 237 (Strontium Nitrate, Magnesium, calcium resinate, potassium perchlorate) *Primer:* Barium Nitrate, Lead Styphn Antimony Sulfide, Aluminum Powder, PETN, Tetracene *Filler*: N/A. …… *Projectile*: .30 cal: antimony, lead, and iron and potentially zinc. *Propellant*: Black Powder (Potassium Nitrate, Sulfur, and Charcoal), nitrocellulose, and nitroglycerine (NG). *Tracer: Tracer – R-321 or R 284, I-136 or R-10-F, I-280*1 or R-20-C* - Magnesium Powder, strontium peroxide, Calcium Resinate, Lead Dioxide, Barium peroxide Primer: FA 70 (Potassium Chlorate, Lead Thiocyanate, Antimony Sulfide, TNT) or FA 675 (Barium Nitrate, Red Phosphorus) *Filler*: N/A.	*MC from rifle/pistol ranges are associated with the firing point and the impact area; therefore, the propellant and the projectile constituents in the "Composition" column) are carried forward for analysis in this SI. See Note #1.* Explosives: • Nitrocellulose (no analysis) • NG • DNT Metals: • Antimony • Copper • Lead • Iron • Nickel • Zinc

Table 2-2. Military Munitions Type and Composition (USACE 2005)

Range ID (MRS)/ Subrange	Munitions ID	Munitions Type	Composition (Filler, Projectile, Body, Propellant, other)	Associated MC Analysis[1, 2]
Range Complex No. 1 (MRS 1)/ Pistol Range	ROCKET	3.5-Inch, Practice, M29	*Filler*: 1.82 lb of Plaster of Paris / Stearic Acid Weight: 8.61 lb *Propellant*: 12 grains of M7 Propellant powder *Projectile:* Common Steel	*MC from rifle/pistol ranges are associated with the firing point and the impact area; therefore. the propellant and the projectile constituents(in the "Composition" column) are carried forward for analysis in this SI.* Explosives: • Perchlorate[3] (no analysis) Metals: • Iron

(MRS) – Munitions Response Site designation
AP=Armor Piercing
Mk=Mark
lb=pound(s)
TNT=trinitrotoluene
HE=High Explosive
Tetryl=Methyl-2,4,6-trinitrophenylnitramine
DNT=Dinitrotoluene
RDX=hexahydro-1,3,5-trinitro-1,3,5-triazine
NG=nitroglycerin
mm=millimeters
in=inch(es)
oz=ounces
CTT= Closed, transferred or transferring
N/A=Not Applicable

[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] No impact/target areas, burial areas, or open burn/open detonation (OB/OD) area are located onsite. No report of explosions associated with the batteries/firing points were found in historical records. The material present in the projectiles, filler, booster, or detonator, to include Explosive D, TNT, mercury fulminate, or tetryl is not likely to be found around the firing points (USACE 2003). As noted in this column, based on the munition type and firing operations, MC from rifle/pistol ranges are associated with the firing point and the impact area and from coastal batteries, at the firing point.

[3] See paragraph 5.1.1.2

Table 2-3. Groundwater Wells Near Fort Tilden

PWSID	Well Name	UTM NAD 83, Zone 18 North		Well Depth (ft)	Well Screened (ft)	Well Yield (gpm)	Aquifer
		Easting (m)	Northing (m)				
No potable or public supply wells located within 4 miles of the site.							

ID-identification
m-meter
ft-feet
gpm-gallons per minute
N/A-not applicable

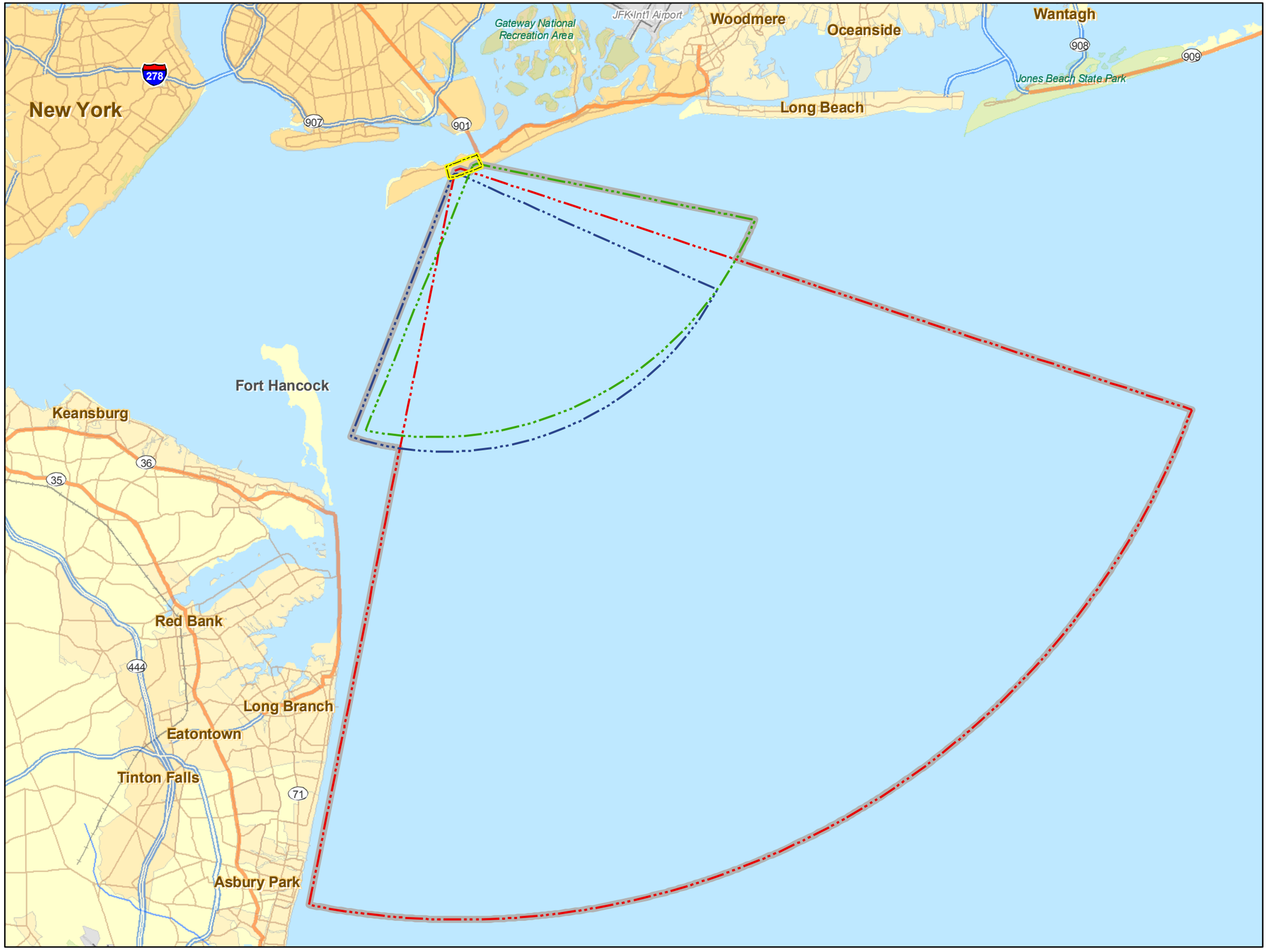
UTM-Universal Transverse Mercator
NAD-North American Datum
PWSID – public water system identification
-, information unknown/unavailable

Table 2-4 Army Checklist for Important Ecological Places

No.	Checklist Item	Yes / No		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		The FUDS is part of the Gateway National Recreation Area (GNRA) managed by the National Park Service (NPS).
2.	Critical habitat for Federal designated endangered or threatened species. See No. 12 below.	X		The site was identified as potential habitat for endangered or threatened species.
3.	Marine Sanctuary		X	
4.	National Park	X		
5.	Designated Federal Wilderness Area		X	
6.	Areas identified under the Coastal Zone Management Act	X		The site is located within a Coastal Management 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		The site was identified as potential habitat for endangered or threatened species.
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		The FUDS is part of the GNRA managed by the NPS.
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	

Table 2-4 Army Checklist for Important Ecological Places

No.	Checklist Item	Yes / No		Comments
24.	Habitat known to be used by species under review as to its Federal endangered or threatened status		X	
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 site contains designated wetlands.
33.	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	X		The site was identified as potential habitat for endangered or threatened species.



Fort Tilden
Long Island, New York

Legend

- Battery Ferguson
  Acreage = 45,360.27 Ac
  Land Acreage = 50.64 Ac
  Water Acreage = 45,309.63 Ac
- Battery Harris
  Acreage = 292,948.68 Ac
  Land Acreage = 72.83 Ac
  Water Acreage = 292,875.85 Ac
- Battery Kessler
  Acreage = 42,044.50 Ac
  Land Acreage = 26.81 Ac
  Water Acreage = 42,017.69 Ac
- RangeComplex1
  Acreage = 302,952.29 Ac
  Land Acreage = 138.86 Ac
  Water Acreage = 302,813.43 Ac
- FUDS Boundary

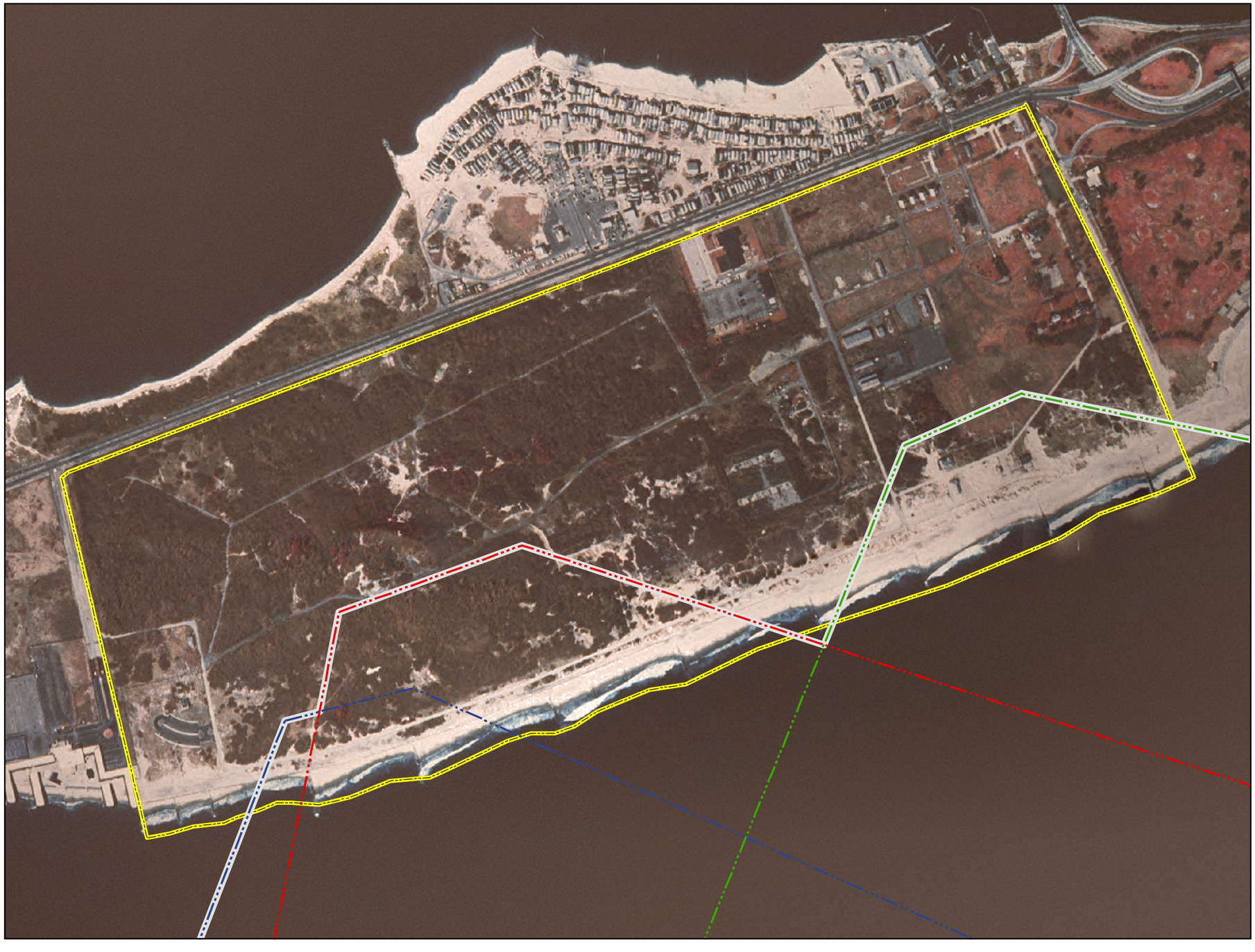
Acronyms
MRS - Munitions Response Site
FUDS - Formerly Used Defense Site

Sources:
USACE, 2004c
ESRI StreetMap, 2006

0 5 10
Miles

\projects\GIS\62023012006\Fort Tilden\FINAL\Figure2-1

Figure 2-1. Munitions Response Sites for Fort Tilden.



Fort Tilden
Long Island, New York

Legend

Battery Ferguson
Acreage = 45,360.27 Ac
Land Acreage = 50.64 Ac
Water Acreage = 45,309.63 Ac

Battery Harris
Acreage = 292,948.68 Ac
Land Acreage = 72.83 Ac
Water Acreage = 292,875.85 Ac

Battery Kessler
Acreage = 42,044.50 Ac
Land Acreage = 26.81 Ac
Water Acreage = 42,017.69 Ac

RangeComplex1
Acreage = 302,952.29 Ac
Land Acreage = 138.86 Ac
Water Acreage = 302,813.43 Ac

FUDS Boundary

Note:
The limits of Range Complex 1, Battery Ferguson, Battery Harris, and Battery Kessler extend into the Atlantic Ocean. Please see Figure 2-1 for complete range extents.

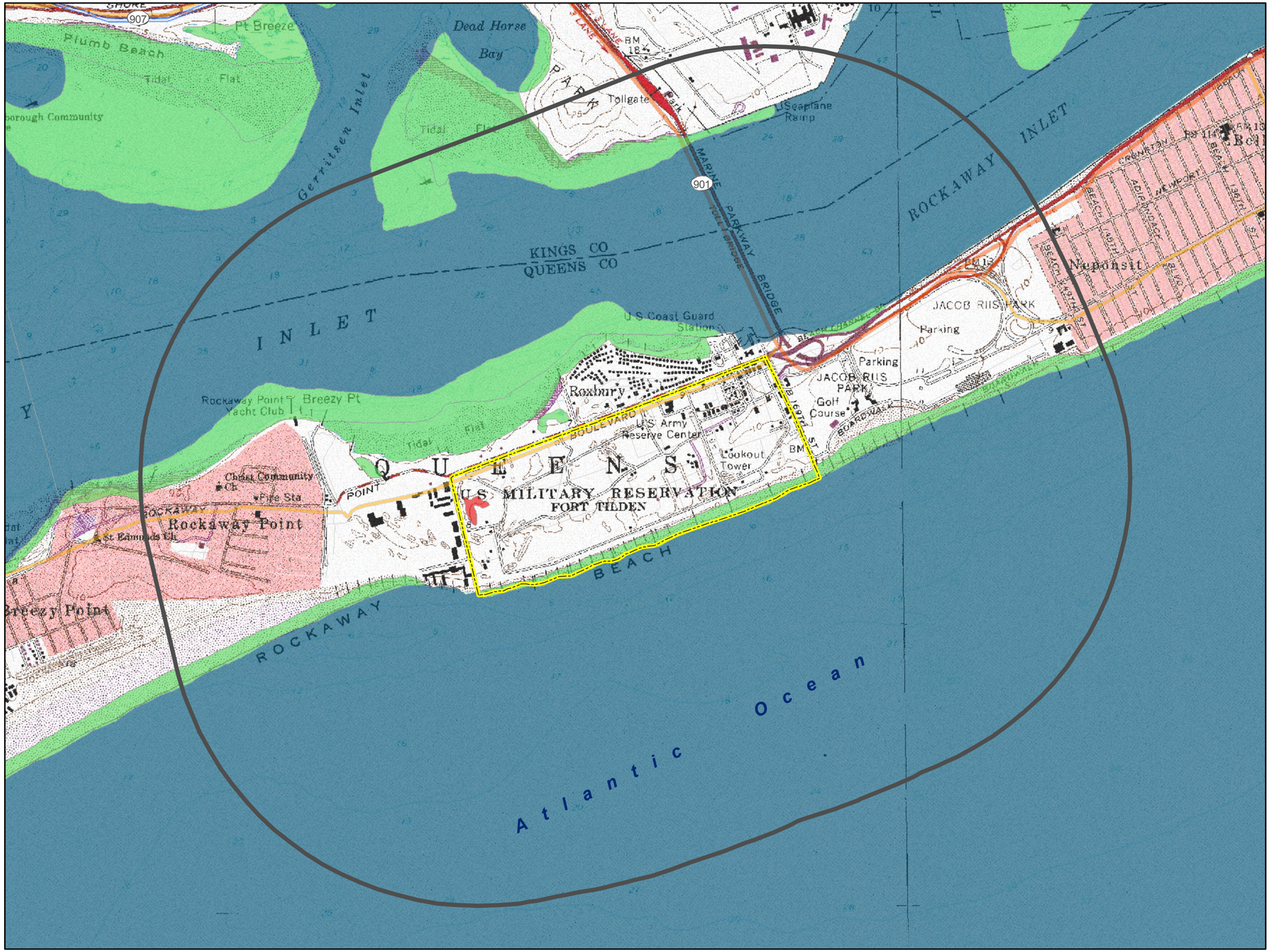
Acronyms
FUDS - Formerly Used Defense Site

Sources:
USACE, 2004
USDA-FSA-APFO, 2004

0 200 400
Meters

\\projects\GIS\62023011\2006\Fort Tilden\FINAL\Figure2-3

Figure 2-2. Range Detail.



Fort Tilden
Long Island, New York

Legend

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Forested/Shrub Wetland
- 1 Mile Radius
- FUDS Boundary

Acronyms
FUDS - Formerly Used Defense Site

Sources:
USGS-NRCS-NCGC, 2002
USFWS National Wetland Inventory, 2006

0 500 1,000
Meters

\projects\GIS\62023011\2006\Fort Tilden\FINAL\Figure2-3

Figure 2-3. Site Location and Surroundings.

Fort Tilden

Long Island, New York

Legend

- 1/4, 1/2, 1, 2, and 4 Mile Radii
- FUDS Boundary

Note:
There are no production supply wells or wellhead protection areas within four miles of Fort Tilden.

Acronyms
FUDS - Formerly Used Defense Site

Sources:
NYSDOH, 2007
USGS-NRCS-NCGC, 2002

0 2,000 4,000
Meters

\projects\GIS\62023012006\Fort Tilden\FINAL\Figure2-4

Figure 2-4. Wells, Wellhead Protection Areas, and Source Water Protection Zones.

3. SITE INSPECTION ACTIVITIES

3.1 Technical Project Planning

3.1.1 The first TPP Meeting for Fort Tilden was conducted on 25 April 2006 at the NPS offices within the Fort Tilden portion of the Gateway National Recreation Area, Jamaica Bay Unit, located in Breezy Point, New York. The Final TPP Memorandum documenting the meeting was issued 12 June 2006 (Alion 2006). The meeting participants included representatives from CENAB and CENAN, the NPS Jamaica Bay Unit, and the Alion Team. During the first TPP meeting, the participants provided valuable information that guided SI activities. Part of the decision making process included an evaluation of Fort Tilden's historic usage and the development of a media sampling plan to characterize any potential impacts from that usage. Meeting participants decided that sampling for surface soil would be sufficient to evaluate potential site impacts. One the media of concern where identified, six Data Quality Objectives (DQOs) were defined for this SI (Alion 006 and 2007). The TPP discussion involved a presentation of and agreement with the general decision rules for completing the SI objectives. These decision rules are stated in the DQO worksheets and summarized below.

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

- Historic data that indicates the presence of MEC or 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.)

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

3.1.4 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 IX Preliminary Remediation Goals (PRGs) based on current and future land use.
- Maximum concentrations at the site exceed EPA ecological risk screening values.
- Data reporting the presence or absence (less than detection limits) of analytes for which no screening criteria (decision limits: PRGs, etc.) are available are to be used to support the weight-of-evidence evaluation of MC at the site.

3.1.5 In each of these instances, 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 decision for an NDAI or RI/FS.

3.1.6 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.[2] 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 6 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 6 months planning time is available.

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

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

- Refers to culmination of DQOs 1 and 2.

[2] 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.

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

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

3.1.10 DQO 6 – Collect the additional data necessary to 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.

3.1.11 The TPP meeting participants concurred with the DQOs and the general technical approach for the planned SI activities discussed during the TPP (Alion 2006) and as revised and subsequently documented in the Final SS-WP (Alion 2007). In summary, these agreements were to inspect the cited areas of concern and conduct multimedia sampling in accordance with the Final SS-WP, and to complete the data assessment in accordance with the DQOs. Please refer to the Final TPP Memorandum (Alion 2006), attached in Appendix B, for more specific details of the TPP meeting. In support of this SI Report, Alion evaluated the DQOs presented in the SS-WP and completed a DQO verification worksheet to document completion of the DQOs (included in Appendix B).

3.2 Supplemental Records Review

3.2.0.1 Supplemental records evaluated during the SI process are detailed below.

3.2.1 Threatened and Endangered Species

3.2.1.1 The USFWS, the National Marine Fisheries Service, and the New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources have indicated that federally and/or state listed, proposed, candidate, species of concern, and critical habitats may occur within or near the project area (USACE 2005). No threatened or endangered species were observed during SI activities.

3.2.2 Cultural and Archaeological Resources

3.2.2.1 The State Historic Preservation Office (SHPO) and the State Archaeologist's Office have indicated previously that no specific known culturally significant historic or archaeological sites are located in the vicinity of Fort Tilden (USACE 2005).

3.3 Site Inspection Field Work

3.3.1 The SI field work included one sampling event completed on 23 January 2007. The field event was conducted in accordance with the PWP (Alion 2005) and the Final SS-WP (Alion 2007). A qualitative site reconnaissance for MEC and sample collection and analyses for MC was completed. A total of 8 acres were assessed through the qualitative reconnaissance. A total of eight surface, four subsurface soil, and five background soil samples were collected. Surface soil samples were collected as 7-point composite wheel samples, and the four subsurface soil 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. Sample locations, sample designations, and sampling rationale are summarized in Table 3-1. Sampling locations are depicted on Figure 3-1. Additional information pertaining to the field activities, including the field notes and forms, are included in Appendix D. Photograph locations and descriptions are presented in Appendix E.

3.4 Work Plan Deviations and Field Determinations

3.4.1 Deviations from the Final SS-WP (Alion 2007) occurred, with respect to the number of samples collected and the location of samples. The SS-WP included a total of 15 soil samples: five surface soil, three subsurface soil, and five background soil samples. The locations of samples were modified slightly due to accessibility issues as agreed upon in the SS-WP. One additional surface soil sample was collected at Battery Harris West and one additional subsurface sample was collected at Battery Harris East to better characterize the conditions at the Battery Harris fortifications (which consist of two separate structures). Deviations to the SS-WP are documented in the DQO Verification Worksheet, included in Appendix B. These deviations are acceptable as they have enhanced the data collection process with additional samples as well as sampling biased towards areas of expected contamination. In addition, quality assurance split samples were collected in accordance with CENAB direction. A USACE Chemical Quality Assurance Report has been included in Appendix G.

3.5 Site Inspection Laboratory Data Quality Indicators

3.5.1 This section summarizes the data quality assessment for the Fort Tilden 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 II 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 (DQI) include precision, accuracy, representativeness, completeness, and comparability (PARCC) as well as sensitivity.

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 compared to acceptable values based on Region II 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 also are 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 II Data Validation Guidelines and assigned qualifiers (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 Tilden. It should also be noted that two additional samples were collected by the field team to better characterize the site.

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 Tilden. None of the 694 total analyte results associated with this sample effort was rejected; therefore, the completeness indicator is 100 percent, and the Fort Tilden data meet the completeness data quality indicator.

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 Tilden 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[3]. If screening criteria exceed detection limits, the certainty of "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 Tilden; consequently, sensitivity has been achieved for all MC associated with Fort Tilden. 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 findings, conclusions, and recommendations of the Draft Final SI Report; review the MRSPP (Appendix K); and confirm that the project objectives and DQOs have been achieved (Alion 2007b and 2006b).

[3] 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) is established at a factor of five to ten times the MDL for the majority of target analytes but no lower then three times the MDL for any target analyte (Alion 2005).

Table 3-1 Fort Tilden Sample Locations and Field Observations

Range Location (MRS)	Sampling ID	Coordinates (UTM,NAD83, ZONE 18, Meters)		Work Plan Rationale for Sampling Locations (Alion 2006b)	Comments
		Easting (m)	Northing (m)		
Background Samples	FTL-BG-SS-02-01	594535	4491177	Areas un-impacted by former DoD use.	None
	FTL-BG-SS-02-02	594412	4491139	Areas un-impacted by former DoD use.	None
	FTL-BG-SS-02-03	593930	4491000	Areas un-impacted by former DoD use.	None
	FTL-BG-SS-02-04	593540	4490893	Areas un-impacted by former DoD use.	None
	FTL-BG-SS-02-05	593213	4490639	Areas un-impacted by former DoD use.	None
Range Complex No. 1 (MRS 1)	FTL-HS-SS-02-01	593484	4490501	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-HS-SB-02-01	593484	4490501	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-HS-SS-12-01	593704	4490633	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-HS-SB-12-01	593704	4490633	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-FG-SS-02-01	594649	4490765	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-FG-SB-02-01	594697	4490786	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-KS-SS-02-01	593420	4490287	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None

Table 3-1 Fort Tilden Sample Locations and Field Observations

Range Location (MRS)	Sampling ID	Coordinates (UTM,NAD83, ZONE 18, Meters)		Work Plan Rationale for Sampling Locations (Alion 2006b)	Comments
		Easting (m)	Northing (m)		
	FTL-KS-SB-02-01	593357	4490280	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	None
	FTL-PR-SS-02-01	593763	4490560	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	Expended bullets/slugs identified in sampling area
	FTL-PR-SS-02-02	593758	4490557	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	Expended bullets/slugs identified in sampling area
	FTL-RR-SS-02-01	593948	4490512	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	Expended bullets/slugs identified in sampling area
	FTL-RR-SS-02-02	593962	4490516	Runoff collection areas, discolored soil, stressed vegetation down gradient of MEC discoveries/ground scarring near the front of the coastal batteries.	Expended bullets/slugs identified in sampling area

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Legend

- Field Sample Location
- Geophysical Reconnaissance Route
- Battery Ferguson
- Battery Harris
- Battery Kessler
- Range Complex 1
- FUDS Boundary

Sample ID Designation
"FTL-HS-SB-12-01"
Site Name-Sampling Location-Sample Type-Sample Depth-Sample #
SS - Surface Soil Sample
SB - Subsurface Soil Sample
BG - Background
HS - Battery Harris
KS - Battery Kessler
FG - Battery Ferguson
PR - Pistol Range
RR - Rifle Range

Acronyms
FUDS - Formerly Used Defense Site

Source:
USDA-FSA-APFO, 2004

0 200 400
Meters

\\projects\GIS\620230\2006\Fort Tilden\FINAL\Figure3-1

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

4. MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING LEVEL RISK ASSESSMENT

4.1 Operational History

4.1.1 Fort Tilden was established as a coastal defense site in 1917 and was utilized for military purposes until 1974. The Department of the Army utilized Fort Tilden from 1917 to 1967. Various munitions were used to defend New York Harbor, ranging from large caliber munitions to small arms (see Table 2-2). Batteries constructed and operated to support the coastal mission included East and West Battery Harris (16-in. Naval guns), Battery Kessler (6-in. guns), and Battery Ferguson.(6-in. guns). In addition, there were both a pistol range and an 800-yard rifle firing range located at Fort Tilden and documented as being present in the early 1960s. Other missions at Fort Tilden included testing of anti-aircraft guns (approximately 1917 to early 1950s) and housing of Nike Ajax, and later, Nike Hercules anti-aircraft missiles (1950s to 1967). Between 1968 and 1974, the Nike Hercules missiles at Fort Tilden were decommissioned (USACE 2005). The Nike missile facilities was not included in this SI since this potential AOC was decommissioned successfully and not included in the INPR Supplement (USACE 2004c). Stakeholders agreed with this conclusion (Alion 2006).

4.1.2 In 1967, the 311 acre installation was decommissioned and remained under Army management. In 1976, the Army transferred 302 acres of land to the Department of the Interior, NPS. The property subsequently was incorporated into the Gateway National Recreation Area. The remaining 9 acres were transferred to the United States Army Reserve to establish a reserve center, which is still active (USACE 2005).

4.2 Site Investigation Munitions and Explosives of Concern Field Observations

4.2.0.1 A qualitative reconnaissance based on both visual observations and analog geophysics was completed. A visual reconnaissance of the site surface was completed to identify MPPEH/MD/MEC, and suspect areas, such as distressed vegetation, stained soil, target remnants, and visual metallic debris. Analog geophysics was used primarily to support anomaly avoidance activities for the field crew. Where appropriate, subsurface 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 8 acres[4].

4.2.1 Range Complex No. 1 (MRS 1)

4.2.1.1 Range Complex No. 1 (MRS 1) encompasses three sub-ranges and two areas of concern (AOCs), including Battery Harris East and West, Battery Kessler, Battery Ferguson, the Pistol Range, and the Rifle Range. Alion completed reconnaissance of the former range areas within MRS 1 using analog geophysics (magnetometer) following a meandering path. Site reconnaissance and sampling locations are shown on Figure 3-1. Field observations related to cultural debris, range-related features, and MD/MEC finds are summarized in Table 4-1 and presented below.

Battery Harris (East and West)

- The area is located along the central access road on-site
- The area was relatively free of heavy vegetation and easy to navigate
- Cultural debris (metal and concrete debris) was found on the surface. No subsurface anomalies were identified
- There was no evidence of burial pits, berms, or other features indicative of an open burn/open detonation (OB/OD) area
- No MD/MEC was observed
- Two surface soil and two subsurface soil samples were collected near designated sampling locations.

Battery Kessler

- The range is located along the southern access road overlooking the beach
- The area was overgrown and hard to navigate, therefore, access was limited to trails within the overgrowth
- No subsurface anomalies were observed
- No evidence of burial pits, berms, or other features indicative of an OB/OD area was observed
- No evidence of MD/MEC was observed
- One surface soil sample and one subsurface soil sample were collected near designated sampling locations.

[4] 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.

Battery Ferguson

- This battery is located in the southeastern portion of the site. The area was overgrown and difficult to navigate
- No subsurface anomalies were observed
- No evidence of burial pits, berms, or other features indicative of an OB/OD area was observed
- No evidence of MD/MEC was observed
- One surface soil sample and one subsurface soil sample were collected near designated sampling locations

Pistol Range

- The range is located south of Battery Harris East and northwest of the Rifle Range
- The area was overgrown and difficult to navigate
- The backstop was located
- No subsurface anomalies were observed
- There was no evidence of burial pits, berms, or other features indicative of an OB/OD area
- Small quantities of expended bullets were located on the surface of the backstop location
- Two surface soils samples were collected from the backstop.

Rifle Range

- The range is located north of the southern access road in the central portion of the site
- The area was overgrown and difficult to navigate
- The backstop was located
- No subsurface anomalies were observed.
- There was no evidence of burial pits, berms, or other features indicative of an OB/OD area.
- Significant quantities of expended bullets were located on the surface of the backstop location.
- Two surface soils samples were collected from the backstop.

4.2.2 Background Samples

4.2.2.1 Five surface soil background samples were collected from the northern portions of the site in areas un-impacted by former DoD use. The qualitative reconnaissance and sampling locations are shown on Figure 3-1. There was no observed evidence of MEC or MD in the any of the background sample locations.

4.3 Munitions and Explosives of Concern Risk Assessment

4.3.0.1 A qualitative MEC screening level risk assessment for potential explosive safety risks was conducted based on the SI qualitative reconnaissance, as well as historical data documented in the INPR, ASR, and INPR Supplement (USACE 2005). 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). A 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 Range Complex No. 1 (MRS 1)

4.3.1.1 MRS 1 encompasses Battery Harris (East and West), Battery Kessler, Battery Ferguson, Pistol Range, and Rifle Range. Although identified in the INPR, the former burn pit and bullet burial area were not evaluated since these areas were not identified as AOCs in the ASR and INPR Supplement, and no evidence of these features was observed during the ASR site visit or the TPP site reconnaissance. As discussed in Sections 2.4.4, 2.5, and 4.2.1, MEC/MD related to the munitions used (see Table 2-2) have been recovered in MRS 1. MEC discoveries included a 3.5-inch practice rocket found in approximately 1991 on-site by children. Since the warhead was inert within the 3.5” practice rocket, only the ballistite in the rocket motor could be potentially

explosive. No MEC was identified during the SI reconnaissance; however, MD (expended small caliber bullets) was identified at the former rifle and pistol ranges.

4.3.1.2 No documented injuries have occurred since DoD transferred the FUDS to the current owners. The site consists of rugged terrain with varying elevations; however, there are no fences restricting access to the former batteries and ranges in this MRS. The MRS, which is fenced on three sides and open to the water, contains trails and roads which are accessible to park visitors for hiking, biking, and picnicking, though some trails and roads are gated and only accessible to NPS employees. The most likely human receptors (adults and children) are recreational users and park personnel who may travel through the park on foot.

4.3.1.3 Given the limited use and nature of the site usage as a coastal artillery battery (range fans extend to open ocean), the areal extent of contamination is estimated to be relatively small. The overall MEC risk is considered low.

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	Battery Harris East	593704	4490633
2	Battery Harris West	593484	4490501
3	Pistol Range Backstop	593763	4490560
4	Rifle Range Backstop	593948	4490512
5	Battery Kessler	593420	4490287

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

5. MUNITIONS CONSITUENTS 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 for this MRS and grouped by media.

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 the 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 2007). Summary tables are arranged by media and contain the complete analyte lists. ***However, the following discussions are limited to those analytes associated with 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 range and munitions-related operations, MC from coastal batteries are associated with the firing point only; therefore, only the propellant constituents are carried forward for analysis in this SI and not the MC from the projectile since those would be present at the impact area, if at all. In addition, MC from the land-based rifle/pistol ranges are associated with the firing point and the impact area; therefore, the propellant and the projectile constituents are carried forward in this SI.*** Specific MC associated with the MRS, as presented in Table 2-2, is summarized below:

Range Complex No. 1 (MRS 1) –

- Explosives (dinitrotoluene [DNT] and nitroglycerin [NG])
- Metals (antimony, barium, copper, iron[5], lead, nickel, and zinc)

[5] 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 is not further evaluated as MC. Refer to Section 5.1.3 for additional information regarding the screening process.

5.1.1.2 Although perchlorate was a component of the M7 propellant powder used within the 3.5-inch practice rocket found at the pistol range, due to the isolated occurrence of the find as well as the lack of other historical documentation regarding practice rocket use, no sampling for perchlorate was completed as discussed during the TPP process.

5.1.2 Data Quality

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

- Eight surface and four subsurface soil samples (between 0 and 2 ft below ground surface)
- five background surface soil samples
- one set of duplicate samples

5.1.2.2 The first step in the process of identifying chemicals of potential concern (COPCs) and chemicals of potential environmental 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:

- Analytical results bearing the U or UJ 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 actual 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.

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 IX PRG Screening Values, as shown in Table 5-1 (EPA 2004a). 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. For the human health risk screening, the surface soil sample analytical results are compared to residential and industrial soil PRGs (EPA 2004a). The EPA Region IX PRG tables combine current EPA toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, water) that are protective of humans, including

sensitive groups, over a lifetime. The PRGs consist of concentrations for nearly 600 chemicals that, in general, correspond to fixed levels of risk (i.e., either a one-in-one-million cancer risk or a non-carcinogenic hazard quotient (HQ) of one, whichever occurs at a lower concentration) in soil, air, and water. To account for potential additivity of non-carcinogenic hazards, non-carcinogenic PRGs have been divided by 10 for screening purposes. There are two important exceptions to risk-based standards for soil: (1) PRGs are based on a soil saturation equation for several volatile organic compounds; and (2) a non-risk-based "ceiling limit" is given as 10^{+5} milligrams per kilogram for relatively less toxic semi-volatile contaminants.

5.1.3.2 For the ecological risk screening, the surface soil sample results are compared to ecological soil screening levels presented in Table 5-2. If the concentration exceeded the screening value the analyte was retained as a COPEC.

5.1.3.3 Per EPA guidance (USEPA 1989), 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 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 it is an essential nutrient of low toxicity, and its reported maximum concentration is unlikely to be associated with adverse health impacts. COPCs/COPECs excluded from further consideration on this basis include aluminum, iron, and magnesium.

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

5.1.4.1 Current EPA guidance (EPA 2001) requires that detection limits be addressed, particularly with respect to the screening values used to select COPCs/COPECs. If a chemical is never detected, but the detection limit is higher than the screening value, or there is no screening value, then it may or may not be appropriate to designate the chemical as a COPC/COPEC,

depending on whether the chemical is site-related or not. There is insufficient information, in such a case, to exclude or include the chemical as a COPC/COPEC. This instance would be noted as a source of uncertainty in the risk assessment screening.

5.1.4.2 Table 5-3 identifies the reporting limits and human health and ecological risk screening values for all analytes in soil for those analytes not detected. All screening values are higher than the detection limits for the analytes of concern at Fort Tilden; consequently, the DQI for sensitivity has been achieved for all MC associated with Fort Tilden. Where no screening values are available (i.e., four analytes for ecological screening values in Table 5-3), 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 the MRS evaluated at Fort Tilden is provided in Appendix J. The 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 CSM has been revised from the CSM presented in the Final SS-WP to reflect the results of the human health and ecological risk screening.

5.2.2 Current and future potential human receptors for MC are expected to be trespassers/recreational users, construction workers, and site workers as depicted in the CSM diagrams in Appendix J. Both residential and industrial receptor scenarios are evaluated in the human health screening-level risk assessment. The residential scenario was assessed for the protection of current and future recreational users on the FUDS. The industrial scenario is assessed for the protection of construction or other workers that may frequent the site. The ecological receptors of concern for the MRS include terrestrial plant/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 medium of concern for human and ecological receptors at the site is surface soil.

5.3 Background Data Evaluation

5.3.1 Table 5-4 presents a range of concentrations in the three background soil samples for chemicals detected on-site. A qualitative comparison was made between the range of concentrations (minimum to maximum) for on-site samples and the range of background samples for the metals associated with past munitions use at the site (including antimony, barium, copper,

lead, nickel, and zinc) which excludes those essential nutrients called out in Section 5.1.3. Some of the ranges of background concentrations (specifically antimony and lead) are noted as being above ecological screening criteria. In those cases where analytes exceed screening criteria but not background values, a weight of evidence approach is applied to determine if those analytes are considered COPCs/COPECs in a particular MRS.

5.3.2 Instances where background exceeds screening criteria or results exceed screening criteria but not the background range are documented in the results sections below and conclusions are drawn based on the weight of evidence in each case.

5.4 Range Complex No. 1 (MRS 1)

5.4.0.1 As presented in Section 5.1.1, two explosives (DNT and NG), and seven metals (antimony, barium, copper, iron, lead, nickel, and zinc) are the MC of interest. As discussed in Section 5.1.3, iron is an essential nutrient and has not been addressed in this analysis. Table 5-1 includes a summary of all data including those analytes that are not associated with the munitions used in MRS 1.

5.4.1 Groundwater Pathway and Screening Results

5.4.1.1 No potable water supply wells are located on the site. Public potable water is supplied from off-site water sources. Therefore, no sampling of groundwater was completed during the January 2007 SI event. Based on this information, the pathway in the CSM is identified as incomplete for human and ecological receptors in this SI Report (Appendix J).

5.4.2 Surface Water and Sediment Pathway and Screening Results

5.4.2.1 As indicated during the TPP Meeting, surface water intemittantly exists on-site in the form of a rainwater fed “pond” or depression. This depression reportedly dries up during periods of hot weather or little precipitation. Therefore, the surface water pathway was viewed as an incomplete pathway for human and ecological receptors for MC in the SS-WP (Alion 2007) and samples of surface water and sediment were not collected during the SI. Consistent with this rationale, the pathway in the CSM is identified as incomplete for human and ecological receptors in this SI Report (Appendix J).

5.4.3 Terrestrial Pathway and Screening Results

5.4.3.1 The site contains natural barriers to include lush vegetation and rugged terrain. However, surface soil in MRS 1 was viewed as a potentially complete pathway for human and ecological receptors for MC in the SS-WP (Alion 2007). A total of eight surface soil, four

subsurface soil, and five background soil samples were collected from MRS 1. Table 5-1 presents a summary of soil sample results compared to human health screening values (residential and industrial) and ecological screening criteria for MRS 1. Antimony and lead were detected above the human health screening criteria (residential or industrial Risk-Based Concentrations [RBCs]) for soil. While 2,4-dinitrotoluene was detected at very low levels once and nitrobenzene three times, none of explosives were detected above human health screening criteria in soil. Based on the sample results, the pathway in the CSM is identified as complete for human receptors for lead and antimony in this SI Report (Appendix J).

5.4.3.2 Antimony, copper, lead, and zinc were reported in surface soil samples as exceeding ecological screening criteria and identified as COPECs for MRS 1. In addition, the range of background concentrations at the FUDS exceeds the ecological screening criteria for lead and antimony. The range of background concentrations for copper and zinc are below the screening criteria. About 50 percent of the lead results are within background; however, three of results are greater than 100 times the screening criteria. Most antimony results are within the range of background concentrations; however, a couple of results are between 30 and 100 times the screening criteria and 7 to 25 times the range of background concentrations. The samples containing high metals were located in a berm used to stop bullets, therefore while bullet fragments were specifically excluded from these samples, abraded metals from the bullets may have mixed with the soil samples. Based on the sample results, the ecological pathway in the CSM is identified as complete in this MRS for the SI Report.

5.4.4 Air Pathway

5.4.4.1 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 surface soil (metals and explosives). Only low levels of metals were detected in soil, and given the non-volatile nature of the constituents detected, the suspension of constituents in air is limited to airborne particulates. Therefore, the fraction of COPCs 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).

			Sample Name:	USEPA Region IX PRG Screening Value [1]	USEPA Region IX PRG Screening Value [2]	Ecological Screening Values [3]	FLT-FB-SB-12-01	FLT-FG-SS-02-01	LT-FG-SS-02-01DU	FLT-HS-SB-02-01	FLT-HS-SB-12-01	FLT-HS-SS-02-01	FLT-HS-SS-12-01	FLT-KS-SB-12-01	FLT-KS-SS-02-01
			Sample Date:				1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007
			Parent Name:						FLT-FG-SS-02-01						
			MRS:				MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1
Analyte	**CAS**	**Unit**													
Explosives															
1,3,5-TRINITROBENZENE	99-35-4	mg/kg		180	1800	NSL	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		0.61	6.2	NSL	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		0.72	2.5	30	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.0063 J	0.04 U	0.04 U	0.04 U
2,6-DINITROTOLUENE	606-20-2	mg/kg		0.72	2.5	30	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		1.2	12	20	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		0.88	2.2	30	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		73	100	30	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		1.2	12	20	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		12	30	30	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		310	3100	NSL	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		2	10	40	0.017 J	0.04 U	0.04 U	0.013 J	0.028 J	0.04 U	0.04 U	0.04 U	0.04 U
NITROGLYCERIN	55-63-0	mg/kg		35	120	NSL	4 U	4 U	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	0.2 U	0.2 U
RDX	121-82-4	mg/kg		4.4	16	100	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		61	620	25	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		3.1	31	30	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		7600	10000	pH < 5.5	1150 J	549 J	547 J	2510 J	1390 J	1710 J	1420 J	758 J	756 J
ANTIMONY	7440-36-0	mg/kg		3.1	41	0.27	***4.9***	*0.5 J*	*0.45 J*	*0.62 J*	***25.4***	*1 J*	*1.9*	*0.61 J*	***7***
ARSENIC	7440-38-2	mg/kg		0.39	1.6	18	**1 J**	**0.51 J**	**0.65 J**	**3.6**	**2.7**	**3.6**	**2.1**	**0.6 J**	**0.65 J**
BARIUM	7440-39-3	mg/kg		540	6700	330	22.8	5.8	5.3	45.4	184	28.3	106	5.1	8.2
BERYLLIUM	7440-41-7	mg/kg		15	190	21	0.043 J	0.028 J	0.026 J	0.42	0.073 J	0.21 J	0.087 J	0.035 J	0.03 J
CADMIUM	7440-43-9	mg/kg		3.7	45	0.36	0.28 J	0.13 J	0.17 J	0.2 J	*2.6*	0.24 J	*3.1*	0.078 J	0.17 J
CALCIUM	7440-70-2	mg/kg		NUT	NUT	NUT	223	382	319	10900	3770	39300	1500	1440	516
CHROMIUM	7440-47-3	mg/kg		22	64	81	14	3.4	2.8	13.5	**31.1**	15.9	**22.6**	3.7	4.2
COBALT	7440-48-4	mg/kg		140	1900	13	0.58	0.27 J	0.29 J	3.5	2	2.6	1.4	0.41	0.28 J
COPPER	7440-50-8	mg/kg		310	4100	28	22.1	3.4	3.1	*44.7*	*30.7*	22.8	15.9	4	8.1
IRON	7439-89-6	mg/kg		NUT	NUT	NUT	2770	1620	1490	8320	9820	7700	4850	1740	1950
LEAD	7439-92-1	mg/kg		400	800	11	*59.1*	*14.6*	*14.8*	*66.4*	***1340***	*54.2*	***498***	*15.7*	*26.6*
MAGNESIUM	7439-95-4	mg/kg		NUT	NUT	NUT	362	207	212	3640	668	21300	559	958	398
MANGANESE	7439-96-5	mg/kg		180	1900	500	24.7	20.8	25.2	66.3	88.6	89.7	91.6	25.7	25.6
MERCURY	7439-97-6	mg/kg		2.3	31	0.1	*0.22*	0.017 J	0.017 J	0.038	0.098	0.038 J	0.017 J	0.0091 U	0.017 J
MOLYBDENUM	7439-98-7	mg/kg		39	510	2	0.15 J	0.099 J	0.075 J	*6.1*	0.23 J	1.5	0.7	0.07 U	0.085 J
NICKEL	7440-02-0	mg/kg		160	2000	38	2.4	1.4	1.3	14.3	7.5	10.8	12.1	1.7	2.1
POTASSIUM	7440-09-7	mg/kg		NUT	NUT	NUT	123 J	84.7 J	91.7 J	331 J	186 J	403 J	210 J	124 J	156 J
SELENIUM	7782-49-2	mg/kg		39	510	1	0.28 J	0.28 U	0.26 U	0.28 U	0.29 U	0.49 J	0.38 J	0.27 U	0.42 J
SILVER	7440-22-4	mg/kg		39	510	4.2	1.1	0.037 U	0.033 U	0.037 U	0.074 J	0.05 U	0.12 J	0.035 U	0.081 J
SODIUM	7440-23-5	mg/kg		NUT	NUT	NUT	79.5 J	87.5 J	77.4 J	138 J	128 J	131 J	129 J	78 J	188 J
STRONTIUM	7440-24-6	mg/kg		4700	10000	NSL	1.7 J	2.4 J	2.1 J	31.5 J	22.1 J	8.3 J	8.4 J	2.3 J	4.7 J
THALLIUM	7440-28-0	mg/kg		0.52	6.7	1	0.53 U	0.56 U	0.5 U	0.56 U	0.57 U	0.77 U	0.61 U	0.54 U	0.62 U
TITANIUM	7440-32-6	mg/kg		10000	10000	NSL	56.9	65.5	61.2	125	82.7	99	88.2	87.7	66.7
VANADIUM	7440-62-2	mg/kg		7.8	100	7.8	6.6	4.2	3.9	***11.3***	4.8	***9.9***	7.8	4	6.4
ZINC	7440-66-6	mg/kg		2300	10000	50	13.5	11.6	13	*160*	*582*	*67.5*	*328*	22.1	23.6
ZIRCONIUM	7440-67-7	mg/kg		NSL	NSL	NSL	12.3	14	12.2	42.3	10.3	25.6	13.2	13.8	9.4

Sample Name:			USEPA Region IX PRG Screening Value [1]	USEPA Region IX PRG Screening Value [2]	Ecological Screening Values [3]	FLT-PR-SS-02-01	FLT-PR-SS-02-02	FLT-RR-SS-02-01	FLT-RR-SS-02-02	FLT-BG-SS-02-01	FLT-BG-SS-02-02	FLT-BG-SS-02-03	FLT-BG-SS-02-04	FLT-BG-SS-02-05
Sample Date:						1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007	1/23/2007
Parent Name:														
MRS:						MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1	MRS 1
Analyte	**CAS**	**Unit**												
Explosives														
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	180	1800	NSL	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
1,3-DINITROBENZENE	99-65-0	mg/kg	0.61	6.2	NSL	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.72	2.5	30	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.72	2.5	30	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	1.2	12	20	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
2-NITROTOLUENE	88-72-2	mg/kg	0.88	2.2	30	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
3-NITROTOLUENE	99-08-1	mg/kg	73	100	30	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	1.2	12	20	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
4-NITROTOLUENE	99-99-0	mg/kg	12	30	30	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
HMX	2691-41-0	mg/kg	310	3100	NSL	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
NITROBENZENE	98-95-3	mg/kg	2	10	40	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
NITROGLYCERIN	55-63-0	mg/kg	35	120	NSL	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	-	-	-	-	-
RDX	121-82-4	mg/kg	4.4	16	100	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
TETRYL	479-45-8	mg/kg	61	620	25	0.08 U	0.08 U	0.08 U	0.08 U	-	-	-	-	-
TNT	118-96-7	mg/kg	3.1	31	30	0.04 U	0.04 U	0.04 U	0.04 U	-	-	-	-	-
Metals														
ALUMINUM	7429-90-5	mg/kg	7600	10000	pH < 5.5	873 J	1080 J	915 J	1120 J	10300 J	10000 J	845 J	957 J	1140 J
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27	*1.1 J*	*0.98 J*	***7.6***	***5.1***	*0.81 J*	*1 J*	*0.54 J*	*0.6 J*	*0.56 J*
ARSENIC	7440-38-2	mg/kg	0.39	1.6	18	**0.6 J**	**0.62 J**	**0.89 J**	**1.6 J**	**4.6**	**14.3**	**0.74 J**	**0.47 J**	**0.53 J**
BARIUM	7440-39-3	mg/kg	540	6700	330	6	8.5	3.4	3.8	48	53.8	6.5	9.3	6.3
BERYLLIUM	7440-41-7	mg/kg	15	190	21	0.057 J	0.054 J	0.045 J	0.055 J	0.32	0.35	0.047 J	0.05 J	0.043 J
CADMIUM	7440-43-9	mg/kg	3.7	45	0.36	0.021 U	0.056 J	0.02 U	0.025 U	0.17 J	*0.4 J*	0.13 J	0.23 J	0.088 J
CALCIUM	7440-70-2	mg/kg	NUT	NUT	NUT	912	1730	220	302	3450	1130	809	774	470
CHROMIUM	7440-47-3	mg/kg	22	64	81	3.4	3.7	2.9	5.9	15.4	13.3	3.1	3.1	3.5
COBALT	7440-48-4	mg/kg	140	1900	13	0.49	0.72	0.44	0.93	2.5	3	0.51	0.52	0.46
COPPER	7440-50-8	mg/kg	310	4100	28	18.7	11.1	*90.4*	*83.8*	14.7	21	4.6	4.4	5.1
IRON	7439-89-6	mg/kg	NUT	NUT	NUT	2130	2330	3190	14400	10500	10900	2020	1830	2160
LEAD	7439-92-1	mg/kg	400	800	11	*220*	*153*	***1290***	***1230***	*51.8*	*181*	*18.6*	*22.3*	*22.7*
MAGNESIUM	7439-95-4	mg/kg	NUT	NUT	NUT	470	642	349	448	1250	1390	389	347	480
MANGANESE	7439-96-5	mg/kg	180	1900	500	41.3	58	24	64.8	**238**	**198**	27.5	26.1	20.1
MERCURY	7439-97-6	mg/kg	2.3	31	0.1	0.018 J	0.018 J	0.0085 U	0.011 U	*0.18*	*0.2*	0.013 J	0.012 J	0.014 J
MOLYBDENUM	7439-98-7	mg/kg	39	510	2	0.078 U	0.39 J	0.073 U	0.29 J	0.44 J	0.58	0.077 U	0.079 U	0.073 U
NICKEL	7440-02-0	mg/kg	160	2000	38	2.7	3.8	2.1	4.4	7.4	7.5	2.1	2.3	2.8
POTASSIUM	7440-09-7	mg/kg	NUT	NUT	NUT	198 J	261 J	149 J	187 J	444 J	609 J	118 J	156 J	226 J
SELENIUM	7782-49-2	mg/kg	39	510	1	0.3 U	0.33 U	0.28 U	0.35 U	0.37 U	0.57 J	0.3 U	0.31 U	0.28 U
SILVER	7440-22-4	mg/kg	39	510	4.2	0.039 U	0.042 U	0.037 U	0.045 U	0.048 U	0.044 U	0.038 U	0.039 U	0.037 U
SODIUM	7440-23-5	mg/kg	NUT	NUT	NUT	106 J	113 J	85 J	113 J	115 J	135 J	87.7 J	86.5 J	91 J
STRONTIUM	7440-24-6	mg/kg	4700	10000	NSL	4.6 J	8.9 J	2 J	1.8 J	6.9 J	8 J	3.3 J	5.2 J	2.5 J
THALLIUM	7440-28-0	mg/kg	0.52	6.7	1	0.59 U	0.64 U	0.56 U	0.69 U	0.73 U	0.67 U	0.58 U	0.6 U	0.56 U
TITANIUM	7440-32-6	mg/kg	10000	10000	NSL	69.1	73.9	62.9	89.1	226	268	64.6	57.3	75.7
VANADIUM	7440-62-2	mg/kg	7.8	100	7.8	6	5.3	4.4	5.7	***21.9***	***19.5***	4.3	4	7.4
ZINC	7440-66-6	mg/kg	2300	10000	50	16.3	19.9	18.8	40.4	49	*79.7*	25.3	42.9	14.5
ZIRCONIUM	7440-67-7	mg/kg	NSL	NSL	NSL	9.9	7.6 J	10.8	13.8	26.6	26.5	15.9	10.3	8.4

(1) USEPA Region IX Preliminary Remediation Goals (PRGs) Table, USEPA, December 2004. For non-carcinogens, value shown is equal to 1/10 the residential soil PRG value. For carcinogens the value shown is equal to the residential soil PRG value.
(2) USEPA Region IX Preliminary Remediation Goals (PRGs) Table, USEPA, December 2004. For non-carcinogens, value shown is equal to 1/10 the industrial soil PRG value. For carcinogens the value shown is equal to the industrial soil PRG value.
(3) Ecological Screening Value refernces are found in Table 5-2.

BG=background sample
SB=subsurface soil
SS=surface soil
J=Analyte is present. Reported value may not be accurate or precise.
U=Not detected. The associated number indicates the approximate sample concentration necessary to be detected.
mg/kg=milligrams per kilogram
CAS=Chemical Abstract Service
NA=not available
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 associated with past munitions use.

Table 5-2 Soil Ecological Screening Values and Sources

Analyte	Screening Value	Screening Source
Surface Soil (mg/kg)		
1,3,5-TRINITROBENZENE	NSV	
1,3-DINITROBENZENE	NSV	
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	20	2-amino-4,6-dinitrotoluene as surrgoate
4-NITROTOLUENE	30	TNT as surrogate
HMX	NSV	
NITROBENZENE	40	Efroymson et al. (1997b)
NITROGLYCERIN	NSV	
PERCHLORATE	NSV	
PETN	NSV	
RDX	100	Talmage et al. (1999)
TETRYL	25	Talmage et al. (1999)
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	NSV	Essential Nutrient
CHROMIUM	81	USEPA (2005f)
COBALT	13	USEPA (2005g)
COPPER	28	USEPA (2007a)
IRON	NSV	Essential Nutrient
LEAD	11	USEPA (2005h)
MAGNESIUM	NSV	Essential Nutrient
MANGANESE	500	Efroymson et al. (1997a)
MERCURY	0.1	Efroymson et al. (1997b)
MOLYBDENUM	2	Efroymson et al. (1997a)
NICKEL	38	USEPA (2007b)
POTASSIUM	NSV	Essential Nutrient
SELENIUM	1	Efroymson et al. (1997a)
SILVER	4.2	USEPA (2006b)
SODIUM	NSV	Essential Nutrient
STRONTIUM	NSV	
THALLIUM	1	Efroymson et al. (1997a)
TITANIUM	NSV	
VANADIUM	7.8	USEPA (2005i)
ZINC	50	Efroymson et al. (1997a)
ZIRCONIUM	NSV	

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

Table 5-2 Soil Ecological Screening Values and Sources

References:

Efroymson, R.A., M.E. Will, G.W. Suter, and A.C. Wooten. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Lab Report ES/ER/TM-85/R3.

Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. U.S. Department of Energy, Office of Environmental Management. November.

Talmage, S.S., D.M. Opresko, C.J. Maxwell, J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. 1999. Nitroaromatic munition compounds: Environmental effects and screening values. Reviews in Environmental Contamination and Toxicology. 161: 1-156

U.S. Environmental Protection Agency (USEPA). 2003. Ecological Soil Screening Levels for Aluminum, Interim Final. OSWER Directive 9285.7-60. November.

U.S. Environmental Protection Agency (USEPA). 2005a. Ecological Soil Screening Levels for Antimony Interim Final. OSWER Directive 9285.7-61. February.

U.S. Environmental Protection Agency (USEPA). 2005b. Ecological Soil Screening Levels for Arsenic Interim Final. OSWER Directive 9285.7-62. March.

U.S. Environmental Protection Agency (USEPA). 2005c. Ecological Soil Screening Levels for Barium Interim Final. OSWER Directive 9285.7-63. February.

U.S. Environmental Protection Agency (USEPA). 2005d. Ecological Soil Screening Levels for Beryllium Interim Final. OSWER Directive 9285.7-64. February.

U.S. Environmental Protection Agency (USEPA). 2005e. Ecological Soil Screening Levels for Cadmium Interim Final. OSWER Directive 9285.7-65. March.

U.S. Environmental Protection Agency (USEPA). 2005f. Ecological Soil Screening Levels for Chromium Interim Final. OSWER Directive 9285.7-66. March.

U.S. Environmental Protection Agency (USEPA). 2005g. Ecological Soil Screening Levels for Cobalt Interim Final. OSWER Directive 9285.7-67. March.

U.S. Environmental Protection Agency (USEPA). 2005h. Ecological Soil Screening Level for Lead, Interim Final. OSWER Directive 9285.7-70. March.

U.S. Environmental Protection Agency (USEPA). 2005i. Ecological Soil Screening Level for Vanadium, Interim Final. OSWER Directive 9285.7-75. April.

U.S. Environmental Protection Agency (USEPA). 2006b. Ecological Soil Screening Levels for Silver, Interim Final. OSWER Directive 9285.7-77. October

U.S. Environmental Protection Agency (USEPA). 2007a. Ecological Soil Screening Level for Copper, Interim Final. OSWER Directive 9285.7-68. February.

U.S. Environmental Protection Agency (USEPA). 2007b. Ecological Soil Screening Level for Nickel. OSWER Directive 9285.7-76. March.

Table 5-3 Non-Detection Concentrations and Screening Values at Fort Tilden MMRP FUDS Site

Analyte	Cas no.	Units	Minimum Non-Detect Concentration	Maximum Non-Detect Concentration	Human Health Screening Value[1]	Ecological Screening Value[2]
Surface Soil						
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.04	0.04	180	NSL
1,3-DINITROBENZENE	99-65-0	mg/kg	0.04	0.04	0.61	NSL
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.04	0.04	0.72	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.04	0.04	1.2	20
2-NITROTOLUENE	88-72-2	mg/kg	0.08	0.08	0.88	30
3-NITROTOLUENE	99-08-1	mg/kg	0.08	0.08	73	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.04	0.04	1.2	20
4-NITROTOLUENE	99-99-0	mg/kg	0.08	0.08	12	30
HMX	2691-41-0	mg/kg	0.08	0.08	310	NSL
NITROGLYCERIN	55-63-0	mg/kg	4	4	35	NSL
RDX	121-82-4	mg/kg	0.08	0.08	4.4	100
TETRYL	479-45-8	mg/kg	0.08	0.08	61	25
TNT	118-96-7	mg/kg	0.04	0.04	3.1	30
Inorganics						
THALLIUM	7440-28-0	mg/kg	0.53	0.77	0.52	1

[1] USEPA Region IX Preliminary Remediation Goals (PRGs) Table, USEPA, December 2004. For non-carcinogens, value shown is equal to 1/10 the residential soil PRG value. For carcinogens the value shown is equal to the residential soil PRG value.

[2] See Table 5-2 for source of ecological screening values.

NSL - No screening value

mg/kg = milligram per kilogram

Yellow shaded analytes are those associated with past munitions use.

Table 5-4 COMPARISON OF ON-SITE AND BACKGROUND SURFACE SOIL CONCENTRATIONS
FORT TILDEN MMRP FUDS SITE

	On-site				Background				Comparisons	
Chemical	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	547 J	2510 J	1140	13/13	845 J	10300 J	4650	5/5	No	No
ANTIMONY	0.45 J	25.4	4.40	13/13	0.54 J	1 J	0.70	5/5	Yes	Yes
ARSENIC	0.51 J	3.6 /	1.47	13/13	0.47 J	14.3	4.13	5/5	No	No
BARIUM	3.4	184	33.3	13/13	6.3	53.8	24.8	5/5	Yes	Yes
BERYLLIUM	0.026 J	0.42	0.09	13/13	0.043 J	0.35	0.16	5/5	Yes	No
CADMIUM	0.02 U	3.1	0.55	10/13	0.088 J	0.4 J	0.20	5/5	Yes	Yes
CALCIUM	220	39300	4730	13/13	470	3450	1330	5/5	Yes	Yes
CHROMIUM	2.8	31.1	10	13/13	3.1 /	15.4	7.7	5/5	Yes	Yes
COBALT	0.27 J	3.5	1.07	13/13	0.46	3	1.40	5/5	Yes	No
COPPER	3.1	90.4	27.6	13/13	4.4	21	10.0	5/5	Yes	Yes
IRON	1490	14400	4790	13/13	1830	10900	5480	5/5	Yes	No
LEAD	14.6	1340	383	13/13	18.6	181	59.3	5/5	Yes	Yes
MAGNESIUM	207	21300	2320	13/13	347	1390	771	5/5	Yes	Yes
MANGANESE	20.8	91.6	50	13/13	20.1	238	102	5/5	No	No
MERCURY	0.0085 U	0.22	0.04	10/13	0.012 J	0.2	0.08	5/5	Yes	No
MOLYBDENUM	0.07 U	6.1	0.76	10/13	0.073 U	0.58	0.25	2/5	Yes	Yes
NICKEL	1.3	14.3	5.12	13/13	2.1	7.5	4.4	5/5	Yes	Yes
POTASSIUM	84.7 J	403 J	193	13/13	118 J	609 J	311	5/5	No	No
SELENIUM	0.26 U	0.49 J	0.32	4/13	0.28 U	0.57 J	0.37	1/5	No	No
SILVER	0.033 U	1.1	0.13	4/13	0.037 U	0.048 U	0.04	0/5	Yes	Yes
SODIUM	77.4 J	188 J	112.0	13/13	86.5 J	135 J	103.0	5/5	Yes	Yes
STRONTIUM	1.7 J	31.5 J	7.75	13/13	2.5 J	8 J	5.18	5/5	Yes	Yes
THALLIUM	0.5 U	0.77 U	0.60	0/13	0.56 U	0.73 U	0.63	0/5	Yes	No
TITANIUM	56.9	125	79	13/13	57.3	268	138	5/5	No	No
VANADIUM	3.9	11.3	6.2	13/13	4	21.9	11.4	5/5	No	No
ZINC	11.6	582	101	13/13	14.5	79.7	42.3	5/5	Yes	Yes
ZIRCONIUM	7.6 J	42.3	15.0	13/13	8.4	26.6	17.5	5/5	Yes	No

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 associated with past munitions use.

6. SUMMARY AND CONCLUSIONS

6.0.1 Fort Tilden was used as a coastal defense facility from 1917 to 1974. One MRS was identified at Fort Tilden and was addressed in this SI consistent with the MMRP Inventory in the DERP Fiscal Year 2005 Annual Report to Congress (DoD 2005). The identified range is as follows (see Table 2-1):

- MRS 1 – Range Complex No. 1 (Range ID No. C02NY001604R01)

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

6.1 Range Complex No. 1 (MRS 1)

6.1.1 MRS 1 encompasses three sub-ranges and two AOCs including Battery Harris East and West, Battery Kessler, Battery Ferguson, the Pistol Range, and the Rifle Range. Although identified in the INPR, the former burn pit and bullet burial area were not evaluated since these areas were not identified as AOCs in the ASR and INPR Supplement, and no evidence of these features was observed during the ASR site visit or the TPP site reconnaissance. MEC discoveries included one 3.5-inch practice rocket found in approximately 1991. No MEC was identified during the SI reconnaissance; however, MD (expended small caliber bullets) was identified in the former pistol and rifle ranges. .

6.1.2 No documented injuries have occurred since the site was transferred to the NPS. Given the limited use and nature of the site usage, the areal extent of contamination is estimated to be relatively small and confined to the areas immediately adjacent to the firing locations and range backstops. The overall MEC risk is considered low.

6.1.3 COPCs (lead and antimony) were identified for the human health screening assessment for MRS 1. Four soil COPECs (antimony, copper, lead, and zinc) were identified as a result of the ecological screening level risk assessment. No explosives were detected above human health or ecological screening criteria. Antimony and lead were detected above the human health screening criteria (residential and/or industrial RBCs) for soil. Based on the sample results, the pathway in the CSM is identified as complete for human receptors. Antimony, copper, lead, and zinc were reported in surface soil samples as exceeding ecological screening criteria and identified as COPECs for MRS 1. Copper and zinc were found at moderate exceedances of screening values and antimony and lead were found at high levels of exceedances. Based on the

sample results, the ecological pathway in the CSM is identified as complete in this MRS for the SI Report (Appendix J).

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

Media of Concern	Human Health COPCs[1]	Ecological COPECs (SLERA)[2]
	MRS 1. Range Complex No. 1	MRS 1. Range Complex No. 1
Groundwater	Not applicable.	Not applicable.
Surface Water	Not applicable.	Not applicable.
Sediment	Not applicable.	Not applicable.
Soil	Two metals (antimony and lead)	Four metals (antimony, copper, lead, and zinc)

1 For the Human Health Risk Screen, EPA Region IX PRG screening values were used for soil comparisons. See Tables 5-1 for the screening values.
2 For Ecological Risk Screen, the screening values identified in Tables 5-2 were applied.

7. RECOMMENDATIONS FOR FURTHER ACTION

7.0.1 The Fort Tilden FUDS has one designated MRS. The recommendations for this MRS are presented below:

MRS 1 – Range Complex No. 1: An RI/FS is recommended for the MRS with additional studies to focus on MC. MC considering that human health and ecological risk screening assessments identify risk from MC. MD has been found in MRS 1 and this area was historically used as a coastal defense site. MEC risk is considered low. A TCRA/NTCRA is not recommended for the MRS addressed in this SI.

8. REFERENCES

Alion Science and Technology Corporation (Alion). 2005. *Programmatic Work Plan for Formerly Used Defense Sites (FUDS) Military Munitions Response Program (MMRP) Site Inspections at Multiple Sites in the Northeast Region.*

Alion Science and Technology Corporation (Alion). 2006. *Final TPP Memorandum for Fort Tilden, June 2006*

Alion Science and Technology Corporation (Alion). 2007. *Final Site-Specific Work Plan Addendum to the MMRP Programmatic Work Plan for the Site Inspection of Fort Tilden, January 2007.*

Department of the Army (DoA). 2005. *Office of the Assistant Secretary, Installations and Environment, Memorandum for the Assistant Chief of Staff for Installation Management, Munitions Response Terminology.*

Department of Defense (DoD). 2001. *Management Guidance for the Defense Environmental Restoration Program.*

Department of Defense, Office of the Secretary (DoD). 2005. Memorandum for the Assistant Chief of Staff for Installation Management, Munitions Response Terminology. 32 Code of Federal Regulations (CFR) Part 179.

Efroymson, R.A., M.E. Will, G.W. Suter, and A.C. Wooten. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Lab Report ES/ER/TM-85/R3.

Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. U.S. Department of Energy, Office of Environmental Management. November.

Environmental Systems Research Institute, Inc. (ESRI). 2006. StreetMap.

New York State Department of State, Division of Coastal Resources. 2007. *New York State Coastal Area Map*. Site accessed 8 June 2007: http://nyswaterfronts.com/maps_ny.asp

Office of the Deputy Under Secretary of Defense (Installations and Environment). 2001. *Management Guidance for the Defense Environmental Restoration Program, September 2001*. Site accessed 27 April 2006: http://www.uxoinfo.com/uxoinfo/downloads/derpguidance.pdf

Talmage, S.S., D.M. Opresko, C.J. Maxwell, J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. 1999. Nitroaromatic munition compounds: Environmental effects and screening values. Reviews in Environmental Contamination and Toxicology. 161: 1-156

United States Army Corps of Engineers (USACE). 1998. *Technical Project Planning (TPP) Process*, 31 August 1998. EM200-1-2.

United Stated Army Corps of Engineers (USACE). 1999. *Risk Assessment Handbook, Volume I: Human Health Evaluation*. EM200-1-4.

U.S. Army Corps of Engineers (USACE). 2000. *Ordnance and Explosives Response. EP 1110-1-18. 24 April.*

United States Army Corps of Engineers (USACE). 2003. *Explosives Safety Submission, Engineering Pamphlet 385-1-95b*.

United States Army Corps of Engineers (USACE). 2004a. *Environmental Quality Formerly Used Defense Sites (FUDS) Program Policy*. ER 200-3-1, 10 May 2004.

U.S. Army Corps of Engineers (USACE). 2004b. *Defense Environmental Restoration Program (DERP) Formerly Used Defense Sites (FUDS) Program Policy, ER 200-3-1*.

U.S. Army Corps of Engineers (USACE). 2004c. *Defense Environmental Restoration Program for Formerly Used Defense Sites Ordnance and Explosives,* INPR *Supplement for Fort Tilden Project No. C02NY001604.*

U.S. Army Corps of Engineers (USACE). 2005. Defense Environmental Restoration Program for Formerly Used Defense Sites Ordnance and Explosives, *Archive Search Report Findings*

for Fort Tilden Project No. CO2NY001604.

United States Army Corps of Engineers (USACE). 2006. *Screening-Level Ecological Risk Assessments for FUDS MMRP Sis Prepared by USACE HTRW CX, 11 August 2006.*

United States Army Corps of Engineers (USACE). 2007. *Memorandum: Application of Munitions Response Site Prioritization Protocol (MRSPP) for the Formerly Used Defense Site (FUDS) Military Munitions Response Program (MMRP) Site Inspection (SI) Program.*

United States Census Bureau. 2000. *United States Census*. Site accessed 20 April 2000. http://www.census.gov/main/www/cen2000.html

U.S. Department of Agriculture (USDA). 2004. *Topography at Fort Tilden*.

U.S. Environmental Protection Agency (USEPA). 1989. *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A).* Report No. EPA/540/1-89/002. Office of Emergency and Remedial Response, Washington, DC. December.

U.S. Environmental Protection Agency (USEPA). 1991. *Memorandum: Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"*. Office of Solid Waste and Emergency Response. OSWER Directive: 9285.6-03. 25 March.

U.S. Environmental Protection Agency (USEPA). 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* Office of Emergency and Remedial Response, U.S. EPA, Washington, D.C. May.

U.S. Environmental Protection Agency (USEPA). 1997a. Exposure *Factors Handbook, Volumes I, II, and III*. EPA/600/P-95/002a,b,c. August.

U.S. Environmental Protection Agency (USEPA). 2001. *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments*. EPA 540/F-01/014. June.

U.S. Environmental Protection Agency (USEPA). 2003. Ecological Soil Screening Levels for Aluminum, Interim Final. OSWER Directive 9285.7-60. November.

U.S. Environmental Protection Agency (USEPA). 2004a. Preliminary Remediation Goals, EPA Region IX. October.

U.S. Environmental Protection Agency (USEPA). 2004b. Software developed by EPA. Obtained on the Internet at http://www.epa.gov/ nerlesd1/tsc/software.htm. Las Vegas Technical Support Center for Monitoring and Site Characterization.

U.S. Environmental Protection Agency (USEPA). 2005a. Ecological Soil Screening Levels for Antimony Interim Final. OSWER Directive 9285.7-61. February.

U.S. Environmental Protection Agency (USEPA). 2005b. Ecological Soil Screening Levels for Arsenic Interim Final. OSWER Directive 9285.7-62. March.

U.S. Environmental Protection Agency (USEPA). 2005c. Ecological Soil Screening Levels for Barium Interim Final. OSWER Directive 9285.7-63. February.

U.S. Environmental Protection Agency (USEPA). 2005d. Ecological Soil Screening Levels for Beryllium Interim Final. OSWER Directive 9285.7-64. February.

U.S. Environmental Protection Agency (USEPA). 2005e. Ecological Soil Screening Levels for Cadmium Interim Final. OSWER Directive 9285.7-65. March.

U.S. Environmental Protection Agency (USEPA). 2005f. Ecological Soil Screening Levels for Chromium Interim Final. OSWER Directive 9285.7-66. March.

U.S. Environmental Protection Agency (USEPA). 2005g. Ecological Soil Screening Levels for Cobalt Interim Final. OSWER Directive 9285.7-67. March.

U.S. Environmental Protection Agency (USEPA). 2005h. Ecological Soil Screening Level for Lead, Interim Final. OSWER Directive 9285.7-70. March.

U.S. Environmental Protection Agency (USEPA). 2005i. Ecological Soil Screening Level for Vanadium, Interim Final. OSWER Directive 9285.7-75. April.

U.S. Environmental Protection Agency (USEPA). 2006a. *National Recommended Water Quality Criteria*.

U.S. Environmental Protection Agency (USEPA). 2006b. Ecological Soil Screening Levels for Silver, Interim Final. OSWER Directive 9285.7-77. October

U.S. Environmental Protection Agency (USEPA). 2007a. Ecological Soil Screening Level for Copper, Interim Final. OSWER Directive 9285.7-68. February.

U.S. Environmental Protection Agency (USEPA). 2007b. Ecological Soil Screening Level for Nickel. OSWER Directive 9285.7-76. March.

United States Geological Survey. 1971. *Historic Aerial of Fort Tilden.*

APPENDIX A - SCOPE OF WORK

Located on CD.

APPENDIX B - TPP MEMORANDUM

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

Data Quality Objective Verification Worksheet			
Site: Fort Tilden			
Project: FUDS MMRP SI Project Number **C02NY001604**			
DQO Statement Number: **1 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine if the site requires additional investigation through a remedial investigation/feasibility study (RI/FS) or if the site may be recommended for No Department of Defense Action Indicated (NDAI) based on the presence or absence of munitions and explosives of concern (MEC) and munitions constituents (MC).	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) and MC	Yes__X__ No ____	
Media of Interest	MEC - Surface Soil MC - Surface Soil and Sub Surface Soil	Yes__X__ No ____	
Required Sampling Locations or Areas	MEC and MC: Areas where military munition-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews.	Yes__X__ No ____	
Number of Samples Required	**MEC** - Analog geophysical and visual reconnaissance data, rather than discrete sampling data, will be collected to accomplish this objective. These data will be collected using "meandering path" to and from the sampling points. The UXO Technician will collect data on an approximate 6-ft wide path using the geophysical equipment. The visual reach of observations is approximately 12 ft, and may be limited by the presence of vegetation. Once at the individual sampling point, the geophysical equipment will be used to assess an approximately 25 ft radius circle for anomalies around the sampling point as site conditions permit. In some areas, there may be limitations to the ability to complete geophysical and visual observations. The Total estimated area on the paths to/from the sampling locations and the area around the sampling locations is approximately 33,960m^2 (*see appendix A, figure. 7)* **MC** - Sampling to include: 7 surface soil samples, 3 subsurface soil samples and 5 background samples	Yes__X__ No ____	Note: 1) Locations of some samples were modified slightly in the field due to accessibility issues as agreed upon in the SS-WP. 2) One additional surface was collected at Battery Harris West and one additional subsurface sample was collected at Battery Harris East.

	MEC: If historic data indicate the presence of MEC and one anomaly classified as of material potentially presenting and explosive hazard (MPPEH) or confirmed MEC is found with the magnetometer or if physical evidence indicating the presence of MEC is found during the visual inspection, then a RI/FS may be recommended. If no anomalies, MPPEH, or confirmed MEC are found, or if the UXO Technician indicates that there is no potential hazard from past use of munitions or MEC discoveries, then MEC found previously may be considered an anomaly and NDAI may be recommended. In each of these instances, all lines of evidence (e.g., historic data, field data, etc.) will be used to make a final decision for an NDAI or RI/FS.	Yes__X__ No ____	
Reference Concentration of Interest or Other Performance Criteria	MC: If SI findings/results exceed Region IX Preliminary Remediation Goals (PRGs) (mg/L), (based on current and future land use), EPA Interim Eco-SSLs (milligram per kilogram [mg/kg]), New York State Department of Environmental Conservation (NYSDEC) Recommended Soil Cleanup Objectives (mg/L), or site-specific background levels and those exceedance result in a potential risk to receptors as identified through human health and ecological risk assessments, a RI/FS may be recommended for the site. If no exceedance are present and acceptable risks are identified for the receptors, then a NDAI may be recommended. In both instances (RI/FS or NDAI), all lines of evidence (e.g., historic data, field data, background concentration of metals, etc. for both MEC and MC) will be used to make a final decision for an NDAI or RI/FS. Screening values selected for this site are specified in the chemical-specific measurement quality objective (MQO) Tables.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysics with a handheld analog magnetometer, which will used to collect related data, is accurate to an approximate depth of 2 ft. Global Positioning System (GPS) equipment will be used to log locations of MEC items encountered by the magnetometer. Visual observations will provide a continuous source of additional information which will be noted in the field log book with GPS coordinates. Photographs also will used as an additional documentation method. Geophysical methods/procedures are described in detail in Section 3 of the SS-WP, and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the S-SWP, and Field Activities section of the PFSP.	Yes__X__ No ____	
Analytical Method	MEC: Analytical methods are not used with analog magnetometry. However, trained UXO professionals, engineers, and scientists will review all data to determine whether evidence gathered indicates the presence or absence of MEC. This analysis will be subject to an independent review within the Alion Team, by the USACE Baltimore District Design Center, and USACE Center of Expertise. MC: The following analytical methods are proposed: Explosives Methods - SW8330A, SW8330M (modified for nitroglycerin and PETN); Metals Methods - SW6010A, SW6020 (for zirconium), SW7471B (for mercury): Explosives Prep methods - SW8330A and Sw8330M (modified for nitroglycerin and PETN); Metals Prep Method - 3050B/3050M (modified for zirconium).	Yes__X__ No ____	

Data Quality Objective Verification Worksheet			
Site: Fort Tilden			
Project: FUDS MMRP SI Project Number **C02NY001604**			
DQO Statement Number: **2 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine the potential need for a Time-Critical Removal Action (TCRA) for MEC and MC by collecting data from previous investigations/reports, conducting site visits, performing analog geophysical activities, and by collecting MC samples.	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC/MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	MEC and/or MC in the surface soil and subsurface soil	Yes__X__ No ____	
Media of Interest	Surface soil and Subsurface soil	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where military munitions-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews.	Yes__X__ No ____	
Number of Samples Required	Refer to DQO 1 for MC/MEC sampling parameters.	Yes__X___ No _____	
Reference Concentration of Interest or Other Performance Criteria	If MC is reported in samples collected at the FUDS at concentrations exceeding screening criteria and those exceedances result in unacceptable risk and an imminent threat to receptors as identified through human health and ecological risk assessments or if one piece of confirmed MEC is found with the magnetometer or if physical evidence indicating the presence of MEC is found during the visual inspection, and if the item(s) is determined by a UXO-qualified Technician, explosive ordnance disposal (EOD) unit, and/or the USACE to be an immediate or imminent threat, one of two actions may be initiated:	Yes__X__ No ____	
	TCRA- If there is a complete pathway between source and receptor and the MEC and the situation is viewed as an "imminent danger threat 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", the Alion Team will immediately notify the Military Munitions Design Center Project Manager at USACE and the property owner. USACE will determine, with input from the Alion Team and stakeholders, whether or not a TCRA will be implemented.	Yes__X__ No ____	
	NonTCRA - A nonTCRA (NTCRA) may be initiated in response to a release or threat of release that poses a risk where more than six months planning time is available.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysical methods/procedures are described in detail in Section 3 of the SS-WP, and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the S-SWP, and Field Activities section of the PFSP	Yes__X__ No ____	
Analytical Method	Refer to DQO 1 for MEC and MC analytical methods to be incorporated.		

Data Quality Objective Verification Worksheet			
Site: Fort Tilden			
Project: FUDS MMRP SI Project Number **C02NY001604**			
DQO Statement Number: **3 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect, or develop, additional data, as appropriate, for potential Hazard Ranking System (HRS) scoring by Environmental Protection Agency (EPA)*.	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MC, Compliance.	Yes__X__ No ____	
Contaminant or Characteristic of Interest	Data for HRS worksheet parameters will be compiled by gathering basic identifying information, general site description, site type, waste description, demographics, water use, sensitive environments, and response actions.	Yes__X__ No ____	
Media of Interest	Surface soil and Subsurface soil	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where MEC has been historically found, used, or disposed as documented in interviews or existing documentation.	Yes__X__ No ____	
Number of Samples Required	Refer to DQO 1and 2.		
Reference Concentration of Interest or Other Performance Criteria	The HRS levels of contamination are Level I (concentrations that meet the criteria for actual contamination and are at or above media-specific benchmark levels), Level II (concentrations that either meet the criteria for actual contamination but are less than media-specific benchmarks, or meet the criteria for actual contamination based on direct observation), and Potential (no observed release is required but targets must be within the target distance limit). These levels are weighted for each target by EPA (Level I carries the greatest weight) and scores of 28.5 or above are then eligible for listing on the National Priorities List (NPL).	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Methods associated with historic data field reconnaissance and sampling (see DQOs 1 and 2). Refer to National Priorities List (NPL) Characteristics Data Collection Form, Version 3.0 (EPA 2001).	Yes__X__ No ____	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

*The HRS scoring may or may not be completed by EPA and is an activity separate from the SI process.

Data Quality Objective Verification Worksheet			
Site: Fort Tilden			
Project: FUDS MMRP SI Project Number **C02NY001604**			
DQO Statement Number: **4 of 4**			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect the additional data necessary to the complete the Munitions Response Site Prioritization Protocol (MRSPP).	Yes__X__ No ____	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes__X__ No ____	
Contaminant or Characteristic of Interest	Explosive Hazard Evaluation (EHE), Chemical Warfare Materiel Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). For the EHE and CHE modules, factors evaluated include the details of the hazard, accessibility to the Munitions Response Site (MRS), and receptor information. HHE factors include an evaluation of MC and any non-munitions-related incidental contaminants present, receptor information, and details pertaining to environmental migration pathways. Typical information compiled includes details pertaining to historical use, current/future use and ownership, cultural/ecological resources, and structures.	Yes__X__ No ____	
Media of Interest	Surface soil and Subsurface soil	Yes__X__ No ____	
Required Sampling Locations or Areas	Areas where MEC has been identified historically and where sampling is recommended.	Yes__X__ No ____	
Number of Samples Required	Refer to DQOs 1and 2 for related sampling required.		
Reference Concentration of Interest or Other Performance Criteria	A MRS priority is determined by USACE based on integrating the ratings from the EHE, CHE, and HHE modules. Refer to Federal Register/Vol. 70, No. 192/Wednesday, October 5, 2005/Rules and Regulations.	Yes__X__ No ____	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Data gathering prior to field activities as well as additional data gathered during field reconnaissance and sampling (DoD 2005).	Yes__X__ No ____	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

APPENDIX C - INTERVIEW DOCUMENTATION

ALION
SCIENCE AND TECHNOLOGY

COMMUNICATIONS RECORD FORM

Date: 05/14/07

Contract Number:W912DY-04-D-0017

Delivery Order #: 00170001

Distribution: SIs MMRP

Person Contacted: Jane Thapa

Affiliation: Bureau of Water Supply Protection - NYSDOH –Senior Sanitary Engineer

Address: 574 River Street Room 400, Troy, NY, 12180

Type of Contact: Phone Call.

Person Making Contact: Tim Reese

Communications Summary: Tim Reese contacted Jane Thapa of the NYSDOH – New York State Department of Health – regarding the location of production supply wells. Ms. Thapa reviewed the NYSDOH database and concluded that there were no production supply wells and no wellhead protection areas within four miles of Fort Tilden.

APPENDIX D - FIELD NOTES AND FIELD FORMS

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

Alion Science and Technology, Inc.

DAILY QUALITY CONTROL REPORT

Report Number:	1-23-07-01	**Date:** 1-23-07	
Project Name:	Fort Tilden C02NY061001	**Contract Number:** W912DY-04-D-0017	
Location of Work:	Fort Tilden, New York		
Description of Work:	Surface and subsurface soil sampling		
Weather: Mostly sunny	**Rainfall:** none	**Temperature:** **Min.** 30	**Max.** 39

1. Work performed today by Alion Team.

Met with Jose Ramirez (NPS) to coordinate site access.

Health and Safety briefing

Collected 12 surface/subsurface soil samples, 1 QA samples, 1 field duplicate, and 5 background surface soil samples.

Reconnaissance Acreage / Discussion:

Travel paths to sample locations were collected via meandering path from vehicle location to sample point.

Travel routes were cleared for UXO prior to mobilizing sampling gear to locations.

Samples Collected:

FTL-FG-SS-02-01	FTL-KS-SS-02-01	FTL-FG-02-01QA
FTL-RR-SS-02-01	FTL-KS-SB-12-01	FTL-FG-SS-02-01DUP
FTL-RR-22-02-02	FTL-HS-SS-02-01	FTL-BG-SS-02-01
FTL-FG-SB-12-01	FTL-HS-SB-02-01	FTL-BG-22-02-02
FTL-PR-SS-02-01		FTL-BG-SS-02-03
FTL-HS-SS-12-01	*Sample ID's on COC and jar labels begin with 'FLT' instead of 'FTL'	FTL-BG-SS-02-04
FTL-HS-SB-12-01		FTL-BG-SS-02-05
FTL-PR-SS-02-02		

Field Tests:

Schonstedt checked ok.

Benchmarks surveyed with Trimble GPS (SEE REMARKS)

Handheld GPS tracking was incorrect and sampling point coordinates were used to identify predetermined sampling locations.

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)
None
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)
Collected surface and subsurface soil samples for areas adjacent to former gun batteries, a pistol range, and rifle range. For samples collected at former batteries, a 25' to 30' buffer was approximated for the length of the gun barrel and samples were collected from beyond that distance. Also, sampling locations were adjusted to avoid road beds or walkways that are continually disturbed. Per Tim Reese (1/22/07) one additional surface soil sample was collected at Battery Harris West and one additional subsurface sample was collected at Battery Harris East to be consistent with the other batteries at Fort Tilden (one surface and one subsurface at each battery). Numerous copper and ferrous metal slugs were identified and photographed at the rifle range berm. Sample soil was screened during compositing to exclude metallic debris from samples. Other than the metal slugs in the berms no other MPPEH/MD was observed at Fort Tilden. Two NGS benchmarks were identified prior to field activities (ROSARIO and H51NY). Pedestals onsite were identified with NPS ranger assistance and both benchmarks have been stolen by vandals. Two benchmarks immediately adjacent to the site were surveyed with the Trimble (GUARD2) and (RIIS). Both benchmarks were within one meter. Samples for GPL Laboratories were picked up by the lab at the Loveton, MD office on 1/24/07. QA samples were FedEx'ed to STL on 1/24/07 for arrival on 1/25/07.

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.

STEVEN YAWKAY

Quality Control System Manager

(Sign and Print Name)

HEALTH AND SAFETY ACTIVITY REPORT

Site: Fort Tilden Location: Rockaway, NY

Weather Conditions: Mostly Sunny Onsite Hours: From 0712 To 1450

Morning Briefing Topic: UXO Avoidance, Poison Ivy, Cold Stress

General Activities Complete: Collected 19 soil samples

Morning Briefing Attendance: Mike Shoop (HFA) Steven Yankay (EA)
Ed Linkewich (EA)

Changes in PPE Levels*	Work Operations	Reasons for Change
-None-		

Site Safety and Health Plan Violations	Corrective Action Specified	Corrective Action Taken (yes/no)
-None-		

Observations and Comments:

-None-

Completed by: _____ Date: 1/23/2007
Site Health and Safety Supervisor

*Only SSHO may change PPE levels, using only criteria specified in Programmatic APP.

Cooler #1

GPL LABORATORIES, LLLP

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

Contract #/Billing Reference

1 of 1 Pgs.

Project: 02NY001604 - FT. TILDEN
Client: EA ENGINEERING / ALION
Send Results To: CORINNE SHIA
Address: 3975 FAIR RIDGE DR. SUITE 1255
FAIRFAX, VA 22033
Phone: 703-259-5147

	EXPLOSIVES 8330A + PETN+NG	METALS 3050/6010B 2000NINA + Hg
Turnaround Time	STND	
# of Containers	1	1
Container Type	8-OZ	8-OZ
Preservative Used	NONE	NONE

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	EXPLOSIVES 8330A + PETN+NG	METALS 3050/6010B 2000NINA + Hg								Lab Cooler No.	CLIENT COMMENTS
FLT-FB-SS-02-01	1/23/07	1226	SOIL	JS	X	X									
FLT-RR-SS-02-01	|	1148	|	JS	|	|									
FLT-RR-SS-02-02	|	1155	|	JS	|	|								* TEMP BLANK
FLT-FR-SB-12-01	|	1225	|	EOL	|	|								INCLUDED
FLT-BG-SS-02-01	|	1410	|	JS		|									
FLT-BG-SS-02-02	|	1355	|	JS		|									
FLT-BG-SS-02-03	|	1305	|	JS		|									
FLT-BG-SS-02-04	|	1320	|	JS		|									
FLT-BG-SS-02-05	|	1337	|	JS		|									

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	1/24/07 1100				

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

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:

G.P. W.O. ____________

GPL LABORATORIES, LLLP

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

COOLER #2

Contract #/Billing Reference

1 of 1 Pgs.

Project: CO2NY001604 - FT. TILDEN
Client: EA ENGINEERING / ALION
Send Results To: CORINNE SHIA
Address: 3975 FAIR RIDGE DR. SUITE 1255
FAIRFAX, VA 22033
Phone: 703-759-5147

Turnaround Time: STND
# of Containers: 1 1
Container Type: 8oz 8oz
Preservative Used: NONE NONE
Type of Analysis: EXPLOSIVES 8330A + PETN, NG | METALS 3050/6010B ZIRCONIUM + Hg | Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	EXPLOSIVES 8330A + PETN, NG	METALS 3050/6010B ZIRCONIUM + Hg	CLIENT COMMENTS
FLT-HS-SS-12-01	1/23/07	0900	SOIL	S	X	X	
FLT-HS-SB-12-01		0907		S			
FLT-PR-SS-02-01		0935		S			* TEMP
FLT-PR-SS-02-01		0951		S			BLANK INCLUDED
FLT-KS-SS-02-01		1115		EOL			
FLT-KS-SB-12-01		1104		S			
FLT-HS-SS-02-01		1012		S			
FLT-HS-SB-02-01		1025		S			
~~FLT-FB-SS-02-01-QA~~		~~1240~~		S			
FLT-FB-SS-02-01DUP		1237		S			

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
	1/24/07 1100				
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp:

G.P. W.O. _____

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: Corinne Shia	Site Contact:	Date: 1/24/2007	COC No:
Alion Science and Technology	Tel/Fax: 703-259-5147	Lab Contact:	Carrier:	1 of 1 COCs
3975 Fair Ridge Dr. Suite 1255	**Analysis Turnaround Time**			Job No.
Fairfax, VA 22033	Calendar (C) or Work Days (W) **STND**			C02NY001604
(703)-259-5147 Phone	TAT if different from Below _____			SDG No.
(703)-259-5212 FAX	☐ 2 weeks			
Project Name: C02NY001604	☐ 1 week			
Site: Fort Tilden, NY	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Explosives 8330A + PETN + NG	Metals 3050/6010B + Zirconium + Hg	Sample Specific Notes:
FLT-FG-SS-02-01-QA	1/23/2007	12:40	COMP.	SOIL	2		X	X	

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:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Location FT. TILDEN Date 1/23/06

Project / Client Sunny 32°F 10-20 mph wind from west

Michael Shoup

0741 Stan Yankey in Mine Shoup [illegible]

0755 EA ONSITE to meet w the José Ramirez / NPS proceeds to get GPS running and review days activities

0815 H&S meeting with EA and NPS

0830 José opens gate - EA enters site; stops at HARRIS EAST (#2) to collect first samples

0840 Mike Shoup reports metal detector tested on source and working OK

0841 Call Tim Reese - notified that we would begin sampling

0845 Mike Shoup (MS) clears area around sample location FTL-HS-SB-12-01 / FTL-HS-SS-12-01 will shoot sample location with Trimble afterwords

photo taken 100-0836

photo taken 100-0837

*0857 Sampled FTL-HS-SB-12-01 - Brown fine Sand & Gravel Dry

photo taken 100-0838

*0900 Sample FTL-HS-SS-12-01 - Same as surface sample

Location FT. TILDEN Date 1/23/06

Project / Client

GPS Coords: NAD83

4490634.18 mN UTM 18 N

593704.45 mE NAD 83 CONUS

Move to pistol range

0930 will collect samples from PR Berm stop - Slugs noted on surface

Samples FTL-PR-SS-02-01

FTL-PR-SS-02-02

GPS coords

-02 4490558.44 N 593755.14 E

-01 4490561.44 N 593763.10 E

* 0935 Sampled FTL-PR-SS-02-01

photo taken 0839

0946 photo taken 100-0840

* 0951 Sampled FTL-PR-SS-02-02

Soil log for sample -01

Lt gray f to m. Sand, well sorted, Dry

Soil log for sample -02

Brown to Gray f to m Sand, Dry w/ organics

Michael Shoup

4 Location FT. TILDEN Date 1/23/07

Project / Client

1005 Move to HARRIS WEST (#1)
Concrete apron surrounds the
Gun casement - will collect
Sample on oppos. te side of
Road

Photos taken 0843-0844

*1012 FTL-HS-SS-02-01

*1025 FTL-HS-SB-02-01
Soil Log:
Very f to f, Dark Brown
organic Rich Sand, Dry,
Frozen
GPS coordinates
4490502.00 mN
593484.47 mE

1045 Move to Battery Kessler
Photos taken 0845, 46, 47

*1104 Sampled FTL-KS-SB-02-01
GPS Coords
4490280.68 mN
593357.22 mE
Lt gray to Brown f to m Sand
Dry

[signature]

Location FT. TILDEN Date 1/23/07 5

Project / Client

*1115 Sampled FTL-KS-SS-02-01
(Lt gray to Brown fine to m Sand)
Dry
GPS coordinates
4490287.96 mN
593421.11 mE
Photo taken 0848

1140 Arrive at Rifle Range
Backstop - Slugs in Ground
Photo taken 0849

1148 Sampled FTL-RR-SS-02-01 P0850 P0851

1155 Sampled FTL-RR-SS-02-02 P0852 P0855
Soil Log: Lt Gray to yellow
f to m Sand, Some Gravel
Slugs (copper & Steel)
Clam shell Fragments
GPS coordinates
-01 4490512.65 mN 593948.97 mE
-02 4490517.15 mN 593963.03 mE

1220 Move to Ferguson
FTL-FG-SS-02-01 (0:20)
4490703.54 mN
594644.55 mE

[signature]

Location FT. TILDEN Date 1/23/07

Project / Client

*1225 Sampled FTL-FG-SB-02-01
U Gray f to m Sand Dry
GPS - 4490785.98 mN
593697.68 mE
Photo 0854

1226 SAMPLED FTL-FG-SS-02-01
4 Gray f to m Sand, Dry
Completed QA : Dup

*1231 FTL-FG-SS-02-01 Dup p0855

*1240 FTL-FG-SS-02-01 QA
GPS coords
4490765.56N
594649.55E

1300 Move to BACKGROUND Sampling
FTL-BG-SS-02-03 Silt 4 Gray
photos taken 100-0856 f to m
100-0857 Sand
4491020.56 mN
593930.19 mE

*1308 Sampled FTL-BG-SS-02-03

1318 Move to FTL-BG-SS-02-04
4490892.53 mN
593539.95 mN
photo taken 100-0858

Location FT. TILDEN Date 1/23/07

Project / Client

*1320 Sampled FTL-FG-SS-02-04
Lt Gray fine to Med. Sand, Dry

1333 Move to FTL-FG-SS-02-05
COORDS 4490640.21 mN / 593214.20 mE
photo TAKEN 100.0859 Sediment above

*1337 Sampled FTL-FG-SS-02-05

1355 Sampled FTL-FG-SS-02-02
photo 100-0860 TAKEN
Brown Silty Fine Sand, Some
Clay, Dry
GPS Coordinates:
4491139.70 mN
594412.65 mE

1400 Move to FTL-FG-SS-02-01

1410 Sampled ABOVE SS
Brown Silty fine Sand

1443 BenchMark COAST GUARD 2
4490843.51 N
594791.61 E

1445 BENCHMARK RIIS 1987
449 0821.76N
594 823.18E

APPENDIX E - PHOTO DOCUMENTATION LOG

APPENDIX E - PHOTOGRAPHIC LOG

Project/Site : MMRP SI for Fort Tilden
Project No.: C02NY001604/USACE

Date	Photo ID	Description
1/23/07	E.1	7-point wheel sampling set-up.
1/23/07	E.2	Sampling at Battery Harris East Location.
1/23/07	E.3	Additional sample location beyond access road adjacent to Battery Harris East
1/23/07	E.4	Sampling location adjacent to Battery Kessler doorway.
1/23/07	E.5	Battery Harris West.
1/23/07	E.6	Sampling location adjacent to Battery Kessler doorway.
1/23/07	E.7	Sampling on rifle range backstop with Battery Harris East in distance.
1/23/07	E.8	Sampling on rifle range backstop.
1/23/07	E.9	Battery Ferguson location in eastern portion of FUDS
1/23/07	E.10	Sample location within Battery Ferguson area in eastern portion of FUDS.
1/23/07	E.11	Background sample location in north-central portion of FUDS.
1/23/07	E.12	Background sample location in northwest portion of FUDS.

Photo E.1 – 7-point wheel sampling set-up.

Photo E.2 – Sampling at Battery Harris East Location.

Photo E.3 – Additional sample location beyond access road adjacent to Battery Harris East.

Photo E.4 – Battery Harris West.

Photo E.5 – Sampling location adjacent to Battery Kessler doorway.

Photo E.6 – Expended bullets/slugs located on rifle range backstop.

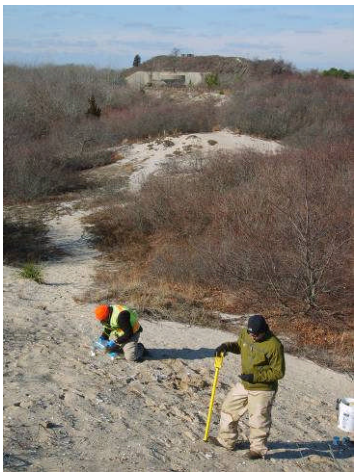


Photo E.7 – Sampling on rifle range backstop with Battery Harris East in distance.

Photo E.8 – Sampling on rifle range backstop.

Photo E.9 – Battery Ferguson location in eastern portion of FUDS.

Photo E.10 – Sample location within Battery Ferguson area in eastern portion of FUDS.

Photo E.11 – Background sample location in north-central portion of FUDS.

Photo E.12 – Background sample location in northwest portion of FUDS.

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.

Located on CD.

APPENDIX H - GEOGRAPHIC INFORMATION SYSTEMS DATA

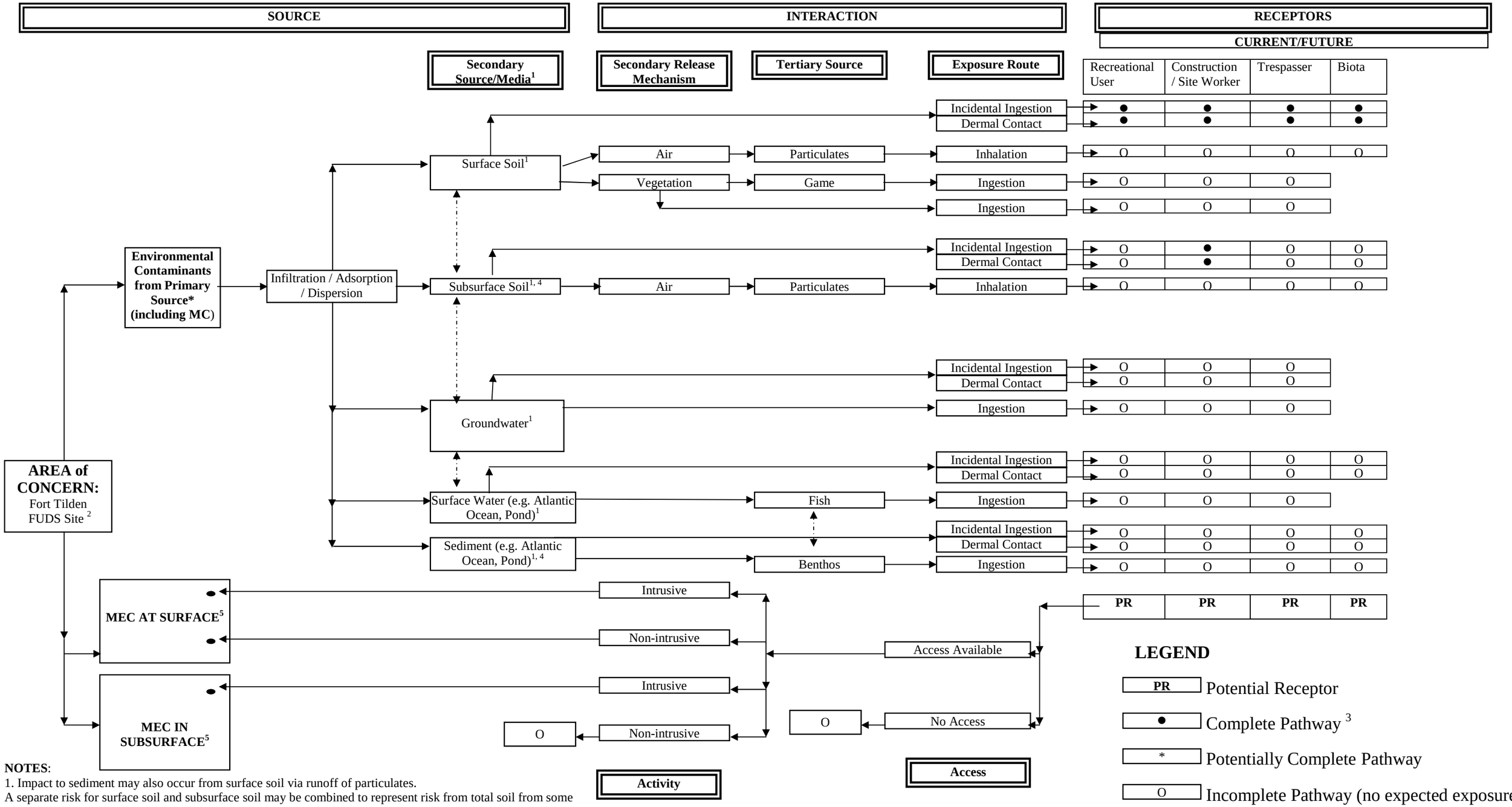
Located on CD.

APPENDIX I - GEOPHYSICAL DATA

Appendix not used.

APPENDIX J - CONCEPTUAL SITE MODEL

- MRS 1



NOTES:

1. Impact to sediment may also occur from surface soil via runoff of particulates. A separate risk for surface soil and subsurface soil may be combined to represent risk from total soil from some receptors. Impact to surface water may also occur from infiltration of groundwater.
2. Primary sources will vary but are expected to include ranges.
3. 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.
4. Media will not be sampled since risk of exposure is very low but is potentially a complete pathway.
5. Interaction between potential receptors and MEC has two components: access and activity.
6. The CSM has evolved throughout the SI process to reflect a current understanding, following the SI, of the source, pathways and receptors potentially affected by MEC and MC.

DIAGRAM OF THE INTEGRATED CONCEPTUAL SITE MODEL FOR FORT TILDEN MMRP FUDS SITE (MRS 1) [6]

J-1

Reference: **USACE. 2003. EM 1110-1-1200. Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects**

APPENDIX K - MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL RESULTS

- MRS 1

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: Range Complex No. 1 - MRS 1

Component: U.S. Army

Installation/Property Name: Fort Tilden

Location (City, County, State): New York, Queens County, New York

Site Name (RMIS ID)/Project Name (Project No.): Fort Tilden (C02NY001604R01)/(C02NY001604)

Date Information Entered/Updated: December 20, 2006 / June 8, 2007

Point of Contact (Name/Phone): Constancio Labeste / 917-790-8330

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 Tilden was established as a coastal defense site in 1917 and utilized for military purposes until 1974. During the period of interest, Fort Tilden included coast artillery, anti-aircraft artillery, and Nike missile sites. The munitions used at the site included: high explosive and armor piercing large caliber munitions (37mm or greater) (HE Classification), propellants (155 mm propelling charge), and various small arms through 30 mm. Historical documentation and interviews indicated the following munitions were used and/or found at the Fort Tilden FUDS: small arms, practice ground rockets, and high explosive artillery. Previous finds at the site include a 3.5-inch practice rocket and expended small arms ammunition. MD items (spent small caliber bullets) were observed during the January 2007 SI site activities.

One MRS is defined for Fort Tilden and includes 139 acres of land and 302,813 acres of tidal water. Range Complex 1, as documented in the INPR Supplement, includes three subranges (Battery Harris, Battery Kessler, and Battery Ferguson). The FUDs also includes a pistol range and firing range. The SI addressed the FUDS up to and including the water within 100 yards of the mean high tide.

Land Portion - Description of Pathways for Human and Ecological Receptors: Surface Soil and Subsurface Soil.

Description of Receptors (Human and Ecological): Receptors include NPS employees/construction workers, recreational visitors, trespassers, and biota.

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).	**5**

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.

Items used at the batteries include high explosive and armor piercing large caliber munitions (37mm or greater) (HE Classification) and propellants (155 mm propelling charge Various small arms through 30 mm were used at the pistol and rifle ranges. Historical documentation and interviews indicated the following munitions were used and/or found at the Fort Tilden FUDS: small arms, a 3.5 practice rocket (approximately 1991), and high explosive artillery. Previous finds at the site include a 3.5-inch practice rocket and expended small arms ammunition. MD items (spent small caliber bullets) were observed during the January 2007 SI site activities. See Sections 2.1 and 4.3.1 and Table 2-2 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).	**10**

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

Fort Tilden's coastal defenses contained many batteries. In addition, a pistol range and 800-yard rifle range are located within this FUDS. One 3.5" practice rocket was found onsite (approximately 1991) (Alion 2006). See Sections 2.1 and 4.3.1 and Table 2-2 of the SI Report (USACE 1996 and 2004b)

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).	**25**

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

NPS personnel reported that one 3.5" practice rocket was found by children onsite approximately 1991 See Sections 2.1 and 4.3.1 and Table 2-2 of the SI Report (USACE 2005)

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** (circled)
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).	**8**

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

The site is located within the Gateway National Recreation Area, the majority of which is open to the public during daylight hours. The site is fenced on three sides and open on the water. (Appendix B-TPP Memorandum and Appendix D-Field Notes and Forms of the SI Report). See Sections 2.3.4 and 4.3.1of 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 MRS is currently located on National Park Service property (USACE 2005). See Sections 2.1, 2.3.3 and 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.

U.S. Census Bureau (2000) cited there are 20,409 persons per square mile in Queens County, New York. See 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 subject property is located on a barrier island located immediately south of the Queens section of New York City. As of 2000, there are over two million people living in Queens county, with over 800,000 households. There are also several inhabited structures onsite. (U.S. Census Bureau 2000). Refer to Sections 2.3.3 and 2.3.4 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 subject site is located approximately 2 miles from Queens County, New York which as of 2000, had over two million residents. The subject property is also part of the Gateway National Recreation Area. 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).	**3**

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

Habitat for threatened and endangered species is located on the site. There are no specific known culturally significant historic or archaeological sites are located in the vicinity of Fort Tilden (USACE 2005). Refer to Sections 2.3.8 and 3.2 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	**5**	**15**
Source of Hazard	Table 2	**10**	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	**25**	**38**
Ease of Access	Table 4	**8**	
Status of Property	Table 5	**5**	
Receptor Factor Data Elements			
Population Density	Table 6	**5**	**18**
Population Near Hazard	Table 7	**5**	
Types of Activities/ Structures	Table 8	**5**	
Ecological and /or Cultural Resources	Table 9	**3**	
EHE MODULE TOTAL			**71**

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.

Both physical and historical evidence indicates that CWM are not present at this MRS. Refer to Section 2.4.2.1 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	**Alternate 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: Contaminant concentrations above the Lab Reporting Limit were not detected.

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.

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.

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 collected.

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 collected

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 Used: FLT-HS-SB-02-01, FLT-HS-SB-12-01, FLT-RR-SS-02-01, FLT-SS-SS-02-01

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio
ANTIMONY AND COMPOUNDS	2.54E+01	3.10E+01	8.19E-01
COPPER AND COMPOUNDS	9.04E+01	3.10E+03	2.92E-02
LEAD	1.34E+03	4.00E+02	3.35E+00
ZINC	5.82E+02	2.30E+04	2.53E-02
CHF Scale	**CHF Value**	**Sum the Ratios**	4.22E+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** (circled)
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** (circled)
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).	**H**

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 Used: FLT-HS-SB-02-01, FLT-HS-SB-12-01, FLT-RR-SS-02-01, FLT-SS-SS-02-01

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)	M	M	H	HMM	**C**

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	**C**

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				**4**	

APPENDIX L - REFERENCE COPIES

- INPR
- ASR
- INPR Supplement

Located on CD